

REPORT ON
2024 ANNUAL GROUNDWATER MONITORING REPORT FOR
FAR I RESIDUAL SOLID WASTE LANDFILL (LANDFILL)
CARDINAL UPLAND DISPOSAL FACILITY
BRILLIANT, OHIO

by
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Cleveland, Ohio

for
Cardinal Operating Company
Brilliant, Ohio

File No. 210218
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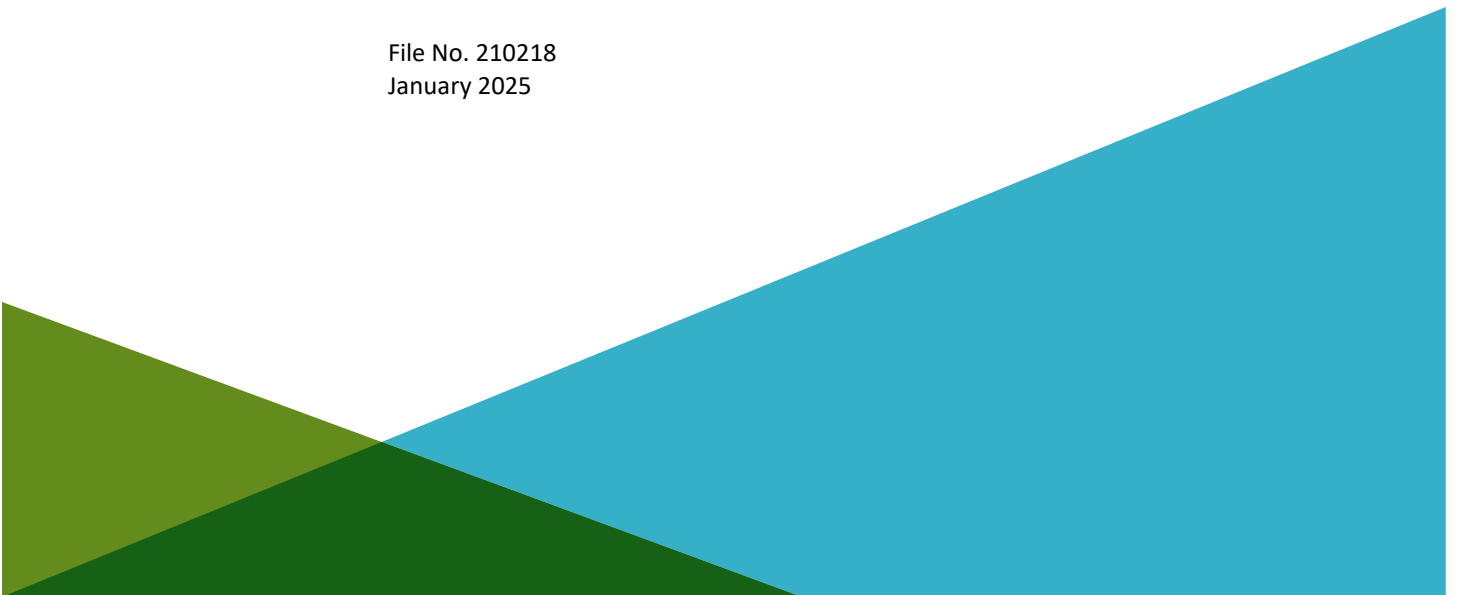


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1. Annual Groundwater Monitoring Report Summary

Haley & Aldrich, Inc. has prepared this 2024 Annual Groundwater Monitoring Report (Report) for the FAR I Residual Solid Waste Landfill (Landfill), an existing coal combustion residual (CCR) unit at the Cardinal Upland Disposal Facility in Brilliant, Ohio. This Report was prepared to comply with the United States Environmental Protection Agency (EPA) Hazardous and Solid Waste Management System; Disposal of CCR from Electric Utilities, Title 40 Code of Federal Regulations (CFR) Part 257, Subpart D dated 17 April 2015 (Rule), specifically subsection § 257.90(e)(1) through (6).

This Report summarizes groundwater monitoring activities conducted pursuant to the CCR Rule from 1 January 2024 through 31 December 2024.

In accordance with § 257.90(e)(6), an overview of the current status of groundwater monitoring and corrective action programs for the CCR unit is provided below:

- At the start of the current annual reporting period (1 January 2024), the Landfill was operating under the detection monitoring program.
- At the end of the current annual reporting period (31 December 2024), the Landfill was operating under the detection monitoring program.
- There were no statistically significant increases (SSIs) of Appendix III constituents identified from the October 2023 and April 2024 monitoring events. The statistical analysis of the October 2024 monitoring event is ongoing and will be presented in the 2025 Annual Report.
- No groundwater corrective measures monitoring activities were required to be completed in the annual reporting period in accordance with § 257.98(a)(1).

2. 40 CFR §257.90 Applicability

To report on the activities conducted during the prior calendar year and document progress complying with the CCR Rule, the specific requirements listed in § 257.90(e)(1) through (5) are provided in the next section in bold/italic type followed by a short narrative stating how that specific requirement was met.

2.1 40 CFR § 257.90(a) AND (c)

All CCR landfills, CCR surface impoundments, and lateral expansions of CCR units are subject to the groundwater monitoring and corrective action requirements under § 257.90 through § 257.98.

Once a groundwater monitoring system and groundwater monitoring program has been established at the CCR unit as required by this subpart, the owner or operator must conduct groundwater monitoring and, if necessary, corrective action through the active life and post-closure care period of the CCR unit.

The Landfill is an existing, active landfill disposal facility. As such, it is subject to the groundwater monitoring and corrective action requirements set forth by the EPA in 40 CFR §§ 257.90 through 257.98. This document satisfies the requirement under § 257.90(e) which requires the CCR Unit Owner/Operator to prepare an Annual Groundwater Monitoring and Corrective Action Report.

2.2 40 CFR § 257.90(e) SUMMARY

Annual groundwater monitoring and corrective action report. For existing CCR landfills and existing CCR surface impoundments, no later than January 31, 2018, and annually thereafter, the owner or operator must prepare an annual groundwater monitoring and corrective action 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, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. For purposes of this section, the owner or operator has prepared the annual report when the report is placed in the facility's operating record as required by § 257.105(h)(1).

This Report documents the activities completed in 2024 for the Landfill as required by the subject regulations. Groundwater sampling and analysis were conducted per the requirements of § 257.93, and the status of the groundwater monitoring program, set forth in § 257.95, is provided in this Report.

2.2.1 Status of the Groundwater Monitoring Program

SSIs of Appendix III constituents were not identified at the Landfill from the Fall 2023 sampling event nor the first (April 2024) semiannual monitoring event. The Landfill remains in detection monitoring.

2.2.2 Key Actions Completed

- In 2024, two groundwater monitoring events were completed. The first semiannual groundwater monitoring event was completed in April and the second semiannual groundwater monitoring event was conducted in October, with a resample in December.

- Potentiometric monitoring was conducted during the semiannual sampling events, as detailed in Section 2.3.5.
- Two semiannual statistical evaluations were completed in 2024. These evaluations were conducted for the October 2023 and April 2024 semiannual sampling events. The statistical evaluation of the October 2024 semiannual sampling event is ongoing and will be presented in the 2025 Annual Report.
- On 26 August 2024, one well was decommissioned in accordance with the Ohio Department of Natural Resources (ODNR) standards based on Rule 3745-07 of the State of Ohio Administrative Code (OAC). Water well sealing reports are included as Appendix A.

2.2.3 Problems Encountered

- During the October sampling event, inconsistent pH and water level measurements were discovered in the data collected in the field. As such, a separate sampling event was conducted to determine more representative data. The sampling equipment was determined to be responsible for the inconsistencies in the data.
- During the October sampling event, monitoring well S-20 exhibited elevated fluoride levels and several wells (S-7, S-10, S-18, S-GS-2) exhibited elevated pH readings. Resamples were taken in December, as allowed by the Landfill's Statistical Analysis Plan.
- Monitoring Well S-17 was unable to be sampled during the Spring and Fall 2024 sampling events due to insufficient water in the well.

2.2.4 Actions to Resolve Problems

- Future sampling events will confirm that field sampling parameters are within the expected ranges for accurate sample collection.

2.2.5 Project Key Activities for Upcoming Year

Key activities to be completed in 2025 include the following:

- Prepare the 2024 annual report; place it in the record as required by § 257.105(h)(1), notify the state [§ 257.106(d)]; and post to website [§ 257.107(d)].
- Prepare the semiannual statistical report for the second semiannual event of 2024.
- Conduct semiannual groundwater monitoring and reporting as required by § 257.95.
- Conduct semiannual statistical analyses in accordance with the Landfill Statistical Analysis Plan.

The background dataset will be updated following the Spring 2025 sampling event.

2.3 40 CFR § 257.90(e) – INFORMATION

At a minimum, the annual groundwater monitoring and corrective action report must contain the following information, to the extent available:

2.3.1 40 CFR § 257.90(e)(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;

As required by § 257.90(e)(1), a map showing the locations of the Landfill and associated upgradient and downgradient monitoring wells is presented as Figure 1.

2.3.2 40 CFR § 257.90(e)(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;

On 26 August 2024, monitoring well S-1 was decommissioned as part of the construction work associated with the future expansion of the landfill. The monitoring well was located within the future footprint of the Landfill and required decommissioning. Work was done in accordance with the ODNR standards based on Rule 3745-07 of the OAC. Water well sealing reports are included as Appendix A.

2.3.3 40 CFR § 257.90(e)(3)

In addition to all the monitoring data obtained under § 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;

In accordance with § 257.95(b) and § 257.95(d)(1), two independent samples from each background and downgradient monitoring well were collected and analyzed. A summary table including the sample names, dates of sample collection, reason for sample collection (detection or assessment), and monitoring data obtained for the groundwater monitoring program for the Landfill is presented in Table 1. A summary of the analytical results is presented in Table 2.

2.3.4 40 CFR § 257.90(e)(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

The Landfill remained in detection monitoring throughout 2024.

2.3.5 40 CFR § 257.90(e)(5)

Other information required to be included in the annual report as specified in § 257.90 through § 257.98.

Other information specified § 257.90 through § 257.98 is discussed in preceding sections.

As specified in § 257.93(c), the groundwater flow rates and directions are provided in Figures 2 and 3 and Tables 3 and 4 for each sampling event.

TABLES

TABLE 1
SUMMARY OF 2024 SAMPLES COLLECTED
 FAR I
 CARDINAL UPLAND DISPOSAL FACILITY
 BRILLIANT, OHIO

Location Name	Type of Well	Sample Date	Constituents Analyzed	Purpose	Sample Type
S-01	Downgradient	04/12/2024	Appendix III	Detection Monitoring	Primary
S-07	Downgradient	04/12/2024	Appendix III	Detection Monitoring	Primary
S-07	Downgradient	10/24/2024	Appendix III	Detection Monitoring	Primary
S-07	Downgradient	12/9/2024	pH	Detection Monitoring	Field Resample
S-10	Downgradient	04/11/2024	Appendix III	Detection Monitoring	Primary
S-10	Downgradient	10/17/2024	Appendix III	Detection Monitoring	Primary
S-10	Downgradient	12/4/2024	pH	Detection Monitoring	Field Resample
S-18	Downgradient	04/10/2024	Appendix III	Detection Monitoring	Primary
S-18	Downgradient	10/16/2024	Appendix III	Detection Monitoring	Primary
S-18	Downgradient	12/4/2024	pH	Detection Monitoring	Field Resample
S-20	Downgradient	04/11/2024	Appendix III	Detection Monitoring	Primary
S-20	Downgradient	10/16/2024	Appendix III	Detection Monitoring	Primary
S-20	Downgradient	12/04/2024	Appendix III	Detection Monitoring	Primary
S-20	Downgradient	12/04/2024	Appendix III	Detection Monitoring	Duplicate
S-GS-1	Downgradient	04/10/2024	Appendix III	Detection Monitoring	Primary
S-GS-1	Downgradient	04/10/2024	Appendix III	Detection Monitoring	Duplicate
S-GS-1	Downgradient	10/17/2024	Appendix III	Detection Monitoring	Primary
S-GS-2	Downgradient	04/10/2024	Appendix III	Detection Monitoring	Primary
S-GS-2	Downgradient	10/17/2024	Appendix III	Detection Monitoring	Primary
S-GS-2	Downgradient	10/17/2024	Appendix III	Detection Monitoring	Duplicate
S-GS-2	Downgradient	12/4/2024	pH	Detection Monitoring	Field Resample
CA-0623A	Upgradient	04/10/2024	Appendix III	Detection Monitoring	Primary
CA-0623A	Upgradient	04/10/2024	Appendix III	Detection Monitoring	Primary
CA-0623A	Upgradient	10/15/2024	Appendix III	Detection Monitoring	Primary
CA-0623A	Upgradient	10/15/2024	Appendix III	Detection Monitoring	Primary
OAE-2005-10-C	Upgradient	04/10/2024	Appendix III	Detection Monitoring	Primary
OAE-2005-10-C	Upgradient	10/17/2024	Appendix III	Detection Monitoring	Primary
S-02	Upgradient	04/12/2024	Appendix III	Detection Monitoring	Primary
S-02	Upgradient	10/24/2024	Appendix III	Detection Monitoring	Primary
S-04	Upgradient	04/11/2024	Appendix III	Detection Monitoring	Primary
S-04	Upgradient	10/24/2024	Appendix III	Detection Monitoring	Primary

TABLE 2
SUMMARY OF 2024 ANALYTICAL RESULTS
 FAR I
 CARDINAL UPLAND DISPOSAL FACILITY
 BRILLIANT, OHIO

Location Name	S-01	S-07	S-07	S-07	S-10	S-10	S-10	S-18	S-18	S-18	S-20	S-20	S-20
Sample Name	S-1-04122024	S-7-04122024	S-7-10242024	Field Resample	S-10-04112024	S-10-10172024	Field Resample	S-18-04102024	S-18-10162024	Field Resample	S-20-04112024	S-20-10162024	S-20-12042024
Sample Date	04/12/2024	04/12/2024	10/24/2024	12/9/2024	04/11/2024	10/17/2024	12/4/2024	04/10/2024	10/16/2024	12/4/2024	04/11/2024	10/16/2024	12/04/2024
Sample Type	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
Well Type	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient
APPENDIX III CONSTITUENTS (mg/L)													
Boron, Total	0.788	1.95	1.89		0.847	0.478		0.511	0.528		0.247	0.258	-
Calcium, Total	327	263	262		275	293		134	152		290	280	-
Chloride	4.2	30.2	29.8		22	16.6		3.2	2.7		3.3	3.2	-
Fluoride	0.095	0.1	0.24		0.21	0.29		0.33	0.36		0.29	0.39	0.33
Sulfate	1030	1100	1060		880	886		532	569		921	866	-
Total Dissolved Solids (TDS)	1730	1780	1860		1520	1540		1020	1050		1720	1610	-
pH, Field (pH units)	7.22	7.07	7.99	7.58	7.13	7.76	7.27	7.2	7.97	7.26	7.05	7.71	6.65

< = Not detected at reporting limit

Bold = detected

- = Not Analyzed

TABLE 2
SUMMARY OF 2024 ANALYTICAL RESULTS
 FAR I
 CARDINAL UPLAND DISPOSAL FACILITY
 BRILLIANT, OHIO

Location Name	S-20	S-GS-1	S-GS-1	S-GS-1	S-GS-2	S-GS-2	S-GS-2	S-GS-2	CA-0623A
Sample Name	Duplicate (S-20A)-12042024	S-GS-1-04102024	S-GS-1-DUP-04102024	S-GS-1-10172024	S-GS-2-04102024	S-GS-2-10172024	S-GS-2A-10172024	Field Resample	CA-0623A-04102024 FAR II
Sample Date	12/04/2024	04/10/2024	04/10/2024	10/17/2024	04/10/2024	10/17/2024	10/17/2024	12/4/2024	04/10/2024
Sample Type	Duplicate	Primary	Duplicate	Primary	Primary	Primary	Duplicate	Primary	Primary
Well Type	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Upgradient
APPENDIX III CONSTITUENTS (mg/L)									
Boron, Total	-	0.828	0.83	0.892	0.427	0.457	0.46		0.506
Calcium, Total	-	109	107	102	5.1	5.08	4.97		1.11
Chloride	-	23	22.7	24	84.8	63.8	63.3		24.2
Fluoride	0.33	0.67	0.69	0.76	3.3	3.5	3.5		2.7
Sulfate	-	857	838	870	13.6	24.8	25		19
Total Dissolved Solids (TDS)	-	1640	1640	1740	1500	1510	1460		-
pH, Field (pH units)	-	7.37	-	8.02	8.31	8.74	-	7.87	9.24

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TABLE 2
SUMMARY OF 2024 ANALYTICAL RESULTS
 FAR I
 CARDINAL UPLAND DISPOSAL FACILITY
 BRILLIANT, OHIO

Location Name	CA-0623A	CA-0623A	CA-0623A	OAE-2005-10-C	OAE-2005-10-C	S-02	S-02	S-04	S-04	S-05	S-05
Sample Name	CA-0623A-04102024 FAR I	CA-0623A-10152024	CA-0623A-10152024 LF	OAE-2005-10-C-04102024	OAE 2005 10C-10172024	S-2-04122024	S-2-10242024	S-4-04112024	S-4-10242024	S-5-04112024	S-5-10242024
Sample Date	04/10/2024	10/15/2024	10/15/2024	04/10/2024	10/17/2024	04/12/2024	10/24/2024	04/11/2024	10/24/2024	04/11/2024	10/24/2024
Sample Type	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
Well Type	Upgradient	Upgradient	Upgradient	Upgradient	Upgradient	Upgradient	Upgradient	Upgradient	Upgradient	Upgradient	Upgradient
APPENDIX III CONSTITUENTS (mg/L)											
Boron, Total	0.481	0.466	0.481	0.504	0.511	2.04	2.26	0.217	0.164	0.0498	0.0429
Calcium, Total	1.16	1.07	1.07	4.76	4.51	364	386	437	303	272	274
Chloride	24.9	18.8	18.9	12.9	18.2	5.2	4	11.5	7.2	7.4	7.5
Fluoride	2.5	2.2	2.3	1.2	1.3	0.25	0.33	0.16	0.3	0.11	0.17
Sulfate	20.2	20	21.8	209	157	1520	1730	1280	885	691	697
Total Dissolved Solids (TDS)	630	616	636	1170	1240	2530	2790	2240	1630	1250	1250
pH, Field (pH units)	9.24	-	-	8.26	8.83	6.33	8.01	7.04	7.51	7.23	7.84

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TABLE 2
SUMMARY OF 2024 ANALYTICAL RESULTS
 FAR I
 CARDINAL UPLAND DISPOSAL FACILITY
 BRILLIANT, OHIO

Location Name	S-06	S-06	S-19A	S-19A	S-GS-3	S-GS-3
Sample Name	S-6-04112024	S-6-10242024	S-19A-04112024	S-19A-10162024	S-GS-3-04102024	S-GS-3-10162024
Sample Date	04/11/2024	10/24/2024	04/11/2024	10/16/2024	04/10/2024	10/16/2024
Sample Type	Primary	Primary	Primary	Primary	Primary	Primary
Well Type	Upgradient	Upgradient	Upgradient	Upgradient	Upgradient	Upgradient
APPENDIX III CONSTITUENTS (mg/L)						
Boron, Total	2.37	2.27	0.435	0.447	0.339	0.328
Calcium, Total	401	410	378	402	5.32	5.24
Chloride	36	32.4	2.7	2.6	493	496
Fluoride	< 0.05	0.11	0.27	0.31	2.2	2.3
Sulfate	1400	1320	1820	1700	0.4	< 0.25
Total Dissolved Solids (TDS)	2120	2240	2760	3700	1950	1840
pH, Field (pH units)	7	7.73	6.96	7.84	8.79	9.03

< = Not detected at reporting limit

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TABLE 3
GROUNDWATER FLOW CALCULATIONS APRIL 2024
 FAR I RESIDUAL SOLID WASTE LANDFILL
 CARDINAL UPLAND DISPOSAL FACILITY
 BRILLIANT, OHIO

Program	Groundwater Zone	Well	Hydraulic Location	Depth to Water (ft)	Potentiometric Elevation (ft)	Gradient ¹ (ft/ft)	Hydraulic Conductivity ² (cm/sec)			Effective Porosity	Groundwater Velocity (ft/day)			Well Diameter ³ (in)	Residence Time in Well ⁶ (days)		
							Low	Representative	High		Low	Representative	High		Low	Representative	High
FAR I	Fly Ash Shallow	CA-0623A	Upgradient	153.62	1009.1	0.007	0.0001	0.05	0.1	0.32	0.0064	3.19	6.37	6	0.078	0.157	78.48
FAR I	Fly Ash Shallow	OAE-2005-10-C	Upgradient	224.29	1016.56	0.018	0.0001	0.05	0.1	0.32	0.0164	8.18	16.36	6	0.031	0.061	30.57
FAR I	Fly Ash Shallow	S-1	Downgradient	8.32	994.09	0.031	0.0001	0.05	0.1	0.32	0.0275	13.75	27.50	3	0.009	0.018	9.09
FAR I	Fly Ash Shallow	S-2	Upgradient	36.79	1002.66	0.018	0.0001	0.05	0.1	0.32	0.0161	8.03	16.07	3	0.016	0.031	15.56
FAR I	Fly Ash Shallow	S-4	Upgradient	19.61	997.72	0.004	0.0001	0.05	0.1	0.32	0.0038	1.91	3.82	3	0.065	0.131	65.45
FAR I	Fly Ash Shallow	S-5	Upgradient	4.48	997.72	0.004	0.0001	0.05	0.1	0.32	0.0035	1.77	3.54	3	0.071	0.141	70.58
FAR I	Fly Ash Shallow	S-6	Upgradient	10.67	995.99	0.005	0.0001	0.05	0.1	0.32	0.0042	2.11	4.23	3	0.059	0.118	59.16
FAR I	Fly Ash Shallow	S-7	Downgradient	44.74	965.87	0.042	0.0001	0.05	0.1	0.32	0.0371	18.57	37.14	3	0.007	0.013	6.73
FAR I	Fly Ash Shallow	S-10	Downgradient	30.96	974.23	0.028	0.0001	0.05	0.1	0.32	0.0248	12.39	24.79	6	0.020	0.040	20.17
FAR I	Fly Ash Shallow	S-17	Upgradient	202.17	995.83	0.009	0.0001	0.05	0.1	0.32	0.0077	3.85	7.69	6	0.065	0.130	64.98
FAR I	Fly Ash Shallow	S-18	Downgradient	153.82	1001.55	0.006	0.0001	0.05	0.1	0.32	0.0056	2.82	5.64	6	0.089	0.177	88.68
FAR I	Fly Ash Shallow	S-19A	Upgradient	98.55	1000.05	0.011	0.0001	0.05	0.1	0.32	0.0097	4.87	9.75	6	0.051	0.103	51.31
FAR I	Fly Ash Shallow	S-20	Downgradient	42.45	963.43	0.042	0.0001	0.05	0.1	0.32	0.0371	18.53	37.06	6	0.013	0.027	13.49
FAR I	Fly Ash Shallow	S-GS-1	Downgradient	20.52	994.05	0.011	0.0001	0.05	0.1	0.32	0.0097	4.87	9.75	6	0.051	0.103	51.31
FAR I	Fly Ash Shallow	S-GS-2	Downgradient	27.14	984.61	0.012	0.0001	0.05	0.1	0.32	0.0108	5.41	10.82	6	0.046	0.092	46.22
FAR I	Fly Ash Shallow	S-GS-3	Upgradient	63.62	975.8	0.023	0.0001	0.05	0.1	0.32	0.0200	9.98	19.96	6	0.025	0.050	25.05

Notes:

Measurements and calculations represent conditions on 9 April 2024.

¹Groundwater Monitoring Network Evaluation; Cardinal Site – Forner Fly Ash Reservoir I - Residual Solid Waste Landfill, Brilliant, Ohio prepared by Geosyntec Consultants in July 2016.

² Elevations datum is National Geodetic Vertical Datum of 1929 (NGVD29).

³ Hydraulic gradient was calculated from a potentiometric surface using Arcmap software tools.

⁴ Low and high conductivity values are from the 2016 Groundwater Monitoring Network Evaluation, with a representative value chosen at the midpoint of this range.

⁵ Well diameter represents the diameter of the borehole (sandpack).

⁶ Residence time is an estimation of how long it would take groundwater to travel a distance equivalent to the well diameter at the calculated velocity.

TABLE 4
GROUNDWATER FLOW CALCULATIONS DECEMBER 2024
 FAR I RESIDUAL SOLID WASTE LANDFILL
 CARDINAL UPLAND DISPOSAL FACILITY
 BRILLIANT, OHIO

Program	Groundwater Zone	Well	Hydraulic Location	Depth to Water (ft)	Potentiometric Elevation (ft)	Gradient ³ (ft/ft)	Hydraulic Conductivity ⁴ (cm/sec)			Effective Porosity	Groundwater Velocity (ft/day)			Well Diameter ⁵ (in)	Residence Time in Well ⁶ (days)		
							Low	Representative	High		Low	Representative	High		Low	Representative	High
FAR I	Fly Ash Shallow	CA-0623A	Upgradient	153.89	1008.83	0.011	0.0001	0.05	0.1	0.32	0.0100	5.02	10.04	6	0.050	0.100	49.80
FAR I	Fly Ash Shallow	OAE-2005-10-C	Upgradient	231.42	1009.43	0.013	0.0001	0.05	0.1	0.32	0.0118	5.90	11.80	6	0.042	0.085	42.38
FAR I	Fly Ash Shallow	S-1 ⁷	Downgradient														
FAR I	Fly Ash Shallow	S-2	Upgradient	42.28	997.17	0.029	0.0001	0.05	0.1	0.32	0.0259	12.96	25.92	3	0.010	0.019	9.64
FAR I	Fly Ash Shallow	S-4 ⁷	Upgradient														
FAR I	Fly Ash Shallow	S-5	Upgradient	4.73	997.47	0.003	0.0001	0.05	0.1	0.32	0.0029	1.44	2.87	3	0.087	0.174	87.07
FAR I	Fly Ash Shallow	S-6	Upgradient	12.17	994.49	0.004	0.0001	0.05	0.1	0.32	0.0034	1.71	3.42	3	0.073	0.146	73.16
FAR I	Fly Ash Shallow	S-7	Downgradient	47.15	963.46	0.068	0.0001	0.05	0.1	0.32	0.0606	30.28	60.57	3	0.004	0.008	4.13
FAR I	Fly Ash Shallow	S-10	Downgradient	35.39	969.8	0.066	0.0001	0.05	0.1	0.32	0.0588	29.38	58.77	6	0.009	0.017	8.51
FAR I	Fly Ash Shallow	S-17	Upgradient	198.41	999.59	0.004	0.0001	0.05	0.1	0.32	0.0035	1.76	3.52	6	0.142	0.284	141.91
FAR I	Fly Ash Shallow	S-18	Downgradient	160.83	994.54	0.004	0.0001	0.05	0.1	0.32	0.0037	1.85	3.70	6	0.135	0.271	135.27
FAR I	Fly Ash Shallow	S-19A	Upgradient	103.08	995.52	0.007	0.0001	0.05	0.1	0.32	0.0065	3.27	6.55	6	0.076	0.153	76.38
FAR I	Fly Ash Shallow	S-20	Downgradient	46.57	959.31	0.046	0.0001	0.05	0.1	0.32	0.0405	20.25	40.50	6	0.012	0.025	12.35
FAR I	Fly Ash Shallow	S-GS-1	Downgradient	23.22	991.35	0.007	0.0001	0.05	0.1	0.32	0.0066	3.29	6.58	6	0.076	0.152	76.00
FAR I	Fly Ash Shallow	S-GS-2	Downgradient	30.88	980.87	0.016	0.0001	0.05	0.1	0.32	0.0145	7.25	14.50	6	0.034	0.069	34.48
FAR I	Fly Ash Shallow	S-GS-3	Upgradient	64.38	975.04	0.018	0.0001	0.05	0.1	0.32	0.0161	8.04	16.09	6	0.031	0.062	31.08

Notes:

Measurements and calculations represent conditions on 2 December 2024.

1 Groundwater Monitoring Network Evaluation; Cardinal Site – Former Fly Ash Reservoir I - Residual Solid Waste Landfill, Brilliant, Ohio prepared by Geosyntec Consultants in July 2016.

2 Elevations datum is National Geodetic Vertical Datum of 1929 (NGVD29).

3 Hydraulic gradient was calculated from a potentiometric surface from the most recent representative conditions.

4 Low and high conductivity values are from the 2016 Groundwater Monitoring Network Evaluation, with a representative value chosen at the midpoint of this range.

5 Well diameter represents the diameter of the borehole (sandpack).




6 Residence time is an estimation of how long it would take groundwater to travel a distance equivalent to the well diameter at the calculated velocity.

7 Well unable to be measured during this sampling event.

FIGURES

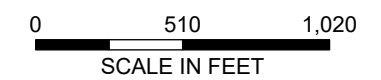
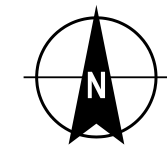


Legend

-  MONITORING WELL
-  RESIDUAL SOLID WASTE LANDFILL
-  FLY ASH RESERVOIR (FAR II)

NOTES:

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE
2. DEFINITIONS
FT=FOOT
NGVD29=NATIONAL GEODETIC VERTICAL DATUM 1929
3. ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (FT MSL)
4. AERIAL IMAGERY SOURCE NEARMAP 14 MAY 2023



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ALDRICH**

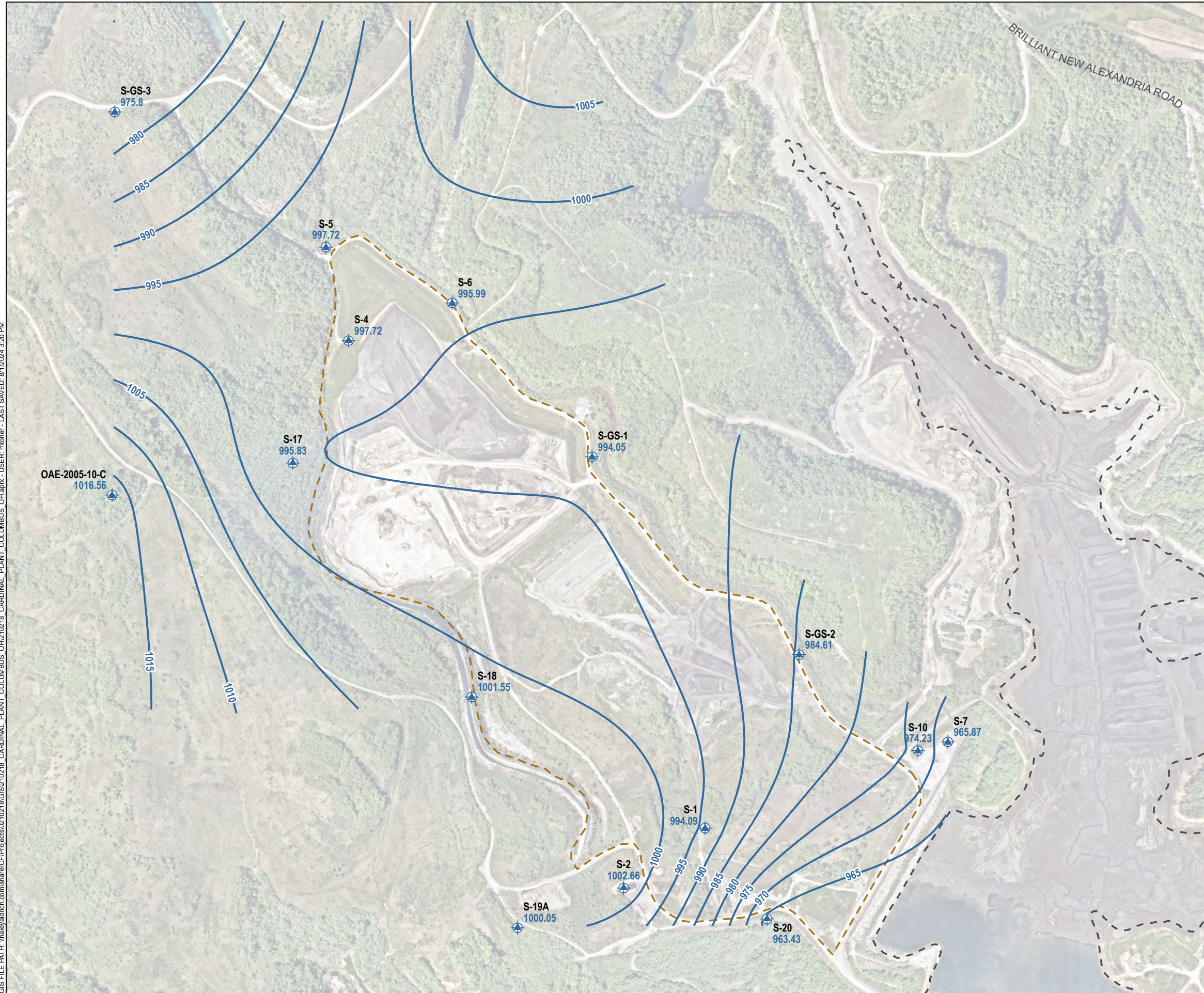
CARDINAL UPLAND
DISPOSAL FACILITY
Brilliant, OHIO

CCR UNIT AND
MONITORING WELLS
FAR I





JANUARY 2025

FIGURE 1

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LEGEND

-  MONITORING WELL WITH **GROUNDWATER ELEVATION** IN FEET
-  GROUNDWATER ELEVATION CONTOUR,
10-FT INTERVAL (NGVD29)
-  RESIDUAL SOLID WASTE LANDFILL
-  FLY ASH RESERVOIR (FAR II)

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. DEFINITIONS:
FT = FOOT
NGVD29 = NATIONAL GEODETIC VERTICAL DATUM 1929
3. GROUNDWATER ELEVATIONS MEASURED 9 APRIL 2024.
4. ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (FT MSL).
5. AERIAL IMAGERY SOURCE: NEARMAP, 14 MAY 2023



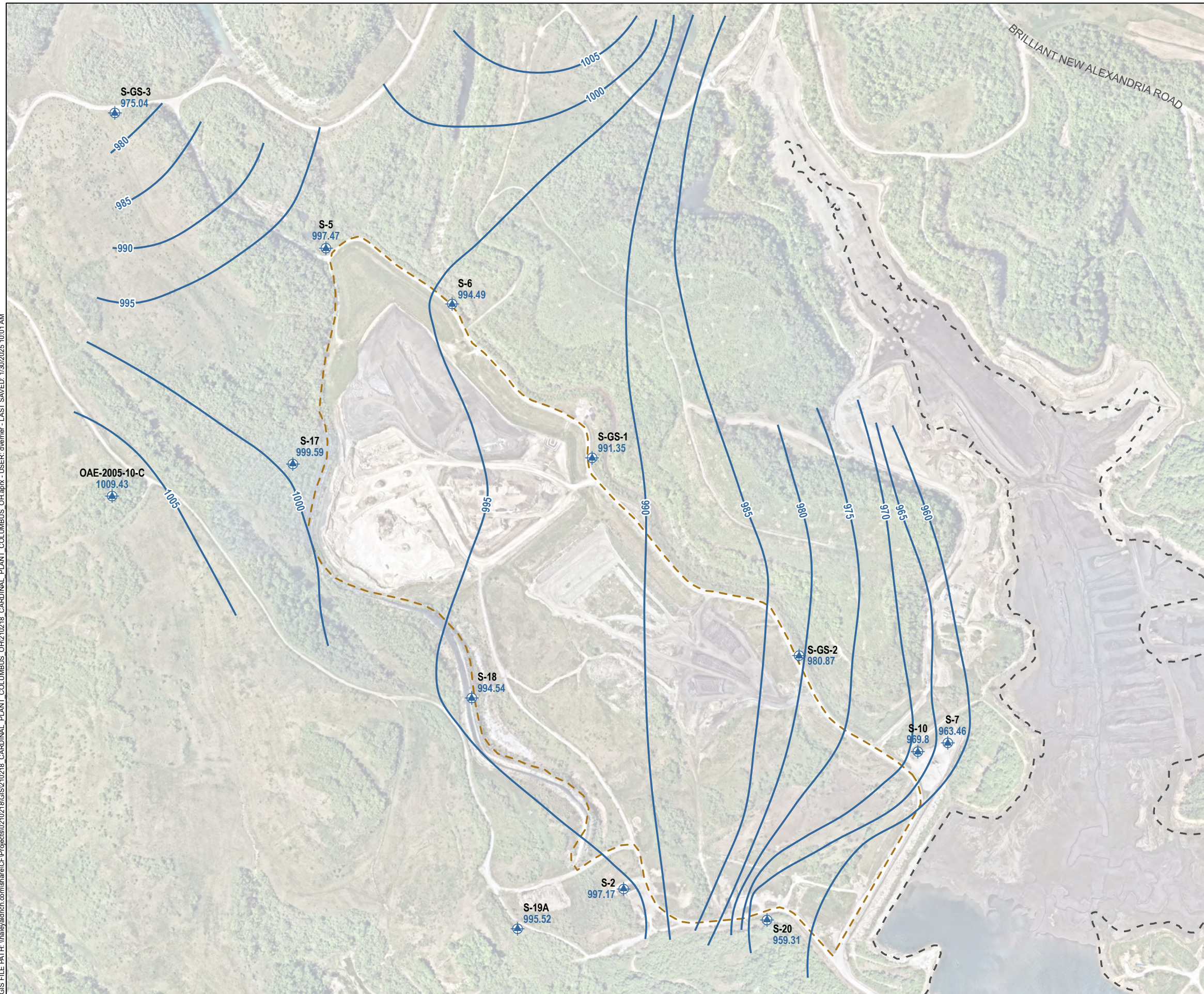
CARDINAL POWER PLANT
BRILLIANT, OHIO

**POTENTIOMETRIC SURFACE
FAR I APRIL 2024**





AUGUST 2024

FIGURE 2

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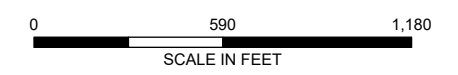


LEGEND

-  MONITORING WELL WITH **GROUNDWATER ELEVATION** IN FEET
-  GROUNDWATER ELEVATION CONTOUR, 5-FT INTERVAL (NGVD29)
-  RESIDUAL SOLID WASTE LANDFILL (FAR I)
-  FLY ASH RESERVOIR (FAR II)

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. DEFINITIONS:
FT = FOOT
NGVD29 = NATIONAL GEODETIC VERTICAL DATUM 1929
3. GROUNDWATER ELEVATIONS MEASURED 2 DECEMBER 2024.
4. ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (FT MSL).
5. AERIAL IMAGERY SOURCE: NEARMAP, 14 MAY 2023



CARDINAL PLANT
BRILLIANT, OHIO

**POTENTIOMETRIC SURFACE
FAR I DECEMBER 2024**

JANUARY 2025

FIGURE 3

APPENDIX A
Monitoring Well Abandonment Report

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Geological Survey
2045 Morse Road, Bldg B
Columbus, OH 43229-6693
Phone: (614) 265-6576

LOCATION

County JEFFERSON Township WELLS Section No. Lot No.

Owner BUCKEYE POWER CARDINAL OPERATING SYSTEM

Address of Well Location 306 COUNTY ROAD 7E RD E

City BRILLIANT Zip Code 43913

Well Location Description PFBC-2/S-1 IN FLYASH RESERVOIR AREA (120 Characters)

Location of Well: Latitude/Longitude Latitude 40.268284 Longitude -80.653599

Previous Well Use MONITOR

Elevation of Well 1001.88 +/- ft. Datum Plane: NAD27 NAD83

Source of Coordinates: GPS Survey Other

Source of Elevation: GPS Survey Other DIGITAL MAP

WELL IDENTIFICATION ODNR Well Log Number Project Well ID PFBC-2/S-1

MEASURED CONSTRUCTION DETAILS

Date of measurements 8/26/2024 No TD/Pump Stuck

Depth of Well 66.5 ft. Static Water Level ft.

Borehole Depth ft. Borehole Diameter in.

Casing Diameter 0.75 in. Casing Length 1 ft. Casing Type PVC

Borehole Depth ft. Borehole Diameter in.

Casing Diameter 1.25 in. Casing Length 65.1 ft. Casing Type PVC

Well Condition

SEALING PROCEDURE

Table with 4 columns: Placement, Sealing Material, Volume/Weight Used, Placement Method. Row 1: From 0 ft. To 66.5 ft. CEMENT/BENTONITE MIX, 188/50 LBS CEMENT/BEMTC, PUMPED WITH TREMIE PIPE.

Condition of Casing GOOD CONDITION Was Casing Removed? Yes or No

If casing Not Removed, was it Perforated? Yes or No Perforations: From 1 ft. To 66.1 ft.

Date Sealing Performed 8/26/2024

Comments/Reason for Sealing decommissioned as part of the FAR I partial closure at Cardinal Power Plant

CONTRACTOR

Name S & ME ODH Registration #

Address 6190 ENTERPRISE CT

City/State/Zip DUBLIN OH 43016

Signed CHRIS HALL Filed electronically on 9/3/2024

I hereby certify the information given is accurate and correct to the best of my knowledge.

Last revised on