ATTACHMENT D

UNDERGROUND SOURCES OF DRINKING WATER

Geology

The Glacial Drift is the only source of groundwater in Grand Traverse County. The Glacial Drift consists of gravel, sand, silt and clay. These unconsolidated deposits ranges in thickness from 100 to 900 feet. Most domestic wells in the County are 50 to 150 feet deep and yield at least 20 GPM. Industrial wells generally deeper than 150 feet are at times capable of producing 250 GPM. The U.S. Geological Survey Investigation Report 90-4122 333 published in 1990 showed fresh water flow in the vicinity of the Weber 4-8 to be towards the Southwest. This same report listed the generalized depth to water-bearing deposits in the area to be 150 to 200 feet.

The base of the drift (top of Coldwater shale) was encountered at 781′ G.L. (+324′ above Sea Level) in the Weber No. 4-8. The four other penetrations within the 1/4-mile Area of Review encountered the base of the drift between 319′ and 343′ above sea level

Bedrock Aquifers

Bedrock in the area is the Coldwater shale of Paleozoic age. The shale is described as being light to medium gray in color, firm and slightly calcareous. The Coldwater is about 725 feet thick at the Weber 4-8 wellsite and is underlain with the Antrim shale.

Water Quality

Nineteen samples of groundwater were collected in Mayfield Township, Grand Traverse County in 1985. Analyses by the U.S. Geological Society were as follows:

Specific Conductance			Nitrate			Chloride		
Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.
932	516	251	8.8	2.4	0.1	96	15	0.6

Glacial Drift & Water Supply

Figure D-1 shows the 1/4 mile AOR and all water wells found within Section 8, the West Quarter of Section 9, the South Quarter of Section 5 of Township 25 North, Range 11 West of Grand Traverse County Michigan. Information on these water wells is summarized on Table D-1. Water well records are at the end of this Attachment.

Figure D-2 shows the Water-table Configuration in Grand Traverse County, Michigan. Figure D-3 shows the Generalized Depth to Water-bearing Deposits in Grand Traverse County, Michigan.

Water Quality Data, Water-table Configuration and Generalized Depth to water-bearing deposits is from:

"HYDROLOGICAL AND LAND USE IN GRAND TRAVERSE COUNTY, MICHIGAN U.S." *Geological Survey,* Water-Resources Investigations Report 90-4122. Prepared in cooperation with: Grand Traverse County and the Michigan Department of Natural Resources Geological Survey Division.

Figure D-4 is an Isopac of Drift Thickness in Grand Traverse County, Michigan.

Drift Isopac Map from:

"GRAND TRAVERSE COUNTY DRIFT THICKNESS MAP" by C. Robert Reszka, drawn by Gregory A. Wilson. Department of Natural Resources Geological Survey Division #3772 DT, Posted 1-18-2005.

Figure D-1

Map showing all water wells found within the West quarter of Section 9, South quarter of Section 5 and all of Section 8 of T25N, R11W, Grand Traverse County MI.

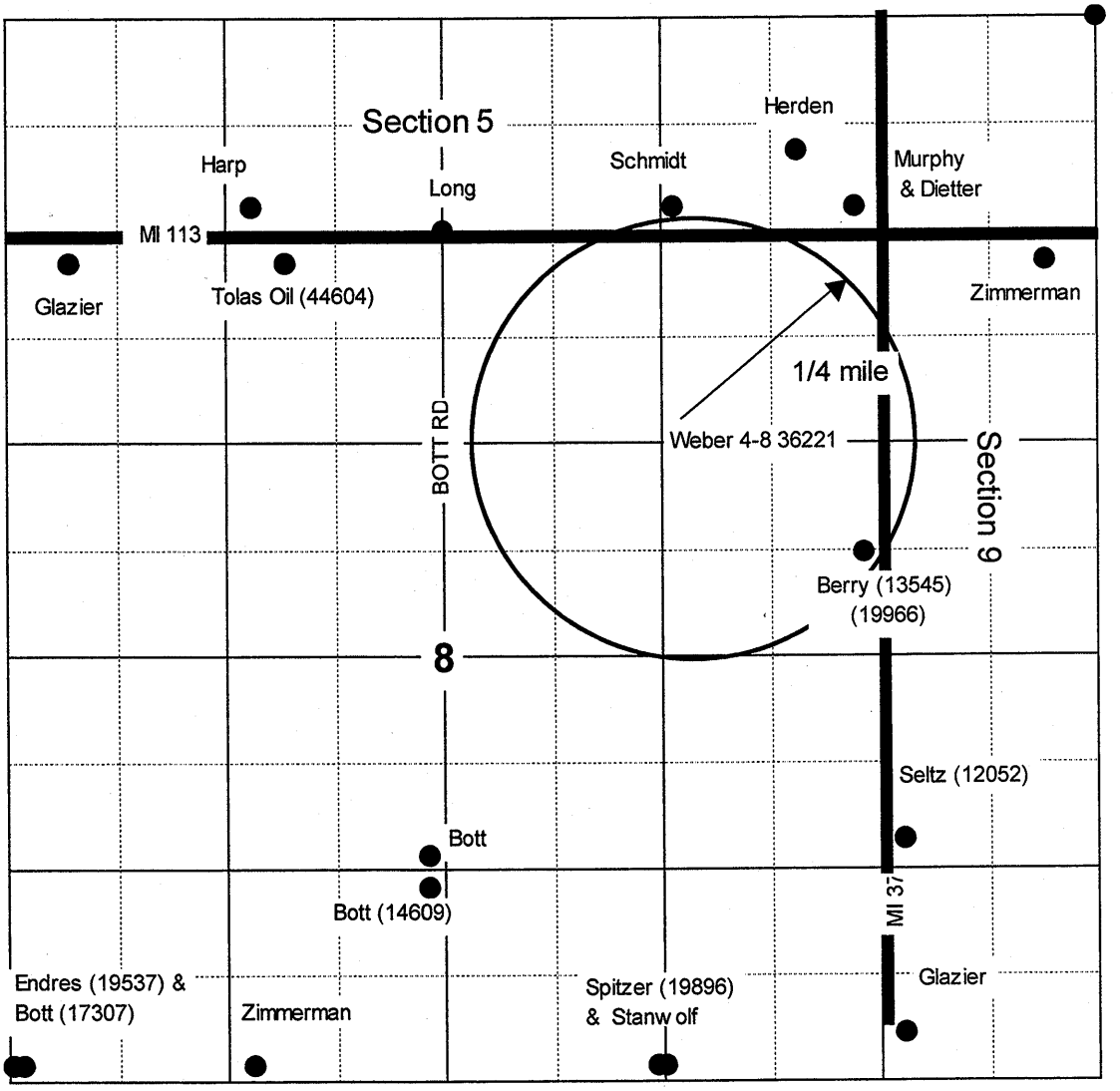

TABLE D-1

Water wells within the West quarter of Section 9, South quarter of Section 5 and all of Section 8 of T25N, R11W, Grand Traverse County MI. (Data From - www.deq.state.mi.us/well-logs/)

Section	Owner of Well (As per permit)	Permit No.	Location	SHL QQQ	Date Completed	Depth
5	Joe Harp	-	Miller Rd. 3/4 mi. west of M37	SWSESW	9/7/1973	214
5	Allen Dietter	-	Jct M37 & M113	SESESE	9/16/1971	93
5	Fred Murphy	-	Corner M37 & Miller Rd.	SESESE	8/1/1974	80
5	Wes Herden	-	1/10 mi. NW of Jct M37 & M113	SESESE	10/23/1978	80
5	Schmidt Real Est.	-	Miller Rd. 1/4 mi. west of M37	SWSESE	2/20/1980	105
8	Ken Berry	13545	0.4 mi. S. of M113 on w. side of M37	SESENE	6/9/1986	81
8	Chris M. Bott	17307	Appr. 1 mi. W. of M37 on N. side Harrand Rd.	SWSWSW	8/9/1981	232
8	Steve Endres	19537	5170 West Harrant Rd.	SWSWSW	8/8/1991	181
8	Ronald W. Spitzer	19876	1/4 mi. W. of M37 On Harrand Rd.	E1/2SWSE	9/13/1991	244
8	Stanwolf		1/4 mi. W. of M37 On Harrand Rd.	SWSESE	9/15/1978	122
8	Tolas Oil & Gas Co.	44604	Lease Miller 1-8	NWNENW	11/5/1991	229
8	Gerald Glazier		1/2 mi. of Bott rd. on Miller Rd.	NWNW	10/16/1978	190
8	Dean Bott	14609	Off Harrand Rd. on W. side of Bott Rd	NESESW	7/16/1987	1222
8	Jack Zimmerman		3/4 mi. W. of M37 On Harrand Rd.	SESWSW	8/4/1987	109
8	Greg Bott		3/4 mi. on Bott Rd S. from Miller Rd.	NESW	8/3/1978	107
9	Gerald Glazier		150' E. of M37 & 300' N. of Harrand Rd	SWSWSW	4/23/1970	129
9	Richard Seltz	12052	Bet. M113 & Harrand Rd. on E. side M37	SWNWSW	3/11/1985	153
9	Jack Zimmerman		0.2 mi. E. of M37 on S. side M113	NENWNW	3/6/1984	70

figure
D-2

figure
D-3

figure
D-4

GEOLOGICAL SURVEY SAMPLE No.

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WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

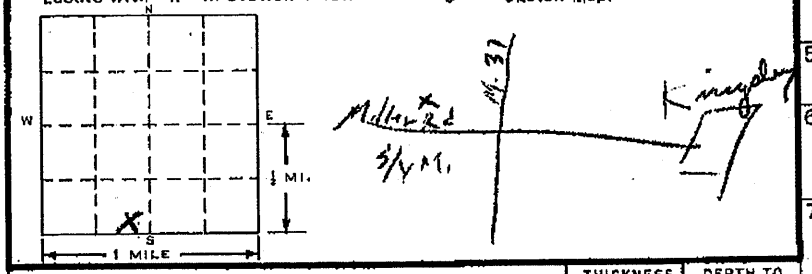
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Grand Traverse	Mary Field	S(W)¼ SE ¼ SE(W)¼	5	25 N/S	11 W.

Distance And Direction from Road Intersections: 3/4 Mi. W. of M-37 on Miller Rd

Street address & City of Well Location: Kingsley, Mich

Locate with "X" in section below — Sketch Map:



3 OWNER OF WELL: Joe + Donald Harp

Address: Kingsley, Mich

4 WELL DEPTH: (completed) 214 ft. Date of Completion: Sept 7, 1973

5 ☑ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐ ____

6 USE: ☑ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐ ____

7 CASING: Threaded ☐ Welded ☐ Diam. 4 in. to 210 ft. Depth; ____ in. to ____ ft. Depth

Height: Above/Below Surface ____ ft. Weight ____ lbs./ft. Drive Shoe? Yes ☒ No ☐

8 SCREEN: Type: Stainless Dia.: 3" Slot/Gauze 7 Length 48" Set between 210 ft. and 214 ft.

Fittings: K Packer + 2' Ext.

9 STATIC WATER LEVEL ____ ft. below land surface

10 PUMPING LEVEL below land surface: 170 ft. after 3 hrs. pumping 12 g.p.m.; ____ ft. after ____ hrs. pumping ____ g.p.m.

11 WATER QUALITY in Parts Per Million: Iron (Fe) ____ Chlorides (Cl) ____ Hardness ____ Other ____

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☑ Pitless Adapter ☐ 12" Above Grade

13 Well Grouted? ☑ Yes ☐ No ☑ Neat Cement ☐ Bentonite ☐ ____ Depth: From 5' ft. to 80' ft.

14 Nearest Source of possible contamination: 80 feet W Direction Septic Tank Type

Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: ☐ Not installed Manufacturer's Name Goulds Model Number 5 11 Stage HP ½ Volts 115 Length of Drop Pipe 185 ft. capacity 7 G.P.M.

Type: ☒ Submersible ☐ Jet ☐ Reciprocating

2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Clay	7	7
Sand	40	47
Clay	20	67
Sand Fine	80	147
Fine Sand + water	40	187
Clay	20	207
Course Sand + water		

USE A 2ND SHEET IF NEEDED

16 Remarks, elevation, source of data, etc.

ADDED INFO. BY DRILLER ITEM No.

CORRECTED BY

CONDITION BY

17 WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Benson Well Drl'g 0798

REGISTERED BUSINESS NAME — REGISTRATION NO.

Address: Mesick, Mich.

Signed: Donald Benson — AUTHORIZED REPRESENTATIVE — Date: Sept. 10, 1973

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WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
GRAND TRAVERSE	MAYFIELD	SE ¼ SE ¼	5	25 N/S.	11 E/W.

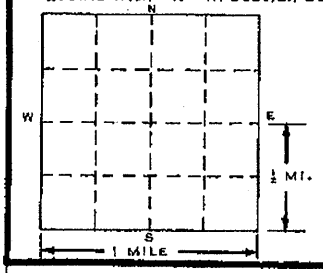
Distance And Direction from Road Intersections

JCT. of M-37 - M113

Street address & City of Well Location

Locate with "X" in section below

Sketch Map:



3 OWNER OF WELL:

Address ALLEN DIETTER

4 WELL DEPTH: (completed) 92 ft. Date of Completion 9-16-71

5 ☐ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☒ Bored ☐ ____

6 USE: ☒ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐ ____

7 CASING: Threaded ☒ Welded ☐ Diam. 2 in. to 87 ft. Depth; ____ in. to ____ ft. Depth

Height: Above/Below Surface ____ ft. Weight 3.75 lbs./ft. Drive Shoe? Yes ☐ No ☐

8 SCREEN: Type: BRASS Dia.: 1 1/4" ~~Slot~~ Gauze 60 Length 5' Set between 87 ft. and 92 ft.

Fittings:

9 STATIC WATER LEVEL 74 ft. below land surface

10 PUMPING LEVEL below land surface

____ ft. after ____ hrs. pumping ____ g.p.m.

____ ft. after ____ hrs. pumping ____ g.p.m.

11 WATER QUALITY in Parts Per Million:

Iron (Fe) ____ Chlorides (Cl) ____

Hardness ____ Other ____

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☐ 12" Above Grade

13 Well Grouted? ☒ Yes ☐ No ☐ Neat Cement ☐ Bentonite ☐ ____

Depth: From ____ ft. to ____ ft.

14 Nearest Source of possible contamination

____ feet ____ Direction ____ Type

Well disinfected upon completion ☐ Yes ☐ No

15 PUMP: ☐ Not Installed

Manufacturer's Name RAPIDAYTON

Model Number 2 stage HP 1 Volts 230

Length of Drop Pipe 78 ft. capacity ____ G.P.M.

Type: ☐ Submersible ☒ Jet ☐ Reciprocating

2

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
CLAY	10	10
GRAVEL	30	40
CLAY	10	50
SAND	25	75
WATER SAND	17	92

USE A 2ND SHEET IF NEEDED

16 Remarks, elevation, source of data, etc.

DRILLER, ITEM No.

CORRECTED BY:

VERIFICATION BY:

17 WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

PHILS WELL DRILLING 0481

REGISTERED BUSINESS NAME REGISTRATION NO.

Address 10785 Grandview Rd T.C.

Signed Phil Shamowski Date 10-21-71

AUTHORIZED REPRESENTATIVE

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WATER WELL RECORD
ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

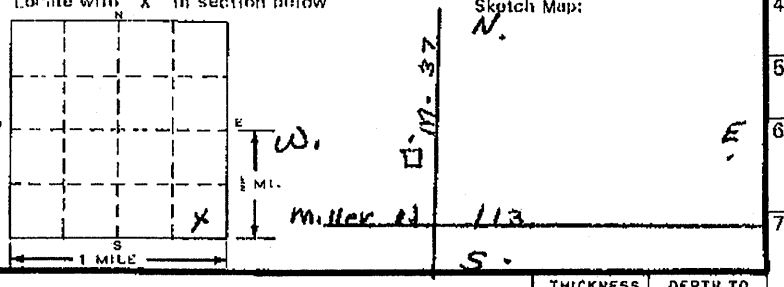
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Grand Traverse	May Feild	SE ¼ SE ¼ SE ¼	5	25 N/S.	11 E/W.

Distance And Direction from Road Intersections: Conner M-37 & Miller Rd. Kingsley Mich.

Street address & City of Well Location

Locate with "X" in section below



Sketch Map:

3 OWNER OF WELL: Fred Murphy.

Address: Kingsley, Michigan

4 WELL DEPTH: (completed) 80 ft. Date of Completion 8-1-74

5 ☐ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☒ Bored ☐ ____

6 USE: ☒ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐ ____

7 CASING: Threaded ☐ Welded ☐
Diam. 4 in. to 75 ft. Depth
____ in. to ____ ft. Depth
Height: Above/Below Surface 1 ft.
Weight 1.00 lbs./ft.
Drive Shoe? Yes ☐ No ☒

2

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
CLAY	25	25
DRY SAND	43	68
WATER SAND	18	86

USE A 2ND SHEET IF NEEDED

8 SCREEN:
Type: DRIVE Dia.: 4"
Slot/Gauze 12 Length 5'
Set between 75 ft. and 80 ft.
Fittings: LEAD COLLAR

9 STATIC WATER LEVEL 60 ft. below land surface

10 PUMPING LEVEL below land surface
____ ft. after ____ hrs. pumping ____ g.p.m.
____ ft. after ____ hrs. pumping ____ g.p.m.

11 WATER QUALITY in Parts Per Million:
Iron (Fe) ____ Chlorides (Cl) ____
Hardness ____ Other ____

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade

13 Well Grouted? ☐ Yes ☒ No
☐ Neat Cement ☐ Bentonite ☐ ____
Depth: From ____ ft. to ____ ft.

14 Nearest Source of possible contamination
60 feet SW Direction septic Type
Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: ☒ Not Installed
Manufacturer's Name ____
Model Number ____ HP ____ Volts ____
Length of Drop Pipe ____ ft. capacity ____ G.P.M.
Type: ☐ Submersible ☐ Jet ☐ Reciprocating

16 Remarks, elevation, source of data, etc.
ADDED INFO BY DRILLER, ITEM NO.
CORRECTED BY
ADDITIONS BY
ELEVATION
DEPTH TO ROCK

17 WATER WELL CONTRACTOR'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
CLASS WELL DRLG CO. (REGISTERED BUSINESS NAME) 1244 (REGISTRATION NO.)
Address 6410 CENTER RD TRAVERSE CITY, MICH.
Signed Frank W. Lynowski (AUTHORIZED REPRESENTATIVE) Date 8-5-74

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JAN 16 1979

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

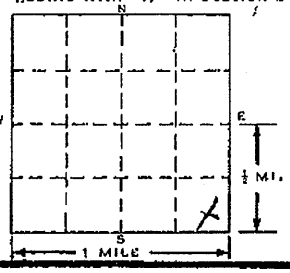
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Grand Traverse	Mayfield	NE¼ SE¼ SE¼	5	T25 N/S.	R11 E/W.

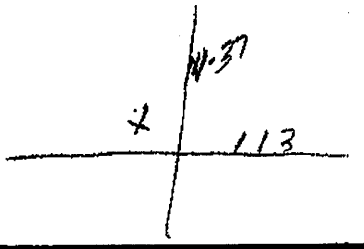
Distance And Direction from Road Intersections: 1/10 MILE N.W. of INTERSECTION M-37 + 113

Street address & City of Well Location

Locate with "X" in section below



Sketch Map:



3 OWNER OF WELL: Wes Herndon

Address 7072 M-37 S

Kingsley Mich.

4 WELL DEPTH: (completed) 80 ft. Date of Completion 10-23-78

5 ☐ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☒ Bored ☐ ____

6 USE: ☒ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐ ____

7 CASING: Threaded ☒ Welded ☐ Diam. 4 in. to 76 ft. Depth; ____ in. to ____ ft. Depth

Height: Above/Below Surface ____ ft.; Weight 11 lbs./ft.; Drive Shoe? Yes ☐ No ☒

8 SCREEN: Type: WESCO Dia.: 4 Slot/~~Gauze~~ 10 Length 4 Set between 76 ft. and 80 ft. Fittings: COUP.

9 STATIC WATER LEVEL 56 ft. below land surface

10 PUMPING LEVEL below land surface 70 ft. after 1 hrs. pumping 12 g.p.m.; ____ ft. after ____ hrs. pumping ____ g.p.m.

11 WATER QUALITY in Parts Per Million: Iron (Fe) ____ Chlorides (Cl) ____ Hardness ____ Other ____

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☒ Pitless Adapter ☐ 12" Above Grade

13 Well Grouted? ☒ Yes ☐ No ☐ Neat Cement ☐ Bentonite ☒ mud. Depth: From 0 ft. to 56 ft.

14 Nearest Source of possible contamination 75 feet N Direction SEPTIC. Type

Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: ☐ Not installed

Manufacturer's Name FLINT + WALLING

Model Number 5BR8 HP 2 Volts 230

Length of Drop Pipe 65 ft. capacity 12 G.P.M.

Type: ☒ Submersible ☐ Jet ☐ Reciprocating

2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Clay	20	20
Sand Gry.	36	56
Water sand	24	80

USE A 2ND SHEET IF NEEDED

16 Remarks, elevation, source of data, etc.

ADDED INFO BY DRILLER, ITEM NO.
*CORRECTED BY
**ADDITION BY
ELEVATION
DEPTH TO ROCK

17 WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Great Well Drilling Co. 1244

REGISTERED BUSINESS NAME REGISTRATION NO.

Address 6410 Cen. Ex. Traverse City Mich

Signed Albert J. Lincoln Date 10-23-78

AUTHORIZED REPRESENTATIVE

D67d 100M (Rev. 12-68)

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GEOLOGICAL SURVEY SAMPLE No.

APR 30 1980

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

1 LOCATION OF WELL

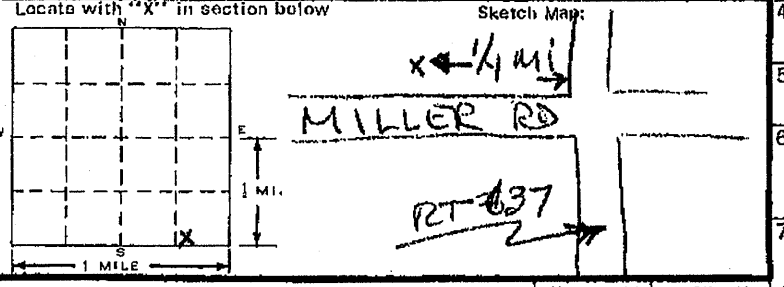
County	Township Name	Fraction	Section Number	Town Number	Range Number
GRAND TRAVERSE	MAYFIELD	SW ¼ SE ¼ SE ¼	57	25 N/S.	11 E/W.

Distance And Direction from Road Intersections: MILLER RD 1/4 MI W of RT #37

Street address & City of Well Location: MAYFIELD, MI 49666

Locate with "X" in section below

Sketch Map:



3 OWNER OF WELL:

SCHMIDT REAL ESTATE

Address: 402 E. FRONT ST. TRAVERSE CITY, MI. 49684

4 WELL DEPTH: (completed)

105 ft. Date of Completion 2-22-80

5

☐ Cable tool ☒ Rotary ☐ Driven ☐ Dug
☐ Hollow rod ☐ Jetted ☐ Bored ☐

6 USE:

☐ Domestic ☐ Public Supply ☐ Industry
☐ Irrigation ☐ Air Conditioning ☐ Commercial
☐ Test Well ☐

7 CASING:

Threaded ☐ Welded ☒

Diam. 5" PVC 100' ft. Depth
in. to ft. Depth

Height: Above/~~Below~~ Surface ft.

Weight 200 lbs./ft.

Drive Shoe? Yes ☐ No ☒

2 FORMATION

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
CLAY & GRAVEL	2	2
CLAY	13	15
SAND & GRAVEL	59	74
Sand	31	105

USE A 2ND SHEET IF NEEDED

8 SCREEN:

Type: STAINLESS Dia.: 2 INCH

Slot/~~Gauze~~ 10 Length 5 FEET

Set between 100 ft. and 105 ft.

Fittings: K-PACKER - PLUG BOTTOM

9 STATIC WATER LEVEL

87 ft. below land surface

10 PUMPING LEVEL below land surface

ft. after hrs. pumping g.p.m.

ft. after hrs. pumping g.p.m.

11 WATER QUALITY in Parts Per Million:

Iron (Fe) Chlorides (Cl)

Hardness Other

12 WELL HEAD COMPLETION:

☐ In Approved Pit
☒ Pitless Adaptor ☐ 12" Above Grade

13 Well Grouted?

☐ Yes ☒ No
☐ Neat Cement ☐ Bentonite ☐

Depth: From ft. to ft.

14 Nearest Source of possible contamination

50 feet NE Direction SEPTIC Type

Well disinfected upon completion ☒ Yes ☐ No

15 PUMP:

☐ Not installed

Manufacturer's Name AERMOTOR

Model Number SD8-50 HP ½ Volts 230

Length of Drop Pipe 85 ft. capacity 8 G.P.M.

Type: ☒ Submersible
☐ Jet ☐ Reciprocating

16 Remarks, elevation, source of data, etc.

ADDED INFO BY DRILLER, ITEM NO.

*CORRECTED BY

**ADDITION BY

ELEVATION

DEPTH TO ROCK

17 WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

B&Z WELL DRILLING 1647

REGISTERED BUSINESS NAME REGISTRATION NO.

Address MAPLE CITY, MI. 49664

Signed [illegible] Date 2/27/80

AUTHORIZED REPRESENTATIVE

D67d 100M (Rev. 12-68)

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY NO

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

WATER WELL AND PUMP RECORD

PERMIT NUMBER 1 3 5 4 5

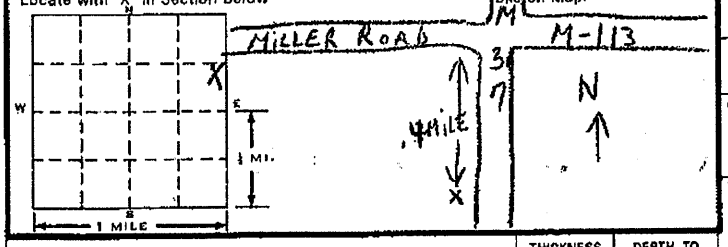
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
GRAND TRAVERSE	MAYFIELD	SE ¼ SE ¼ NE ¼	8	T.25 N/S	R.11 E/W

Distance And Direction From Road Intersection: ¼ MILE SOUTH OF M-113 ON M-37, WEST SIDE OF ROAD.

Street Address & City of Well Location: 7390 M-37 SOUTH

Locate with "X" in Section Below / Sketch Map:



3 OWNER OF WELL: KEN BERRY

Address: 7390 M-37 SOUTH

Address Same As Well Location? ☒ Yes ☐ No

4 WELL DEPTH: (completed) 81 ft. Date of Completion 6-9-86

5 ☐ Cable tool ☒ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Auger ☐ Jetted ☐

6 USE: ☒ Domestic ☐ Type I Public ☐ Type III Public ☐ Irrigation ☐ Type IIa Public ☐ Heat pump ☐ Test Well ☐ Type IIb Public ☐

7 CASING: Diameter ☐ Steel ☐ Threaded ☒ Plastic ☒ Welded

5 in. to 76 ft. depth

in. to ft. depth

Grouted Drill Hole Diameter

6¼ in. to 81 ft. depth

in. to ft. depth

Height: Above/~~Below~~ Surface 1 ft.

Weight 3 lbs /ft

Drive Shoe ☐ Yes ☒ No

8 SCREEN: ☐ Not Installed

Type PVC Diameter 4 INCH

Slot/~~Gauze~~ 10 Length 5 FEET

Set between 76 ft. and 81 ft.

FITTINGS: ☒ K-Packer ☐ Lead Packer ☐ Bremer Check

☒ Blank above screen ft. Other

9 STATIC WATER LEVEL 35 ft. below land surface ☐ Flow

10 PUMPING LEVEL: below land surface

ft. after hrs pumping at G.P.M.

ft. after hrs. pumping at G.P.M.

11 WELL HEAD COMPLETION: ☒ Pitless adapter ☐ 12" above grade ☐ Basement offset ☐ Approved pit

12 WELL GROUTED? ☐ No ☒ Yes From to ft.

☐ Neat cement ☒ Bentonite ☒ Other SAND

No. of bags of cement Additives

13 Nearest source of possible contamination

Type SEPTIC Distance 50 ft. Direction

Well disinfected upon completion? ☒ Yes ☐ No

14 PUMP: ☐ Not Installed ☐ Pump Installation Only

Manufacturer's name RED JACKET

Model number 2W HP 1/2 Volts 230

Length of Drop Pipe 60 ft. capacity 10 G.P.M.

TYPE: ☒ Submersible 1" PVC

PRESSURE TANK:

Manufacturer's name X-TROL

Model number WX202 Capacity 40 Gallons

2 FORMATION DESCRIPTION

	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
SAND	20	20
GRAVEL	40	60
CLAY	1	61
WATER SAND	20	81

USE A 2ND SHEET IF NEEDED

15. Remarks, elevation, source RECEIVED

Mich. Dept. of Public Health

SEP 2 2 1986

Bureau of Environmental and Occupational Health - GWQS

16. WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

PHILS WELL DRILLING 0481

REGISTERED BUSINESS NAME REGISTRATION NO.

Address 10785 GRANDVIEW RD T.C.

Signed Phil Sharnowski Date 6-13-86

AUTHORIZED REPRESENTATIVE

D67d 2/84

Authority: Act 368 PA 1978
Completion: Required
Penalty: Conviction of a violation of any provision is a misdemeanor.

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY NO

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

WATER WELL AND PUMP RECORD

PERMIT NUMBER 1 7 3 0 7

1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
GRAND TRAVERSE	MAYFIELD	SW 1/4 SW 1/4 SW 1/4	8	T. 25 N/S	R. 11 E/W

Distance And Direction From Road Intersection: APPROXIMATELY 1 MILE WEST OF M-37 ON NARRAND ROAD NORTH SIDE OF ROAD.

Street Address & City of Well Location: NARRAND ROAD

Locate with "X" in Section Below

Sketch Map: X; Botts Road; NARRAND ROAD; Fox Road; 1 MILE; 1/4 MI.

3 OWNER OF WELL: CHRIS M. Bott

Address: 336 N.E. SILVER LAKE Rd.

Address Same As Well Location? ☐ Yes ☒ No

4 WELL DEPTH: 232 FT. Date Completed 8 9 81 ☒ New Well ☐ Replacement Well

5 ☐ Cable tool ☒ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Auger ☐ Jetted ☐

6 USE: ☒ Domestic ☐ Type I Public ☐ Type III Public ☐ Irrigation ☐ Type IIa Public ☐ Heat pump ☐ Test Well ☐ Type IIb Public ☐

7 CASING: Diameter ☐ Steel ☐ Threaded ☒ Plastic ☐ Welded

5" in. to ft. depth; in. to 232 ft. depth

Drilled Drill Hole Diameter 7 7/8 in. to ft. depth; in. to 232 ft. depth

Height: Above/Below Surface ft. Weight SDR-21 lbs./ft.

Drive Shoe ☐ Yes ☐ No

8 SCREEN: ☐ Not Installed

Type PVC Diameter 4" Slot Gauge 10 Length 5 FT.

Set between 227 ft. and 232 ft.

FITTINGS: ☒ K-Packer ☐ Lead Packer ☐ Bramer Check ☐ Blank above screen ft. Other

9 STATIC WATER LEVEL: 130 FT. below land surface ☐ Flow

10 PUMPING LEVEL: below land surface

ft. after hrs. pumping at G.P.M.

ft. after hrs. pumping at G.P.M.

11 WELL HEAD COMPLETION: ☒ Pitless adapter ☐ 12" above grade ☐ Basement offset ☐ Approved pit

12 WELL GROUTED? ☐ No ☒ Yes From to ft.

☐ Neat cement ☐ Bentonite ☒ Other Wildcat

No. of bags of cement Additives

13 Nearest source of possible contamination

Type Septic Distance 50 ft. Direction

Well disinfected upon completion? ☒ Yes ☐ No

Was old well plugged? ☐ Yes ☐ No

14 PUMP: ☐ Not Installed ☐ Pump Installation Only

Manufacturer's name Red Jacket

Model number 2-W HP 3/4 HP Volts 230

Length of Drop Pipe 215 ft. capacity 10 G.P.M.

TYPE: ☒ Submersible ☐ Jet

PRESSURE TANK: Manufacturer's name Well Ex Tol

Model number WX 203 Capacity 80 Gallons

2 FORMATION DESCRIPTION

FORMATION DESCRIPTION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Sand & stones	0	60
Gravel	60	85
Sand & Gravel	85	102
Sand & Clay	102	128
Clay & silt	128	210
Clay	210	222
Sand	222	232
Dig 4/1066		

USE A 2ND SHEET IF NEEDED

15. Remarks, elevation, source of data, etc.

17. Rig Operator's Name Bob Nelson

16. WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Phil's Well Drilling 0481

REGISTERED BUSINESS NAME REGISTRATION NO.

Address 10785 Grandview Rd. T.C.

Signed Phil Shumway Jr. Date 8/10/89

AUTHORIZED REPRESENTATIVE

D67d 12/86

Authority: Act 368 PA 1978
Completion: Required
Penalty: Conviction of a violation of any provision is a misdemeanor.

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY NO.

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

WATER WELL AND PUMP RECORD

PERMIT NUMBER 9537

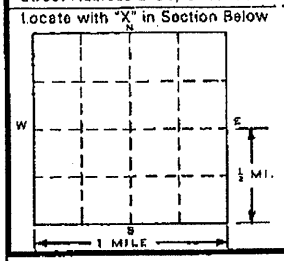
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Grand Traverse	Mayfield	SW1/4 SW1/4 SW1/4	8	25 N/S	11 E/W

Distance And Direction From Road Intersection: 5170 West Hayward Rd.

Street Address & City of Well Location

Locate with "X" in Section Below — Sketch Map:



3 OWNER OF WELL: Steve Endres
Address: 5170 West Hayward Rd. Buckley, Mich
Address Same As Well Location? ☐ Yes ☐ No

4 WELL DEPTH: 181 FT. — Date Completed: 8 8 91 — ☒ New Well ☐ Replacement Well

5 ☐ Cable tool ☒ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Auger ☐ Jetted ☐

6 USE: ☒ Domestic ☐ Type I Public ☐ Type III Public ☐ Irrigation ☐ Type IIa Public ☐ Heat pump ☐ Test Well ☐ Type IIb Public ☐

7 CASING: Diameter 5" — ☐ Steel ☐ Threaded ☒ Plastic ☐ Welded
5 in. to ___ ft. depth
___ in. to 181 ft. depth
Grouted Drill Hole Diameter 7 in. to ___ ft. depth
___ in. to 181 ft. depth
Height Above/Below Surface SDR-21 ft.
Weight ___ lbs./ft.
Drive Shoe ☐ Yes ☐ No

8 SCREEN ☐ Not Installed
Type Wellscreen Diameter 4" 5 FT.
Slot/Gauze 10 Length ___
Set between 176 ft. and 181 ft.
FITTINGS: ☒ K-Packer ☐ Lead Packer ☐ Bremer Check
☒ Blank above screen 2 ft. Other ___

9 STATIC WATER LEVEL: 160 ft. below land surface ☐ Flow

10 PUMPING LEVEL: below land surface
___ ft. after ___ hrs. pumping at ___ G.P.M.
___ ft. after ___ hrs. pumping at ___ G.P.M.

11 WELL HEAD COMPLETION: ☒ Pitless adapter ☐ 12" above grade ☐ Basement offset ☐ Approved pit

12 WELL GROUTED? ☐ No ☒ Yes From 0 to 25 ft
☐ Neat cement ☒ Bentonite ☒ Other Volclay
No. of bags of cement ___ Additives ___

13 Nearest source of possible contamination
Type Septic Distance 50 ft. Direction ___
Well disinfected upon completion? ☒ Yes ☐ No
Was old well plugged? ☐ Yes ☐ No

14 PUMP: ☐ Not Installed ☐ Pump Installation Only
Manufacturer's name Red Jacket
Model number 2-60 HP 3/4 Volts 230
Length of Drop Pipe 170 ft. capacity 10 G.P.M.
TYPE: ☒ Submersible ☐ Jet
PRESSURE TANK:
Manufacturer's name Wellmaster
Model number WX203 Capacity 4.5 Gallons

2 FORMATION DESCRIPTION

	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Sand Gravel & Rocks	0	63
Clay & Sand	63	105
Sand & Gravel & Silt	105	112
Silt & Clay	112	176
Sand	176	181

USE A 2ND SHEET IF NEEDED

RECEIVED
DEC 31 1991
GRAND TRAVERSE COUNTY HEALTH DEPARTMENT

91-80704 15th

RECEIVED
Mich. Dept. of Public Health
JAN 10 1992
BUREAU OF ENVIRONMENTAL AND OCCUPATIONAL HEALTH GWQS

15. Remarks, elevation, source of data, etc

16. WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Phils Well Drilling 0481
REGISTERED BUSINESS NAME — REGISTRATION NO.
Address 328 Kewadin School Rd. TC
Signed Paul F. Kropp — AUTHORIZED REPRESENTATIVE — Date 8/9/91

17. Rig Operator's Name: Doug Schettek

D67d 2/89

Authority: Act 368 PA 1978
Completion: Required
Penalty: Conviction of a violation of any provision is a misdemeanor.

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY NO.

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

WATER WELL AND PUMP RECORD

08-09-008-014-00

PERMIT NUMBER 19896

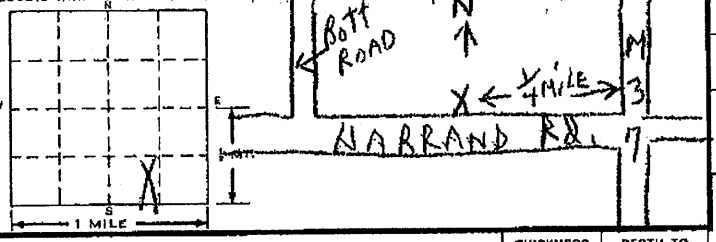
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
GRAND TRAVERSE	MAYFIELD	E½ ¼ SW ¼ SE ¼	8	T.25 N/S	R.11 E/W

Distance And Direction From Road Intersection: ¼ MILE WEST OF M-37 ON HARRAND ROAD.

Street Address & City of Well Location: HARRAND ROAD.

Locate with "X" in Section Below; Sketch Map:



3 OWNER OF WELL: RONALD W. SPITZER

Address: 6572 ZUK ROAD, BUCKLEY, MI.

Address Same As Well Location? ☐ Yes ☒ No

4 WELL DEPTH: 244 FT. Date Completed: MO. 9 DAY 13 YEAR 91 ☒ New Well ☐ Replacement Well

5 ☐ Cable tool ☒ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Auger ☐ Jetted ☐

6 USE: ☒ Domestic ☐ Type I Public ☐ Type III Public ☐ Irrigation ☐ Type IIa Public ☐ Heat pump ☐ Test Well ☐ Type IIb Public ☐

7 CASING: Diameter ☐ Steel ☐ Threaded ☒ Plastic ☐ Welded

5 in. to 234 ft. depth

in. to ft. depth

Grouted Drill Hole Diameter 7 7/8 in. to 244 ft. depth

in. to ft. depth

Height: Above/Below Surface 1 ft.

Weight lbs./ft.

Drive Shoe ☐ Yes ☐ No

8 SCREEN: ☐ Not Installed

Type PVC Diameter 4"

Slot/Gauze 16 Length 10'

Set between 234 ft. and 244 ft.

FITTINGS: ☐ K-Packer ☐ Lead Packer ☐ Bremer Check

☐ Blank above screen ft. Other

9 STATIC WATER LEVEL: 150 ft. below land surface ☐ Flow

10 PUMPING LEVEL: below land surface

175 ft. after 1 hrs. pumping at 14 G.P.M

ft. after hrs. pumping at G.P.M.

11 WELL HEAD COMPLETION: ☒ Pitless adapter ☒ 12" above grade ☐ Basement offset ☐ Approved pit

12 WELL GROUTED? ☐ No ☒ Yes From top to 25 ft

☐ Neat cement ☒ Bentonite ☐ Other

No. of bags of cement Additives

13 Nearest source of possible contamination

Type Septic Distance 70 ft. Direction West

Well disinfected upon completion? ☒ Yes ☐ No

Was old well plugged? ☐ Yes ☐ No

14 PUMP: ☐ Not Installed ☐ Pump Installation Only

Manufacturer's name Flint & Walling

Model number 4FL07 HP 3/4 Volts 230

Length of Drop Pipe 200 ft. capacity 12 G.P.M

TYPE: ☒ Submersible ☐ Jet

PRESSURE TANK:

Manufacturer's name

Model number Capacity 44 Gallons

2 FORMATION DESCRIPTION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Topsoil	1	1
Red and tange gravel	149	150
Gray clay	10	160
Fine tan sand	70	230

USE A 2ND SHEET IF NEEDED

RECEIVED
Mich. Dept. of Public Health
JAN 10 1992
BUREAU OF ENVIRONMENTAL AND OCCUPATIONAL HEALTH-GWQS

15. Remarks, elevation, source of data, etc.

17. Rig Operator's Name: Steve Johnson

WATER WELL CONTRACTOR'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

1908

REGISTERED BUSINESS NAME REGISTRATION NO.

Address

Signed [signature] AUTHORIZED REPRESENTATIVE Date 10/1/91

D67d 2/89

Authority: Act 368 PA 1978
Completion: Required
Penalty: Conviction of a violation of any provision is a misdemeanor.

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY SAMPLE No.

JAN 16 1979

WATER WELL RECORD
ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

2

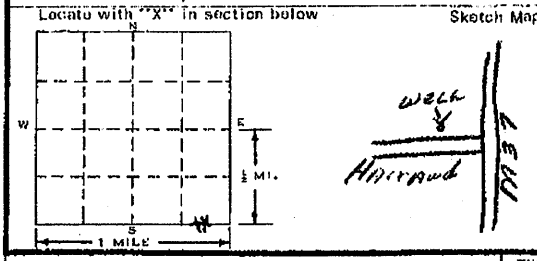
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Grand T.C.	MAYfield	6W ¼ E ¼ SE ¼	8	25 N/S.	R 11 E/W.

Distance And Direction from Road Intersections: 1/4 mile west of M37 on Harrand Rd

Street address & City of Well Location

Locate with "X" in section below — Sketch Map:



3 OWNER OF WELL: STAW Wolf

Address

4 WELL DEPTH: (completed) 122 ft. Date of Completion 7-15-78

5 ☐ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☒ Bored ☐

6 USE: ☒ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐

7 CASING: Threaded ☒ Welded ☐ Diam. 4 in. to 118 ft. Depth; ___ in. to ___ ft. Depth. Height: Above/Below Surface 1 ft. Weight ___ lbs./ft. Drive Shoe? Yes ☐ No ☒

2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Dry sand + clay	100	100
water sand	22	122

USE A 2ND SHEET IF NEEDED

8 SCREEN: Type: Stainless Dia.: 4" Slot/~~Gauze~~ 10 Length 4' Set between 118 ft. and 122 ft. Fittings:

9 STATIC WATER LEVEL 100 ft. below land surface

10 PUMPING LEVEL below land surface 105 ft. after 1 hrs. pumping 20 g.p.m. ___ ft. after ___ hrs. pumping ___ g.p.m.

11 WATER QUALITY in Parts Per Million: Iron (Fe) ___ Chlorides (Cl) ___ Hardness ___ Other ___

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☒ Pitless Adapter ☐ 12" Above Grade

13 Well Grouted? ☐ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ ___ Depth: From ___ ft. to ___ ft.

14 Nearest Source of possible contamination 60 feet N Direction ___ Type ___ Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: ☐ Not installed Manufacturer's Name F x W Model Number ___ HP 1/2 Volts 220 Length of Drop Pipe 115 ft. capacity 8/15 G.P.M. Type: ☒ Submersible ☐ Jet ☐ Reciprocating

16 Remarks, elevation, source of data, etc.

ADDED INFO BY DRILLER, ITEM NO.
CORRECTED BY
ADDITION BY
ELEVATION
DEPTH TO ROCK

17 WATER WELL CONTRACTOR'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Don Inman Well Drilling — REGISTERED BUSINESS NAME — REGISTRATION No.

Address 4689 Betsie River Rd 1286

Signed Don Inman — AUTHORIZED REPRESENTATIVE — Date 10-10-78

D67d 100M (Rev. 12-68)

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY DIVISION
P O BOX 30028
LANSING, MICHIGAN - 48909

ACT 315 PA 1969

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES

LOG OF OIL, GAS OR MINERAL WELL WATER WELL

SUBMIT IN TRIPLICATE WITHIN 30 DAYS AFTER WELL COMPLETION

1. LOCATION DATA

NAME(S) & ADDRESS OF OWNER(S) SHOWN ON PERMIT
Tolas Oil & Gas Company
306 E Broadway
Mt Pleasant, MI 48858

NAME & ADDRESS OF DRILLING CONTRACTOR(S)

PERMIT NUMBER: 44604

LEASE NAME(S) & WELL NUMBER SHOWN PERMIT: Miller 1-8

COUNTY	TOWNSHIP	FRACTION	SECTION NO.	TOWN NO.	RANGE NO.
Grand Traverse	Mayfield	NW/4 NE 1/4 NW 1/4	8	25 N/S	11 E/W

2. FORMATION DESCRIPTION

FORMATION DESCRIPTION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Red Clay	25	25
Gravel & Red Clay Sand	65	90
Tan Clay	40	130
Gray Clay	75	205
Medium Sand	24	229

(USE A 2ND SHEET IF NEEDED)

3. WELL DEPTH (completed): 229 ft — Date of Completion: 11/05/91

4. [ ] Cable tool [X] Rotary [ ] Driven [ ] Dug [ ] Hollow rod [ ] Auger [ ] Jetted [ ]

5. CASING Diameter 4 [ ] Steel [ ] Threaded [X] Plastic [ ] Welded — 0 ft to 209 ft depth; ___ in to ___ ft depth. Greatest Drill Hole Diameter ___ in to ___ ft depth; ___ in to ___ ft depth. Height Above/Below Surface 2 ft. Weight ___ lbs/ft. Drive Shoe [ ] Yes [ ] No

6. SCREEN [ ] Not Installed. Type Plastic. Diameter 4". Slot/Gauze 12. Length 20'. Set between 209 ft and 229 ft. FITTINGS [ ] K Packer [ ] Lead Packer [ ] Brass Check [ ] Blank above screen ___ ft. Other ___

7. STATIC WATER LEVEL 144 ft below land surface [ ] Flow

8. PUMPING LEVEL below land surface: ___ ft after ___ hrs pumping at ___ GPM; ___ ft after ___ hrs pumping at ___ GPM

9. WELL GROUTED? [ ] No [X] Yes from ___ to ___ ft. [ ] Neat cement [XX] Bentonite [ ] Other ___. No. of bags of cement ___ Additives ___

10. PUMP [ ] Not Installed [ ] Pump Installation Date ___. Manufacturer's Name ___. Model number ___ HP ___ Volts ___. Length of Drop Pipe ___ ft capacity ___ GPM. TYPE [ ] Submersible [ ] Jet ___

11. REMARKS (ELEVATION, SOURCE OF DATA, WATER QUALITY, ETC.)

(USE A 2ND SHEET OR ATTACH SUPPLEMENTS IF NEEDED)

12. AUTHORIZED REPRESENTATIVE CERTIFICATION (THIS WELL WAS DRILLED UNDER MY AUTHORITY AND THIS REPORT IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF.)

NAME (PRINT OR TYPE): J&R Well Drilling Inc.

ADDRESS: Rt. 1 Box 78 Elmira Mi. 49730

SIGNED: Ron Sheyock DATE: 11/11/91

(Leave blank for)

PR 1200 (Rev.)

GEOLOGICAL SURVEY SAMPLE No.

JAN 16 1979

WATER WELL RECORD
ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Grand Traverse	Mayfield	¼NW ¼NW ¼	8	25 N/S.	11 E/W.

Distance And Direction from Road Intersections: 1/2 mile west of Bott Rd. on Miller Rd.

Street address & City of Well Location

Locate with "X" in section below

Sketch Map: Miller Rd. Bott Rd. 1 MILE 1 MI.

3 OWNER OF WELL: Gerald Glazier

Address: Traverse City Mich

4 WELL DEPTH: (completed) 190 ft. Date of Completion 10-16-78

5 ☐ Cable tool ☒ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐

6 USE: ☒ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐

7 CASING: Threaded ☒ Welded ☐ Diam. 4 in. to 185 ft. Depth; ___ in. to ___ ft. Depth. Height: Above/~~Below~~ Surface 1 ft. Weight 11.00 lbs./ft. Drive Shoe? Yes ☒ No ☐

8 SCREEN: Type: S.S. Dia.: 4" Slot/~~Gauze~~ .010 Length 5' Set between 185 ft. and 190 ft. Fittings:

9 STATIC WATER LEVEL 165 ft. below land surface

10 PUMPING LEVEL below land surface ___ ft. after ___ hrs. pumping ___ g.p.m. ___ ft. after ___ hrs. pumping ___ g.p.m.

11 WATER QUALITY in Parts Per Million: Iron (Fe) ___ Chlorides (Cl) ___ Hardness ___ Other ___

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☒ Pitless Adapter ☒ 12" Above Grade

13 Well Grouted ☒ Yes ☐ No ☐ Neat Cement ☒ Bentonite ☒ SAND Depth: From ___ ft. to ___ ft.

14 Nearest Source of possible contamination 50 feet ___ Direction Septic Type ___ Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: ☐ Not installed Manufacturer's Name Red Jacket Model Number 2-W HP ¾ Volts 230 Length of Drop Pipe 175 ft. capacity 20 G.P.M. Type: ☒ Submersible ☐ Jet ☐ Reciprocating

2

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
SAND - Gravel	148	148
clay	4	152
Gravel - Clay	13	165
WATER SAND	25	190

USE A 2ND SHEET IF NEEDED

16 Remarks, elevation, source of data, etc.

ADDED INFO BY DRILLER, ITEM NO
*CORRECTED BY
**ADDITION BY
ELEVATION
DEPTH TO ROCK

17 WATER WELL CONTRACTOR'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Phils Well Drilling — REGISTERED BUSINESS NAME — 0481 REGISTRATION NO.

Address 10785 Graphite Rd T.C.

Signed ___ AUTHORIZED REPRESENTATIVE Date 10-23-78

D67d 100M (Rev. 12-68)

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY NO.

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

WATER WELL AND PUMP RECORD

PERMIT NUMBER: 14609

1 LOCATION OF WELL

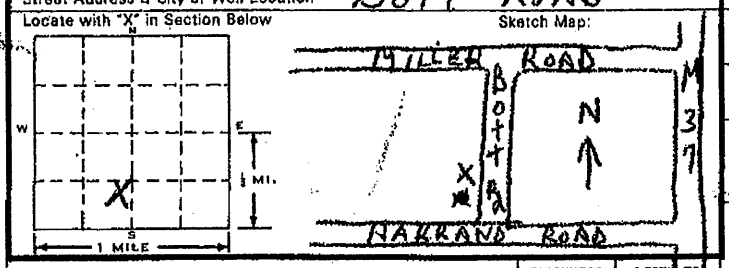
County	Township Name	Fraction	Section Number	Town Number	Range Number
GRAND TRAVERSE	MAYFIELD	NE 1/4 SE 1/4 SW 1/4	8	T. 25 N/S	R. 11 E/W

Distance And Direction From Road Intersection: OFF HARRAND ROAD ON BOTT ROAD, WEST SIDE OF ROAD.

Street Address & City of Well Location: BOTT ROAD

Locate with "X" in Section Below

Sketch Map:



3 OWNER OF WELL: DEAN BOTT

Address: 7134 S. HANNAH ROAD

Address Same As Well Location? ☐ Yes ☒ No

4 WELL DEPTH: 122 FT. Date Completed: MO. 7 DAY 16 YEAR 87 ☒ New Well ☐ Replacement Well

5 ☐ Cable tool ☒ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Auger ☐ Jetted ☐

6 USE: ☒ Domestic ☐ Type I Public ☐ Type III Public ☐ Irrigation ☐ Type IIa Public ☐ Heat pump ☐ Test Well ☐ Type IIb Public ☐

7 CASING: Diameter ☐ Steel ☐ Threaded ☒ Plastic ☒ Welded

5 in. to 117 ft. depth

in. to ft. depth

Grouted Drill Hole Diameter

7 7/8 in. to 122 ft. depth

in. to ft. depth

Height: Above/~~Below~~ Surface 1 ft.

Weight 3 lbs./ft.

Drive Shoe ☐ Yes ☒ No

2 FORMATION DESCRIPTION

	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
SAND & ROCKS	8	8
SAND & GRAVEL	47	55
GRAVEL	26	81
SAND	41	122

USE A 2ND SHEET IF NEEDED

8 SCREEN: ☐ Not Installed

Type PVC Diameter 4 INCH

Slot/~~Gauze~~ 10 Length 5 FEET

Set between 117 ft. and 122 ft.

FITTINGS: ☒ K-Packer ☐ Lead Packer ☐ Bremer Check

☒ Blank above screen ft. Other

9 STATIC WATER LEVEL: 82 ft. below land surface ☐ Flow

10 PUMPING LEVEL: below land surface

ft. after hrs. pumping at G.P.M

ft. after hrs. pumping at G.P.M.

11 WELL HEAD COMPLETION: ☒ Pitless adapter ☐ 12" above grade ☐ Basement offset ☐ Approved pit

12 WELL GROUTED? ☐ No ☒ Yes From to ft.

☐ Neat cement ☒ Bentonite ☒ Other VOLCLAY

No. of bags of cement Additives

13 Nearest source of possible contamination

Type SEPTIC Distance 50 ft. Direction

Well disinfected upon completion? ☒ Yes ☐ No

Was old well plugged? ☐ Yes ☐ No

14 PUMP: ☐ Not Installed ☐ Pump Installation Only

Manufacturer's name RED JACKET

Model number SW HP 1/2 Volts 230

Length of Drop Pipe 100 ft. capacity G.P.M

TYPE: ☐ Submersible ☒ Jet 1" PVC

PRESSURE TANK:

Manufacturer's name WELL X-TROL

Model number WX20 Capacity 40 Gallons

RECEIVED
Mich. Dept. of Public Health
SEP 24 1987
Bureau of Environmental and Occupational Health - GWOS

15. Remarks, elevation, source of data, etc.

16. WATER WELL CONTRACTOR'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

PHILS WELL DRILLING 0481
REGISTERED BUSINESS NAME REGISTRATION NO.

Address 10785 GRANDVIEW RD TC

Signed Phil Sharmuski Date 7-25-87
AUTHORIZED REPRESENTATIVE

17. Rig Operator's Name: DOUG SCHETTEK

D67d 12/85

Authority: Act 368 PA 1978
Completion: Required
Penalty: Conviction of a violation of any provision is a misdemeanor.

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY SAMPLE No.

OCT 18 1977

WATER WELL RECORD
ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

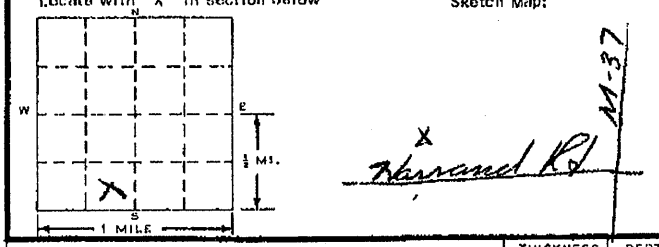
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Grand Traverse	MAYFIELD.	SE ¼ SW ¼ SW ¼	8	T25 N/S.	R11 E/W.

Distance And Direction from Road Intersections: ¾ MILE WEST of M-37 ON HARRAND RD.

Street address & City of Well Location

Locate with "X" in section below — Sketch Map:



3 OWNER OF WELL: Jack Zimmerman
Address: 1212 Garfield Ave. Traverse City, Mich.

4 WELL DEPTH: (completed) 109 ft. Date of Completion 8-4-77

5 [X] Cable tool [ ] Rotary [ ] Driven [ ] Dug [ ] Hollow rod [ ] Jetted [ ] Bored [ ] ____

6 USE: [X] Domestic [ ] Public Supply [ ] Industry [ ] Irrigation [ ] Air Conditioning [ ] Commercial [ ] Test Well [ ] ____

7 CASING: Threaded [X] Welded [ ] Diam. 4 in. to 105 ft. Depth; ____ in. to ____ ft. Depth. Height: Above/Below Surface ____ ft. Weight 11 lbs./ft. Drive Shoe? Yes [X] No [ ]

8 SCREEN: Type: Johnson Dia.: 3" Slot: Gauge 12 Length 4' Set between 105 ft. and 109 ft. Fittings: Packer + set link

9 STATIC WATER LEVEL 90 ft. below land surface

10 PUMPING LEVEL below land surface 100 ft. after 1 hrs. pumping 6 g.p.m. ____ ft. after ____ hrs. pumping ____ g.p.m.

11 WATER QUALITY in Parts Per Million: Iron (Fe) ____ Chlorides (Cl) ____ Hardness ____ Other ____

12 WELL HEAD COMPLETION: [ ] In Approved Pit [X] Pitless Adapter [ ] 12" Above Grade

13 Well Grouted? [X] Yes [ ] No [ ] Neat Cement [ ] Bentonite [X] mud. Depth: From 0 ft. to 60 ft.

14 Nearest Source of possible contamination 100 feet any Direction ____ Type ____ Well disinfected upon completion [X] Yes [ ] No

15 PUMP: [ ] Not installed
Manufacturer's Name DALLEX
Model Number ____ HP ½ Volts 220
Length of Drop Pipe 100 ft. capacity 6 G.P.M.
Type: [X] Submersible [ ] Jet [ ] Reciprocating

2

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
sand + gravel	60	60
hard pan	6	66
gravel	34	100
water sand coarse	9	109

USE A 2ND SHEET IF NEEDED

16 Remarks, elevation, source of data, etc.

17 WATER WELL CONTRACTOR'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Duff Well Drilling Co. — REGISTERED BUSINESS NAME — 1244 — REGISTRATION NO.
Address: 6410 Center Rd Traverse City, Mich.
Signed: Albert Kilinski — AUTHORIZED REPRESENTATIVE — Date 8-8-77

D67d 100M (Rev. 12-68)

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY SAMPLE No.

WATER WELL RECORD
ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

11

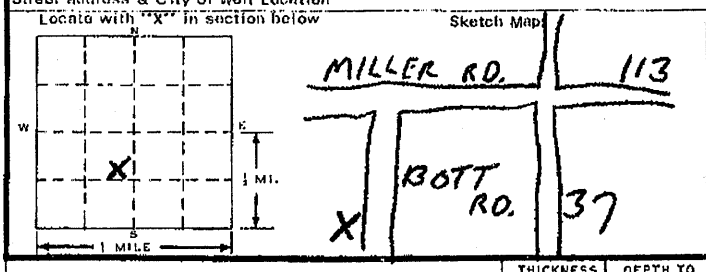
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
GRAND TRAVERSE	MAYFIELD	¼NE¼SW¼	8	25 N/S.	E/W.

Distance And Direction from Road Intersections: 3/4 MILE ON BOTT RD SOUTH FROM MILLER RD.

Street address & City of Well Location

Locate with "X" in section below



3 OWNER OF WELL: GREG BOTT

Address: 7700 BOTT RD.

4 WELL DEPTH: (completed) 107 ft. Date of Completion 8-3-78

5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☒ Bored ☐

6 USE: ☒ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐

7 CASING: Threaded ☒ Welded ☐ Diam. 4 in. to 102 ft. Depth; ___ in. to ___ ft. Depth. Height: Above/~~Below~~ Surface 1 ft. Weight 11.09 lbs./ft. Drive Shoe? Yes ☒ No ☐

8 SCREEN: Type: S.S. Dia.: 4" Slot/~~Gauge~~ .010 Length 5' Set between 102 ft. and 107 ft. Fittings:

9 STATIC WATER LEVEL 82 ft. below land surface

10 PUMPING LEVEL below land surface: ___ ft. after ___ hrs. pumping ___ g.p.m.; ___ ft. after ___ hrs. pumping ___ g.p.m.

11 WATER QUALITY in Parts Per Million: Iron (Fe) ___ Chlorides (Cl) ___ Hardness ___ Other ___

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☒ Pitless Adapter ☐ 12" Above Grade

13 Well Grouted? ☒ Yes ☐ No ☐ Neat Cement ☒ Bentonite ☐ ___ Depth: From ___ ft. to ___ ft.

14 Nearest Source of possible contamination: 50 feet ___ Direction SEPTIC Type. Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: ☐ Not installed. Manufacturer's Name Red Jacket. Model Number J-W HP ½ Volts 230. Length of Drop Pipe 90 ft. capacity 12 G.P.M. Type: ☒ Submersible ☐ Jet ☐ Reciprocating

2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
SAND	8	8
GRAVEL	43	51
ROCK	16	67
SAND	15	82
WATER SAND	25	107

USE A 2ND SHEET IF NEEDED

16 Remarks, elevation, source of data, etc.

17 WATER WELL CONTRACTOR'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

PHIL'S WELL DRILLING — REGISTERED BUSINESS NAME; 0481 — REGISTRATION NO.

Address: 10785 GRAND VIEW RD. T.C.

Signed: Phil Sharnowski — AUTHORIZED REPRESENTATIVE; Date 8-3-78

D. M.

D67d 100M (Rev. 12-68)

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY SAMPLE No.

WATER WELL RECORD
ACT 294 PA 1965

MICHIGAN DEPARTMEN OF PUBLIC HEALTH

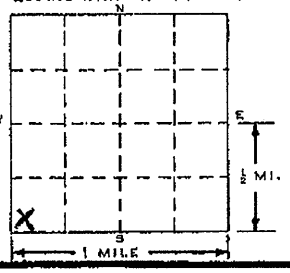
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
GRAND TRAVERSE	MAY FIELD	SW¼ SW¼ SW¼	9	25 N.S.	11 E.W.

Distance And Direction from Road Intersections
150' E. OF M-37
800' N. OF HARRIND RD

Street address & City of Well Location

Locate with "X" in section below — Skotch Map:



3 OWNER OF WELL: GERALD GLAZIER
Address

4 WELL DEPTH: (completed) 129 ft. Date of Completion 4-23-70

5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐

6 USE: ☒ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐

7 CASING: Threaded ☒ Welded ☐ Diam. 4 in. to 129 ft. Depth; ___ in. to ___ ft. Depth
Height: Above/Below Surface 1 ft. Weight 11 lbs./ft. Drive Shoe? Yes ☒ No ☐

8 SCREEN: Type: BRASS Diam. 4" Slot/Gauze .010 Length 5' 3.75
Set between 124 ft. and 129 ft.
Fittings: LEAD PACKER

9 STATIC WATER LEVEL 103 ft. below land surface

10 PUMPING LEVEL below land surface
___ ft. after ___ hrs. pumping ___ g.p.m.
___ ft. after ___ hrs. pumping ___ g.p.m.

11 WATER QUALITY in Parts Per Million:
Iron (Fe) ___ Chlorides (Cl) ___
Hardness ___ Other ___

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☒ Pitless Adapter ☐ 12" Above Grade

13 Well Grouted? ☒ Yes ☐ No
☐ Neat Cement ☐ Bentonite ☐ ___
Depth: From ___ ft. to ___ ft.

14 Nearest Source of possible contamination
75 feet NE Direction TILE FIELD Type
Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: ☐ Not installed
Manufacturer's Name F x W
Model Number ___ HP ½ Volts 230
Length of Drop Pipe 116 ft. capacity ___ G.P.M.
Type: ☒ Submersible ☐ Jet ☐ Reciprocating

2

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
CLAY	20	20
SAND	20	40
CLAY	30	70
GRAVEL	20	90
WATER SAND	39	129

USE A 2ND SHEET IF NEEDED

16 Remarks, elevation, source of data, etc.
ADDED BY DRILLER, ITEM NO.
CORRECTED BY:
[illegible]

17 WATER WELL CONTRACTOR'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
PHILS WELL DRILLING — REGISTERED BUSINESS NAME
0481 — REGISTRATION NO.
Address 10785 Hendricks Rd T.C.
Signed Phil Shamoun — AUTHORIZED REPRESENTATIVE
Date 4-30-70

D67d 100M (Rev. 12-68)

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY NO.

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

WATER WELL AND PUMP RECORD

PERMIT NUI 1 2 0 5 2

Page D-24

1 LOCATION OF WELL

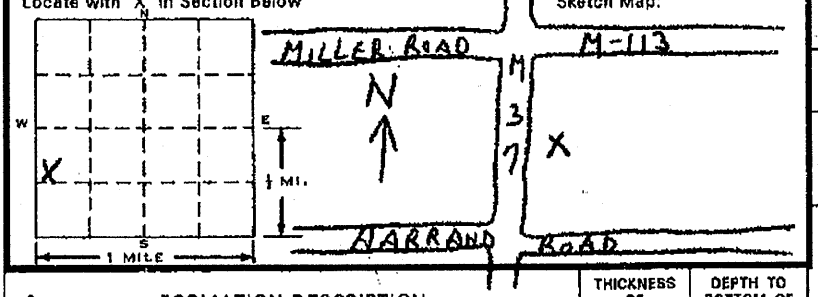
County	Township Name	Fraction	Section Number	Town Number	Range Number
GRAND TRAVERSE	MAYFIELD	SW 1/4 NW 1/4 SW 1/4	9	T.25 N/S	R.11 E/W

Distance And Direction From Road Intersection: BETWEEN M-113 & HARRAND ROAD ON M-37. EAST SIDE OF ROAD.

Street Address & City of Well Location: 7525 M-37 SOUTH

Address Same as Well Location: ☒ Yes ☐ No

Locate with "X" in Section Below



2 FORMATION DESCRIPTION

FORMATION DESCRIPTION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
SURFACE SOIL	1	1
COARSE SAND & SMALL GRAVEL	30	31
GRAY CLAY	58	89
VERY FINE BROWN SAND	7	96
GRAY CLAY	19	115
BROWN CLAY	15	130
MED COARSE BROWN WTR SD	23	153

USE A 2ND SHEET IF NEEDED

3 OWNER OF WELL: RICHARD SELTZ

Address: 7525 M-37 SOUTH, MAYFIELD, MICH. 49649

4 WELL DEPTH: (completed) 153 ft. **Date of Completion** 8-11-85

5 ☐ Cable tool ☒ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☒ Auger ☐ Jetted ☐ ____

6 USE: ☒ Domestic ☐ Type I Public ☐ Type III Public ☐ Irrigation ☐ Type IIa Public ☐ Heat pump ☐ Test Well ☐ Type IIb Public ☐ ____

7 CASING: Diameter ☒ Steel ☒ Threaded ☐ Plastic ☐ Welded

4 in. to 149 ft. depth

____ in. to ____ ft. depth

Grouted Drill Hole Diameter

____ in. to ____ ft. depth

____ in. to ____ ft. depth

Height Above/Below Surface 1 ft.

Weight 11 lbs./ft.

Drive Shoe ☒ Yes ☐ No

8 SCREEN: ☐ Not Installed

Type S/S JOHNSON Diameter 4"

Slot/Gauze 10 Length 4'

Set between 149 ft. and 153 ft

FITTINGS: ☐ K-Packer ☐ Lead Packer ☐ Bremer Check ☐ Blank above screen ____ ft. Other ____

9 STATIC WATER LEVEL: 46 ft. below land surface ☐ Flow

10 PUMPING LEVEL: below land surface

46 ft. after 2 hrs. pumping at 45 G.P.M.

____ ft. after ____ hrs. pumping at ____ G.P.M.

11 WELL HEAD COMPLETION: ☒ Pitless adapter ☒ 12" above grade ☒ Basement offset ☐ Approved pit

12 WELL GROUTED? ☐ No ☒ Yes From 1 to 25 ft.

☐ Neat cement ☒ Bentonite ☐ Other ____

No. of bags of cement ____ Additives ____

13 Nearest source of possible contamination

Type SEPTIC Distance 60 ft. Direction E

Well disinfected upon completion? ☒ Yes ☐ No

14 PUMP: ☐ Not Installed ☐ Pump Installation Only

Manufacturer's name GOULD'S

Model number 10EJ HP 1/2 Volts 230

Length of Drop Pipe 80 ft. capacity 10 G.P.M.

TYPE: ☒ Submersible ☐ Jet ____

PRESSURE TANK:

Manufacturer's name WELL X-TROL

Model number 201 Capacity 14 Gallons

15. Remarks, elevation, source of data, etc.

RECEIVED Dept. of Public Health JUN 26 1985 Bureau of Sanitation Engineering Occupational Health & GWQ

16. WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

L & R WELL DRLG INC 1770

REGISTERED BUSINESS NAME REGISTRATION NO.

Address RR#1 BOX 78 ELMIRA, MICH. 49730

Signed Ron Shipock Date 4-17-85

AUTHORIZED REPRESENTATIVE

D67d 2/84

Authority: Act 368 PA 1978
Completion: Required
Penalty: Conviction of a violation of any provision is a misdemeanor.

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY NO. [ ]

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

WATER WELL AND PUMP RECORD

PART 127 ACT 368, P.A. 1978

PERMIT NU [ ] Page D-25

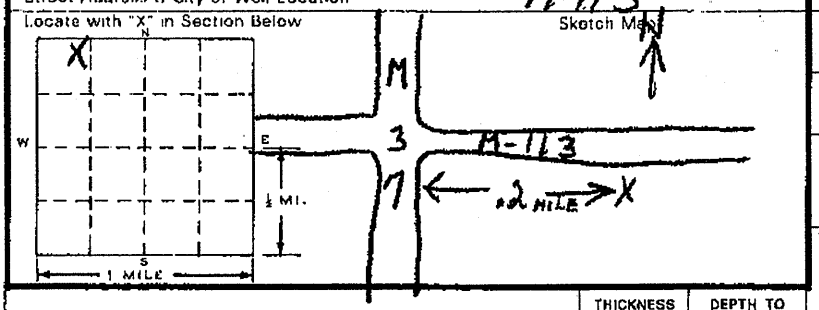
1. LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
GRAND TRAVERSE	MAYFIELD	NE¼ NW¼ NW¼	9	T.25 N/S	R.11 E/W

Distance And Direction From Road Intersection: .2 MILE EAST OF M-37 ON M-113. SOUTH SIDE OF ROAD

Street Address & City of Well Location: M-113

Locate with "X" in Section Below



Sketch Map

3 OWNER OF WELL

JACK ZIMMERMAN

Address: 1719 APACHE PASS

Address Same As Well Location? [ ] Yes [X] No

4 WELL DEPTH: (completed)

70 ft. Date of Completion: 3-6-84

5

[ ] Cable tool [ ] Rotary [ ] Driven [ ] Dug
[ ] Hollow rod [X] Auger [ ] Jetted [ ] ____

6 USE:

[X] Domestic [ ] Type I Public [ ] Type III Public
[ ] Irrigation [ ] Type IIa Public [ ] Heat pump
[ ] Test Well [ ] Type IIb Public [ ] ____

7 CASING:

Diameter [X] Steel [X] Threaded [ ] Plastic [ ] Welded

4 in. to 66 ft. depth

____ in. to ____ ft. depth

Grouted Drill Hole Diameter

____ in. to ____ ft. depth

____ in. to ____ ft. depth

Height Above/Below Surface ____ ft.

Weight 11 lbs./ft.

Drive Shoe [X] Yes [ ] No

2 FORMATION DESCRIPTION

FORMATION DESCRIPTION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Sand	12	12
Clay	24	36
wet gravel	26	62
water sand	8	70

USE A 2ND SHEET IF NEEDED

8 SCREEN:

[ ] Not Installed

Type Johnson Diameter 4

Slot/Gauze 10 Length 4

Set between 66 ft. and 70 ft.

FITTINGS: [ ] K-Packer [X] Lead Packer [ ] Bremer Check

[ ] Blank above screen ____ ft. Other ____

9 STATIC WATER LEVEL

36 ft. below land surface [ ] Flow

10 PUMPING LEVEL: below land surface

50 ft. after 1 hrs. pumping at 35 G.P.M.

____ ft. after ____ hrs. pumping at ____ G.P.M.

11 WELL HEAD COMPLETION

[X] Pitless adapter [ ] 12" above grade
[ ] Basement offset [ ] Approved pit

12 WELL GROUTED?

[ ] No [X] Yes From 0 to 36 ft.

[ ] Neat cement [ ] Bentonite [X] Other mud

No. of bags of cement ____ Additives ____

13 Nearest source of possible contamination

Type Septic Distance 60 ft. Direction W

Well disinfected upon completion? [X] Yes [ ] No

14 PUMP:

[ ] Not Installed [ ] Pump Installation Only

Manufacturer's name Flint & Walling

Model number 5BA8 HP ½ Volts 230

Length of Drop Pipe 50 ft. capacity 10 G.P.M.

TYPE: [X] Submersible [ ] Jet ____

PRESSURE TANK

Manufacturer's name own tank 42 gal.

Model number ____ Capacity ____ Gallons

15. Remarks, elevation, source of data, etc

16. WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Flint Well Drilling Co. 28-1244

REGISTERED BUSINESS NAME REGISTRATION NO.

Address 6410 Cente Rd. Traverse City Mich.

Signed [signature] Date 3-6-84

AUTHORIZED REPRESENTATIVE

D67d (Rev. 10-80)

GEOLOGICAL SURVEY COPY

ATTACHMENT F

MAPS AND CROSS SECTIONS OF GEOLOGIC STRUCTURE OF AREA

Regional Geology

Grand Traverse County is located on the Northwest flank of the Michigan Basin as indicated on Figure F-1. The regional dip to the south into the basin is about 30-40 feet per mile. The basin extends into northwest Ohio and northeast Indiana and covers all of the lower peninsula of Michigan. To the West-Northwest is the Wisconsin Dome. To the southeast is the structural axis of the Findlay Arch and to the southwest is the axis of the Kankakee Arch. A generalized East-West geologic cross section is included as Figure F-2. Figure F-3 is a generalized stratigraphic column for the State of Michigan.

Area Geology

A cross section of the geologic structure through the area of interest is presented in Figure F-5. Figure F-4 shows the trace of this cross sections.

The injection zone is the Traverse Limestone of Devonian age from 1750′ to 2344′. (Total depth of well 2200′) The top confining zone is the Coldwater and Antrim Shales from 781 feet to 1750′. The bottom confining zone is the Bell Shale from 2344 feet to 2448 feet.

The following sample descriptions were prepared by Geologist Warren A. Baumann and Jim Sanborn.

Drift	0 to 781′	Sand & gravel. Sm redish shales.
Coldwater	781′ to 1506′	Sh, lt-med grys, frm, sub rnd, sli calc, pyr.
Antrim	1506′ to 1750′	Shale, blk to dk brn, frm-britt, sub rnd v. grainy text, fnt yel glo flor.
Trav. Form	1750′ to 1816′	Sh, lt grys frm, sub rnd. Smdolic, brn stringers, v. calc. pyr.
Trav. Lime	1816′ to 1870′	Ls, lt tan to buff, fxln, mhd, gd, intrxln & micro pore porosity, no vis, stn, cln.
Trav. Lime	1870′ to 2100′	Ls, lt-med brns, vfxln, hd dns arg, sm gy shale, stringers, Trs, sue porosity cln, abnt fos.
Trav. Lime	2100′ to 2200′	Ls, med gy brn to crmy tans, vfxln, hd dns, arg, sm gd micro, por porosity. intrvl from 2100 - 50. No stn - fos.

The Coldwater shale of the Mississipian System (Paleozoic age) consist primarily of gray and bluish gray shale. The shale is micraceous in some areas and usually contains small amounts of limestone, dolomite, siltstone or sandstone. In the Weber 4-8, the Coldwater Shale was described as being light to medium gray in color, firm and slightly calcareous. The Coldwater is about 725 feet thick at the Weber 4-8 wellsite and is underlain with the Antrim shale.

Below the Coldwater is the Antrim Shale of Devonian age. The Antrim is predominately a dark gray to black and brown, hard, thin-bedded, brittle carbonaceous shale. In the Weber 4-8, the Antrim Shale was described as being black to dark brown, firm, brittle with a very grainy texture. At the Weber 4-8 wellsite the Antrim is about 245 feet thick.

Below the Antrim is the Traverse Group of Devonian age. The Traverse group is generally divided into three units. These units are the Traverse Formation, Traverse Limestone and the Bell Shale. Some consider the Traverse Formation to be a transition zone between the Antrim Shale and Traverse Limestone. This formation generally is composed of Gray shale in the upper portion and graduates to more calcareous shale and limestone near the base. In the Weber 4-8, the Traverse Formation was described as being a light gray firm shale with small brown dolmitic stringers. The Traverse Formation is 60 to 70 feet thick in the vicinity of the Weber 4-8.

The middle unit of the Traverse Group is the Traverse Limestone. In Western Michigan the Traverse Limestone is predominately pure limestone with some beds of dolomite. A series of porosity zones is often present in the upper portion of the Limestone. In the Weber 4-8, the Traverse Limestone was described as being light tan to buff, with intercrystalin and micro porosity and small hard dense shale and sandstone stringers. The Traverse Limestone is over 500 feet thick in the area of the Weber 4-8.

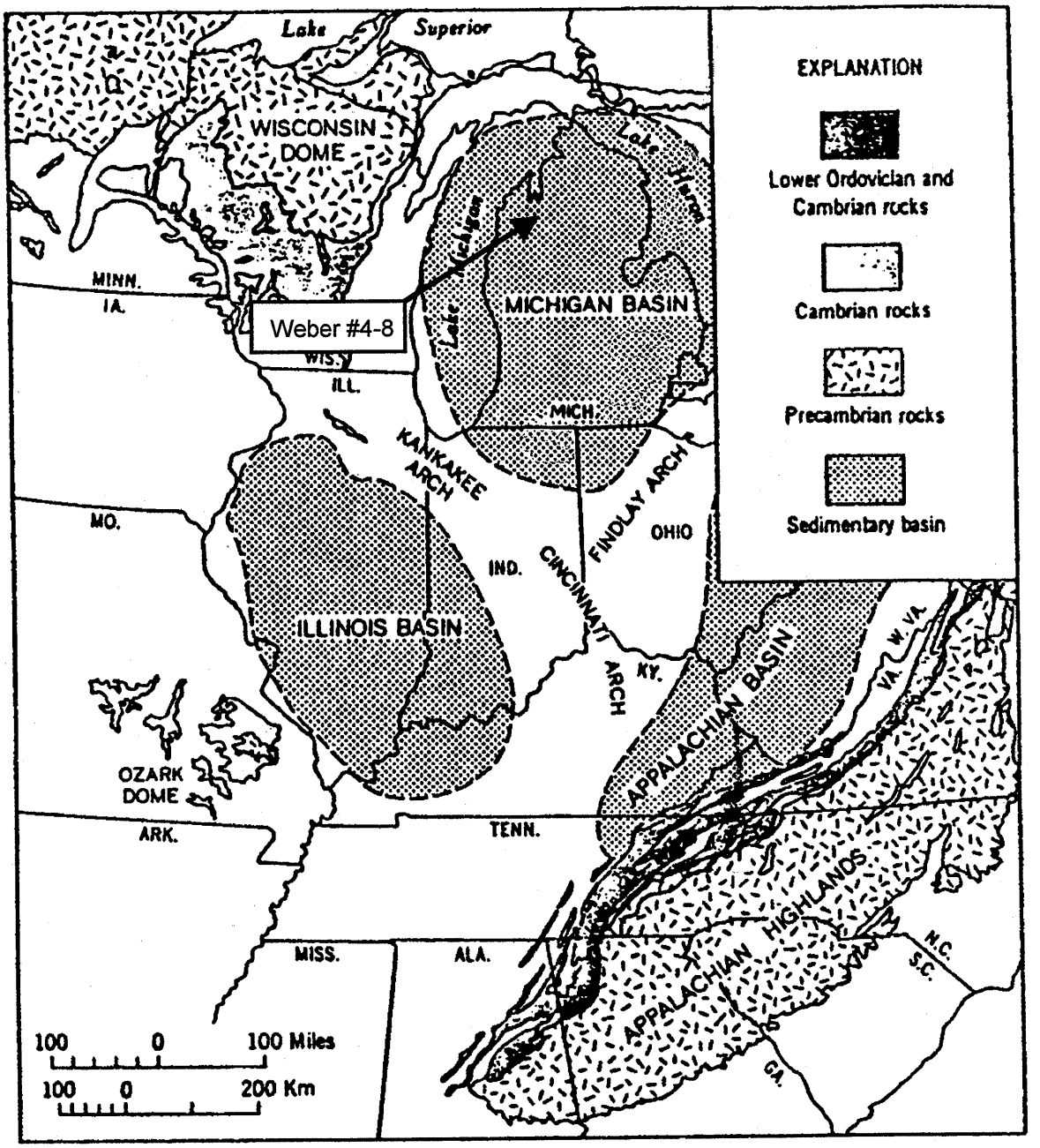
The lowermost formation of the Traverse Group is the Bell Shale. The Bell Shale is a little over 100 feet thick in the area of interest.

Below the Bell Shale is the Dundee Formation of Devonian age. The Dundee is a Limestone predominately buff to brownish in color, and normally fine to coarsely crystalline. The Dundee is 180 to 200 feet thick in the vicinity of the Weber 4-8.

Below the Dundee is the Detroit River Group. The rocks of the Detroit River Group are variously composed dolomite, anhydrite, salt, limestone and sandstone.

FIGURE F-1

MICHIGAN REGIONAL GEOLOGY MAP



From Bulletin 57
Indiana Geological Survey

FIGURE F-2
GENERALIZED EAST-WEST CROSS-SECTION MICHIGAN BASIN

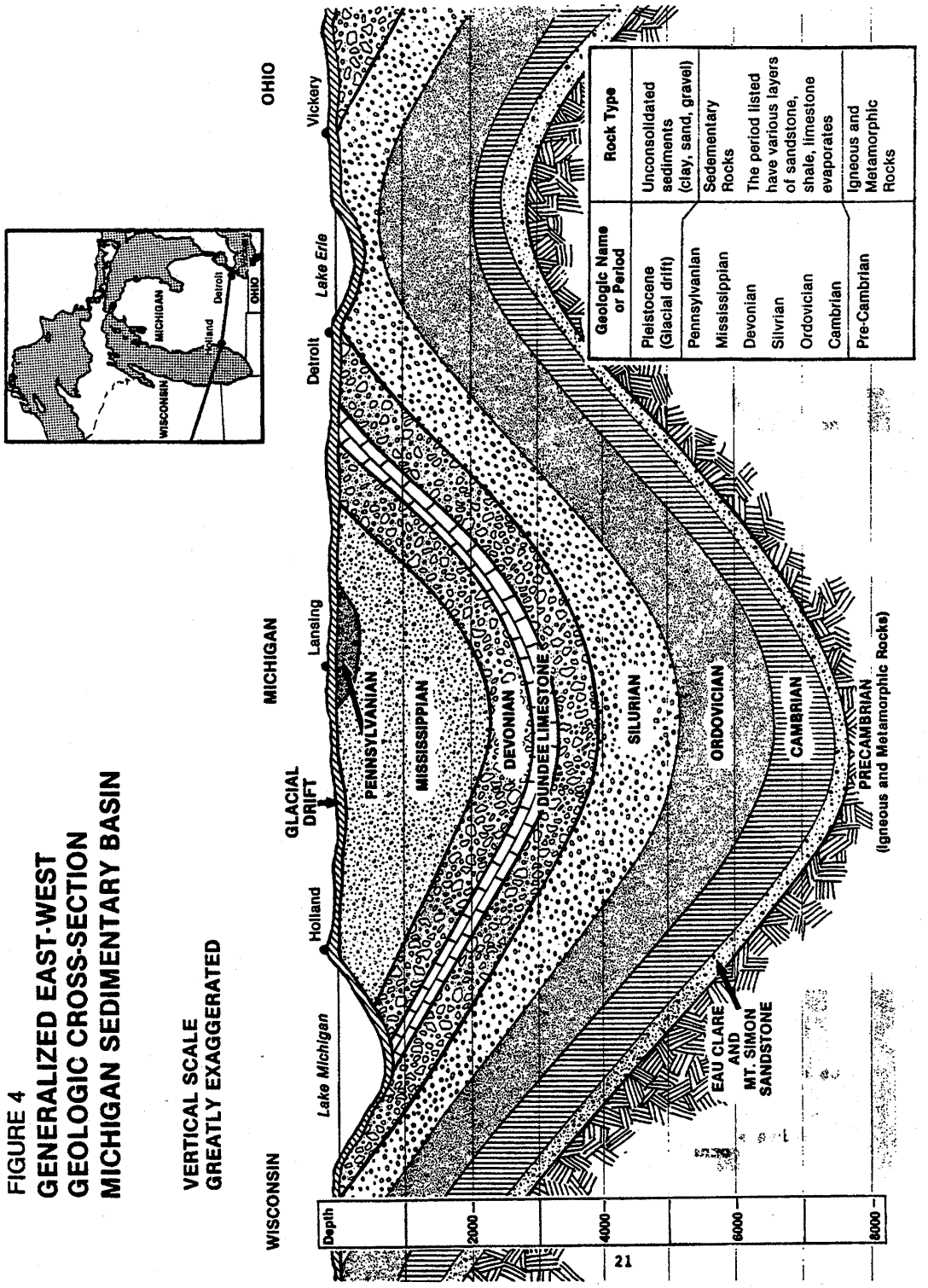
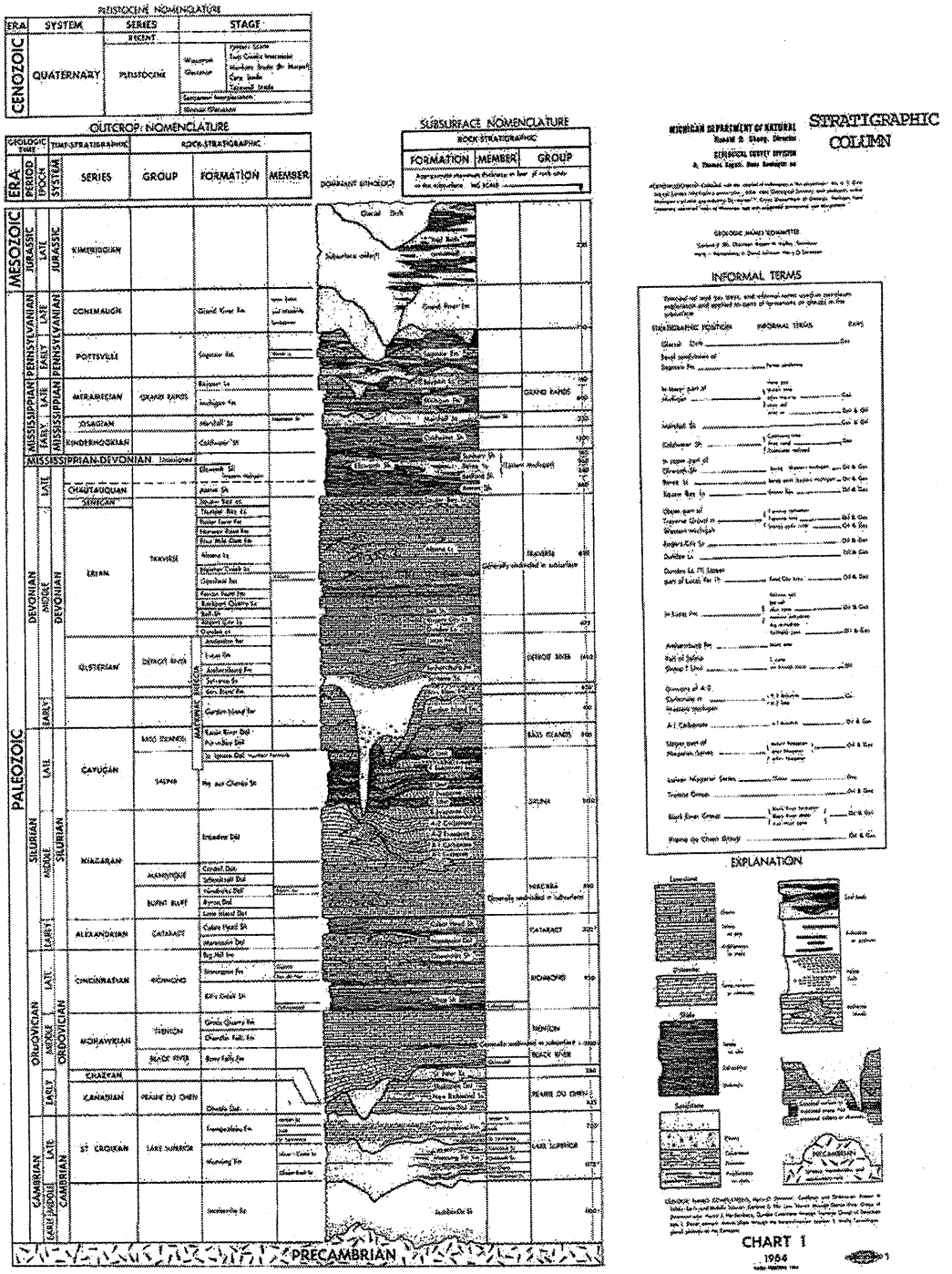
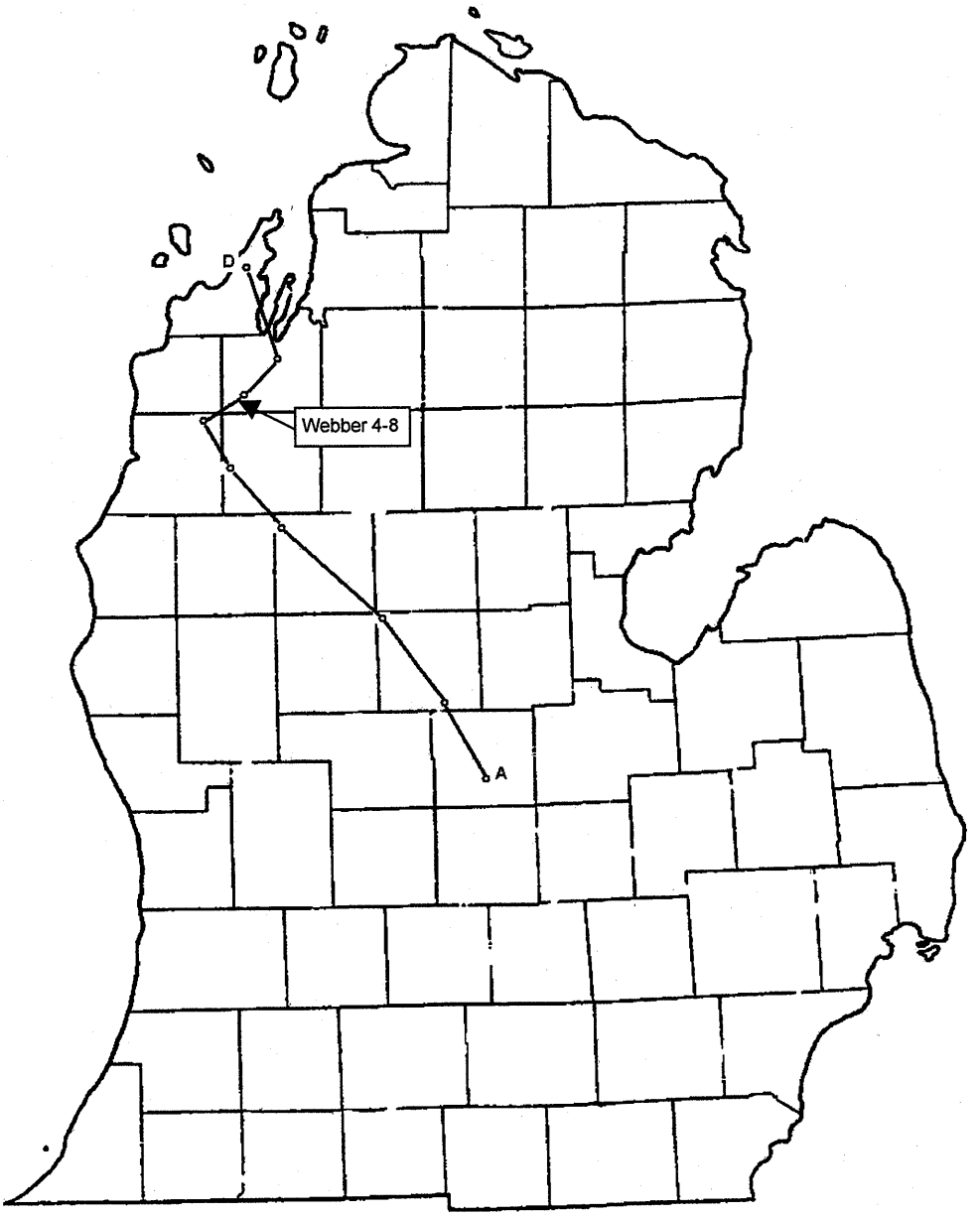


FIGURE F-3
Generalized Michigan Stratigraphic Section



From Bulletin 57
Indiana Geological Survey

Figure F-4

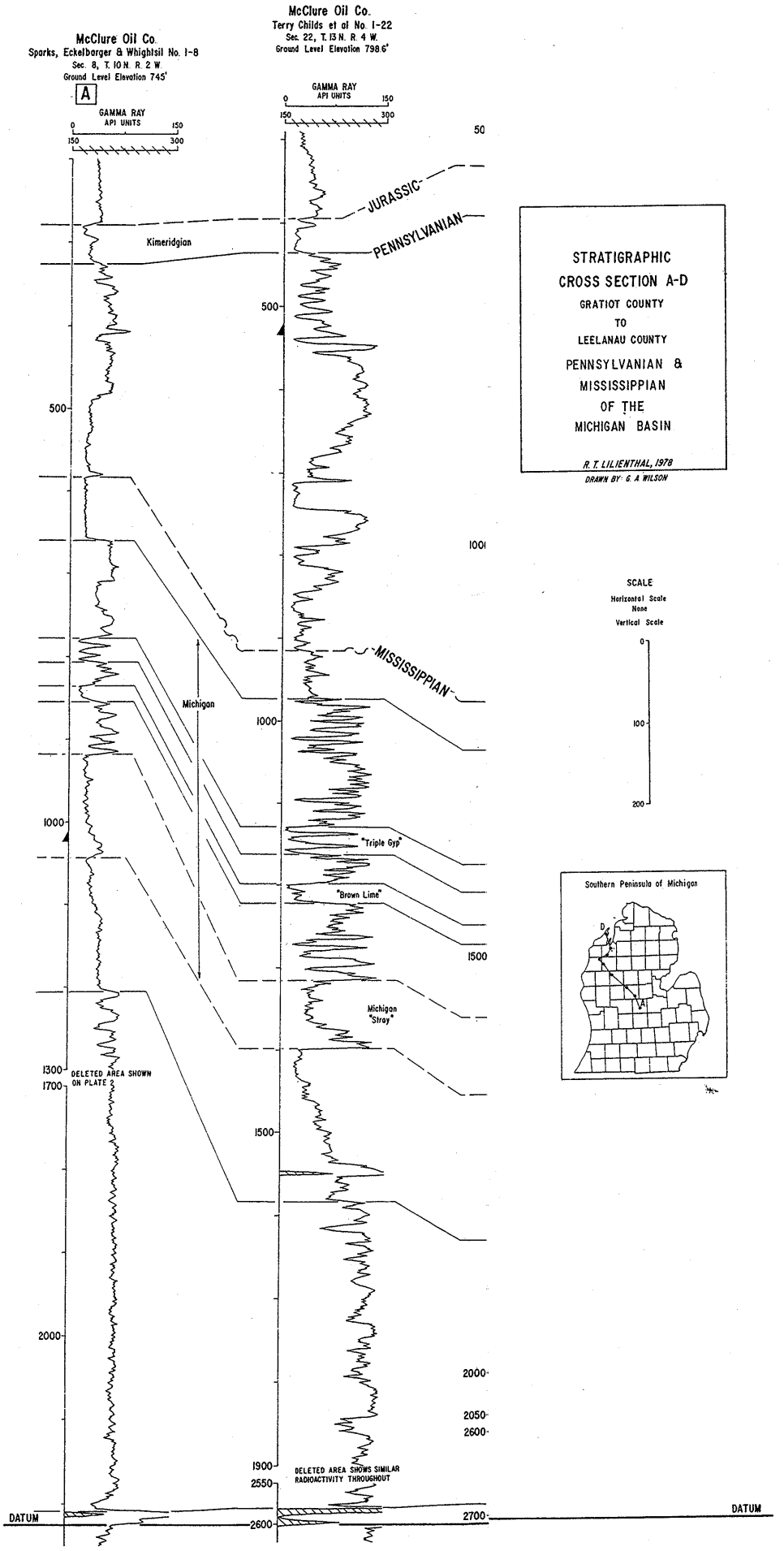


Map of Trace of Cross Section

PLATE 23

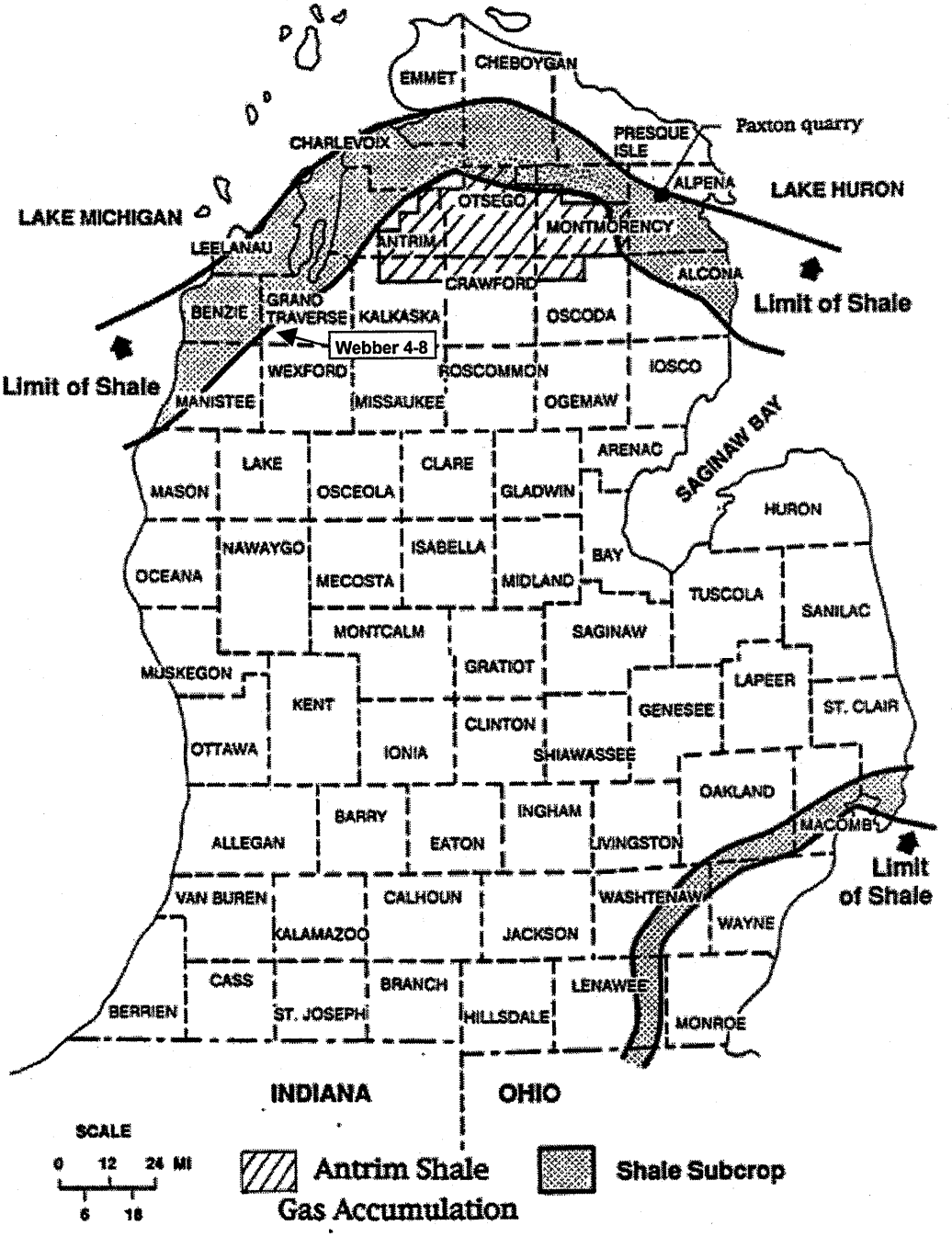
D

Figure F-5



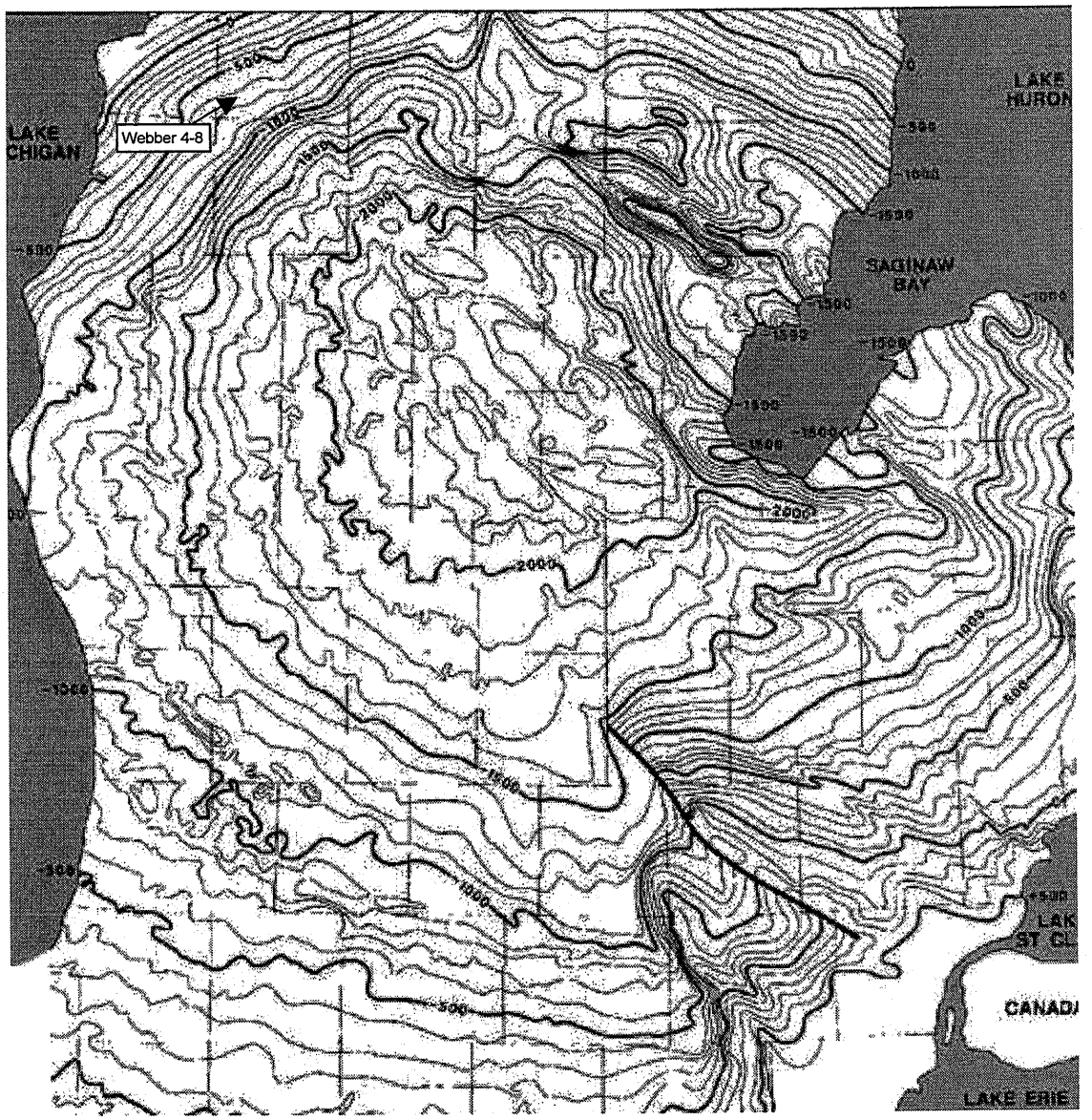
Page F-9
Jan. 2008

Figure 6



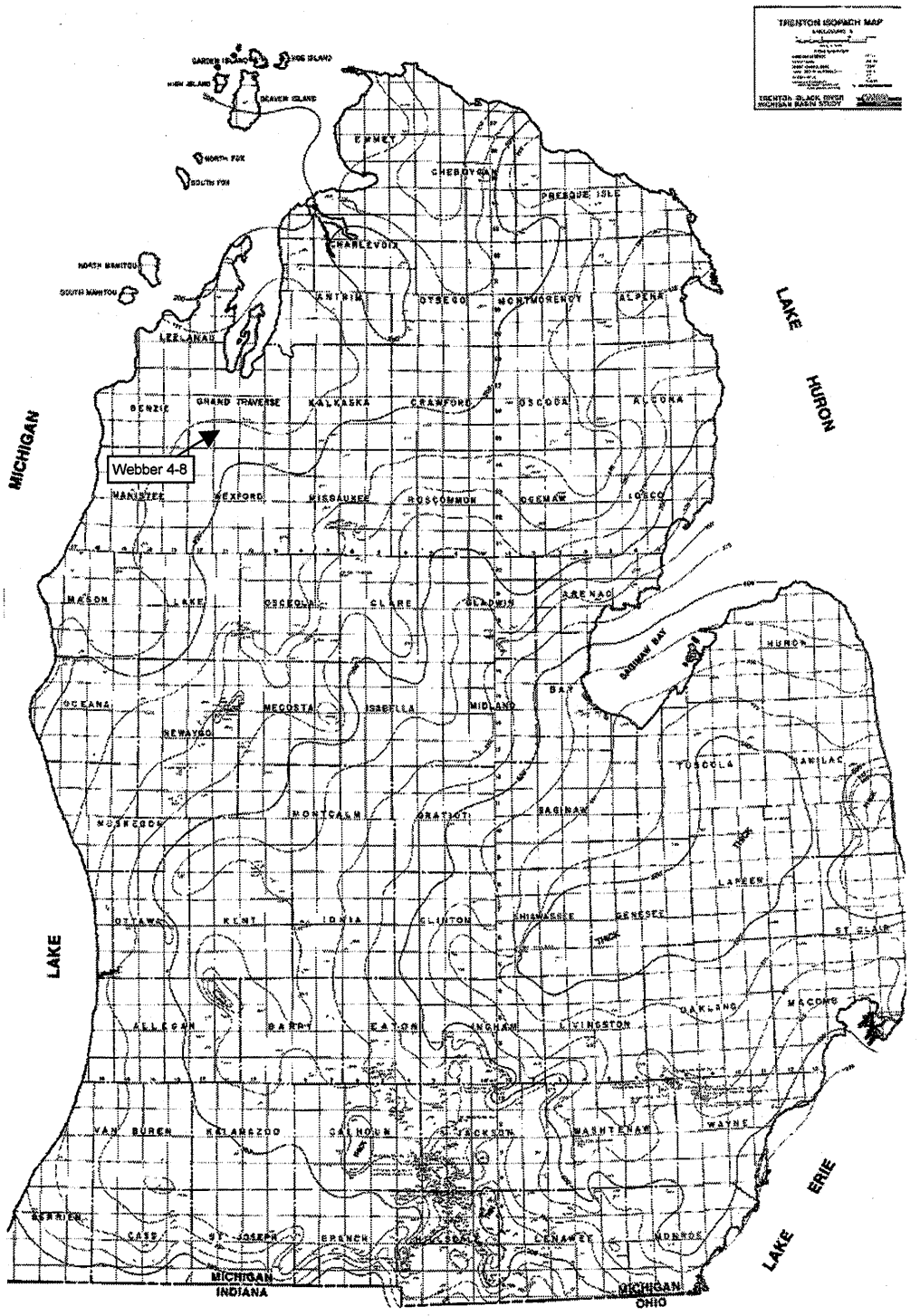
Map Antrim Production

Figure F-7



Structure Map
Top of Trenton

Figure F-8



Isopac Map of Trenton

ATTACHMENT H
OPERATING DATA

This permit application is for the purpose of adding leachate water from the Glen's Sanitary Landfill to the saltwater presently being injected into the Weber #4-8 Saltwater Disposal Well.

The Weber #4-8 was originally drilled in November of 1982 under Michigan Permit #36221. Team Completion L.L.C. submitted a Permit Application to dispose of saltwater from wells owned by other operators in the area and USEPA Permit #MI-055-2D-C034 was issued on April 8, 2003. Approval to start injection into the Weber #4-8 was received on July 23, 2004.

Sodium Chloride/Calcium Chloride brine water produced from the Niagaran is being injected into the Traverse and Traverse Lime Formation between 1791 and 2200 feet. The brine has a specific gravity of from 1.02 to 1.07 (8.5 to 8.9 pounds/gallon). Daily disposal rates are between 29 and 88 gallons per minute (1000 bbl to 3000 bbl per day) with no surface pressure. Typical analysis of the brine water is shown on page H-2.

It is proposed that in addition to the present brine water being injected that leachate from the Glen's Sanitary Landfill at Maple City, Michigan be injected. With the addition of the leachate the anticipate daily injection rates are between 29 and 146 gallons per minute (1000 bbl to 5000 bbl per day). It is expected that the combined waste fluids will be injected at zero surface pressure and no pumps will be required.

Two analysis of the leachate from the Glen's Sanitary Landfill is shown on pages H-3 through H-13. The first sample was collected on August 30, 2006 and the second sampled on May 22, 2007.

ANALYSIS OF INJECTED BRINE WATER

(231) 369-3309
(231) 369-3329
(800) 253-1412
Fax: (231) 369-3331

Midwest
Analytical Laboratories, Inc.
P.O. Box 467
Kalkaska, MI 49646

Company:	Team Services P.O. Box 1104 Kalkaska, MI 49646	Operator:	Schmude Oil Co.
		Well Name:	Townsite 1-17 HD
		Permit #:	39888
		Location:	SE-NE-NE, Sec. 17 T27N-R7W, Kalkaska Twp Kalkaska County
Project #:	na		
Location:	Townsite 1-17 HD		
Sample Date:	06/26/02		
Sample of:	Water		
Submitted Date:	06/26/02		
Sample Point:	na		
Sampled by:	Team Services		
Analysis Date:	07/09/02		
Analysis #:	262602		

EPA Method		Cations	mg/L	Detection Limit
273.1		Sodium	47000	0.01 mg/L
258.1		Potassium	16800	0.04 mg/L
215.1		Calcium	78200	0.04 mg/L
242.1		Magnesium	8300	0.01 mg/L
236.1		Iron (Total)	52	1 mg/L
208.1		Barium	7	1 mg/L

EPA Method		Anions	mg/L	Detection Limit
325.3		Chloride	225000	1 mg/L
375.4		Sulfate	83	10 mg/L
310.1	Alkalinity as	Carbonate	nd	1 mg/L
310.1	Alkalinity as	Bicarbonate	62	1 mg/L
376.2		Sulfide	nd	1.0 mg/L
		Total Dissolved Solids	375504	—

		Result	
120.1	Resistivity(Ohm-m)	0.047	@ 25 Deg. C
150.1	pH	4.81	@ 25 Deg. C
—	Specific Gravity	1.256	@ 60 Deg. F(Water=1)

nd=not detected
USEPA Methods for the Chemical Analysis of Water and Wastes, 3rd. Edition

ANALYSIS OF LEACHATE WATER

GEOCHEMICAL TESTING
Environmental and Energy Analysis

2005 N Center Ave
Somerset PA 15501

814/443-1671
814/445-6666
FAX: 814/445-6729

Friday, September 29, 2006

DEBBIE JOHNSTON
GLEN'S SANITARY LANDFILL INC
WASTE MANAGEMENT OF N MICHIGAN
518 E TRAVERSE HIG
MAPLE CITY, MI 49664

TEL:
FAX

RE: GLENS 500 A

Order No.: G0608586

Dear DEBBIE JOHNSTON:

Geochemical Testing received 1 sample(s) on 8/31/2006 for the analyses presented in the following report.

There were no problems with the analyses and all QC data met NELAC, EPA, and laboratory specifications except where noted in the Case Narrative.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

David M. Glessner
Laboratory Manager

Susan K. Gerhard
Project Manager

Report(s) To:
DON CONWAY

MEMBER ACIL

Geochemical Testing

Date: *29-Sep-06*

CLIENT: GLEN'S SANITARY LANDFILL INC
Project: GLENS 500 A
Lab Order: G0608586

CASE NARRATIVE

No problems were encountered during analysis of this work order number, except as noted.

The determinative step for cyanide was subcontracted to STL-Buffalo. A copy of the subcontractor's laboratory report is enclosed with this Analytical Report. This laboratory meets NELAC and EPA laboratory accreditations. The reference method from this lab for total cyanide is EPA 335.2, "Cyanide, total".

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Indicates an estimated value.
U - The analyte was not detected at or above the listed concentration, which is below the laboratory quantitation limit.
B - Analyte detected in the associated Method Blank
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range
* - Value exceeds Action Limit
H - Method Hold Time Exceeded

ACCREDITED IN ACCORDANCE WITH nelac
I.D. 56-00306 PA DEP

Laboratory Results

Geochemical Testing

Date: *29-Sep-06*

CLIENT: GLEN'S SANITARY LANDFILL INC
Client Sample ID: Tank B
Lab Order: G0608586
Project: GLENS 500 A
Sampled By: Gosling Czubak, Inc.
Lab ID: G0608586-001
Collection Date: 8/30/2006 11:00:00 AM
Matrix: LEACHATE
Received Date: 8/31/2006

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
FIELD PARAMETERS		FLD				Analyst:
pH (Field)	8.32			S.U.	0	8/30/2006 11:00:00 AM
Specific Conductance (Field)	10560			umhos/cm	0	8/30/2006 11:00:00 AM
Temperature (Field)	27.1			deg C	0	8/30/2006 11:00:00 AM
INORGANIC NON-METALS		SM 18 2320B				Analyst: SAG
Alkalinity to pH 4.5	3800	5		mg/L CaCO3	1	9/6/2006 9:55:00 PM
INORGANIC NON METALS		SM4500-CO2D				Analyst: SAG
Bicarbonate	3540	5		mg/L CaCO3	1	9/6/2006 9:55:00 PM
INORGANIC NON-METALS		EPA 325.2				Analyst: BLY
Chloride	1600	20		mg/L	10	9/7/2006 10:19:46 AM
TOTAL CYANIDE		SM 18 4500-CN-C&E				Analyst: SUB
Cyanide, total	0.01	0.01	U	mg/L	1	9/8/2006
INORGANIC NON-METALS		SM4500-CO2D				Analyst: SAG
Carbonate	68	5		mg/L CaCO3	1	9/6/2006 9:55:00 PM
INDICATOR ORGANIC PARAMETERS		HACH 8000				Analyst: AND
Chemical Oxygen Demand	1130	5		mg/L	1	9/5/2006 12:20:00 PM
PHYSICAL TESTS		EPA 120.1				Analyst: SAG
Specific Conductance	9970	1		µmhos/cm	1	9/6/2006 9:55:00 PM
INORGANIC NON-METALS		EPA 350.1D				Analyst: SLY
Ammonia Nitrogen	508	30.0		mg/L as N	200	9/26/2006
INORGANIC NON-METALS		SM4500-B				Analyst: MAP
Nitrite Nitrogen	< 0.05	0.05		mg/L as N	1	9/1/2006 10:15:00 AM
INORGANIC NON-METALS		EPA 353.2				Analyst: SLY
Nitrate Nitrogen	< 0.05	0.05		mg/L as N	1	9/5/2006 1:19:02 PM
PH BY SM 4500 H+B		SM4500-H+B				Analyst: SAG
pH	6.31	0		su	1	9/6/2006 9:55:00 PM
INDICATOR ORGANIC PARAMETERS		EPA 420.1				Analyst: MMR
Phenolics	198	100		µg/L	10	9/18/2006 10:20:00 AM
INORGANIC NON-METALS		EPA 375.4				Analyst: SLY
Sulfate	< 10	10	S	mg/L	1	9/6/2006

NOTES:
S - Outlying spike recovery observed. A duplicate analysis was performed with similar results indicating a matrix effect.

PHYSICAL TESTS		SM2540-C				Analyst: SAG
Total dissolved solids	4810	10		mg/L	1	8/31/2006 7:51:00 PM

ACCREDITED IN ACCORDANCE WITH nelac
I.D. 58-00306 PA DEP

Laboratory Results

Geochemical Testing

Date: *29-Sep-06*

CLIENT: GLEN'S SANITARY LANDFILL INC
Lab Order: G0608586
Project: GLENS 500 A
Lab ID: G0608586-001
Matrix: LEACHATE

Client Sample ID: Tank B
Sampled By: Gosling Czubak, Inc.
Collection Date: 8/30/2006 11:00:00 AM
Received Date: 8/31/2006

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
INORGANIC NON METALS		CALCULATED				Analyst: LAN
Total Inorganic Nitrogen	26.6	0.04		mg/L as N	1	9/5/2006
INORGANIC METALS		EPA 200.7				Analyst: JLH
Barium	0.04	0.01		mg/L	1	9/5/2006 7:00:00 PM
Calcium	47.8	0.1		mg/L	1	9/5/2006 7:00:00 PM
Cobalt	0.019	0.005		mg/L	1	9/5/2006 7:00:00 PM
Iron	2.16	0.05		mg/L	1	9/5/2006 7:00:00 PM
Magnesium	112	0.1		mg/L	1	9/5/2006 7:00:00 PM
Manganese	0.04	0.01		mg/L	1	9/5/2006 7:00:00 PM
Nickel	0.12	0.01		mg/L	1	9/5/2006 7:00:00 PM
Potassium	530	5.0		mg/L	10	9/5/2006 3:40:00 PM
Sodium	1370	2.0		mg/L	10	9/5/2006 3:40:00 PM
Vanadium	0.031	0.005		mg/L	1	9/5/2006 7:00:00 PM
Zinc	0.03	0.01		mg/L	1	9/5/2006 7:00:00 PM
INORGANIC METALS		EPA 200.8				Analyst: NPT
Antimony	< 10	10		µg/L	10	9/12/2006 3:45:00 PM
Arsenic	24.4	10		µg/L	10	9/12/2006 3:45:00 PM
Beryllium	< 10	10		µg/L	10	9/14/2006 3:36:00 PM
Cadmium	< 2.0	2.0		µg/L	10	9/12/2006 3:45:00 PM
Chromium	51.6	20.0		µg/L	10	9/12/2006 3:45:00 PM
Copper	36.0	20.0		µg/L	10	9/19/2006 6:06:00 PM
Lead	< 10	10		µg/L	10	9/12/2006 3:45:00 PM
Selenium	24.3	10		µg/L	10	9/12/2006 3:45:00 PM
Silver	< 5.0	5.0		µg/L	10	9/12/2006 3:45:00 PM
Thallium	< 2.0	2.0		µg/L	10	9/12/2006 3:45:00 PM
VOLATILE ORGANIC COMPOUNDS		EPA 8260B				Analyst: JW
1,1,1,2-Tetrachloroethane	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
1,1,1-Trichloroethane	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
1,1,2,2-Tetrachloroethane	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
1,1,2-Trichloroethane	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
1,1-Dichloroethane	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
1,1-Dichloroethene	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
1,2,3-Trichloropropane	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
1,2-Dibromo-3-chloropropane	< 5.0	5.0		µg/L	1	9/2/2006 5:51:00 AM
1,2-Dibromoethane	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
1,2-Dichlorobenzene	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
1,2-Dichloroethane	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
1,2-Dichloropropane	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
1,4-Dichlorobenzene	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
2-Hexanone	< 5.0	5.0		µg/L	1	9/2/2006 5:51:00 AM

ACCREDITED IN ACCORDANCE WITH nelac
I.D. 56-00306 PA DEP

Laboratory Results

Geochemical Testing

Date: *29-Sep-06*

CLIENT: GLEN'S SANITARY LANDFILL INC
Lab Order: G0608586
Project: GLENS 500 A
Lab ID: G0608586-001
Matrix: LEACHATE

Client Sample ID: Tank B
Sampled By: Gosling Czubak, Inc.
Collection Date: 8/30/2006 11:00:00 AM
Received Date: 8/31/2006

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS		EPA 8260B				Analyst: JW
4-Methyl-2-Pentanone	1.9	1.0		µg/L	1	9/2/2006 5:51:00 AM
Acetone	57.1	25.0		µg/L	1	9/2/2006 5:51:00 AM
Acrylonitrile	< 5.0	5.0		µg/L	1	9/2/2006 5:51:00 AM
Benzene	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
Bromochloromethane	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
Bromomethane	< 5.0	5.0		µg/L	1	9/2/2006 5:51:00 AM
Carbon Disulfide	< 5.0	5.0		µg/L	1	9/2/2006 5:51:00 AM
Carbon Tetrachloride	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
Chlorobenzene	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
Chlorodibromomethane	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
Chloroethane	< 5.0	5.0		µg/L	1	9/2/2006 5:51:00 AM
Chloromethane	< 5.0	5.0		µg/L	1	9/2/2006 5:51:00 AM
cis-1,2-Dichloroethene	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
cis-1,3-Dichloropropene	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
Dibromomethane	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
Dichlorobromomethane	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
Ethylbenzene	2.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
Iodomethane	< 5.0	5.0		µg/L	1	9/2/2006 5:51:00 AM
Methyl Ethyl Ketone	17.6	5.0		µg/L	1	9/2/2006 5:51:00 AM
Methylene Chloride	< 5.0	5.0		µg/L	1	9/2/2006 5:51:00 AM
Styrene	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
Tetrachloroethene	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
Toluene	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
trans-1,2-Dichloroethene	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
trans-1,3-Dichloropropene	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
trans-1,4-Dichloro-2-butene	< 2.0	2.0		µg/L	1	9/2/2006 5:51:00 AM
Tribromomethane	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
Trichloroethene	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
Trichlorofluoromethane	< 5.0	5.0		µg/L	1	9/2/2006 5:51:00 AM
Trichloromethane	5.7	1.0		µg/L	1	9/2/2006 5:51:00 AM
Vinyl Acetate	< 1.0	1.0		µg/L	1	9/2/2006 5:51:00 AM
Vinyl Chloride	< 2.0	2.0		µg/L	1	9/2/2006 5:51:00 AM
Total Xylene	4.8	3.0		µg/L	1	9/2/2006 5:51:00 AM
Surr: 1,2-Dichloroethane-d4	113	70-130		%REC	1	9/2/2006 5:51:00 AM
Surr: 4-Bromofluorobenzene	110	70-130		%REC	1	9/2/2006 5:51:00 AM
Surr: Dibromofluoromethane	105	70-130		%REC	1	9/2/2006 5:51:00 AM
Surr: Toluene-d8	99.9	70-130		%REC	1	9/2/2006 5:51:00 AM
INDICATOR ORGANIC PARAMETERS		SM 19 5310-C				Analyst: JDH
Total Organic Carbon	304	0.5		mg/L	100	9/6/2006 5:31:00 PM

ACCREDITED IN ACCORDANCE WITH nelac
I.D. 56-00306 PA DEP

GEOCHEMICAL TESTING
Environmental and Energy Analysis

2005 N Center Ave
Somerset PA 15501

814/443-1671
814/445-6666
FAX: 814/445-6729

Monday, June 25, 2007

DEBORA JOHNSTON
GLEN'S SANITARY LANDFILL INC
WASTE MANAGEMENT OF N MICHIGAN
518 E TRAVERSE HIG
MAPLE CITY, MI 49664

TEL:
FAX

RE: Glen's Sanitary Landfill 500A

Order No.: G0705558

Dear DEBORA JOHNSTON:

Geochemical Testing received 1 sample(s) on 5/23/2007 for the analyses presented in the following report.

There were no problems with the analyses and all QC data met NELAC, EPA, and laboratory specifications except where noted in the Case Narrative.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

David M. Glessner
Laboratory Manager

Susan K. Gerhard
Project Manager

Report(s) To:
DON CONWAY

MEMBER

Geochemical Testing Date: *25-Jun-07*

CLIENT: GLEN'S SANITARY LANDFILL INC
Project: Glen's Sanitary Landfill 500A
Lab Order: G0705558

CASE NARRATIVE

No problems were encountered during analysis of this work order number, except as noted.

Field parameter data was measured or analyzed by the sampler. The Chain-of-Custody or ancillary forms that record results provided by the sampler are enclosed with the Analytical Reports.

2-Methynaphthalene by Method 8260 is qualified with a "J" on all samples reported in this Lab Order, which signifies that there is increased uncertainty and that all results are estimates. The laboratory was unable to calibrate for this semi volatile compound at the Michigan Target Detection Limit of 5 ug/L. This compound's poor purging efficiency is the suspected cause and the reason that this compound is not specified in Method 8260.

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Indicates an estimated value.
U - The analyte was not detected at or above the listed concentration, which is below the laboratory quantitation limit.
B - Analyte detected in the associated Method Blank
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range
* - Value exceeds Action Limit
H - Method Hold Time Exceeded

ACCREDITED IN ACCORDANCE WITH nelac
I.D. 50-00306 PA DEP

Laboratory Results

Geochemical Testing

Date: *25-Jun-07*

CLIENT: GLEN'S SANITARY LANDFILL INC
Lab Order: G0705558
Project: Glen's Sanitary Landfill 500A
Lab ID: G0705558-001
Matrix: LEACHATE

Client Sample ID: Tank B
Sampled By: Gosling Czubak, Inc.
Collection Date: 5/22/2007 3:00:00 PM
Received Date: 5/23/2007

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
FIELD PARAMETERS		FIELD				Analyst:
pH (Field)	8.37			S.U.	0	5/22/2007 3:00:00 PM
Specific Conductance (Field)	7470			umhos/cm	0	5/22/2007 3:00:00 PM
Temperature (Field)	19.5			deg C	0	5/22/2007 3:00:00 PM
INORGANIC NON-METALS		SM 2320B				Analyst: KMR
Alkalinity to pH 4.5	2530	5		mg/L CaCO3	1	5/24/2007 2:47:00 PM
INORGANIC NON METALS		SM 4500-CO2D				Analyst: KMR
Bicarbonate	2480	5		mg/L CaCO3	1	5/24/2007
TOTAL CYANIDE		SM 4500-CN&E				Analyst: SLY
Cyanide, total	< 0.020	0.020		mg/L	1	5/30/2007
INORGANIC NON-METALS		SM 4500-CO2				Analyst: KMR
Carbonate	44	5		mg/L CaCO3	1	5/24/2007
INDICATOR ORGANIC PARAMETERS		HACH 8000				Analyst: SAG
Chemical Oxygen Demand	< 10	10		mg/L	1	5/23/2007
INORGANIC NON-METALS		EPA 300.0				Analyst: AND
Nitrate Nitrogen	0.02	0.02	U	mg/L as N	1	5/23/2007 5:31:00 PM
Nitrite Nitrogen	0.02	0.02	U	mg/L as N	1	5/23/2007 5:31:00 PM
INORGANIC NON-METALS		EPA 300.0				Analyst: AND
Chloride	1110	1		mg/L	1	5/23/2007 5:31:00 PM
Sulfate	19	2		mg/L	1	5/23/2007 5:31:00 PM
INORGANIC NON-METALS		EPA 350.1				Analyst: JPL
Ammonia Nitrogen	370	0.04		mg/L as N	100	5/23/2007 11:39:35 PM
INDICATOR ORGANIC PARAMETERS		EPA 420.1				Analyst: MMR
Phenolics	< 50.0	50.0		µg/L	5	5/24/2007 10:10:00 AM
INORGANIC NON-METALS		SM 2540 C				Analyst: KLS
Total dissolved solids	3320	50		mg/L	5	5/23/2007 10:03:00 AM
INORGANIC NON METALS		CALCULATED				Analyst: SKG
Total Inorganic Nitrogen	370	0.04		mg/L as N	1	5/23/2007
INORGANIC METALS		EPA 200.7				Analyst: GMG
Barium	0.049	0.005		mg/L	1	5/25/2007 6:28:00 PM
Cobalt	0.015	0.015		mg/L	1	5/25/2007 6:28:00 PM
Iron	1.5	0.02		mg/L	1	5/25/2007 6:28:00 PM
Magnesium	52	1.0		mg/L	1	5/25/2007 6:28:00 PM
Manganese	0.083	0.005		mg/L	1	5/25/2007 6:28:00 PM
Potassium	300	0.2		mg/L	1	5/25/2007 6:28:00 PM

Accredited in Accordance with nelac
I.D. 56-00306 PA DEP

Laboratory Results

Geochemical Testing

Date: *25-Jun-07*

CLIENT: GLEN'S SANITARY LANDFILL INC
Client Sample ID: Tank B
Lab Order: G0705558
Project: Glen's Sanitary Landfill 500A
Lab ID: G0705558-001
Matrix: LEACHATE
Sampled By: Gosling Czubak, Inc.
Collection Date: 5/22/2007 3:00:00 PM
Received Date: 5/23/2007

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
INORGANIC METALS		EPA 200.7				Analyst: GMG
Sodium	939	1		mg/L	10	5/29/2007 3:16:00 PM
Vanadium	0.022	0.002		mg/L	1	5/25/2007 6:28:00 PM
Zinc	0.03	0.01		mg/L	1	5/25/2007 6:28:00 PM
INORGANIC METALS		EPA 200.8				Analyst: NPT
Antimony	2	1		µg/L	1	5/29/2007 4:31:00 PM
Arsenic	12	1		µg/L	1	5/29/2007 4:31:00 PM
Beryllium	< 1	1		µg/L	1	5/30/2007 1:34:00 PM
Cadmium	< 0.2	0.2		µg/L	1	5/29/2007 4:31:00 PM
Chromium	32	1		µg/L	1	5/29/2007 4:31:00 PM
Copper	13	1		µg/L	1	5/29/2007 4:31:00 PM
Lead	1	1		µg/L	1	5/29/2007 4:31:00 PM
Nickel	57	2		µg/L	1	5/29/2007 4:31:00 PM
Selenium	6	1		µg/L	1	5/29/2007 4:31:00 PM
Silver	0.2	0.2	U	µg/L	1	5/30/2007 1:34:00 PM
Thallium	< 2	2		µg/L	1	5/29/2007 4:31:00 PM
VOLATILE ORGANIC COMPOUNDS		EPA 8260				Analyst: JAW
1,1,1,2-Tetrachloroethane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
1,1,1-Trichloroethane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
1,1,2,2-Tetrachloroethane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
1,1,2-Trichloroethane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
1,1-Dichloroethane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
1,1-Dichloroethene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
1,2,3-Trichloropropane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
1,2,4-Trichlorobenzene	< 5.0	5.0		µg/L	1	5/26/2007 2:24:00 AM
1,2,4-Trimethylbenzene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
1,2-Dibromo-3-chloropropane	< 5.0	5.0		µg/L	1	5/26/2007 2:24:00 AM
1,2-Dibromoethane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
1,2-Dichlorobenzene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
1,2-Dichloroethane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
1,2-Dichloropropane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
1,3,5-Trimethylbenzene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
1,3-Dichlorobenzene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
1,4-Dichlorobenzene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
2-Hexanone	< 5.0	5.0		µg/L	1	5/26/2007 2:24:00 AM
2-Methylnaphthalene	< 5 J	5.0		µg/L	1	5/26/2007 2:24:00 AM
4-Methyl-2-Pentanone	24.5	5.0		µg/L	1	5/26/2007 2:24:00 AM
Acetone	< 20.0	20.0		µg/L	1	5/26/2007 2:24:00 AM
Acrylonitrile	< 5.0	5.0		µg/L	1	5/26/2007 2:24:00 AM
Benzene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM

Accredited in accordance with nelac
I.D. 56-00308 PA DEP

Laboratory Results

Geochemical Testing

Date: *25-Jun-07*

CLIENT: GLEN'S SANITARY LANDFILL INC
Lab Order: G0705558
Project: Glen's Sanitary Landfill 500A
Lab ID: G0705558-001
Matrix: LEACHATE

Client Sample ID: Tank B
Sampled By: Gosling Czubak, Inc.
Collection Date: 5/22/2007 3:00:00 PM
Received Date: 5/23/2007

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS		EPA 8260				Analyst: JAW
Bromochloromethane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Bromomethane	< 5.0	5.0		µg/L	1	5/26/2007 2:24:00 AM
Carbon Disulfide	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Carbon Tetrachloride	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Chlorobenzene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Chlorodibromomethane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Chloroethane	< 5.0	5.0		µg/L	1	5/26/2007 2:24:00 AM
Chloromethane	< 5.0	5.0		µg/L	1	5/26/2007 2:24:00 AM
cis-1,2-Dichloroethene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
cis-1,3-Dichloropropene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Dibromomethane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Dichlorobromomethane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Dichlorodifluoromethane	< 5.0	5.0		µg/L	1	5/26/2007 2:24:00 AM
Diethyl Ether	12.9	10		µg/L	1	5/26/2007 2:24:00 AM
Ethylbenzene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Hexachloroethane	< 5.0	5.0		µg/L	1	5/26/2007 2:24:00 AM
Iodomethane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Isopropylbenzene	< 5.0	5.0		µg/L	1	5/26/2007 2:24:00 AM
Methyl Ethyl Ketone	17.1	5.0		µg/L	1	5/26/2007 2:24:00 AM
Methylene Chloride	< 5.0	5.0		µg/L	1	5/26/2007 2:24:00 AM
Methyl-tert-butyl ether	< 5.0	5.0		µg/L	1	5/26/2007 2:24:00 AM
Naphthalene	< 5.0	5.0		µg/L	1	5/26/2007 2:24:00 AM
n-Propylbenzene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Styrene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Tetrachloroethene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Toluene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
trans-1,2-Dichloroethene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
trans-1,3-Dichloropropene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
trans-1,4-Dichloro-2-butene	< 5.0	5.0		µg/L	1	5/26/2007 2:24:00 AM
Tribromomethane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Trichloroethene	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Trichlorofluoromethane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Trichloromethane	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Vinyl Chloride	< 1.0	1.0		µg/L	1	5/26/2007 2:24:00 AM
Total Xylene	< 2.0	2.0		µg/L	1	5/26/2007 2:24:00 AM
Surr: 1,2-Dichloroethane-d4	112	70-130		%REC	1	5/26/2007 2:24:00 AM
Surr: 4-Bromofluorobenzene	100	70-130		%REC	1	5/26/2007 2:24:00 AM
Surr: Dibromofluoromethane	106	70-130		%REC	1	5/26/2007 2:24:00 AM
Surr: Toluene-d8	101	70-130		%REC	1	5/26/2007 2:24:00 AM
INDICATOR ORGANIC PARAMETERS		SM 19 5310-C				Analyst: JDH

I.D. 56-00306 PA DEP

Laboratory Results

Geochemical Testing

Date: *25-Jun-07*

CLIENT:	GLEN'S SANITARY LANDFILL INC	**Client Sample ID:**	Tank B
Lab Order:	G0705558		
Project:	Glen's Sanitary Landfill 500A	**Sampled By:**	Gosling Czubak, Inc.
Lab ID:	G0705558-001	**Collection Date:**	5/22/2007 3:00:00 PM
Matrix:	LEACHATE	**Received Date:**	5/23/2007

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
INDICATOR ORGANIC PARAMETERS		SM 19 5310-C				Analyst: JDH
Total Organic Carbon	223	50.0		mg/L	100	5/30/2007 6:07:00 PM

ACCREDITED IN ACCORDANCE WITH nelac
I.D. 56-00306 PA DEP