2022 Annual Groundwater Monitoring Report

Dairyland Power Cooperative
Alma Off-Site Disposal Facility
Phase IV Landfill
Town of Belvidere, Wisconsin

License 4126

January 2023

Prepared For:

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Executive Summary

This Annual Report presents the monitoring results and the statistical evaluation of the detection monitoring parameters (Appendix III to Title 40 Code of Federal Regulations Part 257) for the March and September 2022 semiannual groundwater monitoring events at the Dairyland Power Cooperative (DPC) Alma Off-site Disposal Facility Phase IV Landfill (Landfill). This groundwater monitoring represents ongoing detection monitoring events performed to comply with Title 40 Code of Federal Regulations §257.94. The detection monitoring data were evaluated to identify statistically significant increases (SSIs) over background levels.

There were no confirmed SSIs over background limits for the Appendix III parameters during the 2022 monitoring events. Therefore, DPC will continue to conduct detection monitoring, and DPC is not required to take additional actions at this time. The next semiannual monitoring events at the Landfill are scheduled for March and September of 2023.

1.0 Introduction

1.1 Program Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) Subpart D - Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments (the CCR Rule). The CCR Rule, which became effective on October 19, 2015, applies to the Dairyland Power Cooperative (DPC) Alma Off-site Disposal Facility Phase IV Landfill (Landfill). Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with Title 40 Code of Federal Regulations (40 CFR) §257.90(e).

TRC Environmental Corporation (TRC), prepared this Annual Groundwater Monitoring Report (Annual Report) for the Landfill on behalf of DPC. This Annual Report was prepared in accordance with the requirements of 40 CFR §257.90(e) and presents the monitoring results and the statistical evaluation of the detection monitoring parameters (Appendix III to Part 257 of the CCR Rule) for the 2022 semiannual groundwater monitoring events for the Landfill. The monitoring was performed in accordance with the *Groundwater Monitoring Program for Compliance with the Federal Coal Combustion Rule* (GWMP) (TRC, 2017). As part of the statistical evaluation, the data collected during detection monitoring events are evaluated to identify statistically significant increases (SSIs) of detection monitoring parameters compared to background levels.

1.2 Site Overview

The Landfill is owned and operated by DPC. The Landfill is located in the NE 1/4 of the NE 1/4 of Section 19 and portions of Sections 18 and 20, T21N, R12W, Town of Belvidere, Buffalo County, Wisconsin (Figure 1). The Landfill accepts CCR produced from electricity generation. DPC operates the Landfill in compliance with the Plan of Operation (RMT, 2000), and subsequent Plan of Operation Modifications, as permitted by the Wisconsin Department of Natural Resources (WDNR, License Number 4126).

1.3 Geology/Hydrogeology

The site is located within the Western Upland physiographic region of South-Central Wisconsin adjacent to the Mississippi River (Figure 1). This area of Wisconsin was not previously glaciated and is known as the “Driftless Area” and is characterized by a significant amount of topographic relief. The facility is situated within a central valley area surrounded by steep slopes.

The thickness of unconsolidated soils beneath the Landfill ranges from approximately 15 to 60 feet. The predominant soil type includes fine- to coarse-grained silty sand, poorly graded sand with gravel, and/or poorly graded gravel with sand. The sandy soils range in thickness from 20 to 60 feet beneath the Landfill and are interpreted to be the result of fluvial deposition with limited sand deposited by in-situ weathering of underlying sandstone bedrock. In some areas beneath the Landfill, silts and clays ranging in thickness from a few feet to 40 feet overlie the sandy soils. The silt and clay soils were associated with loess deposits and, to a lesser degree, isolated lacustrine sediments.

Bedrock in the area is composed of the Prairie du Chien Group dolomite overlying Cambrian sandstone units. However, the Prairie du Chien group is absent beneath the Landfill due to erosion, so the sandy soil is directly underlain by Cambrian sandstone. The Cambrian sandstones were described as fine-grained, fissile, friable, and glauconitic with interbedded lenses of dark brown sandstone and calcareous shaley partings in boreholes performed during the Landfill siting.

The uppermost aquifer beneath the Landfill resides in the sandy soil and the underlying Cambrian sandstone. The saturated thickness of the aquifer ranges from 10 to 20 feet in the sandy soil. The Cambrian sandstone in the region is estimated to be approximately 400 feet in thickness (Young and Borman, 1973). Well drilling logs (WGNHS 2003 and WDNR 2015) in the vicinity of the Landfill present sandstone thicknesses of 338 feet to 435 feet. Precambrian igneous and metamorphic rock underlies the Cambrian sandstone.

Groundwater beneath the Landfill is first observed within the unconsolidated sandy deposits and the sandstone bedrock. A groundwater elevation map (Figure 2) shows that groundwater flows toward the central part of the valley occupied by the facility and then south toward the Mississippi River.

Historical and recent groundwater elevation data are comparable and indicate that groundwater flow at the site is consistent with little temporal variation. The approximate horizontal gradient determined for the Feasibility Report was 0.06 ft/ft (RMT, 1997) and is currently estimated at 0.05 ft/ft over the past several years (2013 through 2022). In-situ hydraulic conductivity data presented in the Feasibility Report (RMT, 1997) indicates a geometric mean hydraulic conductivity of $1.4x10^{-3}$ cm/s for the fluvial sand and gravel unit and $1.1x10^{-3}$ cm/s for the Cambrian sandstone.

Vertical gradients were also evaluated in the Feasibility Report (RMT, 1997) and indicated that the vertical gradients within the sand and sand-to-bedrock were generally upward (0.02 ft/ft to 0.05 ft/ft) and the vertical gradients within the bedrock were generally downward (0.2 ft/ft to 0.49 ft/ft). By applying the same methods used in the Feasibility Report to recent water level data (2015 through 2022), the vertical gradients within the fluvial sand and gravel unit, from sand to bedrock, and within the bedrock are generally downward, with the exception of an upward gradient observed from bedrock to sand at W42/P42A during the 2022 monitoring period.

2.0 Groundwater Monitoring

2.1 Monitoring Well Network

A groundwater monitoring system has been established for the Landfill, as detailed in the GWMP (TRC, 2017). The detection monitoring well network for the Landfill consists of six water table monitoring wells and one piezometer (denoted with an "A" suffix). Three of the water table wells are upgradient (i.e., "background") wells: one represents groundwater within the fluvial sand and gravel unit (W-102R) and the other two represent groundwater within the sandstone bedrock (W-101 and W-107). The four downgradient monitoring wells are W-100R, W-100AR, W-105, and W-106.

The monitoring well locations are shown on Figure 2. There were no changes to the monitoring well network during 2022.

2.2 Background Sampling

Quarterly background groundwater monitoring was conducted at the Landfill from September 2015 through September 2017 in accordance with the GWMP. Groundwater data included eight background sampling events with field and laboratory analysis of the parameters required in the CCR Rule's Appendix III and Appendix IV to Part 257 from both the upgradient and downgradient wells. Background data was included in the first Annual GW monitoring and corrective active report (TRC, 2018). The background dataset has been expanded to include the semiannual monitoring events from September 2017 to September 2019 (TRC, 2021).

2.3 Semiannual Groundwater Monitoring

The semiannual monitoring parameters for the detection groundwater monitoring program were selected per the CCR Rule's Appendix III to Part 257 – Constituents for Detection Monitoring. The Appendix III indicator parameters consist of boron, calcium, chloride, fluoride, pH (field), sulfate, and total dissolved solids (TDS). These parameters were analyzed in accordance with the groundwater monitoring program described in the GWMP.

2.3.1 Data Summary

The semiannual detection monitoring groundwater sampling events were performed by DPC personnel on March 23-24, 2022, and September 20-22, 2022. Samples were analyzed by Pace Analytical Services, LLC, in accordance with the GWMP. This laboratory is accredited with the WDNR.

Static water elevation data were collected at the seven monitoring well locations during each sampling event. Groundwater samples were collected from each of the detection monitoring wells and analyzed for the Appendix III indicator parameters and field parameters. A summary of the groundwater data collected during the March and September 2022 events is provided in Appendix A, including static groundwater elevation data, analytical results, and field data.

2.3.2 Data Quality Review

Data from each round were evaluated for completeness and potential sample contamination.

For the March sampling round, the total boron result for the groundwater sample from well W-100AR was 39 ug/L, which narrowly exceeded the tolerance limit of 38.4 ug/L. In accordance with section 6.5 of the Groundwater Monitoring Program (GWMP, TRC, 2017), verification resampling was performed for total boron at W-100AR on May 10, 2022. The resulting total boron concentration was 24.41 ug/L for the verification resample. This result is below the tolerance limit, confirming that the March round of monitoring did not indicate an SSI in total boron concentrations for well W-100AR.

For the September sampling event, initial total boron results were higher than previously detected for all sampled wells, including the upgradient wells. Because these results were inconsistent with past data, the samples were reanalyzed for total boron. The results for the reanalysis were consistent with previous results for the site. The initial total boron results were elevated due to a confirmed laboratory error. The total boron results from the reanalysis are compared to the TLs in Table 2 and are included in Appendix A.

No other data issues were identified and the remaining data were found to be complete and usable for the purposes of the CCR monitoring program.

2.3.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the March and September 2022 sampling events show that groundwater within the uppermost aquifer generally flows to the south at the site. Groundwater potentiometric surface elevations measured across the Landfill during the September 2022 sampling event are provided on Table 2 and were used to construct a groundwater potentiometric surface map (Figure 2).

The map indicates that current groundwater flow is consistent with previous monitoring events. The average hydraulic gradient throughout the Landfill during this event is estimated at 0.05 ft/ft, resulting in an estimated average seepage velocity of approximately 1.1 ft/day or 395 ft/year for this event, using the average hydraulic conductivity of 4 ft/day (TRC, 2017) and an assumed effective porosity of 20 percent.

The general flow rate and direction in the uppermost aquifer is similar to that identified in previous monitoring and continues to demonstrate that the compliance wells are appropriately positioned to detect the presence of Appendix III parameters that could potentially migrate from the Landfill.

3.0 Statistical Evaluation

3.1 Establishing Background Limits

Background limits were established for the Appendix III indicator parameters following the collection of eight background monitoring events and established and described in the Annual Groundwater Monitoring Report (TRC, 2018). The background datasets and tolerance limits were updated for several parameters in 2020. These updates were performed in accordance with the Groundwater Monitoring Program (TRC, 2017), and additional detail on the updates is provided in Appendix B of the 2020 Annual Groundwater Monitoring Report (TRC, 2021).

3.2 Data Comparison to Background Limits

Concentrations of the indicator parameters in each of the detection monitoring wells (W-100R, W-100AR, W-105, and W-106) were compared to their respective statistical background limits. The comparisons are presented on Table 1 (March 23-24, 2022, as well as the May 10, 2022, resampling of boron at W-100AR) and Table 2 (September 20-22, 2022).

The evaluation of the 2022 results for Appendix III indicator parameters shows that there were no SSIs compared to background for boron, calcium, chloride, fluoride, pH, sulfate, or TDS. Since there were no SSIs in the tested parameters in 2022, the monitoring program has remained in detection monitoring.

4.0 Conclusions and Recommendations

DPC has established a monitoring program at the Landfill in accordance with the CCR Rule and has conducted compliance monitoring for 2022 in accordance with 40 CFR §257.94. There were no confirmed SSIs over background limits for the Appendix III parameters during the March and September 2022 monitoring events. Therefore, DPC will continue to conduct detection monitoring, and is not required to take additional action at this time.

The next semiannual monitoring events at the Landfill are scheduled for March and September of 2023. Sampling and analytical results will be reported in January 2024.

5.0 References

RMT, Inc. 1997. Feasibility Report: Dairyland Power Cooperative Phase IV Disposal Area, Alma Off-Site Ash Disposal Facility. Town of Belvidere, Buffalo County, Wisconsin. September 1997.

RMT, Inc. October 2000. Dairyland Power Cooperative Plan of Operation Phase IV Disposal Area Alma Off-site Ash Disposal Facility, Town of Belvidere, Wisconsin. Prepared for Dairyland Power Cooperative.

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Wisconsin Department of Natural Resources. 2015. Water Well Data Disc. Database. January 2015.

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Young, H.L. and R.G. Borman. 1973. Water Resources of Wisconsin Trempealeau – Black River Basin. Hydrologic Investigations Atlas HA-474. U.S. Geological Survey. Washington, D.C. Maps. 4p.

Table 1: Comparison of Appendix III Parameter Results to Background Limits - March 24-25, 2022
Dairyland Power Cooperative - Off-site Disposal Facility, Phase IV Landfill
Buffalo County, Wisconsin

	W-100R		W-100AR		W-105		W-106	
Parameter	**Data**	**TL[(1)]**	**Data**	**TL[(1)]**	**Data**	**TL[(1)]**	**Data**	**TL[(1)]**
Boron, total (µg/L)	28	52.6	39 / 24.41[(2)]	38.4	20	20	<17	20
Calcium, total (µg/L)	71,200	92,200	76,100	89,100	71,400	80,700	74,100	80,700
Chloride, total (mg/L)	4.7	13.2	4.6	13.2	4.5	13.2	10.5	13.2
Fluoride, total (mg/L)	<0.095	0.21	<0.095	0.21	0.11	0.21	0.13	0.21
pH, field (SU)	7.21	6.61, 7.48	7.31	6.66, 7.60	7.29	6.80, 7.76	7.28	6.81, 7.91
Sulfate (mg/L)	17	32.7	18	29.0	16	29.0	22.0	29.0
Total Dissolved Solids (TDS) (mg/L)	322	488	348	551	306	448	338	448
Water elevation (Feet MSL)	727.66	--	718.10	--	734.07	--	774.09	--

Footnotes:

1. TL = tolerance limit for each parameter. Exceeding a tolerance limit would indicate a possible SSI.
2. Result for verification resample collected May 10, 2022.
3. A detect equal to the TL is not considered an exceedance.

Created By: T. Abramson, 5/3/2022
Checked By: S. Edwards, 5/4/2022

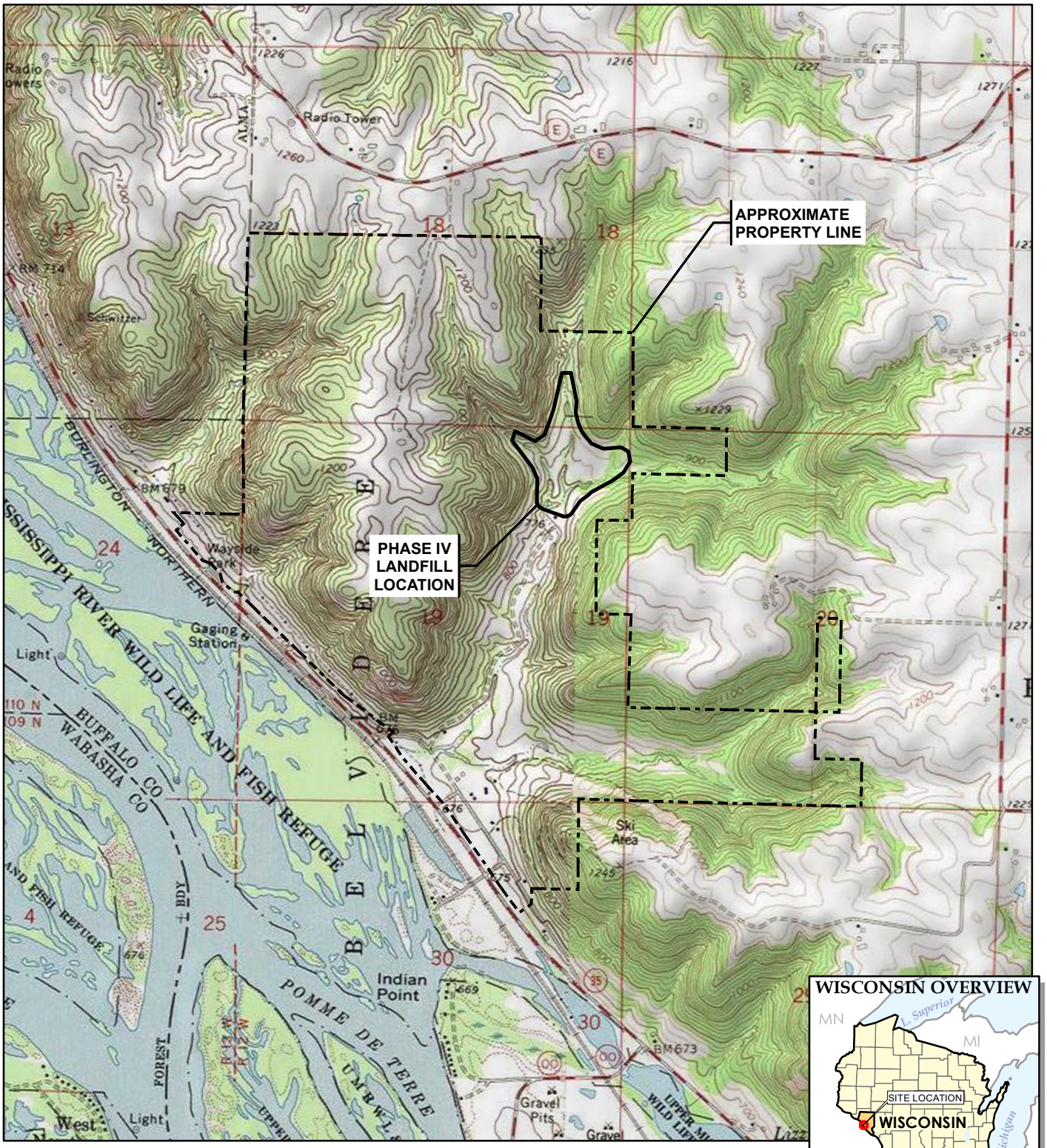
Table 2: Comparison of Appendix III Parameter Results to Background Limits - September 20-22, 2022
Dairyland Power Cooperative - Off-site Disposal Facility, Phase IV Landfill
Buffalo County, Wisconsin

	W-100R		W-100AR		W-105		W-106	
Parameter	**Data**	**TL[(1)]**	**Data**	**TL[(1)]**	**Data**	**TL[(1)]**	**Data**	**TL[(1)]**
Boron, total (µg/L)	11	52.6	15	38.4	7.3	20	6.3	20
Calcium, total (µg/L)	71,200	92,200	73,200	89,100	68,600	80,700	78,600	80,700
Chloride, total (mg/L)	4.9	13.2	4.5	13.2	4.5	13.2	10.6	13.2
Fluoride, total (mg/L)	<0.095	0.21	<0.095	0.21	<0.095	0.21	<0.095	0.21
pH, field (SU)	7.20	6.61, 7.48	7.23	6.66, 7.60	7.39	6.80, 7.76	7.40	6.81, 7.91
Sulfate (mg/L)	16.9	32.7	16.9	29.0	15.4	29.0	20.1	29.0
Total Dissolved Solids (TDS) (mg/L)	330	488	346	551	304	448	342	448
Water elevation (Feet MSL)	727.37	--	717.21	--	733.87	--	773.98	--

Footnotes:

1. TL = tolerance limit for each parameter. Exceeding a tolerance limit would indicate a possible SSI.

Created By: S. Edwards, 1/10/2023
Checked By: S. Sellwood, 1/11/2023



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1 " = 2,000 '
1:24,000

0 2,000 4,000
FEET

TRC
999 Fourier Drive
Suite 101
Madison, WI 53717
Phone: 608.826.3663
TRC - GIS

PROJECT:
DAIRYLAND POWER COOPERATIVE
ALMA OFF-SITE DISPOSAL FACILITY, PHASE IV LANDFILL
ANNUAL GROUNDWATER MONITORING REPORT
BUFFALO COUNTY, WISCONSIN

TITLE:
SITE LOCATION MAP

DRAWN BY:	R. SUEMNICHT
CHECKED BY:	S. EDWARDS
APPROVED BY:	S. SELLWOOD
DATE:	JANUARY 2023
PROJ. NO.:	469888.0000
FILE:	469888-002slm.mxd

FIGURE 1

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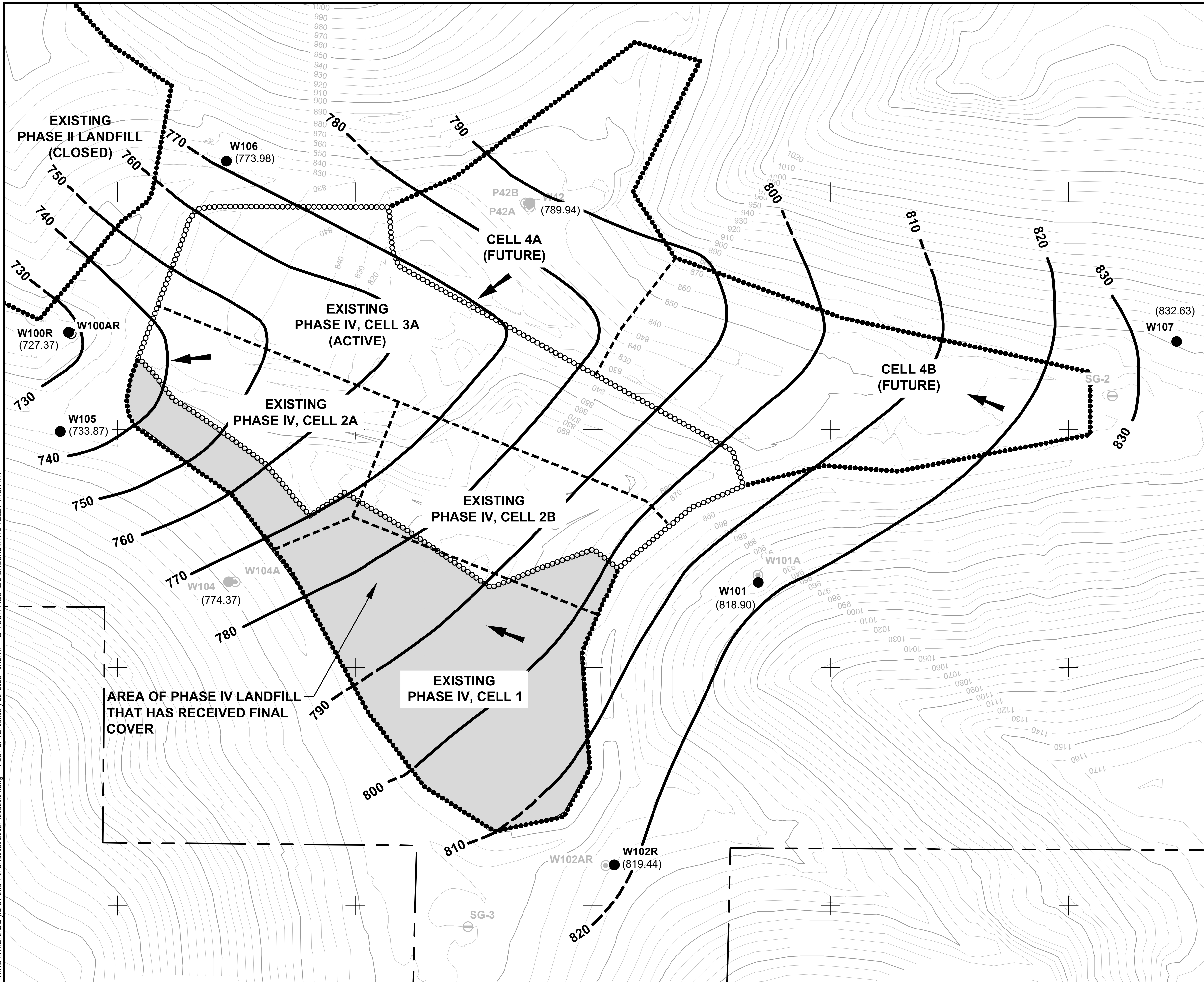

LEGEND

— - —	APPROXIMATE PROPERTY BOUNDARY
+	GRID LOCATION
890	EXISTING 10' CONTOUR
x 895.7	EXISTING SPOT ELEVATION
●●●●●	LIMITS OF PERMITTED LANDFILL
○○○○○	LIMITS OF CCR DISPOSAL (ACTIVE LANDFILL)
- - -	PHASE LINE
W42	MONITORING WELL (NOT INCLUDED IN FEDERAL GWMP)
W42B	PIEZOMETER (NOT INCLUDED IN FEDERAL GWMP)
W101	MONITORING WELL LOCATION
W101A	PIEZOMETER LOCATION
(787.22)	GROUNDWATER ELEVATION
←	GROUNDWATER FLOW DIRECTION
800 ———	GROUNDWATER EQUIPOTENTIAL LINE

NOTES

1. THE BASE MAP WAS COMPILED FROM THE CELL 3B LINER CONSTRUCTION DOCUMENTATION REPORT (OCTOBER, 2016) AND THE NOVEMBER 2, 2016 ANNUAL AIR SPACE SURVEY BY EXETER DESIGN, INC.
2. THE HORIZONTAL DATUM IS REFERENCED TO THE WISCONSIN STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE, NORTH AMERICAN DATUM 1983, US SURVEY FEET.
3. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988. CONTOUR INTERVAL IS 10 FEET.
4. GROUNDWATER ELEVATIONS BASED ON MEASUREMENTS TAKEN SEPTEMBER 20-21, 2022. GROUNDWATER ELEVATIONS ARE BASED ON MEAN SEA LEVEL DATUM.

N

0 200 400

SCALE IN FEET

PROJECT: DAIRYLAND POWER COOPERATIVE
ANNUAL GROUNDWATER MONITORING REPORT
ALMA OFF-SITE PHASE IV LANDFILL
BUFFALO COUNTY, WISCONSIN

TITLE: **GROUNDWATER ELEVATION MAP**

DRAWN BY:	T. FIEBRANZ	PROJ NO.:	469888
CHECKED BY:	S.EDWARDS		
APPROVED BY:	S.SELLWOOD		**FIGURE 2**
DATE:	JANUARY 2023		

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FILE NO.: 469888.01.dwg

DRAWING NAME: J:\Dairyland Power\Alma\469888\0000\469888.01.dwg --- PLOT DATE: January 25, 2023 - 5:12AM --- LAYOUT: FIGURE 2 GROUNDWATER ELEVATION MAP

Version: 2017-03-03

Appendix A: 2022 Detection Monitoring Data

Dairyland Power Cooperative - Alma Off-Site Groundwater Data

March 2022

PARAMETER	UNITS	W-100AR 3/25/2022 40242547001	W-100R 3/25/2022 40242547002	W-101 3/25/2022 40242547004	W-102R 3/25/2022 40242547003	W-105 3/24/2022 40242547005	W-106 3/24/2022 40242547006	W-107 3/24/2022 40242547007
Water elevation	Feet	718.10	727.66	820.17	820.74	734.07	774.09	832.79
Appendix III								
Boron, total	µg/L	39	28	18	20	20	< 17	< 17
Calcium, total	µg/L	76100	71200	66500	66700	71400	74100	83400
Chloride, total	mg/L	4.6	4.7	6.5	3.6	4.5	10.5	18.6
Fluoride, total	mg/L	< 0.095	< 0.095	0.1	0.098	0.11	0.13	0.14
pH, field	SU	7.31	7.21	7.51	7.37	7.29	7.28	7.35
Sulfate	mg/L	17.7	17.2	23.1	16.4	15.7	21.7	24.1
Total Dissolved Solids (TDS)	mg/L	348	322	298	296	306	338	368

September 2022

PARAMETER	UNITS	W-100AR 9/21/2022 40251980001	W-100R 9/21/2022 40251980002	W-101 9/22/2022 40251980004	W-102R 9/22/2022 40251980003	W-105 9/21/2022 40251980005	W-106 9/20/2022 40251980006	W-107 9/20/2022 40251980007
Water elevation	Feet	717.21	727.37	818.90	819.44	733.87	773.98	832.63
Appendix III								
Boron, total	µg/L	15	11	5	5.6	7.3	6.3	5.7
Calcium, total	µg/L	73200	71200	71600	67000	68600	78600	89200
Chloride, total	mg/L	4.5	4.9	7.5	3.6	4.5	10.6	17.7
Fluoride, total	mg/L	< 0.095	< 0.095	< 0.095	< 0.095	< 0.095	< 0.095	< 0.095
pH, field	SU	7.23	7.2	7.4	7.4	7.39	7.4	7.37
Sulfate	mg/L	16.9	16.9	20.3	15.7	15.4	20.1	22.1
Total Dissolved Solids (TDS)	mg/L	346	330	334	304	304	342	394