Annual Groundwater Monitoring Report

Wheeling Power Company

Mitchell Plant

Landfill

Moundsville, WV

January 2026

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AMERICAN ELECTRIC POWER®

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I. Overview

This *Annual Groundwater Monitoring Report* (Report) has been prepared to report the status of activities for the preceding year for the an existing CCR unit at Wheeling Power Company's, a wholly owned subsidiary of American Electric Power Company (AEP), Mitchell Power Plant. The USEPA's CCR rules require that the Annual Groundwater Monitoring Report be posted to the operating record for the preceding year no later than January 31.

In general, the following activities were completed in 2025:

- The unit was in detection monitoring at the beginning and end of 2025.
- Groundwater samples were collected on April 9-10, 2025 and on September 25, 2025, and analyzed for Appendix III constituents, as specified in 40 CFR 257.94 and AEP's *Groundwater Sampling and Analysis Plan (2016)*. A detection monitoring resample corresponding to the September 2024 initial sampling was collected on April 9, 2025. A detection monitoring resample corresponding to the April 2025 initial event was collected in September 2025.
- Groundwater monitoring data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units.
- Appendix III constituents were compared to prediction limits (intervals for pH) established from background data established previously.
- Statistical evaluation of the first half 2024 sampling was completed in 2024 and concluded there was a statistically significant increase (SSI) over background for total dissolved solids (TDS) at MW-1102F. An alternative source demonstration (ASD) was completed in March 2025 and concluded that the SSI was not attributable to the landfill.
- Statistical evaluation of data collected during a September 19, 2024 initial sampling (second half 2024), with a resample collected on April 9, 2025, was completed on June 11, 2025 and concluded that there was one statistically significant increase (SSI) over background at one well (chloride at monitoring well MW-1102F).
- An alternative source demonstration for the chloride SSI at MW-1102F during the second half 2024 sampling was completed on September 3, 2025 and concluded that the SSI was not attributable to the landfill.
- Statistical evaluation of the data collected on April 9-10, 2025 initial sampling (first half 2025), with a resample collected on September 24, 2025 was completed on December 11, 2025 and concluded that there were two SSI's over background at one well (chloride and TDS at monitoring well MW-1102F). Because of these SSI's, an ASD is being pursued and will be completed within 90 days of certifying the statistics.

- Groundwater sampling was completed on September 25, 2025 for the second half of 2025 sampling. Potential SSI's have been identified and resampling, laboratory analysis, and statistical evaluations are ongoing and will be completed in 2026.

The major components of this annual report, to the extent applicable at this time, are presented in sections that follow:

- A map, aerial photograph or a drawing showing the CCR unit(s), all groundwater monitoring wells and monitoring well identification numbers;
- All of the monitoring data collected, including the rate and direction of groundwater flow, plus a summary showing the number of samples collected per monitoring well, the dates the samples were collected and whether the sample was collected as part of detection monitoring or assessment monitoring programs (Attached as Appendix 1);
- Statistical comparison of monitoring data to determine if there have been one or more SSIs over background levels (Attached as Appendix 2, where applicable);
- A discussion of whether any alternate source demonstrations were performed, and the conclusions (Attached as Appendix 3, where applicable);
- A summary of any transition between monitoring programs, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring (Notices attached as Appendix 4, where applicable);
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement regarding the rationale for the installation/decommission (Attached as Appendix 5, where applicable); and
- Other information required to be included in the annual report such as an alternate monitoring frequency, or assessment of corrective measures, if applicable.

In addition, this report summarizes key actions completed, and where applicable, describes any problems encountered and actions taken to resolve those problems. The report includes a projection of key activities for the upcoming year.

II. Groundwater Monitoring Well Locations and Identification Numbers

A figure that depicts the PE-certified groundwater monitoring network, the monitoring well locations, and their corresponding identification is provided in Appendix 1.

III. Monitoring Wells Installed or Decommissioned

There were no monitoring wells installed or decommissioned in 2025. The network design, as summarized in the *Groundwater Monitoring Network Design Report* (2016) and as posted at the CCR web site for Mitchell Plant, did not change. That design report, viewable on the AEP CCR web site, discusses the facility location, the hydrogeological setting, the hydrostratigraphic units, the uppermost aquifer, downgradient monitoring well locations and the upgradient monitoring well locations.

IV. Groundwater Quality Data and Static Water Elevation Data, With Flow Rate and Direction and Discussion

Appendix 1 contains tables showing the groundwater quality data collected during the establishment of background quality and detection monitoring. Static water elevation data from each monitoring event also are shown in **Appendix 1**, along with the groundwater velocities, groundwater flow direction, and potentiometric maps developed after each sampling event.

V. Groundwater Quality Data Statistical Analysis

Groundwater samples were collected on April 9-10, 2025 and on September 25, 2025, and analyzed for Appendix III constituents, as specified in 40 CFR 257.94 and AEP's *Groundwater Sampling and Analysis Plan (2016)*. A detection monitoring resample corresponding to the September 2024 initial sampling was collected on April 9, 2025. A detection monitoring resample corresponding to the April 2025 initial event was collected in September 2025. Statistical analysis reports completed in 2025 are included in **Appendix 2.**

Statistical evaluation of the first half 2024 sampling was completed in 2024 and concluded there was a statistically significant increase (SSI) over background for total dissolved solids (TDS) at MW-1102F. An alternative source demonstration (ASD) was completed in March 2025 and concluded that the SSI was not attributable to the landfill. ASD's completed in 2025 are included in **Appendix 3**.

Statistical evaluation of data collected during a September 19, 2024 initial sampling (second half 2024), with a resample collected on April 9, 2025, was completed on June 11, 2025 and concluded that there was one statistically significant increase (SSI) over background at one well (chloride at monitoring well MW-1102F). Statistical evaluation report is included in Appendix 2.

An alternative source demonstration for the chloride SSI at MW-1102F during the second half 2024 sampling was completed on September 3, 2025 and concluded that the SSI was not attributable to the landfill. ASD report is included in Appendix 3.

Statistical evaluation of the data collected on April 9-10, 2025 initial sampling (first half 2025), with a resample collected on September 24, 2025 was completed on December 11, 2025 and concluded that there were two SSI's over background at one well (chloride and TDS at monitoring well MW-1102F). Because of these SSI's, an ASD is being pursued and will be completed within 90 days of certifying the statistics. Statistical evaluation report is included in Appendix 2.

Groundwater sampling was completed on September 25, 2025 for the second half of 2025 sampling. Potential SSI's have been identified and resampling, laboratory analysis, and statistical evaluations are ongoing and will be completed in 2026.

VI. Alternative Source Demonstrations

Because a potential SSI over background of an Appendix III constituent was detected at Mitchell Plant's landfill during the first semiannual monitoring event in 2024, an ASD study was conducted resulting in a March 11, 2025 ASD report. The report concluded that the SSI was not due to a release from the Mitchell Landfill but was instead attributed to natural variation in the native groundwater.

Because a potential SSI over background of an Appendix III constituent was detected at Mitchell Plant's landfill during the second semiannual monitoring event in 2024, an ASD study was conducted resulting in a September 3, 2025 ASD report. The report concluded that the SSI was not due to a release from the Mitchell Landfill but was instead attributed to natural variation in the native groundwater.

These reports are provided in Appendix 3.

VII. Discussion About Transition Between Monitoring Requirements or Alternate Monitoring Frequency

No transition between monitoring requirements occurred in 2025; the CCR unit was in detection monitoring at the beginning and at the end of the year. A statement to this effect is provided in Appendix 4. The sampling frequency of twice per year will be maintained for the Appendix III constituents (boron, calcium, chloride, fluoride, pH, sulfate and total dissolved solids).

Regarding defining an alternate monitoring frequency, the groundwater velocity and monitoring well production is high enough at this facility that no modification of the semiannual detection monitoring schedule is necessary.

VIII. Other Information Required

The Mitchell landfill has remained in its current status of detection monitoring. All required information has been included in this annual groundwater monitoring report.

IX. Description of Any Problems Encountered in 2025 and Actions Taken

No significant problems were encountered. Through the use of low-flow purging and sampling methodology, samples representative of uppermost aquifer groundwater were obtained and the schedule was met to support this annual groundwater report preparation. There were, however, dry wells encountered during sampling, but this did not affect the statistical evaluation or monitoring network at the landfill.

X. A Projection of Key Activities for the Upcoming Year

Key activities for 2026 include the following:

- Detection monitoring on a semiannual schedule;

- Statistical evaluation of the detection monitoring results to determine any SSIs (or statistically significant decreases with respect to pH);
- Responding to any new data received in light of CCR rule requirements;
- Preparation of the next annual groundwater report.

APPENDIX 1 - Groundwater Data Tables and Figures

Tables follow showing the groundwater monitoring data collected, the rate of groundwater flow each time groundwater was sampled, the number of samples collected per monitoring well, dates that the samples were collected, and whether each sample was collected as part of a detection monitoring or an assessment monitoring program. Figures follow showing the PE-certified groundwater monitoring network with the corresponding well identifications along with static water elevation data and groundwater flow directions each time groundwater was sampled in the form of annotated satellite images.

Legend

Compliance Sampling Location

Upgradient Sampling Location

CCR Landfill (Approximate Limits of Waste)

Notes

- Monitoring well coordinates provided by AEP.

-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.

500 250 0 500 Feet

Site Layout
Landfill - Fish Creek Aquifer

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2018/01/26

Figure 1a

C:\Users\mmuenich\Documents\local_projects\AEP_GIS\Mitchell\MXDs\Landfill-FC\AEP-Mitchell_LF-Fish-Creek_Site_Layout.mxd. MMuenich. 1/26/2018. Project/Phase/Task.

Legend

- Compliance Sampling Location
- Upgradient Sampling Location
- CCR Landfill (Approximate Limits of Waste)

Notes

- Monitoring well coordinates provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.

500 250 0 500 Feet

Site Layout
Landfill - Rush Run Aquifer

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2018/01/26

Figure 1b

C:\Users\mmuenich\Documents\local_projects\AEP_GIS\Mitchell\MXDs\AEP-Mitchell_LF-Rush-Run_Site_Layout.mxd. MMuenich. 1/26/2018. Project/Phase/Task.

Table 1. Groundwater Data Summary: MW-1101F
Mitchell - LF
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
6/15/2016	Background	0.042	88.3	3.87	0.22	7.4	64.3	395
8/03/2016	Background	0.380	91.0	3.30	0.21	7.4	62.1	425
9/28/2016	Background	0.054	88.6	3.73	0.26	8.7	58.1	466

Table 1. Groundwater Data Summary: MW-1101F
Mitchell - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/15/2016	Background	0.21	1.64	159	0.023	0.08	0.6	0.294	0.304	0.22	0.525	0.012	< 0.002 U1	3.87	0.2	0.02 J1
8/03/2016	Background	0.14	1.46	155	0.033	0.08	0.6	0.244	1.494	0.21	0.673	0.017	< 0.002 U1	4.04	0.2	< 0.01 U1
9/28/2016	Background	0.18	1.79	142	0.029	0.12	0.8	0.231	1.561	0.26	0.511	0.016	< 0.002 U1	3.39	0.3	0.02 J1

Table 1. Groundwater Data Summary: MW-1101R
Mitchell - LF
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
6/15/2016	Background	0.287	6.91	8.41	1.20	8.2	76.4	741
8/03/2016	Background	0.518	5.00	10.3	1.56	8.4	76.4	750
9/28/2016	Background	0.382	6.12	13.3	1.83	8.5	43.5	43
11/16/2016	Background	1.80	19.4	15.2	2.29	8.6	32.2	801
2/14/2017	Background	0.501	2.23	15.4	2.40	8.6	32.0	806
4/12/2017	Background	0.360	4.02	14.4	2.17	8.7	39.2	798
5/24/2017	Background	0.380	1.91	15.1	2.41	8.7	28.6	793
7/25/2017	Background	0.415	1.76	15.8	2.61	8.7	28.7	788
10/11/2017	Detection	0.394	1.87	16.9	2.59	8.7	29.1	784
1/11/2018	Detection	--	1.75	--	--	7.9	28.8	--
4/10/2018	Detection	0.344	1.75	16.5	2.62	8.5	29.0	790
8/29/2018	Detection	0.371	2.42	16.3	2.45	9.0	29.7	783
5/01/2019	Detection	0.376	1.90	16.9	2.62	10.5	28.7	809
6/12/2019	Detection	0.371	2.03	16.2	2.38	8.8	27.4	822
10/23/2019	Detection	0.389	1.81	17.2	2.70	8.7	28.4	820
5/06/2020	Detection	0.364	2.17	15.1	2.46	8.2	23.9	828
10/21/2020	Detection	0.409	2.42	16.6	2.57	9.1	28.5	845
5/12/2021	Detection	0.349	2.46	16.8	2.47	8.3	27.5	856
10/20/2021	Detection	0.359	2.6	16.9	2.60	8.6	24.6	850
5/12/2022	Detection	0.373	2.52	17.5	2.67	9.0	29.1	840
10/05/2022	Detection	0.394	2.79	18.3	2.81	8.3	29.3	840
3/22/2023	Detection	--	2.54	17.3	--	8.4	--	--
5/17/2023	Detection	0.361	2.61	17.4	2.73	8.4	28.7	850
10/11/2023	Detection	0.365	3.23	17.1	2.56	8.6	29.4	830
3/06/2024	Detection	--	2.75	--	--	8.6	--	--
4/24/2024	Detection	0.349	2.54	17.5	2.64	8.6	27.8	830
4/09/2025	Detection	0.366	2.60	18.1	2.85	8.8	32.4	810
9/25/2025	Detection	0.391	2.47	17.0	2.74	8.5	28.6	820

Table 1. Groundwater Data Summary: MW-1101R
Mitchell - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/15/2016	Background	0.82	8.11	185	0.031	0.03	1.1	0.650	0.493	1.20	1.22	0.002	0.003 J1	31.8	0.5	0.05 J1
8/03/2016	Background	1.10	10.8	149	0.023	0.03	1.0	0.363	0.4776	1.56	0.674	0.012	< 0.002 U1	32.9	0.5	0.02 J1
9/28/2016	Background	0.92	11.1	149	0.01 J1	0.02	0.7	0.301	0.565	1.83	0.550	0.009	< 0.002 U1	26.2	0.5	0.01 J1
11/16/2016	Background	0.67	14.2	125	0.01 J1	0.02 J1	0.595	0.143	1.808	2.29	0.292	0.026	< 0.002 U1	20.6	0.4	< 0.01 U1
2/14/2017	Background	0.69	15.3	102	0.01 J1	0.02 J1	0.512	0.160	1.661	2.40	0.327	0.012	< 0.002 U1	34.0	0.4	0.02 J1
4/12/2017	Background	0.84	12.4	117	0.02 J1	0.02 J1	0.824	0.333	0.19	2.17	0.634	0.010	0.002 J1	16.7	0.5	< 0.01 U1
5/24/2017	Background	0.66	15.7	102	0.01 J1	0.01 J1	0.526	0.299	0.759	2.41	0.298	< 0.0002 U1	< 0.002 U1	14.8	0.3	< 0.01 U1
7/25/2017	Background	0.62	14.5	91.3	0.01 J1	0.01 J1	0.377	0.126	0.977	2.61	0.235	0.009	< 0.002 U1	18.3	0.3	0.02 J1

Table 1. Groundwater Data Summary: MW-1102F
Mitchell - LF
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
6/15/2016	Background	0.109	4.34	12.4	0.56	8.0	37.2	523
8/03/2016	Background	0.280	5.48	11.9	0.58	8.2	35.9	535
10/03/2016	Background	0.160	5.45	11.8	0.60	8.1	29.5	519
11/15/2016	Background	0.117	4.87	11.7	0.56	8.1	27.4	551
2/14/2017	Background	0.109	5.04	11.3	0.53	8.2	29.9	521
4/12/2017	Background	0.109	4.67	11.3	0.53	8.3	30.6	530
5/24/2017	Background	0.118	5.31	13.7	0.56	8.3	31.8	521
7/26/2017	Background	0.202	5.41	11.4	0.57	8.3	31.5	519
10/10/2017	Detection	0.278	4.79	12.4	0.57	8.4	32.3	526
1/11/2018	Detection	--	4.47	--	--	7.9	32.1	--
4/10/2018	Detection	0.109	4.40	13.4	0.63	8.2	33.2	539
8/28/2018	Detection	0.247	4.48	14.1	0.64	8.6	33.8	549
5/01/2019	Detection	0.126	4.69	15.2	0.66	9.5	37.6	577
6/12/2019	Detection	0.110	4.36	14.9	0.74	8.2	38.0	574
10/23/2019	Detection	0.114	4.46	16.3	0.68	8.3	38.8	564
1/31/2020	Detection	--	--	16.3	--	8.2	--	--
5/06/2020	Detection	0.129	4.33	16.0	0.69	8.8	33.8	574
7/15/2020	Detection	--	--	16.0	--	8.4	--	--
10/21/2020	Detection	0.147	3.81	17.3	0.76	9.0	39.2	580
3/17/2021	Detection	0.113	4.10	18.2	0.84	9.6	38.8	585
5/12/2021	Detection	0.114	4.08	18.2	0.79	8.9	38.4	584
10/12/2021	Detection	--	--	18.3	0.79	8.3	--	610
10/20/2021	Detection	0.121	4.3	18.5	0.82	8.3	35.9	590
5/12/2022	Detection	0.126	4.37	20.0	0.85	8.8	40.8	600
8/31/2022	Detection	--	--	19.9	--	8.2	--	--
10/05/2022	Detection	0.124	4.34	21.5	0.86	7.9	41.3	590
3/22/2023	Detection	--	--	21.1	--	8.1	--	--
5/17/2023	Detection	0.112	3.82	21.3	0.85	8.2	40.8	600
10/10/2023	Detection	--	--	21.0	--	8.2	--	--
10/11/2023	Detection	0.116	4.17	21.3	0.84	8.4	40.1	600
4/24/2024	Detection	0.115	4.20	22.4	0.85	8.4	40.2	620
9/18/2024	Detection	--	--	--	--	8.3	--	630
9/19/2024	Detection	0.147	4.29	22.8	0.81	8.3	39.4	620
4/09/2025	Detection	--	--	24.2	--	8.5	--	600
4/10/2025	Detection	0.120	4.37	23.9	0.90	8.5	44.7	620
9/24/2025	Detection	--	--	24.1	--	8.3	--	640
9/25/2025	Detection	0.132	4.16	23.5	0.97	8.3	38.8	630

Table 1. Groundwater Data Summary: MW-1102F
Mitchell - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/15/2016	Background	0.71	9.37	214	< 0.005 U1	0.04	0.4	0.096	0.352	0.56	0.335	0.003	< 0.002 U1	28.1	0.3	< 0.01 U1
8/03/2016	Background	0.69	8.16	212	< 0.005 U1	0.02 J1	0.4	0.090	0.881	0.58	0.183	0.006	< 0.002 U1	25.8	0.3	0.01 J1
10/03/2016	Background	0.64	8.45	194	0.005 J1	0.01 J1	0.5	0.286	0.972	0.60	0.298	0.002	< 0.002 U1	23.9	0.3	< 0.01 U1
11/15/2016	Background	0.63	8.49	212	0.005 J1	0.008 J1	0.435	0.074	1.859	0.56	0.141	0.003	< 0.002 U1	22.9	0.3	< 0.01 U1
2/14/2017	Background	0.62	8.66	197	0.006 J1	0.006 J1	0.411	0.049	1.015	0.53	0.131	0.004	< 0.002 U1	21.4	0.3	0.02 J1
4/12/2017	Background	0.56	7.68	191	0.005 J1	0.01 J1	0.399	0.079	0.1825	0.53	0.135	0.005	< 0.002 U1	19.3	0.3	0.01 J1
5/24/2017	Background	0.60	8.76	229	0.01 J1	0.02	0.807	0.203	0.3252	0.56	0.335	< 0.0002 U1	< 0.002 U1	20.0	0.4	0.01 J1
7/26/2017	Background	0.54	7.58	205	< 0.004 U1	0.01 J1	0.323	0.072	0.942	0.57	0.121	0.007	< 0.002 U1	34.7	0.3	0.03 J1

Table 1. Groundwater Data Summary: MW-1102R
Mitchell - LF
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
6/15/2016	Background	0.339	3.49	219	2.97	8.2	47.8	1470
8/03/2016	Background	0.467	4.05	217	2.98	8.3	44.9	1450
10/03/2016	Background	0.332	5.33	213	2.96	8.3	35.1	1530

Table 1. Groundwater Data Summary: MW-1102R
Mitchell - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/15/2016	Background	2.01	2.64	292	0.02 J1	0.35	0.5	0.799	0.710	2.97	0.558	0.015	< 0.002 U1	68.7	0.9	0.01 J1
8/03/2016	Background	1.71	3.57	356	0.128	0.14	3.0	1.75	1.217	2.98	2.82	0.021	0.007 J1	66.0	1.2	0.03 J1
10/03/2016	Background	1.73	3.37	441	0.307	0.17	3.9	3.01	2.828	2.96	7.24	0.028	0.007	51.4	1.9	0.03 J1

Table 1. Groundwater Data Summary: MW-1103F
Mitchell - LF
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
6/15/2016	Background	0.355	3.01	243	3.11	8.3	0.5	1390
8/02/2016	Background	0.402	2.99	247	3.20	8.3	0.3	1420
10/03/2016	Background	0.321	3.12	242	3.34	8.4	< 0.04 U1	1380
11/16/2016	Background	0.323	2.97	240	2.96	8.4	0.2	1370
2/15/2017	Background	0.303	2.82	240	3.07	8.5	0.2	1400
4/11/2017	Background	0.304	2.57	234	3.05	8.6	0.4	1400
5/23/2017	Background	0.346	2.88	237	3.23	8.5	0.4	1370
7/26/2017	Background	0.343	2.76	240	3.24	8.5	0.3	1370
10/11/2017	Detection	0.328	3.09	247	3.17	8.6	0.5	1390
4/11/2018	Detection	0.286	2.58	239	3.16	8.3	0.5	1390
8/29/2018	Detection	0.332	2.76	244	3.03	8.6	0.4	1380
5/02/2019	Detection	0.342	2.95	245	3.13	9.1	0.8	1360
6/12/2019	Detection	0.329	2.96	233	3.55	8.3	0.9	1410
10/23/2019	Detection	0.336	3.44	242	3.25	8.5	0.8	1440
5/06/2020	Detection	0.358	3.48	235	2.96	8.9	0.8	1420
10/21/2020	Detection	0.332	3.05	237	3.07	8.8	0.8	1440
5/12/2021	Detection	0.294	3.50	247	2.96	9.1	1.2	1440
10/20/2021	Detection	0.299	3.3	241	3.08	8.5	0.77	1450
5/12/2022	Detection	0.333	4.04	244	3.07	8.7	1.5	1430
10/05/2022	Detection	0.335	4.12	290	3.21	8.1	1.0	1590
5/17/2023	Detection	0.314	3.95	243	3.18	8.1	1.4	1440
10/11/2023	Detection	0.302	4.64	238	2.94	8.3	2.2	1380
4/24/2024	Detection	0.304	4.26	242	3.00	8.2	1.2	1450
4/10/2025	Detection	0.322	5.45	246	3.17	8.5	2.2	1480
9/25/2025	Detection	0.328	4.64	237	3.15	8.1	1.50	1440

Table 1. Groundwater Data Summary: MW-1103F
Mitchell - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/15/2016	Background	0.16	8.03	639	0.029	0.02	1.0	0.351	1.100	3.11	0.674	0.012	< 0.002 U1	10.1	0.2	0.01 J1
8/02/2016	Background	0.14	7.01	704	0.026	0.01 J1	0.9	0.299	0.899	3.20	0.479	0.016	< 0.002 U1	2.61	0.2	< 0.01 U1
10/03/2016	Background	0.04 J1	5.80	558	0.01 J1	0.03	0.4	0.180	1.026	3.34	0.313	0.016	< 0.004 U1	2.66	0.1 J1	0.01 J1
11/16/2016	Background	0.10	7.71	723	0.01 J1	0.009 J1	0.471	0.159	1.570	2.96	0.218	0.015	< 0.002 U1	2.57	0.1	< 0.01 U1
2/15/2017	Background	0.03 J1	7.67	631	0.009 J1	0.008 J1	0.336	0.147	1.416	3.07	0.213	0.016	< 0.002 U1	2.81	0.09 J1	0.03 J1
4/11/2017	Background	0.07	8.46	618	0.006 J1	0.006 J1	0.262	0.102	2.183	3.05	0.088	0.015	< 0.002 U1	3.19	0.1	< 0.01 U1
5/23/2017	Background	0.03 J1	7.85	688	0.006 J1	0.007 J1	0.260	0.149	1.214	3.23	0.194	0.006	< 0.002 U1	2.80	0.06 J1	< 0.01 U1
7/26/2017	Background	0.02 J1	6.81	562	< 0.004 U1	0.007 J1	0.112	0.136	1.798	3.24	0.103	0.015	< 0.002 U1	5.46	0.07 J1	0.02 J1

Table 1. Groundwater Data Summary: MW-1104R
Mitchell - LF
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
6/21/2016	Background	0.431	39.4	485	1.18	7.9	162	2390

Table 1. Groundwater Data Summary: MW-1104R
Mitchell - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/21/2016	Background	0.66	4.35	182	0.570	0.18	3.4	4.36	0.153	1.18	9.41	0.014	< 0.09 U1	42.3	2.3	0.133

Table 1. Groundwater Data Summary: MW-1502R
Mitchell - LF
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L
6/20/2016	Background	0.268	71.5	33.4	0.18	7.3	155	474
8/09/2016	Background	0.160	95.4	34.0	0.17	7.3	187	547
9/27/2016	Background	0.376	103	39.7	0.1 J1	7.4	183	560
11/09/2016	Background	0.214	87.3	25.4	0.1 J1	7.4	186	551
2/15/2017	Background	0.069	90.0	167	0.16	7.5	90.1	564
4/12/2017	Background	0.075	72.2	79.5	0.16	7.6	102	507
5/23/2017	Background	0.100	73.9	52.4	0.17	7.6	118	466
7/25/2017	Background	0.158	61.7	18.8	0.20	7.3	88.6	358
10/11/2017	Detection	0.132	91.0	24.5	0.1 J1	7.3	159	535
1/11/2018	Detection	--	240	--	--	7.0	149	--
4/10/2018	Detection	0.051	78.3	196	0.19	7.4	87.6	616
8/29/2018	Detection	0.150	95.7	99.3	0.17	7.7	167	650
5/02/2019	Detection	0.1 J1	93.6	245	0.17	8.5	105	702
6/12/2019	Detection	0.127	80.7	155	0.23	7.3	114	661
10/23/2019	Detection	0.194	104	102	0.18	7.2	252	758
1/31/2020	Detection	--	--	--	--	7.4	120	474
5/06/2020	Detection	0.081	64.8	74.6	0.18	7.8	93.0	471
9/01/2020	Detection	--	--	--	--	7.2	--	--
10/21/2020	Detection	0.267	92.5	56.6	0.18	7.7	249	679
3/17/2021	Detection	0.083	94.9	274	0.24	7.9	117	759
5/12/2021	Detection	0.121	73.0	113	0.24	8.3	118	540
10/12/2021	Detection	--	--	--	--	7.4	--	--
10/20/2021	Detection	0.194	91.0	91.8	0.21	7.5	176	650
5/12/2022	Detection	0.084	84.0 M1	102	0.21	8.3	105	520
10/05/2022	Detection	0.135	89.5 M1, P3	69.4	0.21	6.9	131	540
3/22/2023	Detection	--	--	--	--	7.4	--	--
5/17/2023	Detection	0.091	69.4 M1	76.7	0.19	7.4	98	470
4/24/2024	Detection	0.076	62.8	32.2	0.21	7.5	90.0	370
4/09/2025	Detection	0.063	82.8	88.5	0.23	7.6	137	500

Table 1. Groundwater Data Summary: MW-1502R
Mitchell - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/20/2016	Background	0.22	0.28	30.6	< 0.005 U1	0.005 J1	0.3	0.082	0.143	0.18	0.064	0.002	< 0.09 U1	3.48	8.2	0.01 J1
8/09/2016	Background	0.20	0.26	34.1	< 0.005 U1	0.006 J1	0.3	0.068	1.029	0.17	0.089	0.010	< 0.002 U1	8.71	7.4	< 0.01 U1
9/27/2016	Background	0.16	0.27	38.2	< 0.005 U1	0.004 J1	0.4	0.076	0.429	0.1 J1	0.064	0.012	< 0.002 U1	8.40	8.8	< 0.01 U1
11/09/2016	Background	0.20	0.84	44.2	0.062	0.009 J1	1.44	0.507	2.497	0.1 J1	0.764	0.006	< 0.002 U1	3.19	5.3	0.03 J1
2/15/2017	Background	0.13	0.24	27.7	0.006 J1	< 0.004 U1	1.90	0.069	2.61	0.16	0.061	0.009	< 0.002 U1	1.84	4.3	0.03 J1
4/12/2017	Background	0.13	0.69	29.2	0.053	0.008 J1	1.20	0.426	0.613	0.16	0.630	0.015	0.002 J1	1.91	4.8	0.02 J1
5/23/2017	Background	0.15	0.53	32.2	0.033	< 0.005 U1	0.918	0.238	0.647	0.17	0.364	0.002	< 0.002 U1	2.46	4.7	0.01 J1
7/25/2017	Background	0.21	0.30	19.0	0.008 J1	< 0.005 U1	0.196	0.082	0.6323	0.20	0.088	0.009	< 0.002 U1	2.47	3.2	0.03 J1

Notes:
Combined radium values were calculated from the sum of the reported radium-226 and radium-228 results.
Radium data quality flags were not included. Reported negative radium-226 or radium-228 results were replaced with zero.
--: Not analyzed
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.
In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.
In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.
M1: The associated matrix spike (MS) or matrix spike duplicate (MSD) recovery was outside acceptance limits.
mg/L: milligrams per liter
P3: The precision on the matrix spike duplicate (MSD) was above acceptance limits.
pCi/L: picocuries per liter
SU: standard unit
µg/L: micrograms per liter

Table 1: Residence Time Calculation Summary
Mitchell Landfill

CCR Management Unit	Monitoring Well Pair	Well Diameter (inches)	2025-04[4] Vertical Groundwater Velocity (ft/year)	2025-04[4] Groundwater Residence Time (days)	2025-04 Vertical Groundwater Velocity (ft/year)	2025-04 Groundwater Residence Time (days)	2025-09[5] Vertical Groundwater Velocity (ft/year)	2025-09[5] Groundwater Residence Time (days)	2025-09 Vertical Groundwater Velocity (ft/year)	2025-09 Groundwater Residence Time (days)
Landfill	MW1101F/R [1]	2.0	NC	NC	3.2	19	3.3	18	3.3	18
	MW1102F/R [1]	2.0	0.3	185	0.3	185	0.3	202	0.3	202
	MW1103F/R [2]	2.0	NC	NC	1.4	44	1.5	40	1.5	40
	MW1104F/R [2]	2.0	NC	NC	1.3	46	1.4	45	1.4	45
	MW1501F/R [3]	4.0	NC	NC	2.5	49	2.5	49	2.5	49
	MW1502R [3]	4.0	NC	NC	NC	NC	NC	NC	NC	NC
	MW1503F/R [3]	4.0	NC	NC	1.3	96	1.5	80	1.5	80

Notes:
[1] - Sidegradient Well
[2] - Background Well
[3] - Downgradient Well
[4] - 2nd Event 2024 Verification event
[5] - 1st Event 2025 Verification event
NC - No calculation can be generated

Legend

- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)
- Groundwater Flow Direction

Notes

1. Monitoring well coordinates and water level data (collected on April 9, 2025) provided by AEP.
2. Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC 2016) provided by AEP.
3. Groundwater elevation units are feet above mean sea level (ft amsl) (NAVD 88).
4. Aerial imagery provided by Google Earth Pro, dated May 21, 2023.

500 250 0 500 Feet

Potentiometric Surface Map - Fish Creek
April 2025

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2025/06/17

Figure **X**

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Legend

- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)
- Groundwater Flow Direction

Notes

1. Monitoring well coordinates and water level data (collected on September 24, 2025) provided by AEP.
2. Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC 2016) provided by AEP.
3. Groundwater elevation units are feet above mean sea level (ft amsl) (NAVD 88).
4. Aerial imagery provided by Google Earth Pro, dated May 21, 2023.

500 250 0 500 Feet

Potentiometric Surface Map - Fish Creek September 2025

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2025/11/12

Figure **X**

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Legend

- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)
- Groundwater Flow Direction

Notes

1. Monitoring well coordinates and water level data (collected on April 9, 2025) provided by AEP.
2. Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC 2016) provided by AEP.
3. Groundwater elevation units are feet above mean sea level (ft amsl) (NAVD 88).
4. Aerial imagery provided by Google Earth Pro, dated May 21, 2023.

Potentiometric Surface Map - Rush Run
April 2025

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2025/06/17

Figure X

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Legend

- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)
- Groundwater Flow Direction

Notes

1. Monitoring well coordinates and water level data (collected on September 24, 2025) provided by AEP.
2. Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC 2016) provided by AEP.
3. Groundwater elevation units are feet above mean sea level (ft amsl) (NAVD 88).
4. Aerial imagery provided by Google Earth Pro, dated May 21, 2023.

Potentiometric Surface Map - Rush Run
September 2025

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Figure

X

Columbus, Ohio | 2025/11/12

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APPENDIX 2 - Statistical Analyses

The following statistical analysis reports, all completed in 2025, are included in this appendix:

- The June 11, 2025 memorandum summarizing the results of statistical evaluations of the second semiannual detection monitoring event of 2024;
- The December 12, 2025 memorandum summarizing the results of statistical evaluations of the first semiannual detection monitoring event of 2025.

Geosyntec consultants

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Memorandum

Date: June 9, 2025

To: David Miller (AEP)

Copies to: Bill Smith (AEP)

From: Allison Kreinberg (Geosyntec)

Subject: Evaluation of Detection Monitoring Data at Mitchell Plant's Landfill

In accordance with United States Environmental Protection Agency (USEPA) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257 Subpart D, "CCR rule"), the second semiannual detection monitoring event of 2024 at the Mitchell Landfill, an existing CCR unit at the Mitchell Power Plant in Moundsville, West Virginia was completed on September 19, 2024. Based on the results, verification sampling was collected on April 9, 2025.

Background values for the Landfill were previously calculated in January 2018, February 2020, and January 2022 and are periodically updated as sufficient data becomes available. After a minimum of four additional detection monitoring events, the results of those events were compared to the existing background and the dataset was updated as appropriate. Revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the most recent calculation of the revised background values are described in Geosyntec's *Statistical Analysis Summary* report, dated February 28, 2024.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is concluded only if both samples in a series of two exceed the UPL (or are below the LPL for pH). In practice, if the initial result did not exceed the UPL, a second sample was not collected or analyzed.

Detection monitoring results and the relevant background values are compared in Table 1 and noted exceedances are described below.

- Chloride concentrations exceeded the intrawell UPL of 22.7 mg/L in both the initial (22.8 mg/L) and second (24.2 mg/L) samples collected at MW-1102F. Therefore, an SSI over background is concluded for chloride at MW-1102F.

In response to the exceedance noted, above, the Mitchell Landfill CCR unit will either transition to assessment monitoring or an alternative source demonstration (ASD) for chloride will be conducted in accordance with 40 CFR 257.94(e)(2). If the ASD is successful, the Mitchell Landfill will remain in detection monitoring.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). A certification of these statistics by a qualified professional engineer is provided in Attachment A.

Table 1. Detection Monitoring Data Comparison
Detection Summary Memorandum
Mitchell Plant, Landfill

Analyte	Unit	Description	MW-1102F	
			9/19/2024	4/9/2025
Boron	mg/L	Intrawell Background Value (UPL)	0.280	
		Analytical Result	0.147	--
Calcium	mg/L	Intrawell Background Value (UPL)	5.49	
		Analytical Result	4.29	--
Chloride	mg/L	Intrawell Background Value (UPL)	22.7	
		Analytical Result	**22.8**	**24.2**
Fluoride	mg/L	Intrawell Background Value (UPL)	0.930	
		Analytical Result	0.81	--
pH	SU	Intrawell Background Value (UPL)	9.6	
		Intrawell Background Value (LPL)	7.6	
		Analytical Result	8.3	--
Sulfate	mg/L	Intrawell Background Value (UPL)	44.7	
		Analytical Result	39.4	--
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	613	
		Analytical Result	**620**	600

Notes:
1. Bold values exceed the background value.
2. Background values are shaded gray.
3. Sidegradient wells MW-1101F, MW-1101R, and MW-1102R and downgradient wells MW-1502R and MW-1503F had insufficient water to sample.
LPL: lower prediction limit
mg/L: milligrams per liter
SU: standard units
UPL: upper prediction limit

ATTACHMENT A

Certification by a Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the February 28, 2024 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Mitchell Landfill CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

David Anthony Miller

Printed Name of Licensed Professional Engineer

Signature

22663	**West Virginia**	**06.11.2025**
License Number	Licensing State	Date

Memorandum

Date: December 11, 2025

To: David Miller (AEP)

Copies to: Ben Kepchar (AEP)

From: Allison Kreinberg (Geosyntec)

Subject: Evaluation of Detection Monitoring Data at Mitchell Plant's Landfill

---

In accordance with United States Environmental Protection Agency (USEPA) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257 Subpart D, "CCR rule"), the first semiannual detection monitoring event of 2025 at the Mitchell Landfill, an existing CCR unit at the Mitchell Power Plant in Moundsville, West Virginia was completed on April 9-10, 2025. Based on the results, verification sampling was collected on September 24, 2025.

Background values for the Landfill were previously calculated in January 2018, February 2020, and January 2022 and are periodically updated as sufficient data becomes available. After a minimum of four additional detection monitoring events, the results of those events were compared to the existing background and the dataset was updated as appropriate. Revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the most recent calculation of the revised background values are described in Geosyntec's *Statistical Analysis Summary* report, dated February 28, 2024.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is concluded only if both samples in a series of two exceed the UPL (or are below the LPL for pH). In practice, if the initial result did not exceed the UPL, a second sample was not collected or analyzed.

Detection monitoring results and the relevant background values are compared in Table 1 and noted exceedances are described below.

- Chloride concentrations exceeded the intrawell UPL of 22.7 mg/L in both the initial (23.9 mg/L) and second (24.1 mg/L) samples collected at MW-1102F. Therefore, an SSI over background is concluded for chloride at MW-1102F.

- Total dissolved solids (TDS) concentrations exceeded the intrawell UPL of 613 mg/L in both the initial (620 mg/L) and second (640 mg/L) samples collected at MW-1102F. Therefore, an SSI over background is concluded for TDS at MW-1102F.

In response to the exceedances noted above, the Mitchell Landfill CCR unit will either transition to assessment monitoring or an alternative source demonstration (ASD) for chloride and TDS will be conducted in accordance with 40 CFR 257.94(e)(2). If the ASD is successful, the Mitchell Landfill will remain in detection monitoring.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). A certification of these statistics by a qualified professional engineer is provided in Attachment A.

Table 1. Detection Monitoring Data Comparison
Detection Summary Memorandum
Mitchell Plant, Landfill

Analyte	Unit	Description	MW-1101R	MW-1102F		MW-1502R
			4/9/2025	4/10/2025	9/24/2025	4/9/2025
Boron	mg/L	Intrawell Background Value (UPL)	0.484	0.280		0.253
		Analytical Result	0.366	0.120	--	0.063
Calcium	mg/L	Intrawell Background Value (UPL)	2.79	5.49		107
		Analytical Result	2.60	4.37	--	82.8
Chloride	mg/L	Intrawell Background Value (UPL)	18.2	22.7		245
		Analytical Result	18.1	**23.9**	**24.1**	88.5
Fluoride	mg/L	Intrawell Background Value (UPL)	3.01	0.930		0.254
		Analytical Result	2.85	0.90	--	0.23
pH	SU	Intrawell Background Value (UPL)	9.1	9.6		8.5
		Intrawell Background Value (LPL)	7.9	7.6		6.9
		Analytical Result	8.8	8.5	--	7.6
Sulfate	mg/L	Intrawell Background Value (UPL)	37.3	44.7		231
		Analytical Result	32.4	44.7	--	137
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	926	613		757
		Analytical Result	810	**620**	**640**	500

Notes:
1. Bold values exceed the background value.
2. Background values are shaded gray.
--: not sampled
LPL: lower prediction limit
mg/L: milligrams per liter
SU: standard units
UPL: upper prediction limit

ATTACHMENT A

Certification by a Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the February 28, 2024 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Mitchell Landfill CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

David Anthony Miller

Printed Name of Licensed Professional Engineer

Signature

22663	**West Virginia**	**12.12.2025**
License Number	Licensing State	Date

APPENDIX 3 – Alternative Source Demonstrations

The March 11, 2025 ASD report concluding that the potential SSI associated with the first semiannual detection monitoring event of 2024 was not due to a release from the Mitchell landfill follows.

The September 3, 2025 ASD report concluding that the potential SSI associated with the second semiannual detection monitoring event of 2024 was not due to a release from the Mitchell landfill follows.

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

2024 1ST SEMIANNUAL EVENT

Mitchell Plant Landfill
Marshall County, West Virginia

Prepared for

American Electric Power
1 Riverside Plaza
Columbus, Ohio 43215-2372

Prepared by

Geosyntec Consultants, Inc.
500 West Wilson Bridge Road, Suite 250
Columbus, Ohio 43085

Project CHA8495B

March 2025

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ACRONYMS AND ABBREVIATIONS

ASD	alternative source demonstration
CCR	coal combustion residuals
CEC	Civil & Environmental Consultants, Inc.
CFR	Code of Federal Regulations
LPL	lower prediction limit
mg/L	milligrams per liter
QA/QC	quality assurance and quality control
SSI	statistically significant increase
TDS	total dissolved solids
UPL	upper prediction limit
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

1. INTRODUCTION AND SUMMARY

This Alternative Source Demonstration (ASD) report has been prepared to address a statistically significant increase (SSI) for total dissolved solids (TDS) at the Mitchell Plant Landfill following the first semiannual detection monitoring event of 2024.

Following completion of four detection monitoring events, the previously calculated upper prediction limits (UPLs) for the Landfill were recalculated for each Appendix III parameter to represent background values (Geosyntec Consultants, Inc [Geosyntec] 2024). A lower prediction limit (LPL) was also recalculated for pH. The revised prediction limits were calculated based on a one-of-two retesting procedure in accordance with the Unified Guidance (United States Environmental Protection Agency [USEPA] 2009) and the statistical analysis plan developed for the site (Geosyntec 2020a). With this procedure, an SSI is concluded only if an initial sample and a resample exceed the UPL, or in the case of pH are both below the LPL or above the UPL.

The first semiannual detection monitoring event of 2024 was performed in April 2024 (initial sampling event) and September 2024 (resampling event), and the results were compared to the recalculated prediction limits. During this detection monitoring event, an SSI was identified for TDS at monitoring well MW-1102F. A summary of the detection monitoring analytical results for all constituents listed in 40 CFR Part 257 Appendix III and the calculated prediction limits for comparison is provided in **Table 1**.

This ASD report has been prepared to address an SSI for TDS at the Mitchell Plant Landfill following the first semiannual detection monitoring event of 2024.

1.1 CCR Rule Requirements

USEPA regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments state the following:

> The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that **the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality**. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer . . . verifying the accuracy of the information in the report. (40 CFR 257.94[e][2])

The first semiannual detection monitoring event for 2024 was completed in April and a resampling event was completed in September 2024 to identify SSIs over background limits. Pursuant to 40 CFR 257.94(e)(2), Geosyntec has prepared this ASD report to identify whether the SSI identified for TDS at MW-1102F is from a source other than the Landfill.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess whether the SSI is indicative of a release from the CCR unit. Alternative sources were assessed from among five types:

- ASD Type I: Sampling Causes
- ASD Type II: Laboratory Causes
- ASD Type III: Statistical Evaluation Causes
- ASD Type IV: Natural Variation
- ASD Type V: Alternative Sources

An evaluation was conducted to assess whether the increase in TDS at MW-1102F was due to a release from the Landfill.

2. ALTERNATIVE SOURCE DEMONSTRATION

This section provides a brief description of the site geology, ASD evaluation methods, and the potential alternative source.

2.1 Landfill Construction and Site Geology Summary

The Landfill was designed and constructed in 2013 in accordance with West Virginia Department of Environmental Protection Class F Industrial Landfill requirements. The Landfill design includes several engineering controls, including a composite liner, groundwater interceptor drainage system, and a leachate collection system (Civil & Environmental Consultants, Inc. [CEC] 2016). The Landfill is being constructed in phases; CCR materials are currently being placed in Phase 3. Phases 1 and 2, which previously received CCR materials, were covered with a temporary vegetative cover in 2021 (GEI 2024; AEP 2021).

The local geology consists of Pennsylvanian/Permian-age clastic (granular) units separated by sharp contacts with shale or coal seams (CEC 2016). These units are components of the Dunkard and Monongahela Groups. From top to bottom, the named sandstone units underlying the Landfill include the Burton Sandstone, the Fish Creek Sandstone, the Rush Run Sandstone, the Jollytown Sandstone, and the Hundred Sandstone. The Rush Run Sandstone was identified as the uppermost aquifer (CEC 2016). A cross section of the geology underlying the Landfill, which was included in the groundwater monitoring network report (CEC 2016), is provided as **Attachment A**.

2.2 Groundwater Monitoring History and Flow Characteristics

Groundwater at the Landfill has been monitored under the West Virginia Solid Waste Management Rule (33CSR1) since 2012, before the Landfill was constructed in 2013 and the initial waste placement in 2014 (CEC 2016). Background monitoring under the Federal CCR Rule began in 2016. Wells set within either the Fish Creek Sandstone or Rush Run Sandstone are both included in the monitoring network for the federal program (CEC 2016). The well of concern with the TDS SSI (MW-1102F) is set within the Pennsylvanian-Permian age Fish Creek Sandstone.

The cross section of the geology shown in **Attachment A** indicates the presence of the Fish Creek Sandstone spanning the entire length of the cross section as a continuous layer. Boring logs indicate that this unit is a clastic aquifer consisting of siltstone and sandstone, with the sandstone described as “micaceous, very fine to medium grained sand” (CEC 2016). The cross-section transect fully encompasses the Landfill; therefore, the continuous nature of the Fish Creek Sandstone within the cross section indicates that the unit extends laterally outside of the identified transect up to where incision from the nearby southern slope occurs.

A potentiometric site map showing the location of Fish Creek Sandstone monitoring wells and groundwater flow directions during April 2024 is provided as **Figure 1**. Groundwater flow direction at and around the Landfill does not display noticeable seasonal variation. Potentiometric maps for the Fish Creek monitoring well network using groundwater elevations from events completed between October 2020 and October 2023 are provided as **Attachment B**.

2.3 Proposed Alternative Source

Our analysis will examine whether the SSI for TDS has been attributed to natural variation associated with the underlying geology, which is a Type IV (natural variation) cause. Other potential types of alternative sources were evaluated but were determined not to be influential in triggering the TDS SSI. Initial review of site geochemistry, site historical data, and laboratory quality assurance and quality controls (QA/QC) did not identify alternative sources of TDS due to Type I (sampling) or Type II (laboratory) causes. A review of the statistical methods used did not identify any Type III (statistical) causes. A preliminary review did not identify any Type V (anthropogenic) causes.

2.3.1 Characterization of TDS at MW-1102F

TDS measurements, which are typically reported in milligrams per liter (mg/L), represent the total mass of dissolved constituents in a sample rather than a single chemical constituent. While TDS is an Appendix III constituent in 40 CFR 257 Subpart D, it is comprised of major ions which either are or are not regulated. As shown in **Figure 2**, the largest contributors to TDS on a mass basis at MW-1102F are total carbonate alkalinity and sodium, neither of which is included as an Appendix III constituent in 40 CFR 257 Subpart D which are commonly associated with CCR impacts. These results indicate that individual Appendix III constituents are not a key driver of higher reported TDS values at MW-1102F.

A Piper diagram, which represent the relative proportions of major cations and anions in aqueous samples, was created to visualize the aqueous geochemistry at MW-1102F over time compared to background and leachate (**Figure 3**). The groundwater major ion geochemistry at MW-1102F has remained nearly unchanged since the initiation of background sampling under 40 CFR 257 Subpart D in 2016, with its groundwater anion composition dominated by carbonate alkalinity and its cation composition dominated by monovalent cations (potassium and sodium; **Figure 3**). These results indicate that non-Appendix III major ions have consistently been key contributors to total TDS at MW-1102F.

2.3.2 Comparison of Groundwater Composition to Landfill Leachate

Landfill leachate samples from 2016 onwards were also included in the Piper diagram to assess the relative composition of leachate compared to MW-1102F and background (**Figure 3**). The Landfill leachate has a distinct anion composition that is dominated by sulfate, as illustrated by the separate clustering of the leachate samples from downgradient well MW-1102F. The composition of groundwater at MW-1102F is more similar to background well MW-1103F (**Figure 3**), which is also screened in the Fish Creek formation, as both Fish Creek groundwater sampling locations have a lower relative abundance of sulfate compared to Leachate. While the cation composition of both MW-1102F and MW-1103F is dominated by monovalent cations, the leachate has historically had a slightly greater relative contribution of calcium.

A comparison of boron concentrations from upgradient and downgradient monitoring wells and Landfill leachate was also completed. Boron is a geochemically conservative parameter that is not significantly attenuated during advective flow. Concentrations of boron in groundwater are unlikely to be modified as a result of geochemical processes common in clastic aquifers, such as mineral precipitation/dissolution, ion exchange, or oxidation-reduction (redox) variations. Increases in boron concentrations at downgradient compliance wells would be expected following a release from the Landfill.

Boron concentrations in Landfill leachate are approximately 100 times greater than those reported at both downgradient well MW-1102F and background well MW-1103F (**Figure 4**). If a release from the Landfill had occurred, the effect of physical mixing is likely to be observed in downgradient groundwater boron concentrations due to the multiple orders of magnitude difference in concentrations between the leachate and the groundwater. Boron concentrations in groundwater at upgradient and downgradient monitoring locations appear stable since monitoring began in 2012 (**Figure 4**). This stability in boron concentrations at MW-1102F provides additional support that the TDS SSI observed at this well is not attributable to Landfill leachate, as boron would be expected to increase if a release had occurred.

2.3.3 Comparison to Background Concentrations

TDS in groundwater at the Landfill is monitored using intrawell prediction limits. A comparison of the reported concentration for TDS between MW-1102F and nearest upgradient background well (MW-1103F) shows that TDS concentrations at the background location have consistently been higher than MW-1102F, including before waste was placed in the unit in 2014 (**Figure 5**). TDS concentrations at downgradient well MW-1102F have continued to remain below 650 mg/L (620 mg/L in April 2024), compared to TDS concentrations at MW-1103F which are consistently around 1,400 mg/L (**Figure 5)**.

Background wells set within the Fish Creek formation (i.e., MW-1103F) were installed prior to the construction of the Landfill at upgradient locations in a groundwater flow system containing little seasonal variation. These background wells provide data points characterizing groundwater chemistry at locations that are not susceptible to Landfill impacts. The pre-construction range of chemical concentrations detected between wells that are upgradient and downgradient of the Landfill establishes that significant natural spatial variation exists within the aquifer unit. Fluctuations of chemical concentrations within this range could result from groundwater flow through the aquifer. Therefore, the changes in TDS concentrations at MW-1102F appear to represent natural background variation in the groundwater TDS from within the Fish Creek Sandstone.

2.3.4 Regional Groundwater TDS Concentrations

The Fish Creek Sandstone is considered a component of the Pennsylvanian/Permian-age Dunkard Group (Fedorko and Skema 2013). Groundwater quality data from wells screened within these geologic periods in West Virginia are presented in United States Geological Survey (USGS) Scientific Investigations Report 2012-5186 (USGS 2012). This study collected groundwater samples from 300 wells across West Virginia, 142 of which were collected from Pennsylvanian-age wells and 19 from Permian-age wells. Multiple wells sampled for this study are in Marshall County, as indicated on the map of sampling locations (**Attachment C**).

While TDS results were not reported for these samples, specific conductance (conductivity) was analyzed. As noted by USEPA in the Federal Register for 40 CFR 257 Subpart D, "conductivity…is merely a proxy for TDS" (USEPA 2015). These data were put into a box-and-whisker plot showing conductivity measurements for these samples for each geologic period in **Attachment C**. The median conductivity value for samples from Pennsylvanian-age wells is approximately 400 microsiemens per centimeter (µS/cm) and the 75th percentile is approximately 650 µS/cm, with select values reported over 1,000 µS/cm. The median conductivity value in samples from Permian-age wells is approximately 600 µS/cm and the 75th percentile is approximately 800 µS/cm. The reported field conductivity results for the April 2024 and September 2024 were 970 and 989 µS/cm, respectively (**Attachment D**). Results of this USGS study demonstrate the degree of variability in conductivity from groundwater wells in West Virginia and support the conclusion that the conductivity measured at monitoring well MW-1102F, as a proxy for TDS, is within the expected range for Pennsylvanian/Permian-age groundwater.

2.4 Monitoring Requirements

The conclusions of this ASD support the determination that the identified TDS SSI is due to natural variation and not a release from the Landfill. Therefore, the unit will remain in the detection monitoring program. Groundwater at the unit will be sampled for Appendix III parameters on a semiannual basis.

3. CONCLUSIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.94(e)(2) and supports the conclusion that the SSI for TDS detected during the first semiannual sampling event of 2024 is not due to a release from the Landfill. The detected TDS SSI is instead attributed to natural background variation.

The alternative source at MW-1102F is the natural background variability of the native groundwater within the Fish Creek Sandstone, which has been shown to contain a range of concentrations for TDS. The Fish Creek Sandstone is documented to be a continuous unit of porous sandstone/siltstone spanning without interruption from upgradient of the Landfill to downgradient of the Landfill (**Attachment A**). Boring logs and cross sections included with the *Groundwater Monitoring System Demonstration* (CEC 2016) indicate that the Fish Creek Sandstone is hydrologically continuous and consists of very-fine- to medium-grained sandstone.

Given the hydrogeology of the unit and geochemistry at upgradient and downgradient monitoring points relative to the Landfill leachate, the concentrations of TDS at MW-1102F are attributed to natural background variability rather than a release from the Landfill. Therefore, variation in background groundwater is the alternative source.

This demonstration meets the requirements in both 40 CFR 257.94(e)(2) and the Technical Manual for the Municipal Solid Waste Landfill regulatory program at 40 CFR 258.54(c)(iii) and supports the position that the TDS SSI is a result from natural variation in the groundwater quality. Therefore, no further action is warranted, and the Mitchell Landfill will remain in the detection monitoring program. Certification of this ASD by a qualified professional engineer is provided in **Attachment E**.

4. REFERENCES

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TABLES

Table 1. Detection Monitoring Data Comparison
Alternative Source Demonstration - 2024 1st Semiannual Event
Mitchell Plant, Landfill

Analyte	Unit	Description	MW-1101R	MW-1102F		MW-1502R
			4/24/2024	4/24/2024	9/18/2024	4/24/2024
Boron	mg/L	Intrawell Background Value (UPL)	0.484	0.280		0.253
		Analytical Result	0.349	0.115	--	0.076
Calcium	mg/L	Intrawell Background Value (UPL)	2.79	5.49		107
		Analytical Result	2.54	4.20	--	62.8
Chloride	mg/L	Intrawell Background Value (UPL)	18.2	22.7		245
		Analytical Result	17.5	22.4	--	32.2
Fluoride	mg/L	Intrawell Background Value (UPL)	3.01	0.930		0.254
		Analytical Result	2.64	0.85	--	0.21
pH	SU	Intrawell Background Value (UPL)	9.1	9.6		8.5
		Intrawell Background Value (LPL)	7.9	7.6		6.9
		Analytical Result	8.6	8.4	--	7.5
Sulfate	mg/L	Intrawell Background Value (UPL)	37.3	44.7		231
		Analytical Result	27.8	40.2	--	90.0
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	926	613		757
		Analytical Result	830	**620**	**630**	370

Notes:
1. Bold values exceed the background value.
2. Background values are shaded gray.
LPL: lower prediction limit
mg/L: milligrams per liter
SU: standard units
UPL: upper prediction limit

FIGURES

Legend

- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)
- Groundwater Flow Direction

Notes

1. Monitoring well coordinates and water level data (collected on April 24, 2024) provided by AEP.
2. Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC 2016) provided by AEP.
3. Groundwater elevation units are feet above mean sea level (ft amsl) (NAVD 88).
4. Aerial imagery provided by Google Earth Pro, dated April 18, 2023.

Potentiometric Surface Map - Fish Creek
April 2024

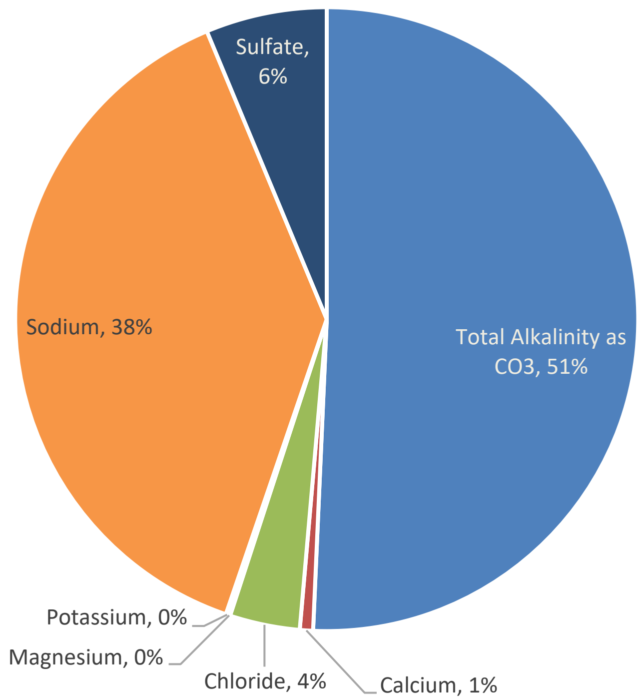
Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | March 2025

Figure **1**

A:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2024\AEP-Mitchell_Landfill-FC_GW_Apr2024.mxd. Okiemute.Commander. 6/12/2024. Project/Phase/Task.



Notes: Data are shown for the April 2024 federal sampling event at MW-1102F. Percentages were calculated using mass of each constituent. Reported alkalinity results have been converted to milligrams per liter of carbonate.

MW-1102F TDS Composition
Mitchell Landfill

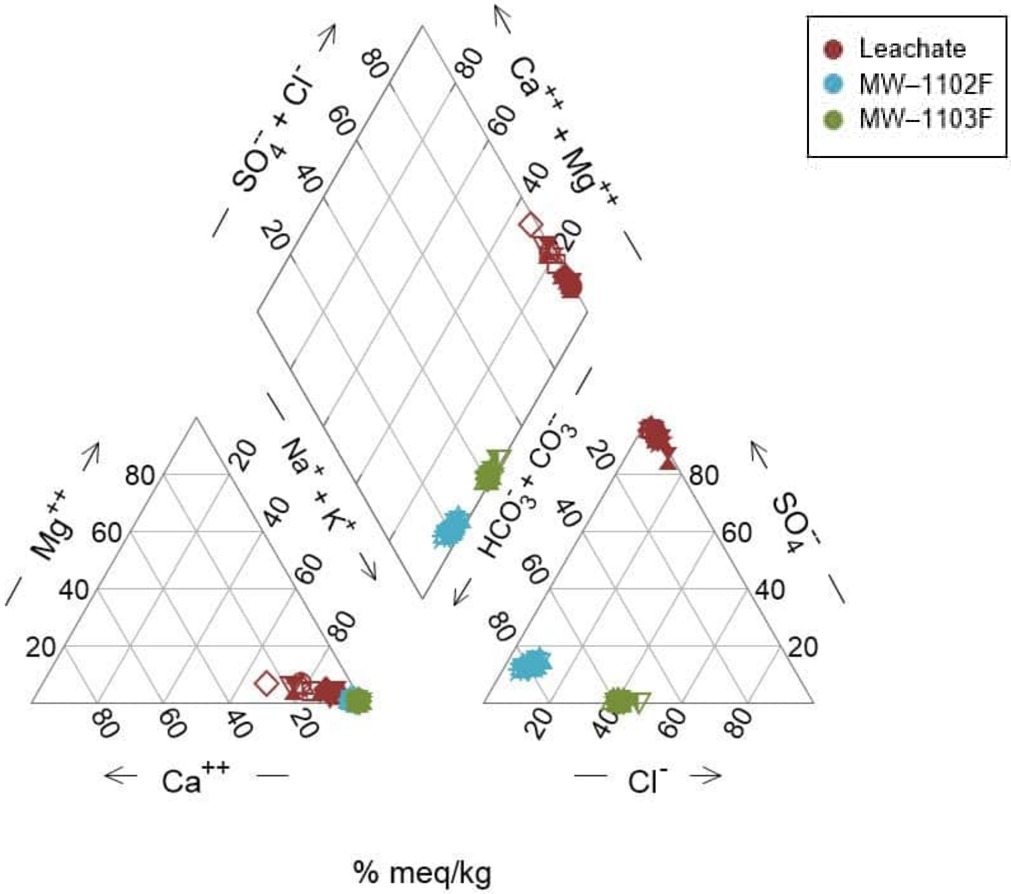
Geosyntec consultants

AMERICAN ELECTRIC POWER

Figure
2

Columbus, Ohio

March 2025



Notes: Groundwater data for background well MW-1103F and downgradient well MW-1102F are shown for federal program sampling events completed from November 2016 through September 2024. Leachate data was collected for the state program from November 2016 through September 2024.
% meq/kg: percent milliequivalents per kilogram

Piper Diagram
Mitchell Landfill

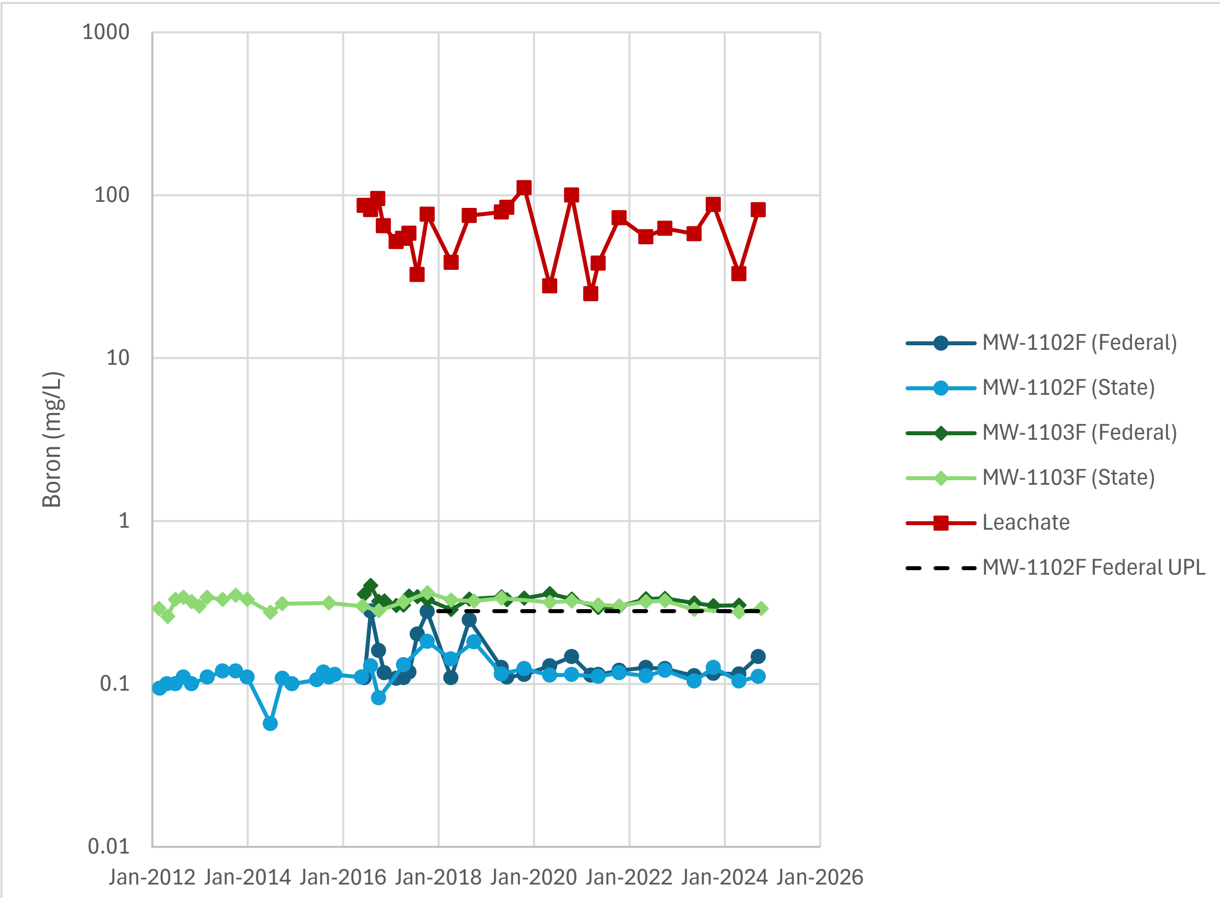
Geosyntec consultants

AMERICAN ELECTRIC POWER

Figure
3

Columbus, Ohio

March 2025



Notes: Data are shown for both the federal and state monitoring programs. MW-1103F is a background monitoring location for the Fish Creek Formation. Downgradient location MW-1102F is also screened in the Fish Creek Formation. Samples for boron analysis were filtered for the state monitoring program, and were not filtered for the federal monitoring program. The MW-1102F UPL was recalculated in January 2024.

mg/L: milligrams per liter
UPL: upper prediction limit

Boron Time Series Graph

Mitchell Landfill

Geosyntec consultants

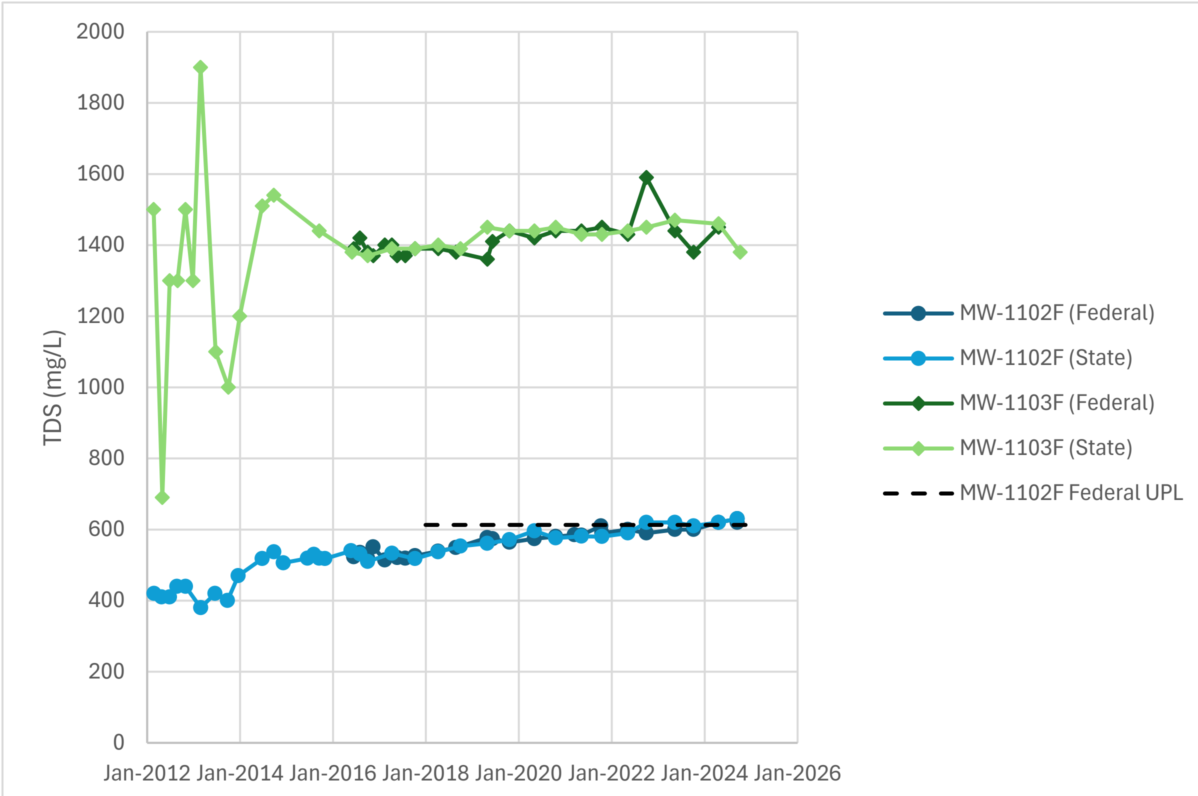
AMERICAN ELECTRIC POWER

Columbus, Ohio

March 2025

Figure

4



Notes: Data are shown for both the federal and state monitoring programs. MW-1103F is a background monitoring location for the Fish Creek Formation. Downgradient location MW-1102F is also screened in the Fish Creek Formation. The MW-1102F UPL was recalculated in January 2024.

mg/L: milligrams per liter
UPL: upper prediction limit

TDS Time Series Graph
Mitchell Landfill

Geosyntec consultants

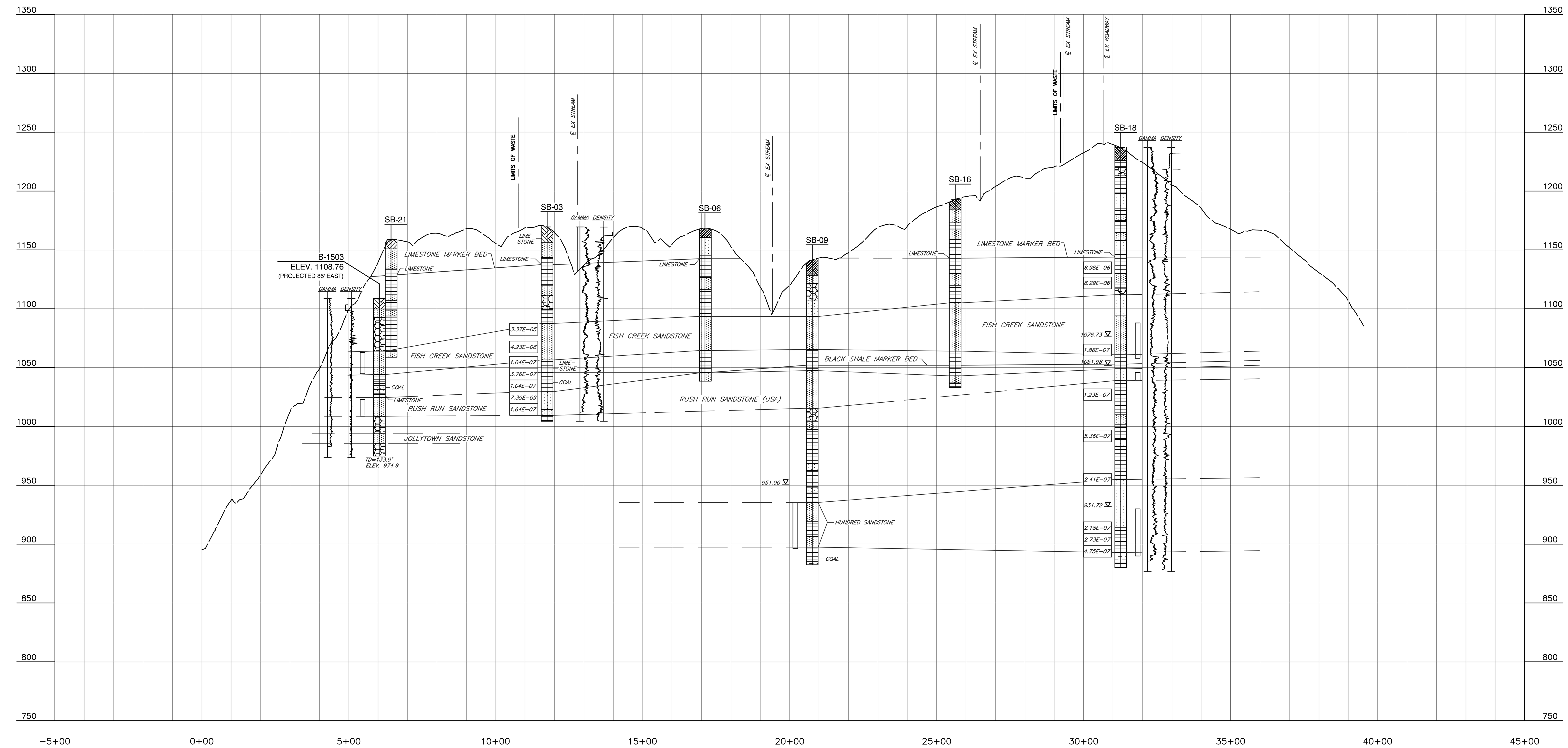
AMERICAN ELECTRIC POWER

Figure **5**

Columbus, Ohio

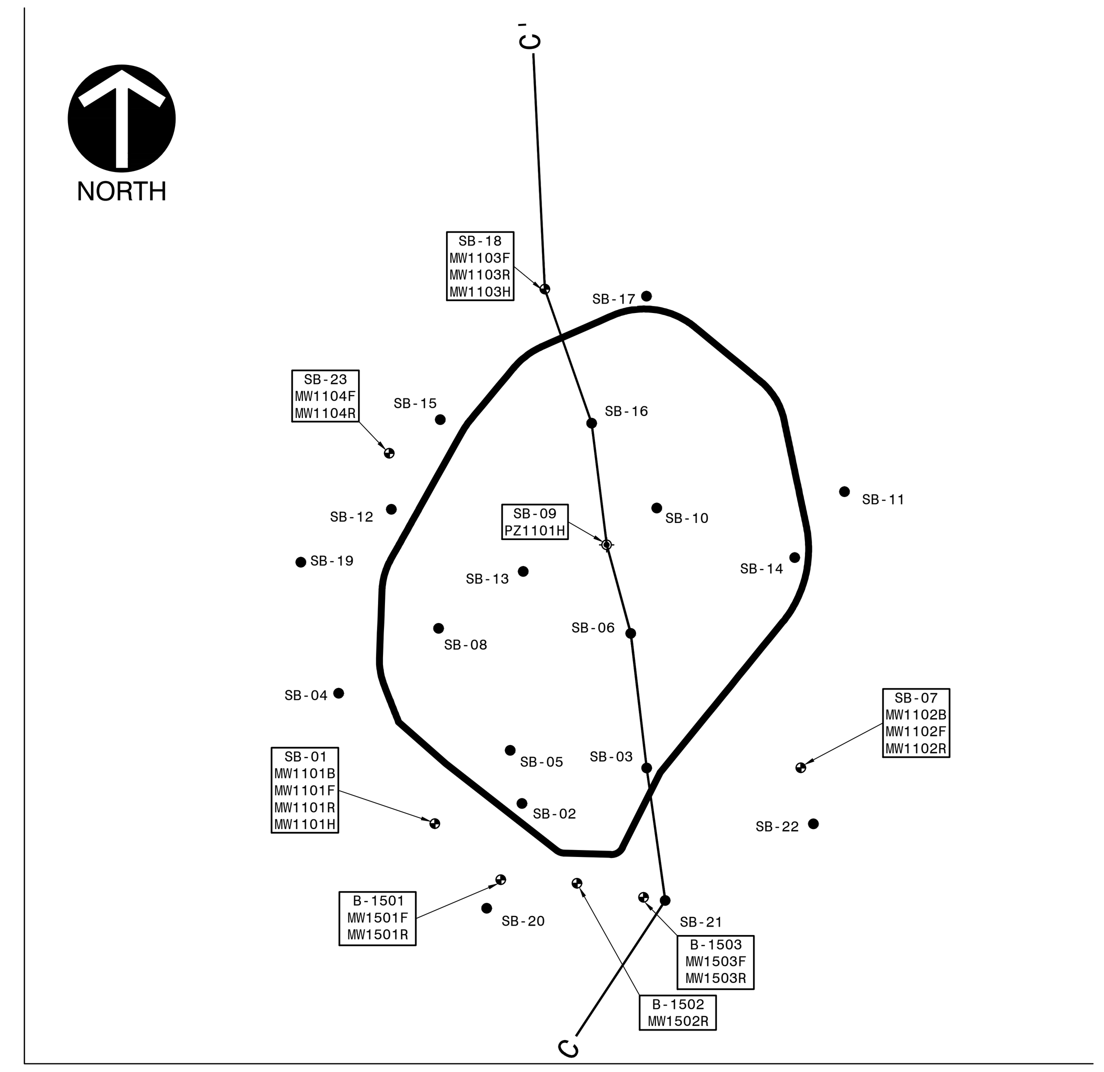
March 2025

ATTACHMENT A
Geologic Cross Section



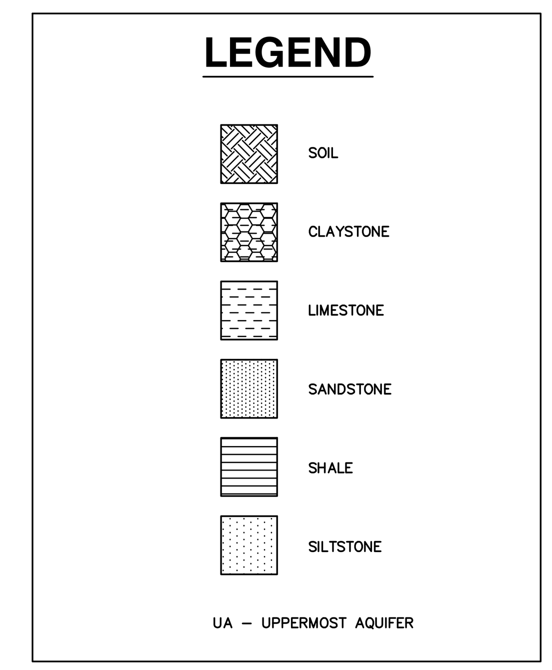
GEOLOGIC CROSS SECTION C - C'

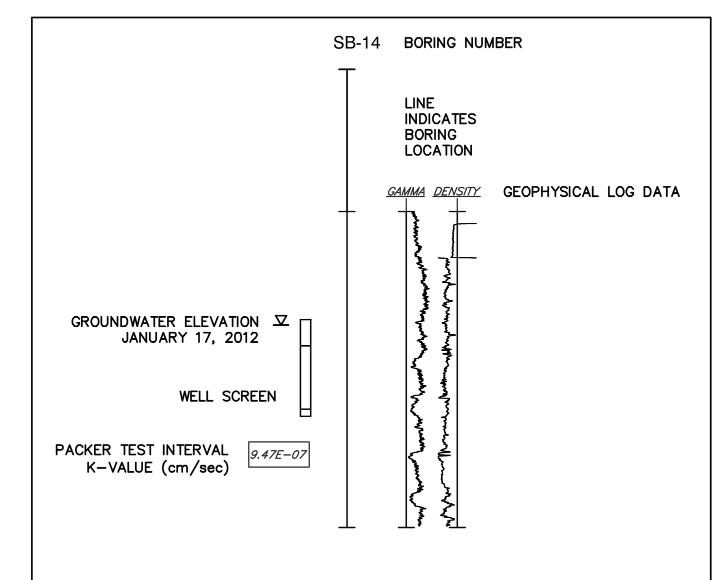
SCALE H:1"=200'; V:1"=50'



KEY PLAN

N.T.S.





MONITORING WELL DIAGRAM

NOTE:

1. THE BORING LOGS AND RELATED INFORMATION PRESENTED HEREIN DEPICT SUBSURFACE CONDITIONS AT THE TEST BORING LOCATIONS AND AT THE TIME OF DRILLING. SOIL CONDITIONS AT OTHER LOCATIONS MAY DIFFER.
2. GEOLOGIC CORRELATIONS SHOWN BETWEEN TEST BORINGS GENERALLY ARE BASED ON A STRAIGHT-LINE INTERPOLATION. ACTUAL CONDITIONS BETWEEN TEST BORINGS MAY DIFFER.

HORZ. SCALE: 1"=200'

VERT. SCALE: 1"=50'

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
5899 Montclair Blvd. - Cincinnati, OH 45150
513-985-0226 · 800-759-5614
www.cecinc.com

AMERICAN ELECTRIC POWER
MITCHELL LANDFILL
MITCHELL POWER GENERATION PLANT
MARSHALL COUNTY, WEST VIRGINIA

GROUNDWATER MONITORING SYSTEM DEMONSTRATION

GEOLOGIC CROSS SECTION C-C'

DATE:	DECEMBER 2015	DRAWN BY:	DAR
DWG SCALE:	AS NOTED	CHECKED BY:	RAS
PROJECT NO:	110-416-7601	APPROVED BY:	APA

FIGURE NO.: 6

ATTACHMENT B
Potentiometric Maps

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on October 20, 2020) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

Potentiometric Surface Map - Fish Creek
October 2020

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Figure **B1**

Columbus, Ohio | 2020/12/29

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2020\AEP-Mitchell_Landfill-FC_GW_Oct2020.mxd. HDuff. 12/29/2020. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on March 16, 2021) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

Potentiometric Surface Map - Fish Creek March 2021

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2021/06/11

Figure **B2**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2021\AEP-Mitchell_Landfill-FC_GW_March2021.mxd. ASoltero. 6/11/2021. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on May 11, 2021) provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

Potentiometric Surface Map - Fish Creek
May 2021

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2021/09/07

Figure **B3**

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on October 19, 2021) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500 Feet

Potentiometric Surface Map - Fish Creek
October 2021

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2022/01/11

Figure **B4**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2021\AEP-Mitchell_Landfill-FC_GW_Oct2021.mxd. ASoltero. 1/11/2022. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)
- Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on May 10, 2022) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

Potentiometric Surface Map - Fish Creek
May 2022

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2022/11/22

Figure **B5**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2022\AEP-Mitchell_Landfill-FC_GW_May2022.mxd. ASoltero. 11/22/2022. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)
- Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on October 5, 2022) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500 Feet

Potentiometric Surface Map - Fish Creek October 2022

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2023/01/23

Figure **B6**

M:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2022\AEP-Mitchell_Landfill-FC_GW_Oct2022.mxd. HDuff. 1/23/2023. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)
- Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on May 16, 2023) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

Potentiometric Surface Map - Fish Creek
May 2023

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2023/09/20

Figure **B7**

\\annarbor-01\Data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2023\AEP-Mitchell_Landfill-FC_GW_May2023.mxd. ASoltero. 9/20/2023. Project/Phase/Task.

Legend
- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)
- Groundwater Flow Direction

Notes
- Monitoring well coordinates and water level data (collected on October 10, 2023) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500
Feet

Potentiometric Surface Map - Fish Creek
October 2023

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Figure
B8

Columbus, Ohio | 2023/10/27

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ATTACHMENT C

Sampling Locations and TDS Results for West Virginia Groundwater

organic compounds, volatile organic compounds, and dissolved gases. A summary of dissolved gas data collected as part of this study can be found in McCoy and Kozar (2007).

Study Area, Design, and Methods

West Virginia lies entirely within the Appalachian Mountains with parts of the State in three physiographic provinces (Fenneman and Johnson, 1946), regions with similar rock types and groundwater characteristics. The western and central parts of the State lie within the Appalachian Plateaus Physiographic Province. The Appalachian Plateaus consist of sub-horizontal consolidated sedimentary rocks of Devonian to Permian age (fig. 1). These rocks have been highly dissected by stream erosion resulting in steep hills and deeply incised valleys. Valleys are filled in part with unconsolidated sediments of Quaternary age.

The eastern part of the State lies primarily in the Valley and Ridge Physiographic Province, named for the series of northeast-southwest trending valleys and ridges formed from Cambrian to Silurian aquifers. These strata are consolidated sedimentary rocks that are extensively faulted and sharply folded. The Blue Ridge Physiographic Province includes only the very easternmost edge of the Eastern Panhandle of West Virginia. In contrast to the sedimentary rocks of the Appalachian Plateaus and Valley and Ridge Physiographic Provinces, the Blue Ridge Physiographic Province is underlain by crystalline rock.

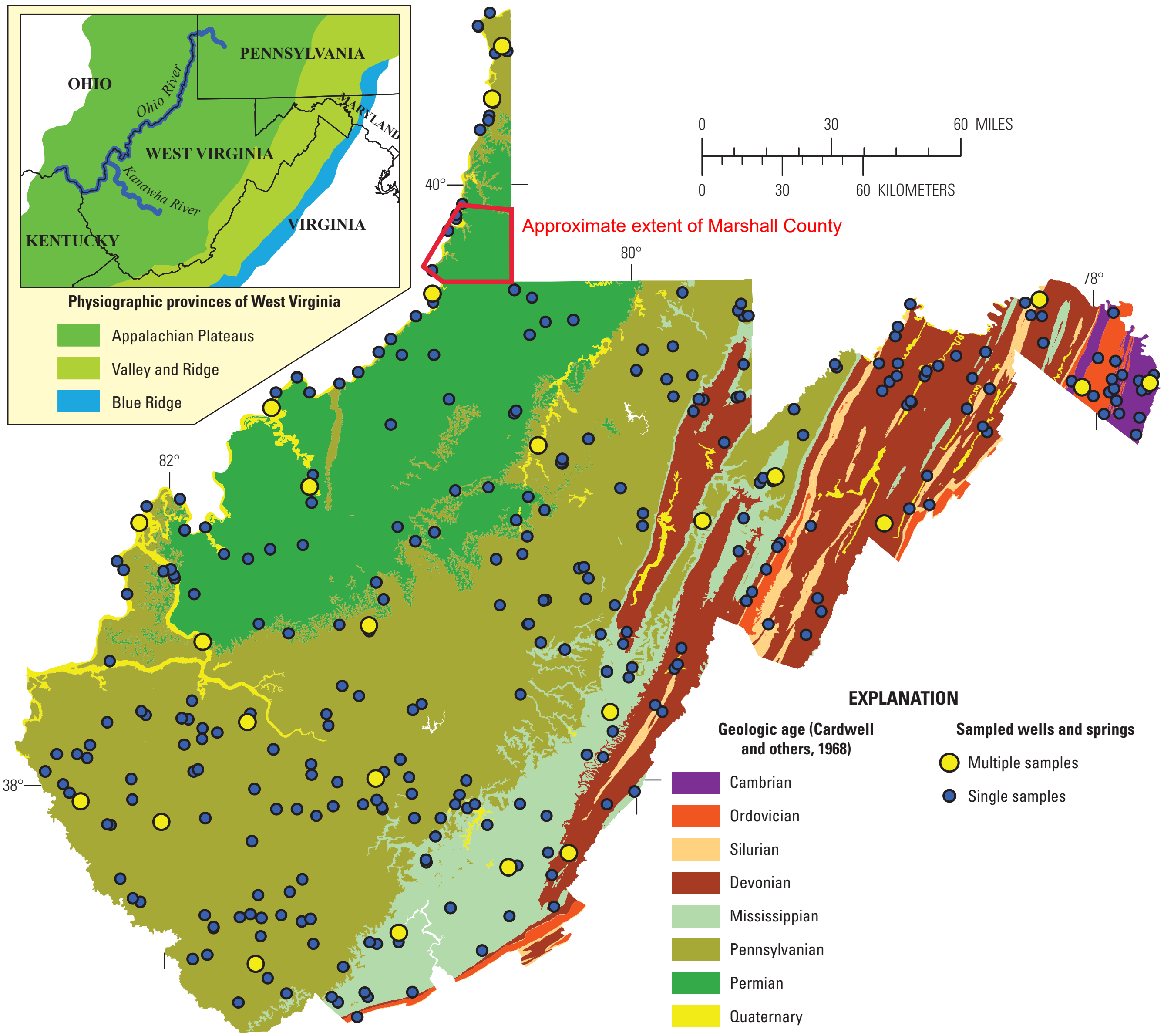

Figure 1. The geology of West Virginia and locations of groundwater-quality sampling sites, wells, and springs in the West Virginia ambient monitoring network, 1993–2008.

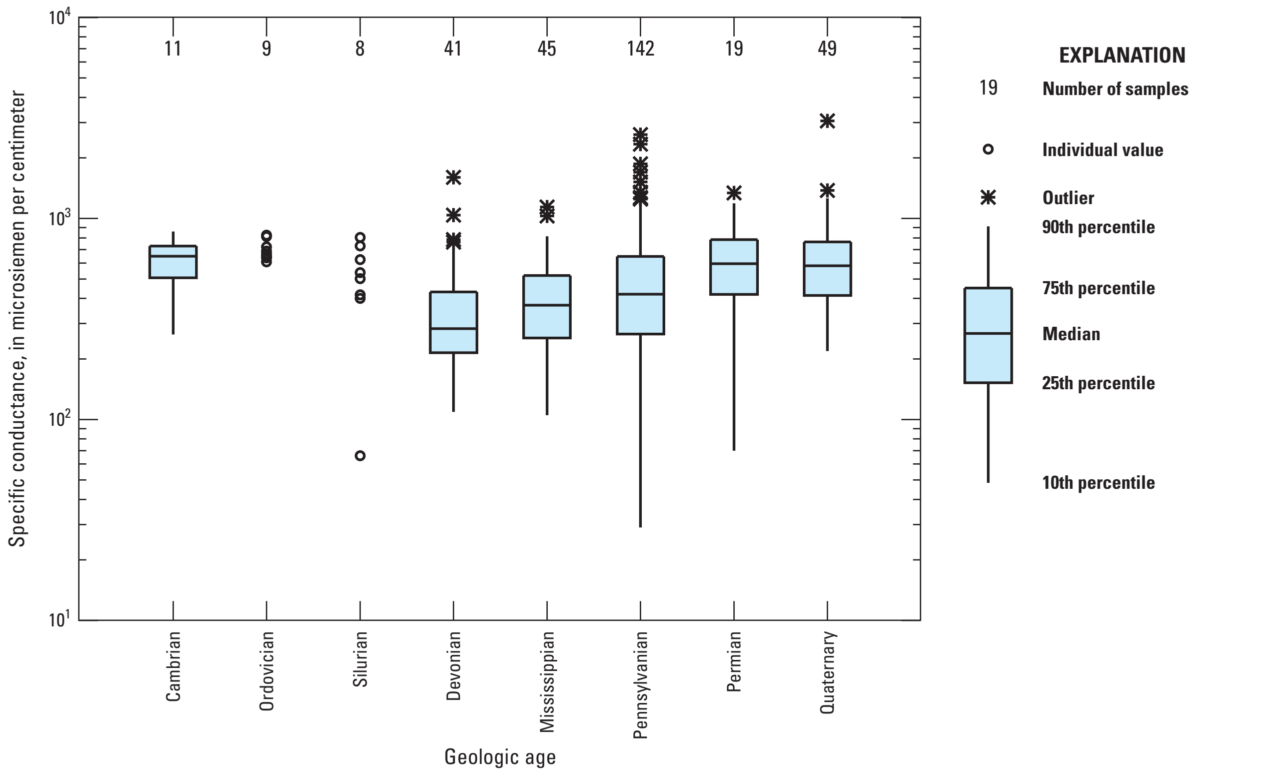

Figure 2. Distribution of specific conductance values in groundwater samples from the West Virginia ambient monitoring network, grouped by geologic age of the aquifers, 1993–2008.

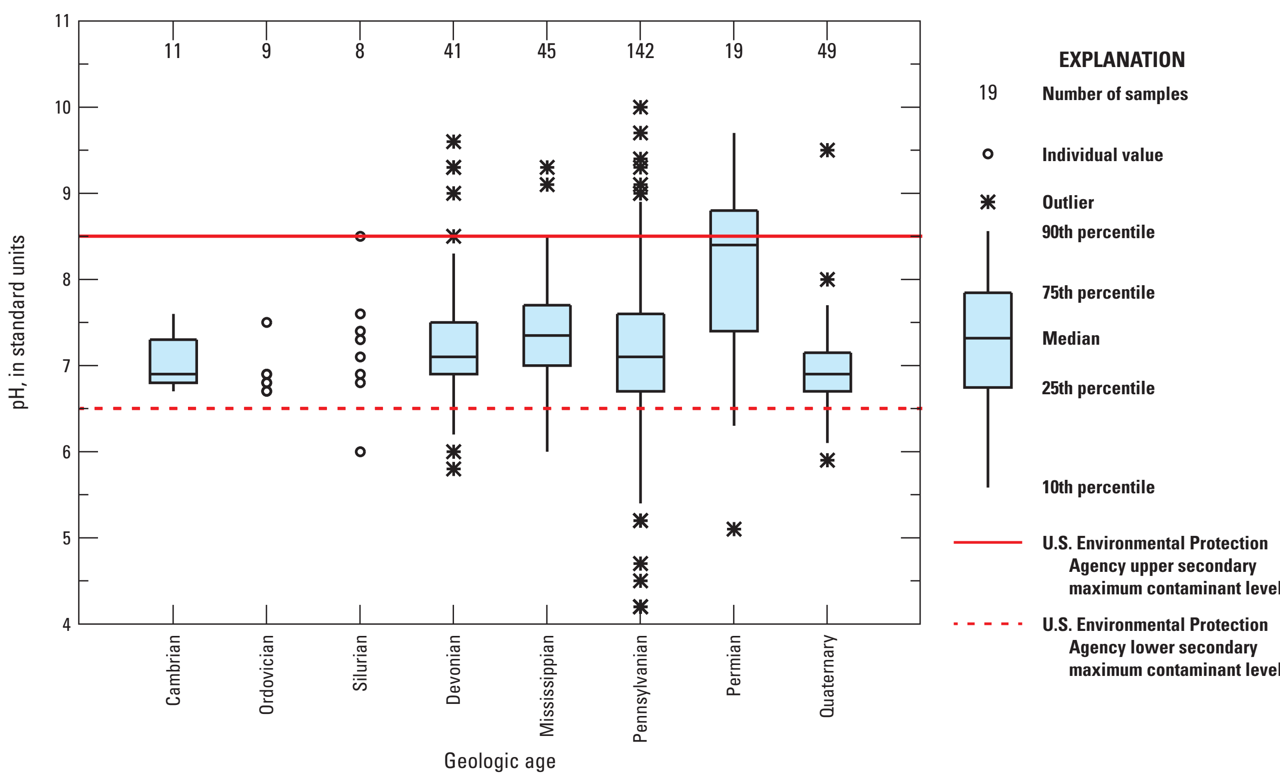

Figure 3. Distribution of pH in groundwater samples from the West Virginia ambient monitoring network, grouped by geologic age of the aquifers, 1993–2008. U.S. Environmental Protection Agency (2009b) recommended upper and lower values for the secondary maximum contaminant level are shown.

ATTACHMENT D

April 2024 and September 2024 Field Sampling Forms

AEP OHIO
A unit of American Electric Power

FIELD INFORMATION FORM

Site: Mitchell Landfill AEP Project Number: 4233025602
Date: 4·24·24 Weather Observations: Cloudy 50's

WELL ID: 1102 F

Water Volume Factors	
Diameter	Gallons/Foot
1 inches	0.04
1.5 inches	0.092
2 inches	0.17
3 inches	0.38
4 inches	0.66

Casing Diameter: 2 (inches) Water Height in Well: 24.0 (feet)

Total Depth: 180.0 (feet) Water Volume in Well: 4.0 (gallons)

Depth to Water: 156.05 (feet) Purge Volume: ______ gal (calculated) 3.0 gal. (removed)

Depth to Top of Screen: 147.0 (feet)

Minimum Purge Volume (drawdown)(gal./ft.) + (well screen length)(gal./ft.) = ______

Measured using: Geo Tech ET Sue Meter

Purged using: Dedicated Bailer/Polypro Rope Grundfos pump/poly tubing Other Dedicated Bladder Pump

Sampled using: Dedicated Bailer/Polypro Rope Grundfos pump/poly tubing Other Dedicated Bladder Pump

Field Measurements

Temperature (degrees C)	pH (s.u.)	Conductivity (umhos/cm)	Turbidity (NTU)	Volume (gallons)	Water Level During Purging (feet)	Time
12.2	8.38	968	2.61	.75	157.65	1225
12.2	8.37	970	3.12	1.50	158.80	1230
12.3	8.37	970	3.88	2.25	159.70	1235

Field Measurements at Time of Sampling

Temperature (degrees C)	pH (s.u.)	Conductivity (umhos/cm)	Turbidity (NTU)	Volume (gallons)	Water Level During Sampling (feet)	Time
12.3	8.36	970	2.01	3.0	160.50	1255

Instrument Calibration

Turbidity Meter Type Hanna Hi 93763
1.0 NTU std = ______ 5.42 NTU std = ______
10.0 NTU std = ______ 51.8 NTU std = ______
499 NTU std = ______

pH/Conductivity Meter Type YSI Pro Plus
4.01 std = ______
7.0 std = ______ 1413 umhos/cm = ______
10.1 std = ______

Physical Properties
Odor: N/A
Color: N/A
Turbidity: N/A

Analysis Required: ______
Sample time/date: 1240 / 4·24·24

Comments: ______

Deviations from FSAP: ______

Sampler: Ron Van Signature: [signature]

Parameter	Method #
Temperature	SM 2550-B 2000/2010
pH	SM4500-H B2011

AEP OHIO
A unit of American Electric Power

FIELD INFORMATION FORM

Site: Mitchell Landfill AEP Project Number: 4233025602
Date: 9/18/24 Weather Observations: Partly Cloudy 80's

WELL ID: 1102F

Casing Diameter: 2 (inches) Water Height in Well: 23.60 (feet)
Total Depth: 180.0 (feet) Water Volume in Well: 4.0 (gallons)
Depth to Water: 156.40 (feet) Purge Volume: ______ gal.(calculated) 3.5 gal. (removed)
Depth to Top of Screen: 147.0 (feet)

Water Volume Factors	
Diameter	Gallons/Foot
1 inches	0.04
1.5 inches	0.092
2 inches	0.17
3 inches	0.38
4 inches	0.66

Minimum Purge Volume (drawdown)(gal./ft.) + (well screen length)(gal./ft.) = ______

Measured using: Geo Tech ET Sure Meter

Purged using: Dedicated Bailer/Polypro Rope Grundfos pump/poly tubing Other Dedicated Bladder Pump

Sampled using: Dedicated Bailer/Polypro Rope Grundfos pump/poly tubing Other Dedicated Bladder Pump

Field Measurements

Temperature (degrees C)	pH (s.u.)	Conductivity (umhos/cm)	Turbidity (NTU)	Volume (gallons)	Water Level During Purging (feet)	Time
12.1	8.28	994	0.49	0.75	157.73	1020
12.1	8.29	985	0.76	1.50	158.44	1025
12.2	8.30	989	0.78	2.25	159.21	1030

Field Measurements at Time of Sampling

Temperature (degrees C)	pH (s.u.)	Conductivity (umhos/cm)	Turbidity (NTU)	Volume (gallons)	Water Level During Sampling (feet)	Time
12.5	8.32	987	1.30	3.0	160.49	1040

Instrument Calibration

Turbidity Meter Type Hanna Hi 93703
1.0 NTU std = ______ 5.42 NTU std = ______
10.0 NTD std = ______ 51.8 NTU std = ______
499 NTU std = ______

pH/Conductivity Meter Type YSI Pro Plus
4.01 std = ______
7.0 std = ______ 1413 umhos/cm = ______
10.1 std = ______

Physical Properties
Odor: N/A
Color: N/A
Turbidity: N/A

Analysis Required: ______
Sample time/date: 1035 / 9-18-24

Comments: TDS Resample

Deviations from FSAP: ______

Sampler: Kyle Blackman / Brian Hepburn Signature: [signature]

Parameter	Method #
Temperature	SM 2550-B 2000/2010
pH	SM4500-H B2011

ATTACHMENT E

Certification by a Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Mitchell Landfill CCR management area and that the requirements of 40 CFR 257.94(e)(2) have been met.

John Seymour
Printed Name of Licensed Professional Engineer

Signature

017091
License Number

West Virginia
Licensing State

JOHN P. SEYMOUR
REGISTERED
17091
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

3/11/2025
Date

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

2024 2nd SEMIANNUAL EVENT

Mitchell Plant Landfill
Marshall County, West Virginia

Prepared for

American Electric Power
1 Riverside Plaza
Columbus, Ohio 43215-2372

Prepared by

Geosyntec Consultants, Inc.
500 West Wilson Bridge Road, Suite 250
Columbus, Ohio 43085

Project CHA8495B

September 2025

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ACRONYMS AND ABBREVIATIONS

ASD	alternative source demonstration
CCR	coal combustion residuals
CEC	Civil & Environmental Consultants, Inc.
CFR	Code of Federal Regulations
LPL	lower prediction limit
mg/L	milligrams per liter
QA/QC	quality assurance and quality control
SSI	statistically significant increase
UPL	upper prediction limit
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

1. INTRODUCTION AND SUMMARY

This Alternative Source Demonstration (ASD) report has been prepared to address a statistically significant increase (SSI) for chloride in groundwater at the Mitchell Plant Landfill following the second semiannual detection monitoring event of 2024.

Following completion of four detection monitoring events, the previously calculated upper prediction limits (UPLs) for the Landfill were recalculated for each Appendix III parameter to represent background values (Geosyntec Consultants, Inc [Geosyntec] 2024a). A lower prediction limit (LPL) was also recalculated for pH. The revised prediction limits were calculated based on a one-of-two retesting procedure in accordance with the Unified Guidance (United States Environmental Protection Agency [USEPA] 2009) and the statistical analysis plan developed for the site (Geosyntec 2020a). With this procedure, an SSI is concluded only if an initial sample and a resample exceed the UPL, or in the case of pH are both below the LPL or above the UPL.

The second semiannual detection monitoring event of 2024 was performed in September 2024 (initial sampling event). Because an SSI was identified for chloride at monitoring well MW-1102F, MW-1102F was resampled in April 2025 (resampling event), and the results were compared to the recalculated prediction limits (Geosyntec 2024a). During the initial detection monitoring event, cross-gradient wells MW-1101F, MW-1101R, and MW1102R and downgradient wells MW-1502R and MW-1503F had insufficient water to sample. A summary of the detection monitoring analytical results for all constituents listed in 40 CFR Part 257 Appendix III and the calculated prediction limits for comparison is provided in **Table 1**.

This ASD report has been prepared to address an SSI for chloride at the Mitchell Plant Landfill following the second semiannual detection monitoring event of 2024.

1.1 CCR Rule Requirements

USEPA regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments state the following:

> *The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that **the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality**. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer . . . verifying the accuracy of the information in the report. (40 CFR 257.94[e][2])*

The second semiannual detection monitoring event for 2024 was completed in September 2024 and a resampling event was completed in April 2025 to identify SSIs over background limits. Pursuant to 40 CFR 257.94(e)(2), Geosyntec has prepared this ASD report to identify whether the SSI identified for chloride at MW-1102F is from a source other than the Landfill.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess whether the SSI is indicative of a release from the CCR unit. Alternative sources were assessed from among five types:

- ASD Type I: Sampling Causes
- ASD Type II: Laboratory Causes
- ASD Type III: Statistical Evaluation Causes
- ASD Type IV: Natural Variation
- ASD Type V: Anthropogenic Sources

An evaluation was conducted to assess whether the increase in chloride at MW-1102F was due to a release from the Landfill.

2. ALTERNATIVE SOURCE DEMONSTRATION

This section provides a brief description of the site geology, ASD evaluation methods, and the potential alternative source.

2.1 Landfill Construction and Site Geology Summary

The Landfill was designed and constructed in 2013 in accordance with West Virginia Department of Environmental Protection Class F Industrial Landfill requirements. The Landfill design includes several engineering controls, including a composite liner, groundwater interceptor drainage system, and a leachate collection system (Civil & Environmental Consultants, Inc. [CEC] 2016). The Landfill is being constructed in phases; CCR materials are currently being placed in Phase 3. Phases 1 and 2, which previously received CCR materials, were covered with a temporary vegetative cover in 2021 (GEI 2024; AEP 2021).

The local geology consists of Pennsylvanian/Permian-age clastic (granular) units separated by sharp contacts with shale or coal seams (CEC 2016). These units are components of the Dunkard and Monongahela Groups. From top to bottom, the named sandstone units underlying the Landfill include the Burton Sandstone, the Fish Creek Sandstone, the Rush Run Sandstone, the Jollytown Sandstone, and the Hundred Sandstone. The Rush Run Sandstone was identified as the uppermost aquifer (CEC 2016). A cross section of the geology underlying the Landfill, which was included in the groundwater monitoring network report (CEC 2016), is provided as **Attachment A**.

2.2 Groundwater Monitoring History and Flow Characteristics

Groundwater at the Landfill has been monitored under the West Virginia Solid Waste Management Rule (33CSR1) since 2012, before the Landfill was constructed in 2013 and the initial waste placement in 2014 (CEC 2016). Background monitoring under the Federal CCR Rule began in 2016. Wells set within either the Fish Creek Sandstone or Rush Run Sandstone are both included in the monitoring network for the federal program (CEC 2016). The well of concern with the chloride SSI (MW-1102F) is set within the Pennsylvanian-Permian age Fish Creek Sandstone.

The cross section of the geology shown in **Attachment A** indicates the presence of the Fish Creek Sandstone spanning the entire length of the cross section as a continuous layer. Boring logs indicate that this unit is a clastic aquifer consisting of siltstone and sandstone, with the sandstone described as “micaceous, very fine to medium grained sand” (CEC 2016). The cross-section transect fully encompasses the Landfill; therefore, the continuous nature of the Fish Creek Sandstone within the cross section indicates that the unit extends laterally outside of the identified transect up to where incision from the nearby southern slope occurs.

A potentiometric site map showing the location of Fish Creek Sandstone monitoring wells and groundwater flow directions during September 2024 is provided as **Figure 1**. Groundwater flow direction at and around the Landfill does not display noticeable seasonal variation. Potentiometric maps for the Fish Creek monitoring well network using groundwater elevations from events completed between October 2020 and April 2024 are provided as **Attachment B**.

2.3 Proposed Alternative Source

Our analysis will examine whether the SSI for chloride has been attributed to natural variation associated with the underlying geology, which is a Type IV (natural variation) cause. Other potential types of alternative sources were evaluated but were determined not to be influential in triggering the chloride SSI. Initial review of site geochemistry, site historical data, and laboratory quality assurance and quality controls (QA/QC) did not identify alternative sources of chloride due to Type I (sampling) or Type II (laboratory) causes. A review of the statistical methods used did not identify any Type III (statistical) causes. A preliminary review did not identify any Type V (anthropogenic) causes.

2.3.1 Comparison of Chloride at MW-1102F to Background Concentrations

Chloride in groundwater at the Landfill is monitored using intrawell prediction limits. A comparison of the reported concentration for chloride between MW-1102F and nearest upgradient background well (MW-1103F) shows that chloride concentrations at the background location have consistently been more than 10 times greater, including before waste was placed in the unit in 2014 (**Figure 2**).

Background wells set within the Fish Creek formation were installed prior to the construction of the Landfill at upgradient locations in a groundwater flow system containing little seasonal variation. These background wells provide data points characterizing groundwater chemistry at locations that are not susceptible to Landfill impacts. The range of chemical concentrations observed between wells that are upgradient and downgradient of the Landfill establishes that significant natural variation exists within the aquifer unit. Fluctuations of chemical concentrations within this range could result from groundwater flow through the aquifer.

Therefore, the changes in chloride concentrations at MW-1102F appear to represent natural variation in the dilution of higher-chloride-concentration groundwater from within the Fish Creek Sandstone as it migrates through the aquifer. This conclusion was also reported in previous ASDs completed for chloride at MW-1102F (Geosyntec 2019; Geosyntec 2020b; Geosyntec 2020c; Geosyntec 2021; Geosyntec 2022; Geosyntec 2023a; Geosyntec 2023b; Geosyntec 2024b).

2.3.2 Comparison of Groundwater Boron Concentrations to Landfill Leachate

A comparison of boron concentrations from upgradient and downgradient monitoring wells and Landfill leachate was conducted to determine whether boron trends were similar or divergent relative to chloride. Boron is a geochemically conservative parameter that is not significantly attenuated during advective flow. Concentrations of boron in groundwater are unlikely to be modified as a result of geochemical processes common in clastic aquifers, such as mineral precipitation/dissolution, ion exchange, or oxidation-reduction (redox) variations. Increases in both chloride and boron concentrations at downgradient compliance wells would be expected following a release from the Landfill if leachate reached the monitored groundwater.

Boron concentrations in Landfill leachate are approximately 100 times greater than those reported at MW-1102F and background well MW-1103F (**Figure 3**). If a release from the Landfill had occurred and migrated to the aquifer, the effect of physical mixing is likely to be observed in downgradient groundwater boron concentrations due to the multiple orders of magnitude difference in concentrations between the leachate and the groundwater. Boron concentrations in groundwater at upgradient and downgradient monitoring locations appear stable since monitoring began in 2012 (**Figure 3**). This stability in boron concentrations at MW-1102F provides additional support that the chloride SSI observed at this well is not attributable to Landfill leachate, as both chloride and boron would be expected to increase if a release had occurred and migrated to the aquifer. Rather, these data suggest that chloride is sourced from within the aquifer, as indicated by the elevated chloride concentrations at upgradient well MW-1103F and stable concentrations of boron.

2.3.3 Comparison of Groundwater Composition to Landfill Leachate

A Piper diagram, which represents the relative proportions of major cations and anions in aqueous samples, was created to visualize the aqueous geochemistry of Landfill leachate and Mitchell Landfill monitoring network groundwater over time (**Figure 4**). Based on the Piper diagram, the groundwater major ion chemistry at MW-1102F has remained nearly unchanged since the initiation of sampling under 40 CFR 257 Subpart D in 2016, with its groundwater cation composition dominated by monovalent cations (potassium and sodium) and its anion composition dominated by carbonate alkalinity.

Landfill leachate samples from 2016 onwards are also shown on the Piper diagram. While the cation and anion signatures of MW-1102F groundwater are similar to background well MW-1103F groundwater, leachate contains a unique anion signature relative to groundwater (**Figure 4**). Leachate is sulfate dominant, whereas background and compliance well groundwater is alkalinity dominant. Both MW-1102F and MW-1103F are screened within the Fish Creek formation, and major ion chemistry for both wells reflects this geochemical similarity in contrast to Landfill leachate. Should a release from the Landfill have occurred and migrated to the aquifer, compliance well groundwater geochemistry would be expected to gradually adjust to reflect the contribution from Landfill leachate, which would be visualized on the Piper diagram as movement of the MW-1102F groundwater towards the leachate samples. This is not observed, and MW-1102F groundwater instead shows expected similarity to Fish Creek formation background groundwater (as represented on the diagram by MW-1103F), indicating that MW-1102F groundwater reflects natural conditions within the aquifer and does not display geochemical changes expected from a Landfill leachate release.

2.3.4 Regional Groundwater Chloride Concentrations

The Fish Creek Sandstone is considered a component of the Pennsylvanian/Permian-age Dunkard Group (Fedorko and Skema 2013). Groundwater quality data from wells screened within these geologic periods in West Virginia are presented in United States Geological Survey (USGS) Scientific Investigations Report 2012-5186 (USGS 2012). This study collected groundwater samples from 300 wells across West Virginia, 142 of which were collected from Pennsylvanian-age wells and 19 from Permian-age wells. Multiple wells sampled for this study are in Marshall County, as indicated on the map of sampling locations (**Attachment C**).

These data were put into a box-and-whisker plot showing chloride concentrations for these samples for each geologic period in **Attachment C**. The median chloride concentration for samples from both Pennsylvanian and Permian groundwater samples (the geologic age of the Fish Creek Sandstone monitored at the Mitchell LF) is approximately 20 mg/L, and the 75th percentile is approximately 40 mg/L. These values are comparable to recent chloride concentrations observed at MW-1102F (22.8 mg/L during the initial sampling event and 24.2 mg/L during the resampling event). Select samples from the USGS report contained chloride concentrations up to 736 mg/L in Pennsylvanian-age wells, exceeding the natural chloride concentrations observed at background location MW-1103F (247 mg/L during the initial sampling event). Results of this USGS study demonstrate the degree of variability in chloride concentrations from groundwater wells in West Virginia and support the conclusion that chloride concentrations observed at monitoring well MW-1102F are within the expected range for Pennsylvanian/Permian-age groundwater.

2.4 Monitoring Requirements

The conclusions of this ASD support the determination that the identified chloride SSI is due to natural variation and not a release from the Landfill. Therefore, the unit will remain in the detection monitoring program. Groundwater at the unit will be sampled for Appendix III parameters on a semiannual basis.

3. CONCLUSIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.94(e)(2) and supports the conclusion that the SSI for chloride detected during the second semiannual sampling event of 2024 is not due to a release from the Landfill. The detected chloride SSI is instead attributed to natural background variation.

The alternative source at MW-1102F is the natural background variability of the native groundwater within the Fish Creek Sandstone, which has been shown to contain a range of concentrations for chloride. The Fish Creek Sandstone is documented to be a continuous unit of porous sandstone/siltstone spanning without interruption from upgradient of the Landfill to downgradient of the Landfill (**Attachment A**). Boring logs and cross sections included with the *Groundwater Monitoring System Demonstration* (CEC 2016) indicate that the Fish Creek Sandstone is hydrologically continuous and consists of very-fine- to medium-grained sandstone.

Given the hydrogeology of the unit and geochemistry at upgradient and downgradient monitoring points relative to the Landfill leachate, the concentrations of chloride at MW-1102F are attributed to natural background variability rather than a release from the Landfill. Therefore, variation in background groundwater is the alternative source.

This demonstration meets the requirements in both 40 CFR 257.94(e)(2) and the Technical Manual for the Municipal Solid Waste Landfill regulatory program at 40 CFR 258.54(c)(iii) and supports the position that the chloride SSI is a result from natural variation in the groundwater quality. Therefore, no further action is warranted, and the Mitchell Landfill will remain in the detection monitoring program. Certification of this ASD by a qualified professional engineer is provided in **Attachment D**.

4. REFERENCES

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TABLES

Table 1. Detection Monitoring Data Comparison
Detection Summary Memorandum
Mitchell Plant, Landfill

Analyte	Unit	Description	MW-1102F	
			9/19/2024	4/9/2025
Boron	mg/L	Intrawell Background Value (UPL)	0.280	
		Analytical Result	0.147	--
Calcium	mg/L	Intrawell Background Value (UPL)	5.49	
		Analytical Result	4.29	--
Chloride	mg/L	Intrawell Background Value (UPL)	22.7	
		Analytical Result	**22.8**	**24.2**
Fluoride	mg/L	Intrawell Background Value (UPL)	0.930	
		Analytical Result	0.81	--
pH	SU	Intrawell Background Value (UPL)	9.6	
		Intrawell Background Value (LPL)	7.6	
		Analytical Result	8.3	--
Sulfate	mg/L	Intrawell Background Value (UPL)	44.7	
		Analytical Result	39.4	--
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	613	
		Analytical Result	**620**	600

Notes:

1. Bold values exceed the background value.

2. Background values are shaded gray.

3. Sidegradient wells MW-1101F, MW-1101R, and MW-1102R and downgradient wells MW-1502R and MW-1503F had insufficient water to sample.

LPL: lower prediction limit

mg/L: milligrams per liter

SU: standard units

UPL: upper prediction limit

FIGURES

Legend

- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)
- Groundwater Flow Direction

Notes

1. Monitoring well coordinates and water level data (collected on September 17, 2024) provided by AEP.
2. Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC 2016) provided by AEP.
3. Groundwater elevation units are feet above mean sea level (ft amsl) (NAVD 88).
4. Aerial imagery provided by Google Earth Pro, dated April 18, 2023.

Potentiometric Surface Map - Fish Creek September 2024

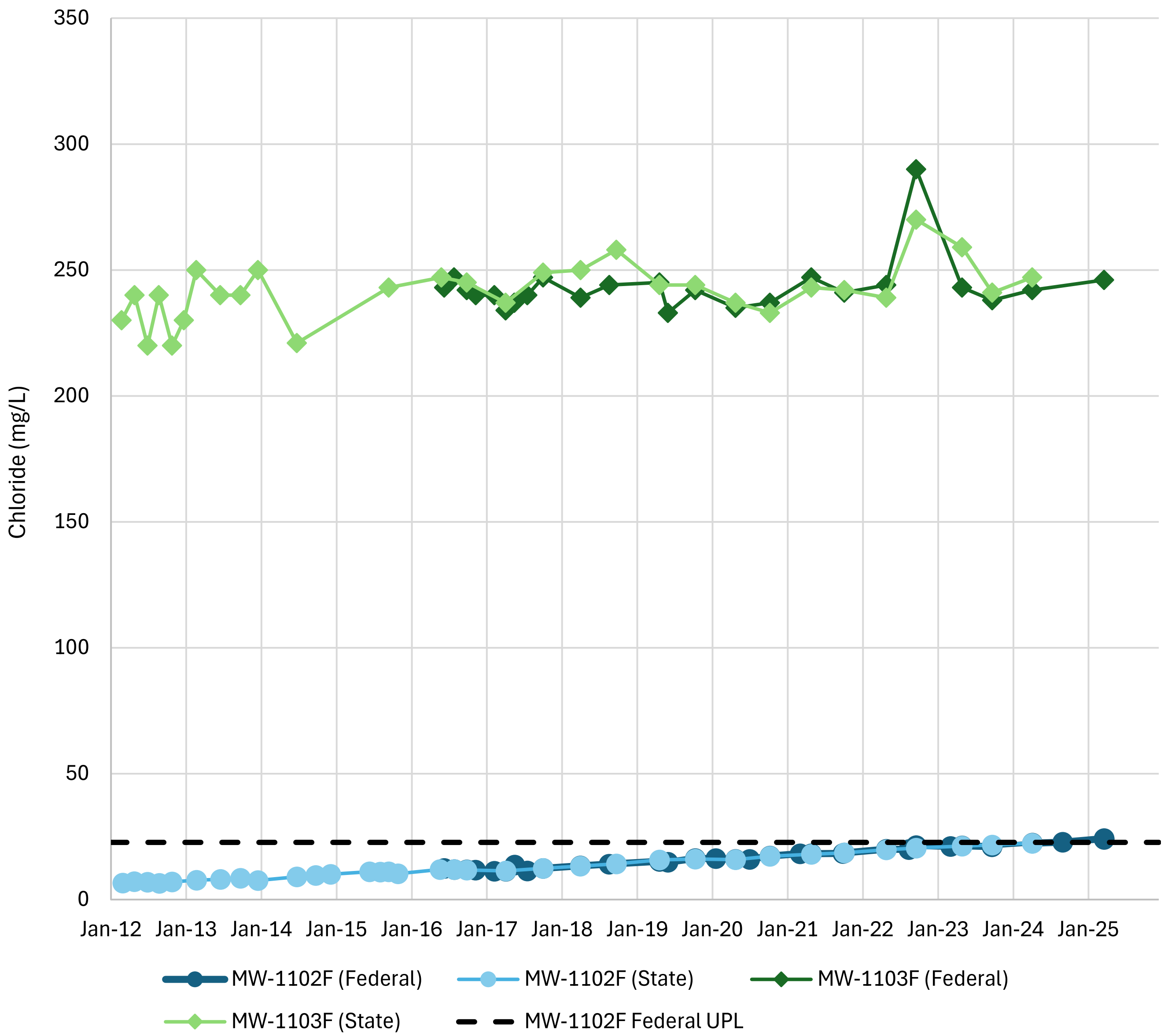
Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | September 2025

Figure **1**

A:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2024\AEP-Mitchell_Landfill-FC_GW_Sep2024.mxd. Okiemute.Commander. 10/24/2024. Project/Phase/Task.



Notes: Data are shown for both the federal and state monitoring programs. MW-1103F is a background monitoring location for the Fish Creek Formation. Downgradient location MW-1102F is also screened in the Fish Creek Formation. Samples for chloride analysis were not filtered for the federal or state programs. The MW-1102 federal UPL for chloride (recalculated in January 2024) is shown.

mg/L: milligrams per liter

UPL: upper prediction limit

Chloride Time Series

Mitchell Landfill

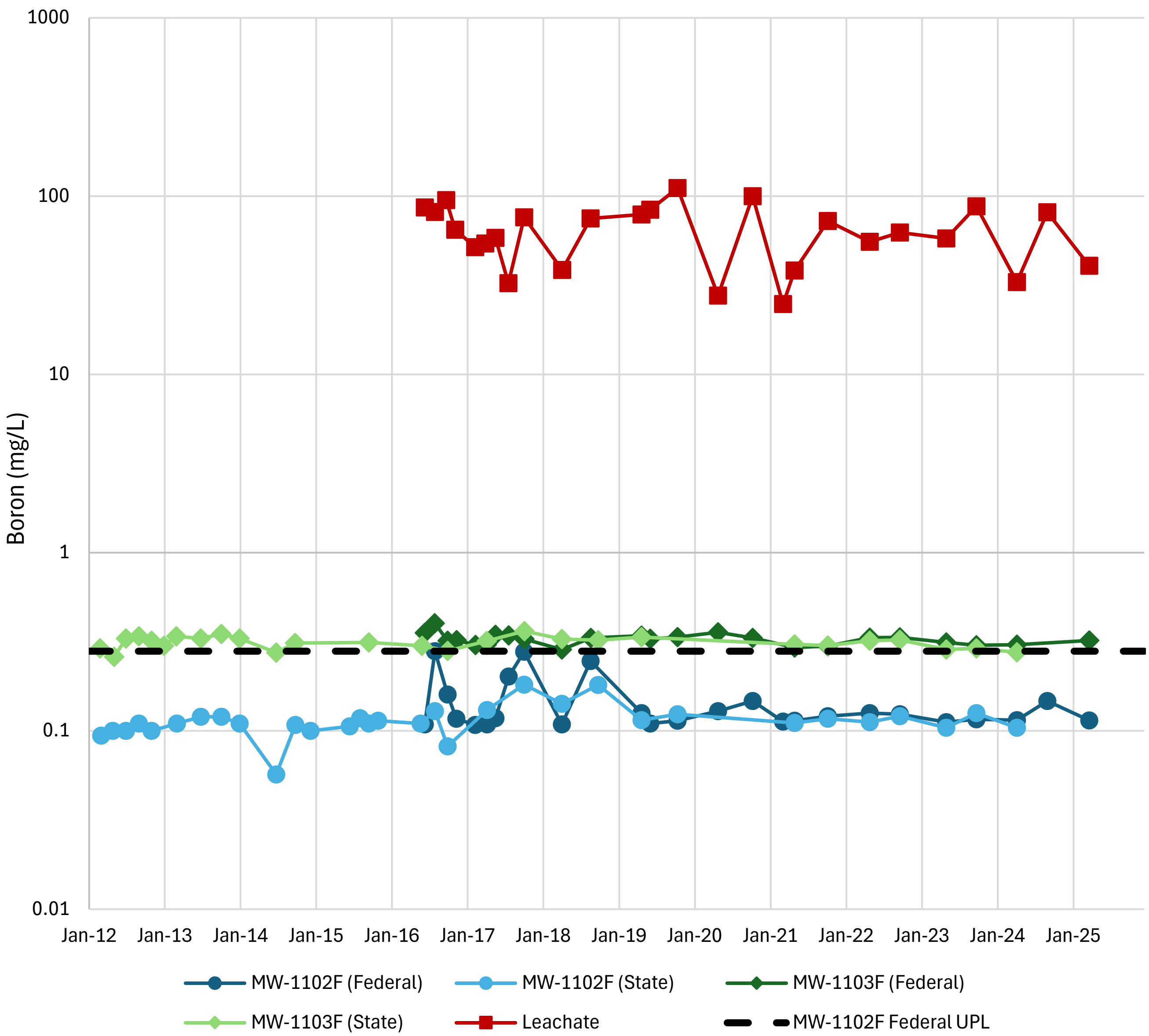
Geosyntec consultants

AMERICAN ELECTRIC POWER

Figure **2**

Columbus, Ohio

September 2025



Notes: Data are shown for both the federal and state monitoring programs. MW-1103F is a background monitoring location for the Fish Creek Formation. Downgradient location MW-1102F is also screened in the Fish Creek Formation. Samples for boron analysis were filtered for the state monitoring program, and were not filtered for the federal monitoring program. The MW-1102F federal UPL (recalculated in January 2024) is shown.

mg/L: milligrams per liter
UPL: upper prediction limit

Boron Time Series
Mitchell Landfill

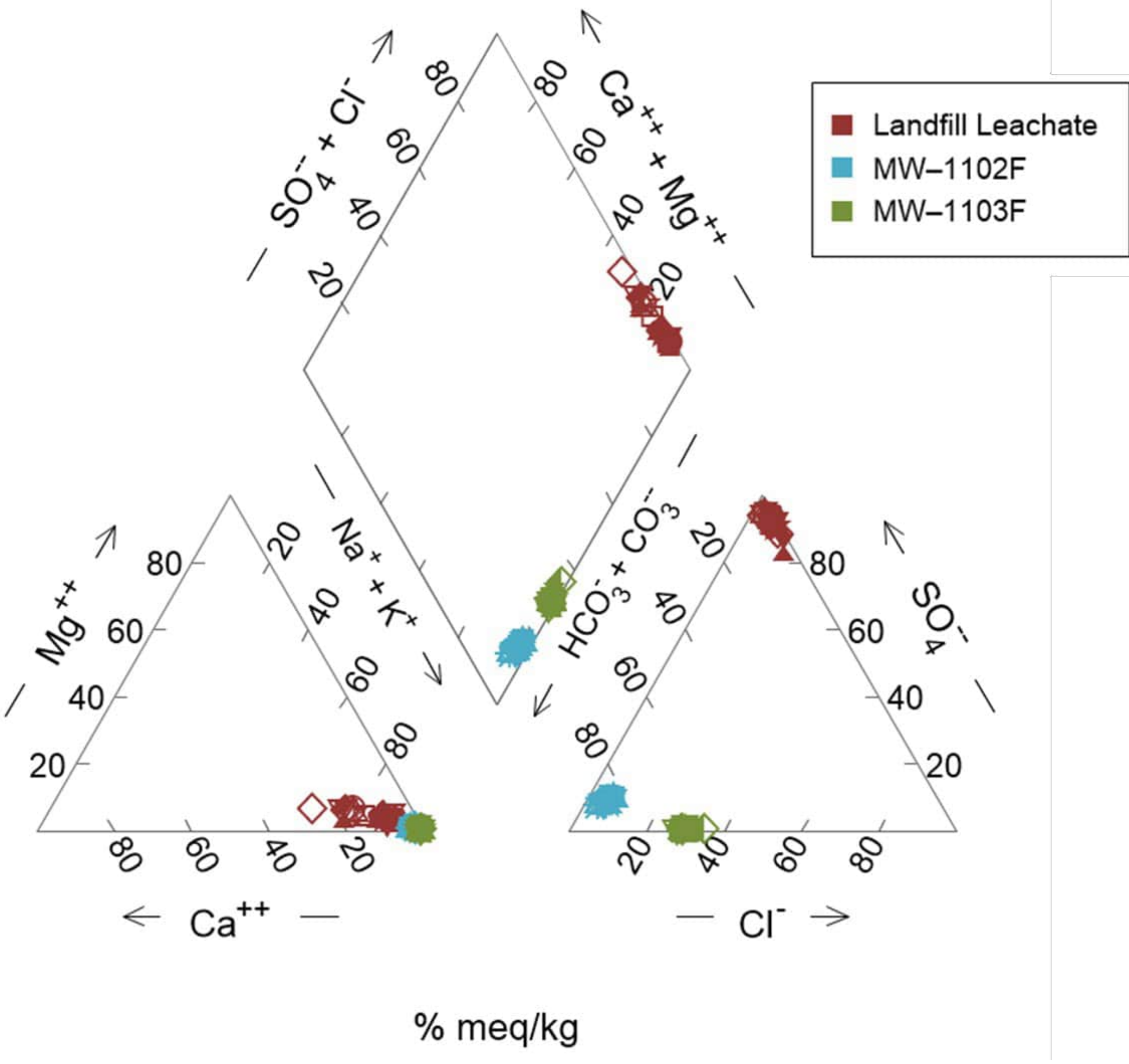
Geosyntec consultants

AMERICAN ELECTRIC POWER

Figure **3**

Columbus, Ohio

September 2025



Notes: Groundwater data for background well MW-1103F and downgradient well MW-1102F are shown for federal program sampling events completed from November 2016 through September 2024. Leachate data was collected for the state program from November 2016 through April 2025. Representative symbology is shown for each location in the legend.
% meq/kg: percent milliequivalents per kilogram

Piper Diagram
Mitchell Landfill

Geosyntec consultants

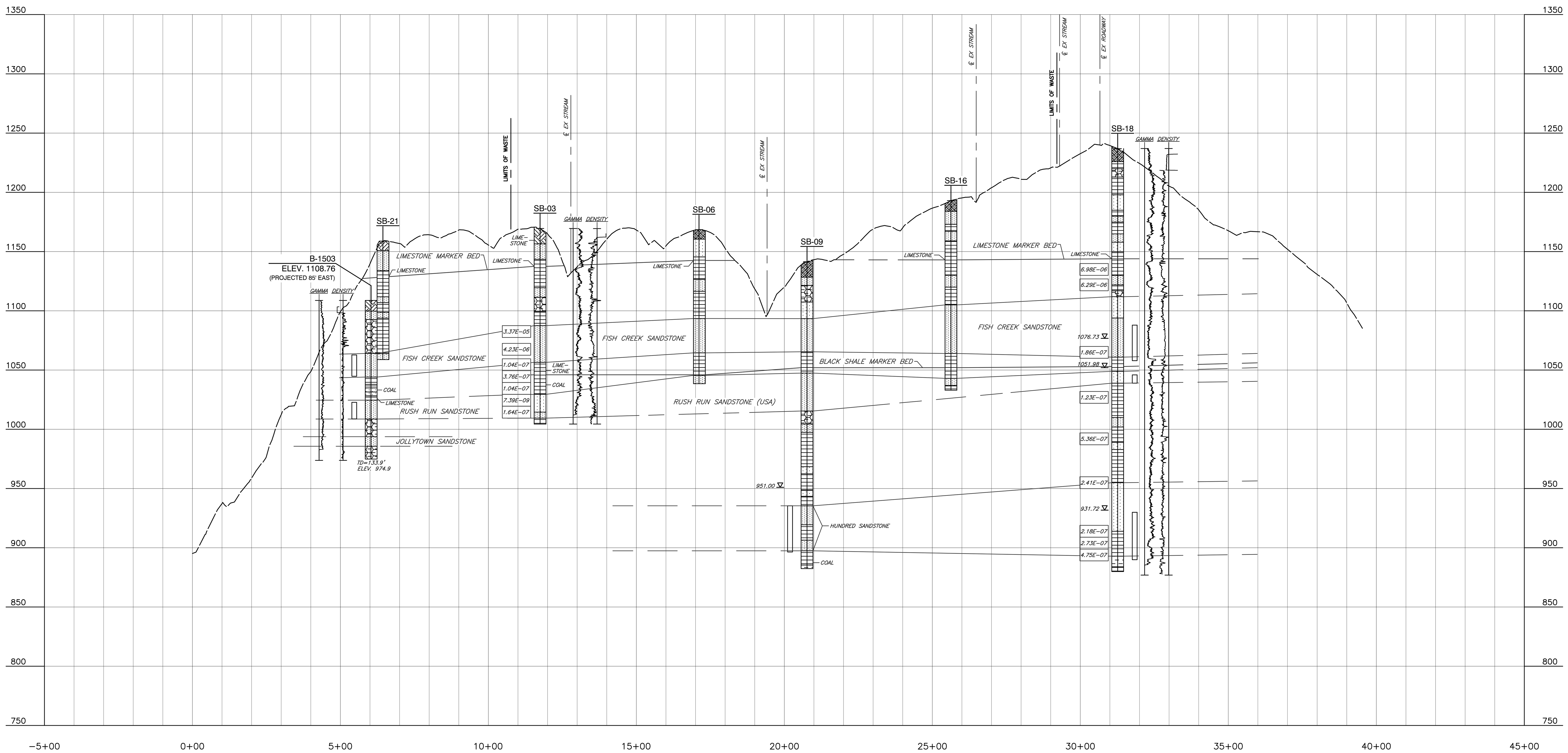
AMERICAN ELECTRIC POWER

Figure
4

Columbus, Ohio

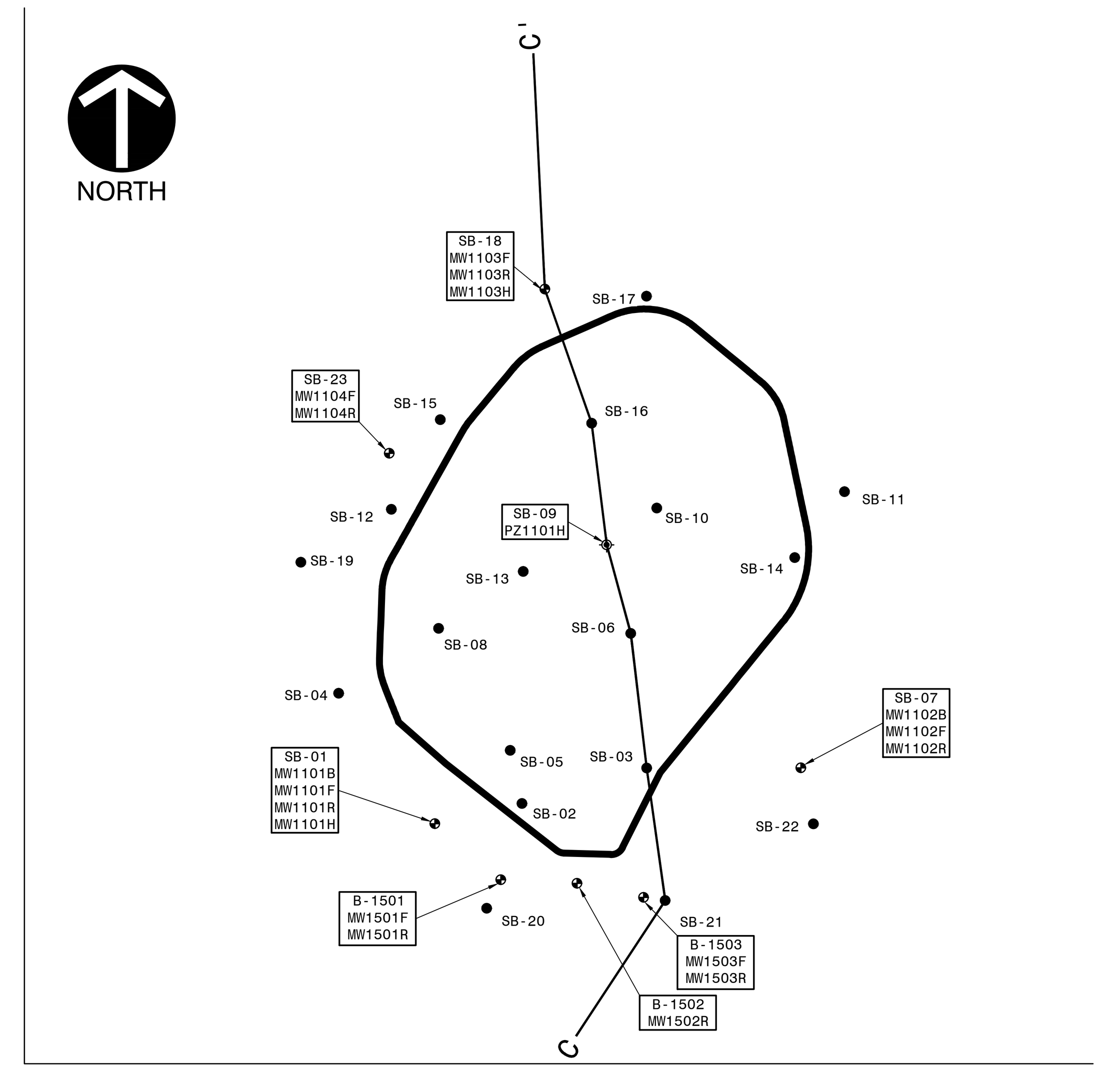
September 2025

ATTACHMENT A
Geologic Cross Section



GEOLOGIC CROSS SECTION C - C'

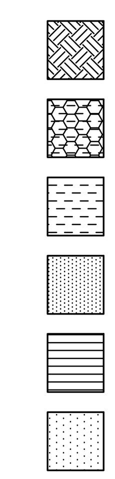
SCALE H:1"=200'; V:1"=50'



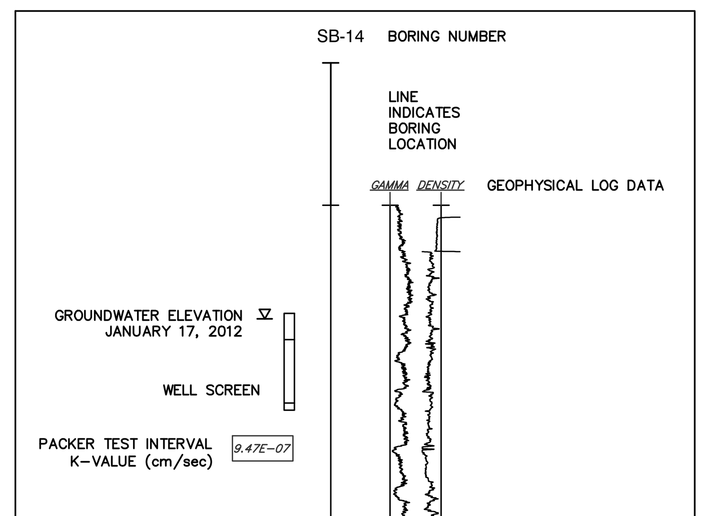
KEY PLAN

N.T.S.

LEGEND



UA – UPPERMOST AQUIFER



MONITORING WELL DIAGRAM

NOTE:

1. THE BORING LOGS AND RELATED INFORMATION PRESENTED HEREIN DEPICT SUBSURFACE CONDITIONS AT THE TEST BORING LOCATIONS AND AT THE TIME OF DRILLING. SOIL CONDITIONS AT OTHER LOCATIONS MAY DIFFER.
2. GEOLOGIC CORRELATIONS SHOWN BETWEEN TEST BORINGS GENERALLY ARE BASED ON A STRAIGHT-LINE INTERPOLATION. ACTUAL CONDITIONS BETWEEN TEST BORINGS MAY DIFFER.

HORZ. SCALE: 1"=200'

VERT. SCALE: 1"=50'

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
5899 Montclair Blvd. · Cincinnati, OH 45150
513-985-0226 · 800-759-5614
www.cecinc.com

AMERICAN ELECTRIC POWER
MITCHELL LANDFILL
MITCHELL POWER GENERATION PLANT
MARSHALL COUNTY, WEST VIRGINIA

GROUNDWATER MONITORING SYSTEM DEMONSTRATION

GEOLOGIC CROSS SECTION C-C'

DATE:	DECEMBER 2015	DRAWN BY:	DAR
DWG SCALE:	AS NOTED	CHECKED BY:	RAS
PROJECT NO:	110-416-7601	APPROVED BY:	APA

FIGURE NO.: 6

ATTACHMENT B
Potentiometric Maps

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on October 20, 2020) provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500
Feet

Potentiometric Surface Map - Fish Creek
October 2020

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Figure **B1**

Columbus, Ohio | 2020/12/29

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2020\AEP-Mitchell_Landfill-FC_GW_Oct2020.mxd. HDuff. 12/29/2020. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on March 16, 2021) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500 Feet

Potentiometric Surface Map - Fish Creek March 2021

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2021/06/11

Figure **B2**

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on May 11, 2021) provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

Potentiometric Surface Map - Fish Creek
May 2021

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2021/09/07

Figure **B3**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2021\AEP-Mitchell_Landfill-FC_GW_May2021.mxd. ASoltero. 9/7/2021. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on October 19, 2021) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500
Feet

Potentiometric Surface Map - Fish Creek
October 2021

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2022/01/11

Figure **B4**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2021\AEP-Mitchell_Landfill-FC_GW_Oct2021.mxd. ASoltero. 1/11/2022. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)
- Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on May 10, 2022) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500 Feet

Potentiometric Surface Map - Fish Creek
May 2022

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2022/11/22

Figure **B5**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2022\AEP-Mitchell_Landfill-FC_GW_May2022.mxd. ASoltero. 11/22/2022. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)
- Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on October 5, 2022) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500 Feet

Potentiometric Surface Map - Fish Creek
October 2022

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2023/01/23

Figure **B6**

M:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2022\AEP-Mitchell_Landfill-FC_GW_Oct2022.mxd. HDuff. 1/23/2023. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)
- Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on May 16, 2023) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500 Feet

Potentiometric Surface Map - Fish Creek May 2023

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2023/09/20

Figure **B7**

\\annarbor-01\Data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2023\AEP-Mitchell_Landfill-FC_GW_May2023.mxd. ASoltero. 9/20/2023. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)
- Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on October 10, 2023) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

Potentiometric Surface Map - Fish Creek
October 2023

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2023/10/27

Figure **B8**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2023\AEP-Mitchell_Landfill-FC_GW_Oct2023.mxd. ASoltero. 10/27/2023. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)
- Groundwater Flow Direction

Notes

1. Monitoring well coordinates and water level data (collected on April 24, 2024) provided by AEP.
2. Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC 2016) provided by AEP.
3. Groundwater elevation units are feet above mean sea level (ft amsl) (NAVD 88).
4. Aerial imagery provided by Google Earth Pro, dated April 18, 2023.

500 250 0 500 Feet

Potentiometric Surface Map - Fish Creek
April 2024

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2024/06/12

Figure B9

ATTACHMENT C

Sampling Locations and Chloride Concentrations for West Virginia Groundwater

Modified by Geosyntec (2025) from USGS (2012)

organic compounds, volatile organic compounds, and dissolved gases. A summary of dissolved gas data collected as part of this study can be found in McCoy and Kozar (2007).

Study Area, Design, and Methods

West Virginia lies entirely within the Appalachian Mountains with parts of the State in three physiographic provinces (Fenneman and Johnson, 1946), regions with similar rock types and groundwater characteristics. The western and central parts of the State lie within the Appalachian Plateaus Physiographic Province. The Appalachian Plateaus consist of sub-horizontal consolidated sedimentary rocks of Devonian to Permian age (fig. 1). These rocks have been highly dissected by stream erosion resulting in steep hills and deeply incised valleys. Valleys are filled in part with unconsolidated sediments of Quaternary age.

The eastern part of the State lies primarily in the Valley and Ridge Physiographic Province, named for the series of northeast-southwest trending valleys and ridges formed from Cambrian to Silurian aquifers. These strata are consolidated sedimentary rocks that are extensively faulted and sharply folded. The Blue Ridge Physiographic Province includes only the very easternmost edge of the Eastern Panhandle of West Virginia. In contrast to the sedimentary rocks of the Appalachian Plateaus and Valley and Ridge Physiographic Provinces, the Blue Ridge Physiographic Province is underlain by crystalline rock.

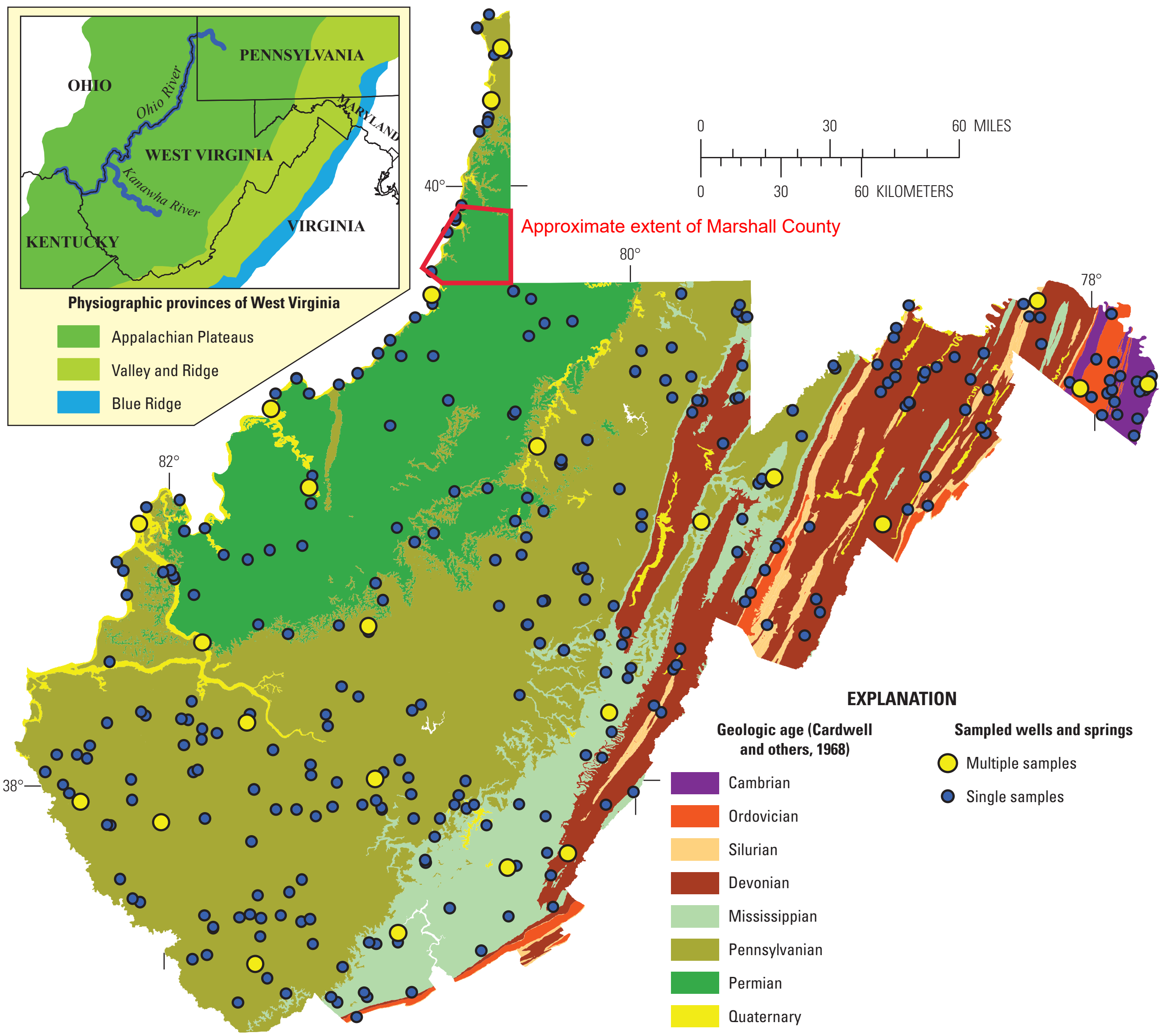


Figure 1. The geology of West Virginia and locations of groundwater-quality sampling sites, wells, and springs in the West Virginia ambient monitoring network, 1993–2008.

Chloride

Chloride, the most abundant halide (Hem, 1985), ranged in concentration from less than the 0.2 mg/L minimum reporting level to 736 mg/L with a median value of 16.6 mg/L (table 4). Most wells, 80 percent, had chloride values from 1.8 mg/L to 77 mg/L. Median values, by geologic ages of aquifers, ranged from 6.6 mg/L for wells in Devonian aquifers to 28 mg/L for wells in Quaternary aquifers (fig. 10).

The SMCL for chloride is 250 mg/L (U.S. Environmental Protection Agency, 2009b). Samples from four wells exceeded this concentration. All four were from areas of Pennsylvanian aquifers.

Sulfate

In West Virginia pyrite-bearing rock formations are a major source of sulfate in groundwater. MacAuley and Kozar (2006) found groundwater sulfate concentrations to be increased in mined areas of West Virginia's Northern Appalachian Coal Basin.

Although sulfate concentrations ranged from less than a reporting level of 0.07 mg/L to 767 mg/L with a median value of 14.7 mg/L for all samples, most wells (80 percent) had sulfate concentrations of 0.3 mg/L to 86 mg/L. Median sulfate concentrations varied widely by geologic age of the aquifers, from a low of 6.7 mg/L for wells in Pennsylvanian aquifers to 58.6 mg/L for wells in Quaternary aquifers (fig. 11). Sulfate concentrations exceeding the SMCL of 250 mg/L (U.S. Environmental Protection Agency, 2009b) were found in samples from nine wells (table 4).

Water Types

Natural waters can be classified by "water type" on the basis of major-ion composition. Water samples with a specific cation or anion constituting more than one-half the total cations or anions can be classified by water type, calcium carbonate type water, for example (Hem, 1985). However, waters in which no single cation or anion constitutes greater than one-half of the total cations or anions are classed as mixed-type waters (Hem, 1985). Samples from aquifers classified by geologic age typically reflect a signature characteristic of the rock type, although the rock-type signatures may overlap broadly. Calcium was the dominant cation in most samples from wells in Quaternary aquifers (fig. 12*A*); the dominant anion in most samples from Quaternary aquifers was bicarbonate with some samples having a sulfate or chloride

Modified by Geosyntec (2025) from USGS (2012)

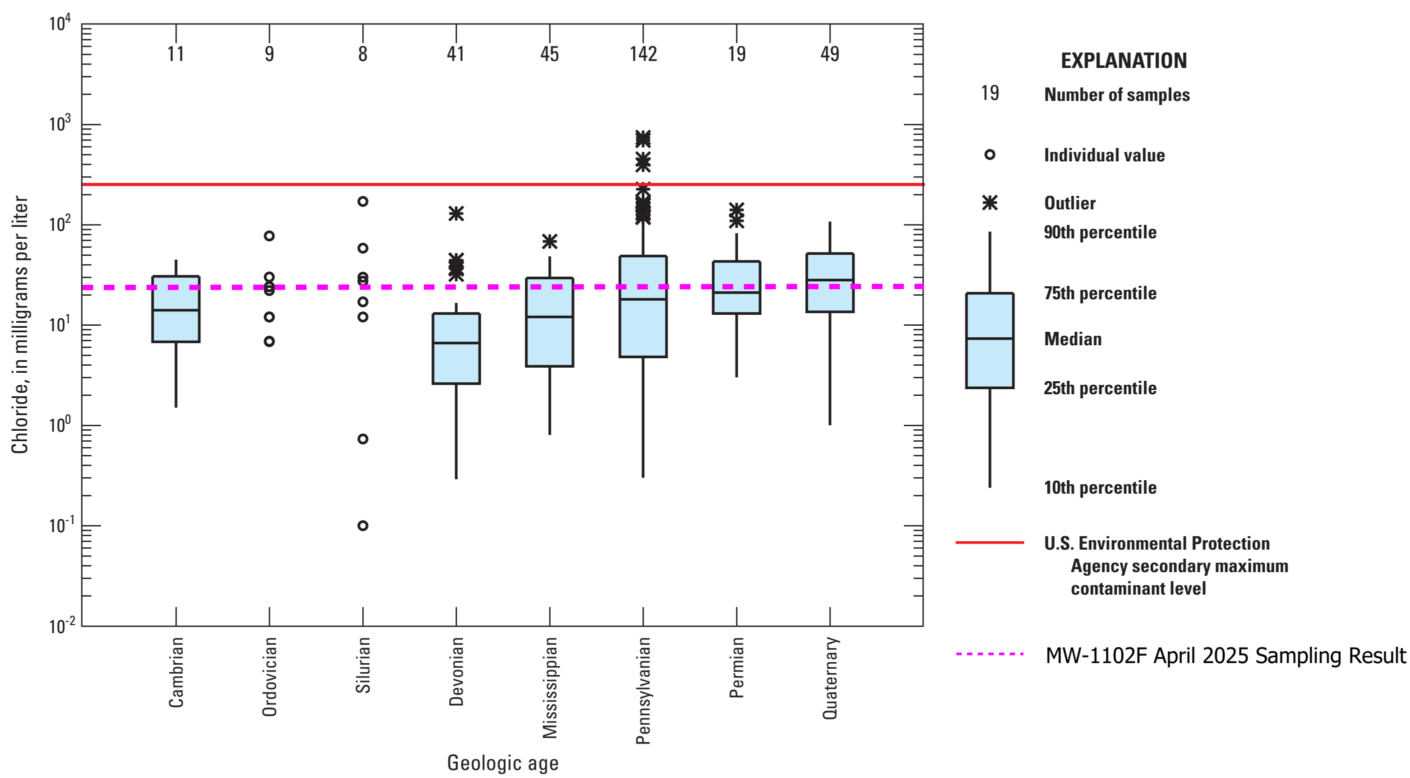


Figure 10. Distribution of chloride concentrations in groundwater samples from the West Virginia ambient monitoring network, grouped by geologic age of the aquifers, 1993–2008. U.S. Environmental Protection Agency (2009b) secondary maximum contaminant level of 250 milligrams per liter for finished drinking water is shown.

ATTACHMENT D
Certification by a Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Mitchell Landfill CCR management area and that the requirements of 40 CFR 257.94(e)(2) have been met.

John Seymour
Printed Name of Licensed Professional Engineer

Signature

017091
License Number

West Virginia
Licensing State

JOHN P. SEYMOUR
REGISTERED
17091
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

9/3/2025
Date

APPENDIX 4 - Notices for Monitoring Program Transitions

No transition between monitoring requirements occurred in 2025; the CCR unit was in detection monitoring at the beginning and at the end of the year. Notices for monitoring program transitions are not applicable at this time.

APPENDIX 5 - Well Installation/Decommissioning Logs

No wells were installed or decommissioned in 2025. Well installation/decommissioning logs are not applicable at this time.