ROZAK ENGINEERING Civil, Construction & Environmental Consulting
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December 20, 1999

Mr. Don Seagren, Environmental Specialist
Alaska Dept. of Environmental Conservation
Kenai Area Office
43335 Kalifonsky Beach Rd., Suite 11
Soldotna, AK 99669

Subject: Interim Characterization Report
Doyle's Fuel Storage Facility
SE 1/4 B.L.M. Lot 51, S34, T6S, R11W, City of Kenai, Alaska
Reckey # 98-23-01-289-01

Dear Mr. Seagren,

This report outlines the groundwater investigation at the subject property conducted on October 25, 26, and 27, 1999. The investigation followed the outline set out in the Interim Site Characterization Plan dated 10-7-99.

SUMMARY

Four groundwater monitoring wells were installed by Hughes Drilling as per ADEC specifications. The wells were developed and water samples were collected from each well for analytical testing. Soil samples were collected during drilling and those samples were field screened using PID and Dexsil PetroFLAG tests. Groundwater and soil samples were sent to MultiChem Analytical Services to be tested for the presence of GRO/BTEX and DRO. Soil samples were also tested for the presence of PAH compounds. Results indicate that contamination is present at the site and that, in areas, contamination exceeds current regulated limits. Analytical testing indicates that the contamination is consistent with a diesel fuel release. Levels of soil contamination in the range of 8000 to 14000 ppm (DRO) were found in an area where the above ground tanks were once located (Figure 1). It is suspected that contamination was caused by two fuel releases in areas adjacent to one another. Additional contamination may have come from small releases from tanks or tank trucks that were used to transport fuel.

Groundwater contamination is present at the site and has migrated beyond the property boundary. The long-term status of the groundwater plume has not been established and subsequent rounds of water sampling will be needed to assess the impact of the soil contamination on the groundwater plume.

WELL INSTALLATION AND SAMPLING

Four monitor wells were installed at the subject property. Figure 1 shows the locations of the wells, the groundwater flow direction, and the gradient. The wells were installed by Hughes Drilling on 10-25-99 using a rotary drill and 6-inch diameter hollow stem auger. All four wells were constructed using 2-inch diameter PVC well pipe and screen (0.01 inch slots). The wells were constructed so that the screened interval extended above and below the current groundwater level to accommodate fluctuations in the water table. Well locations and elevations were surveyed on 10-26-99. Elevations were recorded relative to an on-site benchmark because an official elevation benchmark could not be found near the site. Soil boring logs and well construction diagrams for each well are included with the report. The site was resurveyed and groundwater levels were measured again on 11-30-99. Also at that time, in-situ measurements of pH, electrical conductivity (eC), temperature (T), and dissolved oxygen (DO) were taken using a water analyzer.

The wells were developed by bailing water from them using disposable polyethelyene bailers. About 30 gallons of water were bailed from MW-1, MW-2, And MW-3, and about 35 gallons were bailed from MW-4. The wells were bailed until the water became clear and free of fines. Wells were developed on 10-26-99 and groundwater samples were collected from each well on 10-27-99. Prior to collecting groundwater samples, the water level in each well was measured and about 5 gallons of water were bailed from each well. Groundwater samples were sent to MultiChem Analytical Services to be analyzed for GRO/BTEX and DRO.

Soil samples were collected using a 2-inch diameter split-spoon sampler with brass liner inserts. The split-spoon was driven into the formation with a 340-pound hydraulic hammer attached to the drill rig. Soil samples were collected in 6 inch intervals from 5 to 9 feet bgs at the MW-1, MW-3, and MW-4 locations, and from 5 to 11 feet bgs at the MW-2 location. An additional soil boring (17A) was dug, using a hand auger, to the north of the concrete slab in front of the shop/garage area. The boring was dug by hand because of the close proximity to underground electric and storage trailers parked on the lot. Three soil samples (2-2, 17A-2, and 17A-5) were sent to MultiChem Analytical Services to be analyzed for GRO/BTEX, DRO, and PAH. These samples were selected because they evinced relatively high PID and Dexsil PetroFLAG test readings. The attached boring logs show the locations where field and lab samples were collected from each boring. Soil samples were also collected for physical properties analysis, but testing has been postponed pending the results of the analytical testing.

ANALYTICAL RESULTS

Results of tests on field and analytical samples are reported in Tables 1 and 2. Figures 1 and 2 show the locations of the monitor wells and all soil borings that have been made

TABLE 1 - SUMMARY OF ANALYTICAL RESULTS OF SOIL SAMPLES

SAMPLE ID	DEPTH	PID	P'FLAG	GRO	DRO	BENZENE
		ppm	ppm	mg/kg	mg/kg	mg/kg
1-1	5-5.5	<1				
1-2	6.5-7	<1				
1-3	8-8.5	1	78			
2-1	6.5-7	352				
2-2 DFS-SC-99-01	7.5-8	537	>5000	650	14000	0.2
2-3	9-9.5	279				
2-4	10.5-11	71	0			
3-1	5.5-6	<1				
3-2	7.5-8	1	0			
4-1	6.5-7	1	0			
4-2	7.5-8	1				
17A-1	1	98				
17A-2 DFS-SC-99-02	2	1220	>5000	480	11000	2.6
17A-3	4	1150				
17A-4	6	1590				
17A-5 DFS-SC-99-03	7.5	1960	>5000	93	8000	3.0

PAH ANALYTICAL RESULTS		
	DRO AROMATICS (ppm)	DRO ALIPHATICS (ppm)
2-2 DFS-SC-99-01	910	8700
17A-2 DFS-SC-99-02	540	7900
17A-5 DFS-SC-99-03	580	5100
CLEANUP STANDARDS	100	7200

Empty cells indicated that the test was not performed

at the site (all 1998 and 1999 investigations included). Testing of field screen samples using the PID did not indicate the presence of volatile hydrocarbons. Because the potential contaminant was believed to be DRO, field screen tests were also made using the PetroFLAG test kit which is a better indicator of DRO contamination. Testing, using

the PetroFLAG kit, indicated the presence of diesel contamination at about 78 ppm in the soil sample collected from MW-1 at 8 to 8.5 feet below ground surface (bgs). Additionally, analytical tests on groundwater collected from MW-1 indicated that contamination was indeed present. Low levels of GRO/BTEX, and DRO were detected in the water sample from MW-1. The contaminant levels are well below the current cleanup levels, but the presence of contamination was not expected at this location.

Soil samples collected during the installation of MW-2 show the soil is contaminated, and that the highest levels of contamination are 7 to 8 feet bgs. Contamination appears to have originated at the surface and migrated down to groundwater at this location. PID measurements indicate the presence of volatile contaminants throughout the soil profile. PID measurements on sample 2-2 indicated contamination in the range of 500 ppm. Dexsil PetroFLAG tests indicated that diesel fuel contamination may be as high as 5000 ppm at that depth. Analytical results confirmed that DRO contamination is 14000 ppm, many times greater than the cleanup standards. Analysis of sample 2-2 (DFS-SC-99-01) for PAH indicated that the DRO aromatic constituents were present at 910 ppm and the DRO aliphatics were 8700 ppm. Both of those constituents exceed the Method 2 cleanup standards of 100 and 7200 ppm, respectively. Analytical tests performed on water collected from MW-2 detected contaminant at levels exceeding cleanup standards. The GRO level was 2.4 ppm, the DRO level was 14 ppm, and the total BTEX level was 0.235 ppm. Sample chromatography showed that contamination was consistent with diesel fuel. This is internally consistent with the site history that shows fuels stored on the site were diesel fuels.

TABLE 2 – SUMMARY OF ANALYTICAL RESULTS OF WATER SAMPLES

SAMPLE ID	T	pH	eC	DO	GRO	DRO	BENZENE
	^{0}C		uS	ppm	mg/l	mg/l	Mg/l
MW-1 DFS-SC-99-04	4.1	6.1	9.5	1.9	0.13	0.32	U
MW-2 DFS-SC-99-07	4.8	6.1	210	0.6	2.4	14	U
MW-3 DFS-SC-99-06	4.5	5.1	70	0.8	U	U	0.002
MW-4 DFS-SC-99-05	4.8	5.9	286	6.5	1.2	1.0	0.1
CLEANUP STANDARDS	--	--	--	--	1.3	1.5	0.02(Soil)

U = Analyte was not detected during analysis

0.005 water

Field screen tests performed on grab samples collected from boring 17A indicated that contamination was present at that location as well. This finding confirms the results of previous investigations. Contamination was detected throughout the soil profile, as was indicated by the relatively high PID readings in samples collected from 1, 2, 4, 6, and 7.5 feet bgs. DRO was detected in soil sample 17A-2 at about 11000 mg/kg, much in excess of cleanup levels. PAH analytical tests on samples 17A-2 and 17A-5 indicate that cleanup standards for DRO aromatics were exceeded in both samples. DRO aliphatic cleanup standard was exceeded in sample 17A-5, but not in 17A-2 as shown in Table 1.

Field screen tests did not indicate that soil contamination was present at either MW-3 or MW-4 locations. However, analytical tests detected slight BTEX contamination in groundwater collected from MW-3, and higher level contamination in water from MW-4. The benzene contamination level (0.1 ppm) in the MW-4 sample exceeded the current cleanup levels. These results were not expected, and indicate that contamination has migrated away from the original release location. DRO contamination was detected in a soil sample collected near the MW-4 location in 1998. Because surface contamination was not detected at either the MW-3 or MW-4 locations, it can only be assumed that groundwater contamination is the result of up-gradient releases.

QUALITY CONTROL SUMMARY

The laboratory data report showed the samples were received in good condition and quality assurance/quality control criteria was in compliance with the ADEC and/or MultiChem's Assurance Program Plan. The laboratory evaluated the sample chromatography and reported that the results were consistent with diesel fuels.

CONCLUSIONS

Inspection of the site specific data indicate that contamination is indeed present at the site and that contaminant levels exceed current regulatory limits. We did not expect to encounter contamination at the MW-1 location. However, inspection of aerial photographs taken in 1986 show what appear to be fuel tanks or tank trucks parked at several locations around the site. Several of these tanks are located in the area where MW-1 is presently located. Contamination associated with MW-1 may have resulted from a small leak or release from one of the tank trucks when it was parked on the site. We do not believe that this contamination is associated with what appears to be a larger fuel release that occurred in the vicinity of MW-2 where the above ground tanks were once located (Figure 1). In fact there appear to have been two major releases at the site. Besides the release near the 15,000 gallon above-ground-tanks (AST) as described above, it appears that a release occurred on the concrete slab in front of the building that housed the AST's from 1991 to 1998 (Figure 1). This release is likely responsible for

soil contamination detected at locations 16, 17, and 17A (Figure 2). This spill is also probably responsible for groundwater contamination detected at MW-3, and partially responsible for contamination found at MW-4. If the groundwater direction changes seasonally, then contamination at MW-4 may have resulted from fuel releases near MW-2 and soil borings 16 and 17.

Contamination was detected in samples collected from a soil boring drilled near the current MW-4 location. This boring was drilled during a previous investigation in 1998. DRO was detected at 9.7 ppm in a soil sample collected from below the water table. This indicates that contamination was and still is present in the groundwater at the MW-4 location. Thus, the groundwater plume extends beyond the property boundary and past the MW-4 location. It is unclear from comparison of the contaminant level found during the 1998 investigation and the current groundwater contaminant level, whether or not the contaminant level is increasing, stable, or decreasing. Additional rounds of groundwater monitoring should allow determination of the status of the groundwater plume.

Current levels of soil contamination at the site exceed the regulated levels by many times. It is presently unclear to what degree soil contamination at the site is impacting groundwater. Clearly, groundwater contamination is present and groundwater monitoring needs to continue. However, subsequent rounds of sampling should allow determination of the status of the groundwater plume. If the groundwater plume is not increasing (i.e., stable or decreasing), then the question is, "to what degree should the soil be remediated, if at all?". Because of the large soil area involved and the current site usage, excavating the site is not economically feasible. Bioremediation and natural attenuation would take a longer period of time to accomplish the desired outcome, but could be effective given the shallow water table and lack of asphalt covering on the surface. The site is currently commercial property and there is no reason to believe that the current status will change in the foreseeable future. Thus, if the plume is not expanding, a reasonable approach would be to try simple, cost effective, methods of remediation as a first step.

Comparison of the current groundwater direction and gradient with the direction and gradient determined from the 1998 investigation, shows that the flow direction has changed substantially. The current flow direction is not directly towards MW-4 as was previously thought. If additional monitoring indicates that the flow direction is the same as present, an additional well will probably need to be installed to the north of MW-4. An additional up-gradient well may be installed at that time as well.

At the current time nothing substantiating can be said concerning the groundwater parameter data (T, pH, eC, and DO) found in Table 2. However, the parameter data can give indications whether or not biodegradation is occurring. Significant reductions or increases in DO are indicators of biological activity. It is suspected that significant biological reduction is taking place that leads to reduced DO levels in wells MW-2, and MW-3. DO levels in the range of 3 to 4 ppm would be expected in areas where

biological activity is not occurring. The DO level observed at MW-4 is higher than expected, but tends to indicated that little or no biological activity is occurring. However, more information needs to be collected before any trends in the data will become apparent.

CLOSURE

The findings and conclusions in this report describe the conditions present at the time the subject underground tank system was assessed. The assessment was performed in general accordance with the standards of care and diligence normally practiced by recognized consulting firms in performing services of a similar nature. To the best of our knowledge the information is true, accurate, and complete.

Prepared by,

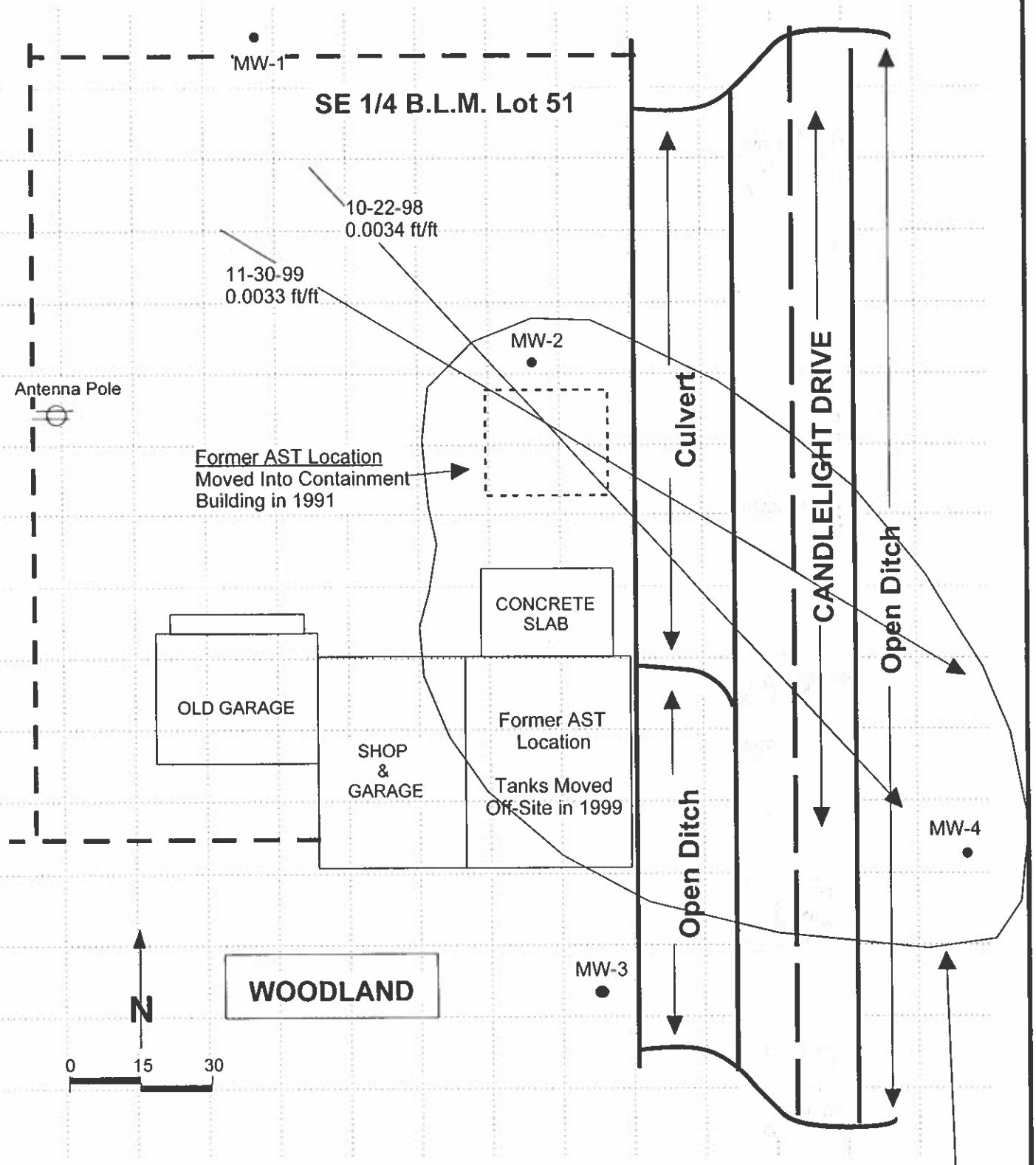
Mark Prieksat, Ph.D.
Soil Physicist

Ronald T. Rozak, P.E.
Principal Investigator

Attachments:

- Figure 1. Soil Contamination Map
- Figure 2. Groundwater Contamination Map
- Well and Soil Boring Logs
- Field Screen Reports
- Laboratory Analytical Results

Rozak Engineering P.O. Box 350 Kenai, Alaska 99611 (907) 283 - 5640	Figure 1. Groundwater Contamination Map Doyles Fuel Service 12-7-99	LEGEND MONITOR WELL • MW-2



Estimated plume boundary based on overall well data and contaminants that exceed cleanup levels.

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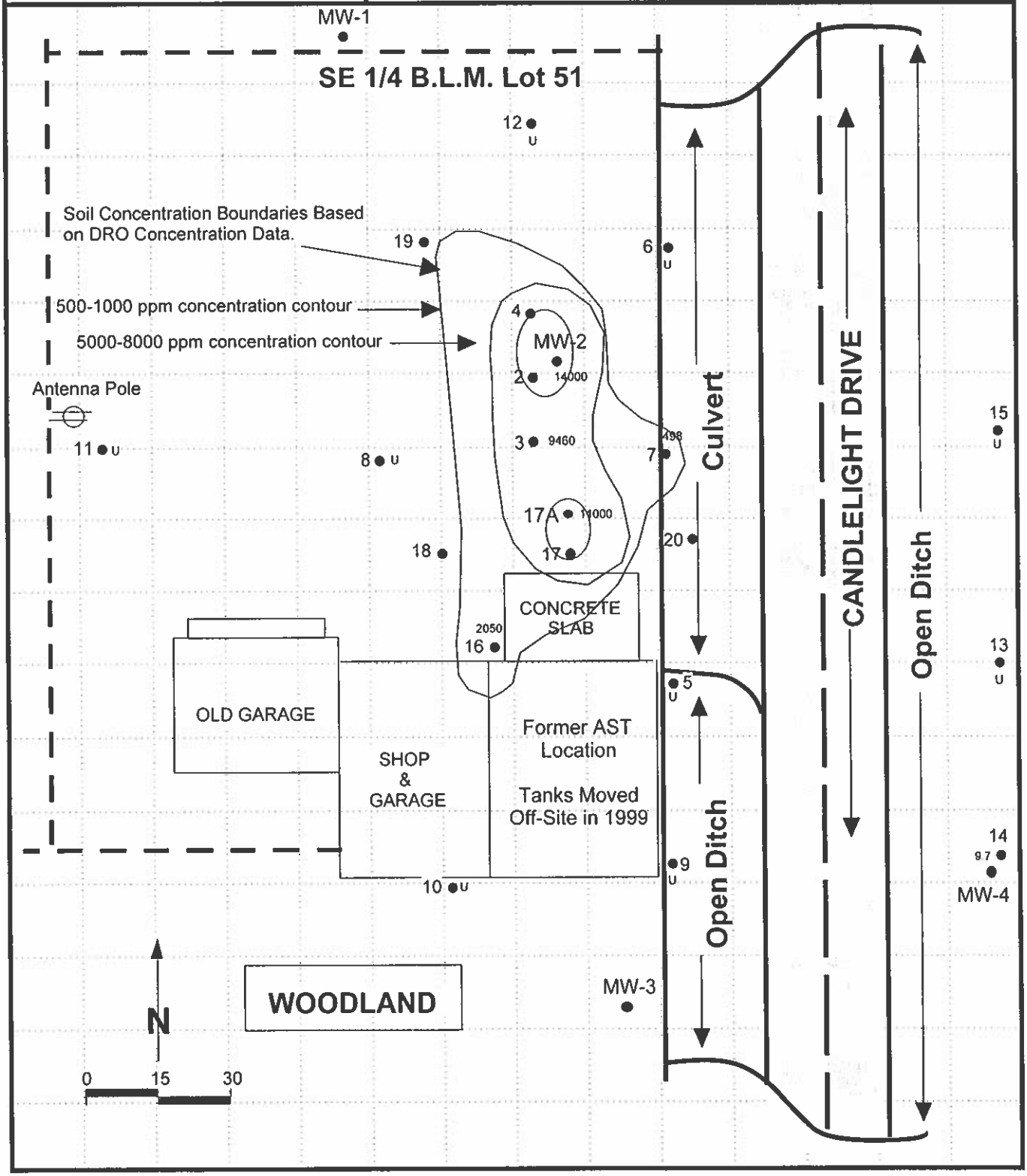
Figure 2. Soil Contamination Map
Doyles Fuel Service
12-2-99

LEGEND

Monitor Well ● MW-2

Soil Boring 12 ● U — Soil Boring Number; Soil Boring Location; DRO Concentration



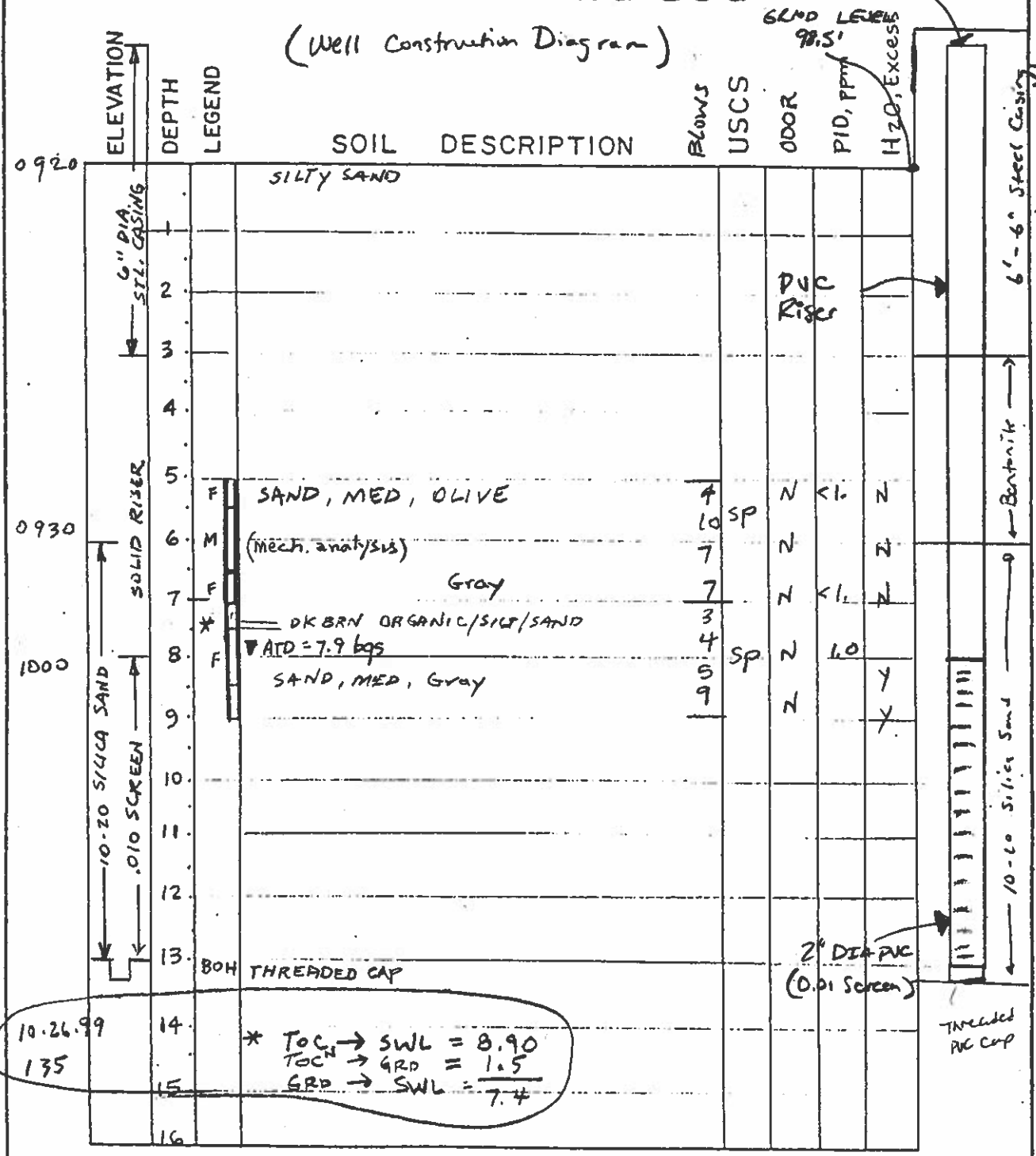
SOIL BORING LOG

(Well Construction Diagram)

TOC = 100' (Relative)

GRND LEVEL 98.5'

BORING NO. MW-1



LEGEND

- F FIELD SCREEN SAMPLE, PID CALIBRATION = 100. ppm @ 0920
- L LAB; D DEXSIL PETROFLAG SAMPLE — PhotoVac Microtip (10.6 eV)
- SPLIT SPOON SAMPLE — 30°F @ 0920
- ▼ GROUND WATER TABLE AT DATE OF BORING (ATD)
- BOH BOTTOM OF HOLE

PROJECT: Monitor Well Installation
LOCATION: Doyle's Fuel Service
DRILLER: Hughes
INSPECTOR: R.T. Rozak, Mark Prieksat
DATE DRILLED: October 25, 1999
START: 0920
FINISH: 1050

FIG. NO.

OF

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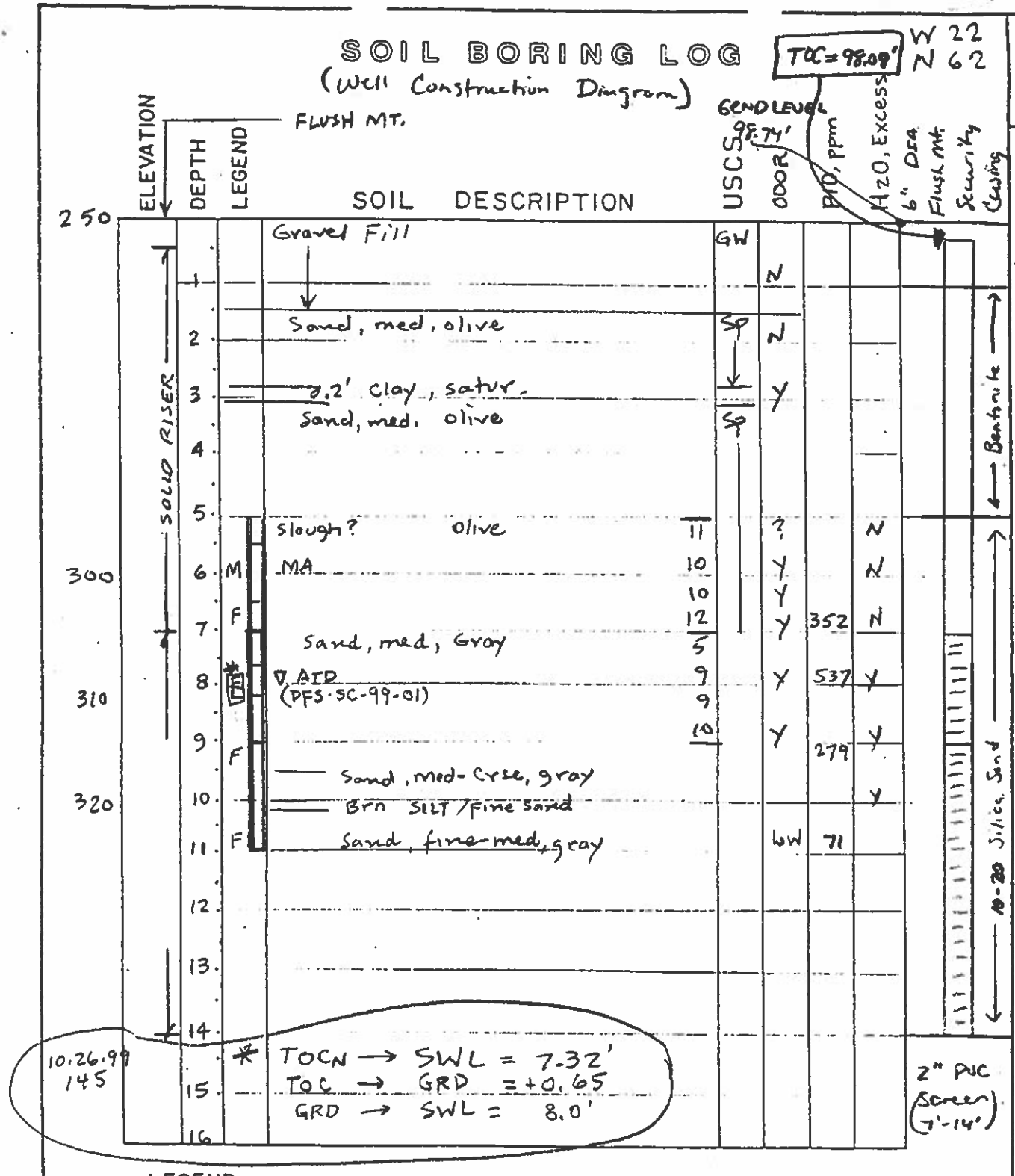
SOIL BORING LOG
(Well Construction Diagram)

TOC = 98.09' W 22 N 62

BORING NO. MW-2



LEGEND

- F FIELD SCREEN SAMPLE, PID CALIBRATION = 100 ppm @ 0920
- L LAB; D DEXSIL PETROFLAG SAMPLE
- PhotoVac Microtip (10.6 eV)
- SPLIT SPOON SAMPLE
- GROUND WATER TABLE AT DATE OF BORING
- BOH BOTTOM OF HOLE

PROJECT: MONITOR WELL INSTALLATION LOCATION: DOYLE'S FUEL SERVICE

DRILLER: HUGHES INSPECTOR: R.T. ROZAK, Mark Prieksat

DATE DRILLED: October 25, 1999 START: 250 FINISH: 415

FIG. NO. OF

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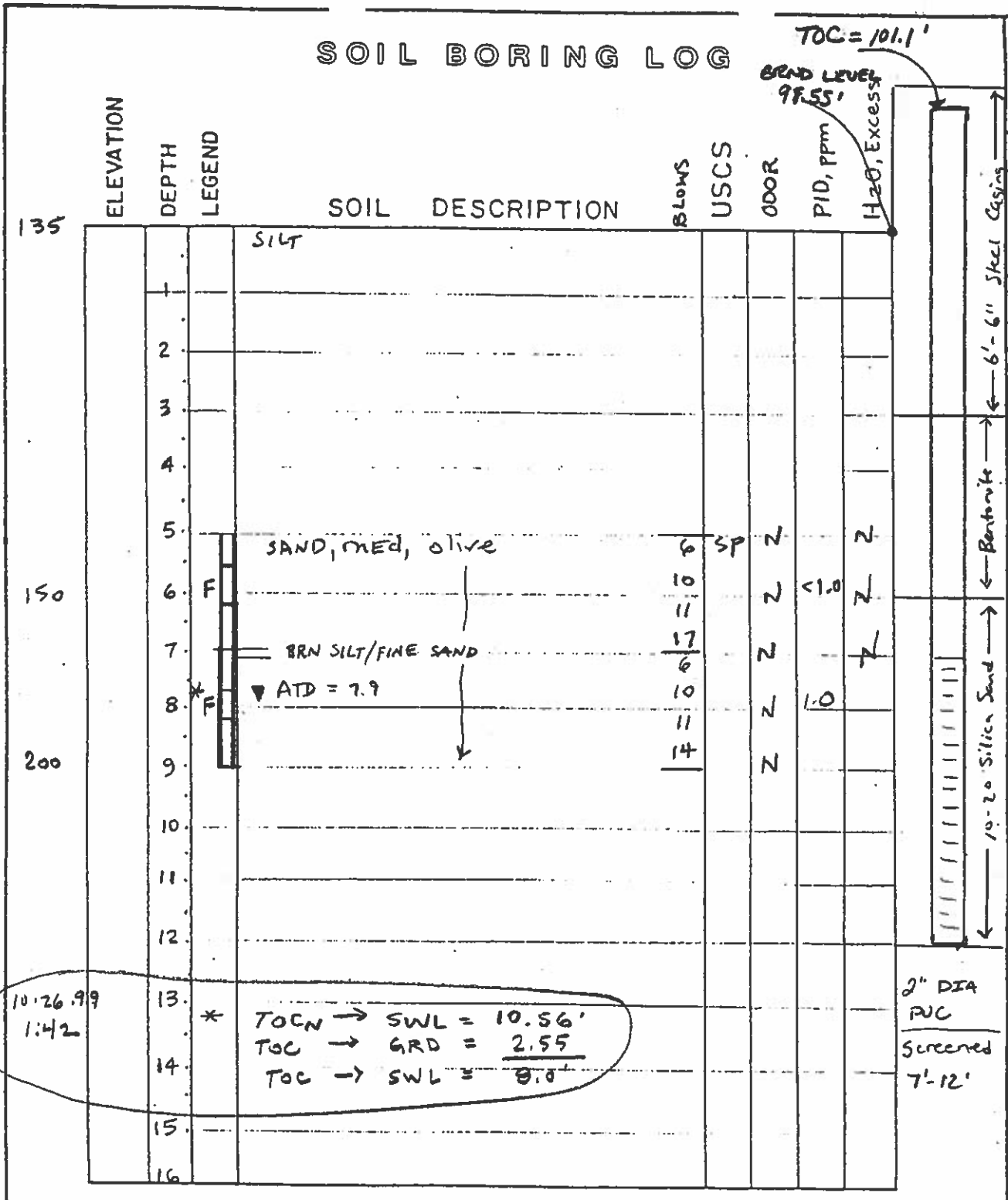
SOIL BORING LOG



LEGEND

- F FIELD SCREEN SAMPLE, PID CALIBRATION = 100 ppm @ 0920
- L LAB; D DEXSIL PETROFLAG SAMPLE — PhotoVac Microtip (10.6 eV)
- SPLIT SPOON SAMPLE
- ▼ GROUND WATER TABLE AT DATE OF BORING
- BOH BOTTOM OF HOLE

PROJECT: MONITOR WELL INSTALLATION LOCATION: DOYLE'S FUEL SERVICE

DRILLER: HUGHES INSPECTOR: R.T. ROZAK, Mark Prieksat

DATE DRILLED: October 25, 1999 START: 1130 FINISH: 245

FIG. NO. OF

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SOIL BORING LOG

BORING NO. MW-4

TOC = 100.28'

GRND LEVEL 97.3'

ELEVATION	DEPTH	LEGEND	SOIL DESCRIPTION	USCS	ODOR	PID, ppm	H2O, Excess
1105			SILT				
	1						
	2						
	3						
	4						
	5		SAND, Med, olive	5 SP	N		N
	6			9			
	7			7	N		N
1120	7	*F	DK BRN ORGANIC/SILT	6	N	1.0	?
			7.1 ATD	4			
1135	8	F	gray	7	N		Y
				10		1.0	
	9			11	N		X
	10						
	11						
	12	BOH	THREADED CAP				
10.26.99 1138	13	*	Toc → SWL = 9.91'				
	14		TOC → GRD = 2.9				
			GRD → SWL = 7.0				
	15						
	16						

PID SCREEN

← 1'-6" Steel Casing

← Bentonite →

← 10-20 Silica Sand →

2" DIA PVC

Screened 7'-12'

LEGEND

F FIELD SCREEN SAMPLE, PID CALIBRATION = 100. ppm @ 0920

L LAB; D DEXSIL PETROFLAG SAMPLE PhotoVac Microtip (10.6 eV)

SPLIT SPOON SAMPLE

GROUND WATER TABLE AT DATE OF BORING

BOH BOTTOM OF HOLE

PROJECT: MONITOR WELL INSTALLATION LOCATION: DOYLE'S FUEL SERVICE

DRILLER: HUGHES DRILLING (Bob Hughes) INSPECTOR: R.T. ROZAK, Mark Prieksat

DATE DRILLED: October 25, 1999 START: 1105 FINISH: 1205

FIG. NO.

OF

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SOIL BORING LOG

BORING NO. 17A

Grd = 0.8' below T.O.C. TBM = 100.00 (P-gun) ⇒ 99.2

ELEVATION	DEPTH	LEGEND	SOIL DESCRIPTION	USCS	ODOR	PID, ppm	H_2O, Excess PID, WARM
							FZN
1500							
1520	1	F	Gravel Fill, brn	GW	No	97	98
1525	2	F	Silt/fine sand, olive (DFS-SC-99-02) Begin HC septic odor		Yes	875	1220
	3		Sand, fine-med gray w/white parts "solvent type" odor				
1535	4	F				1030	1150
	5						
1545	6	F	(TRACE DK BRN SILT)			1330	1590
	7						
		F	7.6' bgs @ 1615 (91.6') (DFS-SC-99-03)			1710	1960
1600	8						
	9						
	10						
	11						
	12						
	13						
	14						
	15						
	16						

LEGEND

- F FIELD SCREEN SAMPLE, PID CALIBRATION = 100 ppm @ 0920
- L LAB; D DEXSIL PETROFLAG SAMPLE
- PhotoVac Microtip (10.6 eV)
- SPLIT SPOON SAMPLE
- GROUND WATER TABLE AT DATE OF BORING
- BOH BOTTOM OF HOLE

MILE 8.5 Kenai Spur Hwy.

PROJECT: SITE CHARACTERIZATION LOCATION: DOYLE'S FUEL SERVICE

DRILLER: ROZAK ENGINEERING INSPECTOR: R.T. Rozak, Mark Prieksat

DATE DRILLED: October 26, 1999 START: 1500 FINISH: 1600

FIG. NO.

OF

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PetroFLAG™ Hydrocarbon Test Kit - Field Data

PetroFLAG is a trademark of Dexsil corporation.

Date: 10-27-97
Operator: M. Priekset
Location: Doyles Fuel Service

Calibration Time/Date: 2130 / 9-1-99
Calibration Temperature: 17.3°C
Test Time / Date: 0930 / 10-27-99
Test Temp: 18.2°C

No.	Sample ID	Weight	Time/Date	Reading (ppm)	DF[1]	RF[2]	Actual (ppm)	Comments
1	1-8-8.5	5 g	0933	39	2	5	78	PID 1 PPM
2	2-7.5-8	2	↓	4E	5	↓	5 x 4E	537
3	2-10.5-11	2	↓	0	5	↓	0	WET - FROZEN 71
4	3-7.5-8	5	↓	0	2	↓	0	1
5	4-6.5-7	5	↓	0	2	↓	0	< 1
6	17A-2	2	↓	4E	5	↓	5 x 4E	1220
7	17A-7.5	2	0942	4E	5	↓	5 x 4E	1960
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

[1]DF = Dilution Factor, e.g., for 5 gram soil sample DF=10g/5g=2, and actual concentration equals reading times DF (reading (ppm) x DF = actual concentration).

[2]RF = Response Factor, selected for the hydrocarbon contamination at the site.