

April 29, 1996

Mr. Benito J. Garcia, Bureau Chief  
New Mexico Environment Department  
Hazardous & Radioactive Materials Bureau  
P.O. Box 26110  
Santa Fe, New Mexico 87502

**GIANT**  
INDUSTRIES, INC.

Route 3, Box 7  
Gallup, New Mexico  
87301

*Barbara ✓  
Ron K, x  
Michael ✓  
get in contact with  
James Harris on  
this; also get  
comments from  
Teds - (coordinate  
with Ron)*



Dear Mr. Garcia:

SUBJECT: CORRECTIVE ACTION PLAN SWMU-6 PRODUCT RECOVERY

Giant Refining Company (Giant) is in receipt of your April 24, 1996, letter informing Giant that New Mexico has obtained RCRA Corrective Action Authorization through its Hazardous and Radioactive Materials Bureau. Recently, on April 15, 1996, Giant transmitted the Environmental Protection Agency (EPA) Region 6 and the New Mexico Oil Conservation Division (OCD) a Corrective Action Plan (CAP) for recovering free product located below Solid Waste Management Unit 6 (SWMU-6). Giant requested that the USEPA and NMOCD review the CAP and if they had any questions to contact me or Mr. David Pavlich.

Enclosed, for your review, is a copy of the CAP submitted to the USEPA and NMOCD. I want to note that this document is intended to be a "living" document and may be modified as additional information is obtained.

If there are any questions in this matter, please contact me at (505) 722-0227 or Mr. David Pavlich at (505) 722-0217.

Sincerely,

A handwritten signature in black ink, appearing to read "Edward L. Horst".

Edward L. Horst, Environmental Manager  
Giant Refining Company  
Ciniza Refinery

- cc: Mr. Ronald Kern, Manager, RCRA Technical Compliance Program, NMED/HRMB  
Ms. Barbara Hoditscheck, Manager, RCRA Permits Program, NMED/HRMB  
Mr. Patricio W. Sanchez, Petroleum Engineer, NMOCD w/o enclosure  
Mr. David Neleigh, Chief, New Mexico Federal Facilities Section, EPA Region 6  
Mr. Dick Platt, General Manager Giant Refining Company w/o enclosures  
Mr. David Pavlich, HSE Manager Giant Refining Company w/o enclosures  
Mr. Kim Bullerdick, Legal Counsel, Giant Industries Arizona



April 15, 1996

Route 3, Box 7  
Gallup, New Mexico  
87301

Mr. Patricio W. Sanchez  
Petroleum Engineer  
New Mexico Energy, Minerals and Natural Resources Department  
Oil Conservation Division  
2040 South Pacheco  
Santa Fe, New Mexico 87505

Dear Mr. Sanchez:

SUBJECT: CORRECTIVE ACTION PLAN SWMU-6 PRODUCT RECOVERY.

Enclosed is Giant Refining Company's Corrective Action Plan for product recovery at the area known as the Tank Farm and identified as part of the Solid Waste Management Unit (SWMU) - 6. A copy of this document is being transmitted to Mr. James Harris, Region 6, U. S. Environmental Protection Agency (USEPA) for his review. Please review this document and if there are any questions please contact me at (505) 722-0227 or Mr. David Pavlich at (505) 722-0217.

Thank you for all the help you have given to me on this issue.

Sincerely

A handwritten signature in black ink, appearing to read "Edward L. Horst", written over a horizontal line.

Edward L. Horst, Environmental Manager  
Giant Refining Company  
Ciniza Refinery

cc: Mr. James Harris, RCRA Facility Manager/Geologist  
U. S. Environmental Protection Agency Region 6

w/o enclosure  
Kim Bullerdick, Legal Counsel, Giant Industries Arizona  
Dick Platt, General Manager Giant Refining Company  
David Pavlich, HSE Manager  
Steve Morris, Environmental Spec.

## **1.0 INTRODUCTION**

Giant Refining Company (Giant) owns and operates the Ciniza Refinery Located 17 miles east of Gallup, New Mexico (Figure 1). In August, 1987, a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) was conducted at the refinery. As a result of this RFA, 14 potential solid waste management units (SWMUs) were identified. Between 1990 and 1992, Giant conducted a series of RCRA Facility Investigations (RFIs) to characterize all of the SWMUs. The RFI was performed in three phases. Phase I is the site-specific investigation schedule for SWMUs # 6, 8, 9, 10, and 12. Phase II covers the site-specific investigation schedule for SWMUs # 1, 2, and 13. While Phase III is concerned with the site specific investigation schedule for SWMUs # 3, 4, 5, 7, 11, and 12.

Phase I of the RFI, as it applies to SWMU-6, states that soil borings will be drilled near and under each tank that contained leaded gasoline. The borings will be drilled to a depth of 7.5 feet below the ground surface. Samples will be taken from each boring and analyzed. As a result, additional drilling,

sampling and analytical work was necessary to complete SWMU-6 site characterization.

As a result of these efforts, it has been determined that a corrective action plan (CAP) be submitted for the remediation and recovery of hydrocarbons found in monitoring wells B-2 and BG-4.

This report is the CAP for the remediation and recovery of hydrocarbons found in monitoring wells B-2 and BG-4.

## **2.0 SITE CONDITIONS**

The Ciniza Refinery site is located on clays, silts, shales , and thin interbedded sand units of the Triassic Chinle Formation (Fm). The Chinle has a structural dip of approximately two degrees to the northwest. The uppermost aquifer unit that underlies the entire facility, including SWMU-6, is the Sonsela Sandstone. The top of the Sonsela Sandstone in this area occurs at a depth of approximately 55 feet. Ground water in the Sonsela is confined under artesian conditions by the relatively impermeable Chinle clays and shales above and below. A localized, lenticular, water-bearing sand body, locally called the Ciniza Sand, has also been identified underlying the northwestern part of the refinery area, but it is not present in the vicinity of SWMU-6.

Field observations and aquifer test data suggest that the shales and clays of the Chinle Formation do not contain free ground water and that low hydraulic conductivity inhibits horizontal and vertical migration of water, qualifying the Chinle as an aquitard.

## **2.1. SUBSURFACE GEOLOGY**

The Ciniza Refinery site is located on predominantly clayey soil derived from weathering of the underlying Petrified Forest Member of the Triassic Chinle Formation (Figure 2). Clay, silt, and shale, along with thin interbedded sand units were encountered in borings drilled across the refinery site. The clay and shale of the Petrified Forest Member overlie the Sonsela Sandstone, which occurs at depths ranging from approximately 30 feet in the southeastern part of the refinery to over 100 feet to the northwest (Figure 2). The Sonsela Sandstone is composed of fine to coarse-grained quartz sand which is partially cemented with silica and carbonate. The Sonsela unit is approximately 10 to 30 feet thick and dips to the northeast and northwest beneath the Ciniza refinery location (Figure 2). The near surface fine-grained sequence is thickest towards the northwestern part of the refinery property and thins to the southeast. The clay and shale unit is predominantly reddish brown, highly weathered, and dry. It also contains relatively high background concentrations of naturally occurring metals.

## **2.2 HYDROGEOLOGY**

The principle aquifer units in west central New Mexico are the Sonsela Sandstone and the San Andres Formations. Both are confined, artesian aquifers and both underlie the Ciniza Refinery site. The San Andres is present at a depth of approximately 800 feet. Wells completed in the San Andres produce in excess of a 1,000 gallons per minute (gpm) of good quality water, and the aquifer is the principle water supply source to the refinery. In comparison, the Sonsela Aquifer is present from 30 to over 100 feet below ground and produces 1 to 10 gallons per minute (gpm) of fair to poor quality water. Ground water, of poor quality, is also present under confined conditions in the “Ciniza Sand” beneath the northwestern part of the refinery. Clays and shales overlying both the Sonsela and Ciniza units are dry and act as aquitards (GCL, 1986).

### **2.2.1 Sonsela Sandstone Aquifer**

The Sonsela Sandstone is the uppermost aquifer underlying the Ciniza Refinery and occurs at depths ranging from 30 to over 100 feet. The

Sonsela is confined above and below by clay and shale of the Chinle formation. Resulting artesian conditions in the Sonsela are manifest by artesian heads ranging from 30 to 100 feet in the refinery area (Figures 3 and 4). The resulting upward gradient between the Sonsela and the overlying Chinle aquitard results in localized saturation of Chinle shales and clay immediately above the Sonsela contact.

The potentiometric surface of ground water in the Sonsela dips to the northeast, roughly parallel with structural dips observed in the Sonsela Sandstone (Figure 5). The potentiometric surface has a gradient of approximately 0.010 ft/ft and is relatively uniform across the site (Figure 3).

Aquifer slug and pump test data in the western area of the refinery indicates that the hydraulic conductivity of the Sonsela Sandstone is  $3.9 \times 10^{-6}$  ft./sec. or 0.35 ft/day (Shomaker, 1984). Assuming an average porosity of 10 percent and a gradient of 0.010 ft./ft., the ground water velocity would be 13 feet per year.

### **2.2.2 Chinle Aquitard**

The Sonsela Aquifer is confined above and below by low permeability clays and shales of the Chinle aquitard. Aquifer slug and pump tests indicate that the Chinle aquitard has a hydraulic conductivity of  $8.3 \times 10^{-9}$  ft./sec. or  $7.1 \times 10^{-4}$  ft./day (Shomaker, 1984). Assuming an average porosity of 40 percent and a gradient of 0.010 ft./ft., free ground water flow in the Chinle aquitard, if it exists, would be at a rate of 0.007 ft/yr. With the exception of shale and clay immediately overlying the Sonsela Aquifer, no ground water has been noted in Chinle shales and clays beneath the refinery site.

### **2.3 SUBSURFACE CONDITIONS IN SWMU-6 AREA**

In March, 1995, eleven (11) borings and two (2) wells were drilled as part of the RCRA Facility Investigation (RFI). The identification, geologist log and respective locations for each boring drilled during the RFI are shown in Attachment "A". Clays, shales, and water bearing sands were encountered in all borings. It should be noted that a hydrocarbon order was

present in most borings; and both of the wells (BG-4 and B-2) did contain floating “free product”.

### **3.0 SITE ASSESSMENT**

SWMU 6 consists of seven hydrocarbon storage tanks (ranging in size from 1,000 to 24,000 barrels) that have contained leaded gasoline (that is, gasoline blended with the compound tetraethyl lead). After reviewing the first set of data results (samples collected from 0-0.5 feet, 3.5-4 feet, and 7-7.5 feet from drilling locations throughout SWMU-6), Giant decided that it would be necessary to collect samples at deeper intervals. It was agreed as part of the supplemental sampling requirements that ten (10) additional samples would be collected at depths from 11-11.5 feet. These samples would all be analyzed for BTEX with two (2) of the samples being analyzed for metals.

After Giant conducted the supplemental sampling events and reviewed the results of the sample analyses, it was determined that additional samples should be collected around TANK 569. Three additional borings were made with one sample collected from each boring. These samples were collected at different depth intervals as follows: 11-11.5 feet, 14-14.5 feet, and 16-16.5 feet.

Because BTEX levels were all below any of the proposed corrective actions levels, Giant proposed no corrective action be performed. EPA did not agree and stated:

“Giant shall complete additional soil borings as close as possible to the following sample points (numbers correspond to previous RFI sampling points completed in May, 1991): 21, 22, 23, 25 , 26, 27, 30 and 31. The sampling interval shall be at 16 feet with the exception of sample point 31 which shall be sampled at 20 feet. Samples will be analyzed for BTEX constituents. Sampling must extend vertically until no subsequent increase in contamination levels is likely to occur. A minimum of two (2) “clean” samples are required to verify delineation. The results of this sampling event shall be submitted to EPA by October 1, 1994.”

EPA’s required drilling, sampling and analytical work was performed and, as a result, it was discovered that there exists a plume of free product. Through laboratory “finger printing”, the free product appears to be gasoline.

### **3.1 ORGANIC COMPOUNDS**

Hydrocarbon contamination was detected in all but two borings, B1 and BG3. The hydrocarbon contamination was laboratory “finger printed” as gasoline. This is consistent with the type of materials historically stored in tanks located within the boundaries of SWMU-6.

### **4.0 REMEDIAL ACTION**

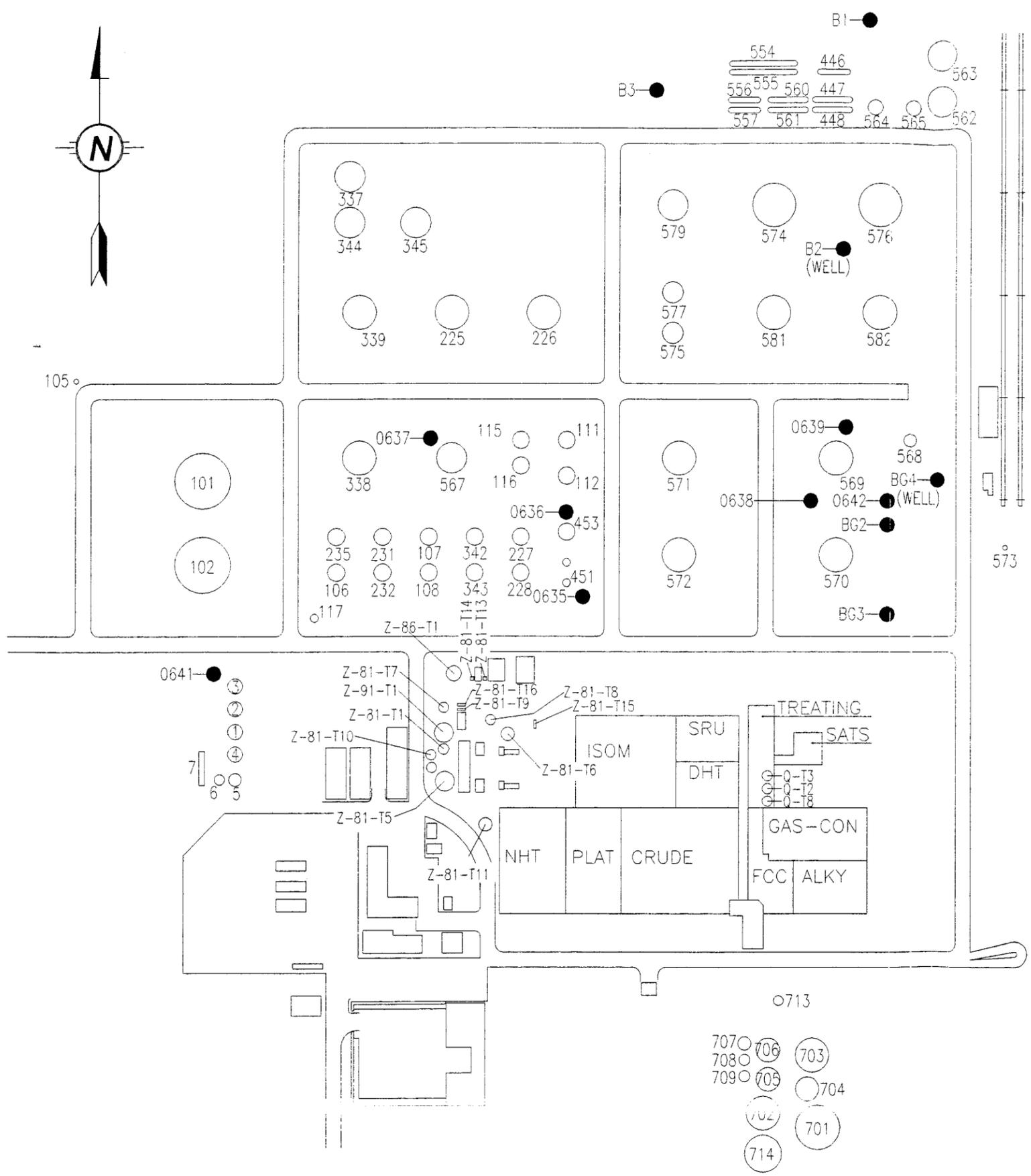
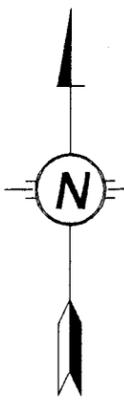
Giant Refining proposes to begin remediation through a pump and treat method. Initially, two (2) submergible pumps will be installed at wells B-2 and BG-4, see Appendix “A”. Free product removed from these wells will be sent to the API Separator, via the sewer system, where the water will be removed and the product recovered and sent back through the refining process.

This operation will continue until all the recoverable free product has been removed. Monitoring of the success of this operation will be conducted

through water sampling at down gradient wells OW-14 and OW-13. One additional boring will be drilled down gradient of OW-14, and water samples will be gathered and analyzed for BTEX. Once the analytical results have been received and evaluated, Giant will be able to determine if additional drilling is necessary.

In the first year of operations, Giant will submit written quarterly progress reports to the regulatory authority(ies). After the first year, Giant will submit written progress reports on an annual basis.

As in many operations of this nature, unforeseen events may occur and adjustments to this plan will be necessary. In an effort to maintain continuous and uninterrupted operations, Giant proposes to make any necessary adjustments and contact the regulatory authority(ies), by telephone within 72 hours of implementing adjustments. A written follow-up report would then be submitted within 30 days.



# ATTACHMENT "A"

**GIANT**  
 REFINING CO.  
 A DIVISION OF GIANT INDUSTRIES  
 CINIZA REFINERY GALLUP NEW MEXICO  
 BORING PLAN  
 DRILLING PLAN

MARK	DATE	DESCRIPTION	BY	APRVD	SCALE:	APRVD	REV
					NONE	APRVD	
					DRN BY: CLM	1=1	
REVISIONS					DATE: 04-10-96	DWG NO. Z86-09-131	0

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6956.0  
 TOTAL DEPTH: 35.0  
 LOGGED BY: WHK  
 DATE: 3-23-95  
 STATIC WATER: 15.0  
 BORING ID: 0635  
 PAGE: 1

PROJECT: RFI  
 LOCATION: East Side of Tank

LOG OF TEST BORINGS

DEPTH	T	E	S	A	M	P	L	O	L	L	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		PID (ppm)
0.0-0.2	xxxxxxx										C	Asphalt	
0.2-2.7	///---///	1.0									C	Clay, red brown, soft, silty, wet, (fill)	
	///---///										C		
	///---///										C		
2.7-7.1	///--*///										C	Clay, silty, slightly sandy, red brown, firm, wet, carbonate filaments (not fill)	0.0
	///--*///	3.0									C		
	///--*///										C		
	///--*///										C		
	///--*///										C		
	///--*///	5.0									C		
	///--*///										C		
	///--*///										C		
7.1-8.0	///**--//	7.0									C	Clay, sandy, red brown, silty, wet, carbonate filaments, dark brown	0.2
	///**--//										C		
8.0-9.8	*****	8.0									C	Sand, fine, moist, moderately dense, light brown, no odor	0.0
	*****										C		
	*****										C		
9.8-10.0	***000***										C	Sand, gravelly, moist, dense, light brown, some clay infilling	
10.0-10.6	///000///	10									C	Clay, gravelly, wet, hard, red brown, no odor	
10.6-11.3	///--*///										C	Clay, silty, sandy, soft, red brown, wet, no odor	
	///--*///	11									C		2.0
11.3-11.7	///--*///										C	as above but with hydrocarbon odor and black	0.0
11.7-14.2	*****	12									C	Sand, medium, silty, moist, dense, red brown, no odor	
	*****										C		
	*****										C		
	*****										C		
	*****	14									C		
14.2-15.8	***000***										C	Sand, very gravelly to 2", subrounded, sandstone and lime rock, some clay	0.0
	***000***	15									C	infilling, no odor, dense, multicolored, light brown	150
15.8-17.8	000**//00										C	Gravel, sandy, clayey, dense, brown, no odor, water bearing	
	000**//00	16									C		
	000**//00										C		
	000**//00										C		
17.8-19.0	*****										C	Sand, coarse, red brown, wet, strong hydrocarbon odor, dense	300
	*****	18									C		
	*****										C		
19.0-22.6	*****	19									C	Sand, fine to medium, dense, red brown, water saturated, hydrocarbon	210
	*****										C	odor	
	*****										C		
	*****										C		
	*****										C		
	*****	22									C		
22.6-23.3	***//00**										C	Sand, clayey, water bearing, red brown, scattered gravel, odor	200
	***//00**	23									C		

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" BSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6956.0  
 TOTAL DEPTH: 35.0  
 LOGGED BY: WEK  
 DATE: 3-23-95  
 STATIC WATER: 15.0  
 BORING ID: 0635  
 PAGE: 2

PROJECT: RFI  
 LOCATION: East Side of Tank  
 451

LOG OF TEST BORINGS

DEPTH	T	E	S	A	M	P	L	A	L	L	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		PID
													(ppm)
23.3-25.0	***000***		C								<u>Sand</u> , coarse, gravelly, loose, <u>water bearing</u> , black to dark grey	180	
	***000***	24	C										
	***000***		C									200	
	***000***	25	C										
	***000***		C										
	***000***		C										
	***000***		C										
	***000***		C										
	***000***		C										
	***000***		C										
	***000***	28	C										
28.4-30.0	-----		C								<u>CHINLE FORMATION</u>	0.0	
	-----		C								<u>Shale</u> , green, sandy, hard, moist, no odor		
	-----		C										
30.0-33.4	-----	30	C								<u>Shale</u> , red brown, green interbedded, sandy partings, slightly blocky		
	-----		C								somewhat sandy, laminar bedding, moist		
	-----		C										
	-----		C										
	-----		C										
	-----		C										
	-----	33	C										
33.4-34.2	000**0000		C								<u>Conglomerate</u> , hard, weakly cemented, few pebbles and very coarse sand, moist		
	000**0000	34	C								to wet, multicolored		
34.2-35.0	-----		C								<u>Shale</u> , red brown, hard, moist	0.5	
	-----	35	C										
TD											end 4:45p pull auger, depth of water 15.0 @ 5:30p backfill with bentonite slurry from bottom of boring		

LOGGED BY: WEK

SIZE AND TYPE OF BORING: 4'-1/4" HSA



PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6951.5  
 TOTAL DEPTH: 35.0  
 LOGGED BY: WHK  
 DATE: 3-27-95  
 STATIC WATER:  
 BORING ID: 0636  
 PAGE: 2

PROJECT: RFI  
 LOCATION: N. Manway, Tank 453

LOG OF TEST BORINGS

DEPTH	P L O T	S C A L E	S A M P L E	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		PID (ppm)
23.6-24.8	-----		C	CHINLE FORMATION		
	-----	24	C	Shale, sandy, wet, grey green, slight odor, hard		30
24.8-25.0	-----		C	Shale, red brown, hard, moist, no odor, some green laminations		2.0
25.0-29.3	-----	25	C	Shale, sandy, fissile, green grey, no odor, moist, hard		2.0
	-----		C			
	-----		C			
	-----		C			
	-----		C			
	-----	28	C			
	-----		C			
	-----	29	C			
29.3-30.0	-----		C	Shale, fine blocky, green grey, no odor, damp, hard		1.0
30.0-35.0	-----	30	C	Shale, blocky, red brown, moist, hard, slightly fissile		1.0
	-----		C			
	-----		C			
	-----		C			
	-----		C			
	-----		C			
	-----		C			
	-----		C			
	-----	35	C			
TD				pull auger 11:00a backfill with montmorillonite clay and hydrate (13 50# bags)		

LOGGED BY: WEX

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6945.6  
 TOTAL DEPTH: 40.0  
 LOGGED BY: WHK  
 DATE: 3-22-95  
 STATIC WATER:  
 BORING ID: 0637  
 PAGE: 1

PROJECT: RFI  
 LOCATION: N. Manway, Tank 567

LOG OF TEST BORINGS

DEPTH	P L O T	S A L T	S A M P L E	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		PID
						(PDM)
0.0-4.6	////*/		C	Clay, sandy, coarse, gravelly, wet, soft, brown, no odor		0.0
	////*/	1.0	C			
	////*/		C			
	////*/		C			
	////*/		C			
	////*/		C			
	////*/	4.0	C			
4.6-6.9	*****		C	Sand, red brown, coarse, loose, wet, rounded pebbles		0.0
	*****	5.0	C			
	*****		C			
	*****		C			
	*****		C			
6.9-8.7	///-***	7.0	C	Clay, silty, very fine sandy, brown, soft, wet, hydrocarbon odor (old)		4.0
	///-***		C	odor only below 7.5'		
	///-***		C			
8.7-9.3	////*/		C	Clay, sandy, brown, soft, wet, odor		2.0
	////*/	9.0	C			
9.3-12.0	*****		C	Sand, fine, light grey, loose, moist, odor (old)		5.0
	*****		C			
	*****		C			
	*****		C			
	*****		C			
12.0-13.3	**0000**	12	C	Sand, very gravelly, moist, brown, some cobbles, dense, odor		13.0
	**0000**		C			
	**0000**	13	C			
13.3-16.7	*****		C	Sand, coarse, red brown, dense, moist, odor, some pebbles		10.0
	*****		C			
	*****		C			
	*****		C			
	*****		C			
	*****	16	C			
16.7-17.2	///***/		C	Clay, sandy, very wet, soft, brown-grey, odor, saturated (not water bearing)		500
	///***/	17	C			
17.2-19.1	****00**		C	Sand, fine to coarse, some pebbles, odor, saturated water bearing		250
	****00**		C			
	****00**		C			
19.1-20.5	-----	19	C	<u>CHINLE FORMATION</u>		80
	-----		C	Shale, green to red brown, laminar bedding, blocky structure, hard, moist		
	-----	20	C			
20.5-25.0	-----		C	Shale, green, fissle to blocky, moist to wet, hard		3.0
	-----		C			
	-----		C			
	-----		C			
	-----		C			

LOGGED BY: WEX

SIZE AND TYPE OF BORING: 4'-1/4" HSA



PRECISION ENGINEERING, INC.

PROJECT: Tank 569  
 LOCATION: Adjacent to South  
 Manway, Tank 569

LOG OF TEST BORINGS

FILE #: 95-018  
 ELEVATION: 6947.1  
 TOTAL DEPTH: 45.0  
 LOGGED BY: WEK  
 DATE: 3-22-95  
 STATIC WATER: None  
 BORING ID: 0638  
 PAGE: 1

DEPTH	T	E	S A M P L E	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		PID (DPM)
0.0-3.4	///-///		C	time in 10:00a--PID calibrated 0.54 hexane		0 @ 1.8'
	///-///		C	Clay, silty, some gravel in upper 6", wet, soft		
	///-///		C			0.3 @ 2.3'
	///-///	2.0	C			540 @ 2.8'
	///-///		C			
	///-///	3.0	C			
3.4-4.0	///+///		C	Clay, sandy, some odor, red brown, wet, soft		
4.0-5.6	+///+///	4.0	C	Sand, clayey, some odor, red brown, wet to moist, loose		1000 @ 4.2'
	+///+///		C			
	+///+///	5.0	C			
5.6-11.3	///-+///		C	Clay, silty, sandy, blocky, red brown, firm, wet		>1438 @ 6.5'
	///-+///	6.0	C			
	///-+///		C			
	///-+///		C			
	///-+///		C			
	///-+///		C			
	///-+///	9.0	C			>1438 @ 9.5'
	///-+///		C			
	///-+///	10	C			
	///-+///		C			
	///-+///	11	C			
11.3-11.9	///+///		C	Clay, firm, red brown, wet		
11.9-12.1	+///+///	12	C	Sand, wet, loose, red brown, weak hydrocarbon odor		
12.1-12.4	///+///		C	Clay, firm, red brown, wet, odor		
12.4-13.3	///-+///	13	C	Clay, silty, slightly sandy, soft, red brown, odor, wet		300 @ 13.3'
13.3-13.9	///+///		C	Clay, sandy, silty, soft, red brown, odor		
13.9-14.8	///+///	14	C	Clay, firm, some carbonate streaks, brown, wet		
14.8-15.0	+///+///		C	Sand, loose, silty, red brown		
15.0-15.9	///+///	15	C	Clay, sandy, red brown, soft, wet, odor		
	///+///		C			
15.9-17.7	+///+///	16	C	Sand, silty, moist, light brown, loose, strong hydrocarbon odor		
	+///+///		C			
	+///+///	17	C			>1438 @ 17.6'
17.7-18.8	///-+///		C	Clay, silty, wet, light brown, soft, sand lens 1"		
	///-+///	18	C			
18.8-21.3	+///+///		C	Sand, clayey, moist, hydrocarbon odor, dense, brown, jar sample @ 20.0'		
	+///+///	19	C			
	+///+///		C			
	+///+///	20	C			650 @ 20'
	+///+///		C			
	+///+///	21	C			
21.3-23.7	///+///		C	Clay, sandy, wet, hydrocarbon odor, soft, brown to red brown		
	///+///		C			
	///+///		C			
	///+///	23	C			

LOGGED BY: WEK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6947.1  
 TOTAL DEPTH: 45.0  
 LOGGED BY: WEK  
 DATE: 3-22-95  
 STATIC WATER: None  
 BORING ID: 0638  
 PAGE: 2

PROJECT: TANK 569  
 LOCATION: Adjacent to South  
 Manway, Tank 569

LOG OF TEST BORINGS

DEPTH	P L O T	S C A L E	S A M P L E	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		PID (ppm)
23.7-24.8	****/****		24	C	Sand, slightly clayey in laminations, wet to moist, loose to moderately dense	
24.8-25.0	****/****			C	Sand, (sandstone rock @ 24.8'), moderately dense, light brown, moist	60 @ 25'
25.0-28.3	*****		25	C	Sand, slightly gravelly below 27.5', moderately dense, moist, slightly sweet	
	*****			C	hydrocarbon odor	
	*****			C		
	*****			C		
	****OO****			C		
	****OO****		28	C		580 @ 28.0'
28.3-30.0	OOOOO/OOO			C	Gravel, some minor clay, sandstone gravel and cobble material, moist, dense	
	OOOOO/OOO			C	mottled red brown, strong odor	
	OOOOO/OOO			C		
30.0-30.5	OOOOO/OOO		30	C	as above but saturated with fresh gasoline odor	960 @ 30.0'
30.5-32.7	////+////			C	Clay, sandy, firm, brown, wet, hydrocarbon odor	1200 @ 30.3'
	////+////		31	C		
	////+////			C		
	////+////		32	C		
32.7-36.1	///-+///			C	Clay, silty, some sandy zones as infilling in joints or cracks, wet, firm to	
	///-+///		33	C	very firm, few pebbles; 33.3'-33.6', breaks into blocky fragments @ silt seams	
	///-+///			C	at random angles, weak hydrocarbon odor	
	///-+///			C		
	///-+///			C		
	///-+///		35	C		32 @ 35.0'
	///-+///			C		
36.1-37.5	***OOO***		36	C	Sand, very gravelly, gravel to 1.5", subrounded, sandstone pieces as fragments	
	***OOO***			C	black staining to 37.0', moist	
	***OOO***		37	C		
37.5-40.0	////+////			C	Top of CHINLE FORMATION	
	////+////		38	C	Clay, mottled green blotches, shaley, (weathered in-situ?), moist to wet, hard	
	////+////			C		
	////+////			C		
	////+////			C		
40.3	---+---		40	C	Grades to	70 @ 40.0'
	---+---			C	Shale, carbonate nodules, hard, red brown, moist to wet	
	---+---			C		
	---+---			C		
	---+---		42	C	more carbonate @ 42.3'-42.6'	
	---+---			C		
	---+---		43	C		
43.5-44.5	---+---			C	Shale, sandy, laminated, moist, green grey, hard, fissle	
	---+---		44	C		
44.5-45.0	---+---			C	Shale, fissle, dry to moist, brown, hard, light green grey last 1.5"	
	---+---		45	C		15 @ 45.0'
TD					boring abandoned and backfilled with highyield montmorillonite clay (bentonite) at 1:35p	

LOGGED BY: WEK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

FILE #: 95-018  
 ELEVATION: 6948.2  
 TOTAL DEPTH: 60.0  
 LOGGED BY: WHK  
 DATE: 3-20-95  
 STATIC WATER: 44.3  
 BORING ID: 0639  
 PAGE: 1

DEPTH	P L O T	S C A L E	S A M P L E	M A T E R I A L C H A R A C T E R I S T I C S  (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)	PID (ppm)
0.0-2.0	///OO*OO// ///OO*OO// ///OO*OO//		C C C	Clay, gravelly, sandy, wet, soft, red brown	
2.0-3.8	///--O--// ///--O--// ///--O--//	2.0	C C C	Clay, silty, soft carbonate nodules give blotchy appearance	
3.8-4.3	///***// ///***//	4.0	C C	Clay, sandy, hydrocarbon odor, moist to wet, soft, red brown	>1438
4.3-4.8	///-***-//		C	Clay, silty, sandy, hydrocarbon odor, wet, red brown, 1" roots	570 @ 4'
4.8-5.8	***----- ***-----	5.0	C C	Sand, fine, silty, red brown, loose, moist, roots	480 @ 4.8'
5.8-7.0	///---// ///---//	6.0	C C	Clay, silty, red brown, firm, root matter (1") and filaments, wet	
7.0-10.7	///*---// ///*---// ///*---// ///*---// ///*---// ///*---//	7.0     10	C C C C C C	Clay, sandy to silty, hydrocarbon odor, wet, soft, red brown	204 @ 7.5'     330 @ 10'
10.7-12.6	///---// ///---// ///---// ///---//	11   12	C C C C	Clay, slightly silty, wet, red brown, firm, slight odor, 1" root at 12.6'	142 @ 11'
12.6-15.5	///****// ///****// ///****// ///****// ///****//	15	C C C C C	Clay, sandy to very sandy, very slightly bedded, red brown, strong odor	1220 @ 13'    >1438 @ 14'
15.5-21.9	***///*** ***///*** ***///*** ***///*** ***///*** ***///*** ***///*** ***///*** ***///*** ***///*** ***///*** ***///***	20	C C C C C C C C C C C	Sand, clayey, slightly laminated, brown to red brown, firm to moderately dense, moist, strong odor	>1438 @ 17.8' >1438 @ 20'
21.9-22.8	***** *****	22	C C	Sand, fine, loose, brown, moist-odor	>1438
2.8-25.0	***OOO***		C	Sand, gravelly, light brown, sandstone gravel, dense, slightly laminar structure	>1438 @ 23'

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6948.2  
 TOTAL DEPTH: 60.0  
 LOGGED BY: WHK  
 DATE: 3-20-95  
 STATIC WATER: 44.3  
 BORING ID: 0639  
 PAGE: 2

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	P L O T	S C A L E	S A M P L E	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		PID
						(ppm)
	***00***		C	continued from page 1		
	***00***	24	C			
	***00***		C			
25.0-27.4	***0000***	25	C	<u>Sandstone cobble material</u> , sandy, sandstone is white with psolomoline staining		>1438 @ 26.2
	***0000***		C	dense, strong hydrocarbon odor, free moisture condenses on sampler since 16'		
	***0000***		C			
	***0000***		C			
	***0000***	27	C			
27.4-28.0	*****		C	<u>Sandstone</u> , hard, no sample taken-refusal to push, (large rock)		
28.0-30.0	***000***	28	C	<u>Sand</u> , gravelly, cobbly, sandstone cobbles are white and hard, conglomeratic @		>1438 @ 28.5
	***000***		C	29.7'		
	***000***		C	driller note -- 32' drills very soft, 30'-35' pull sampler, PID readings from bore		
	***000***		C	vapor range from 600-700 PID		>1438 @ 30'
30.0-30.8	*0*0*0*0*	30	C	<u>Conglomerate</u> , fine to 1/4", hard		
	*0*0*0*0*		C			
30.8-32.8	////*///	31	C	<u>Clay</u> , sandy, red brown, soft, hydrocarbon odor, wet (not water bearing)		
	////*///		C			
	////*///	32	C			
32.8-33.3	****//		C	<u>Sand</u> , clayey, red brown, soft, wet, hydrocarbon odor		1080 @ 32.8
	****//	33	C			
33.3-33.9	///-///		C	<u>Clay</u> , silty, red brown, soft, wet		
33.9-35.0	///+///	34	C	sharp contact with above		
	///+///		C	<u>Clay</u> , red, filaments of carbonate, hard, wet, no odor, sandstone cobble in clay		
	///+///	35	C	matrix (geology note--not formation--eroded and redeposited from above)		
35.1-38.3	***000***		C	<u>Sand</u> , gravelly, hydrocarbon odor, dense, sandstone and siliceous rock, gravel		800 @ 36.8
	***000***	36	C	rounded to subrounded--80% is 1", <u>weakly water bearing</u>		
	***000***		C			
	***000***	37	C	pull sampler 35'-40'--PID reading 800-1100 water on top head of sampler when		
	***000***		C	withdrawn from hole		
	***000***	38	C			
38.3-40.0	-----		C	<u>CHINLE FORMATION</u>		730 @ 38.3
	-----		C	<u>Shale</u> , clayey, weathered in-situ, hard, blocky, green band 2" @ 39.5, red brown,		340 @ 38.8
	-----		C	moist		
40.0-42.4	-----	40	C	<u>Shale</u> , wet (saturated), does not appear water bearing, soft red brown, fine blocky		1200 @ 40.5
	-----		C			
	-----		C			
	-----	42	C			
42.4-45.0	-----		C	<u>Shale</u> , hard, red brown, some green grey mottling, fine blocky, moist		500 @ 44.5
	-----		C			
	-----		C	drilling stopped @ 3:30p, sample downhole fluid @ 4:00p, shows hydrocarbon layer		
	-----	44	C	PID reading - 800, headdress reading of fluid - 1200		
	-----		C			
45.0-50.0	-----	45	C	<u>Shale</u> , fissle, red brown, redder when dry, green grey reduction zones of 10"		1200 @ 45.5
	-----		C	in intervals of 3', green grey from 46.8'-48.0', dry		
	-----		C			

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6948.2  
 TOTAL DEPTH: 60.0  
 LOGGED BY: WHK  
 DATE: 3-20-95  
 STATIC WATER: 44.3  
 BORING ID: 0639  
 PAGE: 3

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	P L O T	S C A L E	S A M P L E	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		PID (ppm)
					continued from page 2	
			47			317 @ 49.5
			50		<p>hole allowed to remain open 1 hr--it is believed product flows down hole and contaminates soil between sample intervals. -- suspect zone 35'-38'</p> <p>ream hole to 13" with little difficulty to 50' set 10" PVC casing--slip coupled and screw set, hole remained open to 48', set casing easily to 50', plug inside of casing with 50# - 1/2" bentonite pellets, hydrate pellets set 1" tremmie tube with some difficulty as hole was beginning to swell closed</p> <p>grout outside annulus with 8-94# bags cement, 50# high yield bentonite, approx 100 gallons of fresh water</p> <p>finish clean up 10:00p</p> <p>begin drilling through casing 03-21-95 @ 12:10p 2' of product measured on water placed inside casing 03-20-95, light phase amber product. Product then water pumped from interior of casing.</p> <p>5' of plug in bottom of casing, upper 3' bentonite pellets lost bottom "soup"-- appears to be free of product however drilled 4' with continuous sampler, encountered refusal @ 54' with continuous sampler, pulled sampler and drilled to 55'</p>	
TD (day 1) Begin day 2						
50.0-55.0			50		Shale, fissile, hard, red brown, dry to moist, no odor, some siltstone lenses, very difficult to auger drill with continuous sampler, dry @ 55'	0.0
55.0-57.2	*****		55		Sandstone, dry, hard, red brown	
57.2-58.0	*****		57		Shale and Siltstone, red brown, hard, dry	

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6948.2  
 TOTAL DEPTH: 60.0  
 LOGGED BY: WHK  
 DATE: 3-21-95  
 STATIC WATER: 44.3  
 BORING ID: 0639  
 PAGE: 4

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	P L O T	S C A L E	S A M P L E	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		PID (ppm)
58.0-58.6	*****	58		Sandstone, hard, white to light grey, water bearing		
58.6-59.5	*****	59		Sandstone and Shale, interbedded, water bearing		
59.5-60.0	*****	60		Sandstone, white to light green grey, water bearing, very hard, sample may be slightly contaminated with clay fines from drilling		12
TD				stop drilling 5:10p sample method--2" split spoon sampler driven water level @ 5:20p---44.24', water appears to be filling casing rapidly decision made to grout immediately. Drilling believed to penetrate water bearing sandstone member of the Chinle (Sonsela). Stabilized water elevation not determined. grout to surface, clean up, finish--7:30p		

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6944.0  
 TOTAL DEPTH: 30.0  
 LOGGED BY: WHK  
 DATE: 3-24-95  
 STATIC WATER: 15.2  
 BORING ID: 0641  
 PAGE: 1

PROJECT: RFI  
 LOCATION: Marketing Tank 3

LOG OF TEST BORINGS

DEPTH	P L O T	S C A L E	S A M P L E	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAIN SIZE, ETC.)		PID (ppm)
0.0-0.9	***---***		C	start 9:15a PID calibrated with span gas 61		
	***---***	1.0	C	Sand, silty, red brown, moist, loose		
0.9-3.1	///--+///		C	Clay, silty, stiff, wet, red brown, odor, some carbonate filaments and scattered carbonate nodules		15
	///--+///		C			
	///--+///		C			
3.1-4.0	***000***	3.0	C	Sand, gravelly, red brown, loose, some gravel to 1.5", moist, hydrocarbon odor		280
	***000***		C			
4.0-5.0	///00*///	4.0	C	Clay, gravelly, some sand, red brown, wet, stiff, weak hydrocarbon odor		300
	///00*///		C			
5.0-8.5	///+////	5.0	C	Clay, red brown, stiff, wet, some carbonate filaments and occasional carbonate nodules, slightly blocky (fine), odor		150
	///+////		C			
	///+////		C			
	///+////		C			
	///+////		C			
	///+////		C			
	///+////	8.0	C			
8.5-8.7	***///***		C	Sand, clayey, loose, red brown, moist, odor		50
8.7-11.0	///--++//	9.0	C	Clay, silty, red brown, stiff, carbonate filaments and nodules, blocky (fine) slightly fissured, hydrocarbon odor		220
	///--++//		C			
	///--++//	10	C			
	///--++//		C			
11.0-13.9	***---/**	11	C	Sand, silt, clay interbeds to 1" each, red brown, wet, odor, soft/loose		300
	***---/**		C			
	***---/**		C			
	***---/**		C			
	***---/**		C			
	***---/**		C			
13.9-14.7	***//****	14	C	Sand, fine, slightly clayey, red brown/purple, saturated, odor, loose		300
14.7-15.2	///**////		C	Clay, sandy in streaks, soft, purple/red brown, wet, odor		200
15.2-17.4	***//****	15	C	Sand, clayey, water bearing, soft, hydrocarbon odor, laminar banding brown to red brown		150
	***//****		C			
	***//****		C			
	***//****		C			
	***//****	17	C			
17.4-18.4	***---***		C	Sand, fine, silty, water bearing, loose, red brown		210
	***---***	18	C			
18.4-20.0	***--//**		C	Sand, silt, clay interbedded, soft/loose, odor, wet, (not water bearing), red brown		1.0
	***--//**		C			
	***--//**		C			
20.0-21.3	*****	20	C	Sand, fine/medium, laminar, water bearing, loose, red brown		0.0
	*****		C			
	*****	21	C			
21.3-25.0	///--**//		C	Clay, silt, sand, interbedded, mainly clay, sand/silt in <1" bands, and are individually laminar banded, brown to red brown overall, not water bearing		2.0
	///--**//		C			
	///--**//		C	no odor		
	///--**//		C			

LOGGED BY: WZK

SIZE AND TYPE OF BORING: 4'-1/4" BSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6944.0  
 TOTAL DEPTH: 30.0  
 LOGGED BY: WHK  
 DATE: 3-24-95  
 STATIC WATER: 15.2  
 BORING ID: 0641  
 PAGE: 2

PROJECT: RFI  
 LOCATION: Marketing Tank 3

LOG OF TEST BORINGS

DEPTH	T	E	S A P L O L E	S A M P L E	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		PID (ppm)
	///---*///			C	continued from page 1		
	///---*///	24		C			
	///---*///			C			
25.0-28.1	///---*///	25		C	Clay, silty, wet (not water bearing), brown, stiff to firm, no odor		0.0
	///---*///			C			
	///---*///			C			
	///---*///			C			
	///---*///			C			
28.1-28.5	///***/	28		C	Clay, sandy, wet, brown, no odor, stiff		0.0
28.5-30.0	///***/			C	Clay, sandy, sand seam 1", water bearing, brown, stiff		0.0
	///***/			C			
	///***/			C			
	///***/	30		C			
TD					stop drilling for sample analysis @ 10:15a leave auger in hole lab analysis OK--abandon hole with bentonite @ 2:45p		

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6947.9  
 TOTAL DEPTH: 39.0  
 LOGGED BY: WHK  
 DATE: 3-22-95  
 STATIC WATER: 28.3  
 BORING ID: 0642  
 PAGE: 1

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	P L O T	S A C A L E	S A M P L E	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAIN SIZE, ETC.)		PID (ppm)
0.0-1.3	///---///		C	Clay, silty, sandy, brown, wet, soft	500 @ 0.3'	
	///---///	1.0	C			
1.3-2.5	////+///		C	Clay, some carbonate nodules, wet, firm, brown with white nodules		
	////+///	2.0	C			
2.5-4.0	///*---///		C	Clay, sandy, silty, soft, brown, wet		
	///*---///		C			
	///*---///		C			
4.0-4.6	****/---*	4.0	C	Sand, clayey, silty, loose, brown, wet	44 @ 4.4'	
4.6-5.4	////-////		C	Clay, slightly silty, wet, soft, brown		
	////-////	5.0	C			
5.4-8.2	///**---//		C	Clay, sandy, silty, wet, soft, brown, fine sands and silts in interbeds 1/2"-1"		
	///**---//		C			
	///**---//		C		4 @ 6.3'	
	///**---//		C			
8.2-8.9	//////////	8.0	C	Clay, firm, brown, wet		
	//////////		C			
8.9-10.0	///**---//	9.0	C	Clay, fine sandy, silty, very little sand, soft, wet, in interbeds 1/2"-1"		
	///**---//		C		33 @ 9.7'	
10.0-11.3	//////////	10	C	Clay, wet, soft, brown		
	//////////		C			
	//////////	11	C			
11.3-12.0	///-*////		C	Clay, silty, very little sand, soft, wet, brown		
12.0-12.9	****/****	12	C	Sand, fine, slightly clayey, wet, loose, dark grey, black		
	****/****		C		6 @ 12.6'	
12.9-14.0	///---///	13	C	Clay, silty, firm, wet, brown		
	///---///		C			
14.0-15.2	****/****	14	C	Sand, fine, some minor clay, moist, moderately dense		
	****/****		C		2 @ 14.7'	
	****/****	15	C			
15.2-16.7	****/****		C	Sand, clayey, wet, loose, brown		
	****/****	16	C			
16.7-17.9	///**---//		C	Clay, sandy, silty, 1/2"-1" bedding, wet, soft		
	///**---//	17	C			
	///**---//		C			
17.9-21.2	**///---*	18	C	Sand, very clayey, silty, bedding and laminations as above, wet, loose/soft		
	**///---*		C	no odor, brown		
	**///---*		C			
	**///---*		C			
	**///---*	20	C			
	**///---*		C			
21.2-22.2	///***////	21	C	Clay, sandy, fine, soft, wet, brown		
	///***////		C			
22.2-23.8	*****	22	C	Sand, fine, dense, moist, light brown to white		
	*****		C			
	*****	23	C			

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6947.9  
 TOTAL DEPTH: 39.0  
 LOGGED BY: WHK  
 DATE: 3-22-95  
 STATIC WATER: 28.3  
 BORING ID: 0642  
 PAGE: 2

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	P L O T	S C A L E	S A M P L E	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAIN SIZE, ETC.)		PID (ppm)
23.8-26.1	**000****	24	C	Sand, very gravelly, dense, light brown, moist, subrounded to rounded gravel		27 @ 25.0'
	**000****		C	no odor		
	**000****	25	C			
	**000****		C			
26.1-26.3	*****	26	C	Sandstone cobble		
26.3-27.8	***000***		C	Sand, fine gravelly, moist, dense, light brown to white		
	***000***		C			
27.8-28.1	*****		C	Sandstone cobble		7.6 @ 27.8'
28.1-31.1	***00****	28	C	Sand, medium to coarse, some gravel, dense, moist, strong odor, multicolored		
	***00****		C			
	***00****		C			
	***00****		C			
	***00****	30	C			
	***00****		C			
31.1-32.9	***00****	31	C	Sand as above--saturated with hydrocarbon product and water		>1438 @ 31.5'
	***00****		C			
	***00****		C			
32.9-36.0	***000***		C	Sand, very gravelly, very dense, strong, hydrocarbon odor, does not appear		
	***000***	33	C	saturated, angular sandstone pieces, some subrounded, wet		
	***000***		C			
	***000***		C			
	***000***		C			
	***000***	35	C			9.9 @ 35.0'
	***000***		C			
36.0-37.1	0000**000	36	C	Gravel, cobbly, sandstone blocks, water bearing, hard, brown		
	0000**000		C			
37.1-39.0	-----	37	C	Top of <u>CHINLE FORMATION</u>		
	-----		C	Shale, red brown, hard, shows some green grey banding, (green grey @ 38.4-38.9)		
	-----		C	green grey appears more sandy in general, fine blocky, damp to dry.		
	-----		C			
39.0	-----	39	C			0.0 @ 39.0'
TD				pull auger, temporary hole covered pending decision on whether to continue drilling or abandon hole clean up and decon 5:45p 50# TR30 1/2 pellets added @ 5:30p grout boring from the bottom of bore elevation to the surface with 8# bentonite (montmorillonite clay) and cement grout 03-23-95 AM. Water level 28.3' 03-23-95 AM		

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6955.4  
 TOTAL DEPTH: 45.0  
 LOGGED BY: WHK  
 DATE: 3-27-95  
 STATIC WATER: 27.9  
 BORING ID: BG3  
 PAGE: 1

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	P L O T	S C A L E	S A M P L E	MATERIAL CHARACTERISTICS		PID (ppm)
				(MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		
0.0-0.9	///---///		C	Clay, silty, wet, red brown, soft		0.0
0.9-3.0	***//OO**	1.0	C	Sand, clayey, gravelly, wet, red brown, loose, no odor		0.0
	***//OO**		C			
	***//OO**		C			
	***//OO**		C			
3.0-5.0	///---///	3.0	C	Clay, silty, wet, brown, firm, slightly laminar bedding.		0.0
	///---///		C			
	///---///		C			
	///---///		C			
5.0-5.3	***---***	5.0	C	Sand, silty, wet, brown, no odor		0.0
5.3-5.9	///---///		C	Clay, silty, wet, brown, stiff, some carbonate nodules		0.0
5.9-8.8	***OO***	6.0	C	Sand, medium, some fine gravel, moist, brown, loose, no odor, some gravel to 1.5"		0.0
	***OO***		C			
	***OO***		C			
	***OO***		C			
8.8-11.2	///**///		C	Clay, very fine sandy, wet, brown, firm, no odor		0.0
	///**///	9.0	C			
	///**///		C			
	///**///		C			
	///**///	11	C			
11.2-13.0	///---///		C	Clay, silty, sandy, wet, brown, soft, some laminar bedding, no odor		0.0
	///---///		C			
	///---///		C			
13.0-14.1	//////////	13	C	Clay, wet, brown, stiff		0.0
	//////////		C			
	//////////	14	C			
14.1-14.7	*****		C	Sand, fine, moist, brown, loose		0.0
14.7-15.0	///**///	15	C	Clay, sandy, wet, brown, soft, laminar		0.0
15.0-16.1	//////////		C	Clay, wet, brown, stiff		1.0
	//////////	16	C			
16.1-18.2	///**///		C	Clay, sandy, wet, brown, soft, laminar banding, no odor		2.0
	///**///		C			
	///**///		C			
	///**///	18	C			
18.2-19.0	///---///		C	Clay, slightly silty, wet, brown, stiff, no odor		1.0
19.0-20.4	///**///	19	C	Clay, sandy, wet, brown, soft, laminar banding, no odor		0.0
	///**///		C			
	///**///	20	C			
20.4-21.5	***---***		C	Sand, fine, slightly silty, moist, brown, loose		
	***---***	21	C			
21.5-24.2	***OOO***		C	Sand, gravelly, rounded to subrounded sandstone and silica rock, moist, light brown		
	***OOO***		C	loose to very dense		
	***OOO***		C			
	***OOO***		C			

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA



PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6954.6  
 TOTAL DEPTH: 45.0  
 LOGGED BY: WHK  
 DATE: 3-23-95  
 STATIC WATER: 35.7  
 BORING ID: BG2  
 PAGE: 1

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	P L O T	S C A L E	S A M P L E	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAIN SIZE, ETC.)		PID (ppm)
0.0-2.1	///---+//		C	Clay, silty, slightly sandy, stiff, wet, red brown		
	///---+//	1.0	C			
	///---+//		C			
2.1-6.0	///---+//	2.0	C	Clay, silty, very slightly more sandy than above (fill?), black, piece of sandstone	1100 @ 2.6'	
	///---+//		C	at 4.7'		
	///---+//		C			
	///---+//		C			
	///---+//	4.0	C		18 @ 4.7'	
	///---+//		C			
	///---+//	5.0	C			
	///---+//		C			
6.0-11.6	///+---//	6.0	C	Clay, sandy, silty, stiff, wet, red brown, some black mottling to 7', natural banding and laminations of sand and silt, blocky, scattered carbonate nodules	28 @ 6.0'	
	///+---//		C	very weak odor 11.6'		
	///+---//		C			
	///+---//		C			
	///+---//		C			
	///+---//		C			
	///+---//		C			
	///+---//	10	C		21 @ 9.0'	
	///+---//		C			
	///+---//	11	C			
11.6-12.9	///---+//		C	Clay, silty, wet, stiff, blocky, dark brown		
	///---+//	12	C			
12.9-13.8	****/---*		C	Sand, clayey, silty, wet to moist, laminar banding, slight odor, dark brown	0.0 @ 12.6'	
	****/---*	13	C			
13.8-15.0	/////////		C	Clay, brown, stiff, wet, slight odor		
	/////////	14	C			
	/////////		C			
15.0-16.7	///---+//	15	C	Clay, silty, sandy, wet, soft, brown, very thin bedded <1/4", very slight odor	0.0 @ 15.0'	
	///---+//		C			
	///---+//		C			
16.7-18.2	/////////		C	Clay, brown, wet, stiff, blocky	5 @ 16.9'	
	/////////	17	C			
	/////////		C			
	/////////	18	C			
18.2-19.4	///---+//		C	Clay, very silty, slightly sandy, soft, wet, slight odor		
	///---+//	19	C			
19.4-20.2	/////////		C	Clay, brown, wet, stiff, slightly blocky		
	/////////	20	C		2 @ 19.8'	
20.2-21.6	///---+//		C	Clay, silty, wet, soft, brown		
	///---+//	21	C		1.4 @ 21.0'	
21.6-24.5	**///---*		C	Sand, very clayey, very silty, loose, wet, brown, fine laminar banded, few cleaner zones, weak odor		
	**///---*		C			
	**///---*		C			
	**///---*		C			

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6954.6  
 TOTAL DEPTH: 45.0  
 LOGGED BY: WHK  
 DATE: 3-23-95  
 STATIC WATER: 35.7  
 BORING ID: BG2  
 PAGE: 2

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	P L O T	S C A L E	S A M P L E	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		PID (pdm)
	****/----		C	continued from page 1		25 @ 24.0'
24.5-26.1	****/----	24	C	Clay, slightly sandy, stiff, brown, wet, weak odor		
26.1-27.4	****/----	25	C			
26.1-27.4	*****	26	C	Sand, fine, loose, moist, brown		1 @ 26.8'
27.4-30.0	*****	27	C			
27.4-30.0	*****	28	C	Clay, very sandy, wet, soft, brown, laminar banded, weak odor		8 @ 28.0'
30.0-30.9	*****	29	C			
30.0-30.9	*****	30	C	Clay, sandy, soft, wet, brown, slight odor		0.0
30.9-32.5	*****	31	C	Sand, slightly clayey, loose, moist, brown, slight odor		
32.5-34.1	*****	32	C			
32.5-34.1	***000***		C	Sand, gravelly, dense, slight odor, moist, grey brown		7.0
34.1-35.6	***000***		C			
34.1-35.6	**0000***	34	C	Sand, gravelly, cobbly, moist, dense, slight odor, multicolored, cobbles		12.0
35.6-37.2	**0000***	35	C	sandstone (white), subrounded to rounded silica gravel		
35.6-37.2	****00***		C	Sand, coarse, fine gravelly, grey to multicolored, saturated with fluid		>1438 @ 37.0
37.2-38.5	****00***	36	C	gasoline odor strong		
37.2-38.5	****00***	37	C			
37.2-38.5	000000000		C	Gravel, cobbly, sandstone blocks, very dense, white to multicolored		>1438
38.5-40.0	000000000	38	C	wet (not saturated)		
38.5-40.0	****00***		C	Sand, fine, slightly gravelly, water bearing, grey, strong hydrocarbon odor		
40.0-41.3	****00***		C	very loose		
40.0-41.3	****00***	40	C			
41.3-42.4	****00***	41	C			
41.3-42.4	000***000		C	Gravel, fine, sandy, dense, water bearing, strong odor, grey.		2000
42.4-43.2	000***000	42	C			2000
42.4-43.2	000***000	43	C	as above but brown		
43.2-45.0	000***000	43	C			
43.2-45.0	-----		C	CHINLE FORMATION		30
	-----		C	Shale, weathered in-situ, some green mottling, fine blocky, moist		
	-----		C	very slight odor		
TD	-----	45	C			
				Water level after 2 hours 35.7'. Grouted hole closed from bottom to surface.		
				1/8" of amber colored product observed on water surface prior to grouting.		

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6943.7  
 TOTAL DEPTH: 48.5  
 LOGGED BY: WHK  
 DATE: 3-28-95  
 STATIC WATER: 28.0  
 BORING ID: BG4  
 PAGE: 1

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	P L O T	S C A L E	S A M P L E	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)	PID (ppm)
0.0-0.3	*****		C	Sand, fine, dry, brown, loose	
0.3-0.4	xxxxxxxx	1.0	C	Asphalt Cement Concrete	11.0
0.4-5.0	///***/		C	Clay, sandy, wet, brown, firm, (fill), odor below 3.9', water saturated @ 4.8'	>1438
	///***/		C	bottom of fill is at 4.8'	
	///***/		C		
	///***/		C		
	///***/		C		
	///***/		C		
5.0-11.8	///--+/	5.0	C	Clay, silty, blocky, wet, brown, firm, scattered carbonate filaments, some nodules, native, no odor, redder >10'	0.0
	///--+/		C		
	///--+/		C		
	///--+/		C		
	///--+/		C		
	///--+/		C		
	///--+/		C		
	///--+/		C		
	///--+/		C		
	///--+/	11	C		
	///--+/		C		
11.8-13.0	///***/	12	C	Clay, sandy, very fine, wet, red brown to brown, soft	0.0
	///***/		C		
13.0-14.1	///+*/	13	C	Clay, stiff, fissured, wet, brown, some carbonate nodules	0.0
	///+*/		C		
14.1-14.6	*****	14	C	Sand, fine, clean, damp, white, loose	0.0
14.6-15.0	///***/		C	Clay, sandy, slightly gravelly, wet, brown, very stiff to hard	0.0
15.0-16.9	///***/	15	C	Clay, very fine sandy, laminar bedded, wet, brown, soft	0.0
	///***/		C		
	///***/		C		
	///***/		C		
16.9-18.1	///***/	17	C	Clay, very fine sandy, slightly less than above, slightly blocky, wet, brown, firm	0.0
	///***/		C		
	///***/	18	C		
18.1-19.8	****/		C	Sand, some clay, sandy in bands, moist to wet, brown, moderately dense to soft	0.0
	****/		C	interbedded with finer soil	
19.8-21.3	000**000		C	Gravel, sandy, moist, light grey to white, dense, subrounded	0.0
	000**000	20	C		
	000**000		C		
	000**000	21	C		
21.3-21.8	///***/		C	Clay, sandy, wet, brown, soft	
21.8-25.5	000**000	22	C	Gravel, slightly sandy, some clay as binder, moist, grey to brown, dense	
	000**000		C	odor @ 24.4'	20 @ 22.5'
	000**000		C		

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6943.7  
 TOTAL DEPTH: 48.5  
 LOGGED BY: WHK  
 DATE: 3-28-95  
 STATIC WATER: 28.0  
 BORING ID: BG4  
 PAGE: 2

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	P L O T	S C A L E	S A M P L E	MATERIAL CHARACTERISTICS		PID (ppm)
				(MOISTURE, CONDITION, COLOR, GRAIN SIZE, ETC.)		
	000**/000		C	continued from page 1		
	000**/000	24	C			
	000**/000		C			160 @ 24.4'
	000**/000	25	C			
25.5-29.4	*****		C	<u>Sand</u> , fine, clean of silt and clay, moist, brown, loose		45.0
	*****	26	C			
	*****		C			
	*****		C			
	*****		C			
	*****		C			
	*****	29	C			
29.4-30.5	*****		C	<u>Sand</u> as above but <u>very weakly water bearing @ 29.4'</u> , grey to black, strong odor		1100
	*****	30	C			
30.5-31.2	///****		C	<u>Clay</u> , sandy, wet, brown, soft, odor		770
	///****	31	C			
31.2-34.0	///+///		C	<u>Clay</u> , blocky, wet, very stiff, numerous carbonate filaments, brown, slightly fissured, odor		770
	///+///		C			
	///+///		C			
	///+///		C			
	///+///		C			
34.0-35.0	***-----	34	C	<u>Sand</u> , silty, very fine, does not appear water bearing, but sample covered with water from above, very dark brown to black, soft, strong odor		700
	***-----		C			
35.0-37.3	***//***	35	C	<u>Sand</u> , very fine, clayey, <u>saturated, water bearing zones--2" thick</u> , gradational to clay below, brown, strong odor		1000
	***//***		C			
	***//***		C			
	***//***		C			
	***//***	37	C			
37.3-39.2	///+///		C	<u>Clay</u> , wet, brown, stiff, carbonate filaments, soft to firm, not blocky or fissured		320
	///+///		C			
	///+///		C			
	///+///	39	C			
39.2-40.9	000**/000		C	<u>Gravel</u> , sandy, slightly clayey, <u>water bearing</u> , brown, dense, rounded to subrounded		800
	000**/000		C	odor		
	000**/000		C			
40.9-45.0	-----*	41	C	<u>CHINLE FORMATION</u>		
	-----*		C	<u>Shale</u> , slightly sandy, fissle, fissured, slightly blocky, moist, red brown, hard		2.0
	-----*		C	some grey green banding, no odor		
	-----*		C			
	-----*		C			
	-----*		C			
	-----*		C			
45.0-48.5	-----*	45	C	<u>Shale</u> , sandy, fissle, moist to damp, hard, water from above runs into fissle		
	-----*		C	partings (dry on interior of sample) difficult to obtain uncontaminated sample		
	-----*		C	dark red brown, suspect samples taken may be contaminated by water from above		

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6943.7  
 TOTAL DEPTH: 48.5  
 LOGGED BY: WHK  
 DATE: 3-28-95  
 STATIC WATER: 28'-7"  
 BORING ID: BG4  
 PAGE: 3

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	T	E	E	MATERIAL CHARACTERISTICS		PID (ppm)
				(MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		
	-----**-----		C	continued from page 2		
	-----**-----	47	C			23 @ 47.0'
	-----**-----		C			
	-----**-----	48	C			
	-----**-----		C			12 @ 48.5'
TD				stop drilling 11:05a water @ 18.8' @ 11:30a -- 8" of hydrocarbon on water @ 2:00p water level @ 28'-7" completed 4" well, screened from 25' to 40' (see attached completion diagram)		

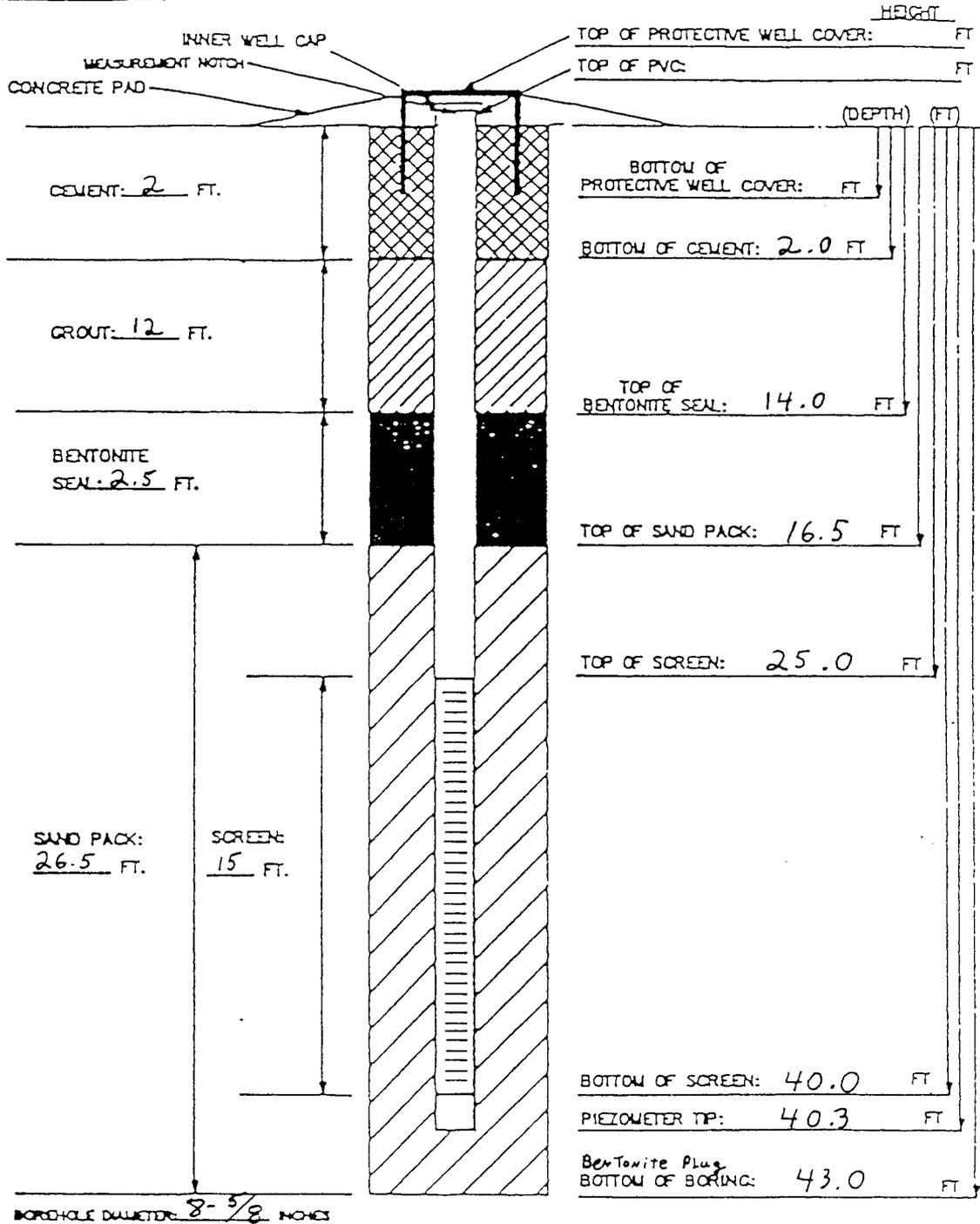
LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

INSTALLATION DATE: 032895

INSTALLATION DIAGRAM  
MONITORING WELL NO.

B6-4



MATERIALS USED:

SAND TYPE AND QUANTITY: 20-40  
 BENTONITE PELLETS (5-GALLON BUCKETS): 1  
 BAGS OF GROUT: 1  
 AMOUNT OF CEMENT: 8-94# Bags + 75# Gel  
 AMOUNT OF WATER USED: 8 gal  
 OTHER:

Bottom Cap Used? YES  
 Screen Lengths: 15'  
 Risers Used: 30'  
 Top Cap Used? \_\_\_\_\_  
 Well Size: 4" Dia.

J-Plug Used? YES  
 Flush Mount Vault \_\_\_\_\_  
 Above Ground Vault YES  
 Bollards, No. & Size: \_\_\_\_\_

TASK: TANK 569

GEOLOGIST/ENGINEER: W H K

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6918.6  
 TOTAL DEPTH: 50.0  
 LOGGED BY: WHK  
 DATE: 3-30-95  
 STATIC WATER: 28.0  
 BORING ID: B1  
 PAGE: 1

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	T	E	S	A	M	P	L	A	P	O	L	L	MATERIAL CHARACTERISTICS		PID
													(MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		
0.0-1.2	****//	****	C										Sand, clayey, damp, brown, soft/loose, some fine gravel	0.0	
1.2-5.0	///**--//	///**--//	C										Clay, sandy, silty, moist to wet, brown, stiff, some root fibers in upper 3'	0.0	
	///**--//	///**--//	C										no odor		
	///**--//	///**--//	C												
	///**--//	///**--//	C												
	///**--//	///**--//	C												
	///**--//	///**--//	C												
5.0-8.8	///---//	///---//	C										Clay, silty, moist, brown, hard, scattered root fibers	0.0	
	///---//	///---//	C												
	///---//	///---//	C												
	///---//	///---//	C												
	///---//	///---//	C												
	///---//	///---//	C												
8.8-9.1	ooo//ooo	ooo//ooo	C										Gravel, fine, clayey, damp, brown, dense, silica gravel to 1/2", no odor	0.0	
9.1-10.0	///**//	///**//	C										Clay, sandy, damp, brown, hard, some root matter, no odor	0.0	
	///**//	///**//	C												
10.0-12.4	////////	////////	C										Clay, blocky, moist to wet, brown, hard, root matter, gradational above and below	0.0	
	////////	////////	C												
	////////	////////	C												
	////////	////////	C												
	////////	////////	C												
	////////	////////	C												
12.4-16.4	///---//	///---//	C										Clay, silty, sandy, sandier @ 14' but gradational, moist to wet, brown, stiff to hard, does not appear weathered in-situ, slightly fissured, pieces (2-3 mm) of clay in sandy matrix, root matter	0.0	
	///---//	///---//	C												
	///---//	///---//	C												
	///---//	///---//	C												
	///---//	///---//	C												
	///---//	///---//	C												
	///---//	///---//	C												
16.4-16.7	*****	*****	C										Sand, fine, moist, red brown, loose	0.0	
16.7-17.4	///**//	///**//	C										Clay, sandy, wet, brown, very stiff	0.0	
17.4-22.9	///+//	///+//	C										Clay, slightly fissured but not as much as above, some 4" slightly sandy zones	0.0	
	///+//	///+//	C										some carbonate nodules, wet, dark brown, hard		
	///+//	///+//	C												
	///+//	///+//	C												
	///+//	///+//	C												
	///+//	///+//	C												
	///+//	///+//	C												
	///+//	///+//	C												
22.9-30.0	///**+//	///**+//	C										Clay, slightly sandy, some carbonate filaments, occasional individual coarse sand grains of silica rock, wet, dark brown, soft, no odor, free water on tip of sample	0.0	
	///**+//	///**+//	C										but not in samples		
	///**+//	///**+//	C												

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6918.6  
 TOTAL DEPTH: 50.0  
 LOGGED BY: WHK  
 DATE: 3-30-95  
 STATIC WATER: 28.0  
 BORING ID: B1  
 PAGE: 2

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	S A M P L E S	S A M P L E S	S A M P L E S	S A M P L E S	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		PID (DDM)
					T E E	E E	
						continued from page 1	
				24			
30.0-32.5	***O****	30	C			<u>Sand</u> , slightly clayey, occasional pebbles, <u>weakly water bearing</u> , brown, very soft/loose	0.0
	***O****		C				
	***O****		C				
	***O****		C				
	***O****	32	C				
32.5-39.5	///----//		C			<u>Clay</u> , silty, some carbonate filaments and staining, more carbonate filaments below 32', wet, saturated but not water bearing, light brown, soft to firm	0.0
	///----//		C				
	///----//		C				
	///----//		C				
	///----//		C				
	///----//		C				
	///----//		C				
	///----//		C				
	///----//		C				
	///----//		C				
	///----//	39	C				
39.5-41.1	///OOO///		C			<u>Clay</u> , gravelly, wet, saturated but not water bearing, light brown, soft	0.0
	///OOO///		C				
	///OOO///		C				
	///OOO///	41	C				
41.1-47.1	***OO****		C			<u>Sand</u> , coarse, fine to medium gravelly, <u>water bearing</u> , brown, dense, subrounded to rounded silica rock, some sandstone pieces	0.0
	***OO****		C				
	***OO****		C				
	***OO****		C				
	***OO****		C				
	***OO****		C				
	***OO****		C				
	***OO****		C				
	***OO****		C				
	***OO****		C				
	***OO****		C				

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6918.6  
 TOTAL DEPTH: 50.0  
 LOGGED BY: WHK  
 DATE: 3-30-95  
 STATIC WATER: 28.0  
 BORING ID: B1  
 PAGE: 3

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	T	E	L	A	P	C	M	S	A	MATERIAL CHARACTERISTICS		
										(MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)	PID (ppm)	
	***000***									C	continued from page 2	
	***000***	47								C		
47.1-50.0	-----									C	<u>CHINLE FORMATION</u>	
	-----									C	Shale, some green mottling, fissle, moist, hard, slightly blocky, no odor	0.0
	-----									C		
	-----									C		
	-----	50								C		
TD											end 11:00a -- depth to water @ 12:15p 28.0' grout hole with bentonite/cement/8% grout to surface time end 1:15p -- water depth affected by hole collapse	

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA



PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6927.3  
 TOTAL DEPTH: 38.0  
 LOGGED BY: WHK  
 DATE: 3-29-95  
 STATIC WATER: 24'-3"  
 BORING ID: B2  
 PAGE: 2

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	P L O T	S C A L E	S A M P L E	MATERIAL CHARACTERISTICS		PID (ppm)
				(MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		
23.6-24.2	***00****		C	Sand, coarse, some fine gravel, saturated but does not appear water bearing, brown dense, hydrocarbon odor		1000
24.2-25.5	//////////		C	Clay, wet, not water bearing, brown, stiff, hydrocarbon odor		1060
25.5-27.1	***//***		C	Sand, clayey, water bearing, brown, odor		610
27.1-28.5	//////////	27	C	Clay, some sand @ 28'-28.5', wet, brown, soft, slightly blocky, hydrocarbon odor saturated but not water bearing		
28.5-30.9	///**//		C	Clay, sandy, some laminations, wet, brown, stiff		60
30.9-32.9	000**0000	31	C	Gravel, some sand, silica rock, water bearing, brown, dense, rounded to subrounded		1030
32.9-35.0	-----	33	C	CHINLE FORMATION Shale, weathered, wet to moist, some green mottling, red brown overall, stiff weak odor		20
35.0-38.0	-----	35	C	Shale, as above, slightly more sand, blocky, dark red brown, wet to moist suspect contamination by water flowing from gravel above--gravel produces more water at this location than previous drilling		57
TD				stop drilling 11:25a completed 4" well - see attached well completion diagram 24'-3" to water 2" product on water		

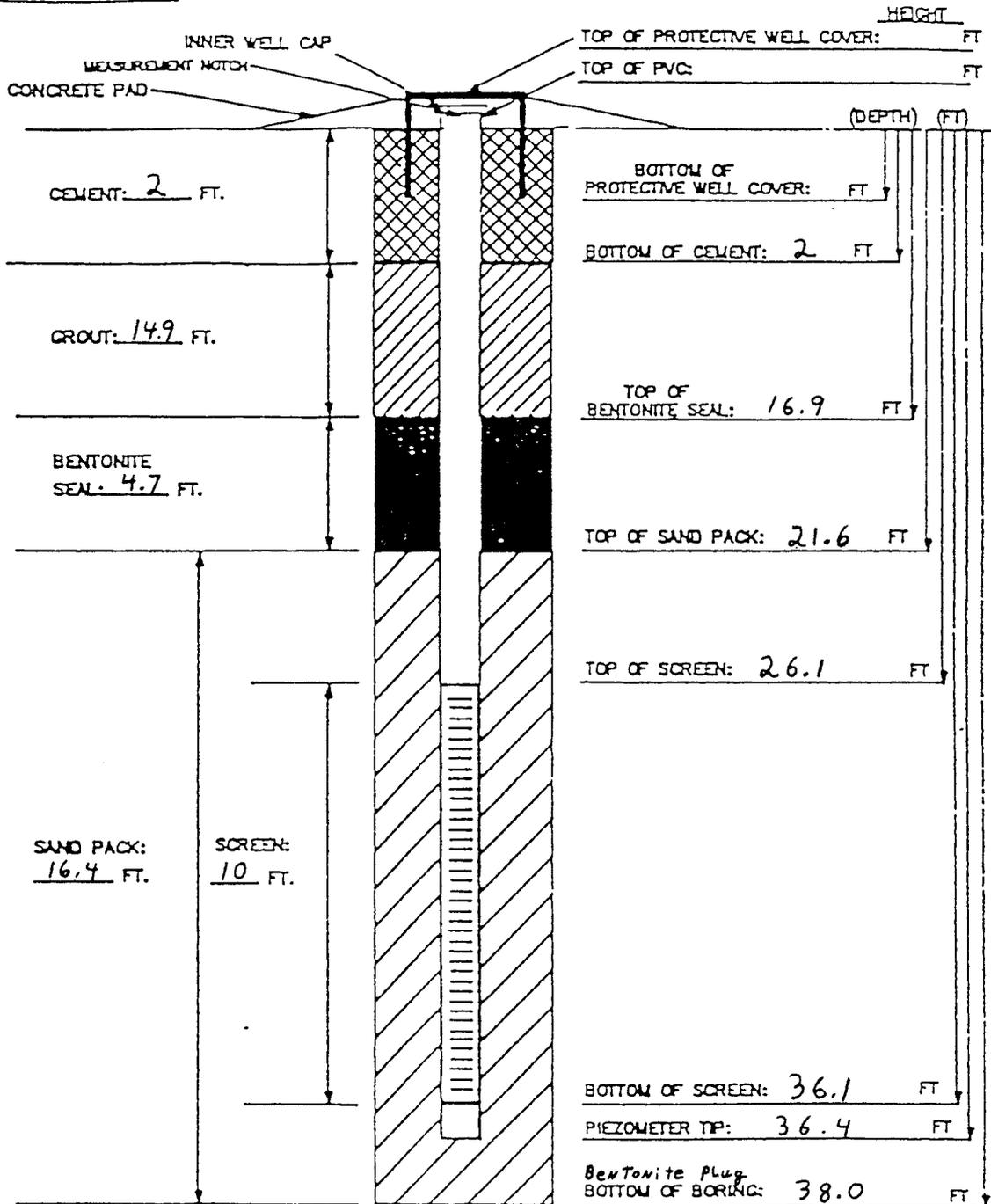
LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

INSTALLATION DATE: 032995

INSTALLATION DIAGRAM  
MONITORING WELL NO.

B-2



BORING DIAMETER: 8 1/2 INCHES

**MATERIALS USED:**  
 SAND TYPE AND QUANTITY: 20-40  
 BENTONITE PELLETS (5-GALLON BUCKETS): 2  
 BAGS OF GROUT:             
 AMOUNT OF CEMENT: 8-94# Bags + 75#  
 AMOUNT OF WATER USED: 8 Gal  
 OTHER:           

Bottom Cap Used? YES  
 Screen Lengths: 10'  
 Riser Used: 30'  
 Top Cap Used?             
 Well Size: 4" Dia.

J-Plug Used? YES  
 Flush Mount Vault             
 Above Ground Vault YES  
 Bollards, No. & Size:           

TASK: Tank 569      GEOLOGIST/ENGINEER: WHK

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6917.6  
 TOTAL DEPTH: 30.0  
 LOGGED BY: WHK  
 DATE: 3-30-95  
 STATIC WATER: 22.3  
 BORING ID: B3  
 PAGE: 1

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	P L O T	S C A L E	S A M P L E	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		PID (ppm)
0.0-1.3	///+*OO//		C	Clay, sandy, gravelly, wet, brown, soft, no odor	0.0	
1.3-2.7	///+*OO//	1.0	C	Clay, fine sandy, wet, brown to red brown, soft, no odor	0.0	
2.7-5.0	///+*OO//	2.0	C	Clay, wet, very soft, some root matter	0.0	
	///+*OO//	3.0	C			
	///+*OO//		C			
	///+*OO//		C			
5.0-8.4	///+*OO//	5.0	C	Clay, wet, dark brown, stiff, no odor, some root matter	0.0	
	///+*OO//		C			
	///+*OO//		C			
	///+*OO//		C			
	///+*OO//		C			
	///+*OO//	8.0	C			
8.4-10.3	///+*OO//	9.0	C	Clay, carbonate filaments common, some carbonate nodules scattered, wet, stiff red brown, no odor	0.0	
	///+*OO//		C			
	///+*OO//		C			
	///+*OO//	10	C			
10.3-10.6	///OOO//		C	Clay, gravelly, wet, red brown, stiff, no odor	0.0	
10.6-12.9	///+*OO//	11	C	Clay, fine sandy, silty, wet, light red brown, firm, no odor, scattered fine gravel, some root matter, some carbonate filaments, slightly blocky	0.0	
	///+*OO//		C			
	///+*OO//		C			
12.9-14.1	///+*OO//	13	C	Clay, slightly sandy, carbonate filaments abundant, wet, brown, firm, carbonate filaments stain sample, white CCI2, no odor, root matter abundant	0.0	
	///+*OO//		C			
	///+*OO//		C			
14.1-14.4	*****	14	C	Sand, fine, moist, light brown, loose, no odor	0.0	
14.4-15.3	///+*OO//		C	Clay as at 12.9'-14.1' but slightly more fine sand, no odor	0.0	
	///+*OO//	15	C			
15.3-16.7	///+*OO//		C	Sand, fine, slightly clayey, moist to wet, brown, loose, no odor	0.0	
	///+*OO//	16	C			
16.7-18.3	///+*OO//		C	Clay, fine sandy in laminations, wet, dull brown, soft, root matter common, no odor	0.0	
	///+*OO//	17	C			
	///+*OO//		C			
	///+*OO//	18	C			
18.3-18.9	///+*OO//		C	Clay, blocky, slabby, wet, dull brown, firm, no odor	0.0	
18.9-20.0	///+*OO//	19	C	Clay, very sandy, wet, brown, soft	0.0	
	///+*OO//		C			
20.0-24.4	///+*OO//	20	C	Sand, very gravelly, rounded to subrounded silica rock, some sandstone white, some odor in upper 5", stained black to dark grey, water bearing, dense, multicolored red brown matrix	5 (upper 6")	
	///+*OO//		C			
	///+*OO//		C			
	///+*OO//		C			
	///+*OO//		C			
	///+*OO//		C			

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

PRECISION ENGINEERING, INC.

FILE #: 95-018  
 ELEVATION: 6917.6  
 TOTAL DEPTH: 30.0  
 LOGGED BY: WHK  
 DATE: 3-30-95  
 STATIC WATER: 22.3  
 BORING ID: B3  
 PAGE: 2

PROJECT: Tank 569  
 LOCATION: See Boring Plan

LOG OF TEST BORINGS

DEPTH	T	E	S A M P L E S	MATERIAL CHARACTERISTICS		PID (DDM)
				(MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)		
	***OOO***		C			
	***OOO***	24	C			
24.4-25.0	-----		C	<u>CHINLE FORMATION</u>		
	-----	25	C	Shale, very sandy, weathered, grey, green, no odor, hard		0.0
25.0-30.0	-----		C	Shale, sandy, fissle, some green grey streaks, moist, hard		0.0
	-----		C			
	-----		C			
	-----		C			
	-----		C			
	-----		C			
	-----		C			
	-----		C			
	-----		C			
	-----		C			
	-----	30	C			
TD				stop drilling @ 4:05p water @ 4:20p -- 22.3' grout to surface with bentonite/cement		

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4'-1/4" HSA

REVISION NO. 0

FILE NAME J4679\F04-001.DWG

DATE 12/21/92

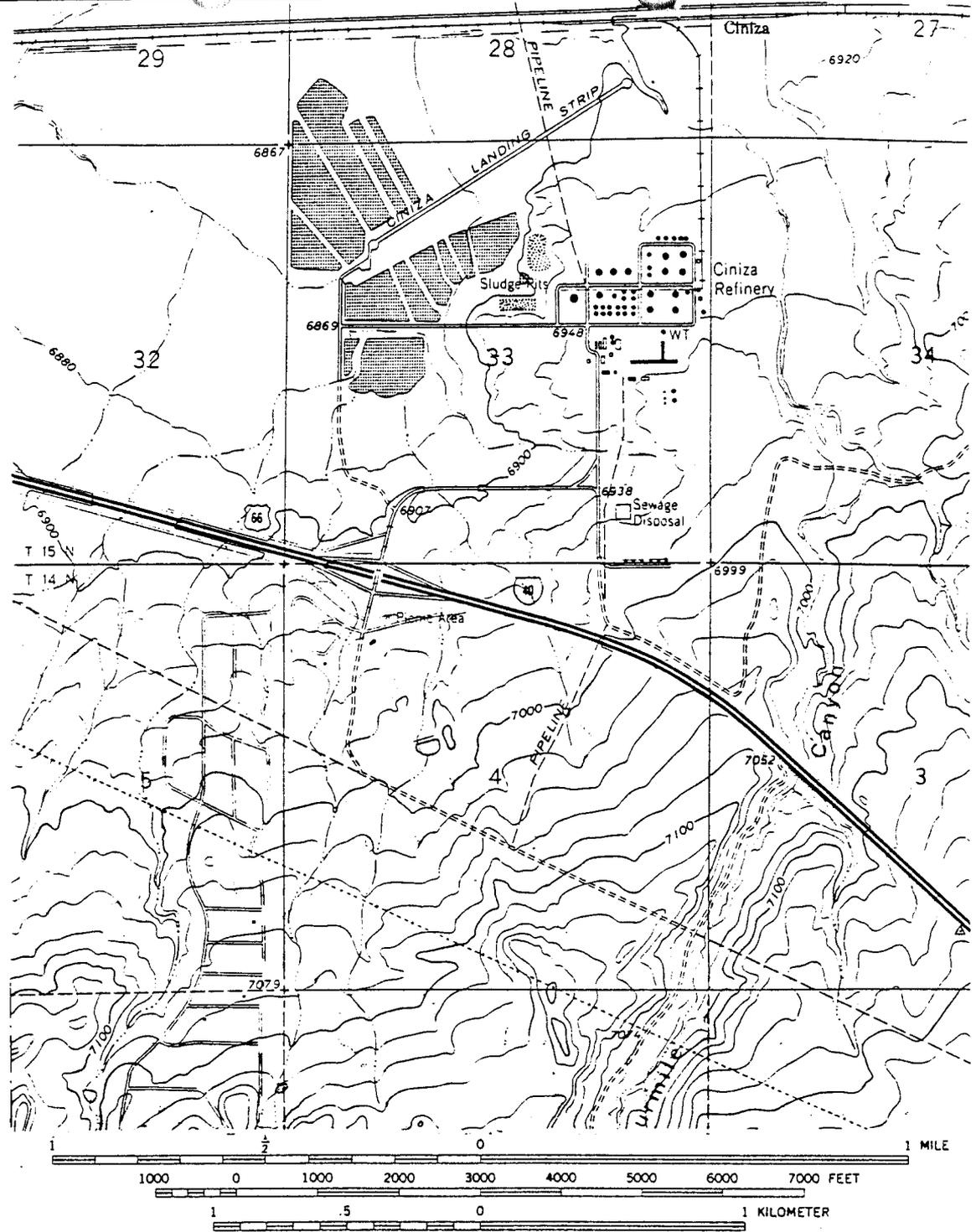
DRAWN BY EMH

APPROVED BY

CHECKED BY



Gallup  
17 miles



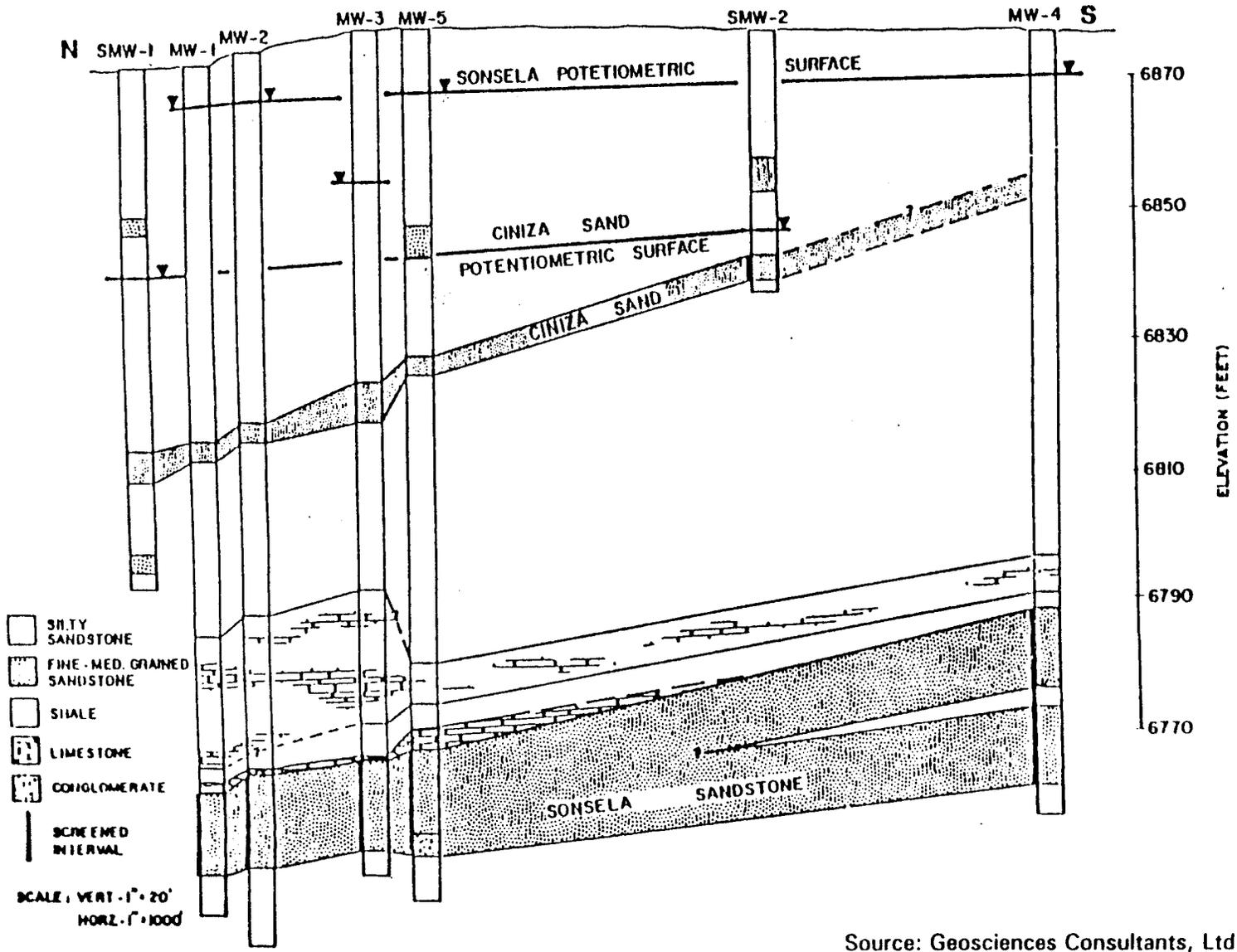
CINIZA QUADRANGLE  
 NEW MEXICO-MCKINLEY CO.  
 7.5 MINUTE SERIES (TOPOGRAPHIC)



FIGURE 1  
 LOCATION MAP

CINIZA REFINERY  
 GIANT REFINING COMPANY  
 GALLUP, NEW MEXICO



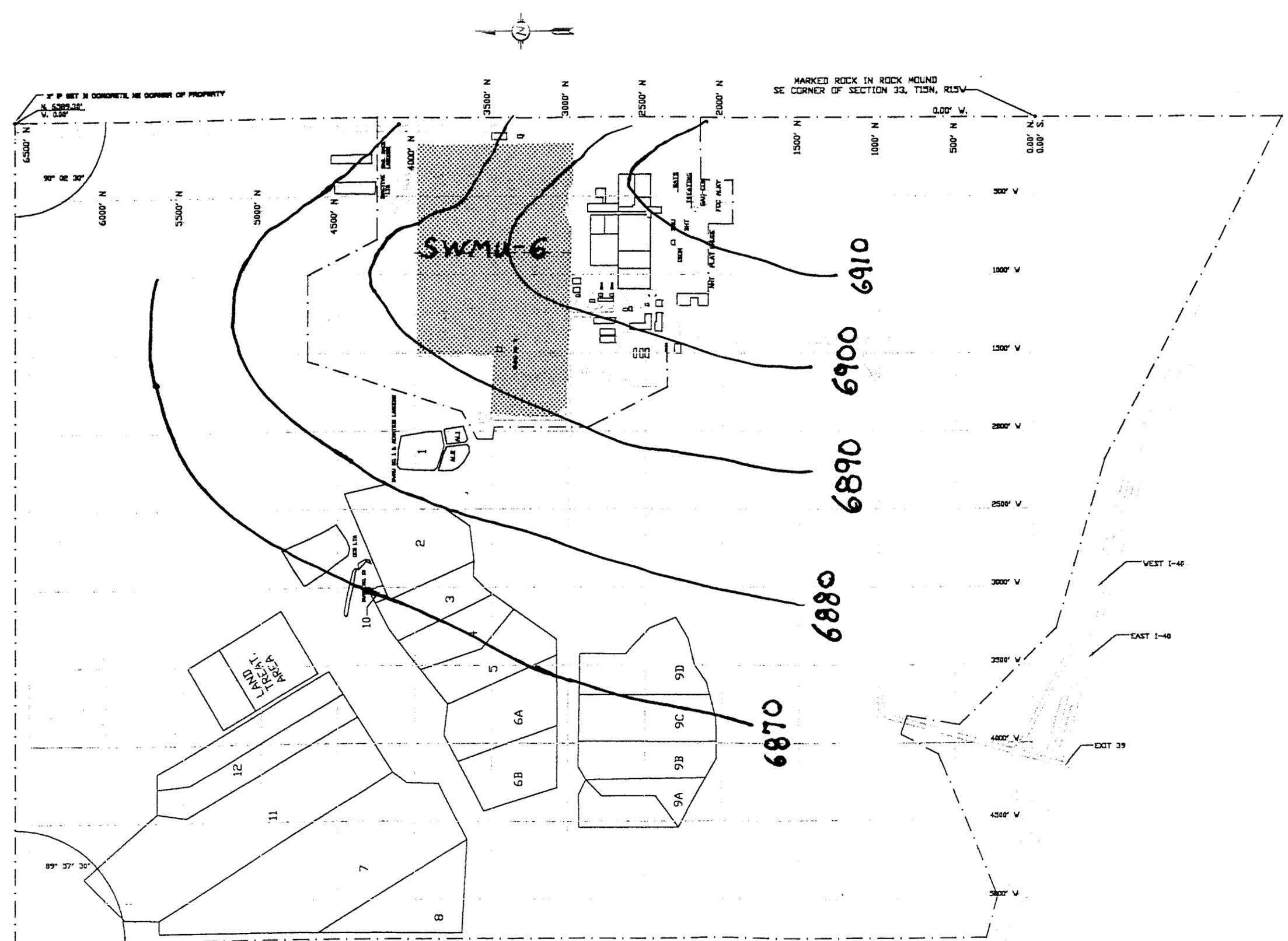


Source: Geosciences Consultants, Ltd. 1986



FIGURE 2  
GEOLOGIC CROSS SECTION

CINIZA REFINERY  
GIANT REFINING COMPANY  
GALLUP, NEW MEXICO



POTENTIOMETRIC SURFACE (SONSEIA AQUIFER)

FIGURE 3

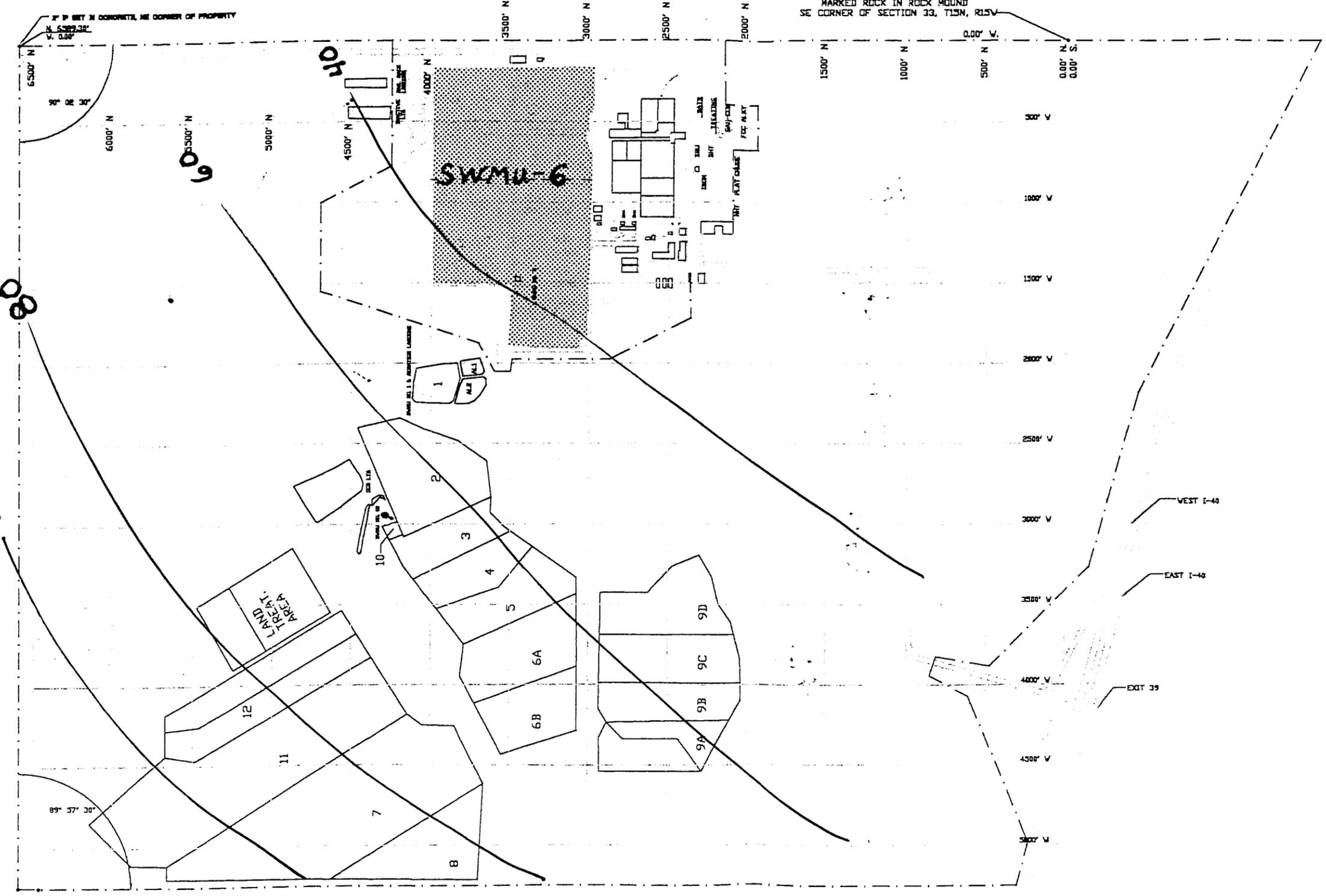
CINIZA REFINERY **GIANT** GALLUP NEW MEXICO  
 REFINING CO.  
 A DIVISION OF GIANT INDUSTRIES

MASTER PLOT PLAN

SCALE	1"=300'	APR/VN	
DATE	9-1-94	APR/VN	
DRN	SPS	DRS	300MS
CHK'D	DWG. NO. 7-02-146	REV.	1



MARKED ROCK IN ROCK MOUND  
SE CORNER OF SECTION 33, T15N, R15W



001  
002  
003

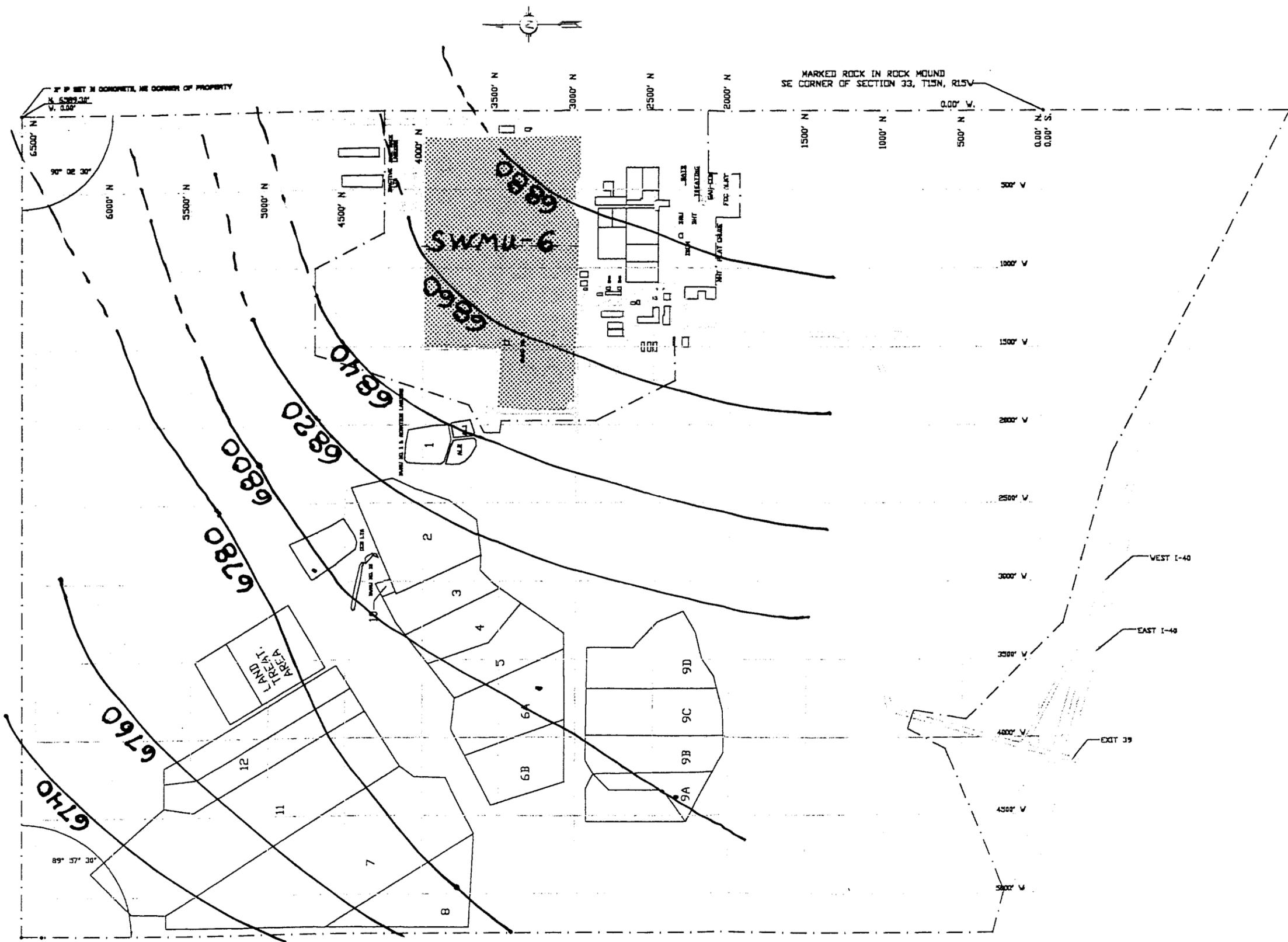
ARTESIAN HEAD OF THE SONSELA AQUIFER

### FIGURE 4

CINIZA GALLUP  
REFINERY **GIANT** NEW MEXICO  
REFINING CO.  
A DIVISION OF GIANT INDUSTRIES

#### MASTER PLOT PLAN

SCALE	1"=300'	APRV'D	
DATE	9-1-94	APRV'D	
DRN	SPS	IPS	300MS
CHK'D	DRG NO. 7-02-146	REV	1



STRUCTURE CONTOUR MAP TOP OF SONSEIA SANDSTONE

# FIGURE 5

CINIZA REFINERY **GIANT** GALLUP NEW MEXICO  
 REFINING CO.  
 A DIVISION OF GIANT INDUSTRIES

## MASTER PLOT PLAN

SCALE	1"=300'	APPROV'D	
DATE	9-1-94	APPROV'D	
DRN.	SPS	IPS	300MS
CHK'D.	DWG. NO. 7-02-146	REV.	1

DATE	DESCRIPTION	BY	APPROV'D