

## *Hydrostratigraphic Database of West-Central Wisconsin*

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<b>Site:</b>	Former New Richmond Landfill
<b>Location:</b>	New Richmond, St. Croix County, Wisconsin
<b>Unit Evaluated:</b>	Ordovician Prairie du Chien

### ***File includes excerpts from:***

Cedar Corporation, 1992, Environmental Conditions Assessment, Former City of New Richmond Landfill #310, New Richmond, Wisconsin, on file at Wisconsin Department of Natural Resources.

- Text: introduction and hydrogeology discussion
- Tables (interspersed with text): water-level elevation
- Figures: site plan, cross-sections, potentiometric surface maps
- Boring logs

Short Elliot Hendrickson, Inc., 2002, Site Investigation Report, Former New Richmond Landfill, WDNR License No. 2492, New Richmond, Wisconsin, on file at Wisconsin Department of Natural Resources.

- Text: introduction, hydrogeology discussion, geophysics discussion
- Table: project chronology
- Figures: cross-section, site locations
- Geophysical survey figures

ENVIRONMENTAL CONDITIONS ASSESSMENT  
FORMER CITY OF NEW RICHMOND LANDFILL #310  
NEW RICHMOND, WISCONSIN

November, 1992

Prepared for:

City of New Richmond  
156 East First Street  
New Richmond, WI 54017

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A total of 12 plan sheets accompany this report and are presented on 11" x 17" format. These sheets include:

Sheet 1	-	Cover Page
Sheet 2	-	Surrounding Property Owners
Sheet 3	-	Existing Topography and Boring Locations
Sheet 4	-	Magnetic Intensity Survey
Sheet 5	-	Induced Electromagnetic Conductivity Survey
Sheet 6	-	Groundwater Table Contours - June, 1992
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## I. INTRODUCTION

The Environmental Conditions Assessment for the City of New Richmond former landfill, License No. 310, has been prepared under Wisconsin Department of Natural Resources (WDNR) Consent Order No. WD-91-08, to determine if the facility poses a potential hazard to public health, safety or welfare, or the environment. This report discusses the existing hydrogeological conditions of the site and presents recommendations based on our findings for additional work. This report is being submitted in accordance with NR 108 and NR 512 and is accompanied by a set of plan sheets. The consent order and work approval letters from the DNR are presented in Appendix A.

The site is located on City property in the NE 1/4 of the SW 1/4, Section 34, Township 31 North, Range 18 West, Town of Star Prairie, St. Croix County, Wisconsin (see Plan Sheet 1). The site is not within the City limits of New Richmond.

All correspondence concerning the landfill should be directed to:

Mr. H. William Smith, Mayor  
City of New Richmond  
156 East First Street  
New Richmond, WI 54017  
715-246-4268

The engineering consultant for the project is:

Cedar Corporation  
604 Wilson Avenue  
Menomonie, WI 54751  
715-235-9081

## II. GENERAL FACILITY LOCATION

The City of New Richmond operated this landfill on property owned by H. Rebhan, a farmer, who owns the adjoining lands to the south and east. In 1976, the City closed the landfill in accordance with existing regulations. The closure was engineered by Banister, Short, Elliot, Hendrickson and Associates and the present cover fill (two feet soil and six inches topsoil) was placed in 1976. The property has been an empty field primarily used as pasture lands for horses since that time. In 1991, the City purchased the property from H. Rebhan.

Landfill operations on the site commenced prior to 1945 and operated as a typical municipal waste landfill with the waste being placed in unlined trenches and borrow areas.

**TABLE 2. SOIL BORING AND MONITORING WELL LOCATIONS**  
**CITY OF NEW RICHMOND**  
**FORMER LANDFILL LICENSE NO. 310**

<u>BORING/WELL</u>	<u>NORTHING</u>	<u>EASTING</u>	<u>*SURFACE ELEVATION</u>	<u>*BOTTOM ELEVATION</u>	<u>*BEDROCK ELEVATION</u>
MW-1	1000.76	499.64	1013.9	910.9	947
MW-2	1448.81	55.41	1016.1	904.1	955
MW-3	1197.54	59.52	1019.8	892.8	946
MW-4	1741.7	55.88	1021.4	900.4	956
P-5	1743.32	61.19	1021.6	865.6	956
MW-6	1806.16	-461.53	1051.8	886.8	986
SB-7	1050	200	1017	980	NE
SB-8	1150	300	1021	1006	NE
SB-9	1400	350	1025	1003	NE
SB-10	1575	225	1028	996	NE
SB-11	975	70	1013	1008	NE
SB-12	975	200	1015	1010	NE
SB-13	975	300	1017	1007	NE
SB-14	975	400	1018	1013	NE
SB-15	1000	490	1014	1009	NE
SB-16	1100	490	1014	1009	NE
SB-17	1200	490	1017	1012	NE
SB-18	1400	490	1017	1012	NE
SB-19	1500	490	1016	1011	NE
SB-20	1600	500	1018	1013	NE
SB-21	1700	650	1019	1014	NE
SB-22	1700	600	1020	1015	NE
SB-23	1700	550	1021	1016	NE
SB-24	1755	500	1031	1026	NE
SB-25	1760	200	1035	1029	NE
SB-26	1750	200	1034	1024	NE
SB-27	1755	150	1032	1026	NE
SB-28	1760	100	1028	1022	NE
SB-29	1755	100	1027	1022	NE
SB-30	1700	70	1021	1016	NE
SB-31	1665	70	1020	1015	NE
SB-32	1625	70	1019	1009	NE
SB-33	1500	70	1017	1012	NE
SB-34	1400	70	1018	1013	NE
SB-35	1200	70	1019	1014	NE
SB-36	1050	70	1014	1009	NE
SB-37	1755	400	1036	1031	NE
SB-38	1755	300	1037	1032	NE
SB-39	1750	600	1025	1020	NE
SB-40	1650	550	1019	1014	NE
SB-41	1650	650	1017	1012	NE

\*m.s.l. = mean sea level

NE = not encountered

Four borings (labelled SB-7, SB-8, SB-9, and SB-10) were drilled to determine the vertical extent of waste and 31 shallow borings were drilled to determine the horizontal extent of waste. Plan Sheet 3 presents the locations of all borings and monitoring wells. All boring logs are presented in Appendix E.

The drilling program was completed after geophysical surveys were interpreted to determine boring placement. Drilling started on May 5, 1992, by defining the horizontal extent of the landfill waste boundary. Hollow stem augers were drilled five to seven feet in depth or until waste was observed on the auger flights. In cases where waste material was observed, the borehole was abandoned and a second hole was drilled further towards the marked property boundary. Boreholes were drilled in this manner at an average spacing of 100 feet around the anticipated perimeter of the waste. Borings used to determine the limits of the waste are numbered SB-11 to SB-41. Borehole abandonment documentation is included in Appendix F.

Soil borings SB-7 through SB-10 were drilled through the center of the landfill to determine the thickness of the waste. Waste thicknesses ranged from seven feet at SB-8 to as much as 23 feet at SB-10. No unusual waste was observed during drilling procedures nor were drums or other large metallic objects encountered.

#### C. Monitoring Wells:

Groundwater monitoring wells MW-1 through MW-6 and P-5 were initially drilled to recover geological data. The borings were drilled by mud-rotary and were sampled at five foot intervals with a split spoon sampler. As each of the boreholes intercepted the dolomitic bedrock, all of the drilling mud was lost to large voids and/or fractures present in the rock. Well completion was obtained using water as a drilling fluid. In two borings, MW-1 and P-5, a core barrel was used to obtain bedrock cores. This technique proved to be inadequate due to the highly fractured bedrock. Core recovery was less than 30 percent due to the highly fractured nature of the rock.

A variance was obtained to discontinue coring due to the coring problems encountered. This variance is presented in Appendix A.

Two other boreholes were started but had to be abandoned during construction. The first hole was at P-5. The core barrel was drilled into the rock and could not be removed. The drillers reluctantly had to leave the core barrel in the bedrock and abandon the hole. The second case occurred when the soil samples from MW-3 were not properly returned to the hydrogeologist. A boring was drilled adjacent to MW-3 to acquire new

soil samples from surface to bedrock. All borings were abandoned per Wisconsin Administrative Code NR 141.25. All well completion documents are included in Appendix G.

D. Water Level Measurements:

Well development in the New Richmond Landfill was completed between May 21 and June 5, 1992 in accordance with s. NR 141.21. All wells, except P-5, were developed by surging with a P.V.C. bailer and pumping with an air pressure actuated bladder pump with vacuum capability. The bailers and pump were thoroughly cleaned between wells by washing with an alconox detergent solution and triple rinsing with deionized water. Monitoring well P-5, was developed by surging with a bailer and bailing. A slight bend in the two inch P.V.C. casing of the well prohibited the use of the bladder pump. Approximately 10 well volumes of water was removed from each well in order to develop the wells properly. Purge water was deposited on the surface of the landfill.

Each well was labelled to USGS elevation datum. The benchmark was provided by the City of New Richmond and the elevations were tied via standard looping techniques to this benchmark. The survey is accurate to 0.01 feet. Form 4400-89 is included in Appendix G to provide horizontal and vertical information of each well.

Water level measurements were recorded for each of the six wells prior to development and during the two subsequent sampling rounds in June and August, 1992. Depth to water measurements have not been recorded as of August 5, 1992. Depth to water was acquired using a Solinst electronic depth to water measuring device which consists of a weighted sensor at the end of a measuring tape graduated in increments of 0.01 feet. Measurements were acquired from that point on the well casing which had been surveyed to a USGS elevation datum. The recorded depth to water information for the three month period is presented in Table 3.



TABLE 3. GROUND WATER ELEVATIONS  
CITY OF NEW RICHMOND LANDFILL #310

		WELL NAME							
	DATE	MW-1	MW-2	MW-3	MW-4	P-5	MW-6		
DEPTH TO WATER	06-12-92	92.2	103.14	105.97	109.31	109.71	142.69		
	08-05-92	95.4	102.37	105.24	108.57	108.97	141.7		
TOP OF PVC WELL CASING		1016.44	1018.53	1022.23	1023.89	1024.32	1054.41		
ELEVATIONS (M.S.L.)	06-12-92	924.24	915.39	916.26	914.58	914.61	911.72	GRAD	AZIMUTH (°)
	08-05-92	921.04	916.16	916.99	915.32	915.35	912.71	0.018 0.014	280 010

1. GRADIENTS AND AZIMUTHS ARE CALCULATED USING WELLS MW-1, MW-2 AND MW-6 AND REFERENCE FLOW AT MW-2.

2. THE GRADIENTS AND AZIMUTHS CALCULATED MAY NOT DEFINE TRUE HYDRAULIC CONDITIONS DUE TO HETEROGENOUS GEOLOGICAL CONDITIONS.

E. Site Geology:

Soil properties (sieve, hydrometer and Atterburg tests) were determined for the soils and eight geologic units have been defined in this area. All soil testing information is presented in Appendix H. These units range from topsoil to highly fractured dolomite and are characterized as:

Unit 1:	Topsoil	- 1 to 3 feet in thickness - brown to black sandy loam
Unit 2:	Well Rounded Sands	- till layer with gravel, cobbles, and large boulders - only encountered in MW-6
Unit 3:	Poorly Graded Sands	- sandy silt
Unit 4:	Silty Sand	- high silt content
Unit 5:	Inorganic Silt, Silty Clay	- found at MW-2 only
Unit 6:	Weathered Sandstone	- Prairie du Chien?
Unit 7:	Prairie du Chien Dolomites	- interbedded chert - oolitic beds - weathered or fractured
Unit 8:	Assumed Prairie du Chien Group	- highly fractured - sample recovery as chips in drilling fluid

Unit 1 - Topsoil:

The landfill is covered with fill brought on site from a borrow area south of the landfill. The soils tend to be sandy loam, brown to black in places with some gravel.

Unit 2 - Well Rounded Sands:

Identified as the second litho stratigraphic unit in MW-6 and that layer above the bedrock contact in MW-3, the unit is typically coarse, well rounded, and poorly sorted. Color is 10 YR 4/3 (dark brown) and the sand is interspersed with cobbles, gravel, and boulders. In MW-3, boulders were not intersected but may be present. USCS grade is GW.

### Unit 3 - Poorly Graded Sands - Glacial Outwash

A widespread unit recognized in all wells, this layer immediately underlies the waste. It is typified as a medium to coarse sand with traces of silt or clay and minor gravel. Color varies from 7.5 YR 1/6 (strong brown) to 10 YR 4/4 (dark brown). USCS grade is SW/SP.

### Unit 4 - Silty Sands - Glacial Till

Also widespread and noted in all well borings, this unit is USCS graded as SM and contains traces of clay and gravel. Color varies from 10 YR 1/6 (yellowish brown) to 10 YR 5/2 (grayish brown).

### Unit 5 - Silts or Clay Sand Mixtures - Glacio Lacustrine

Noted as the surficial unit (below topsoil) in MW-2 a similar unit was identified in MW-1 below Unit 3. These two units, although similar in physical characteristics are not considered to be the same geological event. In MW-2, the unit is a silty clay with a trace of sand encountered. Color is 2.5 Y 5/4 (light olive brown). It is USCS graded as ML. Also observed in MW-1, the unit is described as a fine to medium grained silty sand and grades USCS as SM/ML. Color is noted as 7.5 YR 4/3 (dark brown) to 7.5 YR 5/6 (strong brown).

### Unit 6 - Weathered Sandstone

This unit was identified only in MW-6. It is reported as a clean, fine grained sandstone, white to light yellowish brown in color. Coring was not required in well MW-6 under the approved work plan. Sample identification is based on hammer driven spoon samples.

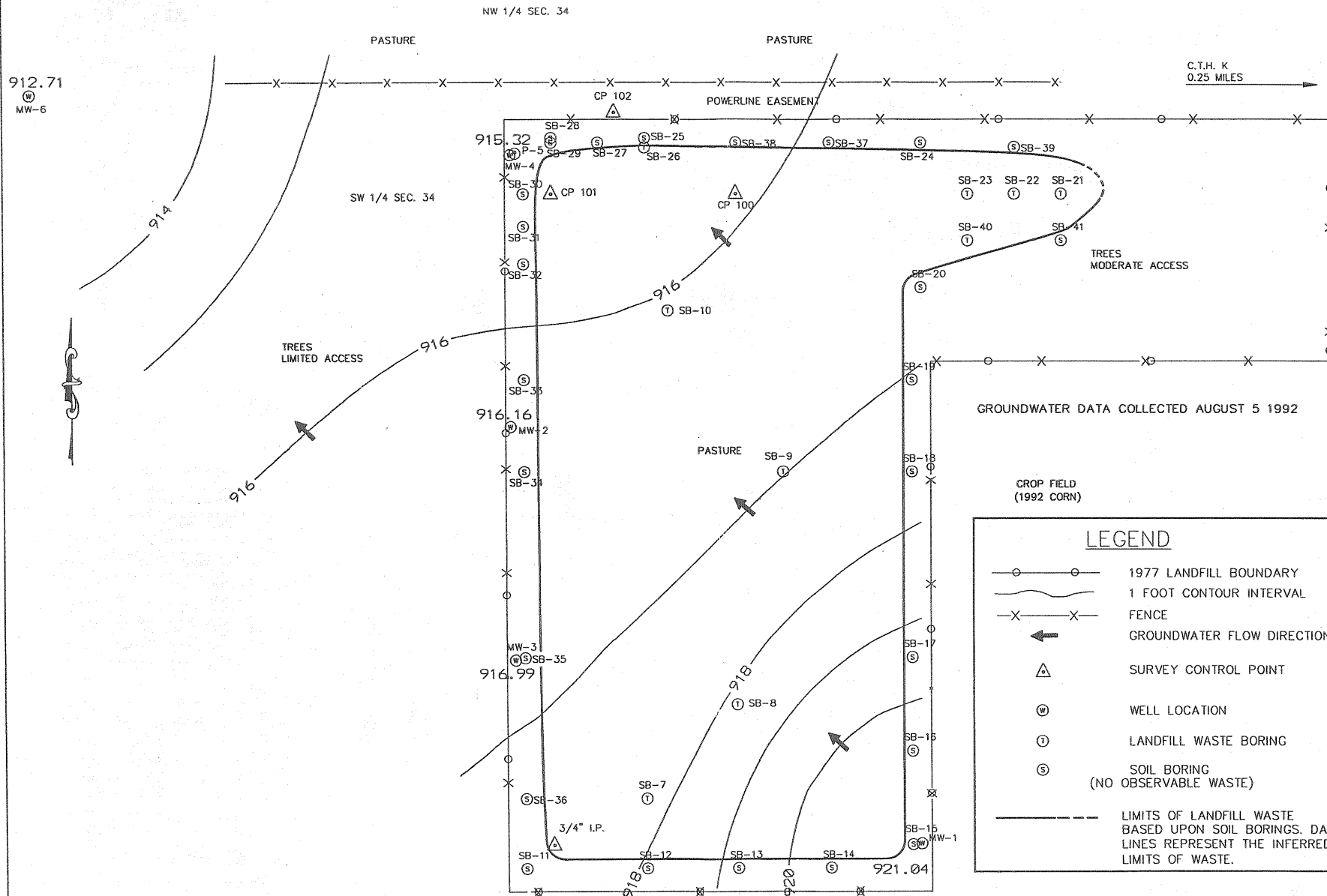
### Unit 7, 8 - Dolomite Limestone:

Interpreted as the Prairie du Chien Group dolostones, these units were encountered in all six well borings except MW-1 and MW-3 where Unit 7 was not encountered. From the response of the drill rig during drilling, the limestone was divided into a weathered unit (Unit 7) and a highly fractured unit (Unit 8). The division of the units was based on the loss of drilling fluid circulation which occurs at the top of unit 8. This is highly subjective, but is an attempt to establish the elevation of fragmented bedrock.

The principal soil unit underlying the waste area are labelled 3, 4, and 5. Tables 4, 5, and 6 present grain size analyses and ratios. Plan Sheets 8 and 9 provide cross sections parallel and semi-perpendicular to groundwater flow.







date JUNE '92

rev.

architects engineers land surveyors planners

**cedar corporation**

604 Wilson Avenue  
Baltimore, Maryland 21202  
410-552-5681  
FAX 410-552-2727

project

**NEW RICHMOND LANDFILL #310**

1992 EXISTING CONDITIONS  
GROUNDWATER TABLE ELEVATIONS, AUGUST'92

drawn by KLS

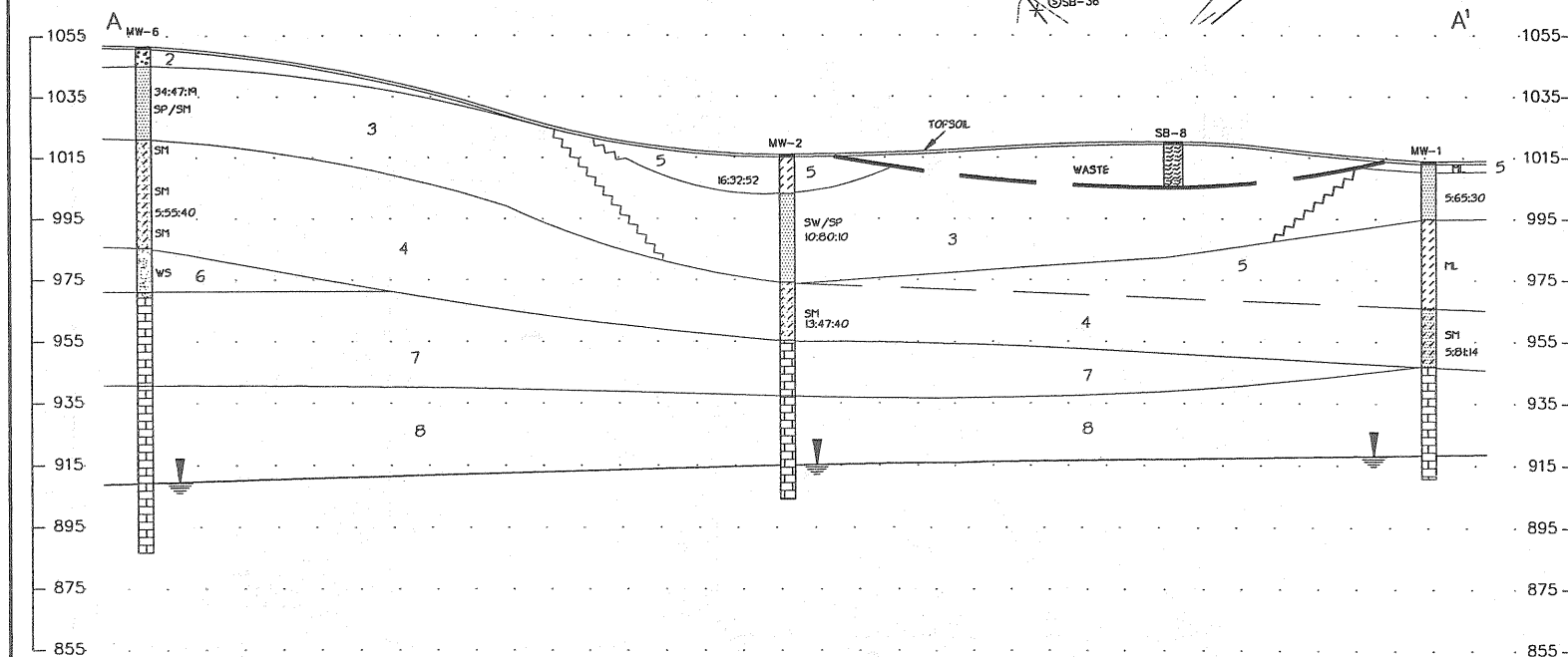
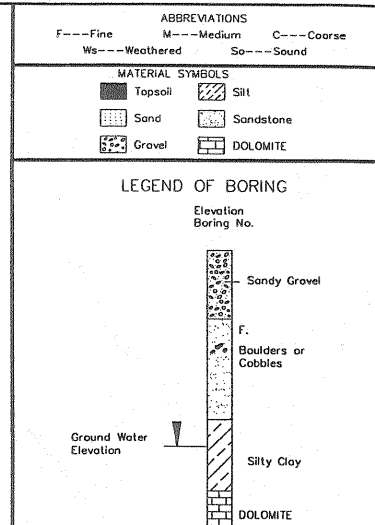
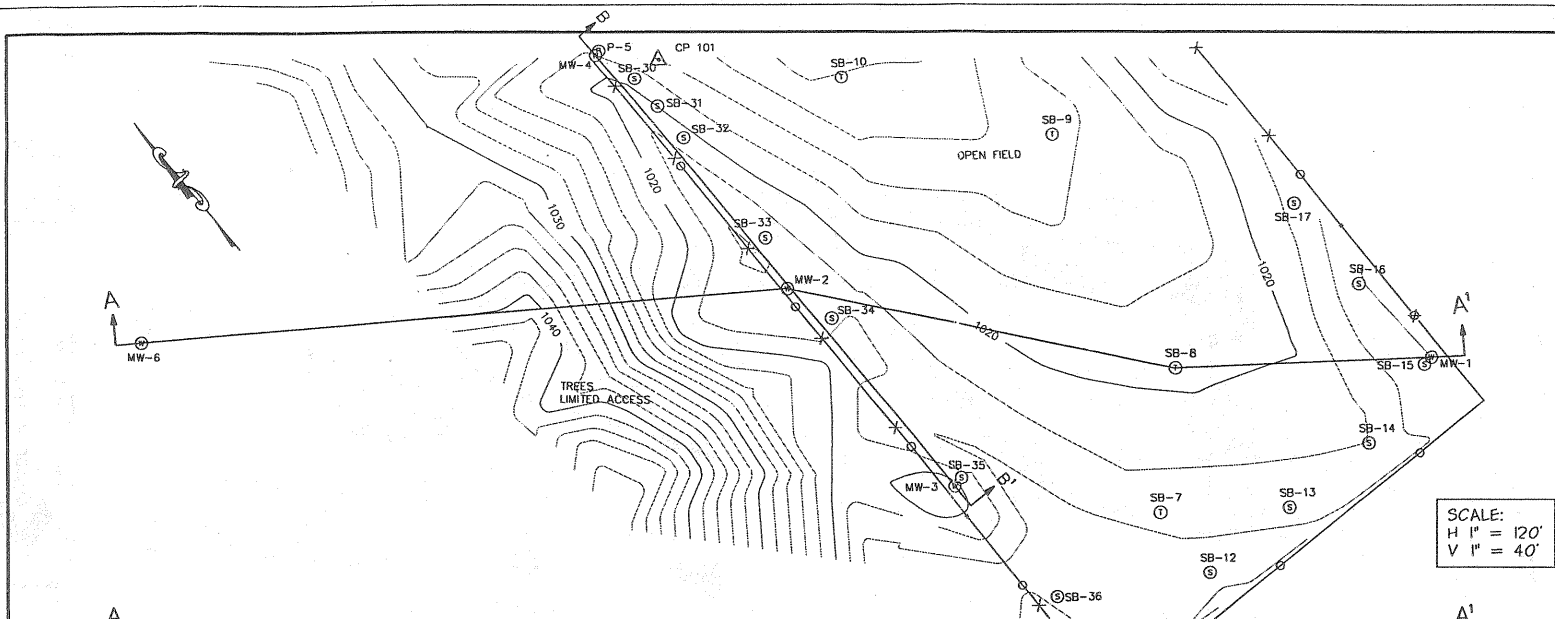
checked by MWV

scale 1" = 100'

sheet no.

7 OF 12

job no. 1530-002-14



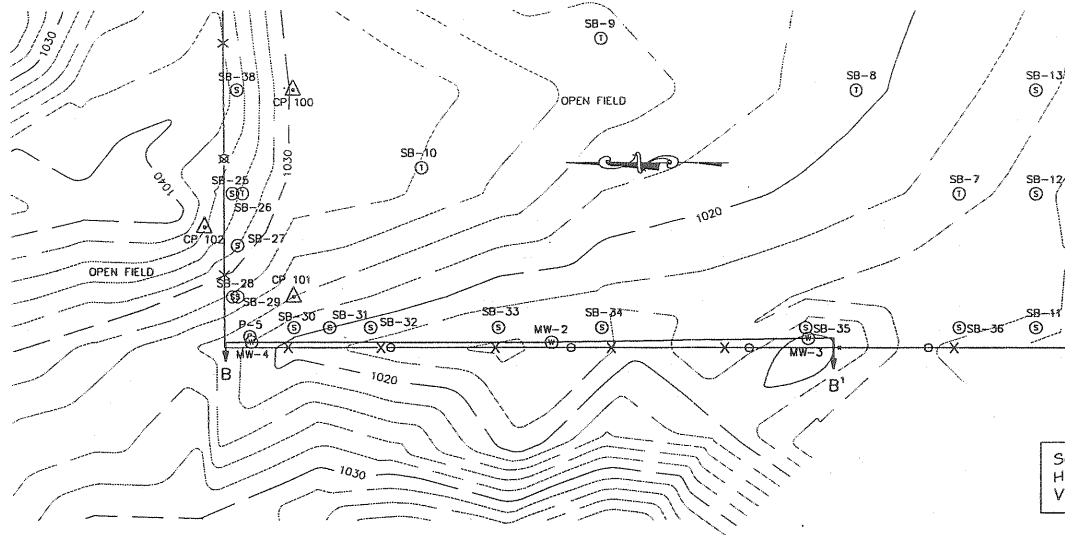
## GEOLOGIC LEGEND

- 1.) TOPSOILS RANGE IN THICKNESS FROM 1 TO 3 FEET
  - 2.) WELL ROUNDED SAND - GRAVEL MIXTURES WITH COBBLES AND BOULDERS.
  - 3.) POORLY GRADED SAND AND SAND-SILT MIXTURES (USCS = SP/SM)
  - 4.) SILTY SAND, SAND SILT MIXTURES (USCS = SM)
  - 5.) NONCALC SILT, VERY FINE SAND, SILTY OR CLAY FINE SAND (USCS = ML)
  - 6.) PORTIONS OF THE PRAIRIE DU CHEN GROUP, WITH SAND-STONE
  - 7.) PRAIRIE DU CHEN GROUP GREY DOLOSTONES WITH INTERBEDDED CHERT AND OOLITIC BEDS.
  - 8.) PRAIRIE DU CHEN HIGHLY FRACTURED DOLOSTONES. NO SAMPLE RECOVERY
- 5.0% = % GRAVEL : SAND : P200
- GROUNDWATER ELEVATIONS MEASURED JUNE 12 1992

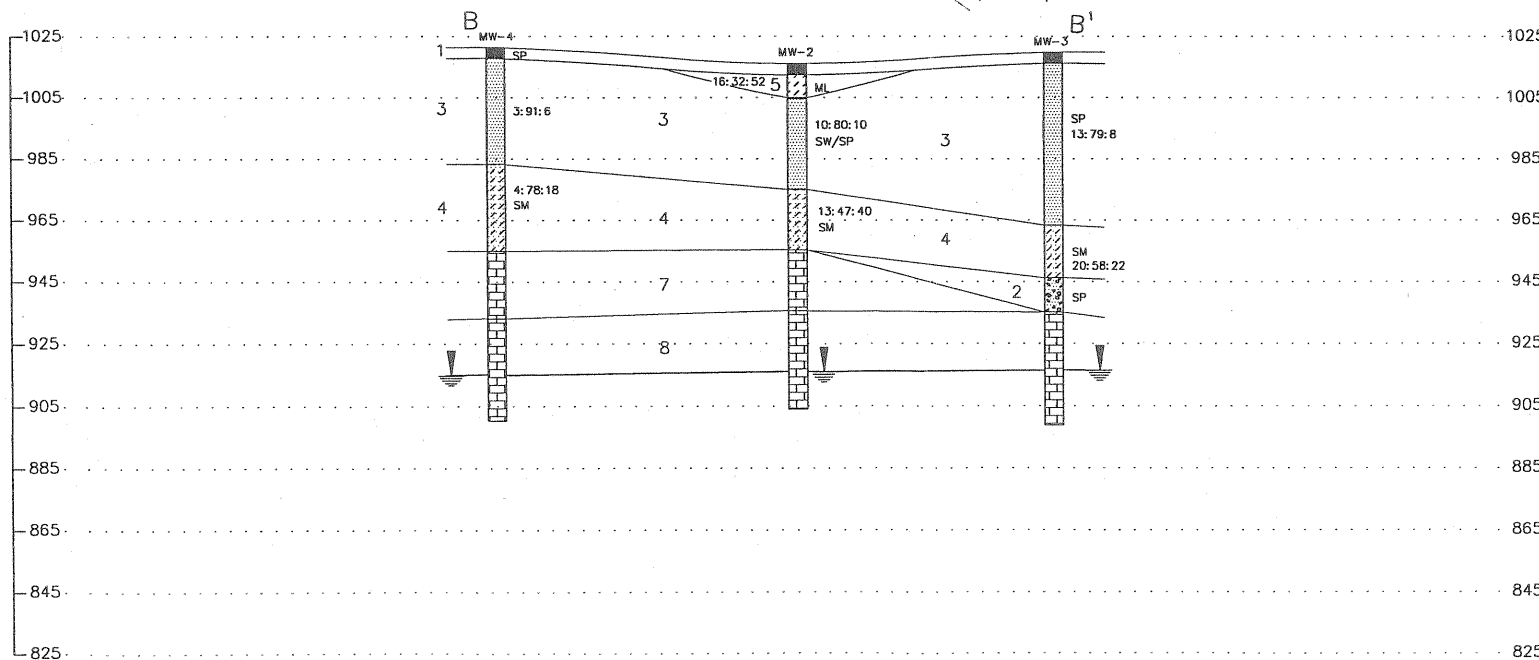
NEW RICHMOND LANDFILL  
 NEW RICHMOND, WI

NORTHWEST - SOUTHEAST  
 CROSS SECTION

Drawn By	KLS	Plans Checked	SEM
cedar corporation		SHEET NUMBER	8 OF 12
		JOB NUMBER	1530-002-14



SCALE:  
H 1" = 120'  
V 1" = 40'

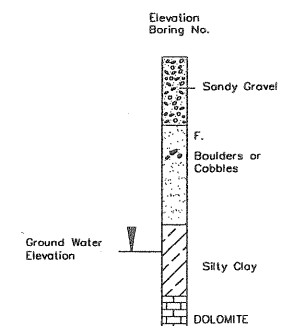


ABBREVIATIONS  
F---Fine M---Medium C---Coarse  
Ws---Weathered So---Sound

#### MATERIAL SYMBOLS

Topsoil Silt  
Sand Sandstone  
Gravel DOLOMITE

#### LEGEND OF BORING



#### GEOLOGIC LEGEND

- 1.) TOPSOILS RANGE IN THICKNESS FROM 1 TO 3 FEET
- 2.) WELL ROUNDED SAND - GRAVEL MIXTURES WITH COBBLES AND BOULDERS.
- 3.) POORLY GRADED SAND AND SAND-SILT MIXTURES (USCS = SP/SH)
- 4.) SILTY SAND, SAND SILT MIXTURES, (USCS = SM)
- 5.) INORGANIC SILT, VERY FINE SAND, SILTY OR CLAY FINE SAND, (USCS = ML)
- 6.) PORTIONS OF THE PRAIRIE DU CHIEN GROUP, WITH SANDSTONE
- 7.) PRAIRIE DU CHIEN GROUP GREY DOLOSTONES WITH INTERBEDDED CHERT AND OOLITIC BEDS.
- 8.) PRAIRIE DU CHIEN HIGHLY FRACTURED DOLOSTONES. NO SAMPLE RECOVERY  
SBEM = % GRAVEL : SAND : P200  
GROUNDWATER ELEVATIONS MEASURED JUNE 12 1992

NEW RICHMOND LANDFILL  
NEW RICHMOND, WI

NORTH - SOUTH  
CROSS SECTION

Drawn By	KLS	Plans Checked	SEM
cedar corporation		SHEET NUMBER	9 OF 12
		JOB NUMBER	1530-002-05



[illegible]

Route To:  
☒ Solid Waste  
☐ Emergency Response  
☐ Wastewater  
☐ Haz. Waste  
☐ Underground Tanks  
☐ Water Resources  
☐ Other

SOIL BORING LOG INFORMATION  
Form 4400-122 7-91

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Facility/Project Name

New Richmond Landfill #310

License/Permit/Monitoring Number

Boring Number

MW-1

Boring Drilled By (Firm name and name of crew chief)

WTD Environmental Drilling  
Eric Schoenberg

Date Drilling Started

05/11/92  
MM DD YY

Date Drilling Completed

05/14/92  
MM DD YY

Drilling Method

6" Tri-cone

Mud Rotary

Borehole Diameter

6" inches

DNR Facility Well No.

WI Unique Well No.

Common Well Name

MW-1

Final Static Water Level

920 Feet MSL

Surface Elevation

1013.90 Feet MSL

Boring Location

State Plane

N

E S/C/N

Lat

Local Grid Location (If applicable)

1013.90 N

1000.76 Feet S 499.64 Feet W

NE 1/4 of SW 1/4 of Section 34, T 31 N, R 18 E

County

St. Croix

DNR County Code

56

Civil Town/City/ or Village

Town of Stan Pharric

Sample 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	Soil Properties					RQD/ Comments
									Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	
			2	Topsoil										
1	1.5	5	6	10 YR 3/2 Clayey silts with trace of very fine sand	ML					D				
2	1.6	6	12	10 YR 4/3 Fine grained silty sands	SM					D				
3	1.0	20	14	7.5 YR 4/6 Fine grained sands with trace of silt	SP					D				
4	1.2	20	20	10 YR 4/4 Fine-Medium grained silty sand	SM					D				
5	1.8	20	24	10 YR 4.5/4 Clayey sands and silts with some pebbles & gravel	SC/ML					D				

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Mark W. Vint

Firm

Cedar Corporation

This form is authorized by Chapters 144.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than \$10 nor more than \$5,000 for each violation. Fined not less than \$10 or more than \$100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 144.99 and 162.06, Wis. Stats.

Sample		Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties					RQD/ Comments
Number	Length Recovered (in)								Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	
6	-	11	26 28 30 32	No Recovery	-					-				
7	1.6	22	34 36 38	7.5 YR 5/2 Fine-Medium grained silty sands with trace clay	SM /SC					D				
8	1.8	25	40 42 44	7.5 YR 4.5/2 Fine grained silty sands with trace clay	SM /SC					D				
9	1.8	20	46 48 50	7.5 YR 4/2 Fine grained sandy, clayey silts	ML /CL					D				
10	1.6	33	52 54 56	7.5 YR 4/3 Fine - Coarse grained sands with trace clay and gravel.	SM /SC					D				
11	1.3	31	58 60 62	7.5 YR 5/6 Fine-Coarse sands with trace of silt and clay	SM /SC					D				
12	1.2	37	64 66 68	7.5 YR 5/6 Fine grained silty sands	SM					D				
13	.5	21	70 72 74	7.5 YR 4/6 Fine-Medium grained sands	SM					D				

[illegible]

State of Wisconsin  
Department of Natural Resources

Route To:

- ☒ Solid Waste  
☐ Emergency Response  
☐ Wastewater

- ☐ Haz. Waste  
☐ Underground Tanks  
☐ Water Resources  
☐ Other

SOIL BORING LOG INFORMATION  
Form 4400-122 7-91

Page 1 of 3

Facility/Project Name

New Richmond Landfill #310

License/Permit/Monitoring Number

Boring Number

Boring Drilled By (Firm name and name of crew chief)

WTD Environmental Drilling  
Lanny Erdman

Date Drilling Started

05/21/92  
M M D D Y Y

Date Drilling Completed

05/28/92  
M M D D Y Y

Drilling Method

6" TWT Cone  
Mud Rotary

DNR Facility Well No.

WI Unique Well No.

Common Well Name

MW-2

Final Static Water Level

Feet MSL

Surface Elevation

1016.08 Feet MSL

Borehole Diameter

6" inches

Boring Location

State Plane

N

E S/C/N

Lat

Local Grid Location (If applicable)

☒ N

☒ E

NE 1/4 of SW 1/4 of Section 34, T 31 N, R 18 E

Long

1448.81 Feet ☐ S 55.41 Feet ☐ W

County

St. Croix

DNR County Code

56

Civil Town/City/ or Village

Town of Star Prairie

Sample 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	Soil Properties					P 200	RQD/ Comments
									Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit			
			2	Topsoil											
1	1.4	7	4	2.5 Y 5/4 Silty clay with trace of sand	CL					M					
			6												
			8												
2	.2	57	10	Hit rock, some gravel present	GW					M					
			12												
			14												
3	.6	27	16	10 YR 5/6 Fine - Coarse grained sands & gravels with trace silt	SW					M					
			18												
			20												
4	0	28	20	No Recovery											
			22												
			24												

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Mark W. Vint

Firm

Cedar Corporation

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Sample		Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties					P 200	RQD/ Comments
Number	Length Recovered (in)								Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit			
13	0		66 68 70 75 80 85 90 95 100 105 110 115	No Recovery - Bedrock  Dolomite fragments in cuttings  * change in scale  Lost Circulation @ 79.0'          E.O.B. @ 112'			#30 Sand 1/2" BENTONITE PELLETS GRANULAR BENTONITE								

Route To:  
☒ Solid Waste  
☐ Emergency Response  
☐ Wastewater  
☐ Haz. Waste  
☐ Underground Tanks  
☐ Water Resources  
☐ Other

SOIL BORING LOG INFORMATION  
Form 4400-122 7-91

Page 1 of 3

Facility/Project Name New Richmond Landfill #310  
 Boring Drilled By (Firm name and name of crew chief)  
WTD Environmental Drilling  
Steve Shackleton  
 License/Permit/Monitoring Number \_\_\_\_\_ Boring Number \_\_\_\_\_  
 Date Drilling Started 05/07/92 Date Drilling Completed 05/18/92 Drilling Method 6" Thr Cone  
MM DD YY MM DD YY Mud Rotary  
 DNR Facility Well No. \_\_\_\_\_ Unique Well No. \_\_\_\_\_ Common Well Name MW-3 Final Static Water Level \_\_\_\_\_ Surface Elevation 1019.83 Feet MSL Borehole Diameter 6 inches  
 Boring Location \_\_\_\_\_ State Plane \_\_\_\_\_ N. \_\_\_\_\_ E S/C/N \_\_\_\_\_ Lat \_\_\_\_\_ Local Grid Location (If applicable) \_\_\_\_\_  
NE 1/4 of SW 1/4 of Section 34 T 31 N, R 18 E/W Long \_\_\_\_\_  
 County St. Croix DNR County Code 56 Civil Town/City/ or Village Town of Star Prairie

Sample 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	Soil Properties					ROD/ Comments
									Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	
1	1.4	25	6	7.5 YR 4/4 Fine - Medium grained sands with trace silt	SM				M					
2	1.2	45	8	7.5 YR 4/4 Fine - Medium grained sands with trace silts and gravels	SM				M					
3	.3	80	14	10 YR 5/4 Fine - Coarse grained sands and gravels, some cobbles present	GM				M					
4	.1	135	20	10 YR 5/4 Same as above	GM				M					
5	.6	66	24	10 YR 5/4 Fine - Coarse grained sands with trace silt	SW				M					

I hereby certify that the information on this form is true and correct to the best of my knowledge.  
 Signature Mark W. Vinate Firm Cedar Corporation

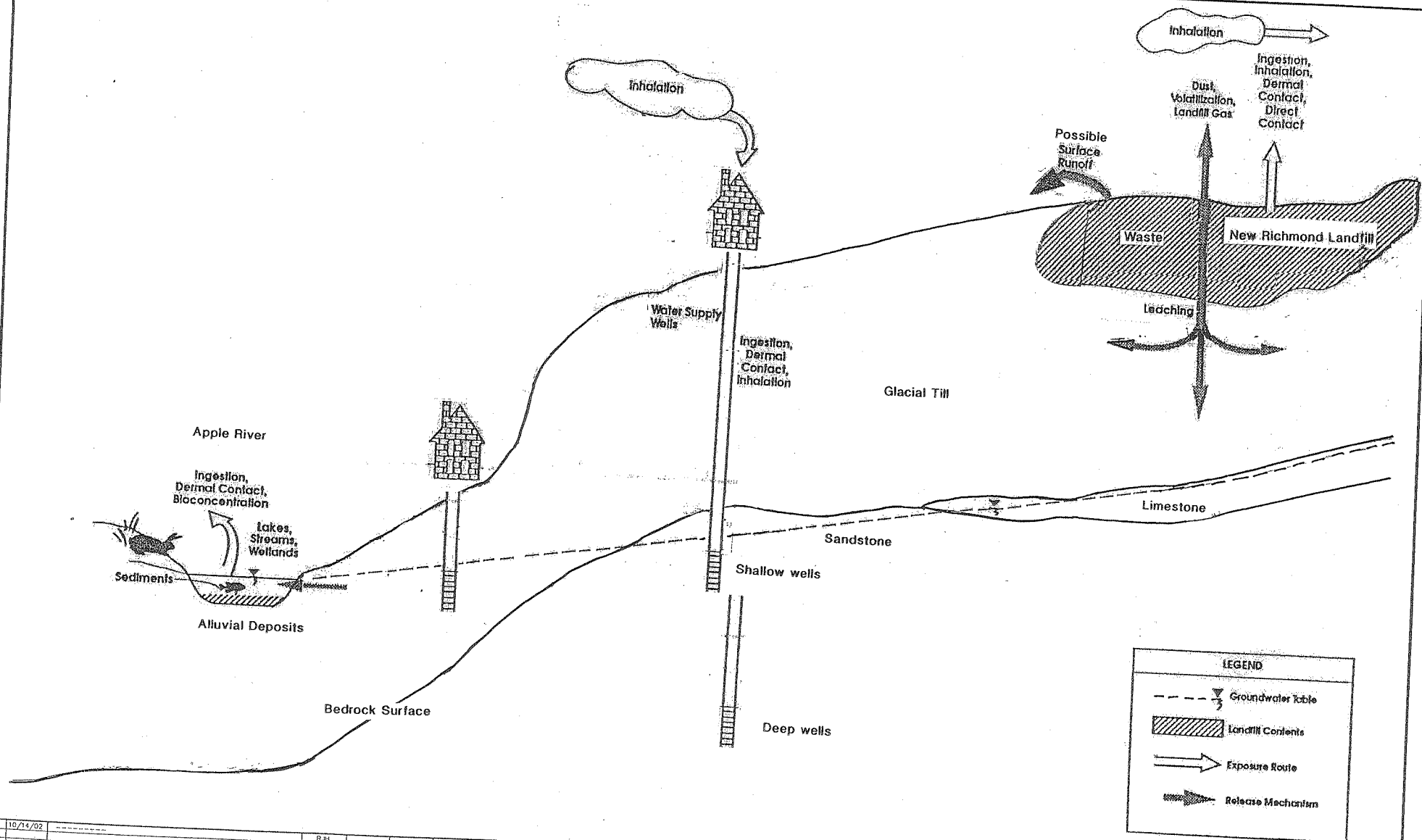
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Sample		Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties					RQD/ Comments
Number	Length Recovered (in)								Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	
			26											
6	-	81	28	10 YR 4/3 Fine - Coarse grained sands with trace silt	SW					M				
			30											
			32											
7	.5	100	34	10 YR 4/3 Same as above	SW					M				
			36											
			38											
8	.5	130	40	10 YR 6/4 Fine grained sands with trace silt	SM					M				
			42											
			44											
9	1.3	105	46	10 YR 6/4 Same as above	SM					M				
			48											
10	-	100 15	50	10 YR 6/4 Same as above with trace sandstone fragments	SM					M				
			52											
			54											
11	.1	170	56	10 YR 4/4 Fine grained sands with trace of silt and gravel	SM					M				
			58											
12	1.5	87	60	10 YR 4/4 Fine - Medium grained silty sand with trace clay and gravel	SM					M				
			62											
			64											

GRANULAR BENTONITE

[illegible]



State of Wisconsin  
Department of Natural Resources

Route To:  
☒ Solid Waste  
☐ Emergency Response  
☐ Wastewater  
☐ Haz. Waste  
☐ Underground Tanks  
☐ Water Resources  
☐ Other

SOIL BORING LOG INFORMATION  
Form 4400-122  
7-91

Page 1 of 3

Facility/Project Name <u>New Richmond Landfill # 310</u>		License/Permit/Monitoring Number		Boring Number	
Boring Drilled By (Firm name and name of crew chief) <u>WTD Environmental Drilling</u> <u>Larry Erdman</u>		Date Drilling Started <u>05/09/92</u> MM DD YY		Date Drilling Completed <u>05/20/92</u> MM DD YY	
DNR Facility Well No. <u>WI Unique Well No.</u>		Common Well Name <u>MW-4</u>		Final Static Water Level ____ Feet MSL	
Boring Location State Plane _____ N, _____ E S/C/N		Local Grid Location (If applicable) <input checked="" type="checkbox"/> N <input checked="" type="checkbox"/> E <u>NE 1/4 of SW 1/4 of Section 34, T 31 N, R 18 E(W)</u>		Surface Elevation <u>1021.40</u> Feet MSL	
County <u>St. Croix</u>		DNR County Code <u>5 6</u>		Civil Town/City/ or Village <u>Town of Stan Prairie</u>	
Borehole Diameter <u>6"</u> inches		Drilling Method <u>6" Tr Cone</u> <u>Mud Rotary</u>			

Sample 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	Soil Properties					P 200	RQD/ Comments
									Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit			
1	.8	15	6	7.5 YR 4/4 Fine-Medium grained sands with trace silt and gravel	SW					M					
2	0	42	10	No Recovery											
3	.1	28	16	Pounded on rock. Believe to be sands and gravels	GP										
4	.1	53	20	Pounded on rock. Believe to be gravel and cobbles	GP										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Mark W. Venable

Firm

Cedar Corporation

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Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties					RQD/ Comments
Number	Length Recovered (in)								Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	
5	1.0	32	26	7.5 YR 4/4 Medium-coarse grained sand, trace silt	SW					W				
			28											
6	.4	39	30	7.5 YR 4/4 same as above with trace gravel	SW					W				
			32											
7	0	70	34	No Recovery	-					-				
			36											
			38											
8	0	59	40	No Recovery	-					-				
			42											
			44											
9	1.0	42	46	7.5 YR 5/6 silty sands with traces of clay and gravel	SM					W				
			48											
10	.6	75	50	7.5 YR 5/8 silty sands with traces of silt	SM					W				
			52											
			54											
11	1.0	41	56	10 YR 5/6 silty sands with traces gravel.	SM					W				
			58											
12	1.0	58	60	10 YR 5/6 same as above	SM					M				
			62											
			64											

GRANULAR BENTONITE SLURRY

[illegible]

State of Wisconsin  
Department of Natural Resources

Route To:

- ☒ Solid Waste  
☐ Emergency Response  
☐ Wastewater  
☐ Haz. Waste  
☐ Underground Tanks  
☐ Water Resources  
☐ Other

SOIL BORING LOG INFORMATION  
Form 4400-122 7-91

Page 1 of 2

Facility/Project Name

New Richmond Landfill #310

License/Permit/Monitoring Number

Boring Number

Boring Drilled By (Firm name and name of crew chief)

WTD Environmental Drilling

Lanny Endman

Date Drilling Started

05/15/92  
M M D D Y Y

Date Drilling Completed

06/03/92  
M M D D Y Y

Drilling Method

DNR Facility Well No.

WI Unique Well No.

Common Well Name

P-5

Final Static Water Level

Feet MSL

Surface Elevation

Feet MSL

Borehole Diameter

inches

Boring Location

State Plane

N

E S/C/N

Lat

Local Grid Location (If applicable)

☐ N

☐ E

Feet

☐ S

Feet

☐ W

NE 1/4 of SW 1/4 of Section 34, T 31 N, R 18 E Long

County

St. Croix

DNR County Code

5 6

Civil Town/City/ or Village

Town of Stan Prairie

Sample		Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties					RQD/ Comments
Number	Length Recovered (in)								Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	
			5 10 15 20 25 30 35 40 45 50 55 60	Blind Drill.  See Boring Log for MW-4		GRANULAR KENTONITE SLURRY								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Mark W. Vint

Firm

Cedar Corporation

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Sample		Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties					RQD/ Comments
Number	Length Recovered (in)								Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	
			65											
			70											
			75											
			80											
			85											
			90											
			95											
			100											0.0'
			105											28 %
			110											
			115											
			120											
			125											
			130											
			135											
			140											
			145											
			150											
			155											
			160											
			165											

Start coring @ 93.0'  
 #1 recovered 1.0'  
 Fractured Dolomite  
 #2 recovered 4.1'  
 Fractured Dolomite

GROUND BEA TONITE CLAY  
 12" BEA TONITE PELLETS  
 #30 FINE SAND

E.O.B. @ 156.0'



Route To:

- ☒ Solid Waste  
☐ Emergency Response  
☐ Wastewater  
☐ Haz. Waste  
☐ Underground Tanks  
☐ Water Resources  
☐ Other

SOIL BORING LOG INFORMATION  
Form 4400-122  
7-91

Page 1 of 4

Facility/Project Name

New Richmond Landfill #310

License/Permit/Monitoring Number

Boring Number

Boring Drilled By (Firm name and name of crew chief)

WTD Environmental Drilling

Eric Schoenberg

Date Drilling Started

05/05/92  
MM DD YY

Date Drilling Completed

05/14/92  
MM DD YY

Drilling Method

6" Tri-Cone  
Mud Rotary

DNR Facility Well No. WI Unique Well No.

Common Well Name

MW-6

Final Static Water Level

Feet MSL

Surface Elevation

1052 Feet MSL

Borehole Diameter

6 inches

Boring Location

State Plane

N

E S/C/N

Lat

Local Grid Location (If applicable)

☒ N

☒ E

NE 1/4 of SW 1/4 of Section 34, T 31 N, R 18 E/W

1806.18 Feet ☐ S 461.53 Feet ☐ W

County

St. Croix

DNR County Code

56

Civil Town/City or Village

Town of Stan Prairie

Sample 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	Soil Properties					RQD/ Comments
									Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	
				TOPSOIL										
			2	Upper 8 feet is composed of cobbles, gravel and sands. Could not sample.										
			4											
			6											
			8											
1	.6	21	10	10 YR 4/3 coarse grained sand with cobbles and gravel.	GW					D				
			12											
2	.8	32	14	10 YR 4/3 Medium - Coarse grained sands with cobbles and gravel.	GW					D				
			16											
3	-	21	18											
			20		GW									
			22											
4	-	18	24	Drilled as if in same material as before. Cuttings were similar to those in samples 1 and 2.	GW									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Mark W. Vinate

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Cedar Corporation

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Sample		Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties					ROD/ Comments
Number	Length Recovered (in)								Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	
4			26											
5	1.0	24	28	10 YR 4/4 Fine - Coarse grained sands with trace silt and clay.	SM					D				
6	1.1	27	30											
			32											
7	1.1	27	34	7.5 YR 5/8 Fine grained silty sands with trace gravel	SM					D				
			36											
			38											
7	1.3	77	40	7.5 YR 5/6 Fine - Medium grained sands with trace silt	SM					D				
			42											
8	1.6	18	44	10 YR 5/6 Silty sands with trace of clay	SM/ SC					D				
			46											
			48											
9	1.6	17	50	10 YR 5/6 Silty sands with trace clay and gravel	SM/ SC					D				
			52											
10	0.3	11	54	10 YR 5/6 Same as above	SM/ SC					D				
			56											
			58											
11	1.7	12	60	10 YR 5/6 Same as above	SM/ SC					D				
			62											
12	1.1	11	64	10 YR 5/4.5 Silty sands with trace clay. Some pebbles	SM/ SC					D				

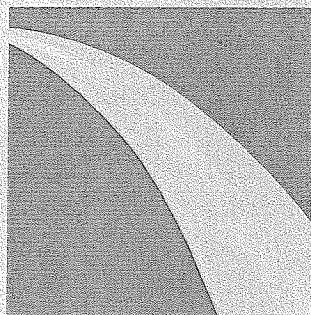
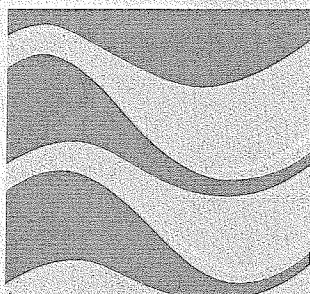
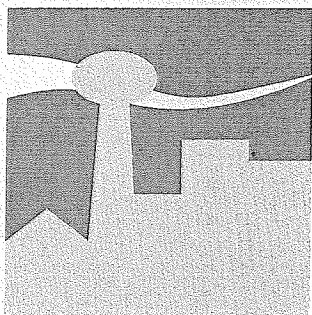
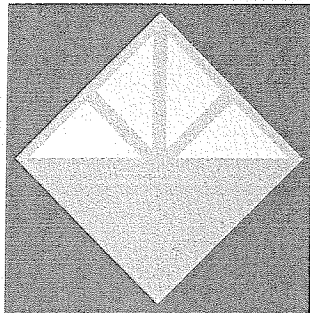
GRANULAR KENTONITE SLURRY

Sample		Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties					RQD/ Comments
Number	Length Recovered (m)								Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	
12	1.1	11	66	10 YR 5/4.5 silty sands with trace clay. some pebbles.	SM /SC					D				
13	1.0	43	68	10 YR 6.5/4 Clean fine grained <del>to</del> sand. Looks like weathered sandstone	SP					D				
14	1.3	47	70	Weathered Bedrock - white (sandstone)	-					D				
15	-	78	72	Slightly weathered bedrock * <u>scale change</u>	-					-				
			74											
			76											
			78											
			80											
			85											
			90											
			95											
			100	Lost drilling mud through fractures on voids										
			105	Regained circulation after filling void with holeplug.										
			110	Lost all drilling mud through a 1.0 ft fracture on void. Never regained circulation.										
			115											
			120	Rate of drilling suggests highly fractured rock from 111' to 135'										
			125											
			130											
			135											
			140											

10 YR 5/4.5 silty sands with trace clay. some pebbles.  
 10 YR 6.5/4 Clean fine grained ~~to~~ sand. Looks like weathered sandstone  
 Weathered Bedrock - white (sandstone)  
 Slightly weathered bedrock \* scale change  
 Lost drilling mud through fractures on voids  
 Regained circulation after filling void with holeplug.  
 Lost all drilling mud through a 1.0 ft fracture on void. Never regained circulation.  
 Rate of drilling suggests highly fractured rock from 111' to 135'



Duplicate



## Site Evaluation Report

*Former New Richmond Landfill*  
*WDNR License No. 2492*

New Richmond, Wisconsin

SEH No. NRLSP0301.00

October 2002



**SHORT ELLIOTT HENDRICKSON INC**

Multidisciplined.  
Single Source.

---

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# Site Evaluation Report

**Former New Richmond Landfill  
WDNR License No. 2492**

Prepared for the New Richmond Landfill Settling PRPs

---

## 1.0 Introduction and Background

Short Elliott Hendrickson Inc. (SEH) has prepared this Site Evaluation Report (SER) on behalf of the New Richmond Landfill Settling Potentially Responsible Parties (Settling PRPs) listed on Table 1, "New Richmond Landfill Settling PRPs." On September 17, 2002 (Effective Date), the Secretary of the Wisconsin Department of Natural Resources (WDNR) signed Environmental Repair Contract #SF-02-01 (Contract) for the New Richmond Landfill (WDNR License No. 2492).

This SER is required to be submitted to the WDNR to document background information and studies pertinent to the project and as a scoping document to preliminarily identify proposed investigation activities, operable units, and sampling needs that will be further detailed in a Draft Remedial Investigation (RI) and Feasibility Study (FS) Work Plan due to the WDNR on December 15, 2002.

### 1.1 Project Objectives

The purpose of the RI is to collect data necessary to adequately define the boundaries of the site and off-site study area and to characterize the degree and extent of impacts to groundwater, subsurface soil, surface water, and sediment that may be the result of migration from the landfill. Landfill gas and leachate generation at the landfill will also be evaluated during the RI.

A Baseline Risk Assessment will be prepared to determine if unacceptable risk exists to human health and the environment. The purpose of the FS is to develop and evaluate appropriate remedial action alternatives to prevent, mitigate, or otherwise remedy those releases or threatened releases of hazardous substances from the

---

Several small lakes and wetland areas occur in the Apple River floodplain. Moderate to slightly steep river valley slopes characterizes the transition from the flat, low-lying Apple River valley to the rolling hills area near the landfill.

**Physiography:** Properties in the area are primarily undeveloped, residential, and/or agricultural. The primary agricultural activities occurring in the area consist of grazing land and dairy farm operations. Some previous agricultural land has been developed into pine plantations. Portions of several properties are in Managed Forest Law (MFL) programs under the WDNR and/or Conservation Reserve Program (CRP) under the United States Department of Agriculture (USDA) Farm Service Agency (FSA). There is minimal to moderate recreational activities in the small lakes and Apple River within the study area.

### 3.1.3 Hydrology

Average annual precipitation in the New Richmond area is approximately 23 inches. Approximately 82 percent of the precipitation re-enters the atmosphere through evapotranspiration, with the remainder either entering surface water as runoff or infiltrating into groundwater (Young and Hindall, 1973). The area is characterized by low groundwater discharge due to low permeability and the poor storage capacity of the glacial deposits and underlying Prairie du Chien Group bedrock unit.

Direction and volume of surface runoff varies with location and topography. Surficial soils in the area are generally poorly drained due to the underlying fine-grained soils that limit infiltration. Several surface water ponds exist in the area west and northwest of the landfill. Based on surface water elevations and area topography, regional groundwater flow direction is expected to be to the northwest towards the Apple River.

### 3.1.4 Geology

Based on review of the Hydrologic Investigations Atlas "Water Resources of Wisconsin - St. Croix River Basin" (Young and Hindall, 1973), the uppermost bedrock unit at the site consists of Ordovician aged dolomites and sandstones of the Prairie du Chien Group. A thick layer of Cambrian sandstone underlies this bedrock unit. The contact between these groups at the bedrock surface occurs just to the northwest of the landfill resulting in disappearance of the Prairie du Chien Group just to the northwest of the site. A regional fault is present in bedrock in the approximate vicinity of the site (Young and Hindall, 1973). The fault trends north-northeast to south-southwest, with the upthrown side located on the west side of the fault line. The exact location of this fault has not been determined.

Boring logs from site monitoring wells indicate the thickness of the Prairie du Chien Group at the landfill ranges from approximately 0 to 50 feet. Elevation of the bedrock surface at the landfill ranges from approximately 915 to 965 MSL. Review of available regional well logs indicates the elevation of the bedrock surface drops considerably to the north and west of the site. Wells drilled to elevations as low as 785 MSL did not encounter bedrock approximately one mile to the northwest of the site.

A geological cross section of the landfill is shown on Figure 3, "Geologic Cross Section." However, geological cross sections have not been generated for the remainder of the study area due to differing interpretations of subsurface features by well drillers.

Unconsolidated deposits at the landfill generally consist of sand, silty sand, and gravel glacial end moraine and unpitted outwash deposits. Unconsolidated deposits at the landfill range from approximately 60 to 105 feet thick. Regional thickness of unconsolidated deposits generally range from 50 to 150 feet (Young and Hindall, 1973). However, available regional well logs indicate thicker unconsolidated deposits are present to the northwest of the landfill. Available well logs in this area indicate that up to 210 feet of unconsolidated deposits are present at some locations.

### 3.1.5 Hydrogeology

Depth to groundwater measurements from landfill monitoring wells indicate direction of shallow groundwater flow in the vicinity of the landfill is generally to the northwest toward the Apple River. The horizontal hydraulic gradient based on measurements at the landfill wells is approximately 0.01 ft/ft. Depth to groundwater at the landfill ranges from approximately 100 to 150 below ground surface (bgs).

The water table is generally located within the limestone or sandstone bedrock beneath the landfill. According to available well logs, private wells in residential development north of the site along 115<sup>th</sup> Street generally obtain potable water from the bedrock aquifer. Available well construction details indicate several wells further to the north and west of the landfill are completed in the unconsolidated glacial soils. Since this is the anticipated direction of shallow groundwater flow, it appears that groundwater flows out of the bedrock and into the glacial soils moving toward the Apple River due to the aforementioned drop in bedrock surface elevation to the north and west. Figure 4, "Well Location Map and Groundwater Status" shows the location of the respective private wells.

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Analytical laboratory reports for private well sampling events have been previously provided as required by the WDNR.

Geochemical data has been collected from select private wells. Private wells, typically, are not ideal for aquifer characterization since they are generally pumped rapidly to produce relatively large volumes of water. However, select private wells were tested for comparative trend analysis and to provide design information for the POE treatment systems. Results of the geochemical testing on the selected private wells are shown on Table 6.

### **3.4 Landfill Gas**

Landfill gas samples were collected from monitoring wells MW-1, MW-2, and MW-3 and analyzed for VOCs using U.S. EPA Method TO-14. Results of the landfill gas monitoring indicated that the chemical constituents in the vapor are very similar to the constituents in the groundwater, suggesting that volatilization and partitioning are likely occurring. Table 9, "Landfill Gas Analytical Results" contains results of the landfill gas monitoring.

Several forms of Freon™ were also detected in the landfill gas samples. Freon is a trademark for a series of fluorocarbon products used in refrigeration and air conditioning equipment, and is generally very volatile. Freons are commonly found in landfill gas due to the disposal of refrigerators, air conditioners, and aerosol cans. Under normal conditions, freon is in the gaseous state and essentially stable and inert.

### **3.5 Geophysical Investigation**

#### **3.5.1 Geophysical Survey Results and Interpretations**

Locations of seismic refraction lines, resistivity profiling lines and resistivity sounding stations are shown on Figure 5, "New Richmond Landfill Investigation - Base Map for Geophysical Survey." The results of the seismic refraction, profiling and resistivity sounding surveys agree fairly well with known subsurface conditions in the study area. Fromm's resistivity profiling and seismic refraction interpretations are presented on Figure 6, "New Richmond Landfill Investigation - Contour Plot of Apparent Resistivity for a 50 m A Space (ohm\*m)" and Figure 7, "New Richmond Landfill Investigation - Contour Plot of Seismic Refraction Derived Overburden Thickness (ft.)," respectively.

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The resistivity profiling data shown on Figure 6 indicates several prominent high resistivity (above 700 ohm\*m) areas along the east and north regions of the study area. The high resistivity areas within the electrode "A" spacing (50 feet to +/- 140 feet bgs) have been interpreted using resistivity sounding data as either representing:

- A sand/gravel unit with little or no clay fraction; or
- The remains of highly weathered, poorly cemented bedrock unit.

A lower resistivity trough can also be discerned from the resistivity profile data. As shown on Figure 6, the axis of the trough trends northwesterly from the landfill area. This low resistivity trough may represent:

- A significant increase in the clay content of the overburden; or
- Depth to groundwater has decreased.

Seismic refraction interpretations have been used to estimate overburden thicknesses and develop a bedrock surface contour map in the study area. Figure 8, "New Richmond Landfill Investigation - Contour Plot of Seismic Refraction Derived Bedrock Elevation (ft.)" shows a general thinning of overburden in the north and southeast regions of the study area. Overburden thicknesses are greatest north and west of the landfill as shown on Figure 7. The average overburden thickness in the study area is 58 feet. A minimum overburden thickness of 34 feet was determined in the northern region of the study area. A maximum overburden thickness of 93 feet was determined in the southeast corner of the study area near the landfill.

Inherent with the seismic refraction data interpretation is the assumption that seismic velocities increase with depth. However, velocity inversions can occur where lower velocity subsurface units underlie higher velocity units. In the study area, Fromm interpreted velocity inversions using the resistivity sounding data. This velocity inversion can affect the interpreted depths to the bedrock surface. However, the seismic refraction data is consistent within the study area, and good correlation of the data with known geologic conditions, indicate that velocity inversions may have limited impact on the seismic results. The results of any velocity inversions may result in assuming a correction factor by using a constant factor or percentage of the projected depths to the interpreted bedrock elevations.

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In order to develop a bedrock elevation map for the study area, overburden thicknesses were subtracted from the ground surface elevations to produce Figure 8. As indicated on Figure 8, the bedrock surface is interpreted to slope in a general northerly direction across the study area. A bedrock trough or low area, is interpreted to extend north and northwesterly from the southeast region of the study area. Comparison of the bedrock surface topography to the ground surface topography indicates that the variations in bedrock topography are generally responsible for surface topographic relief. This conclusion may allow for interpretation of bedrock topography outside the study area by analyzing ground surface elevations.

**Table 2**  
**Project Chronology**

**Initial Discovery of VOCs in Groundwater/Interim Action**

4,5,6/99	Wisconsin Department of Natural Resources (WDNR) collects groundwater samples from select private wells down gradient of the landfill. Volatile organic compounds (VOCs) detected at concentrations above ch. NR 140 Enforcement Standards (ES) in samples from ten private wells.
4/99	Short Elliott Hendrickson (SEH) collects groundwater samples from landfill wells for analysis of VOCs as a result of identifying VOCs in private well samples.
7/99	City of New Richmond (City) provides bottled water to 13 residences with concentrations of VOCs above or near ch. NR 140 ES concentrations.
8/99	City, WDNR, and SEH meet to discuss known private well impacts and an approach to sample other nearby private wells potentially impacted. WDNR requests that an Alternative Water Supply evaluation be conducted to determine, at a minimum, a short-term approach to provide residences with a clean potable water supply.
1/00	SEH submits Plumbing Product Review Applications to Wisconsin Department of Commerce (DCOM) for nine point-of-entry (POE) granular activated carbon (GAC) treatment systems provided by North American Aqua (NAA). SEH collects groundwater samples from WDNR-recommended private wells. Results of residential well sampling submitted to WDNR and residents.
2/00	SEH and City receive written approval from DCOM to proceed with experimental approval process for NAA POE systems. SEH submits Water Treatment System Application to the WDNR for installation approval of POE systems provided by NAA.
3/00	WDNR approves Water Treatment System Application and prescribes operations, maintenance and monitoring (OMM) schedule for POE systems.
4/00	SEH collects groundwater samples from WDNR-recommended private wells. Results of residential well sampling submitted to WDNR and residents.

**POE System Installation/OMM**

5/00	POE systems installed at nine residences. Initiation of DCOM and WDNR prescribed monitoring programs. OMM schedules are specific to residence contaminant concentrations and water use calculations.
8/00	SEH submits first quarterly report documenting POE system OMM to residents, WDNR, and DCOM.
9/00	SEH submits proposed POE system OMM modifications to WDNR.

10/00	WDNR provides conditional approval to modify POE system OMM at select residences. SEH submits additional information required by the WDNR regarding conditional approval of POE system OMM modifications.
2/01	SEH submits second quarterly report documenting POE system OMM to residents, WDNR, and DCOM.
5/01	SEH performs POE system GAC canister change-outs per WDNR requirements at the nine POE system residences. SEH submits annual report documenting POE system OMM to residents, WDNR, and DCOM.
5/02	SEH performs POE system GAC canister change-outs per WDNR requirements at the nine POE system residences.
7/02	SEH submits annual report documenting POE system OMM to residents, WDNR, and DCOM.

#### **Non-System Monitoring**

7/00	SEH collects groundwater samples from all WDNR recommended non-system residences. Results of residential well sampling submitted to WDNR and residents.
10/00	SEH collects groundwater samples from all WDNR recommended non-system residences. Results of residential well sampling submitted to WDNR and residents.
12/00	SEH submits proposed monitoring modifications to non-system sampling schedule designating certain wells for quarterly, semi-annual, or annual sample collection. The proposal also recommended discontinuing monitoring at a few select private wells.
2/01	City receives WDNR conditional approval of non-system monitoring modifications SEH submits letters to non-system residents informing them of the monitoring modifications. SEH collects groundwater samples from quarterly non-system residences in accordance with WDNR approvals. Results of residential well sampling submitted to WDNR and residents.
4/01	SEH collects groundwater samples from semi-annual non-system residents in accordance with WDNR approvals. Results of residential well sampling submitted to WDNR and residents.
7/01	SEH collects groundwater samples from quarterly non-system residents. Results of residential well sampling submitted to WDNR and residents.
10/01	SEH collects groundwater samples from annual non-system residents. Results of residential well sampling submitted to WDNR and residents.
1/02	SEH collects groundwater samples from quarterly non-system residents. Results of residential well sampling submitted to WDNR and residents.
4/02	SEH collects groundwater samples from semi-annual non-system residents. Results of residential well sampling submitted to WDNR and residents.
7/02	SEH collects groundwater samples from quarterly non-system residents. Results of residential well sampling submitted to WDNR and residents.



### Preliminary Site Investigation Activities

9/99	SEH submits groundwater sampling plan to WDNR.
10/99	SEH collects groundwater samples from landfill monitoring wells and private wells in accordance with work plan. SEH collects samples from select private wells and landfill monitoring wells for analysis of geochemical parameters.
11/99	SEH submits results of 10/99 sampling to WDNR.
12/99	WDNR approves discontinuing monitoring landfill wells until sampling is required during a negotiated remedial investigation scope of work.
5/00	SEH submits first informational newsletter regarding status of landfill project.
7/00	SEH prepares and submits Preliminary Site Investigation Work Plan to WDNR.
9/00	SEH receives Conditional Preliminary Site Investigation Work Plan approval from the WDNR.
10/00	SEH negotiates access agreements with landowners to perform geophysical study.
11/0-12/00	Fromm Applied Technologies performs geophysical study (electrical resistivity soundings and seismic refraction) of study area. SEH performs survey of study area to locate geophysical monitoring points, to collect control data for Horizons, Inc.'s topographical study, and to locate locations and elevations of private wells in the study area and monitoring wells at the landfill.
1/01-3/01	Horizons, Inc. conducts topographical survey of study area.



# USGS NEW RICHMOND NORTH QUADRANGLE

WISCONSIN - ST. CROIX CO. 7.5 MINUTE SERIES

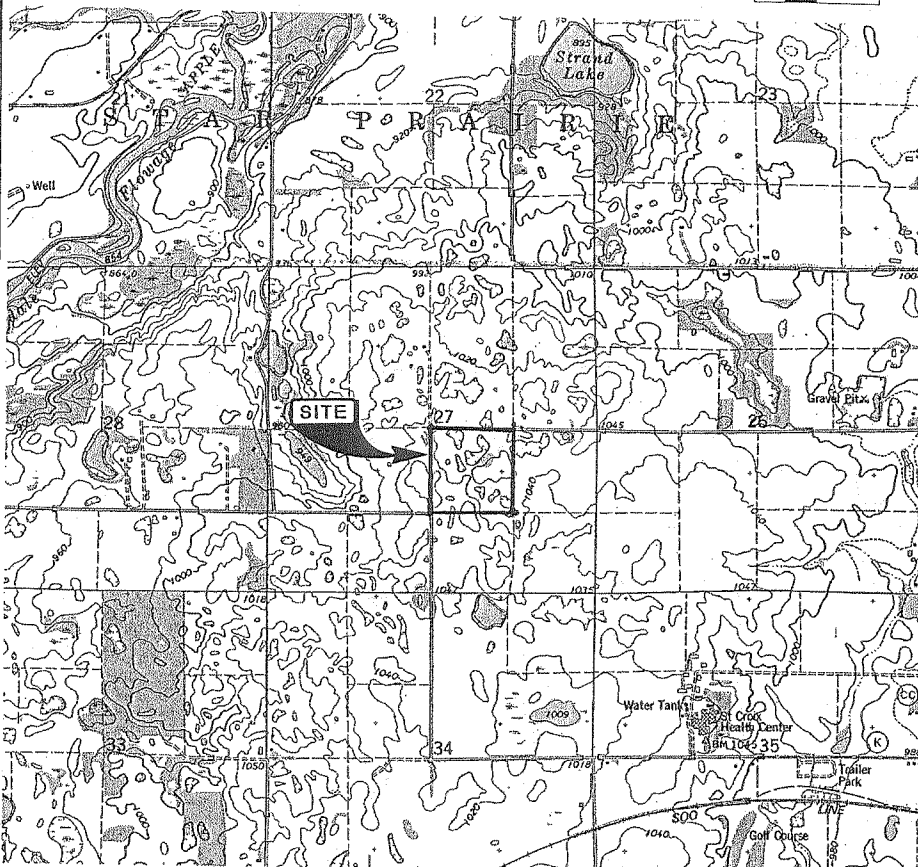
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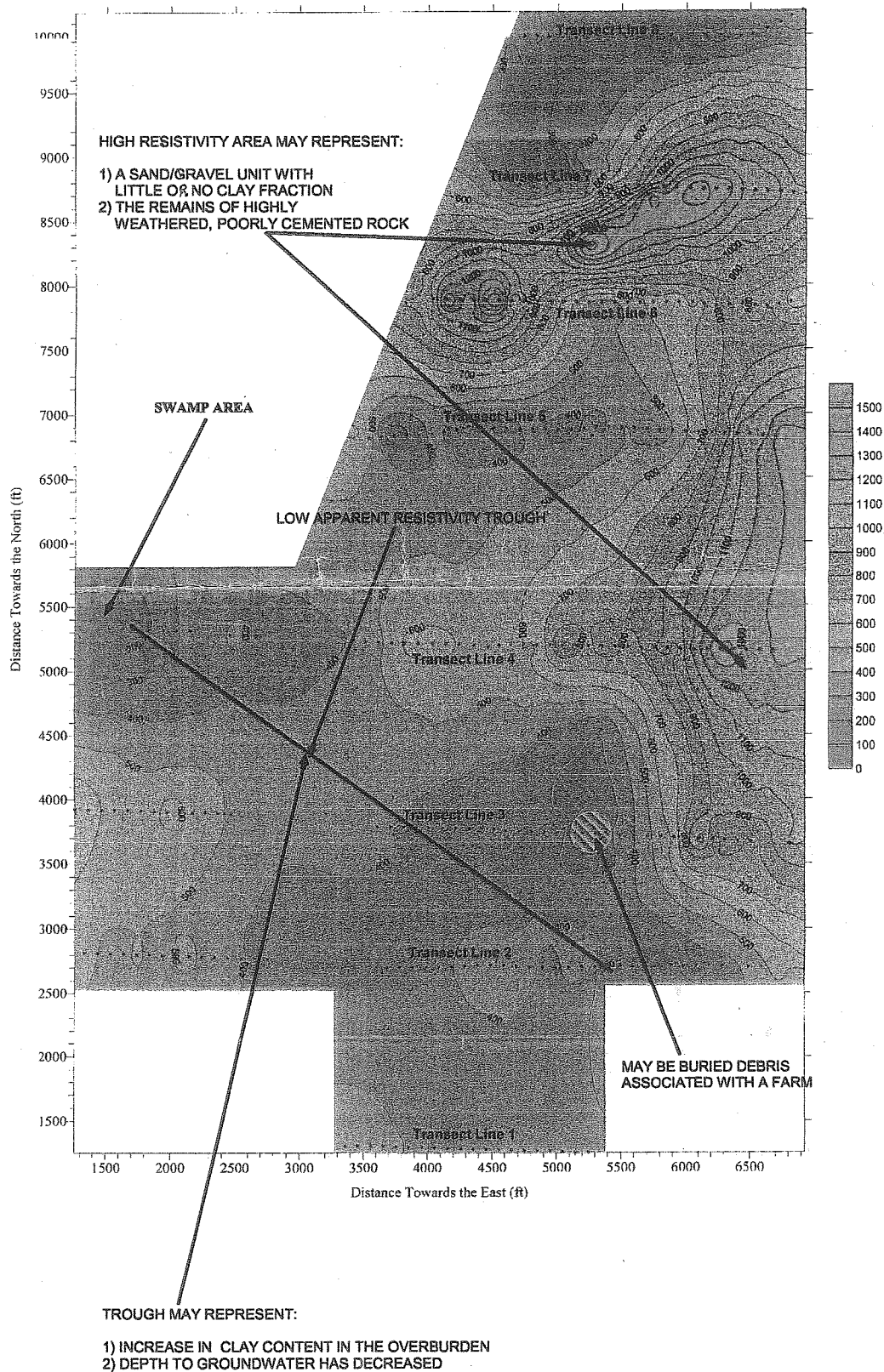
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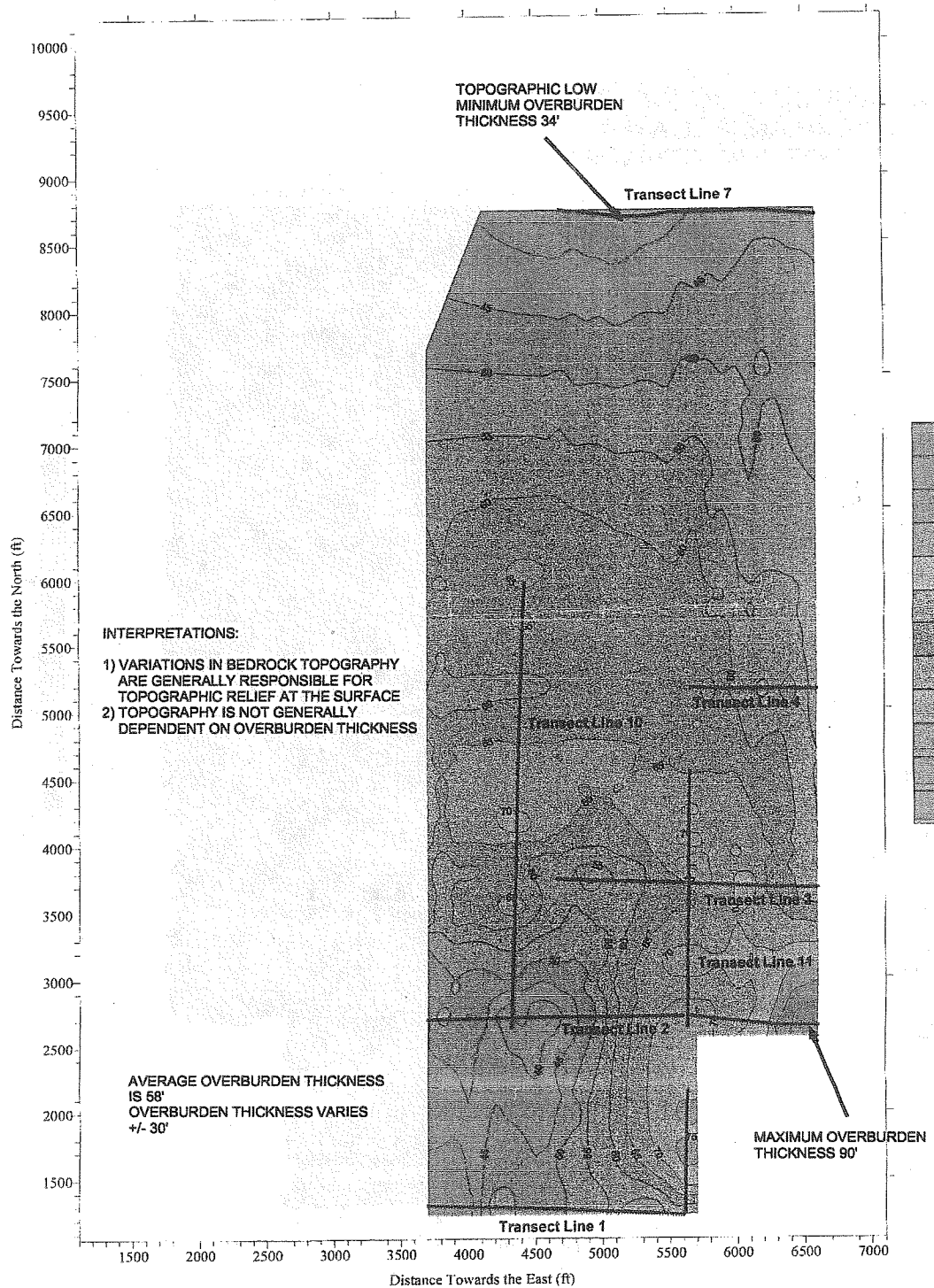
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NO.	DATE	ISSUE/REVISIONS	DRAWN BY	DESIGN	FIELD REVIEW	QC CHECK	
		<b>NEW RICHMOND LANDFILL SITE EVALUATION REPORT</b>		<b>FIGURE 1 SITE LOCATION</b>		PROJ. NO. BLOOM9501.00 DATE 10/10/02	
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Figure 6: New Richmond Landfill Investigation--Contour Plot of Apparent Resistivity for a 50m A Space (ohm\*m)



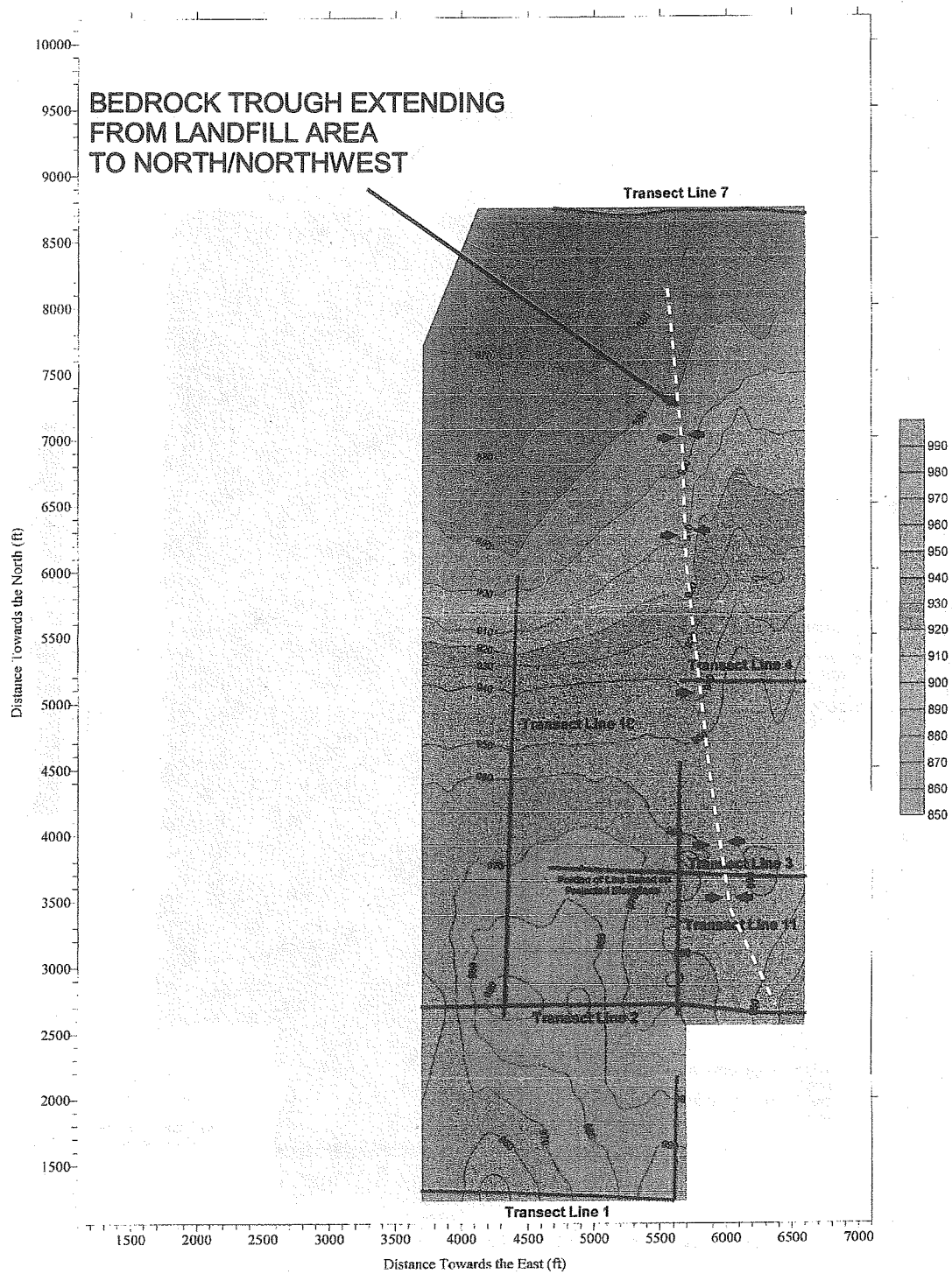
(modified from Fromm Applied Technology Report, 2001)

Figure 7: New Richmond Landfill Investigation--Contour Plot of Seismic Refraction Derived Overburden Thickness (ft.)



(modified from Fromm Applied Technology Report, 2001)

Figure 8: New Richmond Landfill Investigation--Contour Plot of Seismically Derived Bedrock Elevation (ft)



(modified from Fromm Applied Technology Report, 2001)