REMEDIAL INVESTIGATION AND CORRECTIVE ACTION DESIGN REPORT

Steer Truck Stop
3401 West Oakland Avenue
Austin, Minnesota 55912

MPCA LEAK LUST # 8578

January 2, 1996

Northern Environmental℠
Hydrologists • Engineers • Geologists

372 West County Road D
New Brighton, MN 55112
Fax 1-612-635-0643
1-612-635-9100
1-800-776-7169

REMEDIAL INVESTIGATION AND CORRECTIVE ACTION DESIGN REPORT

Steer Truck Stop
3401 West Oakland Avenue
Austin, Minnesota 55912

MPCA ID NO. 8578

January 2, 1996

Prepared For:

Ellsworth Jackson
701 36th Drive SW
Austin, Minnesota 55912

Prepared By:

Northern Environmental Technologies, Incorporated
372 West County Road D
New Brighton, MN 55112

Project Number CMG235084

John J. McCarthy
Senior Project Manager

Douglas J. Bergstrom, C.P.G.
Director, Minnesota Operations

Paul T. Kittelson
Staff Geologist

JJM/slm

TABLE OF CONTENTS

FIGURES

TABLE OF CONTENTS - Figures Continued

TABLES

APPENDICES

1.0 EXECUTIVE SUMMARY

Ellsworth Jackson holds the Contract for Deed for the Steer Truck Stop located at 3401 West Oakland Avenue in Austin, Minnesota ("the Property"). A 12,000-gallon underground storage tank (UST) was discovered to be taking on water in June 1995. This diesel tank was taken out of service and removed in July 1995. During the tank removal sampling, diesel was found to have contaminated soils and groundwater underlying the tank. Northern Environmental Technologies, Incorporated (Northern Environmental) was retained to investigate the degree and extent of contamination at the property.

The depth to groundwater at the site is approximately 6 feet below grade depending on site topography. Site lithology is comprised primarily of fine to medium grained sands with interbedded silts and clays to a depth of approximately 10 feet, where dense, low permeability clay is encountered. Petroleum contaminants were found in both soil and ground water during the investigation activities. However, contamination did not significantly penetrate into the dense clay layer encountered at the 10 foot depth.

Since the extent of contamination is limited to shallow soils and groundwater and no known receptors are present in the impacted area, Northern Environmental recommends no further action at this site.

2.0 INTRODUCTION AND BACKGROUND INFORMATION

This report describes environmental work Northern Environmental Technologies, Incorporated (Northern Environmental) completed at the Steer Truck Stop located at 3401 West Oakland Avenue, in Austin, Minnesota (hereafter referred to as "the Property"). The Property is located in the Southwest Quarter of the Northwest Quarter of Section 5, Township 102 North, Range 18 West in Mower County, Minnesota (Figure 1) (Reference 1). Four underground storage tanks (USTs) were operated at the property; one 8,000-gallon gasoline, one 10,000-gallon gasoline, one 6,000-gallon diesel, and one 12,000-gallon diesel.

The 12,000-gallon diesel UST was discovered to have water mixed in with diesel product in June 1995. On June 15, 1995 Wayne Transport removed 7500 gallons of water and product from the UST and shipped the contents to a refinery in Kansas City. A potential release was reported to the MPCA on June 6, 1995. The tank was taken out of service and subsequently removed on July 24, 1995. The Minnesota Pollution Control Agency (MPCA) Excavation Report (Fact Sheet #4) is included in Appendix A.

The tank was approximately 35 years old, single walled steel construction and found to be in poor condition. During the tank removal, diesel was found to have contaminated soils and shallow groundwater underlying the tank. The confirmed release was reported to the MPCA on this date. Soils excavated during removal of the tank were returned to the excavation as backfill. The approximate location of the former UST is shown on Figure 2.

Photoionization detector (PID) readings recorded during the tank removal ranged from 564 parts per million (ppm) to 1,783 ppm. Laboratory results from soil samples collected during the tank removal activities indicated diesel range organic (DRO) concentrations up to a maximum of 2,100 mg/kg and benzene, ethylbenzene, toluene, and xylene (BETX) combined total concentration up to 1,002 mg/kg. Laboratory results from a single groundwater grab sample collected from standing water in the excavation during the tank removal activities indicated DRO concentrations at 45.1 mg/l and a BETX combined total concentration of 45.55 mg/l.

Subsequent to the tank removal, Ellsworth Jackson solicited bids for conducting a remedial investigation, and awarded the project to Northern Environmental. This report describes the methods used to investigate the release, summarizes and interprets the findings, and provides a corrective action design recommendation.

3.0 DESCRIPTION OF PROJECT ACTIVITIES

Two rounds of Geoprobe soil exploration boreholes were drilled on the Property to help define the vertical and horizontal extent of soil and groundwater affected by released petroleum products. In addition, three groundwater monitoring wells were installed and sampled to check for free product and determine ground-water elevation, flow direction, and quality. Methods used to drill geoprobe boreholes, collect samples, and field results are described in more detail in Appendix B. Methods used to drill soil exploration boreholes, install groundwater monitoring wells, and examine soil and groundwater samples are described in more detail in Appendix C.

3.1 Geoprobe Investigation

Ten Geoprobe soil and groundwater exploration boreholes (GP1 through GP10) were drilled and sampled by Mobile Environmental Sampling and Analysis, Inc (MESA) on October 26, 1995. These boreholes were drilled to determine the lateral extent of on site contamination. Boreholes were drilled at the locations depicted in Figure 2. Geoprobe soil exploration drilling, and sampling techniques, are described in Appendix B.

Northern Environmental observed drilling, described soil samples, conducted field headspace PID readings, and produced boring logs. Soil and groundwater samples were also analyzed by MESA using a field gas chromatogram (GC). Soil lithologic descriptions and headspace readings are presented in Table 1. Boring logs are included in Appendix D. Field GC analytical results from soil and groundwater samples are summarized in Tables 2 and 3, respectively.

Contamination was encountered during the drilling and sampling activities. Free product was documented during geoprobe applied vacuum groundwater sampling activities. The product was limited to the central portion of the site and appeared to be comprised of both diesel and gasoline. Delineation of free product and dissolved phase contamination could only be achieved in three directions (South, East, and West) during initial geoprobe sampling because contamination appeared to migrate off site in the northerly direction under Oakland Avenue.

Subsequently, access agreements were procured for properties north of the site and six additional Geoprobe soil and groundwater boreholes (GP11 through GP16) were drilled and sampled by MESA on November 16 and 17, 1995. These boreholes were drilled to determine the northerly extent of contamination and also to determine the vertical extent of contamination both on and off site. Boreholes were drilled at the locations depicted in Figure 2. Geoprobe exploration drilling and sampling techniques are described in Appendix B.

Northern Environmental observed drilling, conducted field headspace PID readings, and produced boring logs. Soil and groundwater samples were analyzed by MESA using a field GC. Soil PID headspace readings and lithologic descriptions are summarized in Table 1 and presented on the boring logs in Appendix D. Field GC analytical results from soil and groundwater samples are summarized in Tables 2 and 3, respectively.

Confirmation soil samples which were believed to represent the lateral and vertical extent of contamination at the site (based upon PID reading and field GC analysis) were selected for laboratory analyses during the second round of Geoprobe drilling. These samples were analyzed for DRO, GRO, and BETX. Laboratory results are summarized in Table 2. Laboratory reports and chain-of-custody forms for these samples are included in Appendix E.

3.2 Groundwater Monitoring Well Construction, Development, and Sampling

Three ground-water monitoring wells (RW1, RW2, and RW3) were constructed in boreholes B1, B2, and B3, to help determine ground-water quality and flow direction. These monitoring wells were constructed by Agassiz Environmental under the supervision of Northern Environmental in accordance with Minnesota Department of Health (MDH) requirements. The location of the monitoring wells are illustrated in Figure 2.

The wells are constructed of four-inch inside diameter (I.D.), flush-joint, threaded, schedule 40 polyvinyl chloride (PVC) pipe. Ten feet of 0.010-inch mill-slotted well screen was positioned so that two or three feet of the screen was above the expected seasonal high water table. Locking cap and protective flush-mount manhole covers were installed to provide protection from automobile traffic and tampering. Monitoring well construction, development, and ground-water sampling are described in more detail in Appendix C.

The elevation and location of the ground-water monitoring wells were surveyed by Northern Environmental personnel on November 17, 1995. The bench mark is the southwest corner of the cement containment vault for the kerosene aboveground storage tank which has been arbitrarily assigned an elevation of 100.00 feet. Water levels were measured at each monitoring well on November 17 and December 6, 1995 (Table 4).

Ground-water monitoring wells were developed on November 17, 1995. The table in Appendix G summarizes the approximate volume of water removed from each well using a clean, bottom filling PVC bailer. Measurements and observations of pH, specific conductance, temperature, and turbidity were collected and recorded. When the readings were relatively consistent, the well was considered developed.

Water samples were collected from each well using a new disposable polyethylene bailer. Samples were obtained by gently lowering the bailer into contact with the water to a depth approximately equal to the length of the bailer. The water was transferred from the bailer using a bottom emptying device into appropriate sample containers supplied by the laboratory, then preserved on ice, and transported under chain-of-custody to Midwest Analytical Services (Certification 027-059-156). The samples were analyzed for gasoline range organics (GRO) WDNR Modified Method, diesel range organics (DRO) WDNR Modified Method, benzene, ethylbenzene, toluene, and xylene (BETX) Modified 8020 Method. Copies of laboratory analytical results and chain-of-custody forms are included in Appendix E. Ground-water quality results are summarized in Table 3.

3.3 Recovery Test Data

Recovery tests were performed on recovery wells RW2 and RW3. The wells were bailed for a set amount of time and the residual drawdown was measured as the wells recovered. AQTESOLV was used to analyze the drawdown data by providing a straight-line graph of residual drawdown vs. log t/t'. Calculated hydraulic conductivity was 2.57×10^{-6} meters/second for RW2 and 1.47×10^{-6} meters/second for RW3. Average hydraulic conductivity was 2.02×10^{-6} meters/second. These values fall within the range of conductivity expected for silty clays to clayey fine sands. Porosity expected from soft glacial clays is approximately 0.55.

Using groundwater elevation data collected from the December 6, 1995 sampling, gradient of groundwater flow is 6.49×10^{-3} feet/feet to the east. Groundwater flow velocity was 1.31×10^{-8} meters/second or 0.414 meters/year.

3.4 Well Receptor Survey

A well search was conducted in the Minnesota Geological Society's County Well Index (CWI). Using a search radius of one mile from the site, twenty-three wells were located within the search. The wells found are categorized in the following table:

Type of Well	Number of Wells Located	Receptor Threat
Municipal and Public Supply (bedrock aquifer)	1 (public supply)	None
Domestic Wells (bedrock aquifer)	11	None
Domestic Wells (quaternary aquifer)	0	None
MWs/Others (quaternary aquifer)	11	None

Provided in Appendix F is a list of all the wells within a one mile radius, the CWI reports for these wells, and a map showing the location of the domestic and public supply wells in relation to the site.

3.5 Vapor Risk Assessment

A vapor risk assessment of the Property was conducted on November 16, 1995 to determine if a vapor risk survey would be required for the site. The assessment involved identifying potential areas for petroleum vapors to migrate and accumulate. These areas included underground utilities, basements, and location of nearby sanitary and storm sewers.

Results of the vapor risk assessment did not identify a potential receptor for the migration of petroleum vapors. The nearest accessible utility is a sanitary sewer which runs parallel to the western property line. The sanitary sewer is located in an area outside the soil/groundwater contamination area. Therefore, the site should not require a vapor risk survey.

4.0 SUMMARY OF FINDINGS

4.1 Local Geology and Hydrology

Information available from the United States Department of Agriculture (USDA) indicate that naturally occurring surficial soil at and near the Property belong to the Maxcreek silty clay loam series and the Newry silt loam series (Reference 2). The Maxcreek silty clay loam series are described as poorly drained to very poorly drained soils on moraines which formed on silty sediments and underlying loamy till. The texture of the till ranges from loam to sandy clay loam with no more than 5 percent gravel.

The Newry silt loam series are described as moderately well drained, permeable soils on moraines which formed in silty sediments and underlying calcareous till. The texture of the till ranges from loam to clay loam with between 2 to 8 percent gravel.

Soil textures encountered during drilling activities consisted mainly of brown silty clay and gray sandy clay. Depth to groundwater occurred approximately 6 feet below grade. The location of the site soils are depicted in two cross-sections, A-A' and B-B', as illustrated in Figures 3 through 5.

Since shallow groundwater elevation is normally a subdued reflection of surface topography, groundwater water would normally flow from higher to lower elevations. Based on local topography, shallow groundwater was suspected to flow north towards Turtle Creek (Reference 1). Groundwater was encountered at approximately 6 feet below grade. Results of well gauging prior to well development indicated that the groundwater flows toward the southeast at 9.6×10^{-3} foot per foot (Figure 6). Well gauging data collected on December 6, 1995, indicates groundwater flow towards the east at 6.49×10^{-3} foot per foot (Figure 7). Regionally, shallow groundwater flow should be towards the north. However, the bottom of the ditch along the north property line is just above the groundwater table. Therefore, when water is present within the ditch the groundwater flow may be altered from its normal direction. Ground-water elevations were measured in the monitoring wells using procedures in Appendix C.

4.2 Extent of Contaminated Soil

Elevated PID responses (up to 3500 ppm) were detected in soil near the water table (Table 1). Soil sample field GC results (Table 2) indicated the presence of DRO (up to 88.8 mg/kg), GRO (up to 324 mg/kg), and total BETX (up to 66.9 mg/kg). Confirmation soil sample laboratory results indicated no detectable DRO, GRO, or BETX compounds (Table 2).

The lateral extent of contamination was found to be limited to within property boundaries, with the possible exception of migration immediately beneath Oakland Avenue which was not investigated. The lateral extent of contamination is illustrated in Figure 2.

The vertical extent of contaminated soil appears to coincide with the occurrence of the dense clay at approximately 10 feet below grade, as defined by field GC soil sample analysis on samples from boring GP11 (15 foot), GP12 (10 foot), and GP13 (10 foot). Laboratory analysis of the samples from GP11 and GP12 substantiate this delineation (Table 2).

Site shallow soil (i.e., 6 to 10 feet below grade - above the dense clay) is estimated to have a hydraulic conductivity on the order of 2.57×10^{-6} cm/sec. The subsurface cross sections (Figures 4 and 5) illustrate site lithologic conditions.

4.3 Extent of Free Product and Groundwater Contamination

Of the 14 geoprobes used to collect groundwater samples, free product was collected during the vacuum applied sampling conducted on central geoprobe borings GP-3 through GP-7. The product in GP-3 and GP-6 was a dark colored aged diesel. The product in GP-4 and GP-5 was a light colored gasoline type product. These products are likely attributable to separate site sources. Of the remaining 10 geoprobe groundwater samples collected, all were below field GC detection limits, except for the sample from GP-2, which yielded significant dissolved GRO and BETX concentrations.

The three site groundwater monitoring wells (RW1, RW2, and RW3) did not accumulate free product after development. Two groundwater monitoring wells (RW1 and RW3) detected BETX concentrations which exceed the MDH health risk limits (HRL's). Ground-water sampling results from monitoring well RW1 detected benzene concentrations of 3240 μg/l and toluene concentrations of 1270 μg/l. Ground-water samples collected from RW3 detected benzene concentrations of 138 μg/l and 768 μg/l ethylbenzene. The HRL's established for these compounds are 10 μg/l benzene, 1000 μg/l toluene, and 700 μg/l ethylbenzene. Monitoring well RW2 did not contain BETX concentrations which exceeded the state HRL's. Ground-water results are shown in Table 3. MPCA Hydrogeologic Setting and Groundwater Contamination Worksheet (Fact Sheet #24) are included in Appendix H.

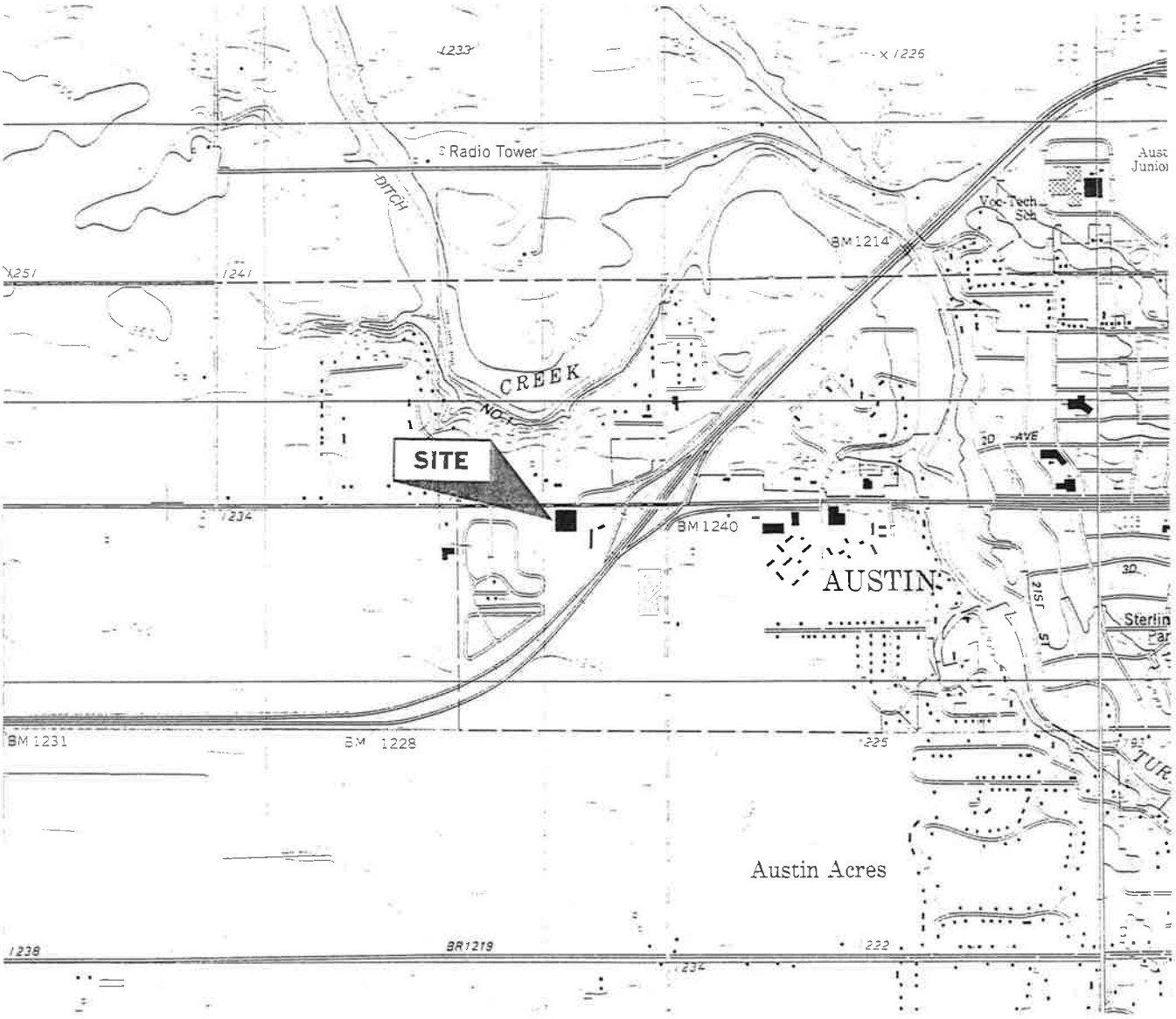
5.0 CORRECTIVE ACTION

The UST systems at the Steer Truck Stop likely released petroleum products into the surrounding soils and ground water. Based on the site lithology and contaminants encountered, it is apparent that contaminants have migrated preferentially along the capillary fringe within property boundaries. Although groundwater has been contaminated in the vicinity of the USTs, there are no known potable or domestic use water supplies for which current contaminant concentrations would pose a threat. For these reasons Northern Environmental would recommend no further action at this site.

6.0 REFERENCES

1) United States Geological Survey, *7.5 Minute Quadrangle Topographic Map, Austin West, Minnesota,* Photo revised 1976.

2) United States Department of Agriculture, *Soil Survey of Mower County, Minnesota,* November 1979.



BASE MAP SOURCE: USGS AUSTIN EAST & WEST, MN 7.5 MINUTE QUADRANGLE

DRAWN BY: PTK	PROJECT: CMG225071	DATE: 08/15/95

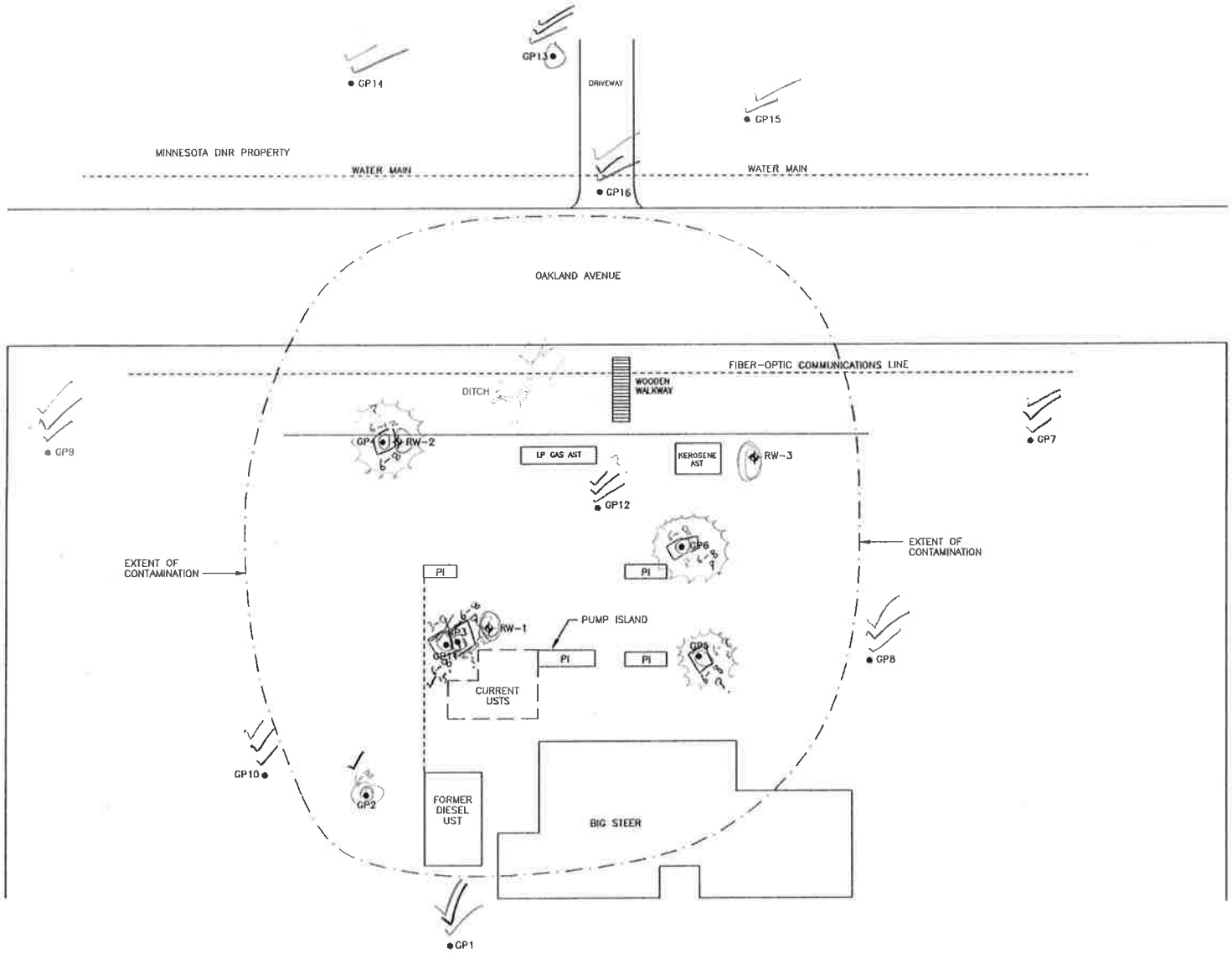
REV. Date

Northern Environmental
Hydrologists · Engineers · Geologists

BIG STEER TRUCK STOP
3401 W. OAKLAND AVENUE, AUSTIN, MINNESOTA

SITE LOCATION AND LOCAL TOPOGRAPHY

FIGURE 1



SCALE
0' 25' 50'

N

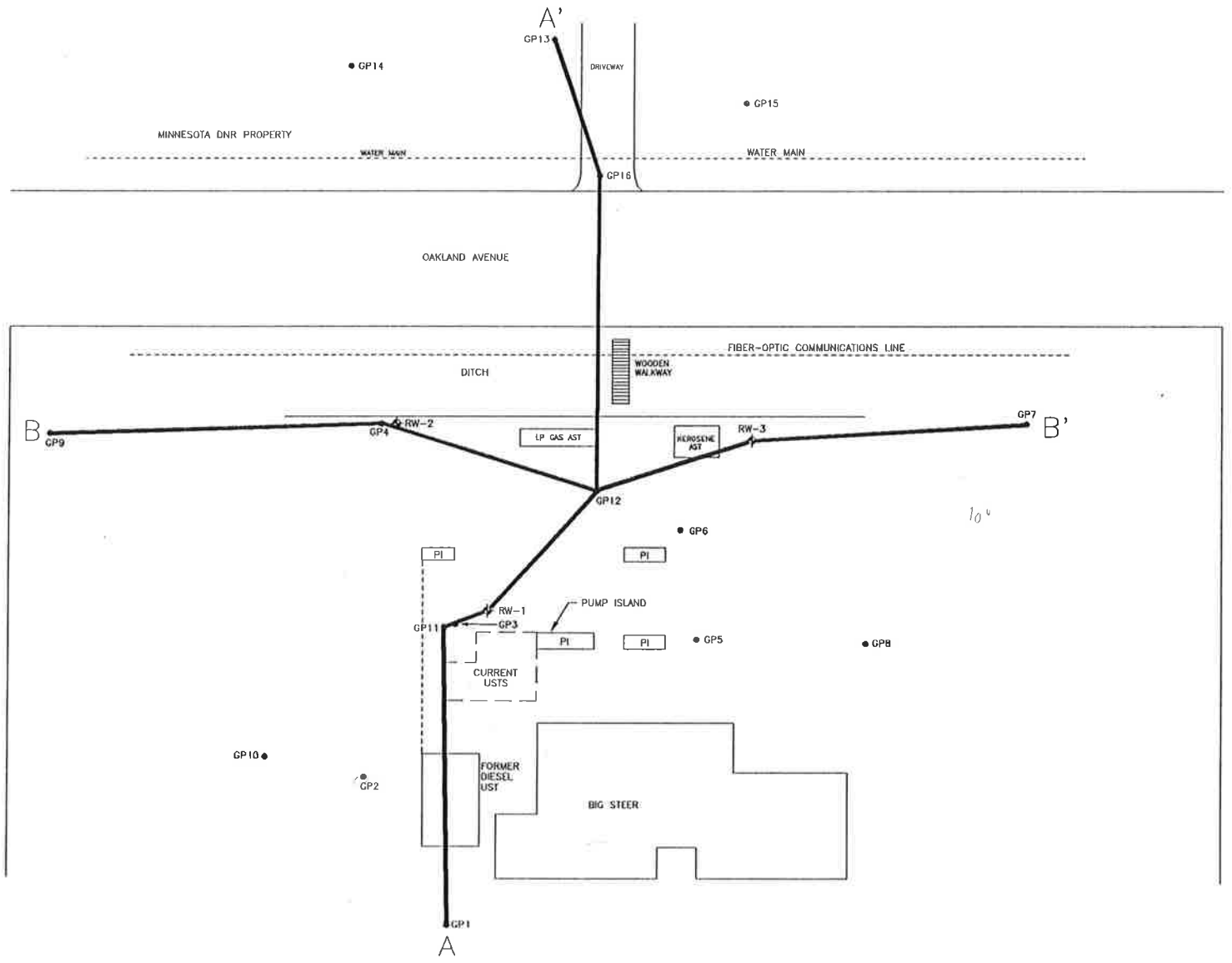
DRAWN BY: CPP	PROJECT: CMG235084	DATE: 11/02/95
REV. 11/22/95 MTJ	THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS THE PROPERTY OF NORTHERN ENVIRONMENTAL INCORPORATED AND SHALL NOT BE COPIED OR USED EXCEPT FOR THE PURPOSE FOR WHICH IT IS EXPRESSLY FURNISHED. THE DRAWING AND ANY COPIES THEREOF SHALL BE RETURNED TO THE OWNER ON DEMAND	
	▲ Northern Environmental *Hydrologists · Engineers · Geologists*	

BIG STEER
AUSTIN, MINNESOTA

SITE LAYOUT

A:\CMG235084\FIGURES\SITELOUT.SKD

FIGURE 2



SCALE

0' 25' 50'

EXPLANATION

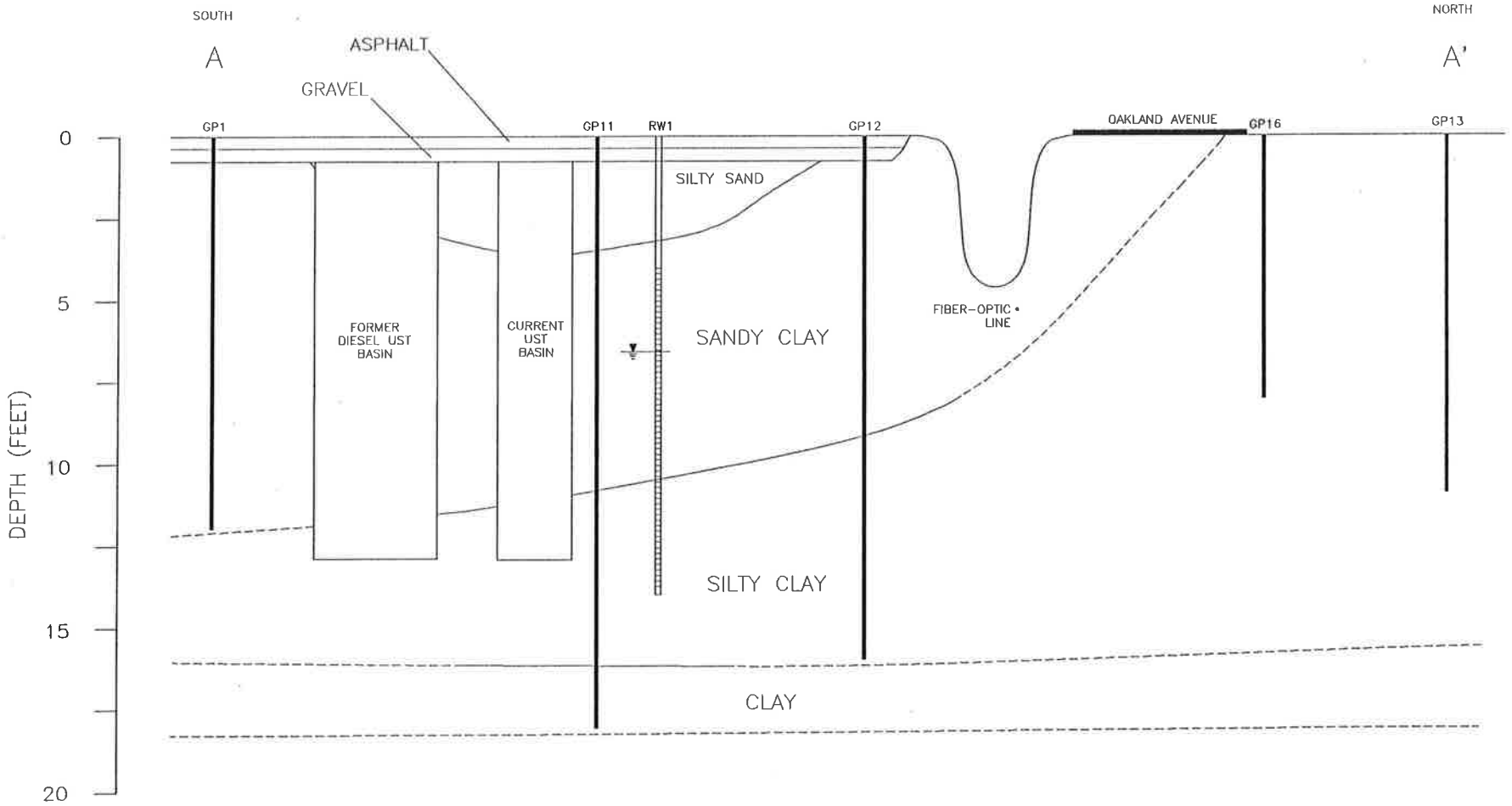
CROSS-SECTION LOCATION

DRAWN BY: MTJ	PROJECT: CMG235084	DATE: 12/18/95
REV.	THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS THE PROPERTY OF NORTHERN ENVIRONMENTAL INCORPORATED AND SHALL NOT BE COPIED OR USED EXCEPT FOR THE PURPOSE FOR WHICH IT IS EXPRESSLY FURNISHED. THE DRAWING AND ANY COPIES THEREOF SHALL BE RETURNED TO THE OWNER ON DEMAND	
	▲ Northern Environmental *Hydrologists · Engineers · Geologists*	

THE STEER TRUCKSTOP
AUSTIN, MINNESOTA

CROSS-SECTION LOCATION MAP

FIGURE 3



HORIZONTAL SCALE
0' 20' 40'

DRAWN BY: MTJ	PROJECT: CMG235084	DATE: 12/18/95
REV.	THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS THE PROPERTY OF NORTHERN ENVIRONMENTAL INCORPORATED AND SHALL NOT BE COPIED OR USED EXCEPT FOR THE PURPOSE FOR WHICH IT IS EXPRESSLY FURNISHED. THE DRAWING AND ANY COPIES THEREOF SHALL BE RETURNED TO THE OWNER ON DEMAND.	

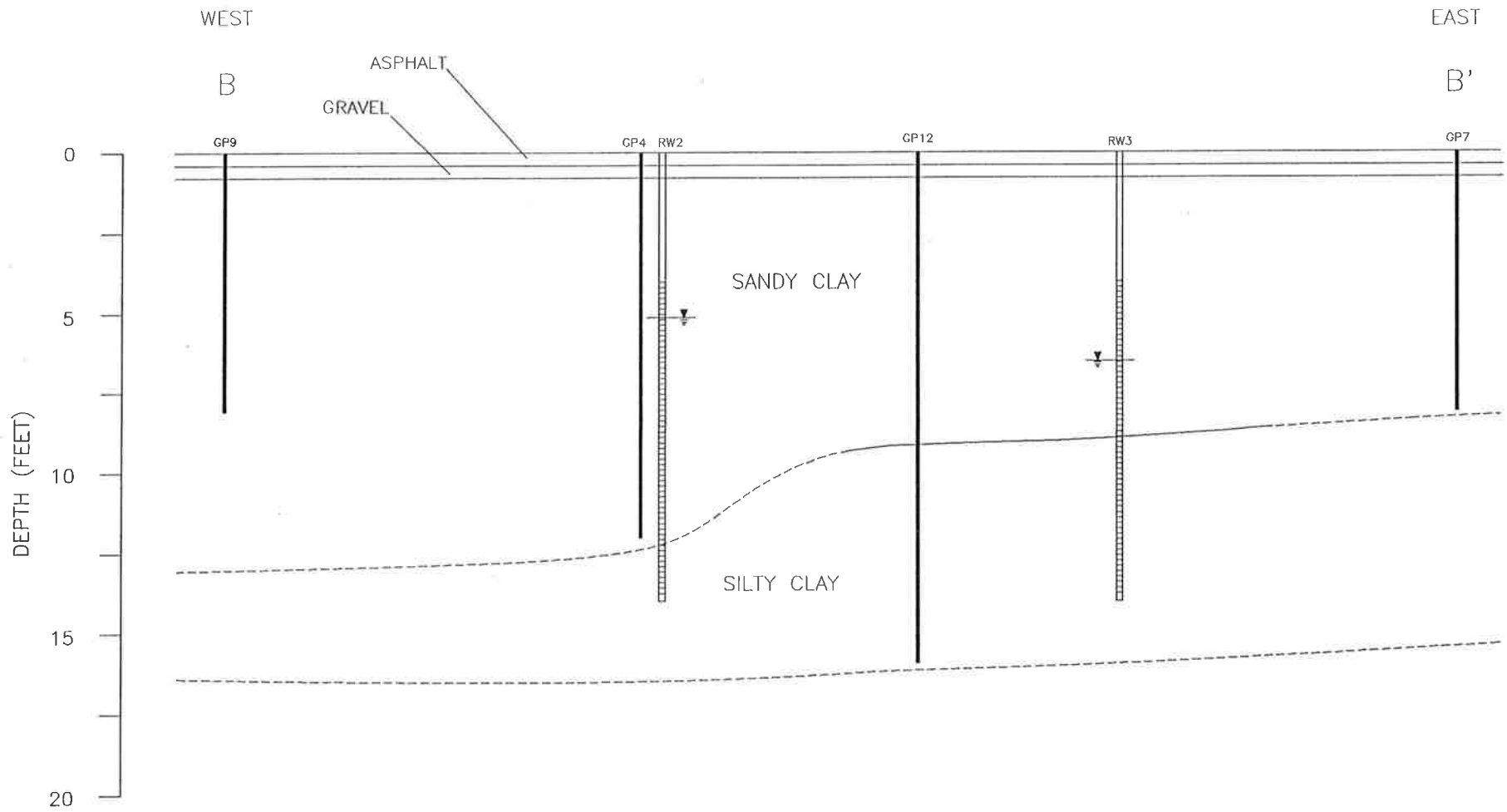
Northern Environmental
Hydrologists · Engineers · Geologists

THE STEER TRUCKSTOP
AUSTIN, MINNESOTA

NORTH-SOUTH CROSS-SECTION (A - A')

GEOPROBE BORING DATA

FIGURE 4



HORIZONTAL SCALE
0' 20' 40'

DRAWN BY: MTJ	PROJECT: CMG235084	DATE: 12/18/95
REV.	THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS THE PROPERTY OF NORTHERN ENVIRONMENTAL INCORPORATED AND SHALL NOT BE COPIED OR USED EXCEPT FOR THE PURPOSE FOR WHICH IT IS EXPRESSLY FURNISHED. THE DRAWING AND ANY COPIES THEREOF SHALL BE RETURNED TO THE OWNER ON DEMAND.	

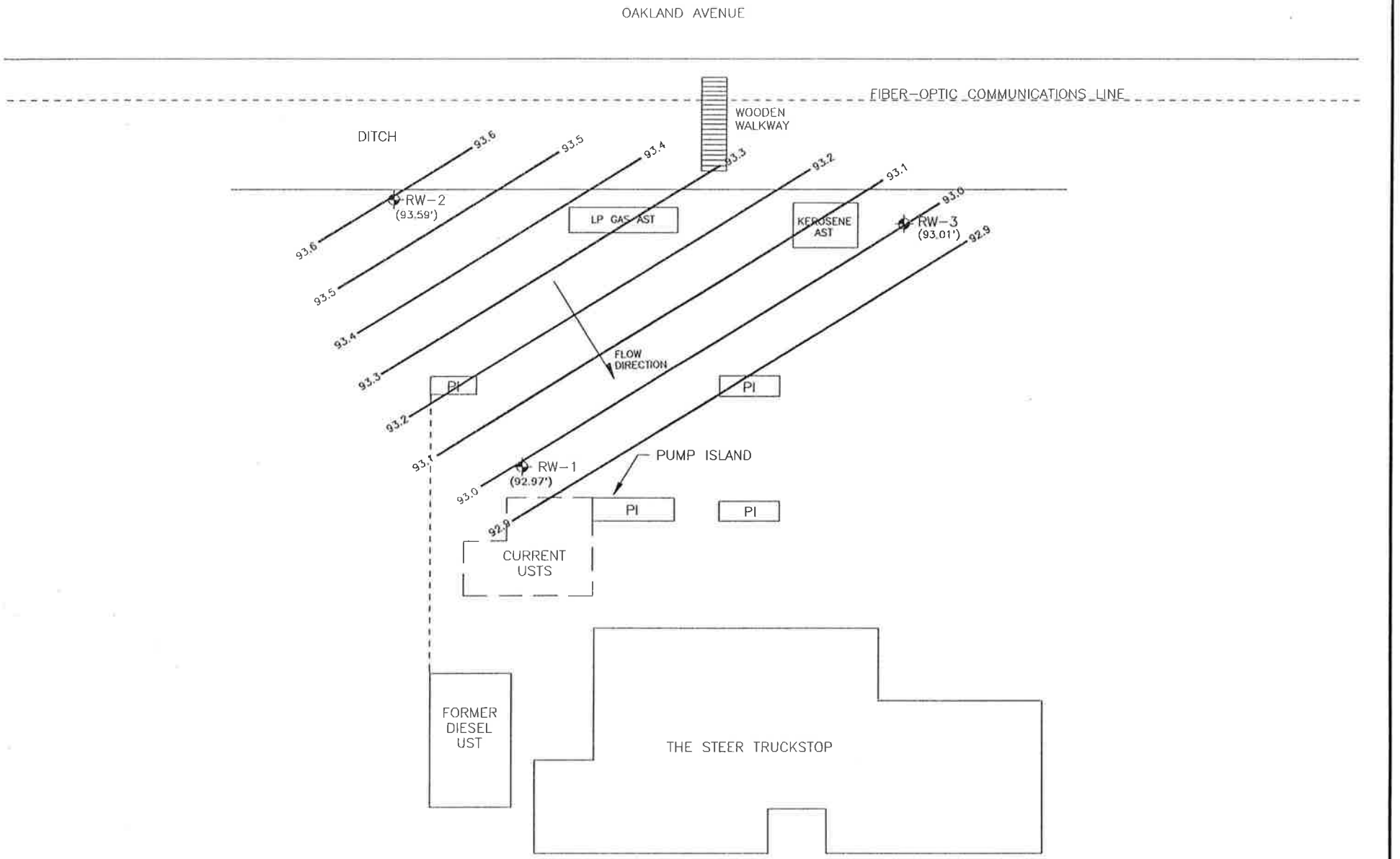
▲ Northern Environmental
Hydrologists · Engineers · Geologists

THE STEER TRUCKSTOP
AUSTIN, MINNESOTA

EAST–WEST CROSS–SECTION (B – B')

GEOPROBE BORING DATA

FIGURE 5



SCALE
0' 15' 30'

N

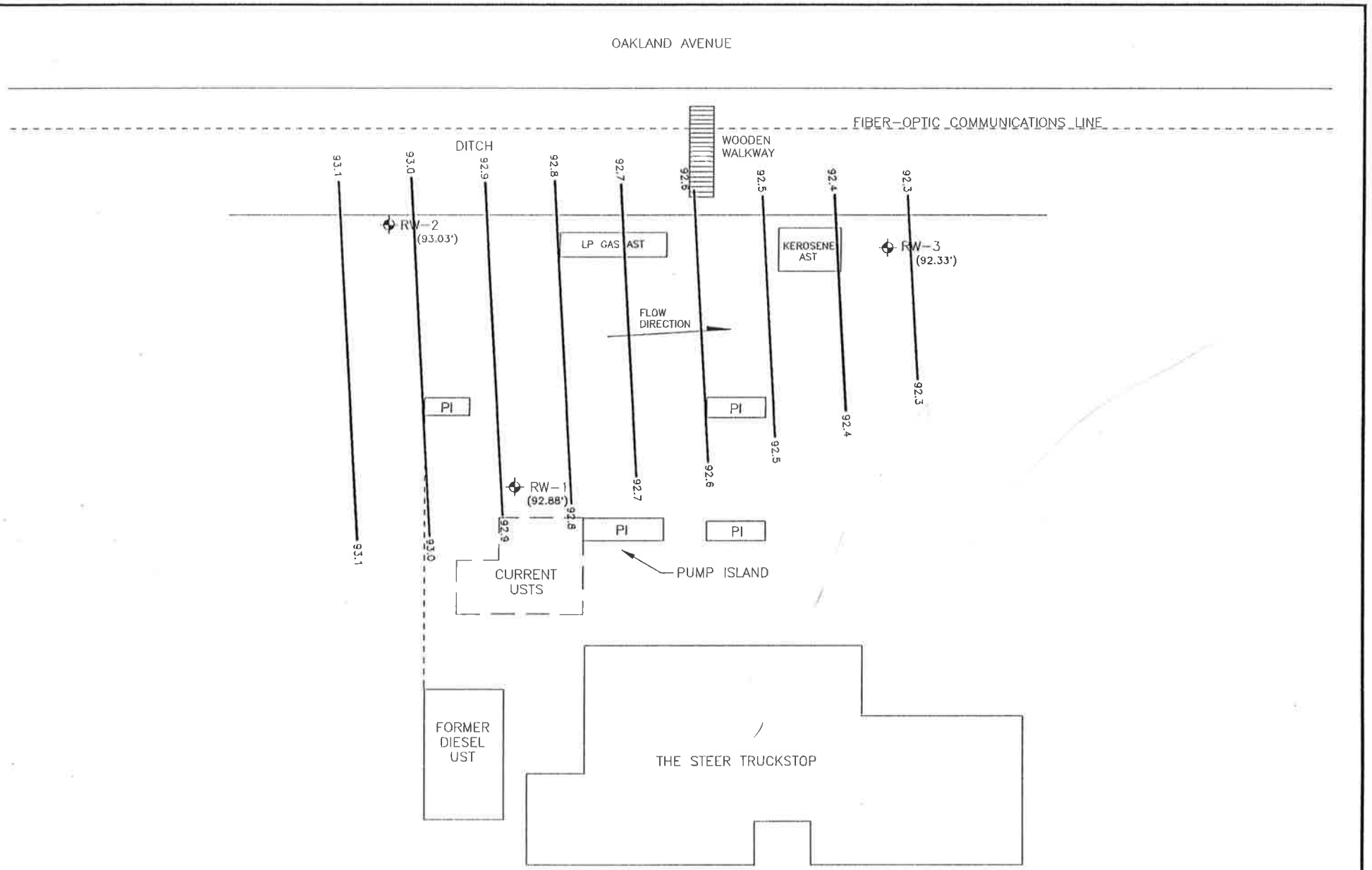
DRAWN BY: MTJ	PROJECT: CMG235084	DATE: 12/16/95
REV.	THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS THE PROPERTY OF NORTHERN ENVIRONMENTAL INCORPORATED AND SHALL NOT BE COPIED OR USED EXCEPT FOR THE PURPOSE FOR WHICH IT IS EXPRESSLY FURNISHED. THE DRAWING AND ANY COPIES THEREOF SHALL BE RETURNED TO THE OWNER ON DEMAND.	
	Northern Environmental *Hydrologists · Engineers · Geologists*	

THE STEER TRUCKSTOP
AUSTIN, MINNESOTA

WATER TABLE CONTOUR MAP AND FLOW DIRECTION

GROUNDWATER ELEVATION DATA FROM 11-17-95

FIGURE 6



DRAWN BY: MTJ	PROJECT: CMG235084	DATE: 12/16/95
REV.	THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS THE PROPERTY OF NORTHERN ENVIRONMENTAL INCORPORATED AND SHALL NOT BE COPIED OR USED EXCEPT FOR THE PURPOSE FOR WHICH IT IS EXPRESSLY FURNISHED. THE DRAWING AND ANY COPIES THEREOF SHALL BE RETURNED TO THE OWNER ON DEMAND	

Northern Environmental
Hydrologists · Engineers · Geologists

THE STEER TRUCKSTOP
AUSTIN, MINNESOTA

WATER TABLE CONTOUR MAP AND FLOW DIRECTION

GROUNDWATER ELEVATION DATA FROM 12-6-95

FIGURE 7

Table 1 - **Summary of Geoprobe Soil Headspace and Lithologic Descriptions, Steer Truck Stop, Austin, Minnesota**

Geoprobe #	Date	Depth	Time Collected	Time Analyzed	PID Reading	Soil Color	Texture
GP1-1	10/26/95	5-7	08:32	09:05	0	gray	sandy clay
GP1-2	10/26/95	10-12	08:50	09:05	0	gray	sandy clay
GP2-1	10/26/95	6-8	09:30	09:46	30	gray	sandy clay
GP2-2	10/26/95	10-12	09:47	10:12	0	brown	sandy clay
GP3-1	10/26/95	6-8	10:58	11:10	3500	gray	sandy clay
GP3-2	10/26/95	10-12	11:22	11:40	454	brown	sandy clay
GP4-1	10/26/95	6-8	12:15	12:46	186	brown	sandy clay
GP4-2	10/26/95	10-12	12:45	12:56	12	brown	sandy clay
GP5-1	10/26/95	6-8	13:50	14:08	1497	gray	sandy clay
GP6-1	10/26/95	6-8	14:57	15:21	168	gray	sandy clay
GP7-1	10/26/95	6-8	15:58	16:15	0	brown	sandy clay
GP8-1	10/26/95	6-8	16:45	17:05	0	gray	sandy clay
GP9-1	10/26/95	6-8	17:38	18:10	0	gray	sandy clay
GP10-1	10/26/95	6-8	18:45	19:06	0	gray	sandy clay
GP11-1	11/16/95	3	09:26	10:31	23	dark brown	silty sand
GP11-2	11/16/95	9	09:40	10:31	1482	gray	sandy clay
GP11-3	11/16/95	11	09:56	10:32	364	brown	silty fat clay
GP11-4	11/16/95	14	10:51	11:17	0	gray	silty fat clay
GP11-5	11/16/95	18	11:46	12:45	0	brown	very dense clay
GP12-1	11/16/95	11	12:43	13:01	3	brown	silty clay
GP12-2	11/16/95	16	13:22	13:46	0	brownish-gray	silty clay
GP13-1	11/16/95	6	14:49	16:15	0	yellowish-brown	silty clay
GP13-2	11/16/95	11	15:28	16:15	0	yellowish-brown	silty clay
GP14-1	11/16/95	9	16:30	17:19	0	yellowish-brown	silty clay
GP15-1	11/16/95	8	16:48	17:20	0	yellowish-brown	silty clay
GP16-1	11/16/95	8	17:02	17:22	0	yellowish-brown	silty clay

Notes:
PID = photoionization detector

(CMG235084)
December 1995
b:\cmg235084\tables\geoprobe.wk4

Table 2 - Summary of Soil Field GC and Laboratory Analysis, Steer Truck Stop, Austin, Minnesota

Boring and Sample No.	Depth (feet)	Date Collected	Field Gas Chromatogram Analysis						Results of Laboratory Analysis (Midwest Analytical)					
			Benzene (µg/kg)	Toluene (µg/kg)	Ethyl-benzene (µg/kg)	Xylenes (µg/kg)	GRO (µg/kg)	Total HC as Fuel Oil (µg/kg)	Benzene (µg/kg)	Toluene (µg/kg)	Ethyl-benzene (µg/kg)	Xylenes (µg/kg)	GRO (µg/kg)	DRO (µg/kg)
GP1-2	10	10/26/95	ND	ND	ND	ND	ND	ND	---	---	---	---	---	---
GP2-1	6-8	10/26/95	ND	ND	ND	ND	ND	ND	---	---	---	---	---	---
GP3-1	6-8	10/26/95	6170	18900	8020	33800	324000	ND	---	---	---	---	---	---
GP4-1	6-8	10/26/95	ND	ND	ND	ND	22100	53700	---	---	---	---	---	---
GP5-1	6-8	10/26/95	1610	3120	5280	1330	271000	ND	---	---	---	---	---	---
GP6-1	6-8	10/26/95	ND	662	ND	ND	63200	88800	---	---	---	---	---	---
GP7-1	6-8	10/26/95	ND	ND	ND	ND	ND	ND	---	---	---	---	---	---
GP-8	6-8	10/26/95	ND	ND	ND	ND	ND	ND	---	---	---	---	---	---
GP-9	6-8	10/26/95	ND	ND	ND	ND	ND	ND	---	---	---	---	---	---
GP-10	6-8	10/26/95	ND	ND	ND	ND	ND	ND	---	---	---	---	---	---
GP11-2	10	10/26/95	1270	ND	ND	ND	8720	ND	---	---	---	---	---	---
GP11-4	15	11/26/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
GP12-1	10	11/26/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
GP12-2	15	11/26/95	ND	ND	ND	ND	ND	ND	---	---	---	---	---	---
GP13-1	6	11/26/95	ND	ND	ND	ND	ND	ND	---	---	---	---	---	---
GP13-2	10	11/26/95	ND	ND	ND	ND	ND	ND	---	---	---	---	---	---
GP-16	7	11/26/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

NOTE:

µg/kg = micrograms per kilogram
PID = photoionization detector
ND = below detection limit
GRO = gasoline range organics
DRO = diesel range organics
HC = hydrocarbons
--- = not analyzed

(CMG235084)
December 1995
b:\cmg235084\tables\analyses.wk4

Table 3 - Summary of Groundwater Field GC and Laboratory Analysis, Steer Truck Stop, Austin, Minnesota

Boring and Sample No.	Depth (feet)	Date Collected	Field Gas Chromatogram Analysis (MESA)						Results of Laboratory Analysis (Midwest Analytical)					
			Benzene (µg/l)	Toluene (µg/l)	Ethyl-benzene (µg/l)	Xylenes (µg/l)	GRO (µg/l)	Total HC as Fuel Oil (µg/l)	Benzene (µg/l)	Toluene (µg/l)	Ethyl-benzene (µg/l)	Xylenes (µg/l)	GRO (µg/l)	DRO (µg/l)
GP-1	6.5	10/26/95	ND	ND	ND	ND	ND	ND	---	---	---	---	---	---
GP-2	6.5	10/26/95	692	187	586	685	9100	ND	---	---	---	---	---	---
GP-3	6.5	10/26/95	Product	Product	Product	Product	Product	Product	---	---	---	---	---	---
GP-4	6.5	10/26/95	Product	Product	Product	Product	Product	Product	---	---	---	---	---	---
GP-5	6.5	10/26/95	Product	Product	Product	Product	Product	Product	---	---	---	---	---	---
GP-6	6.5	10/26/95	Product	Product	Product	Product	Product	Product	---	---	---	---	---	---
GP-7	6.0	10/26/95	ND	ND	ND	ND	ND	ND	---	---	---	---	---	---
GP-8	6.5	10/26/95	ND	ND	ND	ND	ND	ND	---	---	---	---	---	---
GP-9	6.0	10/26/95	ND	ND	ND	ND	ND	ND	---	---	---	---	---	---
GP-10	6.5	10/26/95	ND	ND	ND	ND	ND	ND	---	---	---	---	---	---
GP-13	7	10/26/95	ND	ND	ND	ND	ND	ND	1.7	4.8	ND	11.5	100	ND
GP-14	6	11/26/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
GP-15	6	11/26/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
GP-16	8	11/26/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
RW-1	n/a	11/26/95	---	---	---	---	---	---	3240	1270	179	718	9980	2400
RW-2	n/a	11/26/95	---	---	---	---	---	---	ND	3.6	ND	5.8	680	2700
RW-3	n/a	11/26/95	---	---	---	---	---	---	138	530	768	2153	15100	8500
HRL's									10	1000	700	10,000	NR	NR

NOTE:

µg/l = micrograms per kilogram
ND = below detection limit
GRO = gasoline range organics
DRO = diesel range organics
n/a = not applicable
HC = hydrocarbons
--- = not analyzed

HRL's = Health Risk Limits
NR = not regulated
■ = Exceeds HRL's = Exceeds HRL's

(CMG235084)
December 1995
b:\cmg235084\tables\analys#2.wk4

Table 4 - Summary of Ground-Water Elevation Measurements, Steer Truck Stop, Austin, Minnesota

Well I.D.	Ground Surface Elevation * (feet)	Reference Point Elevation ** (feet)	Date	Depth to Water Below Reference Point (feet) **	Water Table Elevation (feet) *	Personnel
RW1	99.30	99.35	11/17/95	6.38	92.97	NETI
			12/06/95	6.47	92.88	NETI
RW2	93.24	98.26	11/17/95	4.67	93.59	NETI
			12/06/95	5.23	93.03	NETI
RW3	98.83	98.77	11/17/95	5.76	93.01	NETI
			12/06/95	6.44	92.33	NETI

Note: Benchmark is southwest of the kerosene aboveground storage tank (AST) cement vault.
* = elevation above mean sea level
** = reference point is the north side of PVC riser
NETI = Northern Environmental Technologies, Incorporated

(CMG235084)
December 1995
b:\cmg235084\tables\gwtbl#4.wk4

Northern Environmental℠
Hydrologists • Engineers • Geologists

APPENDIX A

EXCAVATION REPORT FOR PETROLEUM RELEASE SITE

EXCAVATION REPORT FOR PETROLEUM RELEASE SITES

Fact Sheet #4
Minnesota Pollution Control Agency
Tanks and Spills Section
March 1994

Complete the information below and submit to the Minnesota Pollution Control Agency (MPCA) Tanks and Spills Section to document excavation and treatment of petroleum contaminated soil. Conduct excavations in accordance with "Excavation of Petroleum Contaminated Soil" (fact sheet #13). Please attach any available preliminary site investigation reports to this excavation report.

Attach additional pages if necessary. Please type or print clearly.

I. BACKGROUND

A. Site: **Big Steer Truck Stop**
3401 West Oakland Avenue

City, Zip: **Austin, MN 55912**
County: **Mower**
MPCA Site ID#: LEAK0000 **8578**

B. Tank Owner/Operator: **Betty Jackson**

Mailing Address: **1807 West Oakland Avenue**
Street/Box:
City, Zip: **Austin, Minnesota 55912**
Telephone: **(507) 437-6357**

C. Excavating Contractor:
Griffin Service Station Equipment Inc.
Contact: **Jim Griffin**
Street/Box: **8834 Xylite St. N.E.**
City, Zip: **Blaine, MN 55434**
Telephone: **(612) 780-6332**
Tank Contractor Certification
Number: **0178**

D. Consultant:
Northern Environmental
Contact: **Paul T. Kittelson**
Street/Box: **372 West County Road D**
City, Zip: **New Brighton, 55112**
Telephone: **(612) 635 - 9100**

E. Others on-site during site work (e.g. fire marshal, local officials, MPCA staff, etc.):

Ron Felton, City of Austin Fire Inspector.

Note: If person other that tank owner and/or operator is conducting the cleanup, provide name, address, and relationship to site on a separate attached sheet.

II. Dates

A. Date release reported to MPCA: **July 24, 1995**

B. Date site work performed:

Work Performed	Date
UST Removal	**July 24, 1995**

III. RELEASE INFORMATION

A. Provide the following information for all removed tanks.

Tank 1: Capacity: 12,000 Type: steel Age: 35 years old

Condition: Poor

Product History: **Diesel fuel**

Approximate quantity of petroleum released, if known: **Unknown**

Cause of release: **Unknown**

Tank 2: Capacity _____ Type _____ Age _____

Condition: _____

Product History:

Approximate quantity of petroleum released, if known:

Cause of Release:

Tank 3: Capacity _____ Type _____ Age _____

Condition: _____

Product History:

Approximate quantity of petroleum released, if known:

Cause of release:

III. RELEASE INFORMATION

A. Provide the following information for all removed tanks.

Tank 1: Capacity: 12,000 Type: steel Age: 35 years old

Condition: Poor

Product History: **Diesel fuel**

Approximate quantity of petroleum released, if known: **Unknown**

Cause of release: **Unknown**

Tank 2: Capacity _____ Type _____ Age _____

Condition: _____

Product History:

Approximate quantity of petroleum released, if known:

Cause of Release:

Tank 3: Capacity _____ Type _____ Age _____

Condition: _____

Product History:

Approximate quantity of petroleum released, if known:

Cause of release:

I. If no soil boring was required, explain.

The site will require a Remedial Investigation.

J. If ground water was encountered or if a soil boring was conducted, was there evidence of ground water contamination? Specify, e.g., free product (specify thickness), product sheen, ground water in contact with petroleum contaminated soil, water analytical results, etc.

[NOTE: If free product was observed, contact MPCA staff immediately as outlined in "Petroleum Tank Release Reports" (fact sheet #3). Also consult fact sheet #18, "Free Product: Evaluation and Recovery"].

Yes, ground water is in contact with petroleum contaminated soil. One water sample (W1) was collected from the excavation. Laboratory results are summarized in Part D of Section V Sampling.

K. Was bedrock encountered in the excavation? At what depth?

No

L. Were other unique conditions associated with this site? If so explain?

V. SAMPLING

A. Briefly describe the field screening methods used to distinguish contaminated from uncontaminated soil:

All soil samples collected were screened using a photoionization detector (PID) in general accordance with the MPCA's "Jar Headspace Analytical Screening Procedure" to evaluate the presence of volatile and semi-volatile organic compounds. Screening was performed by disaggregating each sample, placing the sample into a mason jar, and sealing the jar with aluminum foil. The sample was then allowed to degas in a relatively warm location (i.e. 70°F) for at least 30 minutes. The PID probe, extension was then inserted through the aluminum foil into the jar and the highest stable reading occurring within ten to twenty seconds recorded. The PID utilized for field screening was an OVM 580B organic vapor monitor, outfitted with a 10.6 eV lamp calibrated for direct response to isobutylene. Samples selected for laboratory analysis were placed in sample jars, packed on ice for preservation, and submitted under chain-of-custody to a contract laboratory.

B. List soil vapor headspace analysis results. Indicate sampling locations using sample codes (with sample depths in parentheses), e.g. R-1 (2 feet), R-2 (10 feet), etc. "R" stands for "removed." Samples collected at different depths at the same location should be labeled R-1A (2 feet), R-1B (4 feet), R-1C (6 feet), etc. If the sample was collected from the sidewall or bottom after excavation was complete, label it S-1 (for sidewall) or B-1 (for "bottom"). Be sure the sample codes correspond with the site map required in part VI, below.

B. Provide the following information for all tanks (including newly installed tanks).

Tank No.	Capacity	Contents	Type	Date of Installation
12D	12,000	diesel	steel	1983
6D1	6,000	diesel	steel	1983
10R	10,000	gasoline	steel	1975
8PR	8,000	gasoline	steel	1975

C. If the release was associated with the lines or dispensers, briefly describe the problem: **Unknown**

D. If the release was a surface spill, briefly describe the problem: N/A

IV. EXCAVATION

A. Dimensions of excavation: **32 feet long x 16 feet wide x 13 feet deep**

B. Original tank backfill material (sand, gravel, etc.): **Sand**

C. Native soil type (clay, sand, etc.): **Silty clay and sand**

D. Quantity of contaminated soil removed for treatment (cubic yards): _____
[Note: If more than 150 cubic yards removed, please attach copy of written approval from MPCA.]

None, contaminated soil was returned to excavation.

E. Were new tanks installed at the site? No If yes, how much soil was excavated to accommodate the installation of the new tanks? N/A

F. Was ground water encountered or was there evidence of a seasonally high ground water table? Yes At what depth? **12 feet below grade**

G. If ground water was not encountered during the excavation, what is the expected depth of ground water? N/A

H. If a soil boring was required (see fact sheet #13, "Excavation of Petroleum Contaminated Soil," Part VI Additional Investigation) describe the soil screening and analytical results. Attach the boring logs and laboratory results to this report.

N/A

Sample Code	Soil Type	Reading ppm	Sample Code	Soil Type	Reading ppm
D1	sand	564			
D2	sand	1783			
SW1	silty clay	866			
SW2	sand	751			

C. Briefly describe the soil analytical sampling and handling procedures used:

Visual indications and field screening of samples collected beneath the UST identified petroleum impacts in excess of soil action levels outlined in the MPCA's April 1993 "Excavation of Petroleum Contaminated Soil" guidance document.

Four soil samples were collected from the soil/water interface and submitted for laboratory analysis. Two samples, D1 and D2, were collected from the north and south sidewalls of the UST excavation. Two samples, SW1 and SW2, were collected from the west and east sidewalls of the UST excavation. The locations of the samples are indicated on Figure 2. One water sample, W1, was collected from the bottom of the excavation.

Soil samples collected for laboratory analysis were grab samples taken from freshly exposed soil. Clean disposable gloves and sampling utensils were used to collect the samples to avoid cross contamination. Sample jars were filled with 25 grams of soil. Excess soil was wiped from the vial threads and the sample jar was sealed using a cap with a Teflon septum. The sample were labeled and placed in a covered cooler with ice for transport to Northern Environmental's MPCA-approved contract laboratory.

D. List below the soil sample analytical results from bottom and sidewall samples (i.e., soils left in place when excavation is complete). Code the samples with sampling depths in parentheses as follows: sidewall samples S-1 (8 feet), S-2 (4 feet), etc.; bottom samples B-1 (13 feet), B-2 (14 feet), etc. Be sure the sample codes correspond to the site map required in part VI. Do not include analyses from the stockpiled soils.

Sample Code	GRO/DRO	Benzene ppm	Ethyl-benzene ppm	Toluene ppm	Xylene ppm	MTBE ppm	Lead ppm
D1 (12 ft)	774	69.2	103	293	537	NA	NA
D2 (12 ft)	674	12.3	7.70	42.7	40.7	NA	NA
SW1 (12 ft)	ND	1.20	0.269	1.15	1.11	NA	NA
SW2 (12 ft)	2100	17.4	36.8	102	233	NA	NA
W1 (water)	45.1	17.2	1.84	16.7	9.81	NA	NA

NA = not analyzed ND = not detected
NOTE: ATTACH COPIES OF LABORATORY REPORTS AND CHAIN OF CUSTODY FORMS.

VI. FIGURES

Attach the following figures to this report:

1. Site location map.
2. Site map(s) drawn to scale illustrating the following:

a. Location (or former location) of all present and former tanks, lines, and dispensers;

b. Location of other structures (buildings, canopies, etc.);

c. Adjacent city, township, or county roadways;

d. Final extent of excavation;

e. Location of soil screening samples (e.g. R-1), soil analytical samples (e.g. S-1 or B-1), and soil borings (e.g. SB-1). Also, attach all boring logs.

f. North arrow and map legend.

VII. SUMMARY

Briefly summarize evidence indicating whether additional investigation is necessary at the site, as discussed in part VI of MPCA document "Excavation of Petroleum Contaminated Soil" (fact sheet #13). If no further action is recommended, the MPCA staff will review this report following notification of soil treatment.

VIII. SOIL TREATMENT INFORMATION

A. Soil treatment method used (thermal, land application, other). If you choose "other" specify treatment method: **Other: soil was returned to excavation, pending remedial investigation.**

B. Location of treatment site/facility: N/A

C. Date MPCA approved soil treatment (if thermal treatment was used after May 1, 1991, indicate date that the MPCA permitted thermal treatment facility agreed to accept soil): N/A

D. Identify the location of stockpiled contaminated soil: N/A

IX. CONSULTANT (OR OTHER) PREPARING REPORT

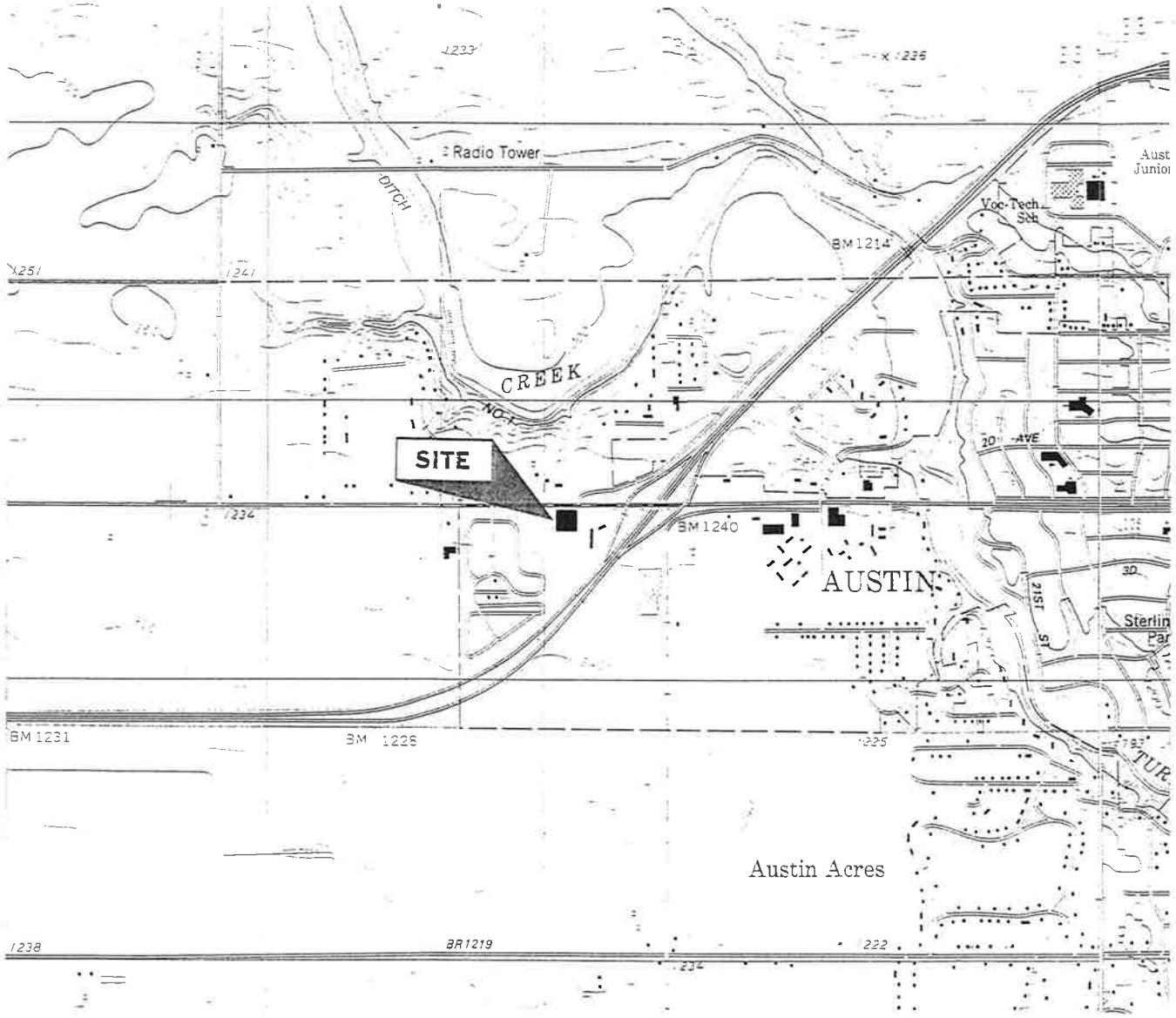
Company Name: **Northern Environmental**
Street/box: **372 West County Road D**
City, Zip: **New Brighton, 55112-3501**
Telephone: **(612) 635 - 9100**
Contact:

Signature: _____ Date: _____

If additional investigation is not required at the site, please mail this form and all necessary attachments to:

(Project Manager)
Minnesota Pollution Control Agency
Hazardous Waste Division
Tanks and Spills Section
520 Lafayette Road North
St. Paul, Minnesota 55115-4194

If additional investigation is required at the site, include this form as an appendix to the Remedial Investigation/Corrective Action Design report. Excavation reports indicating a remedial investigation (RI) will not be reviewed by MPCA staff until the RI has been completed.



BASE MAP SOURCE: USGS AUSTIN EAST & WEST, MN 7.5 MINUTE QUADRANGLE

DRAWN BY: PTK	PROJECT: CMG225071	DATE: 08/15/95

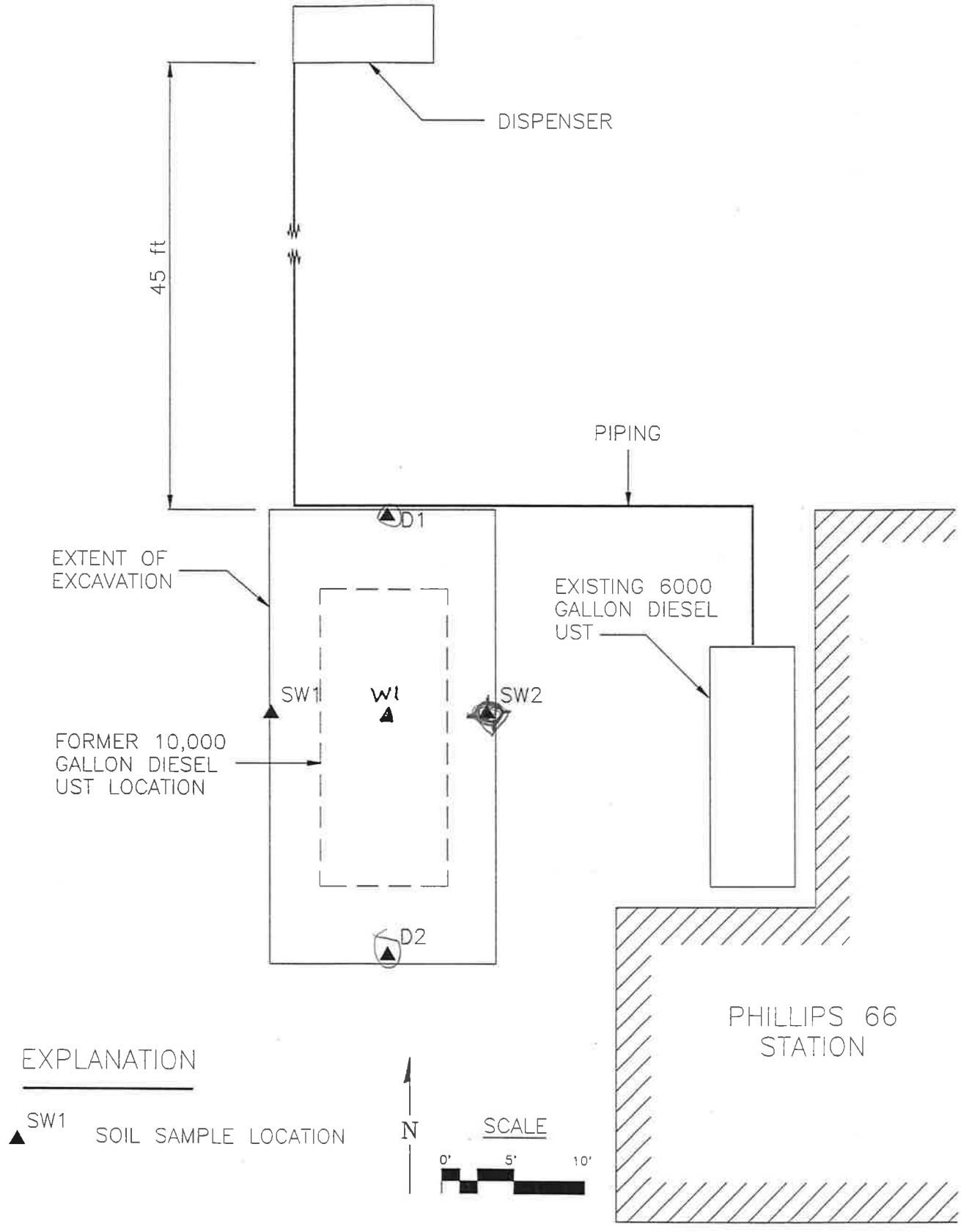
REV. Date

Northern Environmental
Hydrologists · Engineers · Geologists

BIG STEER TRUCK STOP
3401 W. OAKLAND AVENUE, AUSTIN, MINNESOTA

SITE LOCATION AND LOCAL TOPOGRAPHY

FIGURE 1



DRAWN BY: BAG	PROJECT: CMG225071	DATE: 08/15/95

REV.
Date

Northern Environmental
Hydrologists · Engineers · Geologists

BIG STEER TRUCK STOP
3401 W. OAKLAND AVENUE, AUSTIN, MINNESOTA

SITE LAYOUT

FIGURE 2

330 SO. CLEVELAND ST.
P.O. BOX 349
CAMBRIDGE, MN 55008

MIDWEST ANALYTICAL SERVICES

MINNESOTA CERTIFIED LABORATORY
NUMBER 027-059-156

LAB (612) 689-2175
METRO (612) 444-9270
FAX (612) 689-3660

August 7, 1995

John McCarthy
Northern Environmental
372 West County Road D
New Brighton, MN 55112

Project ID: N/A
Chain of Custody: NE 2959
Date Sampled: 07-24-95
Date Received: 07-25-95
Date Analyzed: 08-01-95

Lab ID:	Sample Identification:		Matrix:
	95-05871	D-1	Soil
	95-05872	D-2	Soil
	95-05873	SW1	Soil
	95-05874	SW2	Soil
	95-05875	W1	Water

Samples were analyzed for DRO by the Wisconsin Modified DRO procedure. The results are reported on the following page.

Sincerely,

Lon Jones
Organic/Bio Group Leader

Parameter:	Benzene	Toluene	Ethyl Benzene	Xylenes	Total Hydrocarbons as DRO	Percent Moisture
Units	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(%)
Method Detection Limit	0.050	0.050	0.050	0.150	10.0	
Sample Number						
95-05871 D-1	69.2	293	103	537	774	17.6
95-05872 D-2	12.3	42.7	7.70	40.7	674	17.1
95-05873 SW1	1.20	1.15	0.269	1.11	BDL*	14.6
95-05874 SW2	17.4	102	36.8	233	2100	12.0

BDL = Below Detection Limit
* = Peaks present in range but below detection limit.

Parameter:	Benzene	Toluene	Ethyl Benzene	Xylenes	Total Hydrocarbons as DRO
Units	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(mg/L)
Method Detection Limit	1.0	1.0	1.0	3.0	0.1
Sample Number					
95-05875 W1	17200	16700	1840	9810	45.1

BDL = Below Detection Limit

Northern Environmental℠

☐ 1214 W. Venture Court
Mequon, WI 53092
414-241-3133
FAX 414-241-8222

☒ 372 West County Road D
New Brighton, MN 55112
612-635-9100
FAX 612-635-0643

☐ 952 Circle Drive
Green Bay, WI 54304
414-592-8400
FAX 414-592-8444

Check office originating request

CHAIN OF CUSTODY RECORD

REQUEST FOR ANALYSIS

2959

Project No: Task No:

Project Location: (city) Austin, MN

Project Manager: John McCarthy

Sampler (name): Paul Kittelson

Sampler (signature):

Sampling Date(s): 7/24/95

Reports to be Sent to: John McCarthy

Laboratory: Midwest

Wisconsin DNR Certification #:

Laboratory Contact: Matt Stokes

Price Quote: Lust Reference

TURNAROUND TIME REQUIRED

☒ Normal ☐ Rush

Date Needed August 10, 1995

Sample Integrity - To be completed by receiving lab
Seal intact upon receipt ☐ Yes ☐ No
Method of Shipment _____
Contents Temperature _____ °C Refrigerator No: _____

Lab ID. No.	Sample No.	Collection Date	Collection Time	No. of Containers, Size and Type	Description Water	Description Soil	Description Other	Preservative	DRO (WI Modified Method)	GRO (WI Modified Method)	BETX (EPA Method 8020)	PVOC (EPA Method 8020)	VOC (EPA Method 8021)	PAH (EPA Method)	Pb (EPA Method)
95- 05871	D-1	7/24/95				X			X		X				
5872	D-2	"				X			X		X				
5873	SW1	"				X			X		X				
5874	SW2	"				X			X		X				
5875	W1				X				X		X				

Packed for Shipping by: P. Kittelson

Shipment Date: 7/24/95

Comments: Samples may be quite hot for setting calibration ranges.

Relinquished By:	Date:	Relinquished By:	Date:	Relinquished By:	Date:
John McCarthy	7/25/95		7-25-95		
Company: NETI	Time: 0818	Company: W.A.S.	Time: 1315	Company:	Time:
Received By:	Date: 7.25.95	Received By:	Date: 7.25.95	Received By:	Date:
Company: W.A.S.	Time:	Company: W.A.S.	Time: 1345	Company:	

APPENDIX B

GEOPROBE METHODOLOGIES

SUBSURFACE INVESTIGATION

STEER TRUCKSTOP

3401 West Oakland Avenue
Austin, Minnesota

Prepared For

Northern Environmental, Inc.

Prepared By:

Mobile Environmental Sampling & Analysis, Inc.
P.O. Box 111
New Prague, Minnesota 56071
(612) 492-2196

October 27, 1995

M. E. S. A.
Incorporated

Mobile Environmental Sampling & Analysis, Inc.
P.O. Box 111
New Prague, MN 56071-0111
(612) 492-2196 FAX (612) 492-2196

Innovative Alternatives For
Subsurface Investigations

SUBSURFACE INVESTIGATION RESULTS

STEER TRUCKSTOP

3401 WEST OAKLAND AVENUE
AUSTIN, MINNESOTA

1.0 Introduction

Mobile Environmental Sampling & Analysis, Inc. (M.E.S.A.) conducted a subsurface investigation at the Steer Truckstop located at 3401 West Oakland Avenue in Austin, Minnesota. The work was performed in accordance with Northern Environmental, Inc. written authorization dated September 26, 1995. The purpose of the subsurface investigation was to collect and analyze soil and groundwater samples to evaluate whether petroleum related compounds are present in the soil and groundwater at the site. The soil and groundwater samples were analyzed for benzene, toluene, ethyl benzene xylenes (BTEX), gasoline range organics (GRO) and total hydrocarbons as fuel oil (THC as F.O.).

M.E.S.A. provided the following services in performing the subsurface investigation:

- Advanced ten soil probes to depths ranging from approximately 8 - 12 feet below the ground surface to collect soil and groundwater samples.
- Analyzed six groundwater samples and ten soil samples on-site for BTEX, GRO and THC as F.O.
- Abandoned the probe holes with high solids bentonite grout.
- Prepared a letter report presenting the results of the subsurface investigation.

2.0 Methods and Procedures

2.1. Probe Installation

On October 26, 1995, M.E.S.A. completed ten small diameter probes to collect soil and groundwater samples at the site. The probes were placed adjacent to the underground storage tank basins and pump islands at the site. The probes consisted of hydraulically pushing or hammering one-inch outside diameter stainless steel rods to the desired test depth. At the test depth, soil and groundwater samples were collected. Following removal of the probe rods, the holes were filled with high solids bentonite grout to approximately six inches below the ground surface and completed with either soil or concrete to match the surrounding surface conditions.

Prior to use, the probe rods were scrubbed with an Alconox® solution and rinsed with potable water. Likewise, soil and groundwater sampling tools were scrubbed in Alconox® detergent and rinsed with potable water between each sample location.

2.2. Soil Sample Collection

To collect soil samples, a closed piston-tipped sample barrel equipped with a plastic inner sleeve was attached to the leading end of the probe rods. A threaded stop-pin located at the back of the sample barrel secures the piston rod and piston tip during advancement of the probe rods. Once the probe rods were advanced to the desired test depth, the threaded stop-pin was removed using extension rods inserted down the inside diameter of the probe rods. The sampler and probe rods were advanced allowing soil to enter the sample barrels inner sleeve as the piston retracted. The sample barrel assembly was then retracted and the plastic sleeve containing the soil sample removed for sample collection. New, clean plastic sleeves were used for each soil sample.

Soil samples collected in the piston-tipped sample barrel were placed in clean, VOA glass, screw-top vials having Teflon®-lined caps, labeled, and were placed in a cooler on ice. The vials contained 20 milliliters of methanol, approximately 20 grams of soil (measured to the nearest 0.1 grams on a top loading balance) was placed in each vial.

2.3. Groundwater Sample Collection

To collect groundwater samples at the probe locations, a slotted (0.020" vertical slots) probe rod similar to a well screen was driven below the water table, exposing the slotted section to the water bearing soils. Clean polyethylene tubing with was inserted into the probe rods and connected to a hand actuated vacuum pump to collect a groundwater sample. New, clean polyethylene tubing was used at each sample location. Groundwater samples collected in the polyethylene tubing were emptied into clean, VOA glass vials, having Teflon®-lined caps, labeled, and were placed in a cooler on ice.

2.4. Chemical Analysis

The soil samples and groundwater samples were analyzed in general accordance with EPA Method 8020 for Aromatic Volatile Organic Compounds, the Wisconsin DNR Modified GRO Method and a modified version of EPA Method 8015 for Total Hydrocarbons as fuel oil. A SRI Instruments Model 8610 Gas Chromatograph equipped with an EPA style purge and trap sample concentrator was used to perform the analyses. A ten component GRO standard including methyl tertiary butyl ether, benzene, toluene, ethylbenzene, meta-xylene, para-xylene, ortho-xylene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene and naphthalene was analyzed at a range of concentrations to generate response factors for each analyte.

3.0 Results

3.1. Sample Analysis

Table 1 presents a summary of the soil and groundwater sample analytical results.

Table 1
Sample Analysis Results
Steer Truckstop
Austin, Minnesota

Probe Location	Benzene	Toluene	Ethyl Benzene	Xylenes	GRO	THC as FUEL OIL
GP-1 Soil 10'	<500	<500	<500	<500	<5,000	<5,000
GP-1 GW 6.5'	<4.0	<4.0	<4.0	<4.0	<100	<100
GP-2 Soil 6'- 8'	<500	<500	<500	<500	<5,000	<5,000
GP-2 GW 6.5'	692	187	586	685	9,100	<100
GP-3 Soil 6'-8'	6,170	18,900	8,020	33,800	324,000	<5,000
GP-4 Soil 6'- 8'	<500	<500	<500	<500	22,100	53,700
GP-5 Soil 6'- 8'	1,610	3,120	5,280	13,300	271,000	<5,000
GP-6 Soil 6'- 8'	<500	662	<500	<500	63,200	88,800
GP-7 Soil 6'- 8'	<500	<500	<500	<500	<5,000	<5,000
GP-7 GW 6'	<4.0	<4.0	<4.0	<4.0	<100	<100
GP-8 Soil 6'- 8'	<500	<500	<500	<500	<5,000	<5,000
GP-8 GW 6.5'	<4.0	<4.0	<4.0	<4.0	<100	<100
GP-9 Soil 6'- 8'	<500	<500	<500	<500	<5,000	<5,000
GP-9 GW 6'	<4.0	<4.0	<4.0	<4.0	<100	<100
GP-10 Soil 6'- 8'	<500	<500	<500	<500	<5,000	<5,000
GP-10 GW 6.5'	<4.0	<4.0	<4.0	<4.0	<100	<100

Notes: The groundwater analytical results are presented in ug/L or parts per billion.
The soil analytical results are presented on a wet weight basis in ug/Kg or parts per billion.
< = Parameter not detected at or above the indicated detection limit.
GRO = Gasoline range organics.
THC as Fuel Oil = Total hydrocarbons as fuel oil.

3.2. Probe Locations

Upon completion of the subsurface investigation, the probe locations were measured to the nearest foot by Northern Environmental's on-site geologist.

4.0. Standard Practices in Environmental Testing

The M.E.S.A., Inc. report was prepared based on our observations during on-site field activities, information provided to M.E.S.A. and the results of soil and groundwater screening. Environmental testing carries with it an inherent risk that samples or observations may not be representative of things not sampled or seen and, further, that conditions may change over time. Therefore, M.E.S.A., Inc. does not guarantee that the site is devoid of hazardous or potentially hazardous materials or conditions or that undiscovered conditions will not become apparent in the future. The services provided by M.E.S.A., Inc. were in accordance with the Work Plan agreed to between M.E.S.A., Inc. and Northern Environmental, Inc. No other warranty is made or intended.

Sincerely,

David S. Russell, CPG
Mobile Environmental Sampling & Analysis, Inc.

SUPPLEMENTAL SUBSURFACE INVESTIGATION

STEER TRUCKSTOP

3401 West Oakland Avenue
Austin, Minnesota

Prepared For

Northern Environmental, Inc.

Prepared By:

Mobile Environmental Sampling & Analysis, Inc.
P.O. Box 111
New Prague, Minnesota 56071
(612) 492-2196

November 21, 1995

M. E. S. A.
Incorporated

Mobile Environmental Sampling & Analysis, Inc.
P.O. Box 111
New Prague, MN 56071-0111
(612) 492-2196 FAX (612) 492-2196

Innovative Alternatives For
Subsurface Investigations

SUPPLEMENTAL SUBSURFACE INVESTIGATION RESULTS

STEER TRUCKSTOP

3401 WEST OAKLAND AVENUE
AUSTIN, MINNESOTA

1.0 Introduction

Mobile Environmental Sampling & Analysis, Inc. (M.E.S.A.) conducted a supplemental subsurface investigation at the Steer Truckstop located at 3401 West Oakland Avenue in Austin, Minnesota. The work was performed in accordance with Northern Environmental, Inc. written authorization dated September 26, 1995. The purpose of the additional subsurface investigation was to collect and analyze soil and groundwater samples to evaluate the horizontal and vertical extent petroleum related compounds present in the soil and groundwater at the site. The soil and groundwater samples were analyzed for benzene, toluene, ethyl benzene xylenes (BTEX), gasoline range organics (GRO) and total hydrocarbons as fuel oil (THC as F.O.).

M.E.S.A. provided the following services in performing the subsurface investigation:

- Advanced six soil probes to depths ranging from approximately 10 - 18 feet below the ground surface to collect soil and groundwater samples.
- Analyzed four groundwater samples and seven soil samples on-site for BTEX, GRO and THC as F.O.
- Abandoned the probe holes with high solids bentonite grout.
- Prepared a letter report presenting the results of the subsurface investigation.

2.0 Methods and Procedures

2.1. Probe Installation

On November 16 and 17, 1995, M.E.S.A. completed six small diameter probes to collect soil and groundwater samples at the site. The probes were placed adjacent to the underground storage tank basin, pump islands and down gradient of the site north of Oakland Avenue. The probes consisted of hydraulically pushing or hammering one-inch outside diameter stainless steel rods to the desired test depth. At the test depth, soil and groundwater samples were collected. Following removal of the probe rods, the holes were filled with high solids bentonite grout to approximately six inches below the ground surface and completed with either soil or concrete to match the surrounding surface conditions.

Prior to use, the probe rods were scrubbed with an Alconox® solution and rinsed with potable water. Likewise, soil and groundwater sampling tools were scrubbed in Alconox® detergent and rinsed with potable water between each sample location.

2.2. Soil Sample Collection

To collect soil samples, a closed piston-tipped sample barrel equipped with a plastic inner sleeve was attached to the leading end of the probe rods. A threaded stop-pin located at the back of the sample barrel secures the piston rod and piston tip during advancement of the probe rods. Once the probe rods were advanced to the desired test depth, the threaded stop-pin was removed using extension rods inserted down the inside diameter of the probe rods. The sampler and probe rods were advanced allowing soil to enter the sample barrels inner sleeve as the piston retracted. The sample barrel assembly was then retracted and the plastic sleeve containing the soil sample removed for sample collection. New, clean plastic sleeves were used for each soil sample.

Soil samples collected in the piston-tipped sample barrel were placed in clean, VOA glass, screw-top vials having Teflon®-lined caps, labeled, and were placed in a cooler on ice. The vials contained 20 milliliters of methanol, approximately 20 grams of soil (measured to the nearest 0.1 grams on a top loading balance) was placed in each vial.

2.3. Groundwater Sample Collection

To collect groundwater samples at the probe locations, a slotted (0.020" vertical slots) probe rod similar to a well screen was driven below the water table, exposing the slotted section to the water bearing soils. Clean polyethylene tubing with was inserted into the probe rods and connected to a hand actuated vacuum pump to collect a groundwater sample. New, clean polyethylene tubing was used at each sample location. Groundwater samples collected in the polyethylene tubing were emptied into clean, VOA glass vials, having Teflon®-lined caps, labeled, and were placed in a cooler on ice.

2.4. Chemical Analysis

The soil samples and groundwater samples were analyzed in general accordance with EPA Method 8020 for Aromatic Volatile Organic Compounds, the Wisconsin DNR Modified GRO Method and a modified version of EPA Method 8015 for Total Hydrocarbons as fuel oil. A SRI Instruments Model 8610 Gas Chromatograph equipped with an EPA style purge and trap sample concentrator was used to perform the analyses. A ten component GRO standard including methyl tertiary butyl ether, benzene, toluene, ethylbenzene, meta-xylene, para-xylene, ortho-xylene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene and naphthalene was analyzed at a range of concentrations to generate response factors for each analyte.

3.0 Results

3.1. Sample Analysis

Table 1 presents a summary of the soil and groundwater sample analytical results.

Table 1
Sample Analysis Results
Steer Truckstop
Austin, Minnesota

Probe Location	Benzene	Toluene	Ethyl Benzene	Xylenes	GRO	THC as FUEL OIL
GP-11 Soil 10'	1,270	<500	<500	<500	8,720	<5,000
GP-11 Soil 15'	<500	<500	<500	<500	<5,000	<5,000
GP-12 Soil 10'	<500	<500	<500	<500	<5,000	<5,000
GP-12 Soil 15'	<500	<500	<500	<500	<5,000	<5,000
GP-13 Soil 6'	<500	<500	<500	<500	<5,000	<5,000
GP-13 Soil 10'	<500	<500	<500	<500	<5,000	<5,000
GP-13 GW 7'	<4.0	<4.0	<4.0	<4.0	<100	<100
GP-14 GW 6'	<4.0	<4.0	<4.0	<4.0	<100	<100
GP-15 GW 6'	<4.0	<4.0	<4.0	<4.0	<100	<100
GP-16 Soil 7'	<500	<500	<500	<500	<5,000	<5,000
GP-16 GW 8'	<4.0	<4.0	<4.0	<4.0	<100	<100

Notes: The groundwater analytical results are presented in ug/L or parts per billion.
The soil analytical results are presented on a wet weight basis in ug/Kg or parts per billion.
< = Parameter not detected at or above the indicated detection limit.
GRO = Gasoline range organics.
THC as Fuel Oil = Total hydrocarbons as fuel oil.

3.2. Probe Locations
Upon completion of the subsurface investigation, the probe locations were measured to the nearest foot by Northern Environmental's on-site geologist.

4.0. Standard Practices in Environmental Testing

The M.E.S.A., Inc. report was prepared based on our observations during on-site field activities, information provided to M.E.S.A. and the results of soil and groundwater screening. Environmental testing carries with it an inherent risk that samples or observations may not be representative of things not sampled or seen and, further, that conditions may change over time. Therefore, M.E.S.A., Inc. does not guarantee that the site is devoid of hazardous or potentially hazardous materials or conditions or that undiscovered conditions will not become apparent in the future. The services provided by M.E.S.A., Inc. were in accordance with the Work Plan agreed to between M.E.S.A., Inc. and Northern Environmental, Inc. No other warranty is made or intended.

Sincerely,

David S. Russell

David S. Russell, CPG
Mobile Environmental Sampling & Analysis, Inc.

APPENDIX C

PROJECT METHODOLOGIES

Soil Exploration Drilling and Sampling

All drilling and sampling equipment was steam cleaned or triple rinsed prior to each use. No lubricants or solvents were used on any downhole equipment. All geoprobe boring holes were decommissioned by filling with bentonite.

Relatively undisturbed soil samples were collected from the geoprobe boreholes at 5 foot intervals during drilling using a 2.0 foot closed piston tipped sample barrel equipped with a plastic inner sleeve. The exception to this was geoprobe GP-11 which was continuously sampled to accurately log the site lithology. Methods and procedures are provided in the M.E.S.A. Subsurface Investigation (Reference).

A portion of sample from each interval was immediately transferred into the appropriate sample containers necessary to analyze for GRO, DRO, and BETX. The samples were labeled and stored on ice in a cooler at 4°C for possible laboratory analysis. All samples were transported under chain-of-custody to Midwest Analytical Services for analysis.

Another portion of each sample was subjected to field headspace screening utilizing a photoionization detector (PID). Select soil samples were also analyzed using a field GC for GRO, DRO, and BETX. PID headspace screening consisted of transferring a sample to a clean 16-ounce glass jar and sealing the jar with aluminum foil and a threaded band. Care was taken to maintain a relatively constant soil volume to headspace ratio. The sealed headspace sample was agitated to break up soil clods before being placed in the heated cab of Northern Environmental's field vehicle for approximately 30 minutes. The aluminum foil seal was then carefully punctured with the PID probe and the highest stable response occurring in 10 to 20 seconds was recorded. The PID utilized was a Thermo Model 580B Organic Vapor Monitor (OVM) outfitted with a 10.6 eV lamp.

A third portion of the sample was collected and physically examined (e.g., appearance, gradation, etc.). Soil borings were logged in accordance with ASTM 2488. Soil boring logs included information on soil type, gradation, plasticity, color (Munsell notation), consistency, odor, and PID response. Copies of soil boring logs are included in this report.

References

American Society for Testing and Materials, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, ASTM Method D2488-90.

Ground-Water Monitoring Well Construction, Development, and Sampling

Three groundwater monitoring wells (RW1 through RW3) were constructed to help determine groundwater quality and flow direction. These monitoring wells were constructed by Aggasiz Environmental Drilling under the supervision of Northern Environmental. The location of the monitoring wells are illustrated in figures included in this report.

The wells are constructed of four-inch inside diameter (I.D.), flush-joint, threaded, schedule 40 polyvinyl chloride (PVC) pipe. Ten feet of 0.010-inch mill-slotted well screen was positioned so that two or three feet of the screen was above the expected seasonal high water table. Locking cap and protective casings were installed to provide protection from vandalism and tampering.

The elevation and location of the ground-water monitoring wells were surveyed by Northern Environmental personnel on November 17, 1995. The southwest corner of the kerosene AST containment dike was used as an arbitrary datum. Water levels were measured at each monitoring well using an electronic water level indicator tape to the nearest 0.01 foot. Water levels were collected on November 17 and December 6, 1995.

Ground-water monitoring wells were developed on November 17, 1995. A table summarizing the approximate volume of water removed from each well using a clean bottom filling PVC bailer is included in this report. Measurements and observations of pH, specific conductance, temperature, and turbidity were collected and recorded. When the readings were relatively consistent, the well was considered developed.

Water samples were collected from each well using a new disposable polyethylene bailer. Samples were obtained by gently lowering the bailer into contact with the water to a depth approximately equal to the length of the bailer. The water was transferred from the bailer using a bottom emptying device into appropriate sample containers supplied by the laboratory, then preserved on ice, and transported under chain-of-custody to a an environmental laboratory for analysis.

Ground-water samples were field screened (pH, temperature, and conductivity) and submitted under chain-of-custody to Midwest Analytical Services for DRO (WDNR Modified Method), GRO (WDNR Modified Method), and BETX (EPA Method 8020). A trip blank was supplied by the laboratory. The ground-water samples were immediately labeled and stored on ice in a cooler at 4° C where they were maintained in a chilled condition during field work through delivery to the analytical laboratory. Copies of laboratory analytical results and chain-of-custody forms are included in this report. Ground-water quality results are summarized in Table 3 in the text.

Northern Environmental℠
Hydrologists • Engineers • Geologists

APPENDIX D

BOREHOLE LOGS AND ABANDONMENT FORMS

▲ *Northern Environmental Tech., Inc.*

SOIL BOREHOLE LOG

Sheet 1 of 1

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP1**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

GROUND ELEV:	DRILLER: **M.E.S.A.**		START / END
WATER LEVEL (ft. below grade):	METHOD:	DATE:	10/26/95 / 10/26/95
▽ DURING DRILLING	RIG: **Geoprobe**	TIME:	0815 / 0851
▼ AFTER DEV.(OR STATIC)	BIT(S):		
TOTAL DEPTH: **12.0 ft**	FLUID:	COMPLETED AS: **GP1**	
BOREHOLE DIA: **1-inch**			

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	RQD/ Comments
			1	0.0-0.5 Bituminous Asphalt 0.5-1.0 Gravel Roadbase 1.0-12.0 SANDY CLAY, trace of subrounded fine gravel, slightly plastic, gray, moist, becoming saturated at 6.5 feet with increase plasticity, moderately dense, (SC-Des Moines Lobe Till).	SC									
			2											
			3											
			4											
GP1-1	17		5					0						
			6											
			7											
			8											
			9											
GP1-2	24		10					0						
			11											
			12											
			13											
			14											
			15											
			16											
			17											
			18											
			19											
			20											

Northern Environmental Tech., Inc.

SOIL BOREHOLE LOG

Sheet 1 of 1

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP2**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

			START	END
GROUND ELEV:	DRILLER: **M.E.S.A.**	DATE:	10/26/95	10/26/95
WATER LEVEL (ft. below grade):	METHOD:	TIME:	0925	0949
▽ DURING DRILLING	RIG: **Geoprobe**			
▼ AFTER DEV.(OR STATIC)	BIT(S):			
TOTAL DEPTH: **12.0 ft**	FLUID:	COMPLETED AS: **GP2**		
BOREHOLE DIA: **1-inch**				

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	RQD/ Comments
			1	0.0-0.5 Bituminous Asphalt 0.5-1.0 Gravel Roadbase 1.0-12.0 SANDY CLAY, trace of subrounded fine gravel, slightly plastic, gray to 9 feet then brown, moist, becoming saturated at 6.5 feet with increase plasticity, moderately dense, (SC-Des Moines Lobe Till).	SC									
GP2-1	24		6					30						
			8											
GP2-2	24		10					0						
			12	End of Boring 12.0 feet.										
			20											

▲ *Northern Environmental Tech., Inc.*

SOIL BOREHOLE LOG

Sheet 1 of 1

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP3**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

GROUND ELEV:	DRILLER: **M.E.S.A.**		START / END
WATER LEVEL (ft. below grade):	METHOD:	DATE:	10/26/95 / 10/26/95
▽ DURING DRILLING	RIG: **Geoprobe**	TIME:	1043 / 1122
▼ AFTER DEV.(OR STATIC)	BIT(S):		
TOTAL DEPTH: **12.0 ft**	FLUID:	COMPLETED AS: **GP3**	
BOREHOLE DIA: **1-inch**			

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	RQD/ Comments
			1	0.0-0.5 Bituminous Asphalt 0.5-1.0 Gravel Roadbase 1.0-12.0 SANDY CLAY, trace of subrounded fine gravel, slightly plastic, gray to 9 feet then brown, moist, becoming saturated at 6.5 feet with increase plasticity, moderately dense, (SC-Des Moines Lobe Till).	SC									
			2											
			3											
			4											
			5											
GP3-1	24		6					3500						
			7											
			8											
			9											
GP2-2	24		10					454						
			11											
			12	End of Boring 12.0 feet.										
			13											
			14											
			15											
			16											
			17											
			18											
			19											
			20											

Northern Environmental Tech., Inc.

SOIL BOREHOLE LOG

Sheet 1 of 1

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP4**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

			START	END
GROUND ELEV:	DRILLER: **M.E.S.A.**	DATE:	10/26/95	10/26/95
WATER LEVEL (ft. below grade):	METHOD:	TIME:	1205	1245
▽ DURING DRILLING	RIG: **Geoprobe**			
▼ AFTER DEV.(OR STATIC)	BIT(S):			
TOTAL DEPTH: **12.0 ft**	FLUID:	COMPLETED AS: **GP4**		
BOREHOLE DIA: **1-inch**				

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	RQD/ Comments
			1	0.0-0.5 Bituminous Asphalt 0.5-1.0 Gravel Roadbase 1.0-12.0 SANDY CLAY, trace of subrounded fine gravel, slightly plastic, brown, moist, becoming saturated at 6.5 feet with increase plasticity, moderately dense, (SC-Des Moines Lobe Till).	SC									
			2											
			3											
			4											
			5											
			6											
GP4-1	24		7					186						
			8											
			9											
			10											
GP4-2	24		11					12						
			12	End of Boring 12.0 feet.										
			13											
			14											
			15											
			16											
			17											
			18											
			19											
			20											

Northern Environmental Tech., Inc.

SOIL BOREHOLE LOG

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP5**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

			START	END
GROUND ELEV:	DRILLER: **M.E.S.A.**	DATE:	10/26/95	10/26/95
WATER LEVEL (ft. below grade):	METHOD:	TIME:	1340	1420
▽ DURING DRILLING	RIG: **Geoprobe**			
▼ AFTER DEV.(OR STATIC)	BIT(S):			
TOTAL DEPTH: **8.0 ft**	FLUID:			
BOREHOLE DIA: **1-inch**		COMPLETED AS: **GP5**		

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	RQD/ Comments
			1	0.0-0.5 Bituminous Asphalt 0.5-1.0 Gravel Roadbase 1.0-8.0 SANDY CLAY, trace of subrounded fine gravel, slightly plastic, gray, moist, becoming saturated at 6.5 feet with increase plasticity, moderately dense, (SC-Des Moines Lobe Till).	SC									
			2											
			3											
			4											
			5											
			6											
GP5-1	24		7					1497						
			8	End of Boring 8.0 feet.										
			9											
			10											
			11											
			12											
			13											
			14											
			15											
			16											
			17											
			18											
			19											
			20											

▲ *Northern Environmental Tech., Inc.*

SOIL BOREHOLE LOG

Sheet 1 of 1

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP6**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

GROUND ELEV:	DRILLER: **M.E.S.A.**		START / END
WATER LEVEL (ft. below grade):	METHOD:	DATE:	10/26/95 / 10/26/95
▽ DURING DRILLING	RIG: **Geoprobe**	TIME:	1430 / 1457
▼ AFTER DEV.(OR STATIC)	BIT(S):		
TOTAL DEPTH: **8.0 ft**	FLUID:	COMPLETED AS: **GP6**	
BOREHOLE DIA: **1-inch**			

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	RQD/ Comments
			1	0.0-0.5 Bituminous Asphalt 0.5-1.0 Gravel Roadbase 1.0-8.0 SANDY CLAY, trace of subrounded fine gravel, slightly plastic, gray, moist, becoming saturated at 6.5 feet with increase plasticity, moderately dense, (SC-Des Moines Lobe Till).	SC									
GP6-1	24		6					168						
			8	End of Boring 8.0 feet.										
			10											
			12											
			14											
			16											
			18											
			20											

▲ *Northern Environmental Tech., Inc.*

SOIL BOREHOLE LOG

Sheet 1 of 1

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP7**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

			START	END
GROUND ELEV:	DRILLER: **M.E.S.A.**	DATE:	10/26/95	10/26/95
WATER LEVEL (ft. below grade):	METHOD:	TIME:	1532	1558
▽ DURING DRILLING	RIG: **Geoprobe**			
▼ AFTER DEV.(OR STATIC)	BIT(S):			
TOTAL DEPTH: **8.0 ft**	FLUID:	COMPLETED AS: **GP7**		
BOREHOLE DIA: **1-inch**				

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	RQD/ Comments
			1	0.0-0.5 Bituminous Asphalt										
				0.5-1.0 Gravel Roadbase										
			2	1.0-8.0 SANDY CLAY, trace of subrounded fine gravel, slightly plastic, brown, moist, becoming saturated at 6.5 feet with increase plasticity, moderately dense, (SC-Des Moines Lobe Till).	SC									
			3											
			4											
			5											
			6											
GP7-1	24		7					0						
			8											
				End of Boring 8.0 feet.										
			9											
			10											
			11											
			12											
			13											
			14											
			15											
			16											
			17											
			18											
			19											
			20											

▲ *Northern Environmental Tech., Inc.*

SOIL BOREHOLE LOG

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP8**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

			START	END
GROUND ELEV:	DRILLER: **M.E.S.A.**	DATE:	10/26/95	10/26/95
WATER LEVEL (ft. below grade):	METHOD:	TIME:	1623	1645
▽ DURING DRILLING	RIG: **Geoprobe**			
▼ AFTER DEV.(OR STATIC)	BIT(S):			
TOTAL DEPTH: **8.0 ft**	FLUID:			
BOREHOLE DIA: **1-inch**		COMPLETED AS: **GP8**		

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	RQD/ Comments
			1	0.0-0.5 Bituminous Asphalt 0.5-1.0 Gravel Roadbase 1.0-8.0 SILTY CLAY, trace of subrounded fine gravel, plastic, brown, moist, becoming saturated at 6.5 feet with increase plasticity, moderately dense, (ML-Des Moines Lobe Till).	ML									
			2											
			3											
			4											
			5											
			6											
GP8-1	24		7					0						
			8	END OF BORING 8.0 FEET.										
			9											
			10											
			11											
			12											
			13											
			14											
			15											
			16											
			17											
			18											
			19											
			20											

▲ *Northern Environmental Tech., Inc.*

SOIL BOREHOLE LOG

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP9**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

			START	END
GROUND ELEV:	DRILLER: **M.E.S.A.**	DATE:	10/26/95	10/26/95
WATER LEVEL (ft. below grade):	METHOD:	TIME:	1715	1738
▽ DURING DRILLING	RIG: **Geoprobe**			
▼ AFTER DEV.(OR STATIC)	BIT(S):			
TOTAL DEPTH: **8.0 ft**	FLUID:	COMPLETED AS: **GP9**		
BOREHOLE DIA: **1-inch**				

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	RQD/ Comments
			1	0.0-0.5 Bituminous Asphalt 0.5-1.0 Gravel Roadbase 1.0-8.0 SANDY CLAY, trace of subrounded fine gravel, slightly plastic, gray, moist, becoming saturated at 6.5 feet with increase plasticity, moderately dense, (SC-Des Moines Lobe Till).	SC									
GP9-1	24		6					0						
			8	End of Boring 8.0 feet.										
			9											
			10											
			11											
			12											
			13											
			14											
			15											
			16											
			17											
			18											
			19											
			20											

▲ *Northern Environmental Tech., Inc.*

SOIL BOREHOLE LOG

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP10**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

GROUND ELEV:	DRILLER: **M.E.S.A.**	
WATER LEVEL (ft. below grade):	METHOD:	
▽ DURING DRILLING	RIG: **Geoprobe**	DATE: START **10/26/95** END **10/26/95**
▼ AFTER DEV.(OR STATIC)	BIT(S):	TIME: START **1820** END **1845**
TOTAL DEPTH: **8.0 ft**	FLUID:	COMPLETED AS: **GP10**
BOREHOLE DIA: **1-inch**		

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	RQD/ Comments
			1	0.0-0.5 Bituminous Asphalt 0.5-1.0 Gravel Roadbase 1.0-8.0 SANDY CLAY, trace of subrounded fine gravel, slightly plastic, gray, moist, becoming saturated at 6.5 feet with increase plasticity, moderately dense, (SC-Des Moines Lobe Till).	SC									
GP10-1	24		2 3 4 5 6 7					0						
			8 9 10 11 12 13 14 15 16 17 18 19 20	End of Boring 8.0 feet.										

▲ *Northern Environmental Tech., Inc.*

SOIL BOREHOLE LOG

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP11**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

GROUND ELEV:	DRILLER: **M.E.S.A.**	START / END
WATER LEVEL (ft. below grade):	METHOD:	DATE: **11/16/95** / **11/16/95**
▽ DURING DRILLING	RIG: **Geoprobe**	TIME: **0920** / **1146**
▼ AFTER DEV.(OR STATIC)	BIT(S):	
TOTAL DEPTH: **18.0 ft**	FLUID:	COMPLETED AS: **GP11**
BOREHOLE DIA: **1-inch**		

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	RQD/ Comments
			1	0.0-0.5 Bituminous Asphalt										
				0.5-1.0 Gravel Roadbase										
				1.0-3.0 SILTY SAND, fine to medium grain, poorly sorted, dark brown, dry loose, (FILL).										
GP11-1	24		2					23						
			3	3.0-11.0 SANDY CLAY, trace of subrounded fine gravel, slightly plastic, gray, moist, becoming saturated at 6.5 feet with increase plasticity, moderately dense, (SC-Des Moines Lobe Till).	SC									
			4											
			5											
			6											
			7											
GP11-2	24		8					1482						
			9											
GP11-3	20		10					364						
			11	11.0-16.0 SILTY FAT CLAY, low plasticity, brown to gray with depth, moist, moderately dense, (CL-ML, Des Moines Lobe Till).	CL ML									
			12											
			13											
GP11-4	24		14					0						
			15											
GP11-5	24		16	CLAY, fine grained, light brown, dry, very dense and hard, (CH, Des Moines Lobe Till).	CH			0						
			17											
			18	End of Boring 18.0 feet.										
			19											
			20											

Northern Environmental Tech., Inc.

SOIL BOREHOLE LOG

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP12**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

GROUND ELEV:	DRILLER: **M.E.S.A.**	START / END
WATER LEVEL (ft. below grade):	METHOD:	DATE: **11/16/95** / **11/16/95**
▽ DURING DRILLING	RIG: **Geoprobe**	TIME: **1230** / **1322**
▼ AFTER DEV.(OR STATIC)	BIT(S):	
TOTAL DEPTH: **16.0 ft**	FLUID:	COMPLETED AS: **GP12**
BOREHOLE DIA: **1-inch**		

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	ROD/ Comments
			1	0.0-0.5 Bituminous Asphalt 0.5-1.0 Gravel Roadbase 1.0-9.0 No samples collected										
			2											
			3											
			4											
			5											
			6											
			7											
			8											
GP12-1	24		9		ML			3						
			10											
			11	9.0-16.0 SILTY CLAY, high plasticity, brown to gray with depth, saturated, dense, (ML, Des Moines Lobe Till).										
			12											
			13											
GP12-2	22		14					0						
			15											
			16	End of Boring 16.0 feet.										
			17											
			18											
			19											
			20											

▲ *Northern Environmental Tech., Inc.*

SOIL BOREHOLE LOG

Sheet 1 of 1

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP13**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

GROUND ELEV:	DRILLER: **M.E.S.A.**		START / END
WATER LEVEL (ft. below grade):	METHOD:	DATE:	11/16/95 / 11/16/95
▽ DURING DRILLING	RIG: **Geoprobe**	TIME:	1420 / 1528
▼ AFTER DEV.(OR STATIC)	BIT(S):		
TOTAL DEPTH: **13.0 ft**	FLUID:	COMPLETED AS: **GP13**	
BOREHOLE DIA: **1-inch**			

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	RQD/ Comments
			1	4.0-11.0 SILTY CLAY, high plasticity, yellowish brown, saturated, soft, (ML, Des Moines Lobe Till).	ML									
			2											
			3											
GP13-1	24		4					0						
			5											
			6											
			7											
			8											
GP13-2	22		9					0						
			10											
			11	End of Boring 11.0 feet.										
			12											
			13											
			14											
			15											
			16											
			17											
			18											
			19											
			20											

▲ *Northern Environmental Tech., Inc.*

SOIL BOREHOLE LOG

Sheet 1 of 1

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP14**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

GROUND ELEV:	DRILLER: **M.E.S.A.**		START / END
WATER LEVEL (ft. below grade):	METHOD:	DATE:	11/16/95 / 11/16/95
▽ DURING DRILLING	RIG: **Geoprobe**	TIME:	1612 / 1630
▼ AFTER DEV.(OR STATIC)	BIT(S):		
TOTAL DEPTH: **9.0 ft**	FLUID:	COMPLETED AS: **GP14**	
BOREHOLE DIA: **1-inch**			

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	RQD/ Comments
			1	2.0-9.0 SILTY CLAY, high plasticity, yellowish brown, saturated, soft, (ML, Des Moines Lobe Till).	ML									
			2											
			3											
			4											
			5											
			6											
GP14-1	24		7					0						
			8											
			9	End of Boring 9.0 feet.										
			10											
			11											
			12											
			13											
			14											
			15											
			16											
			17											
			18											
			19											
			20											

Northern Environmental Tech., Inc.

SOIL BOREHOLE LOG

Sheet 1 of 1

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP15**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

GROUND ELEV:	DRILLER: **M.E.S.A.**		START / END
WATER LEVEL (ft. below grade):	METHOD:	DATE:	11/16/95 / 11/16/95
▽ DURING DRILLING	RIG: **Geoprobe**	TIME:	1644 / 1648
▼ AFTER DEV.(OR STATIC)	BIT(S):		
TOTAL DEPTH: **8.0 ft**	FLUID:	COMPLETED AS: **GP15**	
BOREHOLE DIA: **1-inch**			

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	RQD/ Comments
			1	2.0-8.0 SILTY CLAY, high plasticity, yellowish brown, saturated, soft, (ML, Des Moines Lobe Till).	ML									
			2											
			3											
			4											
			5											
GP15-1	24		6					0						
			7											
			8	End of Boring 8.0 feet.										
			9											
			10											
			11											
			12											
			13											
			14											
			15											
			16											
			17											
			18											
			19											
			20											

Northern Environmental Tech., Inc.

SOIL BOREHOLE LOG

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **GP16**

LOCATION: **Austin, Minnesota**

LOGGED BY: **P. Kittelson**

GROUND ELEV:	DRILLER: **M.E.S.A.**	START / END
WATER LEVEL (ft. below grade):	METHOD:	DATE: **11/16/95** / **11/16/95**
▽ DURING DRILLING	RIG: **Geoprobe**	TIME: **1653** / **1702**
▼ AFTER DEV.(OR STATIC)	BIT(S):	
TOTAL DEPTH: **8.0 ft**	FLUID:	COMPLETED AS: **GP16**
BOREHOLE DIA: **1-inch**		

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	RQD/ Comments
			1	2.0-8.0 SILTY CLAY, high plasticity, yellowish brown, saturated, soft, (ML, Des Moines Lobe Till).	ML									
			2											
			3											
			4											
			5											
GP16-1	24		6					0						
			7											
			8	End of Boring 8.0 feet.										
			9											
			10											
			11											
			12											
			13											
			14											
			15											
			16											
			17											
			18											
			19											
			20											

▲ *Northern Environmental Tech., Inc.*

SOIL BOREHOLE LOG

Sheet 1 of 1

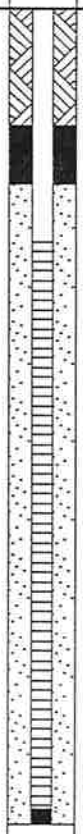
PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **RW1**

LOCATION: **Austin, Minnesota**

LOGGED BY: **M. JANOVEC**

GROUND ELEV:	DRILLER: **AGASSIZ**		START / END
WATER LEVEL (ft. below grade):	METHOD: **HSA**	DATE:	11/16/95 / 11/16/95
▽ DURING DRILLING	RIG: **IR 200**	TIME:	0915 / 1216
▼ AFTER DEV.(OR STATIC)	BIT(S): **10.25**		
TOTAL DEPTH: **14.0 ft**	FLUID: **None**	COMPLETED AS: **RW1**	
BOREHOLE DIA: **1-inch**			

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	RQD/ Comments
			1–20	Recovery Well #1 was a blind drill from 0.0 to 14.0. See GP11 for nearest geoprobe location.										

Northern Environmental Tech., Inc.

SOIL BOREHOLE LOG

Sheet 1 of 1

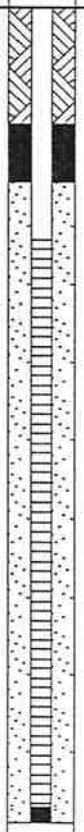
PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **RW2**

LOCATION: **Austin, Minnesota**

LOGGED BY: **M. JANOVEC**

GROUND ELEV:	DRILLER: AGASSIZ		START / END
WATER LEVEL (ft. below grade):	METHOD: HSA	DATE:	11/16/95 / 11/16/95
▽ DURING DRILLING	RIG: IR 200	TIME:	1250 / 1340
▼ AFTER DEV.(OR STATIC)	BIT(S): 10.25		
TOTAL DEPTH: 14.0 ft	FLUID: None	COMPLETED AS: RW2	
BOREHOLE DIA: 1-inch			

Sample Number	Sample Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	RQD/ Comments
			1–20	Recovery Well #2 was a blind drill from 0.0 to 14.0. See GP4 for nearest geoprobe location.										

▲ *Northern Environmental Tech., Inc.*

SOIL BOREHOLE LOG

PROJECT: **Big Steer/Phillips 66**

BOREHOLE ID: **RW3**

LOCATION: **Austin, Minnesota**

LOGGED BY: **M. JANOVEC**

GROUND ELEV:	DRILLER: AGASSIZ		START / END
WATER LEVEL (ft. below grade):	METHOD: HSA	DATE:	11/16/95 / 11/16/95
▽ DURING DRILLING	RIG: IR 200	TIME:	1415 / 1650
▼ AFTER DEV.(OR STATIC)	BIT(S): 10.25		
TOTAL DEPTH: 14.0 ft	FLUID: None	COMPLETED AS: RW3	
BOREHOLE DIA: 1-inch			

Sample									Soil Properties					
Number	Length Recovered(in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	RQD/ Comments
			1–20	Recovery Well #3 was a blind drill from 0.0 to 14.0. See GP12 for nearest geoprobe location.