# 2018 Annual Groundwater Monitoring and Corrective Action Report

Pleasant Prairie Power Plant Ash Landfill
Pleasant Prairie, Wisconsin

## **We Energies**

January 31, 2019



JANUARY 31, 2019 | PROJECT #71202

## 2018 Annual Groundwater Monitoring and Corrective Action Report

Pleasant Prairie Power Plant Ash Landfill

Pleasant Prairie, Wisconsin

Prepared for:

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### **ACRONYMS AND ABBREVIATIONS**

ASD Alternate Source Demonstration

B Boron

CCR Coal Combustion Residuals
CFR Code of Federal Regulations

F Fluoride

mg/L milligrams per liter

OBG O'Brien & Gere Engineers, Inc., part of Ramboll

P4 Pleasant Prairie Power Plant SSI Statistically Significant Increase

TBD To be Determined



#### **INTRODUCTION**

This report has been prepared on behalf of We Energies by O'Brien & Gere Engineers, Inc., part of Ramboll (OBG), to provide the information required by Title 40 of the Code of Federal Regulations (40 CFR) 257.90(e) for the Pleasant Prairie Power Plant (P4) Ash Landfill located in Pleasant Prairie, Wisconsin.

In accordance with 40 CFR 257.90(e), the owner or operator of an existing coal combustion residual (CCR) unit must prepare an annual groundwater monitoring and corrective action report (Annual Report) for the preceding calendar year. The Annual Report must document the status of the groundwater monitoring and corrective action program for the CCR unit and summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. At a minimum, the Annual Report must contain the following information, to the extent available:

- (1) A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;
- (2) Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;
- (3) In addition to all the monitoring data obtained under 40 CFR 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;
- (4) A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels); and
- (5) Other information required to be included in the annual report as specified in 40 CFR 257.90 through 257.98.1

This report provides the required information for the P4 Ash Landfill for calendar year 2018.

<sup>&</sup>lt;sup>1</sup> For calendar year 2018, corrective action and other information required to be included in the annual report as specified in 40 CFR 257.95 through 257.98 is not applicable.



#### 2 MONITORING AND CORRECTIVE ACTION PROGRAM STATUS

The P4 Ash Landfill remained in Detection Monitoring (40 CFR 257.94) during 2018. Detection Monitoring Program sampling dates and parameters collected are provided in Table 1. Analytical results from the two sampling rounds collected and those statistically analyzed in 2018 are included in Table 2.

In accordance with 40 CFR 257.93(h)(2), the *Statistical Analysis Plan, Pleasant Prairie Power Plant Ash Landfill* (Natural Resource Technology, an OBG Company, 2017), and within 90 days of completing sampling and analysis (receipt of data); analytical data was evaluated for statistically significant increases (SSIs) over background concentrations for Appendix III constituents at monitoring wells at the P4 Ash Landfill. SSIs and the SSI determination dates are provided in Table 1.

40 CFR 257.94(e)(2) allows 90 days to demonstrate that a SSI was caused by a source other than the CCR unit or resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (i.e., an alternate source demonstration). An alternate source demonstrations (ASD) was completed for the P4 Ash Landfill on the dates provided in Table 1. The ASD document is provided in Appendix A.

**Table 1. Detection Monitoring Program Summary** 

Detection Monitoring Round	Sampling Date	Parameters Collected	Data Received	SSI Determination Date	SSI Parameters	Resample Date	ASD Date
1	10/23/2017- 10/24/2017	Appendix III	11/20/2017	1/15/2018	B, F	1/18/2018	4/15/2018
2	4/16/2018	Appendix III	5/7/2018	8/5/2018	None	NA	NA
3	10/22/2018- 10/23/2018	Appendix III	11/6/2018	TBD (before 2/4/2019)	TBD	TBD	TBD

B - Boron

F - Fluoride

NA - Not applicable

TBD - To Be Determined

The P4 Ash Landfill remains in the Detection Monitoring Program in accordance with 40 CFR 257.94.



#### 3 KEY ACTIONS COMPLETED IN 2018

Two groundwater sampling events were completed in 2018 as part of the Detection Monitoring Program, Rounds 2 and 3. One groundwater sample was collected from each background and downgradient well in the monitoring system during each event. One resampling event was completed in accordance with the *Statistical Analysis Plan, Pleasant Prairie Power Plant Ash Landfill* (Natural Resource Technology, an OBG Company, 2017). Sampling dates are summarized in Table 1. All samples were collected and analyzed in accordance with the *Sampling and Analysis Plan* (Natural Resource Technology, Inc., 2015) prepared for the Pleasant Prairie Power Plant Ash Landfill. All monitoring data obtained under 40 CFR 257.90 through 257.98 (as applicable) in 2018, are presented in Table 2.

A map showing the groundwater monitoring system, including the CCR unit and all background (upgradient) and downgradient monitoring wells with well identification numbers, for the P4Ash Landfill is presented on Figure 1. There were no changes to the monitoring system in 2018.

Statistical evaluation, including SSI determinations, of analytical data from the Detection Monitoring Program for October 23-24, 2017 (Detection Monitoring Round 1) and April 16, 2018 (Detection Monitoring Round 2) were completed within 90 days of receipt of the analytical data. Statistical evaluation of analytical data is being performed in accordance with the *Statistical Analysis Plan, Pleasant Prairie Power Plant Ash Landfill* (Natural Resource Technology, an OBG Company, 2017).

An ASD for Detection Monitoring Round 1 dated April 15, 2018 was prepared for the P4 Ash Landfill in 2018 and is provided in Appendix A. The ASD was prepared in accordance with 40 CFR 257.94(e)(2) and provides a description, data, and pertinent information supporting an alternate source applicable to the wells and parameters with SSIs at the P4 Ash Landfill. The ASD supports the position that the SSIs observed during the Detection Monitoring Round 1 were not due to a release from the CCR unit but were either from an error in sampling or analysis or from naturally occurring conditions (e.g. natural variation in groundwater quality). There were no wells or parameters with SSIs during Detection Monitoring Round 2, as indicated in Table 1.



# PLEASANT PRAIRIE POWER PLANT ASH LANDFILL 2018 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT PROBLEMS ENCOUNTERED AND ACTIONS TO RESOLVE PROBLEMS

### 4 PROBLEMS ENCOUNTERED AND ACTIONS TO RESOLVE PROBLEMS

No problems were encountered during implementation of the Detection Monitoring Program during 2018. Groundwater samples were collected and analyzed in accordance with the *Sampling and Analysis Plan* (Natural Resource Technology, Inc., 2015) prepared for the Pleasant Prairie Power Plant Ash Landfill, and all data was accepted.



#### 5 KEY ACTIVITIES PLANNED FOR 2019

The following key activities are planned for 2019:

- Continuation of the Detection Monitoring Program with semi-annual sampling scheduled for the 2<sup>nd</sup> and 4<sup>th</sup> quarters of 2019.
- Complete statistical evaluation of analytical data from the downgradient wells, using background data to determine whether a SSI of Appendix III parameters over background concentrations has occurred.
- If an SSI is identified, potential alternate sources (*i.e.*, a source other than the CCR unit caused the SSI or that that SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality) will be evaluated. If an alternate source is demonstrated to be the cause of the SSI, a written demonstration will be completed within 90 days of SSI determination and included in the annual groundwater monitoring and corrective action report for 2019.
  - » If an alternate source(s) is not identified to be the cause of the SSI, the applicable requirements of 40 CFR 257.94 through 257.98 (*e.g.*, assessment monitoring) will apply in 2019, including associated recordkeeping/notifications required by 40 CFR 257.105 through 257.108.



# PLEASANT PRAIRIE POWER PLANT ASH LANDFILL 2018 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT REFERENCES

### **REFERENCES**

Natural Resource Technology, Inc., 2015, Sampling and Analysis Plan - Revision 1, Pleasant Prairie Power Plant Ash Landfill, Pleasant Prairie, Wisconsin, December 8, 2015.

Natural Resource Technology, an OBG Company, 2017, Statistical Analysis Plan, Pleasant Prairie Power Plant Ash Landfill, Pleasant Prairie, Wisconsin, October 17, 2017.



## **Tables**



Pleasant Prairie
Table 2. Pleasant Prairie Power Plant Ash Landfill: Appendix III Analytical Results

Date Range:	10/15/2017 to 10/2	23/2018						
Well Id	Date Sampled	Lab Id	B, tot, mg/L	Ca, tot, mg/L	Cl, tot, mg/L	F, tot, mg/L	pH (field), STD	SO4, tot, mg/L
W17BR	10/23/2017	40159525007	0.6530	12.0000	11.5	1.50	8.29	25.0
W I /BIC	04/16/2018	AE26941	0.6200	12.0000	12.0	1.40	7.29	24.0
	10/23/2018	AE31327	0.6600	13.0000	11.0	1.40	8.40	23.0
V20B	10/23/2017	40159525002	0.3390	85.7000	28.7	0.77	7.20	161.0
V 20B	04/16/2018	AE26935	0.3100	90.0000	35.0	0.71	7.13	180.0
	10/22/2018	AE31322	0.3200	64.0000	17.0	0.83	7.40	110.0
V20D	10/23/2017	40159525001	0.4470	26.5000	11.8	1.10	7.65	184.0
	01/18/2018	40163747005	0.4470			1.10	7.60	
	04/16/2018	AE26934	0.4300	26.0000	11.0	1.10	7.43	170.0
	10/22/2018	AE31321	0.4600	27.0000	12.0	1.00	7.80	180.0
V31B	10/24/2017	40159525009	0.0932	91.2000	38.9	< 0.50	7.07	127.0
	04/16/2018	AE26936	0.0860	90.0000	42.0	0.38	6.68	120.0
	10/22/2018	AE31323	0.0950	98.0000	47.0	0.39	7.40	130.0
/73	10/24/2017	40159525011	0.4630	25.8000	11.2	0.95	8.36	127.0
	01/18/2018	40163747001	0.4660				8.02	
	04/16/2018	AE26943	0.4200	19.0000	11.0	1.00	7.40	120.0
	10/23/2018	AE31326	0.4500	19.0000	11.0	1.00	8.20	130.0
<i>V</i> 74	10/23/2017	40159525003	0.4070	19.5000	13.8	1.20	7.75	162.0
	01/18/2018	40163747004				1.10	8.02	
	04/16/2018	AE26937	0.4000	20.0000	13.0	1.00	7.74	150.0
	10/23/2018	AE31330	0.4100	21.0000	14.0	1.00	8.00	160.0
V75	10/23/2017	40159525004	0.4430	19.9000	10.8	1.00	8.06	145.0
	04/16/2018	AE26938	0.4100	19.0000	9.8	1.00	7.71	130.0
	10/23/2018	AE31329	0.4400	21.0000	9.9	0.98	8.20	140.0
776	10/23/2017	40159525006	0.4460	17.6000	10.8	1.10	7.76	135.0
	04/16/2018	AE26940	0.4300	18.0000	10.0	1.00	7.68	130.0
	10/23/2018	AE31328	0.4600	20.0000	11.0	1.00	7.80	140.0
777	10/24/2017	40159525010	0.4320	25.5000	11.0	1.10	7.71	142.0
	01/18/2018	40163747002	0.4480			1.10	7.51	
	04/16/2018	AE26942	0.4200	25.0000	10.0	1.10	7.47	130.0
	10/22/2018	AE31324	0.4400	26.0000	10.0	1.10	7.50	140.0

Pleasant Prairie
Table 2. Pleasant Prairie Power Plant Ash Landfill: Appendix III Analytical Results

Date Range: 10/15/2017 to 10/23/2018				
Well Id	Date Sampled	Lab Id	TDS, mg/L	
W17BR	10/23/2017	40159525007	172.0	
	04/16/2018	AE26941	190.0	
	10/23/2018	AE31327	140.0	
W20B	10/23/2017	40159525002	510.0	
	04/16/2018	AE26935	630.0	
	10/22/2018	AE31322	470.0	
W20D	10/23/2017	40159525001	382.0	
	04/16/2018	AE26934	390.0	
	10/22/2018	AE31321	390.0	
W31B	10/24/2017	40159525009	530.0	
	04/16/2018	AE26936	520.0	
	10/22/2018	AE31323	560.0	
W73	10/24/2017	40159525011	308.0	
	04/16/2018	AE26943	340.0	
	10/23/2018	AE31326	300.0	
W74	10/23/2017	40159525003	348.0	
	04/16/2018	AE26937	370.0	
	10/23/2018	AE31330	340.0	
W75	10/23/2017	40159525004	330.0	
	04/16/2018	AE26938	350.0	
	10/23/2018	AE31329	310.0	
W76	10/23/2017	40159525006	318.0	
	04/16/2018	AE26940	350.0	
	10/23/2018	AE31328	300.0	
W77	10/24/2017	40159525010	372.0	
	04/16/2018	AE26942	370.0	
	10/22/2018	AE31324	370.0	

## **Figures**



W74

GRL 1/23/19

WE ENERGIES P4 ASH LANDFILL PLEASANT PRAIRIE, WISCONSIN PROJECT NO: 71202

150

SCALE IN FEET

300

FIGURE NO: 1



## **Appendix A**

40 CFR 257.94(e)(2)
Alternate Source
Demonstration (ASD) –
April 15, 2018

# **OBG**

## **Alternate Source Demonstration**

Pleasant Prairie Power Plant Ash Landfill Pleasant Prairie, WI

**We Energies** 

April 15, 2018



APRIL 15, 2018 | PROJECT #67985

## **Alternate Source Demonstration**

Pleasant Prairie Power Plant Ash Landfill Pleasant Prairie, Wisconsin

Prepared for:

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## **LIST OF ATTACHMENTS**

Attachment A Preliminary Bedrock Topography Map of Kenosha County, Wisconsin

### **ACRONYMS AND ABBREVIATIONS**

ASD Alternate source demonstration
CCR Coal Combustion Residuals
CFR Code of Federal Regulations
HDPE High density polyethylene

mg/L milligrams per liter

NRT Natural Resource Technology, an OBG Company

OBG O'Brien & Gere Engineers, Inc.

Pleasant Prairie Power

Plant Ash Landfill

P4 Ash Landfill

SSI statistically significant increase

STD standard units

TDS Total dissolved solids

WAC Wisconsin Administrative Code

WDNR Wisconsin Department of Natural Resources

#### 1 INTRODUCTION

#### 1.1 OVERVIEW

This document has been prepared on behalf of We Energies by O'Brien & Gere Engineers, Inc. (OBG) to provide pertinent information for an alternate source demonstration (ASD) as allowed by 40 CFR § 257.94(e)(2) for the Pleasant Prairie Power Plant (P4) Ash Landfill, located in Pleasant Prairie, Wisconsin (Figure 1).

Initial background groundwater monitoring consisting of a minimum of eight samples as required under 40 CFR § 257.94(b) was initiated in November 2015 and completed prior to October 17, 2017. The first semi-annual detection monitoring sample was collected on October 24, 2017 for which analytical data was received on November 15, 2017. Statistical analysis of the first detection monitoring sample for statistically significant increases (SSIs) of 40 CFR Part 257 Subpart D (CCR Rule) Appendix III parameters over background concentrations was completed within 90 days of collection and receipt of sample results (January 15, 2018). That statistical determination identified the following SSIs at uppermost aquifer (i.e. bedrock groundwater unit) downgradient monitoring wells:

- Boron above the background prediction interval at well W73
- Fluoride above the background prediction interval at well W74

To verify these SSIs, wells W73 and W74 were resampled on January 18, 2018 and analyzed for only the SSI parameters, in accordance the Statistical Analysis Plan<sup>1</sup>. Following evaluation of analytical data from the resamples for SSIs, only one SSI remained as follows:

Boron above the background prediction interval at well W73

40 CFR § 257.94(e)(2) allows the owner or operator 90 days from the date of determination to demonstrate that a source other than the coal combustion residual (CCR) unit caused the SSI, or that the SSI resulted from errors in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Pursuant to 40 CFR § 257.94(e)(2), the following demonstrates that sources other than the P4 Ash Landfill were the cause of the SSI for boron at well W73 listed above. This ASD was completed within 90 days of determination of the SSIs (April 15, 2018) as required by 40 CFR § 257.94(e)(2).

### 1.2 BACKGROUND

The P4 Ash Landfill was constructed in 1980 and began filling in 1981. Initially construction was completed on top of the existing clay (Cell 1). Cells 2-4 were constructed with a base of 5 feet of compacted clay. By 2014, all CCR was removed from previous Cells 1-4 and a new landfill cell was constructed over the footprint of the previous cells. The new landfill cell (Cell 1) was constructed with a composite liner and a leachate collection system in 2013 – 2014. The composite liner consists of a 60-mil high density polyethylene (HDPE) geomembrane and geosynthetic clay liner. The new Cell 1 was placed in service in 2014.

#### 1.3 GROUNDWATER MONITORING

Background groundwater sampling in compliance with the CCR Rule was initiated in November 2015, with the final round of background groundwater samples collected in August 2017. Groundwater is also sampled to meet the requirements of a Wisconsin Department of Natural Resources (WDNR) program and groundwater samples have been collected since the early 1990's. The CCR Rule monitoring program includes background wells W20D and W77, and downgradient wells W73 through W77. A map showing the groundwater monitoring system, including the WDNR program and CCR Rule monitoring wells, is presented on Figure 1. Groundwater generally flows to the northwest/ north, representative groundwater contours are shown on Figure 2.

OBG | APRIL 15, 2018

P4 ASD FINAL 180415.docx

<sup>&</sup>lt;sup>1</sup> Natural Resource Technology, an OBG Company, 2017, Statistical Analysis Plan, Pleasant Prairie Power Plant Ash Landfill, Pleasant Prairie, Wisconsin, October 17, 2017.

Samples were collected and analyzed in accordance with the Sampling and Analysis Plan (Natural Resource Technology, Inc. 2015) prepared for the P4 Ash Landfill. All monitoring data obtained under 40 CFR § 257.90 through 257.98 (as applicable) are presented in Tables 1. Statistical evaluation of analytical data was performed in accordance with the Statistical Analysis Plan (Natural Resource Technology, an OBG Company, 2017) prepared for the landfill.

#### 1.4 GEOLOGY

The P4 landfill overlies more than 100 feet of unlithified glacial deposits. The glacial unit is underlain by Silurian dolomite (bedrock groundwater unit), which is the uppermost aquifer beneath and in the vicinity of the P4 Ash Landfill (Figure 3). The groundwater flows toward the north-northeast in the Silurian dolomite in the landfill area. The glacial deposits consist largely of clay-rich till of the Oak Creek Formation and have low hydraulic conductivity. Silt, sand and gravel lenses also exist in the unlithified material beneath the current landfill area. Cross-sections (Figures 4 through 7) indicate most of the silt, sand, and gravel lenses are not laterally continuous beneath the current landfill area. However, southwest to northeast trending silt, sand, and gravel lenses occurring between elevations 625 and 660 feet may be laterally continuous beneath the current landfill area (Figures 4 and 5) and represent units for monitoring a potential contaminant pathway in accordance with 40 CFR § Part 257. Based on available data, groundwater flow in the potentially continuous silt, sand, and gravel lenses appears to be east-northeast.

In addition, a sandy unit exists just above bedrock beneath most of the landfill area. The sand unit is laterally continuous in some areas and is hydraulically connected to the underlying bedrock unit. Where present, the sand unit mantling the bedrock is monitored with the CCR Rule groundwater monitoring network.

#### **ALTERNATE SOURCE DEMONSTRATION** 2

#### 2.1 **SUMMARY**

As allowed by 40 CFR § 257.94(e)(2), this ASD demonstrates that sources other than the P4 Landfill caused the SSI or that the apparent SSI was a result of natural variation in groundwater quality. Lines of evidence supporting this ASD include the following:

- Resample Event and Turbidity: Downgradient wells with SSI determinations were resampled to confirm the concentrations were representative. Results of the resample eliminated the SSI for fluoride at W74, but the SSI remained for boron at W73. Filtered groundwater samples from W73 indicate that concentrations decline, primarily below the background prediction interval.
- Landfill Construction: The existing P4 Ash Landfill Cell 1 was constructed in 2013-2014 with a composite liner (consisting of a geosynthetic clay liner and 60-mil HDPE geomembrane) and a leachate collection system. The P4 Ash Landfill also overlies a significant thickness of the Oak Creek Formation which has very low hydraulic conductivity.
- Aguifer Geochemistry: The distribution of naturally occurring inorganic constituents in the dolomite aquifer is variable and geochemical conditions which control the equilibrium concentrations change both laterally and vertically within the aquifer, resulting in concentrations which are variable, but unrelated to the P4 Ash Landfill.

Data and information supporting these ASD lines of evidence are discussed in more detail below.

#### 2.2 **ASD SUPPORTING INFORMATION**

#### 2.2.1 **Resample Event and Turbidity**

Monitoring well W73 and background wells were resampled for total and dissolved boron. The SSI for boron in W73 remained after the resample event (0.466 mg/L); however, the dissolved boron sample had a concentration of 0.431 mg/L, which is below the prediction interval for background (0.455 mg/L). The turbidity measured in the sample was 10.37 NTU. Measurements of turbidity at W73 have been variable, ranging from 6.49 to 149 NTU, while turbidity in background is below 38 NTU, with most turbidity measurements below 10 NTU. Generally, the higher the concentration of total boron, the more the concentration declines following filtering. A summary of the boron concentrations and percent reduction is included in Table 2 below. Note that only one dissolved concentration in downgradient well W73 (0.461 mg/L in April 2016) exceeds the background prediction interval 0.455 mg/L. This indicates that turbidity is likely affecting the concentrations of total boron in groundwater samples collected from downgradient well W73, and these concentrations are not indicative of impacts from the P4 Ash landfill.

Table 2. Summary of Boron Concentrations and Comparison of Total and Dissolved Concentrations

Well	Date	Boron, dissolved.	Boron, total	Turbidity, NTU	Percent Reduction
W73	12/2/2015		0.418	9.8	
W73	1/25/2016	0.42	0.422	116	0.47%
W73	4/14/2016	0.461	0.464	28	0.65%
W73	7/13/2016	0.433	0.437	17	0.92%
W73	10/12/2016	0.438	0.447	149	2.01%
W73	1/11/2017	0.395	0.401	12.5	1.50%
W73	4/11/2017		0.43	6.49	
W73	8/31/2017	0.45	0.46	90.74	2.17%
W73	10/24/2017	0.45	0.463	98.19	2.81%
W73	1/18/2018	0.431	0.466	10.37	7.51%

#### 2.2.2 Landfill Construction

This ASD is also supported by the fact that the P4 Ash Landfill was recently constructed with a composite liner including 60-mil HDPE geomembrane and geosynthetic clay liner, and a leachate collection system. Precipitation and/or leachate that collects on top of the liner is removed by a leachate collection system and managed in accordance with the landfill operating permit. Leachate levels are monitored with leachate headwells in the landfill and collection sump level monitoring; the system includes high level alarms to notify the landfill operators if leachate levels exceed predetermined levels. The system is flushed annually as part of regular operation and maintenance. System monitoring and reporting indicate that the leachate collection system is functioning as designed and indicate there is not significant leachate migration into underlying materials.

In the unlikely event that leachate is not captured by the collection system, the landfill overlies 50-100 feet of silty clay and the potential for downward migration of leachate into the uppermost aquifer is limited by the low hydraulic conductivity of the Oak Creek Formation. Simpkins and Bradbury (1992) calculated downward velocities of 0.3 to 0.5 cm/yr in the Oak Creek Formation. At the highest velocities, it would require over 3,000 years for leachate to migrate through 50 feet of Oak Creek Formation, but the P4 Ash Landfill has only been active for 30 years indicating the SSIs are attributable to another source.

### 2.2.3 Aquifer Geochemistry

#### **General Groundwater Chemistry of the Silurian Dolomite**

The general water chemistry is displayed in the Piper diagram below (Figure 8). Background and downgradient groundwater samples all plot within the same region of sodium-potassium-magnesium dominated cations and sulfate anions. Leachate samples collected from the CCR Unit indicate sodium-potassium-calcium dominated cations and chloride-sulfate dominated anions. The downgradient wells within the anion plot are bracketed by upgradient wells W20D and W77, indicating that the groundwater is not being influenced by the leachate. This conclusion is also supported by the Stiff diagrams (Figure 9) which show that all the groundwater, upgradient and downgradient, is very similar and unlike the leachate.

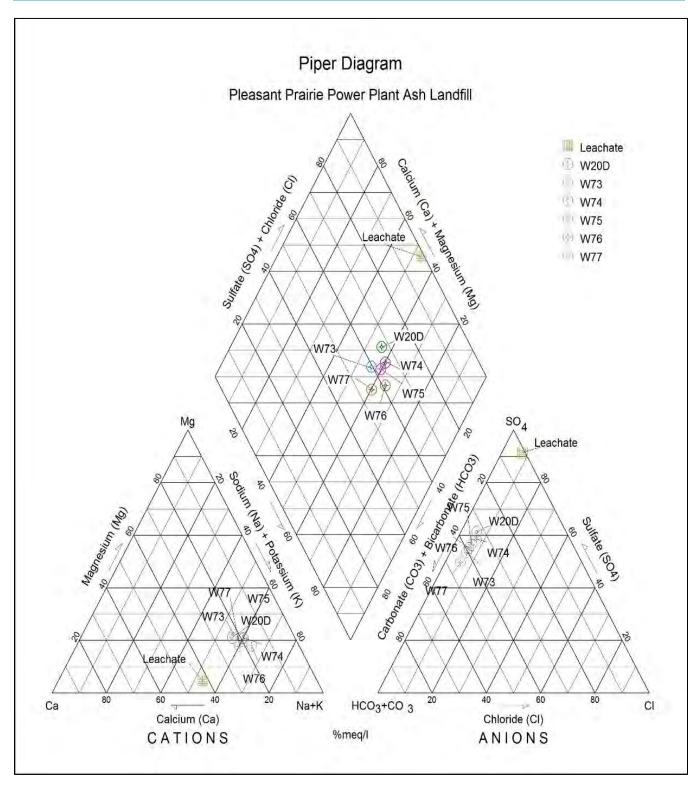


Figure 8. Piper Diagram for P4 Ash Landfill CCR Rule Monitoring Wells

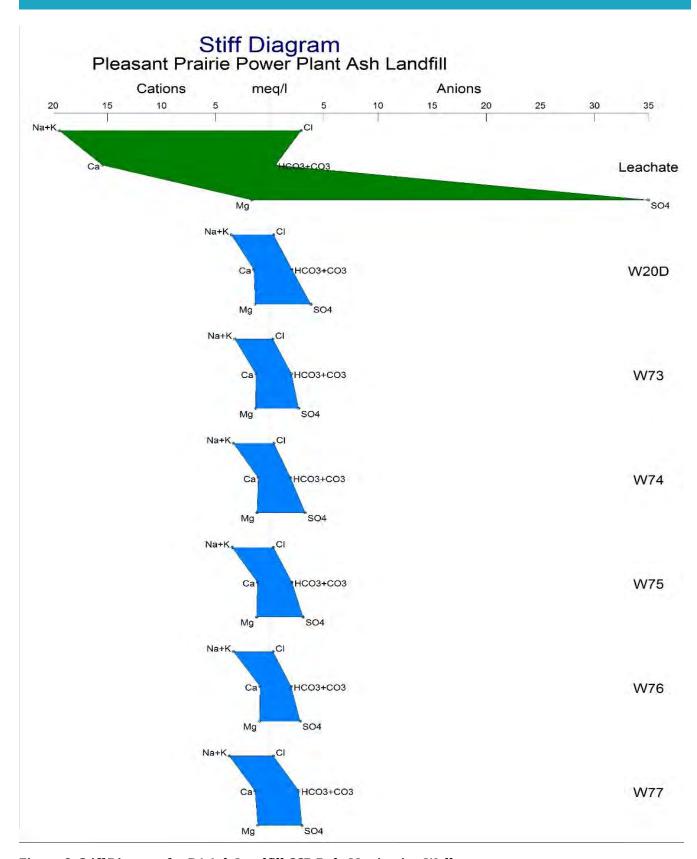


Figure 9. Stiff Diagram for P4 Ash Landfill CCR Rule Monitoring Wells

#### **Geochemical Variations within the Silurian Dolomite**

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Natural variations in the composition (i.e. minerology) of the Silurian dolomite bedrock, which affect the presence of minerals and associated trace elements in groundwater, are observed at the P4 Ash Landfill. This natural variability of the dolomite bedrock, both vertically and laterally across the site, has resulted in variations in concentrations of boron in groundwater, amongst other naturally occurring inorganic constituents. Slightly elevated concentrations of boron at well W73 can be evaluated by looking at the screened bedrock intervals of monitoring wells at the P4 Ash Landfill along with the geologic descriptions of those intervals.

The screened intervals of the CCR Rule monitoring wells are provided on Table 3. Well W73 is screened from an elevation of 559 to 564 ft, the same approximate screened elevation as background well W77. Background well W20D and downgradient wells W74, W75, and W76 are all screened at significantly lower elevations in the bedrock between 545 and 553 ft. Geologic descriptions of the dolomite bedrock on the boring logs for all of the background and downgradient wells are generally similar with the exception of the description for well W73. At a depth of 115.5 to 130 ft, corresponding to an elevation of approximately 559 to 573 ft, the boring description for W73 is as follows: "Weathered bedrock, gray (10YR 4/1), microcrystalline, with frequent vugs. Vugs range from 1-2 mm to 3 cm in length. Secondary mineralization within vugs is mostly dolomite, trace pyrite and possibly other iron minerals (black)". At a depth of 116 ft (elevation of 573 ft), additional description on the boring log for W73 was: "Vugs appear well interconnected at least in top 5'. Most vugs are open, not closed-up with minerals. Vugs are still frequent down to 130'. No vertical fracturing is apparent, small fossils can be seen in the rock. Possibly near a reef deposit".

The presence of vugs was not noted in any of the other well borings and the potential for additional iron minerals was only observed in the boring description for W77. In addition, based on the topography of the bedrock surface (see bedrock surface contour map on Figure 3), monitoring well W73 is sampling a different (higher elevation) part of the groundwater flow path than upgradient well W20D and the other downgradient wells.

Groundwater upgradient of W73 is likely within the unlithified glacial units while groundwater at the same elevations upgradient of the other wells remains within the dolomite bedrock. This provides the potential for different geochemical conditions to occur within the uppermost portion of the bedrock. In general, groundwater flow in the upper portion of the Silurian dolomite is to the north; however, there are small variations resulting from seasonal pumping (i.e. drawdown) within the aquifer. Groundwater elevations for the background wells and well W73 are plotted below (Figure 10).

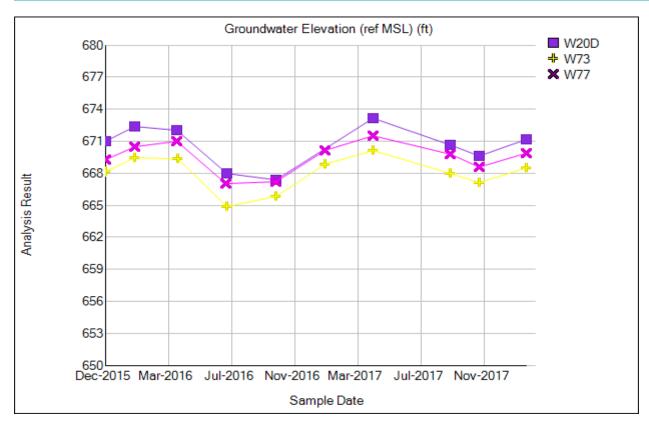


Figure 10. Plot of Groundwater Elevations for W73, W20D, and W77

The plot shows that lower groundwater elevations typically occur in the summer and higher elevations in the winter. Based on locations of private wells within the uppermost aquifer (Attachment A), it is likely that summer groundwater pumping from the Silurian dolomite induces more northerly and potentially northeasterly flow directions, which may influence water quality as a result of changes to the groundwater flow path.

The temporal variability in concentrations of boron, calcium, chloride and sulfate at well W73 versus background locations W20D and W77 are shown on the time series plots (Figure 11-14) below. Although the concentrations vary between wells for each of the parameters, the trends are generally the same in magnitude and direction except for calcium and chloride. In background wells W20D and W77, the calcium and chloride concentrations have been declining since the wells were installed. This indicates that the drilling process disturbed the aquifer materials and concentrations are now returning to stabilized values. Parallel trends in boron and sulfate, the primary indicator parameters of CCR leachate impacts on groundwater, would not be expected in background wells and downgradient well W73 if the P4 Ash landfill was impacting groundwater.

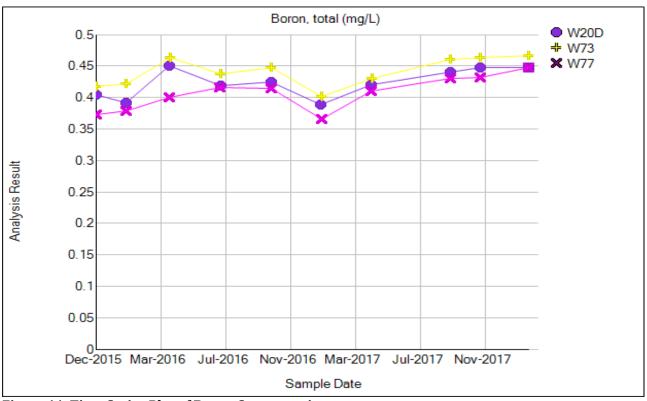


Figure 11. Time Series Plot of Boron Concentrations

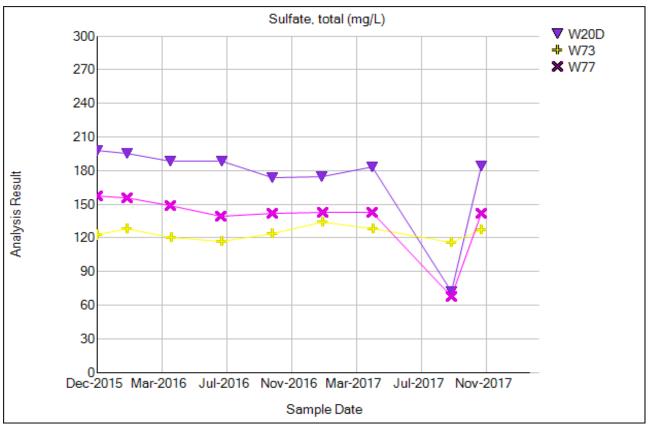


Figure 12. Time Series Plot of Sulfate Concentrations

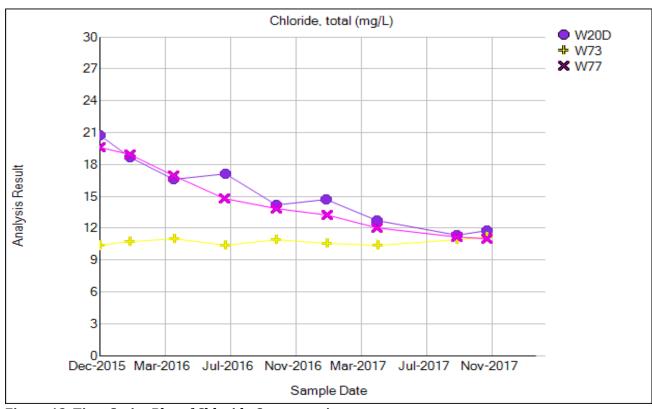


Figure 13. Time Series Plot of Chloride Concentrations

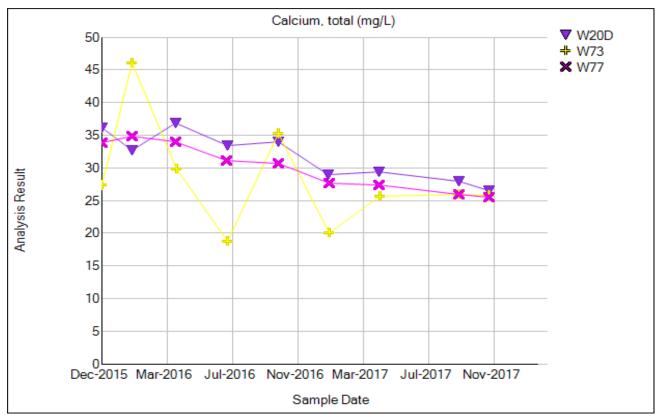


Figure 14. Time Series Plot of Calcium Concentrations

#### **Ion Ratios**

The final line of evidence for this ASD, which is supported by previous analysis, is ion ratios for boron compared to other primary indicators of CCR impacts - calcium, chloride, and sulfate. A summary of the ion ratios in groundwater at background wells W20D and W77, downgradient well W73, and leachate is presented in Table 4 below. The results show that both of the background wells have ratios that are closer to leachate than W73. Background wells W20D and W77 have calcium/boron ion ratios of 75 and 76 versus 110 for Leachate; well W73 had a ratio of 65, lower than the background wells and further from leachate. Background wells W20D and W77 have a chloride/boron ion ratio of 37, the same as leachate, versus a lower ratio of 25 for well W73. Finally, background wells W20D and W77 have sulfate/boron ratios of 345 and 414 versus 544 for leachate; the lowest ratio of 284 occurred at well W73. All three ratios demonstrate that groundwater quality at the background wells in the Silurian dolomite is more like the leachate than groundwater at well W73, which is less like the leachate. Based on the ion ratios of four primary indicator parameters of CCRs, groundwater quality at well W73 has not been impacted by leachate from the P4 Ash Landfill.

**Table 4. Summary of Average Ion Ratios** 

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Sample ID	Ca/B	CI/B	SO4/B
Leachate	110	37	544
W73	65	25	284
W20D	76	37	414
W77	75	37	345

#### 3 CONCLUSIONS AND CERTIFICATION

This document has been prepared on behalf of We Energies by OBG to provide pertinent information for an ASD as allowed by 40 CFR §257.94(e)(2) for the Pleasant Prairie Power Plant Ash Landfill located in Pleasant Prairie, Wisconsin.

Initial background groundwater monitoring consisting of a minimum of eight samples as required under 40 CFR §257.94(b) was initiated in November 2015 and completed prior to October 17, 2017. The first semi-annual detection monitoring sample was collected on October 24, 2017 for which analytical data was received on November 15, 2017. Statistical analysis of the first detection monitoring sample for SSIs of 40 CFR Part 257 Appendix III parameters over background concentrations was completed within 90 days of collection of the sample (January 15, 2018). Following resampling, the determination identified the following SSIs (concentrations greater than background prediction intervals) at downgradient monitoring well:

#### Boron at well W73

40 CFR §257.94(e)(2) allows the owner or operator 90 days from the date of determination to demonstrate that a source other than the CCR unit caused the SSI, or that the apparent SSI was from a source other than the CCR unit, or that the SSI resulted from errors in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Pursuant to 40 CFR §257.94(e)(2), this document demonstrates that sources other than the P4 Ash Landfill were the cause of the SSI listed above. This ASD was completed within 90 days of determination of the SSIs (April 15, 2018) as required by 40 CFR §257.94(e)(2).

Pursuant to 40 CFR §257.94(e)(2), the following lines of evidence were presented in this report to demonstrate that the listed SSIs are due to alternate sources as follows:

- Resample Event and Turbidity
- Landfill Construction
- Aguifer Geochemistry

The preceding information serves as the ASD prepared in accordance with 40 CFR §257.94(e)(2) and supports the position that the SSI observed during the first semi-annual detection monitoring event is not due to a release from the CCR unit but were from naturally occurring conditions. Therefore, no further action (i.e. assessment monitoring) is warranted and the P4 Ash Landfill will remain in detection monitoring.

I, Glenn R. Luke, a qualified professional engineer in good standing in the State of Wisconsin, certify that enclosed information is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Glenn R. Luke, PE

Professional Engineer No. 42834-6

State of Wisconsin

O'Brien & Gere Engineers, Inc.

Date: April 15, 2018

# PLEASANT PRAIRIE POWER PLANT ASH LANDFILL 40 CFR § 257.94(E)(2): ALTERNATE SOURCE DEMONSTRATION

I, Nathaniel R. Keller, a qualified professional geologist, certify that the enclosed information is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Nathaniel R. Keller, PG

Professional Geologist No. 1283-013

State of Wisconsin

O'Brien & Gere Engineers, Inc.

Date: April 15, 2018

#### **REFERENCES**

Natural Resource Technology, Inc., 2015, Sampling and Analysis Plan Revision 1, Pleasant Prairie Power Plant Ash Landfill, Pleasant Prairie, Wisconsin, December 8, 2015.

Natural Resource Technology, an OBG Company, 2017, Statistical Analysis Plan, Pleasant Prairie Power Plant Ash Landfill, Pleasant Prairie, Wisconsin, October 17, 2017.

Simpkins, W.W and K.R. Bradbury. 1992. Groundwater flow, velocity, and age in a thick, fine-grained till unit in southeastern Wisconsin. Journal of Hydrology. 132 (283-319).

Peters, Roger M. 2004. Preliminary Bedrock Topography Map of Kenosha County, Wisconsin. Wisconsin Geological and Natural History Survey. Open File Report 2004-13B



Pleasant Prairie
Table 1. Pleasant Prairie Power Plant Ash Landfill: Appendix III Analytical Results

Date Range: 12/02/2015 to 01/18/2018 Well Id **Date Sampled** Lab Id B, tot, mg/L Ca, tot, mg/L Cl, tot, mg/L F, tot, mg/L pH (field), STD SO4, tot, mg/L W17BR 11.400 12/03/2015 40125664010 0.5900 13.500 1.400 8.200 30.700 01/25/2016 40127593005 0.5850 13.600 11.400 1.400 8.040 28.100 04/14/2016 40130923011 0.6680 15.200 11.100 1.400 7.900 28.100 0.6260 13.900 28.900 07/12/2016 40135262002 11.600 1.300 7.900 10/12/2016 40140105006 0.6210 13.200 11.100 1.400 26.500 8.600 01/11/2017 40144447006 0.5560 12.000 10.800 1.400 25.300 8.420 25.300 04/11/2017 40148263007 0.6300 12.000 10.700 1.500 8.540 08/31/2017 40156109006 0.6500 12.700 11.000 1.500 8.020 25.100 40159525007 12.000 25.000 10/23/2017 0.6530 11.500 1.500 8.290 W20B 12/02/2015 40125664002 0.2860 54.800 14.300 0.770 7.600 95.700 01/25/2016 40127593002 0.2870 47.500 13.800 93.400 0.840 7.450 04/13/2016 40130923006 0.3200 57.800 10.400 0.840 10.000 74.500 07/13/2016 40135283003 0.3010 60.800 17.200 0.720 7.100 108.000 10/12/2016 40140105002 0.3070 91.300 23.400 0.740 7.500 125.000 01/10/2017 40144447002 0.2720 58.900 16.900 0.900 7.570 108.000 04/10/2017 40148263002 0.3000 52.400 13.500 0.800 7.680 93.100 08/31/2017 40156109002 0.3100 63.600 18.400 0.830 6.990 57.000 10/23/2017 40159525002 0.3390 85.700 28.700 0.770 7.200 161.000 W20D 0.4040 198.000 12/02/2015 40125664001 36.200 20.700 0.880 7.800 01/25/2016 40127593001 0.3910 32.700 18.700 0.990 7.660 195.000 04/13/2016 40130923005 0.4500 36.800 0.990 188.000 16.600 9.600 07/13/2016 40135283002 0.4190 33.400 17.100 0.940 7.400 188.000 10/12/2016 40140105001 0.4250 34.000 174.000 14.200 1.000 7.900 40144447001 0.3880 01/10/2017 29.000 14.700 1.100 7.800 175.000 04/10/2017 40148263001 0.4200 29.400 12.700 1.000 7.750 183.000 40156109001 0.4400 27.900 72.200 08/31/2017 11.300 1.100 7.400 10/23/2017 40159525001 0.4470 26.500 11.800 1.100 7.650 184.000 01/18/2018 40163747005 0.4470 1.100 7.600 W31B 12/03/2015 40125664006 0.0872 86.700 33.700 0.370 7.500 118.000 01/26/2016 40127593007 0.0796 84.700 34.000 0.380 7.420 121.000 04/14/2016 40130923010 0.0933 94.300 32.300 0.380 7.400 113.000 07/12/2016 40135262006 0.0844 84.900 33.200 0.350 7.200 115.000 0.0924 0.330 119.000 10/12/2016 40140105004 98.400 40.800 7.600 01/11/2017 40144447009 0.0798 88.400 42.000 0.280 131.000 7.540 04/10/2017 40148263004 0.0960 86.200 35.400 0.300 7.590 123.000 08/31/2017 40156109003 0.0990 91.300 40.500 0.400 6.970 61.600

Pleasant Prairie
Table 1. Pleasant Prairie Power Plant Ash Landfill: Appendix III Analytical Results

Date Range: 12	2/02/2015 to 01/18/20	18						
			B, tot, mg/L	Ca, tot, mg/L	Cl, tot, mg/L	F, tot, mg/L	pH (field), STD	SO4, tot, mg/I
W31B	10/24/2017	40159525009	0.0932	91.200	38.900	< 0.500	7.070	127.000
W73	12/02/2015	40125664005	0.4180	27.300	10.400	0.990	8.200	123.000
W /3	01/25/2016	40127593006	0.4220	46.000	10.700	1.100	7.970	128.000
	04/14/2016	40130923007	0.4640	29.800	11.000	1.100	8.300	120.000
	07/13/2016	40135283001	0.4370	18.800	10.400	1.000	8.100	117.000
	10/12/2016	40140105010	0.4470	35.300	10.900	0.990	8.500	124.000
	01/11/2017	40144447010	0.4010	20.000	10.600	1.000	7.970	134.000
	04/11/2017	40148263011	0.4300	25.600	10.400	1.000	8.500	128.000
	08/31/2017	40156109010	0.4600	26.000	10.900	1.100	8.190	116.000
	10/24/2017	40159525011	0.4630	25.800	11.200	0.950	8.360	127.000
	01/18/2018	40163747001	0.4660	23.000	11.200	0.550	8.020	127.000
W74	12/03/2015	40125664007	0.3670	34.700	22.100	0.870	7.900	147.000
	01/26/2016	40127593011	0.3700	33.600	21.100	0.950	7.270	145.000
	04/13/2016	40130923004	0.4080	31.500	18.300	0.960	8.800	139.000
	07/12/2016	40135262008	0.3820	26.000	15.900	0.950	7.200	141.000
	10/12/2016	40140105009	0.3890	23.700	13.400	0.990	8.200	152.000
	01/10/2017	40144447011	0.3590	22.500	13.000	1.100	8.110	163.000
	04/11/2017	40148263010	0.3800	21.200	13.900	1.100	8.220	157.000
	08/31/2017	40156109009	0.4000	20.300	12.700	1.100	7.550	136.000
	10/23/2017	40159525003	0.4070	19.500	13.800	1.200	7.750	162.000
	01/18/2018	40163747004				1.100	8.020	
W75	12/03/2015	40125664008	0.4100	28.900	24.300	0.910	8.200	208.000
	01/26/2016	40127593010	0.4170	30.100	24.500	0.950	7.550	197.000
	04/13/2016	40130923003	0.4480	29.500	20.600	0.960	8.800	179.000
	07/12/2016	40135262005	0.4220	24.700	16.200	0.910	7.500	157.000
	10/12/2016	40140105008	0.4250	23.700	14.000	0.950	8.500	155.000
	01/10/2017	40144447003	0.3750	21.300	13.500	1.000	8.240	147.000
	04/11/2017	40148263009	0.4200	22.600	12.100	1.000	8.440	148.000
	08/31/2017	40156109008	0.4300	20.500	10.600	1.100	7.860	132.000
	10/23/2017	40159525004	0.4430	19.900	10.800	1.000	8.060	145.000
W76	12/03/2015	40125664011	0.4240	20.000	18.300	1.000	8.200	138.000
	01/26/2016	40127593008	0.4310	20.600	16.400	1.000	7.660	140.000
	04/13/2016	40130923002	0.4630	20.900	14.100	1.000	9.500	130.000
	07/12/2016	40135262003	0.4360	18.800	12.400	0.980	7.500	125.000
	10/12/2016	40140105007	0.4430	19.500	12.600	0.940	8.700	135.000
	01/11/2017	40144447007	0.3950	18.200	11.200	1.000	8.400	142.000

Pleasant Prairie
Table 1. Pleasant Prairie Power Plant Ash Landfill: Appendix III Analytical Results

Date Range: 12/02/2015 to 01/18/2018												
			B, tot, mg/L	Ca, tot, mg/L	Cl, tot, mg/L	F, tot, mg/L	pH (field), STD	SO4, tot, mg/L				
W76	04/11/2017	40148263008	0.4200	18.000	10.900	1.000	8.580	135.000				
	08/31/2017	40156109007	0.4500	18.100	10.700	1.100	8.060	122.000				
	10/23/2017	40159525006	0.4460	17.600	10.800	1.100	7.760	135.000				
W77	12/03/2015	40125664009	0.3730	33.800	19.600	0.850	7.600	157.000				
	01/25/2016	40127593003	0.3780	34.800	18.900	0.870	7.290	156.000				
	04/13/2016	40130923001	0.4000	34.000	16.900	0.920	8.400	149.000				
	07/12/2016	40135262001	0.4160	31.100	14.800	0.910	7.300	139.000				
	10/12/2016	40140105005	0.4150	30.700	13.800	0.970	7.900	142.000				
	01/11/2017	40144447005	0.3650	27.700	13.200	1.000	7.630	143.000				
	04/10/2017	40148263005	0.4100	27.300	12.000	1.000	7.700	143.000				
	08/31/2017	40156109004	0.4300	26.000	11.200	1.100	7.190	67.700				
	10/24/2017	40159525010	0.4320	25.500	11.000	1.100	7.710	142.000				
	01/18/2018	40163747002	0.4480			1.100	7.510					

Pleasant Prairie
Table 1. Pleasant Prairie Power Plant Ash Landfill: Appendix III Analytical Results

Date Range: 12	2/02/2015 to 01/18/2	018	
Well Id	Date Sampled	Lab Id	TDS, mg/L
W17DD	12/02/2015	40125664010	169 000
W17BR	12/03/2015 01/25/2016	40125664010 40127593005	168.000 172.000
	04/14/2016	40130923011	208.000
			202.000
	07/12/2016	40135262002	
	10/12/2016 01/11/2017	40140105006 40144447006	178.000 178.000
	04/11/2017		184.000
	04/11/2017 08/31/2017	40148263007	182.000
		40156109006	
W20D	10/23/2017	40159525007	172.000
W20B	12/02/2015	40125664002	410.000
	01/25/2016	40127593002	362.000
	04/13/2016	40130923006	362.000
	07/13/2016	40135283003	458.000
	10/12/2016	40140105002	502.000
	01/10/2017	40144447002	412.000
	04/10/2017	40148263002	382.000
	08/31/2017	40156109002	450.000
Wann	10/23/2017	40159525002	510.000
W20D	12/02/2015	40125664001	452.000
	01/25/2016	40127593001	410.000
	04/13/2016	40130923005	428.000
	07/13/2016	40135283002	464.000
	10/12/2016	40140105001	424.000
	01/10/2017	40144447001	406.000
	04/10/2017	40148263001	398.000
	08/31/2017	40156109001	396.000
	10/23/2017	40159525001	382.000
W31B	12/03/2015	40125664006	530.000
	01/26/2016	40127593007	512.000
	04/14/2016	40130923010	546.000
	07/12/2016	40135262006	572.000
	10/12/2016	40140105004	528.000
	01/11/2017	40144447009	522.000
	04/10/2017	40148263004	530.000
	08/31/2017	40156109003	536.000
	10/24/2017	40159525009	530.000

Pleasant Prairie
Table 1. Pleasant Prairie Power Plant Ash Landfill: Appendix III Analytical Results

Date Range: 12/0	02/2015 to 01/18/201	18	
, and the second			TDS, mg/L
W73	12/02/2015	40125664005	310.000
	01/25/2016	40127593006	306.000
	04/14/2016	40130923007	318.000
	07/13/2016	40135283001	328.000
	10/12/2016	40140105010	324.000
	01/11/2017	40144447010	280.000
	04/11/2017	40148263011	336.000
	08/31/2017	40156109010	328.000
	10/24/2017	40159525011	308.000
W74	12/03/2015	40125664007	384.000
	01/26/2016	40127593011	360.000
	04/13/2016	40130923004	388.000
	07/12/2016	40135262008	376.000
	10/12/2016	40140105009	346.000
	01/10/2017	40144447011	340.000
	04/11/2017	40148263010	360.000
	08/31/2017	40156109009	372.000
	10/23/2017	40159525003	348.000
W75	12/03/2015	40125664008	438.000
	01/26/2016	40127593010	432.000
	04/13/2016	40130923003	430.000
	07/12/2016	40135262005	416.000
	10/12/2016	40140105008	362.000
	01/10/2017	40144447003	298.000
	04/11/2017	40148263009	358.000
	08/31/2017	40156109008	356.000
	10/23/2017	40159525004	330.000
W76	12/03/2015	40125664011	334.000
	01/26/2016	40127593008	330.000
	04/13/2016	40130923002	366.000
	07/12/2016	40135262003	360.000
	10/12/2016	40140105007	336.000
	01/11/2017	40144447007	306.000
	04/11/2017	40148263008	334.000
	08/31/2017	40156109007	336.000
	10/23/2017	40159525006	318.000
	10,23,2017	.010,020,000	510.000

### Pleasant Prairie Table 1. Pleasant Prairie Power Plant Ash Landfill: Appendix III Analytical Results

Date Range: 1	12/02/2015 to 01/18/20	TDS, mg/L 2/03/2015 40125664009 410.000											
			TDS, mg/L										
W77	12/03/2015	40125664009	410.000										
	01/25/2016	40127593003	396.000										
	04/13/2016	40130923001	412.000										
	07/12/2016	40135262001	428.000										
	10/12/2016	40140105005	388.000										
	01/11/2017	40144447005	386.000										
	04/10/2017	40148263005	382.000										
	08/31/2017	40156109004	384.000										
	10/24/2017	40159525010	372.000										

### Table 3. CCR Rule Groundwater Monitoring Well Information

### Pleasant Prairie Power Plant Ash Landfill

### Pleasant Prairie, Wisconsin

Well Designation	Wisconsin Unique Well Number	Date Well Installed	Drilling Subcontractor	Drilling Method	Gradient Position	State Plane Northing	State Plane Easting	Latitude	Longitude	Ground Surface Elevation (ft NAVD88)	Top of Protective Cover Pipe Elevation (ft NAVD88)	Top of Well Riser Elevation (ft NAVD88)	Borehole Drilled Depth (ft bgs)	Borehole Bottom Elevation (ft NAVD88)	Depth to Top of Well Screen (ft bgs)	Depth to Well Bottom (ft bgs)	Top of Screen Elevation (ft NAVD88)		Depth to Top of Bedrock (ft bgs)	Top of Bedrock Elevation (ft NAVD88)
W17BR	VN431	10/1/2013	Boart Longyear Company	Sonic	downgradient	213,385.17	2,534,203.49	42°33'57.3084"	-87°53'59.9346"	688.31	690.55	690.35	42.0	646.3	37.0	42.0	651.3	646.3		
W20B <sup>1</sup>		3/17/1993	STS Consultants	Rotary	upgradient	212,752.70	2,533,099.53	42°33'51.3396"	-87°54'14.8968"	684.3		687.0	35.0	649.3	29.0	34.0	655.3	650.3		
W20D	VQ580	3/4/2015	Cascade Drilling	Sonic	upgradient	212,757.97	2,533,085.40	42°33'51.3592"	-87°54'15.0776"	686.45	689.03	688.41	140.0	546.4	135.0	140.0	551.4	546.4	125.0	561.4
W31B <sup>1</sup>		2/26/1993	STS Consultants	Rotary	upgradient	211,923.81	2,533,157.23	42°33'43.1382"	-87°54'14.403"	681.0		683.8	38.5	642.5	33.0	38.0	648.0	643.0		
W73	VN433	10/2/2013	Boart Longyear Company	Sonic	downgradient	213,367.88	2,534,399.36	42°33'57.0560"	-87°53'57.3214"	688.66	691.07	690.58	130.0	558.7	125.0	130.0	563.7	558.7	114.0	574.7
W74	VQ578	3/3/2015	Cascade Drilling	Sonic	downgradient	213,321.15	2,533,126.93	42°33'56.9099"	-87°54'14.3343"	685.02	687.49	686.83	140.0	545.0	135.0	140.0	550.0	545.0	124.5	560.5
W75	VQ577	3/23/2015	Cascade Drilling	Sonic	downgradient	213,321.56	2,533,540.32	42°33'56.8116"	-87°54'08.8120"	687.42	690.31	689.91	141.0	546.4	136.0	141.0	551.4	546.4	125.0	562.4
W76	VQ576	3/24/2015	Cascade Drilling	Sonic	downgradient	213,300.53	2,534,065.51	42°33'56.4738"	-87°54'01.8036"	689.00	692.11	691.63	141.0	548.0	136.0	141.0	553.0	548.0	125.0	564.0
W77	VQ575	3/19/2015	Cascade Drilling	Sonic	upgradient	212,178.92	2,534,660.05	42°33'45.2513"	-87°53'54.2383	684.89	687.63	687.23	126.0	558.9	121.0	126.0	563.9	558.9	110.0	574.9

### Notes:

bgs = below ground surface

HSA = Hollow Stem Auger

Sonic = vibratory (i.e. roto-Sonic®)

- 1. The data source for ground surface and top of well riser elevations is STS Consultants Ltd. Final Hydrogeologic Investigation Report: Wisconsin Electric Power Company, Pleasant Prairie Power Plant Ash Landfill, Pleasant Prairie, Wisconsin. April 4, 1997.
- 2. Ground surface, top of protective cover pipe and top of well riser elevations for wells were surveyed by A.W. Oakes & Son, Inc. on March 16, 2015 and March 27, 2015. Vertical datum assumed to be NAVD88.
- 3. Horizontal datum is Wisconsin State Plane Coordinates South Zone, NAD 83.
- 4. All wells constructed with 2-inch nominal size schedule 80 PVC with 5-foot long 10-slot screens. All wells are screened in dolomite bedrock.

<sup>&</sup>quot;--" indicates data is not available or does not apply.





DRAWN BY/DATE: SDS 4/11/18 REVIEWED BY/DATE: JJW 4/11/18 APPROVED BY/DATE: NRK 4/12/18

### GROUNDWATER SAMPLING WELL LOCATION MAP

WE ENERGIES CCR RULE GROUNDWATER MONITORING
ALTERNATE SOURCE DEMONSTRATION
WE ENERGIES P4 ASH LANDFILL
PLEASANT PRAIRIE, WISCONSIN

PROJECT NO: 67985

FIGURE NO: 1



DRAWN BY/DATE: SDS 4/11/18 REVIEWED BY/DATE: JJW 4/11/18 APPROVED BY/DATE: NRK 4/12/18

### PLEASANT PRAIRIE POWER PLANT ASH LANDFILL UPPERMOST AQUIFER UNIT GROUNDWATER ELEVATION CONTOUR MAP OCTOBER 12, 2016

WE ENERGIES CCR RULE GROUNDWATER MONITORING
ALTERNATE SOURCE DEMONSTRATION
PLEASANT PRAIRIE POWER PLANT ASH LANDFILL
PLEASANT PRAIRIE, WISCONSIN

PROJECT NO: 67985

FIGURE NO: 2



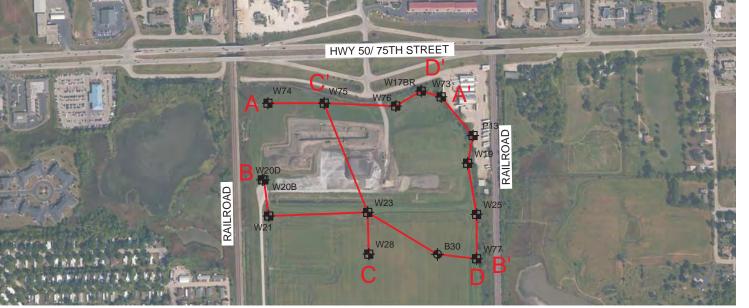
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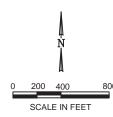
### TOP OF BEDROCK CONTOUR MAP

WE ENERGIES CCR RULE GROUNDWATER MONITORING ALTERNATE SOURCE DEMONSTRATION PLEASANT PRAIRIE POWER PLANT ASH LANDFILL PLEASANT PRAIRIE, WISCONSIN PROJECT NO: 67985

FIGURE NO: 3

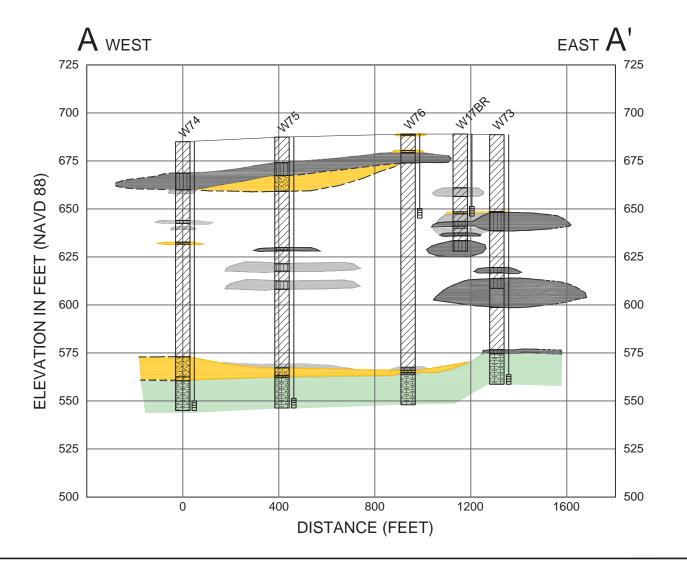


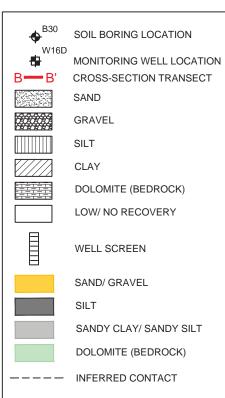


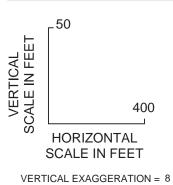


### SOURCE NOTES:

- DIGITAL ORTHOPHOTO FROM BING MAPS © 2012. COORDINATE SYSTEM IS NAD27 WISCONSIN STATE PLANE, SOUTH ZONE, U.S. FOOT.







## A-A **CROSS-SECTION** GEOLOGIC

04/15/15 05/15/15 05/15/15

DMD DATE: DATE: DATE:

DRAWN BY:

WLL MCC

CHECKED BY:

APPROVED BY: DRAWING NO:

1660-171-B02

REFERENCE:

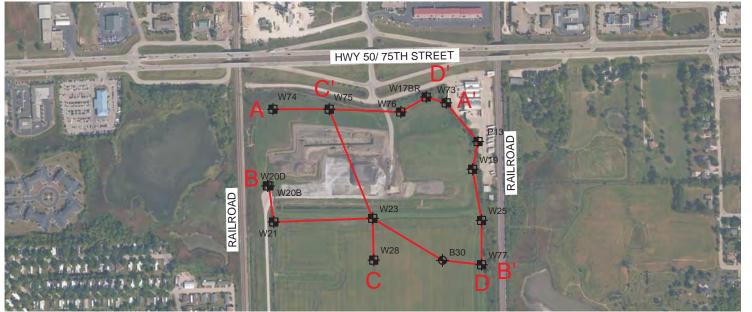
WE ENERGIES CCR RULE GROUNDWATER ALTERNATE SOURCE DEMONSTRATION WE ENERGIES P4 ASH LANDFILL PLEASANT PRAIRIE, WISCONSIN

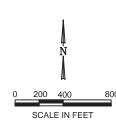
PROJECT NO. 67985

FIGURE NO.

4

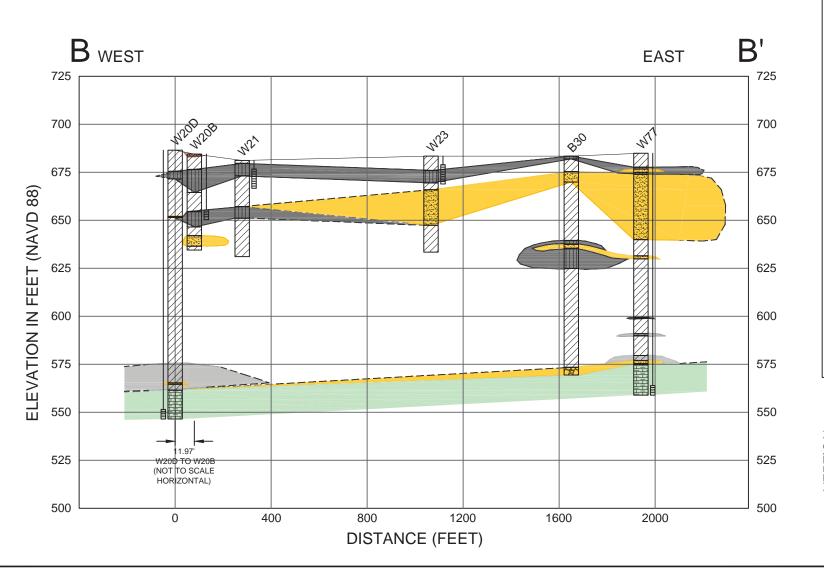
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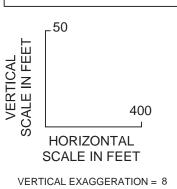


### SOURCE NOTES:

- DIGITAL ORTHOPHOTO FROM BING MAPS  $\,\,@$  2012. COORDINATE SYSTEM IS NAD27 WISCONSIN STATE PLANE, SOUTH ZONE, U.S. FOOT.







05/06/15 05/15/15 05/15/15

DMD DATE: DATE: DATE: JJW DATE: JJW DATE: 1660-171-B03

DRAWN BY:

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REFERENCE:

WE ENERGIES CCR RULE GROUNDWATER ALTERNATE SOURCE DEMONSTRATION WE ENERGIES P4 ASH LANDFILL PLEASANT PRAIRIE, WISCONSIN

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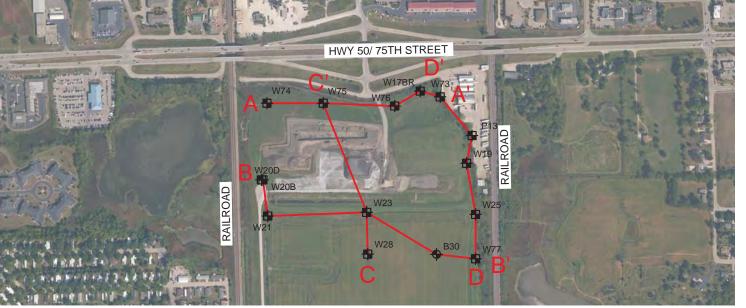
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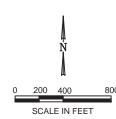
GEOLOGIC

PROJECT NO. 67985

FIGURE NO.

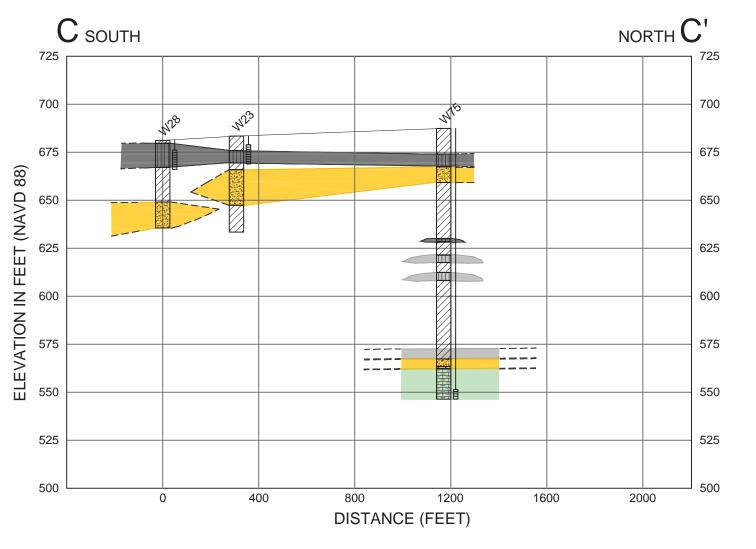
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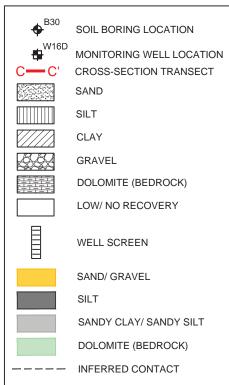


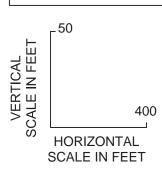


### SOURCE NOTES:

- DIGITAL ORTHOPHOTO FROM BING MAPS  $\,\,@$  2012. COORDINATE SYSTEM IS NAD27 WISCONSIN STATE PLANE, SOUTH ZONE, U.S. FOOT.







VERTICAL EXAGGERATION = 8

## С С **CROSS-SECTION** GEOLOGIC

05/06/15 05/15/15 05/15/15

DMD DATE: DATE: DATE:

DRAWN BY:

1660-171-B04

REFERENCE:

wcc wcc

APPROVED BY: DRAWING NO:

CHECKED BY:

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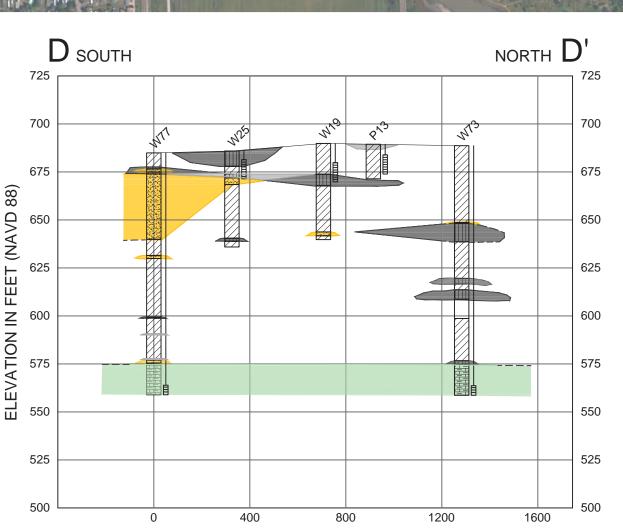


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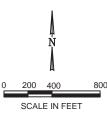
FIGURE NO.

6

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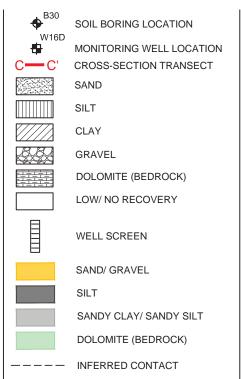


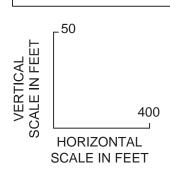
**DISTANCE (FEET)** 



### SOURCE NOTES:

- DIGITAL ORTHOPHOTO FROM BING MAPS © 2012. COORDINATE SYSTEM IS NAD27 WISCONSIN STATE PLANE, SOUTH ZONE, U.S. FOOT.





VERTICAL EXAGGERATION = 8

## D-D **CROSS-SECTION** GEOLOGIC

05/07/15 05/15/15 05/15/15

DMD DATE: DATE: DATE: JJW DATE: JJW DATE: 1660-171-B05

DRAWN BY:

APPROVED BY: DRAWING NO:

REFERENCE:

CHECKED BY:

WE ENERGIES CCR RULE GROUNDWATER ALTERNATE SOURCE DEMONSTRATION WE ENERGIES P4 ASH LANDFILL PLEASANT PRAIRIE, WISCONSIN



PROJECT NO. 67985

FIGURE NO.

7

May 27, 2015 11:53am PLOTTED BY: dduda SAVED BY: dduda Y: \ACAOrid \Projects\16\1660\1-7-1\1660-171-B05.6wg Layoutl MAGES: Y: \ACAOrid \Projects\16\1660\1-7-1\Image\ESRI Aerid 150414\_pg;

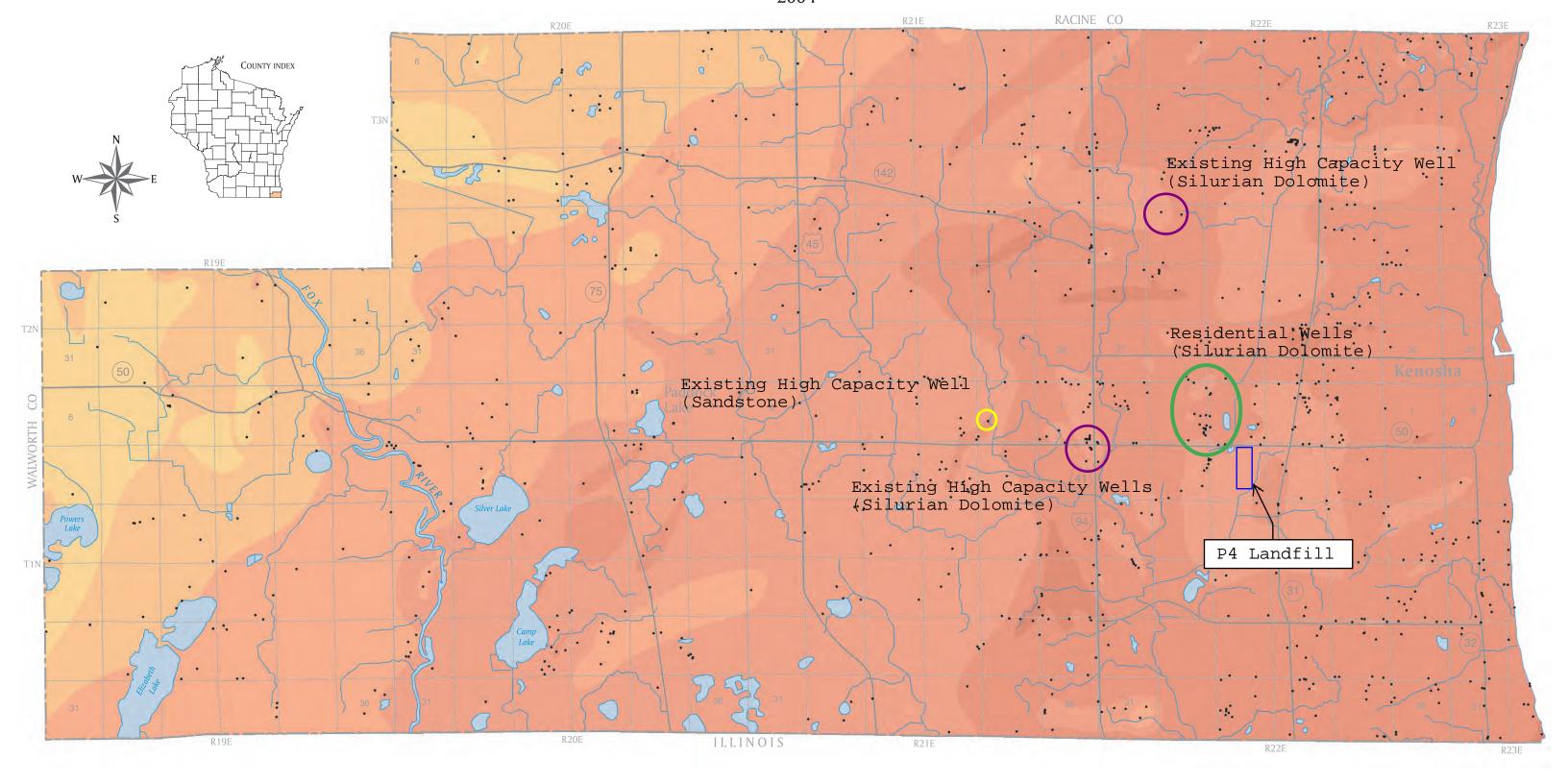
### **Attachment A**

Preliminary Bedrock Topography Map of Kenosha, County

### Preliminary bedrock topography map of Kenosha County, Wisconsin

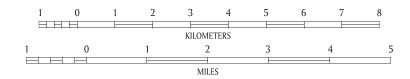
R.M. Peters





# ESTIMATED ELEVATION IN FEET (ABOVE MEAN SEA LEVEL) > 850 700 - 750 550 - 600 800 - 850 650 - 700 500 - 550 750 - 800 600 - 650 < 500

data point



Wisconsin Transverse Mercator Projection 1991 adjustment to the North American Datum of 1983 (NAD 83/91) This map represents work performed by the Wisconsin Geological and Natural History Survey and is released to the open files in the interest of making the information readily available. This map has not been edited or reviewed for conformity with Wisconsin Geological and Natural History Survey standards and nomenclature.

This map is part of an ongoing project funded by STATEMAP, the state component of the National Cooperative Geologic Mapping Program of the U.S. Geological Survey.



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James M. Robertson, Director and State Geologist

Data entry and processing by K.K. Zeiler. Cartography by D.L. Patterson.

Wisconsin Geological and Natural History Survey Open-File Report 2004-13B



### OBG

THERE'S A WAY





