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GEOLOGICAL SURVEY
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PETROLEUM VAPOR PROBLEM
AT MILLER, SOUTH DAKOTA

by

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INTRODUCTION

During the past several years, the City of Miller has experienced intermittent petroleum vapors in the basements of several houses, the basement of the High School, in the Hand County Library, and in the sanitary sewer system. In April, 1985, explosive levels of combustible gases were measured by the Deputy State Fire Marshall in a residential basement on the north side of town. Subsequently, the City requested assistance and entered into a contract with the South Dakota Geological Survey to conduct a study to determine the origin and/or occurrence of the petroleum vapors.

The study was financed by the South Dakota Geological Survey and the City of Miller. The tremendous cooperation and assistance afforded by city officials and service station owners during the course of the investigation are gratefully acknowledged. Their assistance was invaluable to the successful completion of the study. Special thanks to Mayor Sisk, City Auditor Dave Blachford, Deputy State Fire Marshall Art Manning, Assistant City Fire Chief Keith Stobb, Utility and Water Department personnel Merle Dirksen, Don Holley, and Cliff Peterson, and all the service stations owners.

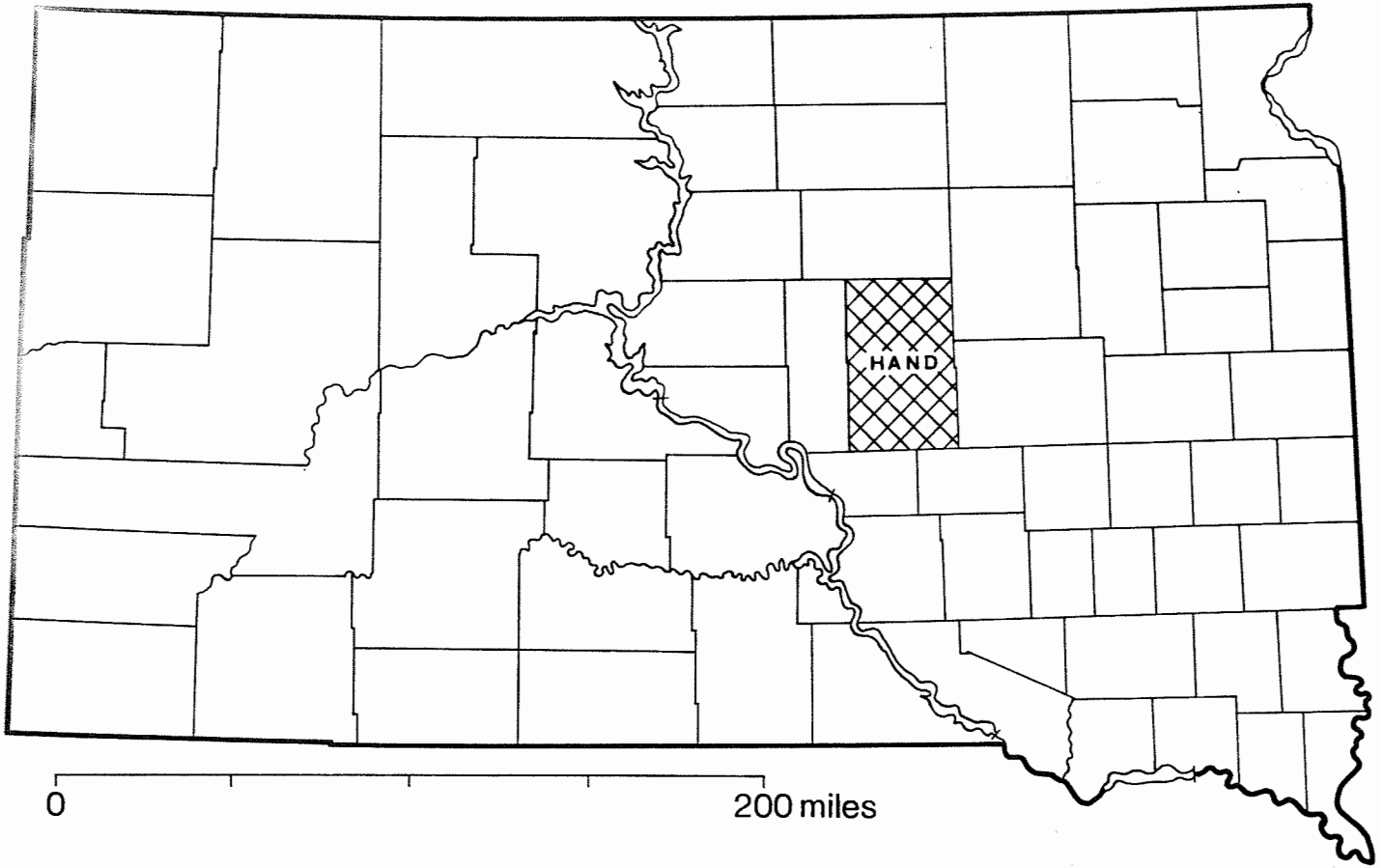
The study began on April 22, 1985. Fifteen potential sources of contamination were identified and 35 test holes were drilled around the potential sources. Observation wells were installed in 32 of the test holes. Water levels were measured on five separate occasions and water samples were collected for volatile hydrocarbon analysis from the 32 observation wells, a private observation well, and 17 sanitary sewer manholes. Reference petroleum samples were collected from the active service stations for identification. The basement of houses and sanitary sewer manholes were monitored for the presence of combustible gases.

This report contains the findings, conclusions, and recommendations of the investigation.

GEOLOGY

The City of Miller (fig. 1) is underlain by approximately 250 to 300 feet of late Wisconsin age (7,000 to 25,000 years before present) glacial drift (Hedges and others, 1982). Glacial drift is defined as all rock material transported and deposited by glacial processes. There are two types of drift in the Miller area, till and outwash. Till is deposited directly from glacial ice and consists of poorly-sorted sediments ranging in size from clay to boulders. Outwash is deposited by meltwater streams from the ice and consists mainly of sand and gravel with minor amounts of silt and clay (Flint, 1971).

Till typically transmits water very slowly and hence does not make a good aquifer. Outwash, on the other hand, usually transmits water readily and typically does make a good aquifer. An



0 30 miles

0 1 mile

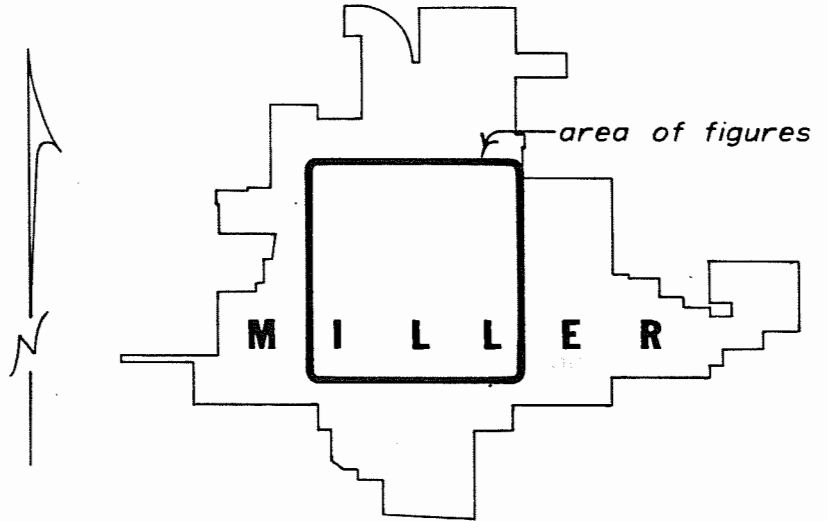
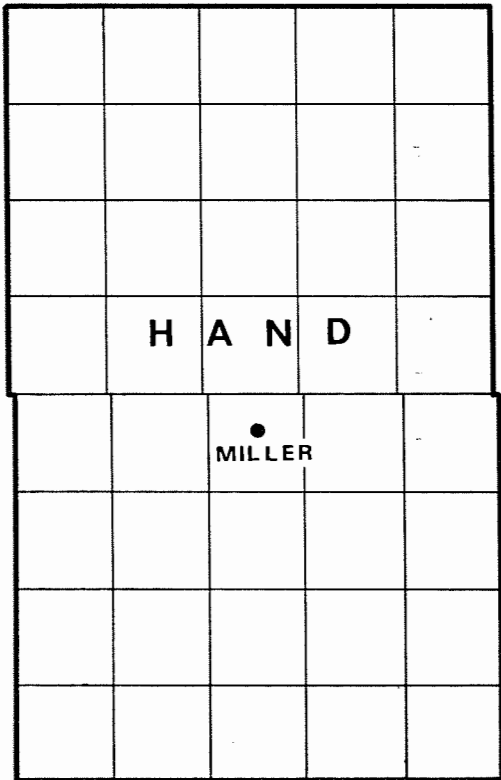


Figure 1. Location of study area.

outwash deposit called the Tulare Aquifer is present beneath the City of Miller and ranges in saturated thickness from 6 to 25 feet. The top of the aquifer is located at depths ranging from 134 to 157 feet. Several isolated sand and gravel lenses also occur at shallower depths (in the 50- to 70-foot range) but apparently are very limited in areal extent (Rothrock, 1941; Christensen, 1962; Koch, 1980).

The bedrock units occurring beneath the glacial drift in descending order include the Pierre Shale, Niobrara Formation, Carlile Shale, Greenhorn Limestone, Graneros Shale, and the Dakota Formation, followed by the Precambrian basement complex.

INITIAL ASSESSMENT

The initial step was to determine the immediate threat to life and property imposed by the reported explosive levels of combustible gases. A total of seven houses and buildings (table 1, fig. 2) had reported petroleum vapor problems for the past several years. Vapors were also reported in the main line of the sanitary sewer system underlying Broadway. The residences, buildings, and sanitary sewer system manholes were tested with a combustible-gas indicator on several different occasions during the investigation. Explosive levels of combustible gases were never found. However, prior to the inspection with the combustible gas indicator, the main stem of the sanitary sewer system under Broadway had been cleaned as a result of regularly scheduled maintenance. This probably reduced the levels of combustible gases that were present in the sanitary sewer system.

Having found no immediate threat to life or property as a result of combustible gases, a systematic program to identify the affected areas and locate the potential sources of contamination was begun. An inventory of potential sources identified 15 current and past service station locations (table 2, fig. 2). Service station owners acknowledged losses of petroleum product at several locations. Niederauer Northside (north Standard) reported a loss of 4,000 to 5,000 gallons of Amoco regular (leaded) from a leaky tank around 1970. The leaky tank was replaced but none of the gasoline was recovered. Niederauer Oil and Gas Company (south Standard) replaced a leaky tank in the fall of 1984; however, the amount of loss was not known. Hargens APCO Station replaced both its tanks 7 to 10 years ago but no losses were reported. No losses were reported by other service station owners in Miller.

Since the shallowest glacial aquifer occurs at a depth of 50 to 70 feet below the land surface, there was no apparent danger of shallow well contamination. The city wells are located outside the problem area and are developed in the Dakota Formation at depths of approximately 1,200 feet. As a result, there was no apparent threat to the city water supply. Therefore, the greatest potential threat was from petroleum vapors in the area.

TABLE 1

Reported petroleum vapor problems in buildings

Map Location Number *	Building Affected	Area of Building Affected
A	L. Heitzman residence	Basement (floor drain)
B	C. Klages residence	Basement (floor drain)
C	R. Moser residence	Basement (floor drain)
D	E. Lewis residence	Basement (floor drain)
E	High School	Basement
F	Hand County Library	Restrooms (no basement)
G	J. Meyer residence	Basement (floor drain)

* Refer to figure 2 for location.

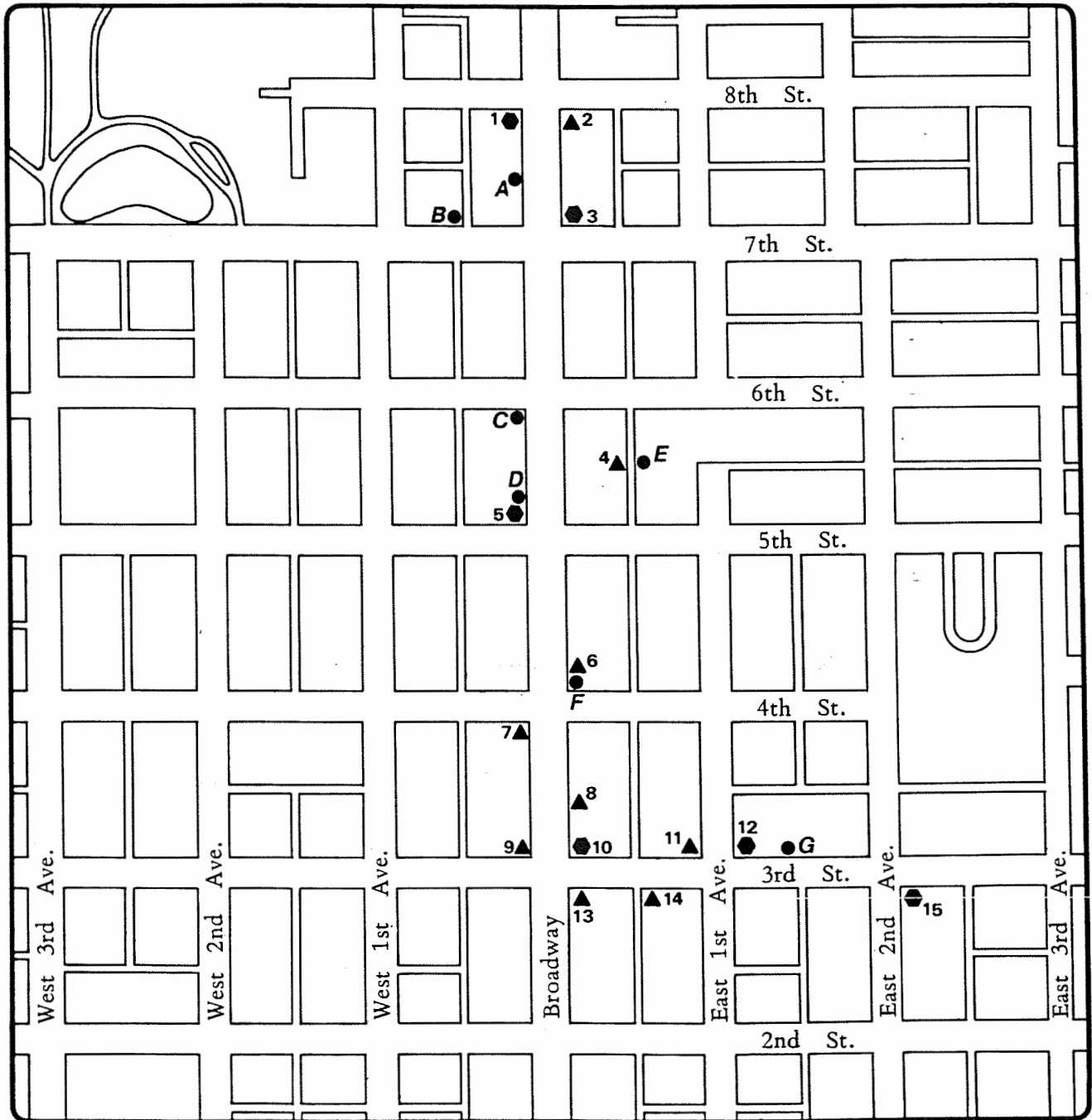
Perhaps the most important task in providing a solution to petroleum contamination incidences is to adequately assess the areal extent and magnitude of the contamination. Without adequate assessment, a proper program for abatement/recovery operations cannot be developed.

To determine the areal extent and magnitude of the contamination in the ground, test holes were drilled and an observation-well network was installed to monitor the ground water. Water samples were collected and analyzed for total volatile hydrocarbons present.

DRILLING AND OBSERVED CONTAMINATION

Test holes near the affected areas and potential sources were drilled with a 5-inch diameter flight auger (fig. 3, and app. A). Three of the holes were drilled outside the affected area for hydrogeological control at map locations (ML) 11, 16, 21 (fig. 3).

The drilling indicated that a weathered (oxidized) till occurs directly beneath the surface and ranges in thickness from 13 feet (ML 2, fig. 3) to 49 feet (ML 11, fig. 3) in the area. The average thickness of the weathered till is 31 feet. This is



- B●** Building that experienced petroleum vapors.
- 1●** Buried tanks currently in use.
- 4▲** Buried tanks removed or abandoned.

Letters refer to Table 1 and numbers refer to Table 2.

Figure 2. Location of reported petroleum vapor problems and potential sources of petroleum contamination.

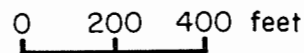
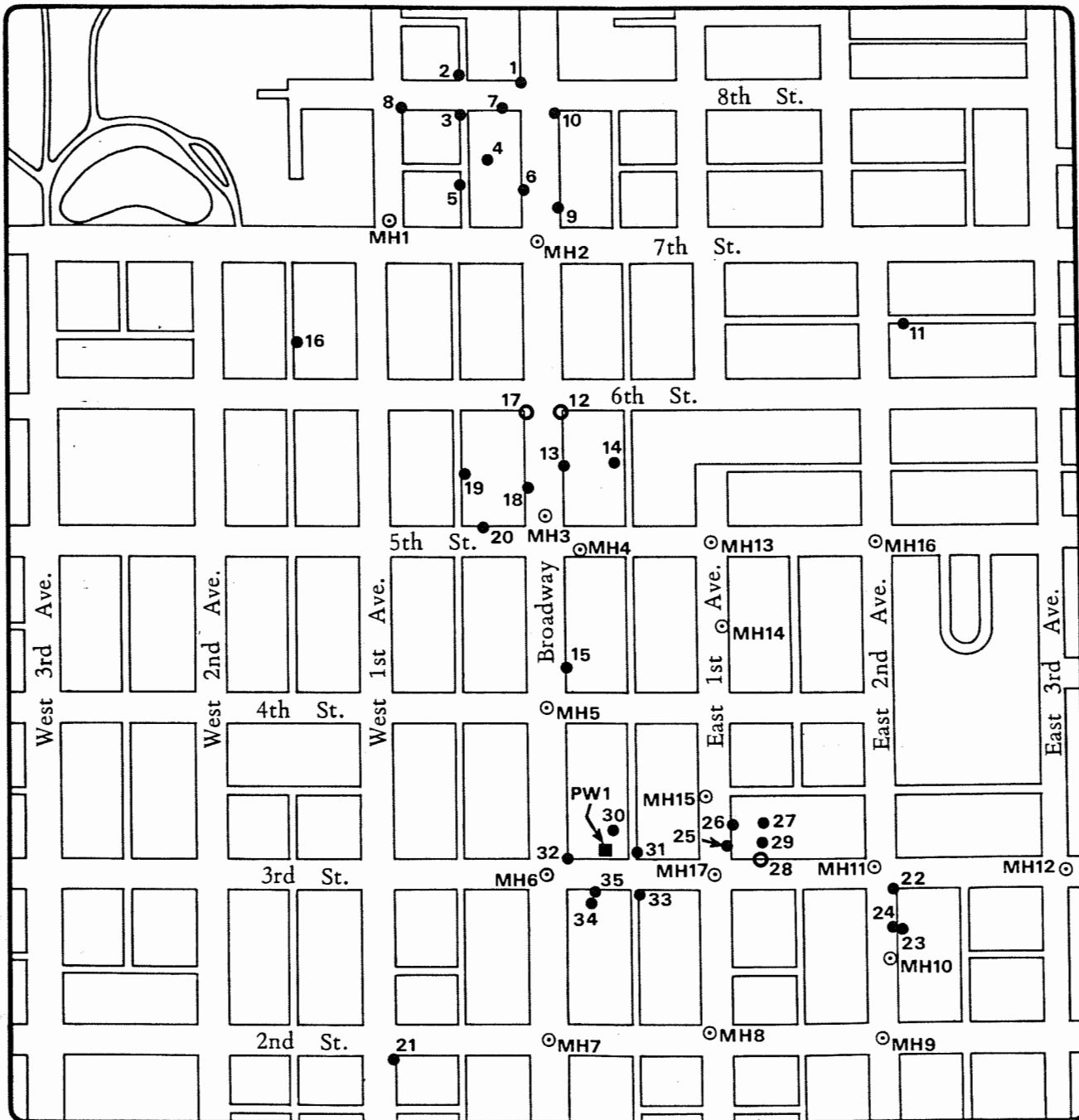
TABLE 2

Inventory of potential sources of petroleum contamination

Map Location Number *	Source	Buried Tanks (Gasoline and Diesel)		
		Number	In Use	Removed (yr)
1	Niederauer Northside	6	6	
2	OK Tire Store	7	0	Yes (1978)
3	Lil' Feller Store	4	4	
4	High School	1	0	Yes (unknown)
5	Old Coop	Unknown	1	
6	Past Station Site	Unknown	0	Unknown
7	Past Station Site	Unknown	0	Unknown
8	Past Station Site	Unknown	0	Unknown
9	Past Station Site	Unknown	0	Unknown
10	Niederauer Oil & Gas Company	3	3	
11	Past Station Site	Unknown	0	Unknown
12	Hargens APCO	2	2	
13	Old Mobil Station	Unknown	0	Yes (unknown)
14	Old Ford Garage	2	0	No
15	Stobbs Sales, Inc.	4	4	

*Refer to figure 2 for location

significant because the weathered till will have a much greater hydraulic conductivity than the underlying unweathered till due to the presence of fractures. Hence, the unweathered till will retard product movement and will for all practical purposes limit vertical movement of petroleum product. Horizontal and vertical product movement, however, can be expected in the weathered till.



- 17○ Test hole
- 8● Observation well
- PW1■ Private observation well
- MH17⊕ Sanitary sewer manhole

Numbers are map location numbers.
 For logs of observation wells and
 test holes see Appendix A.

Figure 3. Location of observation wells, test holes and selected sanitary sewer manholes.

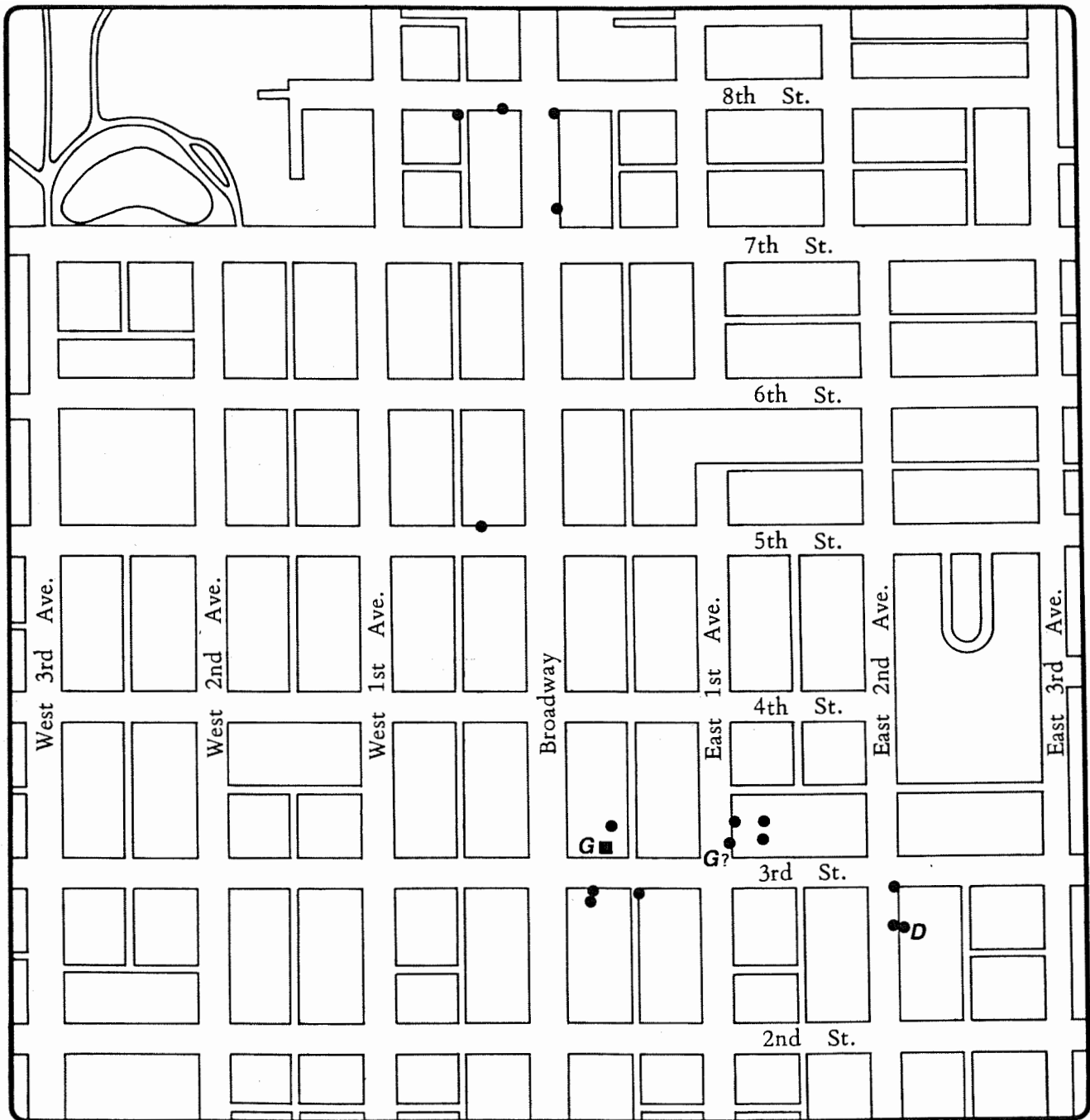
Drill cuttings from the test holes were examined for evidence of petroleum contamination including sediment discoloration and the presence of petroleum odors or free petroleum product in the ground. Locations of petroleum-contaminated sediment are shown on figure 4. The average depth of contaminated sediment was found from 5 to 12 feet below the land surface. The usual indication of petroleum-contaminated sediment was the change in color from brown (uncontaminated) to blue-gray (contaminated zone). See appendix A for examples of test holes with contaminated sediment. The color change results from bacterial action on the petroleum product in the sediment. The bacteria present in the shallow sediments are aerobic (i.e., utilize free oxygen) and use the petroleum as a food source. As they continually feed on the petroleum product, dissolved oxygen is depleted resulting in a reducing environment (oxygen deficient). The reducing environment causes the sediment to change from brown to blue-gray. Petroleum odors were commonly found in association with the contaminated sediment but no free product was encountered in any of the test holes.

OBSERVATION-WELL NETWORK

Observation wells were installed in 32 of the 35 test holes that were drilled. The locations are shown in figure 3. These observation wells provide the opportunity to measure the depth to water (to determine ground-water flow direction) and to collect water samples for chemical analyses (to determine degree of contamination). The observation wells were installed to provide for both short- and long-term monitoring of the ground water in the affected areas.

The general construction of the observation wells is shown in figure 5. The wells consist of 2-inch diameter schedule 40 polyvinyl chloride (PVC) casing and screen installed in the 5-inch diameter auger holes. The casing is joined with glued slip-fit couplings. A manufactured 10-foot screen, which consisted of 0.020-inch horizontal slotted casing and a capped bottom, was typically placed in the interval from 4 to 14 feet below the land surface. The screen was purposely located at this interval to place the screen 5 feet above and 5 feet below the mean water table to allow for seasonal fluctuations. This also enables any free petroleum product that reaches the water table to enter the observation well, since petroleum products are lighter and float on water. The wells were gravel packed from the bottom to within 1 foot above the screen and the remaining hole was sealed with granular bentonite. A vented, threaded cap was placed on top to complete the well.

The water in the observation wells was evacuated several days after installation with a bailer to remove sediments and muddy water resulting from the drilling operation. They were then left undisturbed to allow the water to reach its static level. The altitude of the casing tops were surveyed to the nearest 0.01 foot.



D● Observation well
G■ Private observation well

Letters indicate presence of free petroleum product (gasoline or diesel). See figure 3 for map location numbers.

Figure 4. Location of observation wells with contaminated sediment and free petroleum product.

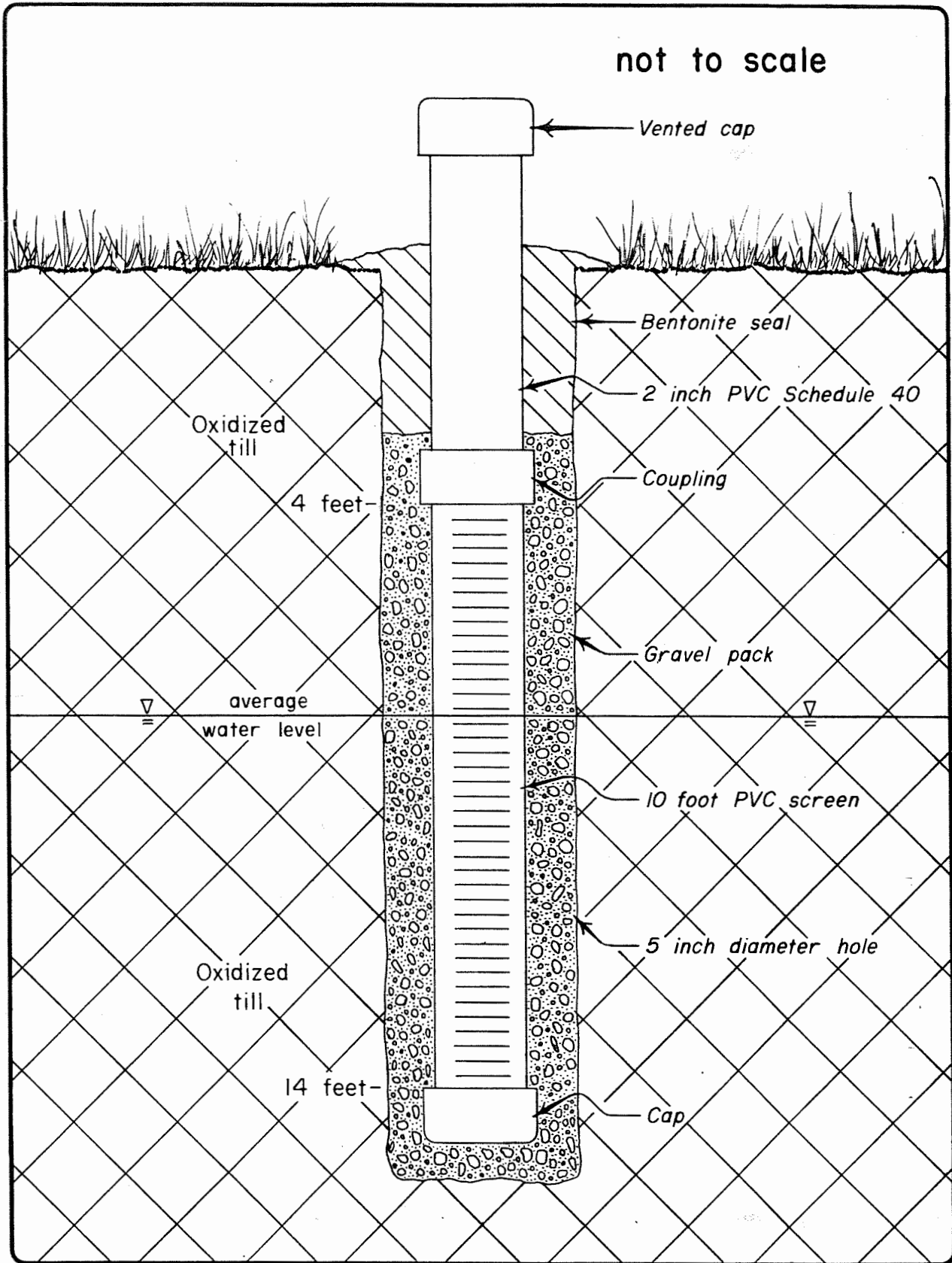


Figure 5. Typical observation well construction.

WATER-LEVEL MEASUREMENTS

The depth to water in the observation wells was measured on five separate occasions as shown on table 3. On July 27, 1985, the depth to water ranged from 3.00 feet to 10.40 feet below the land surface (ML 26 and 15, respectively, fig. 3). The mean depth to water was 6.52 feet below the land surface.

Water levels were also measured in selected sanitary sewer manholes to determine the degree of connection between the ground water and water in the sewer. These values are shown on table 4. On June 16, 1985, the depth to water ranged from 4.05 feet to 11.05 feet (MH 14 and MH 6, respectively, fig. 3). The mean depth to water was 7.81 feet below the land surface.

A plot of the water-level altitudes (casing-top altitude minus depth to water) from the observation wells and selected sanitary sewer manholes is shown on figure 6. This figure shows that in general the ground-water gradient and hence ground-water flow direction is to the northeast. Also of interest is that the sanitary sewer water-level altitudes are lower than the water-table altitudes indicating ground-water flow into the sanitary sewer system. This demonstrates that petroleum contaminated ground water could enter the sanitary sewer system.

WATER SAMPLING AND ANALYSES

The observation wells were sampled with a product sampler to ascertain the presence of free petroleum product floating on the water table. Locations of observation wells containing free petroleum product are shown on figure 4. All observation wells were sampled for free product on May 1, May 21, and June 27, 1985. The Niedarauer Oil and Gas Company observation well PW1 (fig. 3) contained one-sixteenth of an inch of free gasoline on May 1 and May 21 and 4 inches on June 21. At Hargens APCO Station, observation well ML 25 (fig. 3) contained one-sixteenth of an inch of free gasoline on May 1, but none was found on subsequent sampling dates. Stobbs Sales, Inc. observation well ML 23 (fig. 3) contained 2.25 inches of free diesel on May 1 and 12 inches plus on June 27.

Sampling on June 27 was done with a manufactured product sampler while the previous sampling was done with a homemade product sampler. This may account for the increase in product found on June 27. It is assumed that the manufactured product sampler provided a more representative sample of free product present on the water table.

Water samples were collected from all observation wells on May 21, 1985, and selected sanitary sewer manholes on May 22, 1985. A second set of samples was collected on June 26, 1985.

TABLE 3

Observation-well altitudes and water-level measurements

Well Map Loca- tion No.*	Alti- tude of casing top in feet	Date Drilled	Depth to water from casing top (in feet)				
			4-26-85	5-1-85	5-8-58	5-21-85	6-27-85
1	1573.40	4-23-85	8.20	8.23	8.07	8.10	8.05
2	1571.85	5-02-85	----	----	8.38	8.75	9.05
3	1572.66	4-23-85	9.35	9.41	9.41	9.59	9.88
4	1574.82	4-23-85	13.10	6.95	8.18	8.98	10.14
5	1572.59	4-24-85	9.00	5.55	7.93	8.31	8.36
6	1574.26	4-24-85	8.85	8.81	8.62	8.67	8.42
7	1573.37	4-25-85	Dry	Dry	14.76	12.26	8.90
8	1572.54	5-02-85	----	----	Dry	Dry	Dry
9	1573.99	4-24-85	8.50	8.49	8.32	8.29	7.87
10	1573.87	4-24-85	8.15	8.06	7.86	8.20	8.32
11	1575.59	4-25-85	6.25	10.80	10.66	10.81	11.11
13	1574.51	4-24-85	10.40	8.17	8.14	8.37	7.74
14	1577.90	4-25-85	Dry	12.76	11.58	11.27	10.98
15	1576.86	4-24-85	Dry	12.68	11.51	11.33	12.10
16	1576.16	4-25-85	Dry	10.32	9.52	9.16	9.12
18	1573.82	4-24-85	15.50	9.55	7.34	6.84	6.97
19	1574.46	4-24-85	Dry	9.86	8.40	8.86	9.42
20	1574.85	4-24-85	7.00	6.96	6.74	6.84	6.87
21	1578.51	4-25-85	8.85	8.80	9.01	9.34	8.93
22	1573.88	4-25-85	8.60	8.55	8.21	8.29	8.02
23	1574.12	4-25-85	Dry	14.20	9.72	7.93	6.70
24	1570.93	5-02-85	----	----	5.14	5.17	4.98
25	1574.68	4-26-85	12.60	7.30	6.83	6.72	6.45
26	1574.44	4-24-85	6.00	6.20	5.97	5.92	5.00
27	1574.64	4-24-85	7.12	7.20	7.14	7.52	7.66
29	1574.97	4-25-85	Dry	9.80	8.80	9.05	10.12
30	1581.02	4-24-85	8.55	8.80	8.69	8.72	7.90
31	1579.28	4-24-85	10.30	7.95	7.95	7.89	8.10
32	1579.36	4-24-85	9.80	8.94	8.73	8.58	8.35
33	1578.57	4-25-85	Dry	11.00	9.10	9.02	9.11
34	1579.09	4-25-85	7.75	7.80	7.85	7.88	7.66
35	1578.91	4-25-85	8.00	7.90	7.72	7.77	7.69
PW1	1577.87	----	----	6.00	5.70	5.75	5.55

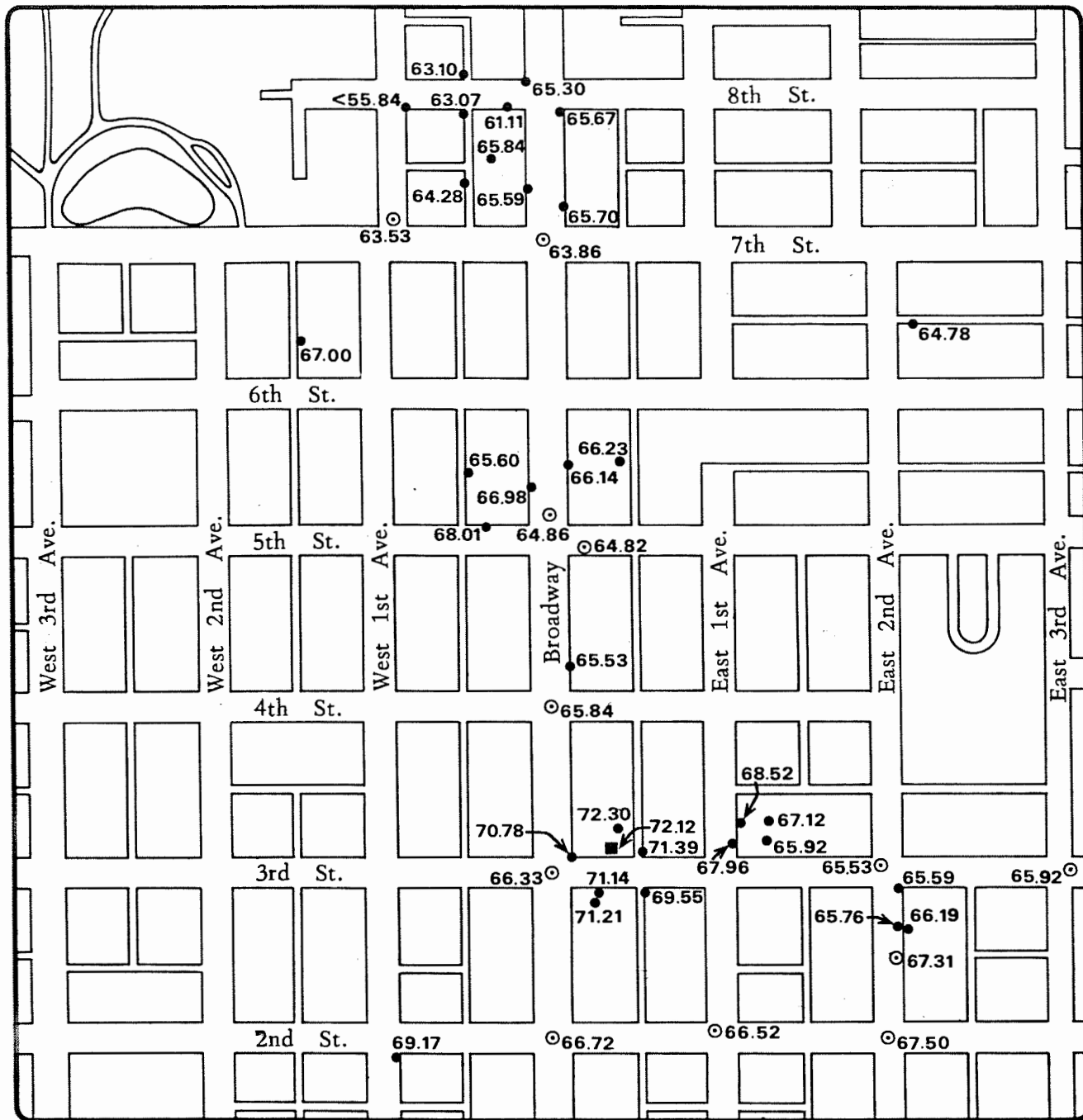
* Refer to figure 3 for location

TABLE 4

Sanitary sewer manhole altitudes and water-level measurements

Map Location Number *	Altitude of Measuring point (in feet)	Depth to water from measuring point (in feet)			
		5-1-85	5-9-85	5-22-85	6-26-85
MH 1	1570.40	6.77	6.73	6.87	6.77
MH 2	1572.74	8.71	8.70	8.88	8.78
MH 3	1573.45	8.65	8.67	8.59	8.70
MH 4	1574.52	9.74	9.67	9.70	9.70
MH 5	1575.24	9.35	9.30	9.40	9.42
MH 6	1577.36	10.87	10.99	11.03	11.05
MH 7	1577.36	10.56	10.52	10.64	10.71
MH 8	1572.90	6.30	6.30	6.38	6.38
MH 9	1576.91	----	----	9.41	9.29
MH10	1572.94	----	----	5.63	5.48
MH11	1571.73	6.23	6.10	6.20	6.20
MH12	1572.85	6.65	6.90	6.93	6.82
MH13	-----	----	----	----	8.35
MH14	-----	----	----	----	4.05
MH15	-----	----	----	----	5.05
MH16	-----	----	----	----	8.65
MH17	-----	----	----	----	8.18

* Refer to figure 3 for location



0 200 400 feet

- 68.01 ● Observation well
- 72.12 ■ Private observation well
- 65.92 ⊙ Sanitary sewer manhole

Numbers are altitude of water level, in feet, above datum. Datum is 1,500 feet above mean sea level.

Figure 6. Water-level altitudes in observation wells and selected sanitary sewer manholes, May 21-22, 1985.

A bailer was used to collect water samples from the observation wells, while a quart jar tied to a rod was used in collecting samples from the sewer manholes. The samples were collected in pint glass jars, filled level full, with a Saran Wrap seal placed between the sample and the lid. To retard chemical and biological activity, all samples were iced and then taken to the State Health Laboratory in Pierre for volatile hydrocarbon analysis. The results of the analyses are shown on tables 5 and 6 and figures 7 and 8.

Dissolved gasoline and petroleum mixtures in excess of 100 parts per million (ppm) were found in observation wells located around the Niederauer Northside, Lil' Feller Store, old Mobil Station, and Hargens APCO Station. Samples from the sanitary sewer system ranged from nondetectable to 12 ppm of mostly gasoline except for MH4 (figs. 3 and 7) which contained 100 ppm gasoline. This prompted another set of sanitary sewer samples to be taken on June 26, 1985. The results are shown on figure 8. Additional sewer manholes were also sampled at this time. The previously high value found at MH4 had reduced to 15 to 22 ppm of gasoline. However, MH17 showed 100 ppm of gasoline. The high concentrations of dissolved petroleum in both the observation wells and sanitary sewer system indicate a constant source of petroleum contamination.

SUMMARY

The investigation to determine the origin and/or occurrence of petroleum vapors in residential basements and buildings included:

1. Identification of problem areas and potential sources of contamination,
2. Drilling of test holes and installation of observation wells, and
3. Measurements of water levels and collection of water samples.

Petroleum-contaminated sediment was found around the Niederauer Northside, OK Tire Store, Lil' Feller Store, old COOP, Niederauer Oil and Gas Company, old Mobil, old Ford Garage, Hargens APCO, and Stobbs Sales, Inc. Ground-water flow is to the north in the general area and at a higher altitude relative to the sanitary sewer indicating that ground water may flow into the sanitary sewer. Significant dissolved petroleum product occurred at points in the sanitary sewer system and in the ground water around the Niederauer Northside, Lil' Feller Store, Niederauer Oil and Gas Company, old Mobil, and Hargens APCO. Free petroleum product occurred in observation wells at the Niederauer Oil and Gas Company (4 inches of gasoline), Stobbs Sales, Inc. (12 inches plus of diesel fuel), and initially at the Hargens APCO (one-sixteenth of an inch gasoline). However, subsequent sampling at Hargens APCO did not show any free product.

TABLE 5

Volatile hydrocarbon analysis of water samples
from observation wells

Map Location Number *	Volatile hydrocarbon concentration in parts per million (ppm)	
	5-21-85	
1	ND
2	ND
3	> 20 G
4	>100 D,G(S?)
5	2 M
6	2 S
7	15 G
8	----
9	>100 G
10	ND
11	ND
13	> 55
14	< 1 S
15	ND
16	ND
18	ND
19	ND
20	~ 1 G
21	ND
22	~ 5 G,D
23	Saturated diesel
24	~ 5 D
25	>100 G
26	>100 G
27	2 D
29	>100 G
30	50 D
31	Trace D
32	ND
33	5 D,G
34	>100 M
35	100 D,G
PW1	Saturated gasoline

* Refer to figure 3 for location

ND = Not detected (detection limit 0.1 ppm)
 G = Gasoline
 D = Diesel
 M = Petroleum mixture or light solvent
 S = Light solvent

TABLE 6

Volatile hydrocarbon analysis of water samples
from sanitary sewer manholes

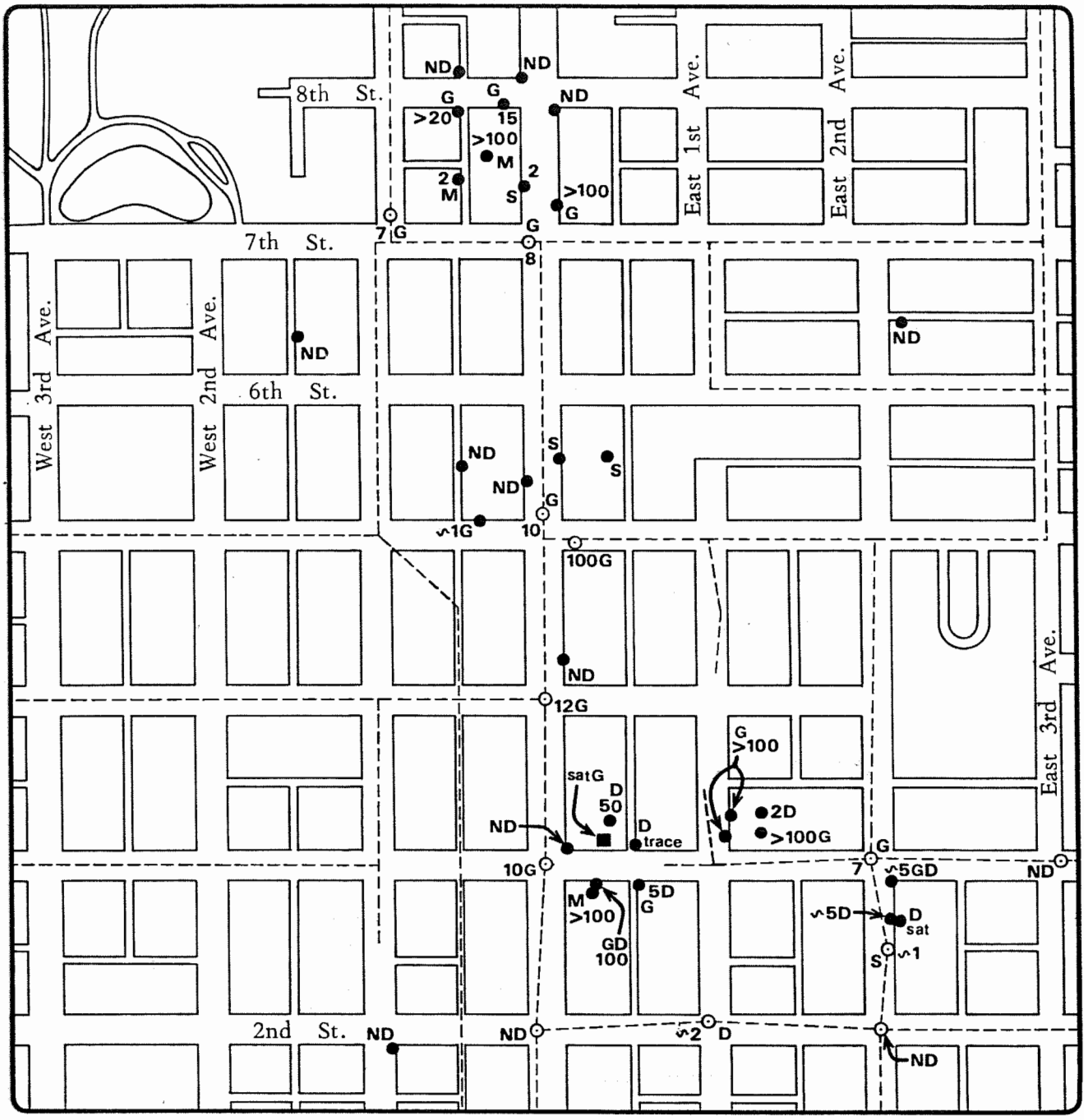
Map Location Number *	Volatile hydrocarbon concentration in parts per million (ppm)	
	5-22-85	6-26-85
MH 1	7 G	5 G
MH 2	8 G	5 G
MH 3	10 G	10-12 G
MH 4	100 G	15-20 G
MH 5	12 G	10-12 G
MH 6	10 G	12 G, D
MH 7	ND	5 G
MH 8	~ 2 D	2 G, D
MH 9	ND	1 D
MH10	~ 1 S	1 D
MH11	7 G	10 G, D
MH12	ND	2 G, D
MH13	---	6 G, D
MH14	---	4 G, 1 D
MH15	---	1 G
MH16	---	12 G
MH17	---	>100 G

* Refer to figure 3 for location

- ND = Not detected (detection limit 0.1 ppm)
- G = Gasoline
- D = Diesel
- M = Petroleum mixture or light solvent
- S = Light solvent

CONCLUSIONS

The petroleum vapors experienced in basements, buildings, and sanitary sewer system are the result of petroleum products (free and dissolved) entering the sanitary sewer system (via ground water) from leaking underground petroleum storage tanks. Data indicated that the Niederauer Oil and Gas Company, Hargens APCO and Stobbs Sales, Inc. as probable sources of free and dissolved product contamination while the Lil' Feller Store, Niederauer Northside, and old Mobil Station may be contributing dissolved product. Petroleum product and vapors migrate down gradient (to the north) in the sanitary sewer and petroleum vapors enter residences with faulty or nonexistent sewer traps.



0 200 400 feet

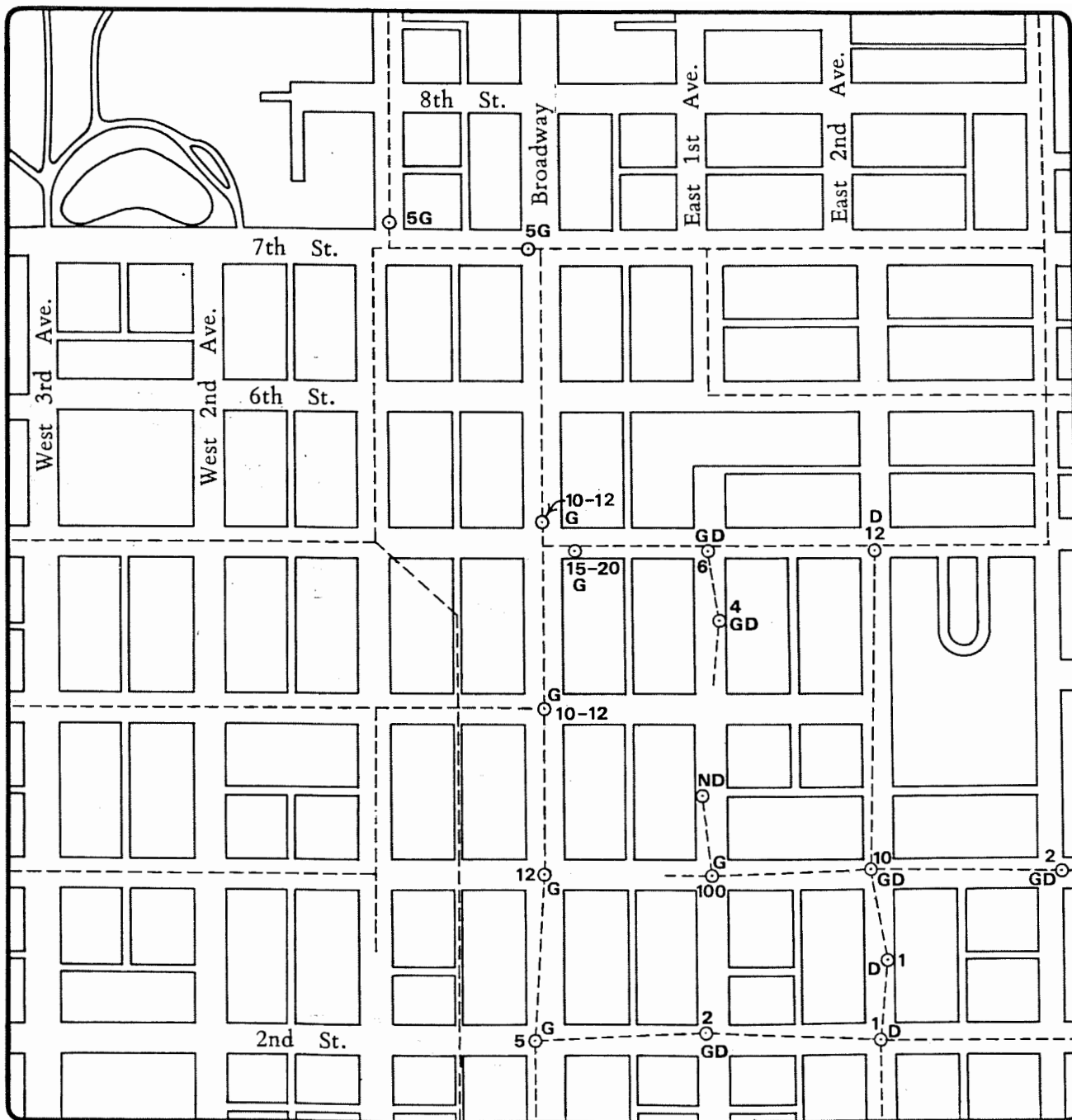
4D ● Observation well
 2S ■ Private observation well
 ND ⊙ Sanitary sewer manhole

--- Sanitary sewer lines

Numbers indicate concentrations in parts per million (ppm).
 Letters indicate:

G...Gasoline	M...Petroleum mixture
D...Diesel	S...Light solvent
sat...Saturated	ND...Not detected (detection limit 0.1 ppm)

Figure 7. Volatile hydrocarbon concentrations in observation wells and selected sanitary sewer manholes, May 21-22, 1985.



0 200 400 feet

D
12
⊙ Sanitary sewer manhole

---Sanitary sewer lines

Numbers indicate concentrations in parts per million (ppm).
 Letters indicate
 G...Gasoline
 D...Diesel
 ND...Not detected (detection limit 0.1 ppm)

Figure 8. Volatile hydrocarbon concentrations in selected sanitary sewer manholes, June 26, 1985.

RECOMMENDATIONS

For the immediate protection of the public from the occurrence of petroleum vapors in the sanitary sewer system, the following actions are suggested:

1. Monitoring of petroleum vapors should be conducted at regular intervals in the affected area for early detection of explosive levels of petroleum vapors.
2. Repair or replace the sanitary sewer traps in buildings experiencing petroleum vapors to prohibit the migration of sewer vapors from the sanitary sewer into the buildings.
3. If explosive levels of petroleum vapors persist in the sanitary sewer system, periodic flushing of the sewer with water may reduce the concentrations below explosive levels. A venting system may also be required to draw petroleum vapors from the sewer system.

The above measures will treat the symptoms of the problem but will not solve the problem. Further recommended remedial actions necessary for petroleum product/vapors abatement are listed below.

1. Eliminate the source of petroleum contamination. This may require testing of underground storage tanks to determine which tanks may be leaking. Replace leaking tanks.
2. Initiate recovery operations at Niederauer Oil and Gas Company and Stobbs Sales, Inc. to remove free petroleum product that occurs in the ground. Consult with or contact companies specializing in fuel recovery for assistance. Once the free product is removed and the sources eliminated (leaky tanks), the dilution of dissolved product in the ground water will gradually reduce the levels of petroleum product/vapors entering the sanitary sewer system. Recovery and disposal plans should be submitted in writing to Leland Baron, Office of Water Quality, Joe Foss Building, Pierre, SD 57501, as soon as possible for approval.
3. Insure stronger inventory control practices as a first line of defense for indicating when petroleum product losses occur.
4. Continue monitoring of observations wells placed near buried tanks for early indication of spills or leaky tanks.

REFERENCES

- Christensen, Cleo M., 1962, Water supply for the City of Miller: South Dakota Geological Survey Special Report 17, 23 p.
- Flint, Richard Foster, 1971, Glacial and Quaternary geology: John Wiley and Sons, Inc., New York, 892 p.
- Hedges, Lynn S., Burch, Stephen L., Iles, Derric, L., Barari, Rachel A., and Schoon, Robert A., 1982, Evaluation of ground-water resources Eastern South Dakota and Upper Big Sioux River, South Dakota and Iowa, TASKS 1, 2, 3, 4: Prepared by the South Dakota Geological Survey for the U.S. Army Corps of Engineers, Omaha, Nebraska, Contract DACW45-80-C0185.
- Koch, Neil C., 1980, Geology and water resources of Hand and Hyde Counties, South Dakota: Part II, Water resources: South Dakota Geological Survey Bulletin 28, 46 p.
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APPENDIX A

Logs of test holes and observation wells

MAP LOCATION (ML)

A number which is assigned to the log according to the order in which it is listed (see LEGAL LOCATION and LOCATION). This number corresponds to the numbers shown on figure 3.

LEGAL LOCATION and LOCATION

The logs are listed by smallest township number, then the smallest range number, the smallest section number, and then by quarter section: NE = A; NW = B; SW = C; SE = D. A comparison of LEGAL LOCATION and LOCATION is as follows. A LEGAL LOCATION of NW SE NE SW sec. 30, T. 99 N., R. 64 W. is the same as a LOCATION of 099N-64W-30CADB.

LATITUDE and LONGITUDE

The format is DD.MMSS where D is degrees, M is minutes, and S is seconds.

DRILLING COMPANY

SDGS is an abbreviation for South Dakota Geological Survey.

TOTAL DRILL HOLE DEPTH and SCREEN LENGTH

The numbers are presented in feet.

SCREEN TYPE and CASING TYPE

PVC - polyvinyl chloride

CASING TOP ELEVATION and GROUND SURFACE ELEVATION

The numbers are presented in feet above mean sea level. The elevations were surveyed to the nearest 0.01 foot with an automatic level.

CASING DIAMETER

The numbers are presented in inches.

COUNTY: HAND LOCATION: 112N-68W-10ACDA 1
MAP LOCATION: 1
LEGAL LOCATION: NE SE SW NE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.1226 LONGITUDE: 98.5919

LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT DRILLER'S LOG:
GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
DATE DRILLED: 04-23-1985 DRILLING METHOD: AUGER
GROUND SURFACE ELEVATION: 1571.30 I
TOTAL DRILL HOLE DEPTH: 28 TEST HOLE NUMBER: A1-85-1
WATER RIGHTS WELL: SDGS WELL NAME: A1-85-1
OTHER WELL NAME:

BASIN: JAMES AQUIFER: TILL
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1573.40 I
CASING STICK-UP: 2.10 TOTAL CASING AND SCREEN: 16.0
WELL MAINTENANCE DATE: 04-26-1985
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO 3 FEET. DEPTH TO WATER WAS 8.07 FEET AND FIELD CONDUCTIVITY WAS 3800 MICROMHDS PER CENTIMETER ON 05-08-1985.

0 -	10	CLAY, LIGHT- TO MEDIUM-BROWN, VERY SILTY, SANDY, SLIGHTLY PEBBLY; DRY (TILL)
10 -	15	CLAY, LIGHT-BROWN, VERY SILTY, SLIGHTLY SANDY AND PEBBLY; DAMP (TILL)
15 -	20	CLAY, DARK-BROWN, SILTY; MOIST (TILL)
20 -	28	CLAY, GRAY, SILTY, SLIGHTY SANDY AND PEBBLY; MOIST (TILL)

* * * *

COUNTY: HAND LOCATION: 112N-68W-10ACDA 2
MAP LOCATION: 2
LEGAL LOCATION: NE SE SW NE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.3126 LONGITUDE: 98.5921
LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS

DRILLER: L. FRYKMAN
 GEOLOGIST: D. HOLLY
 DATE DRILLED: 05-02-1985
 GROUND SURFACE ELEVATION: 1569.75 I
 TOTAL DRILL HOLE DEPTH: 15
 WATER RIGHTS WELL:
 OTHER WELL NAME:
 BASIN: JAMES
 MANAGEMENT UNIT:
 SCREEN TYPE: PVC, MFG.
 CASING TYPE: PVC, SCH. 40
 CASING TOP ELEVATION: 1571.85 I
 CASING STICK-UP: 2.10
 WELL MAINTENANCE DATE: 05-02-1985
 USGS HYDROLOGICAL UNIT CODE: 10160009
 ELECTRIC LOG INFORMATION:
 SPONTANEOUS POTENTIAL:
 NATURAL GAMMA:
 SAMPLES:

DRILLER'S LOG:
 GEOLOGIST'S LOG: X
 DRILLING METHOD: AUGER
 TEST HOLE NUMBER: A1-85-42
 SDGS WELL NAME: A1-85-42
 AQUIFER: TILL
 SCREEN LENGTH: 10.0
 CASING DIAMETER: 2.0
 TOTAL CASING AND SCREEN: 16.9
 SINGLE POINT RESISTIVITY:
 EXTRA:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
 3 FEET. DEPTH TO WATER WAS 8.38 FEET AND FIELD
 CONDUCTIVITY WAS 3600 MICROMHOS PER CENTIMETER
 ON 05-08-1985.

0 -	4	TOPSOIL, BLACK
4 -	7	SAND, BROWN, COARSE, CLAYEY
7 -	13	CLAY, BROWN, SILTY, SANDY, PEBBLY; MOIST (TILL)
13 -	15	CLAY, OLIVE-GRAY, SILTY, SANDY, PEBBLY; MOIST (TILL)

* * * *

COUNTY: HAND
 MAP LOCATION: 3
 LEGAL LOCATION: SE SE SW NE SEC. 10, T. 112 N., R. 68 W.
 LATITUDE: 44.3125
 LAND OWNER:
 PROJECT: MILLER PETROLEUM SPILL
 DRILLING COMPANY: SDGS
 DRILLER: M. JARRETT
 GEOLOGIST: D. HOLLY
 DATE DRILLED: 04-23-1985
 GROUND SURFACE ELEVATION: 1570.56 I
 TOTAL DRILL HOLE DEPTH: 15
 WATER RIGHTS WELL:
 OTHER WELL NAME:
 BASIN: JAMES

LOCATION: 112N-68W-10ACDD 1
 LONGITUDE: 98.5921
 DRILLER'S LOG:
 GEOLOGIST'S LOG: X
 DRILLING METHOD: AUGER
 TEST HOLE NUMBER: A1-85-2
 SDGS WELL NAME: A1-85-2
 AQUIFER: TILL

MANAGEMENT UNIT:
 SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
 CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
 CASING TOP ELEVATION: 1572.66 I
 CASING STICK-UP: 2.10 TOTAL CASING AND SCREEN: 14.6
 WELL MAINTENANCE DATE: 04-26-1985
 USGS HYDROLOGICAL UNIT CODE: 10160009
 ELECTRIC LOG INFORMATION:
 SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
 NATURAL GAMMA: EXTRA:
 SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
 3 FEET. DEPTH TO WATER WAS 9.41 FEET AND FIELD
 CONDUCTIVITY WAS 4100 MICROMHOS PER CENTIMETER
 ON 05-08-1985.

0 -	2	TOPSOIL, BROWN; ORGANIC
2 -	5	CLAY, BROWN
5 -	7	SAND, BROWN, FINE TO MEDIUM; SATURATED
7 -	9	SAND, GRAY, FINE TO MEDIUM; SATURATED, GASOLINE ODOR
9 -	11	SAND, BROWN, FINE TO MEDIUM; SATURATED
11 -	15	CLAY, GRAY-BROWN, SILTY, SANDY (TILL)

* * * *

COUNTY: HAND LOCATION: 112N-68W-10ACDD 2
 MAP LOCATION: 4
 LEGAL LOCATION: SE SE SW NE SEC. 10, T. 112 N., R. 68 W.
 LATITUDE: 44.3124 LONGITUDE: 98.5920
 LAND OWNER:
 PROJECT: MILLER PETROLEUM SPILL
 DRILLING COMPANY: SDGS
 DRILLER: M. JARRETT DRILLER'S LOG:
 GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
 DATE DRILLED: 04-23-1985 DRILLING METHOD: AUGER
 GROUND SURFACE ELEVATION: 1573.00 I
 TOTAL DRILL HOLE DEPTH: 18 TEST HOLE NUMBER: A1-85-3
 WATER RIGHTS WELL: SDGS WELL NAME: A1-85-3
 OTHER WELL NAME:
 BASIN: JAMES AQUIFER: TILL
 MANAGEMENT UNIT:
 SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
 CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
 CASING TOP ELEVATION: 1574.82 I
 CASING STICK-UP: 1.60 TOTAL CASING AND SCREEN: 13.7
 WELL MAINTENANCE DATE: 04-26-1985
 USGS HYDROLOGICAL UNIT CODE: 10160009

ELECTRIC LOG INFORMATION:

SPONTANEOUS POTENTIAL:
NATURAL GAMMA:
SAMPLES:

SINGLE POINT RESISTIVITY:
EXTRA:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO 3 FEET. DEPTH TO WATER WAS 8.18 FEET AND FIELD CONDUCTIVITY WAS 7600 MICROMHOS PER CENTIMETER ON 05-08-1985.

- 0 - 11 CLAY, LIGHT-BROWN, SILTY, SLIGHTLY SANDY, SLIGHTLY PEBBLY; DAMP, MAY HAVE DARK-BROWN-GRAY FRACTURE ZONE FROM 8 TO 11 FEET (TILL)
- 11 - 18 CLAY, DARK-BROWN, SILTY, SANDY; FEW PEBBLES, MOIST (TILL)

* * * *

COUNTY: HAND

LOCATION: 112N-68W-10ACDD 3

MAP LOCATION: 5

LEGAL LOCATION: SE SE SW NE SEC. 10, T. 112 N., R. 68 W.

LATITUDE: 44.3123

LONGITUDE: 98.5921

LAND OWNER:

PROJECT: MILLER PETROLEUM SPILL

DRILLING COMPANY: SDGS

DRILLER: M. JARRETT

DRILLER'S LOG:

GEOLOGIST: D. HOLLY

GEOLOGIST'S LOG: X

DATE DRILLED: 04-24-1985

DRILLING METHOD: AUGER

GROUND SURFACE ELEVATION: 1570.49 I

TOTAL DRILL HOLE DEPTH: 18

TEST HOLE NUMBER: A1-85-4

WATER RIGHTS WELL:

SDGS WELL NAME: A1-85-4

OTHER WELL NAME:

BASIN: JAMES

AQUIFER: TILL

MANAGEMENT UNIT:

SCREEN TYPE: PVC, MFG.

SCREEN LENGTH: 10.0

CASING TYPE: PVC, SCH. 40

CASING DIAMETER: 2.0

CASING TOP ELEVATION: 1572.59 I

CASING STICK-UP: 2.10

TOTAL CASING AND SCREEN: 16.2

WELL MAINTENANCE DATE: 04-26-1985

USGS HYDROLOGICAL UNIT CODE: 10160009

ELECTRIC LOG INFORMATION:

SPONTANEOUS POTENTIAL:
NATURAL GAMMA:
SAMPLES:

SINGLE POINT RESISTIVITY:
EXTRA:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO 3 FEET. DEPTH TO WATER WAS 7.93 FEET AND FIELD CONDUCTIVITY WAS 5000 MICROMHOS PER CENTIMETER

DN 05-08-1985.

0 - 1 TOPSOIL, BROWN; ORGANIC
1 - 4 CLAY, LIGHT-TAN-BROWN, SILTY, PEBBLY,
SANDY; DAMP (TILL)
4 - 18 CLAY, BROWN, VERY SILTY, SANDY; FEW
PEBBLES, MOIST (TILL)

* * * *

COUNTY: HAND LOCATION: 112N-68W-10ACDD 4
MAP LOCATION: 6
LEGAL LOCATION: SE SE SW NE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.3123 LONGITUDE: 98.5919
LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT DRILLER'S LOG:
GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
DATE DRILLED: 04-24-1985 DRILLING METHOD: AUGER
GROUND SURFACE ELEVATION: 1572.96 I
TOTAL DRILL HOLE DEPTH: 18 TEST HOLE NUMBER: A1-85-5
WATER RIGHTS WELL: SDGS WELL NAME: A1-85-5
OTHER WELL NAME:
BASIN: JAMES AQUIFER: TILL
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1574.26 I
CASING STICK-UP: 1.30 TOTAL CASING AND SCREEN: 15.6
WELL MAINTENANCE DATE: 04-26-1985
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
3 FEET. DEPTH TO WATER WAS 8.62 FEET AND FIELD
CONDUCTIVITY WAS 4400 MICROMHOS PER CENTIMETER
DN 05-08-1985.

0 - 2 TOPSOIL, BROWN; DAMP
2 - 6 CLAY, TAN, SILTY, SLIGHTLY PEBBLY, SANDY;
MOIST (TILL)
6 - 14 CLAY, BROWN, SILTY, SANDY, PEBBLY; MOIST
(TILL)
14 - 18 CLAY, LIGHT-TAN-BROWN, VERY SANDY, SILTY;

* * * *

COUNTY: HAND LOCATION: 112N-68W-10ACDD 6
MAP LOCATION: 8

LEGAL LOCATION: SE SE SW NE SEC. 10, T. 112 N., R. 68 W.

LATITUDE: 44.3125 LONGITUDE: 98.5924

LAND OWNER:

PROJECT: MILLER PETROLEUM SPILL

DRILLING COMPANY: SDGS

DRILLER: M. YESKE

DRILLER'S LOG:

GEOLOGIST: D. HOLLY

GEOLOGIST'S LOG: X

DATE DRILLED: 05-02-1985

DRILLING METHOD: AUGER

GROUND SURFACE ELEVATION: 1569.94 I

TOTAL DRILL HOLE DEPTH: 15

TEST HOLE NUMBER: A1-85-43

WATER RIGHTS WELL:

SDGS WELL NAME: A1-85-43

OTHER WELL NAME:

BASIN: JAMES

AQUIFER: TILL

MANAGEMENT UNIT:

SCREEN TYPE: PVC, MFG.

SCREEN LENGTH: 10.0

CASING TYPE: PVC, SCH. 40

CASING DIAMETER: 2.0

CASING TOP ELEVATION: 1572.54 I

CASING STICK-UP: 2.60

TOTAL CASING AND SCREEN: 16.7

WELL MAINTENANCE DATE: 05-02-1985

USGS HYDROLOGICAL UNIT CODE: 10160009

ELECTRIC LOG INFORMATION:

SPONTANEOUS POTENTIAL:

SINGLE POINT RESISTIVITY:

NATURAL GAMMA:

EXTRA:

SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
3 FEET. WELL WAS DRY ON 05-08-1985.

0 -	3	CLAY, DARK-BROWN, SILTY (TOPSOIL)
3 -	5	SAND, BROWN, MEDIUM TO COARSE, CLAYEY; DRY
5 -	15	CLAY, DARK-BROWN, SILTY, SANDY, PEBBLY; DRY, OXIDIZED (TILL)

* * * *

COUNTY: HAND

LOCATION: 112N-68W-10ADCC 1

MAP LOCATION: 9

LEGAL LOCATION: SW SW SE NE SEC. 10, T. 112 N., R. 68 W.

LATITUDE: 44.3122

LONGITUDE: 98.5918

LAND OWNER:

PROJECT: MILLER PETROLEUM SPILL

DRILLING COMPANY: SDGS

DRILLER: M. JARRETT

DRILLER'S LOG:

GEOLOGIST: D. HOLLY
 DATE DRILLED: 04-24-1985
 GROUND SURFACE ELEVATION: 1572.09 I
 TOTAL DRILL HOLE DEPTH: 18
 WATER RIGHTS WELL:
 OTHER WELL NAME:
 BASIN: JAMES
 MANAGEMENT UNIT:
 SCREEN TYPE: PVC, MFG.
 CASING TYPE: PVC, SCH. 40
 CASING TOP ELEVATION: 1573.99 I
 CASING STICK-UP: 1.90
 WELL MAINTENANCE DATE: 04-26-1985
 USGS HYDROLOGICAL UNIT CODE: 10160009
 ELECTRIC LOG INFORMATION:
 SPONTANEOUS POTENTIAL:
 NATURAL GAMMA:
 SAMPLES:

GEOLOGIST'S LOG: X
 DRILLING METHOD: AUGER
 TEST HOLE NUMBER: A1-85-6
 SDGS WELL NAME: A1-85-6
 AQUIFER: TILL
 SCREEN LENGTH: 10.0
 CASING DIAMETER: 2.0
 TOTAL CASING AND SCREEN: 15.7
 SINGLE POINT RESISTIVITY:
 EXTRA:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO 3 FEET. DEPTH TO WATER WAS 8.32 FEET AND FIELD CONDUCTIVITY WAS 2400 MICROMHOS PER CENTIMETER ON 05-08-1985.

0 -	1	CLAY, TAN, SILTY, SANDY (TILL)
1 -	4	CLAY, DARK-BROWN, GRAY, SILTY, SANDY; FEW PEBBLES, MOIST (TILL)
4 -	6	CLAY, BROWN, SILTY, SANDY; SOME PEBBLES, MOIST (TILL)
6 -	14	CLAY, BLUE-GRAY, SANDY, SILTY; FEW PEBBLES, SATURATED AT 7 FEET, GASOLINE ODOR (TILL)
14 -	18	CLAY, BROWN, SILTY, SANDY, PEBBLY; MOIST (TILL)

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COUNTY: HAND
 MAP LOCATION: 10
 LEGAL LOCATION: SW SW SE NE SEC. 10, T. 112 N., R. 68 W.
 LATITUDE: 44.3125
 LAND OWNER:
 PROJECT: MILLER PETROLEUM SPILL
 DRILLING COMPANY: SDGS
 DRILLER: M. JARRETT
 GEOLOGIST: D. HOLLY
 DATE DRILLED: 04-24-1985
 GROUND SURFACE ELEVATION: 1571.97 I
 TOTAL DRILL HOLE DEPTH: 18

LOCATION: 112N-68W-10ADCC 2
 LONGITUDE: 98.5918
 DRILLER'S LOG:
 GEOLOGIST'S LOG: X
 DRILLING METHOD: AUGER
 TEST HOLE NUMBER: A1-85-7

WATER RIGHTS WELL: SDGS WELL NAME: A1-85-7
 OTHER WELL NAME:
 BASIN: JAMES AQUIFER:
 MANAGEMENT UNIT:
 SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
 CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
 CASING TOP ELEVATION: 1573.87 I
 CASING STICK-UP: 1.90 TOTAL CASING AND SCREEN: 15.6
 WELL MAINTENANCE DATE: 04-26-1985
 USGS HYDROLOGICAL UNIT CODE: 10160009
 ELECTRIC LOG INFORMATION:
 SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
 NATURAL GAMMA: EXTRA:
 SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
 3 FEET. DEPTH TO WATER WAS 7.86 FEET AND FIELD
 CONDUCTIVITY WAS 3800 MICROMHOS PER CENTIMETER
 ON 05-08-1985.

0 -	1	TOPSOIL, LIGHT-BROWN; DRY
1 -	5	CLAY, LIGHT-BROWN TO BROWN, SILTY, SANDY; FEW PEBBLES (TILL)
5 -	10	CLAY, BROWNISH-GRAY TO GRAY, SILTY, SANDY; FEW PEBBLES, MOIST, GASOLINE ODOR (TILL)
10 -	15	CLAY, LIGHT-TAN-BROWN TO BROWN, SILTY, SANDY; SATURATED (TILL)
15 -	18	CLAY, LIGHT-TAN-BROWN, VERY SANDY; SATURATED

* * * *

COUNTY: HAND LOCATION: 112N-68W-10DAAA
 MAP LOCATION: 11
 LEGAL LOCATION: NE NE NE SE SEC. 10, T. 112 N., R. 68 W.
 LATITUDE: 44.3120 LONGITUDE: 98.5904
 LAND OWNER:
 PROJECT: MILLER PETROLEUM SPILL
 DRILLING COMPANY: SDGS
 DRILLER: M. JARRETT DRILLER'S LOG:
 GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
 DATE DRILLED: 04-25-1985 DRILLING METHOD: AUGER
 GROUND SURFACE ELEVATION: 1573.69 I
 TOTAL DRILL HOLE DEPTH: 53 TEST HOLE NUMBER: A1-85-31
 WATER RIGHTS WELL: SDGS WELL NAME: A1-85-31
 OTHER WELL NAME:
 BASIN: JAMES AQUIFER: TILL
 MANAGEMENT UNIT:

SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
 CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
 CASING TOP ELEVATION: 1575.59 I
 CASING STICK-UP: 1.90 TOTAL CASING AND SCREEN: 14.4
 WELL MAINTENANCE DATE: 04-26-1985
 USGS HYDROLOGICAL UNIT CODE: 10160009
 ELECTRIC LOG INFORMATION:
 SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
 NATURAL GAMMA: EXTRA:
 SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
 3 FEET. DEPTH TO WATER WAS 10.66 FEET AND FIELD
 CONDUCTIVITY WAS 6400 MICROMHOS PER CENTIMETER
 ON 05-08-1985.

0 - 17 CLAY, YELLOW-BROWN, SILTY, SLIGHTLY
 SANDY AND PEBBLY; MOIST (TILL)
 17 - 44 CLAY, BROWN, SILTY, SLIGHTLY SANDY AND
 PEBBLY; MOIST (TILL)
 44 - 49 SILT, LIGHT-BROWN, SANDY; SATURATED
 (LOESS?)
 49 - 53 CLAY, GRAY, SILTY, SANDY, PEBBLY; MOIST
 (TILL)

* * * *

COUNTY: HAND LOCATION: 112N-68W-10DABC 1
 MAP LOCATION: 12
 LEGAL LOCATION: SW NW NE SE SEC. 10, T. 112 N., R. 68 W.
 LATITUDE: 44.3117 LONGITUDE: 98.5918
 LAND OWNER:
 PROJECT: MILLER PETROLEUM SPILL
 DRILLING COMPANY: SDGS
 DRILLER: M. JARRETT DRILLER'S LOG:
 GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
 DATE DRILLED: 04-24-1985 DRILLING METHOD: AUGER
 GROUND SURFACE ELEVATION: 1574.00 T
 TOTAL DRILL HOLE DEPTH: 20 TEST HOLE NUMBER: A1-85-12
 USGS HYDROLOGICAL UNIT CODE: 10160009
 ELECTRIC LOG INFORMATION:
 SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
 NATURAL GAMMA: EXTRA:
 SAMPLES:

HOLE WAS BACKFILLED WITH CUTTINGS.

0 - 20 CLAY, LIGHT-BROWN TO DARK-BROWN, SILTY,

PROJECT: MILLER PETROLEUM SPILL
 DRILLING COMPANY: SDGS
 DRILLER: M. JARRETT
 GEOLOGIST: D. HOLLY
 DATE DRILLED: 04-25-1985
 GROUND SURFACE ELEVATION: 1576.00 I
 TOTAL DRILL HOLE DEPTH: 15
 WATER RIGHTS WELL:
 OTHER WELL NAME:
 BASIN: JAMES
 MANAGEMENT UNIT:
 SCREEN TYPE: PVC, MFG.
 CASING TYPE: PVC, SCH. 40
 CASING TOP ELEVATION: 1577.90 I
 CASING STICK-UP: 1.90
 WELL MAINTENANCE DATE: 04-26-1985
 USGS HYDROLOGICAL UNIT CODE: 10160009
 ELECTRIC LOG INFORMATION:
 SPONTANEOUS POTENTIAL:
 NATURAL GAMMA:
 SAMPLES:

DRILLER'S LOG:
 GEOLOGIST'S LOG: X
 DRILLING METHOD: AUGER
 TEST HOLE NUMBER: A1-85-32
 SDGS WELL NAME: A1-85-32
 AQUIFER: TILL
 SCREEN LENGTH: 10.0
 CASING DIAMETER: 2.0
 TOTAL CASING AND SCREEN: 16.1
 SINGLE POINT RESISTIVITY:
 EXTRA:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
 3 FEET. DEPTH TO WATER WAS 11.58 FEET AND FIELD
 CONDUCTIVITY WAS 7200 MICROMHOS PER CENTIMETER
 ON 05-08-1985.

0 - 15 CLAY, BROWN, SITLY; LITTLE SAND AND
 PEBBLES, MOIST (TILL)

* * * *

COUNTY: HAND
 MAP LOCATION: 15
 LEGAL LOCATION: SW SW NE SE SEC. 10, T. 112 N., R. 68 W.
 LATITUDE: 44.3110
 LAND OWNER:
 PROJECT: MILLER PETROLEUM SPILL
 DRILLING COMPANY: SDGS
 DRILLER: M. JARRETT
 GEOLOGIST: D. HOLLY
 DATE DRILLED: 04-24-1985
 GROUND SURFACE ELEVATION: 1575.16 I
 TOTAL DRILL HOLE DEPTH: 15
 WATER RIGHTS WELL:
 OTHER WELL NAME:
 BASIN: JAMES
 MANAGEMENT UNIT:
 SCREEN TYPE: PVC, MFG.

LOCATION: 112N-68W-10DACC
 LONGITUDE: 98.5918
 DRILLER'S LOG:
 GEOLOGIST'S LOG: X
 DRILLING METHOD: AUGER
 TEST HOLE NUMBER: A1-85-14
 SDGS WELL NAME: A1-85-14
 AQUIFER: TILL
 SCREEN LENGTH: 10.0

CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1576.86 I
CASING STICK-UP: 1.70 TOTAL CASING AND SCREEN: 15.9
WELL MAINTENANCE DATE: 04-26-1985
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
3 FEET. DEPTH TO WATER WAS 11.51 FEET AND FIELD
CONDUCTIVITY WAS 11,200 MICROMHOS PER CENTIMETER
ON 05-08-1985.

0 - 15 CLAY, BROWN, SILTY; SOME SAND AND
PEBBLES, OXIDIZED, MOIST (TILL)

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COUNTY: HAND LOCATION: 112N-68W-10DBAB
MAP LOCATION: 16
LEGAL LOCATION: NW NE NW SE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.3120 LONGITUDE: 98.5926
LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT DRILLER'S LOG:
GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
DATE DRILLED: 04-25-1985 DRILLING METHOD: AUGER
GROUND SURFACE ELEVATION: 1574.26 I
TOTAL DRILL HOLE DEPTH: 48 TEST HOLE NUMBER: A1-85-29
WATER RIGHTS WELL: SDGS WELL NAME: A1-85-29
OTHER WELL NAME:
BASIN: JAMES AQUIFER: TILL
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1576.16 I
CASING STICK-UP: 1.90 TOTAL CASING AND SCREEN: 16.0
WELL MAINTENANCE DATE: 04-26-1985
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
3 FEET. DEPTH TO WATER WAS 9.52 FEET AND FIELD

CONDUCTIVITY WAS 9400 MICROMHOS PER CENTIMETER
ON 05-08-1985.

0 - 5 CLAY, LIGHT-BROWN, SILTY, SLIGHTLY SANDY
AND PEBBLY; MOIST, OXIDIZED (TILL)
5 - 44 CLAY, CHOCOLATE-BROWN, SILTY; FEW
PEBBLES, LITTLE SAND, MOIST,
OXIDIZED (TILL)
44 - 48 CLAY, GRAY, SILTY, SANDY, PEBBLY; MOIST,
UNOXIDIZED (TILL)

* * * *

COUNTY: HAND LOCATION: 112N-68W-10DBAD 1
MAP LOCATION: 17
LEGAL LOCATION: SE NE NW SE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.3117 LONGITUDE: 98.5919
LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS
DRILLER: M. JARRET DRILLER'S LOG:
GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
DATE DRILLED: 04-24-1985 DRILLING METHOD: AUGER
GROUND SURFACE ELEVATION: 1574.00 T
TOTAL DRILL HOLE DEPTH: 15 TEST HOLE NUMBER: A1-85-8
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

HOLE WAS BACKFILLED WITH CUTTINGS.

0 - 15 CLAY, LIGHT-BROWN TO BROWN, SILTY; LITTLE
SAND AND FEW PEBBLES, DRY TO DAMP
(TILL)

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COUNTY: HAND LOCATION: 112N-68W-10DBAD 2
MAP LOCATION: 18
LEGAL LOCATION: SE NE NW SE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.1315 LONGITUDE: 98.5919
LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS

DRILLER: M. JARRETT
GEOLOGIST: D. HOLLY
DATE DRILLED: 04-24-1985
GROUND SURFACE ELEVATION: 1572.42 I
TOTAL DRILL HOLE DEPTH: 15
WATER RIGHTS WELL:
OTHER WELL NAME:
BASIN: JAMES
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG.
CASING TYPE: PVC, SCH. 40
CASING TOP ELEVATION: 1573.82 I
CASING STICK-UP: 1.40
WELL MAINTENANCE DATE: 04-26-1985
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL:
NATURAL GAMMA:
SAMPLES:

DRILLER'S LOG:
GEOLOGIST'S LOG: X
DRILLING METHOD: AUGER
TEST HOLE NUMBER: A1-85-9
SDGS WELL NAME: A1-85-9
AQUIFER: TILL
SCREEN LENGTH: 10.0
CASING DIAMETER: 2.0
TOTAL CASING AND SCREEN: 15.6
SINGLE POINT RESISTIVITY:
EXTRA:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO 3 FEET. DEPTH TO WATER WAS 7.34 FEET AND FIELD CONDUCTIVITY WAS 5200 MICROMHOS PER CENTIMETER ON 05-08-1985.

0 - 15 CLAY, LIGHT-TAN TO BROWN, SILTY, SLIGHTLY SANDY AND PEBBLY; DRY TO MOIST (TILL)

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COUNTY: HAND
MAP LOCATION: 19
LEGAL LOCATION: SE NE NW SE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.3116
LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT
GEOLOGIST: D. HOLLY
DATE DRILLED: 04-24-1985
GROUND SURFACE ELEVATION: 1572.66 I
TOTAL DRILL HOLE DEPTH: 15
WATER RIGHTS WELL:
OTHER WELL NAME:
BASIN: JAMES
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG.
CASING TYPE: PVC, SCH. 40
CASING TOP ELEVATION: 1574.46 I

LOCATION: 112N-68W-10DBAD 3
LONGITUDE: 98.5921
DRILLER'S LOG:
GEOLOGIST'S LOG: X
DRILLING METHOD: AUGER
TEST HOLE NUMBER: A1-85-11
SDGS WELL NAME: A1-85-11
AQUIFER: TILL
SCREEN LENGTH: 10.0
CASING DIAMETER: 2.0

CASING STICK-UP: 1.80 TOTAL CASING AND SCREEN: 16.0
WELL MAINTENANCE DATE: 04-26-1985
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
3 FEET. DEPTH TO WATER WAS 8.40 FEET AND FIELD
CONDUCTIVITY WAS 11,200 MICROMHOS PER CENTIMETER
ON 05-08-1985.

0 - 15 CLAY, BROWN, SILTY, SLIGHTLY SANDY AND
PEBBLY; DRY TO MOIST, OXIDIZED (TILL)

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COUNTY: HAND LOCATION: 112N-68W-10DBDA
MAP LOCATION: 20
LEGAL LOCATION: NE SE NW SE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.3114 LONGITUDE: 98.5920
LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT DRILLER'S LOG:
GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
DATE DRILLED: 04-24-1985 DRILLING METHOD: AUGER
GROUND SURFACE ELEVATION: 1572.85 I
TOTAL DRILL HOLE DEPTH: 18 TEST HOLE NUMBER: A1-85-10
WATER RIGHTS WELL: SDGS WELL NAME: A1-85-10
OTHER WELL NAME:
BASIN: JAMES AQUIFER: TILL
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1574.85 I
CASING STICK-UP: 2.00 TOTAL CASING AND SCREEN: 17.0
WELL MAINTENANCE DATE: 04-26-1985
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
3 FEET. DEPTH TO WATER WAS 6.74 FEET AND FIELD
CONDUCTIVITY WAS 5000 MICROMHOS PER CENTIMETER
ON 05-08-1985.

0 - 4 CLAY, BROWN TO BROWNISH-GRAY, SILTY,
 SANDY; FEW PEBBLES, DAMP, GASOLINE ODOR
 (TILL)
 4 - 6 CLAY, BROWNISH-GRAY, SILTY, SANDY; FEW
 PEBBLES, MOIST, STRONG GASOLINE ODOR
 (TILL)
 6 - 11 CLAY, BROWN TO BROWNISH-GRAY, SILTY,
 SANDY; FEW PEBBLES, MOIST, SLIGHT
 GASOLINE ODOR (TILL)
 11 - 16 CLAY, GRAY-BLUE, SILTY, VERY SANDY; MOIST
 TO SATURATED, STRONG GASOLINE ODOR
 (TILL?)
 16 - 18 CLAY, BROWN, SILTY, SANDY, PEBBLY; MOIST
 (TILL)

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COUNTY: HAND LOCATION: 112N-68W-10DCDB
 MAP LOCATION: 21
 LEGAL LOCATION: NW SE SW SE SEC. 10, T. 112 N., R. 68 W.
 LATITUDE: 44.3101 LONGITUDE: 98.5924
 LAND OWNER:
 PROJECT: MILLER PETROLEUM SPILL
 DRILLING COMPANY: SDGS
 DRILLER: M. JARRETT DRILLER'S LOG:
 GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
 DATE DRILLED: 04-25-1985 DRILLING METHOD: AUGER
 GROUND SURFACE ELEVATION: 1576.61 I
 TOTAL DRILL HOLE DEPTH: 33 TEST HOLE NUMBER: A1-85-30
 WATER RIGHTS WELL: SDGS WELL NAME: A1-85-30
 OTHER WELL NAME:
 BASIN: JAMES AQUIFER: TILL
 MANAGEMENT UNIT:
 SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
 CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
 CASING TOP ELEVATION: 1578.51 I
 CASING STICK-UP: 1.90 TOTAL CASING AND SCREEN: 16.1
 WELL MAINTENANCE DATE: 04-26-1985
 USGS HYDROLOGICAL UNIT CODE: 10160009
 ELECTRIC LOG INFORMATION:
 SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
 NATURAL GAMMA: EXTRA:
 SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
 3 FEET. DEPTH TO WATER WAS 9.01 FEET AND FIELD
 CONDUCTIVITY WAS 3600 MICROMHOS PER CENTIMETER
 ON 05-08-1985.

0 - 20 CLAY, BROWN, SILTY, SLIGHTLY SANDY AND
PEBBLY; MOIST, OXIDIZED (TILL)
20 - 27 CLAY, DARK-BROWN, SILTY, SLIGHTLY SANDY
AND PEBBLY; MOIST, PARTIALLY OXIDIZED
(TILL)
27 - 33 CLAY, GRAY, SILTY, PEBBLY, SANDY; MOIST,
UNOXIDIZED (TILL)

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COUNTY: HAND LOCATION: 112N-68W-10DDAC 1
MAP LOCATION: 22
LEGAL LOCATION: SW NE SE SE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.3105 LONGITUDE: 98.5905
LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT DRILLER'S LOG:
GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
DATE DRILLED: 04-25-1985 DRILLING METHOD: AUGER
GROUND SURFACE ELEVATION: 1571.68 I
TOTAL DRILL HOLE DEPTH: 15 TEST HOLE NUMBER: A1-85-23
WATER RIGHTS WELL: SDGS WELL NAME: A1-85-23
OTHER WELL NAME:
BASIN: JAMES AQUIFER: TILL
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1573.88 I
CASING STICK-UP: 2.20 TOTAL CASING AND SCREEN: 16.3
WELL MAINTENANCE DATE: 04-26-1985
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
3 FEET. DEPTH TO WATER WAS 8.21 FEET AND FIELD
CONDUCTIVITY WAS 3800 MICROMHOS PER CENTIMETER
ON 05-08-1985.

0 - 8 CLAY, BROWN, SILTY, SLIGHTLY SANDY AND
PEBBLY; MOIST
8 - 10 CLAY, GRAY, SILTY, SLIGHTLY SANDY AND
PEBBLY; MOIST, OLD GASOLINE ODOR
(TILL)

10 - 11 CLAY, GRAYISH-BROWN, SILTY, SLIGHTLY
SANDY AND PEBBLY; MOIST, SLIGHT
GASOLINE ODOR (TILL)
11 - 15 CLAY, BROWN, SILTY, SLIGHTLY SANDY AND
PEBBLY; MOIST (TILL)

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COUNTY: HAND LOCATION: 112N-68W-10DDAC 2
MAP LOCATION: 23
LEGAL LOCATION: SW NE SE SE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.3104 LONGITUDE: 98.5904
LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT DRILLER'S LOG:
GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
DATE DRILLED: 04-25-1985 DRILLING METHOD: AUGER
GROUND SURFACE ELEVATION: 1572.72 I
TOTAL DRILL HOLE DEPTH: 15 TEST HOLE NUMBER: A1-85-24
WATER RIGHTS WELL: SDGS WELL NAME: A1-85-24
OTHER WELL NAME:
BASIN: JAMES AQUIFER: TILL
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1574.12 I
CASING STICK-UP: 2.40 TOTAL CASING AND SCREEN: 16.2
WELL MAINTENANCE DATE: 04-26-1985
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
3 FEET. DEPTH TO WATER WAS 9.72 FEET ON
05-08-1985. WELL CONTAINED 2.25 INCHES OF FREE
DIESEL FUEL WHEN SAMPLED ON 05-01-1985.

0 - 6 CLAY, BROWN TO DARK-BROWN, SILTY; LITTLE
SAND, FEW PEBBLES, MOIST
6 - 12 CLAY, BLUE-GRAY, SILTY, SLIGHTLY SANDY
AND PEBBLY; MOIST, GASOLINE ODOR
(TILL)
12 - 13 CLAY, GRAYISH-BROWN, SILTY, SLIGHTLY
SANDY AND PEBBLY; MOIST, SLIGHT
GASOLINE ODOR (TILL)
13 - 15 CLAY, BROWN, SILTY; LITTLE SAND AND

PEBBLES, MOIST (TILL)

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COUNTY: HAND LOCATION: 112N-68W-10DDAC 3
MAP LOCATION: 24
LEGAL LOCATION: SW NE SE SE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.3104 LONGITUDE: 98.5905
LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS
DRILLER: M. YESKE DRILLER'S LOG:
GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
DATE DRILLED: 05-02-1985 DRILLING METHOD: AUGER
GROUND SURFACE ELEVATION: 1571.23 I
TOTAL DRILL HOLE DEPTH: 15 TEST HOLE NUMBER: A1-85-41
WATER RIGHTS WELL: SDGS WELL NAME: A1-85-41
OTHER WELL NAME:
BASIN: JAMES AQUIFER: TILL
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1570.93 I
CASING STICK-UP: TOTAL CASING AND SCREEN: 13.1
WELL MAINTENANCE DATE: 05-06-1985
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
3 FEET. DEPTH TO WATER WAS 5.14 FEET AND FIELD
CONDUCTIVITY WAS 6200 MICROMHOS PER CENTIMETER
ON 05-08-1985. STICK-UP: -0.3.

0 - 2 CLAY, DARK-GRAY, SILTY, SANDY, VERY
PEBBLY; DISCOLORATION DUE TO CON-
TAMINATION (ROADFILL)
2 - 12 CLAY, LIGHT-GRAY, SILTY, SANDY, PEBBLY;
MOIST, CONTAMINATED
12 - 15 CLAY, LIGHT-BROWN, SILTY, SANDY, PEBBLY;
MOIST, OXIDIZED, SLIGHT CONTAMINATION
(TILL)

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COUNTY: HAND LOCATION: 112N-68W-10DDBA 1
MAP LOCATION: 25
LEGAL LOCATION: NE NW SE SE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.3106 LONGITUDE: 98.5911
LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT DRILLER'S LOG:
GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
DATE DRILLED: 04-26-1985 DRILLING METHOD: AUGER
GROUND SURFACE ELEVATION: 1572.68 I
TOTAL DRILL HOLE DEPTH: 15 TEST HOLE NUMBER: A1-85-18
WATER RIGHTS WELL: SDGS WELL NAME: A1-85-18
OTHER WELL NAME:
BASIN: JAMES AQUIFER: TILL
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1574.68 I
CASING STICK-UP: 2.00 TOTAL CASING AND SCREEN: 16.1
WELL MAINTENANCE DATE: 04-26-1985
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
3 FEET. DEPTH TO WATER WAS 6.83 FEET AND FIELD
CONDUCTIVITY WAS 2800 MICROMHOS PER CENTIMETER
ON 05-08-1985.

0 -	1	ROADFILL
1 -	5	CLAY, BLUE-GRAY, SILTY, SLIGHTLY SANDY, SLIGHTLY PEBBLY; MOIST, STRONG GASOLINE ODOR (TILL)
5 -	15	CLAY, BROWNISH-GRAY TO BROWN, SILTY, SLIGHTLY SANDY AND PEBBLY; MOIST, SLIGHT GASOLINE ODOR

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COUNTY: HAND LOCATION: 112N-68W-10DDBA 2
MAP LOCATION: 26
LEGAL LOCATION: NE NW SE SE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.3107 LONGITUDE: 98.5911
LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS

DRILLER: M. JARRETT
 GEOLOGIST: D. HOLLY
 DATE DRILLED: 04-24-1985
 GROUND SURFACE ELEVATION: 1572.44 I
 TOTAL DRILL HOLE DEPTH: 18
 WATER RIGHTS WELL:
 OTHER WELL NAME:
 BASIN: JAMES
 MANAGEMENT UNIT:
 SCREEN TYPE: PVC, MFG.
 CASING TYPE: PVC, SCH. 40
 CASING TOP ELEVATION: 1574.44 I
 CASING STICK-UP: 2.00
 WELL MAINTENANCE DATE: 04-26-1985
 USGS HYDROLOGICAL UNIT CODE: 10160009
 ELECTRIC LOG INFORMATION:
 SPONTANEOUS POTENTIAL:
 NATURAL GAMMA:
 SAMPLES:

DRILLER'S LOG:
 GEOLOGIST'S LOG: X
 DRILLING METHOD: AUGER
 TEST HOLE NUMBER: A1-85-19
 SDGS WELL NAME: A1-85-19
 AQUIFER: TILL
 SCREEN LENGTH: 2.0
 CASING DIAMETER: 2.0
 TOTAL CASING AND SCREEN: 13.5
 SINGLE POINT RESISTIVITY:
 EXTRA:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
 3 FEET. DEPTH TO WATER WAS 5.97 FEET AND FIELD
 CONDUCTIVITY WAS 1200 MICROMHOS PER CENTIMETER
 ON 05-08-1985.

0 -	1	TOPSOIL, DARK-BROWN; ORGANIC, MOIST
1 -	5	CLAY, CHOCOLATE-BROWN, SLIGHTLY SANDY AND PEBBLY; MOIST (TILL)
5 -	8	CLAY, BROWN-GRAY, SILTY, SLIGHTLY SANDY AND PEBBLY; MOIST, FRESH GASOLINE ODOR FROM 5 TO 8 FEET (TILL)
8 -	11	CLAY, GRAY, SILTY, SLIGHTLY SANDY AND PEBBLY; MOIST, OLD GASOLINE ODOR (TILL)
11 -	18	CLAY, DARK-BROWN, SILTY, SLIGHTLY SANDY AND PEBBLY; MOIST, SLIGHT GASOLINE ODOR, ODOR DECREASES WITH DEPTH, GONE BY 17 FEET (TILL)

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COUNTY: HAND
 MAP LOCATION: 27
 LEGAL LOCATION: NE NW SE SE SEC. 10, T. 112 N., R. 68 W.
 LATITUDE: 44.3107
 LAND OWNER:
 PROJECT: MILLER PETROLEUM SPILL
 DRILLING COMPANY: SDGS
 DRILLER: M. JARRETT

LOCATION: 112N-68W-10DDBA 3
 LONGITUDE: 98.5910
 DRILLER'S LOG:

GEOLOGIST: D. HOLLY
 DATE DRILLED: 04-24-1985
 GROUND SURFACE ELEVATION: 1572.42 I
 TOTAL DRILL HOLE DEPTH: 15
 WATER RIGHTS WELL:
 OTHER WELL NAME:
 BASIN: JAMES
 MANAGEMENT UNIT:
 SCREEN TYPE: PVC, MFG.
 CASING TYPE: PVC, SCH. 40
 CASING TOP ELEVATION: 1574.64 I
 CASING STICK-UP: 2.20
 WELL MAINTENANCE DATE: 04-26-1985
 USGS HYDROLOGICAL UNIT CODE: 10160009
 ELECTRIC LOG INFORMATION:
 SPONTANEOUS POTENTIAL:
 NATURAL GAMMA:
 SAMPLES:

GEOLOGIST'S LOG: X
 DRILLING METHOD: AUGER
 TEST HOLE NUMBER: A1-85-20
 SDGS WELL NAME: A1-85-20
 AQUIFER: TILL
 SCREEN LENGTH: 10.0
 CASING DIAMETER: 2.0
 TOTAL CASING AND SCREEN: 14.9
 SINGLE POINT RESISTIVITY:
 EXTRA:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
 3 FEET. DEPTH TO WATER WAS 7.14 FEET AND FIELD
 CONDUCTIVITY WAS 2400 MICROMHOS PER CENTIMETER
 ON 05-08-1985.

0 -	1	TOPSOIL, BROWN; ORGANIC
1 -	4	CLAY, DARK-GRAY-BLUE, SILTY, SLIGHTLY SANDY, SLIGHTLY PEBBLY; MOIST STRONG GASOLINE ODOR (TILL)
4 -	9	CLAY, GRAY-BLUE, SILTY, SLIGHTLY SANDY AND PEBBLY; MOIST, OLD GASOLINE ODOR (TILL)
9 -	13	CLAY, GRAY-BROWN, SILTY, SANDY, SLIGHTLY PEBBLY; MOIST, SLIGHT GASOLINE ODOR (TILL)
13 -	15	CLAY, BROWN, SILTY, SANDY, SLIGHTLY PEBBLY; MOIST, VERY SLIGHT GASOLINE ODOR (TILL)

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COUNTY: HAND
 MAP LOCATION: 28
 LEGAL LOCATION: NE NW SE SE SEC. 10, T. 112 N., R. 68 W.
 LATITUDE: 44.3106
 LAND OWNER:
 PROJECT: MILLER PETROLEUM SPILL
 DRILLING COMPANY: SDGS
 DRILLER: M. JARRETT
 GEOLOGIST: D. HOLLY

LOCATION: 112N-68W-10DDBA 4
 LONGITUDE: 98.5910
 DRILLER'S LOG:
 GEOLOGIST'S LOG: C

DATE DRILLED: 04-24-1985 DRILLING METHOD: AUGER
GROUND SURFACE ELEVATION: 1575.00 T
TOTAL DRILL HOLE DEPTH: TEST HOLE NUMBER: A1-85-21
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

HOLE WAS BACKFILLED WITH CUTTINGS.

0 - 15 CLAY, BROWN, SILTY, SLIGHTLY SANDY AND
PEBBLY; DRY TO 10 FEET, MOIST AFTER 10
FEET (TILL)

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COUNTY: HAND LOCATION: 112N-68W-10DDBA 5
MAP LOCATION: 29
LEGAL LOCATION: NE NW SE SE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.3106 LONGITUDE: 98.5910
LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT DRILLER'S LOG:
GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
DATE DRILLED: 04-25-1985 DRILLING METHOD: AUGER
GROUND SURFACE ELEVATION: 1572.77 I
TOTAL DRILL HOLE DEPTH: 15 TEST HOLE NUMBER: A1-85-22
WATER RIGHTS WELL: SDGS WELL NAME: A1-85-22
OTHER WELL NAME:
BASIN: JAMES AQUIFER: TILL
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1574.97 I
CASING STICK-UP: 2.20 TOTAL CASING AND SCREEN: 15.1
WELL MAINTENANCE DATE: 04-26-1985
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
3 FEET. DEPTH TO WATER WAS 8.80 FEET AND FIELD
CONDUCTIVITY WAS 6000 MICROMHOS PER CENTIMETER
ON 05-08-1985.

0 - 1 TOPSOIL, BROWN; ORGANIC
 1 - 8 CLAY, BROWN, SILTY, SLIGHTLY SANDY AND
 PEBBLY; MOIST (TILL)
 8 - 12 CLAY, BLUE-GRAY, SILTY, SLIGHTLY SANDY
 AND PEBBLY; MOIST, OLD GASOLINE ODOR
 (TILL)
 12 - 15 CLAY, BROWNISH-GRAY, SILTY, SLIGHTLY
 SANDY AND PEBBLY; MOIST, SLIGHT
 GASOLINE ODOR (TILL)

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COUNTY: HAND LOCATION: 112N-68W-10DDBB 1
 MAP LOCATION: 30
 LEGAL LOCATION: NW NW SE SE SEC. 10, T. 112 N., R. 68 W.
 LATITUDE: 44.3107 LONGITUDE: 98.5915
 LAND OWNER:
 PROJECT: MILLER PETROLEUM SPILL
 DRILLING COMPANY: SDGS
 DRILLER: M. JARRETT DRILLER'S LOG:
 GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
 DATE DRILLED: 04-24-1985 DRILLING METHOD: AUGER
 GROUND SURFACE ELEVATION: 1579.92 I
 TOTAL DRILL HOLE DEPTH: 15 TEST HOLE NUMBER: A1-85-15
 WATER RIGHTS WELL: SDGS WELL NAME: A1-85-15
 OTHER WELL NAME:
 BASIN: JAMES AQUIFER: TILL
 MANAGEMENT UNIT:
 SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
 CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
 CASING TOP ELEVATION: 1581.02 I
 CASING STICK-UP: 2.10 TOTAL CASING AND SCREEN: 15.9
 WELL MAINTENANCE DATE: 04-26-1985
 USGS HYDROLOGICAL UNIT CODE: 10160009
 ELECTRIC LOG INFORMATION:
 SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
 NATURAL GAMMA: EXTRA:
 SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
 3 FEET. DEPTH TO WATER WAS 8.69 FEET AND FIELD
 CONDUCTIVITY WAS 3400 MICROMHOS PER CENTIMETER
 ON 05-08-1985.

0 - 5 CLAY, BROWN, PEBBLY, SANDY (TILL)
 5 - 11 CLAY, GRAY-BLUE, GRADUALLY TURNING TO
 GRAY-BROWN, SILTY; SOME SAND AND
 PEBBLES, MOIST, GASOLINE ODOR FROM 5 TO
 8 FEET (TILL)

11 - 15 CLAY, TAN-BROWN, SILTY; SOME SAND AND
PEBBLES, MOIST, FAINT GASOLINE ODOR
(TILL)

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COUNTY: HAND LOCATION: 112N-68W-10DDBB 2
MAP LOCATION: 31
LEGAL LOCATION: NW NW SE SE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.3106 LONGITUDE: 98.5914
LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT DRILLER'S LOG:
GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
DATE DRILLED: 04-24-1985 DRILLING METHOD: AUGER
GROUND SURFACE ELEVATION: 1577.38 I
TOTAL DRILL HOLE DEPTH: 15 TEST HOLE NUMBER: A1-85-16
WATER RIGHTS WELL: SDGS WELL NAME: A1-85-16
OTHER WELL NAME:
BASIN: JAMES AQUIFER: TILL
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1579.28 I
CASING STICK-UP: 1.90 TOTAL CASING AND SCREEN: 16.2
WELL MAINTENANCE DATE: 04-26-1985
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
3 FEET. DEPTH TO WATER WAS 7.95 FEET AND FIELD
CONDUCTIVITY WAS 6600 MICROMHOS PER CENTIMETER
ON 05-08-1985.

0 - 15 CLAY, LIGHT-TAN TO BROWN, VERY SILTY; FEW
PEBBLES AND LITTLE SAND, MOIST (TILL)

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COUNTY: HAND LOCATION: 112N-68W-10DDBB 3
MAP LOCATION: 32
LEGAL LOCATION: NW NW SE SE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.3106 LONGITUDE: 98.5917

LAND OWNER:
 PROJECT: MILLER PETROLEUM SPILL
 DRILLING COMPANY: SDGS
 DRILLER: M. JARRETT
 GEOLOGIST: D. HOLLY
 DATE DRILLED: 04-24-1985
 GROUND SURFACE ELEVATION: 1577.26 I
 TOTAL DRILL HOLE DEPTH: 15
 WATER RIGHTS WELL:
 OTHER WELL NAME:
 BASIN: JAMES
 MANAGEMENT UNIT:
 SCREEN TYPE: PVC, MFG.
 CASING TYPE: PVC, SCH. 40
 CASING TOP ELEVATION: 1579.36 I
 CASING STICK-UP: 2.10
 WELL MAINTENANCE DATE: 04-26-1985
 USGS HYDROLOGICAL UNIT CODE: 10160009
 ELECTRIC LOG INFORMATION:
 SPONTANEOUS POTENTIAL:
 NATURAL GAMMA:
 SAMPLES:

DRILLER'S LOG:
 GEOLOGIST'S LOG: X
 DRILLING METHOD: AUGER
 TEST HOLE NUMBER: A1-85-17
 SDGS WELL NAME: A1-85-17
 AQUIFER: TILL
 SCREEN LENGTH: 10.0
 CASING DIAMETER: 2.0
 TOTAL CASING AND SCREEN: 16.4
 SINGLE POINT RESISTIVITY:
 EXTRA:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
 3 FEET. DEPTH TO WATER WAS 8.73 FEET AND FIELD
 CONDUCTIVITY WAS 5000 MICROMHOS PER CENTIMETER
 ON 05-08-1985.

0 - 15 CLAY, TAN TO DARK-BROWN, SILTY, SLIGHTLY
 SANDY AND PEBBLY; MOIST, SLIGHT
 GASOLINE ODOR FROM 10 TO 12 FEET, VERY
 SLIGHT ODOR FROM 12 TO 15 FEET (TILL)

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COUNTY: HAND
 MAP LOCATION: 33
 LEGAL LOCATION: SW NW SE SE SEC. 10, T. 112 N., R. 68 W.
 LATITUDE: 44.3104
 LAND OWNER:
 PROJECT: MILLER PETROLEUM SPILL
 DRILLING COMPANY: SDGS
 DRILLER: M. JARRETT
 GEOLOGIST: D. HOLLY
 DATE DRILLED: 04-25-1985
 GROUND SURFACE ELEVATION: 1576.77 I
 TOTAL DRILL HOLE DEPTH: 15
 WATER RIGHTS WELL:
 OTHER WELL NAME:

LOCATION: 112N-68W-10DDBC 1
 LONGITUDE: 98.5914
 DRILLER'S LOG:
 GEOLOGIST'S LOG: X
 DRILLING METHOD: AUGER
 TEST HOLE NUMBER: A1-85-25
 SDGS WELL NAME: A1-85-25

BASIN: JAMES AQUIFER: TILL
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1578.57 I
CASING STICK-UP: 1.80 TOTAL CASING AND SCREEN: 15.9
WELL MAINTENANCE DATE: 04-26-1985
USGS HYDROLOGICAL UNIT CODE: 10160009
ELECTRIC LOG INFORMATION:
 SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
 NATURAL GAMMA: EXTRA:
 SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO 3 FEET. DEPTH TO WATER WAS 9.10 FEET AND FIELD CONDUCTIVITY WAS 5600 MICROMHOS PER CENTIMETER ON 05-08-1985.

0 - 6 CLAY, BROWN, SILTY; FEW PEBBLES, LITTLE SAND, MOIST (TILL)
6 - 8 CLAY, GRAYISH-BROWN, SILTY, SLIGHTLY SANDY AND PEBBLY; MOIST, SLIGHT GASOLINE ODOR (TILL)
8 - 15 CLAY, BROWN, SILTY, SLIGHTLY SANDY AND PEBBLY; MOIST (TILL)

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COUNTY: HAND LOCATION: 112N-68W-10DDBC 2
MAP LOCATION: 34
LEGAL LOCATION: SW NW SE SE SEC. 10, T. 112 N., R. 68 W.
LATITUDE: 44.3103 LONGITUDE: 98.5917
LAND OWNER:
PROJECT: MILLER PETROLEUM SPILL
DRILLING COMPANY: SDGS
DRILLER: L. FRYKMAN DRILLER'S LOG:
GEOLOGIST: D. HOLLY GEOLOGIST'S LOG: X
DATE DRILLED: 04-25-1985 DRILLING METHOD: AUGER
GROUND SURFACE ELEVATION: 1577.09 I
TOTAL DRILL HOLE DEPTH: 18 TEST HOLE NUMBER: A1-85-26
WATER RIGHTS WELL: SDGS WELL NAME: A1-85-26
OTHER WELL NAME:
BASIN: JAMES AQUIFER: TILL
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC, SCH. 40 CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1579.09 I
CASING STICK-UP: 2.00 TOTAL CASING AND SCREEN: 12.9
WELL MAINTENANCE DATE: 04-26-1985

USGS HYDROLOGICAL UNIT CODE: 10160009

ELECTRIC LOG INFORMATION:

SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
3 FEET. DEPTH TO WATER WAS 7.85 FEET AND FIELD
CONDUCTIVITY WAS 1600 MICROMHOS PER CENTIMETER
ON 05-08-1985.

0 -	5	SAND, BROWN, MEDIUM TO COARSE, SILTY; SOME CLAY, MOIST AT 5 FEET (ROADFILL)
5 -	9	SAND, GRAY, MEDIUM TO COARSE; LITTLE CLAY, SATURATED, GASOLINE ODOR (ROADFILL)
9 -	15	SAND, DARK-GRAY, COARSE; SATURATED, GASOLINE ODOR (ROADFILL)
15 -	18	CLAY, BROWN, SILTY, SLIGHTLY SANDY AND PEBBLY; MOIST

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COUNTY: HAND	LOCATION: .112N-68W-10DDBC 3
MAP LOCATION: 35	
LEGAL LOCATION: SW NW SE SE SEC. 10, T. 112 N., R. 68 W.	
LATITUDE: 44.3103	LONGITUDE: 98.5917
LAND OWNER:	
PROJECT: MILLER PETROLEUM SPILL	
DRILLING COMPANY: SDGS	
DRILLER: L. FRYKMAN	DRILLER'S LOG:
GEOLOGIST: D. HOLLY	GEOLOGIST'S LOG: X
DATE DRILLED: 04-25-1985	DRILLING METHOD: AUGER
GROUND SURFACE ELEVATION: 1576.91 I	
TOTAL DRILL HOLE DEPTH: 16	TEST HOLE NUMBER: A1-85-27
WATER RIGHTS WELL:	SDGS WELL NAME: A1-85-27
OTHER WELL NAME:	
BASIN: JAMES	AQUIFER: TILL
MANAGEMENT UNIT:	
SCREEN TYPE: PVC, MFG.	SCREEN LENGTH: 10.0
CASING TYPE: PVC, SCH. 40	CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1578.91 I	
CASING STICK-UP: 2.00	TOTAL CASING AND SCREEN: 15.9
WELL MAINTENANCE DATE: 04-26-1985	
USGS HYDROLOGICAL UNIT CODE: 10160009	
ELECTRIC LOG INFORMATION:	
SPONTANEOUS POTENTIAL:	SINGLE POINT RESISTIVITY:
NATURAL GAMMA:	EXTRA:
SAMPLES:	

WELL WAS GRAVEL PACKED. BENTONITE SEAL FROM 0 TO
3 FEET. DEPTH TO WATER WAS 7.72 FEET AND FIELD
CONDUCTIVITY WAS 3800 MICROMHOS PER CENTIMETER
ON 05-08-1985.

0 -	5	CLAY, OLIVE-BROWN, SILTY, SLIGHTLY SANDY, PEBBLY; MOIST, FRESH GASOLINE ODOR (TILL)
5 -	9	CLAY, OLIVE-GRAY TO GRAY, VERY SILTY, SLIGHTLY SANDY, PEBBLY; MOIST, GASOLINE ODOR (TILL)
9 -	16	CLAY, OLIVE-GRAY TO BROWN, VERY SILTY, SLIGHTLY SANDY AND PEBBLY; MOIST, SLIGHT GASOLINE ODOR (TILL)

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