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Dynegy Zimmer, LLC

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2019 Annual Groundwater Monitoring and Corrective Action Report

Date

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2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

ZIMMER LANDFILL, ZIMMER POWER STATION

RAMBOLL Bright ideas. Sustainable change.

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
ZIMMER LANDFILL, ZIMMER POWER STATION

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Description	**Annual Report in Support of the CCR Rule Groundwater Monitoring Program**

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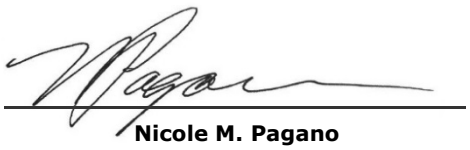

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ACRONYMS AND ABBREVIATIONS

ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
GWPS	Groundwater Protection Standard
LF	Landfill
SAP	Sampling and Analysis Plan
SSL	Statistically Significant Level

EXECUTIVE SUMMARY

This report has been prepared to provide the information required by Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.90(e) for Zimmer Landfill (LF) located near Zimmer Power Station and Moscow, Ohio.

Groundwater is being monitored at Zimmer LF in accordance with the Assessment Monitoring Program requirements specified in 40 C.F.R. § 257.95.

No changes were made to the monitoring system in 2019 (no wells were installed or decommissioned).

The following Statistically Significant Levels (SSLs) of 40 C.F.R. Part 257 Appendix IV parameters were determined during one or more sampling events in 2019:

- Lithium at well MW-F

Alternate Source Demonstrations (ASDs) were completed for the SSLs referenced above and Zimmer LF remains in the Assessment Monitoring Program.

1. INTRODUCTION

This report has been prepared by Ramboll on behalf of Dynegy Zimmer, LLC, to provide the information required by 40 C.F.R.§ 257.90(e) for Zimmer LF located near Zimmer Power Station and Moscow, Ohio.

In accordance with 40 C.F.R. § 257.90(e), the owner or operator of a Coal Combustion Residuals (CCR) unit must prepare an Annual Groundwater Monitoring and Corrective Action Report for the preceding calendar year that documents the status of the Groundwater Monitoring and Corrective Action Program for the CCR unit, summarizes key actions completed, describes any problems encountered, discusses actions to resolve the problems, and projects key activities for the upcoming year. At a minimum, the Annual Report must contain the following information, to the extent available:

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

This report provides the required information for Zimmer LF for calendar year 2019.

2. MONITORING AND CORRECTIVE ACTION PROGRAM STATUS

No changes have occurred to the Monitoring Program status in calendar year 2019, and Zimmer LF remains in the Assessment Monitoring Program in accordance with 40 C.F.R. § 257.95.

3. KEY ACTIONS COMPLETED IN 2019

The Assessment Monitoring Program is summarized in Table A. The groundwater monitoring system, including the CCR unit and all background and downgradient monitoring wells is presented in Figure 1. No changes were made to the monitoring system in 2019 (no wells were installed or decommissioned). In general, one groundwater sample was collected from each background and downgradient well during each monitoring event. All samples were collected and analyzed in accordance with the Sampling and Analysis Plan (SAP) (OBG/Ramboll, 2019). All monitoring data obtained under 40 C.F.R. §§ 257.90 through 257.98 (as applicable) in 2019 are presented in Tables 1 and 2. Analytical data were evaluated in accordance with the Statistical Analysis Plan (NRT/OBG, 2017) to determine any SSLs of Appendix IV parameters over Groundwater Protection Standards (GWPSs).

Statistical background values are provided in Table 3 and GWPSs in Table 4.

Analytical results for the May and September 2018 sampling events were provided in the 2018 Annual Groundwater Monitoring and Corrective Action Report.

Potential alternate sources were evaluated as outlined in the 40 C.F.R. § 257.95(g)(3)(ii). ASDs were completed and certified by a qualified professional engineer. The dates the ASDs were completed are provided in Table A. The ASDs completed in 2019 are included in Appendix A.

Table A – 2018-2019 Assessment Monitoring Program Summary

Sampling Dates	Analytical Data Receipt Date	Parameters Collected	SSL(s)	SSL(s) Determination Date	ASD Completion Date
May 7-8, 2018	July 9, 2018	Appendix III Appendix IV	NA	NA	NA
September 17-27, 2018	October 8, 2018	Appendix III Appendix IV Detected [1]	Lithium (MW-F)	January 7, 2019	April 8, 2019
March 12-13, 2019	April 29, 2019	Appendix III Appendix IV	Lithium (MW-F)	July 29, 2019	October 28, 2019
September 11-12, 2019	November 4, 2019	Appendix III Appendix IV Detected [1]	NA	TBD	TBD

Notes:

NA: Not Applicable
TBD: To Be Determined
1. Groundwater sample analysis was limited to Appendix IV parameters detected in previous events in accordance with 40 C.F.R. § 257.95(d)(1).

4. PROBLEMS ENCOUNTERED AND ACTIONS TO RESOLVE THE PROBLEMS

No problems were encountered with the Groundwater Monitoring Program during 2019. Groundwater samples were collected and analyzed in accordance with the SAP (OBG/Ramboll, 2019), and all data were accepted.

5. KEY ACTIVITIES PLANNED FOR 2020

The following key activities are planned for 2020:

- Continuation of the Assessment Monitoring Program with semi-annual sampling scheduled for the first and third quarters of 2020.
- Complete evaluation of analytical data from the downgradient wells, using GWPSs to determine whether an SSL of Appendix IV parameters has occurred.
- If an SSL is identified, potential alternate sources (i.e., a source other than the CCR unit caused the SSL or that that SSL resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality) will be evaluated.
  - If an alternate source is demonstrated to be the cause of the SSL, a written demonstration will be completed within 90 days of SSL determination and included in the 2020 Annual Groundwater Monitoring and Corrective Action Report.
  - If an alternate source(s) is not identified to be the cause of the SSL, the applicable requirements of 40 C.F.R. §§ 257.94 through 257.98 (e.g., assessment of corrective measures) as may apply in 2020 will be met, including associated recordkeeping/notifications required by 40 C.F.R. §§ 257.105 through 257.108.

6. REFERENCES

OBG, Part of Ramboll, 2019, Sampling and Analysis Plan, CCR Rule Groundwater Monitoring, Zimmer Residual Waste Landfill, Unit 122, Zimmer Power Landfill, Moscow, Ohio, Job Number: 72762, Revision 1, April 8, 2019.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017, Statistical Analysis Plan, Zimmer Power Station, Dynegy Zimmer, LLC, October 17, 2017.

TABLES

TABLE 1.
2019 ANALYTICAL RESULTS - GROUNDWATER ELEVATION AND APPENDIX III PARAMETERS
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
ZIMMER POWER STATION
UNIT ID 122 - ZIMMER LANDFILL
MOSCOW, OHIO
ASSESSMENT MONITORING PROGRAM

Well Identification Number	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Date & Time Sampled	Depth to Groundwater (ft)[1]	Groundwater Elevation (ft NAVD88)	40 C.F.R. Part 257 Appendix III						
						Boron, total (mg/L) 6020A[2]	Calcium, total (mg/L) 6020A[2]	Chloride, total (mg/L) 9251[2]	Fluoride, total (mg/L) 9214[2]	pH (field) (S.U.) SM 4500 H+B[2]	Sulfate, total (mg/L) 9036[2]	Total Dissolved Solids (mg/L) SM 2540C[2]
Background / Upgradient Monitoring Wells												
MW-3	38.850484	-84.166787	3/12/2019 15:20	9.33	863.52	<0.080	195	206	<1.00	6.8	50.0	827
			9/11/2019 8:50	12.24	860.61	<0.080	176	154	<1.00	6.6	56.3	827
MW-13S	38.861118	-84.157722	3/12/2019 11:55	8.86	853.24	<0.080	109	140	<1.00	7.1	36.9	499
			9/11/2019 NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW-18	38.856449	-84.153394	3/12/2019 12:40	11.40	877.17	<0.080	90.3	19.9	<1.00	7.2	153	595
			9/11/2019 NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW-21	38.854684	-84.157370	3/12/2019 13:50	10.24	851.91	1.22	85.2	168	<1.00	7.1	68.4	759
			9/11/2019 15:20	12.41	849.74	1.40	93.0	129	<1.00	7.2	66.4	687
Downgradient Monitoring Wells												
MW-9D	38.858152	-84.163302	3/13/2019 11:25	30.78	827.13	0.499	90.4	206	<1.00	7.1	<5.00	790
			9/11/2019 12:30	30.93	826.98	0.730	84.4	193	<1.00	7.1	<5.00	849
MW-11D	38.860311	-84.163353	3/13/2019 8:50	16.12	835.73	0.156	76.3	5.06	<1.00	7.2	11.3	385
			9/11/2019 11:25	16.57	835.28	0.169	75.2	3.67	<1.00	7.3	11.9	352
MW-16D	38.853278	-84.171775	3/12/2019 16:45	8.62	816.60	0.895	51.5	59.5	<1.00	7.3	<5.00	541
			9/11/2019 9:35	9.03	816.19	0.979	51.0	56.6	<1.00	7.0	<5.00	514
MW-20D	38.859381	-84.167952	3/12/2019 18:35	20.85	803.83	0.224	81.5	23.4	<1.00	7.2	18.9	353
			9/12/2019 8:25	20.80	803.88	0.274	85.3	23.0	<1.00	6.7	19.0	362
MW-22	38.856191	-84.160444	3/13/2019 12:05	16.10	850.84	0.392	118	36.9	<1.00	7.0	96.1	590
			9/11/2019 13:55	16.81	850.13	0.466	117	36.4	<1.00	6.9	93.7	589
MW-24	38.861830	-84.166930	3/12/2019 19:20	18.34	834.02	0.130	54.9	9.41	<1.00	7.4	36.3	269
			9/11/2019 10:05	21.28	831.08	0.184	53.4	5.80	<1.00	7.4	27.1	246
MW-D	38.860871	-84.165350	3/13/2019 7:55	16.91	835.43	4.18	2.93	29.6	2.20	8.4	14.4	533
			9/11/2019 10:45	17.25	835.09	4.41	3.42	22.3	1.95	8.2	12.3	508
MW-E	38.857475	-84.161252	3/13/2019 9:40	24.23	839.19	0.805	50.7	17.6	<1.00	7.3	20.5	361
			9/11/2019 13:15	25.13	838.29	1.01	51.2	25.6	<1.00	7.3	40.0	450
MW-F	38.853745	-84.161190	3/13/2019 12:55	8.71	875.31	4.04	92.3	548	<1.00	7.3	169	1490
			9/11/2019 14:40	10.82	873.20	4.42	98.4	506	<2.50	7.3	151	1390
MW-G	38.856604	-84.169920	3/12/2019 17:30	33.93	787.47	0.875	68.3	180	<1.00	7.2	<5.00	704
			9/11/2019 16:10	34.23	787.17	1.03	70.2	151	<1.00	7.2	<5.00	693
MW-H	38.855369	-84.171121	3/12/2019 16:10	9.81	801.32	0.548	114	132	<1.00	7.0	39.6	671
			9/12/2019 9:05	9.98	801.15	0.627	118	105	<1.00	6.7	29.0	629

[O: RAB 12/25/19, C: KLT 12/26/19]

Notes:
40 C.F.R. = Title 40 of the Code of Federal Regulations
ft = foot/feet
mg/L = milligrams per liter
NAVD88 = North American Vertical Datum of 1988
NS = Not Sampled
S.U. = Standard Units
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method; estimated concentrations below the reporting limit and associated qualifiers are not provided since not utilized in statistics to determine Statistically Significant Increases (SSIs) over background.
[1]All depths to groundwater were measured on the first day of the sampling event.
[2]4-digit numbers represent SW-846 analytical methods.

TABLE 2.
2019 ANALYTICAL RESULTS - APPENDIX IV PARAMETERS
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
ZIMMER POWER STATION
UNIT ID 122 - ZIMMER LANDFILL
MOSCOW, OHIO
ASSESSMENT MONITORING PROGRAM

Well Identification Number	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Date & Time Sampled	40 C.F.R. Part 257 Appendix IV														
				Antimony, total (mg/L) 6020A[1]	Arsenic, total (mg/L) 6020A[1]	Barium, total (mg/L) 6020A[1]	Beryllium, total (mg/L) 6020A[1]	Cadmium, total (mg/L) 6020A[1]	Chromium, total (mg/L) 6020A[1]	Cobalt, total (mg/L) 6020A[1]	Fluoride, total (mg/L) 6020A[1]	Lead, total (mg/L) 6020A[1]	Lithium, total (mg/L) 6020A[1]	Mercury, total (mg/L) 7470A[1]	Molybdenum, total (mg/L) 6020A[1]	Radium 226/228, Combined (pCi/L) 903/904[1]	Selenium, total (mg/L) 6020A[1]	Thallium, total (mg/L) 6020A[1]
Background / Upgradient Monitoring Wells																		
MW-3	38.850484	-84.166787	3/12/2019 15:20	<0.00200	<0.00100	0.0468	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0134	<0.000200	<0.00500	0.237	<0.00500	<0.00100
			9/11/2019 8:50[2]	NA	<0.00100	0.0595	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0161	NA	<0.00500	0.798	<0.00500	NA
MW-13S	38.861118	-84.157722	3/12/2019 11:55	<0.00200	<0.00100	0.0349	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0138	<0.000200	<0.00500	0.264	<0.00500	<0.00100
			9/11/2019 NS[2]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW-18	38.856449	-84.153394	3/12/2019 12:40	<0.00200	<0.00100	<0.010	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0816	<0.000200	<0.00500	0.0784	<0.00500	<0.00100
			9/11/2019 NS[2]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW-21	38.854684	-84.157370	3/12/2019 13:50	<0.00200	<0.00100	0.0777	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0752	<0.000200	<0.00500	0.897	<0.00500	<0.00100
			9/11/2019 15:20[2]	NA	<0.00100	0.0833	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0735	NA	<0.00500	0.856	<0.00500	NA
Downgradient Monitoring Wells																		
MW-9D	38.858152	-84.163302	3/13/2019 11:25	<0.00200	0.00408	0.501	<0.00100	<0.00100	<0.00200	0.000887	<1.00	<0.00100	0.0396	<0.000200	<0.00500	1.77	<0.00500	<0.00100
			9/11/2019 12:30[2]	NA	0.00265	0.608	<0.00100	<0.00100	<0.00200	0.00193	<1.00	<0.00100	0.0523	NA	<0.00500	2.06	<0.00500	NA
MW-11D	38.860311	-84.163353	3/13/2019 8:50	<0.00200	0.00191	0.161	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0103	<0.000200	<0.00500	0.460	<0.00500	<0.00100
			9/11/2019 11:25[2]	NA	0.00255	0.174	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0107	NA	<0.00500	0.390	<0.00500	NA
MW-16D	38.853278	-84.171775	3/12/2019 16:45	<0.00200	0.00904	0.106	<0.00100	0.00265	<0.00200	<0.0005	<1.00	<0.00100	0.0471	<0.000200	<0.00500	0.266	<0.00500	<0.00100
			9/11/2019 9:35[2]	NA	0.00654	0.112	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0448	NA	<0.00500	0.344	<0.00500	NA
MW-20D	38.859381	-84.167952	3/12/2019 18:35	<0.00200	0.00125	0.140	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0163	<0.000200	0.00525	0.390	<0.00500	<0.00100
			9/12/2019 8:25[2]	NA	0.00187	0.162	<0.00100	<0.00100	0.0026	0.000771	<1.00	<0.00100	0.0201	NA	0.0057	0.269	<0.00500	NA
MW-22	38.856191	-84.160444	3/13/2019 12:05	<0.00200	0.00182	0.0484	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0239	<0.000200	<0.00500	0.415	<0.00500	<0.00100
			9/11/2019 13:55[2]	NA	0.00294	0.0526	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0246	NA	<0.00500	0.462	<0.00500	NA
MW-24	38.861830	-84.166930	3/12/2019 19:20	<0.00200	<0.00100	0.0394	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0186	<0.000200	<0.00500	0.218	<0.00500	<0.00100
			9/11/2019 10:05[2]	NA	<0.00100	0.0452	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0194	NA	<0.00500	0.260	<0.00500	NA
MW-D	38.860871	-84.165350	3/13/2019 7:55	<0.00200	<0.00100	0.0281	<0.00100	<0.00100	<0.00200	<0.0005	2.20	<0.00100	0.125	<0.000200	<0.00500	0.165	<0.00500	<0.00100
			9/11/2019 10:45[2]	NA	<0.00100	0.0270	<0.00100	<0.00100	0.00646	<0.0005	1.95	<0.00100	0.119	NA	<0.00500	0.919	<0.00500	NA
MW-E	38.857475	-84.161252	3/13/2019 9:40	<0.00200	<0.00100	0.186	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0344	<0.000200	<0.00500	1.19	<0.00500	<0.00100
			9/11/2019 13:15[2]	NA	0.00106	0.246	<0.00100	<0.00100	0.00351	0.00232	<1.00	0.00131	0.0416	NA	<0.00500	0.348	<0.00500	NA
MW-F	38.853745	-84.161190	3/13/2019 12:55	<0.00200	<0.00100	0.0326	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.231	<0.000200	<0.00500	1.36	<0.00500	<0.00100
			9/11/2019 14:40[2]	NA	0.00103	0.0423	<0.00100	<0.00100	<0.00200	<0.0005	<2.50	<0.00100	0.232	NA	<0.00500	1.84	<0.00500	NA
MW-G	38.856604	-84.169920	3/12/2019 17:30	<0.00200	0.00171	0.530	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0391	<0.000200	<0.00500	0.798	<0.00500	<0.00100
			9/11/2019 16:10[2]	NA	0.00196	0.452	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0416	NA	<0.00500	0.521	<0.00500	NA
MW-H	38.855369	-84.171121	3/12/2019 16:10	<0.00200	0.00107	0.111	<0.00100	<0.00100	<0.00200	<0.0005	<1.00	<0.00100	0.0376	<0.000200	<0.00500	0.461	<0.00500	<0.00100
			9/12/2019 9:05[2]	NA	0.00105	0.124	<0.00100	<0.00100	0.00216	<0.0005	<1.00	<0.00100	0.0400	NA	<0.00500	0.254	<0.00500	NA

[O: RAB 12/25/19, C: KLT 12/26/19]

Notes:

40 C.F.R. = Title 40 of the Code of Federal Regulations
mg/L = milligrams per liter
NA = Not Analyzed
NS = Not Sampled
pCi/L = picoCuries per liter
< = concentration is less than concentration shown, which corresponds to the reporting limit for the method; estimated concentrations below the reporting limit and associated qualifiers are not provided since not utilized in statistics to determine Statistically Significant Levels (SSLs) over Groundwater Protection Standards.
[1]4-digit numbers represent SW-846 analytical methods and 3-digit numbers represent Clean Water Act analytical methods.
[2]Only the parameters detected during the previous sampling events were analyzed during this sampling event, in accordance with 40 C.F.R. § 257.95(d)(1).

TABLE 3.
STATISTICAL BACKGROUND VALUES
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
ZIMMER POWER STATION
UNIT ID 122 - ZIMMER LANDFILL
MOSCOW, OHIO
ASSESSMENT MONITORING PROGRAM

Parameter	Statistical Background Value (UPL)
40 C.F.R. Part 257 Appendix III	
Boron (mg/L)	1.88
Calcium (mg/L)	241
Chloride (mg/L)	201
Fluoride (mg/L)	0.761
pH (S.U.)	6.6 / 7.4
Sulfate (mg/L)	227.443
Total Dissolved Solids (mg/L)	887

[O: RAB 12/26/19, C: KLT 12/26/19]

Notes:

40 C.F.R. = Title 40 of the Code of Federal Regulations
mg/L = milligrams per liter
S.U. = Standard Units
UPL = Upper Prediction Limit

TABLE 4.
GROUNDWATER PROTECTION STANDARDS
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
ZIMMER POWER STATION
UNIT ID 122 - ZIMMER LANDFILL
MOSCOW, OHIO
ASSESSMENT MONITORING PROGRAM

Parameter	Groundwater Protection Standard[1]
40 C.F.R. Part 257 Appendix IV	
Antimony (mg/L)	0.006
Arsenic (mg/L)	0.010
Barium (mg/L)	2
Beryllium (mg/L)	0.004
Cadmium (mg/L)	0.005
Chromium (mg/L)	0.10
Cobalt (mg/L)	0.006
Fluoride (mg/L)	4
Lead (mg/L)	0.015
Lithium (mg/L)	0.040
Mercury (mg/L)	0.002
Molybdenum (mg/L)	0.10
Radium 226+228 (pCi/L)	5
Selenium (mg/L)	0.05
Thallium (mg/L)	0.002

[O: RAB 12/26/19, C: KLT 12/26/19][U: KLT 1/17/20, C: RAB 1/17/2020]

Notes:
40 C.F.R. = Title 40 of the Code of Federal Regulations
mg/L = milligrams per liter
pCi/L = picoCuries per liter
[1]Groundwater Protection Standard is the higher of the Maximum Contaminant Level / Health-Based Level or background.

FIGURES

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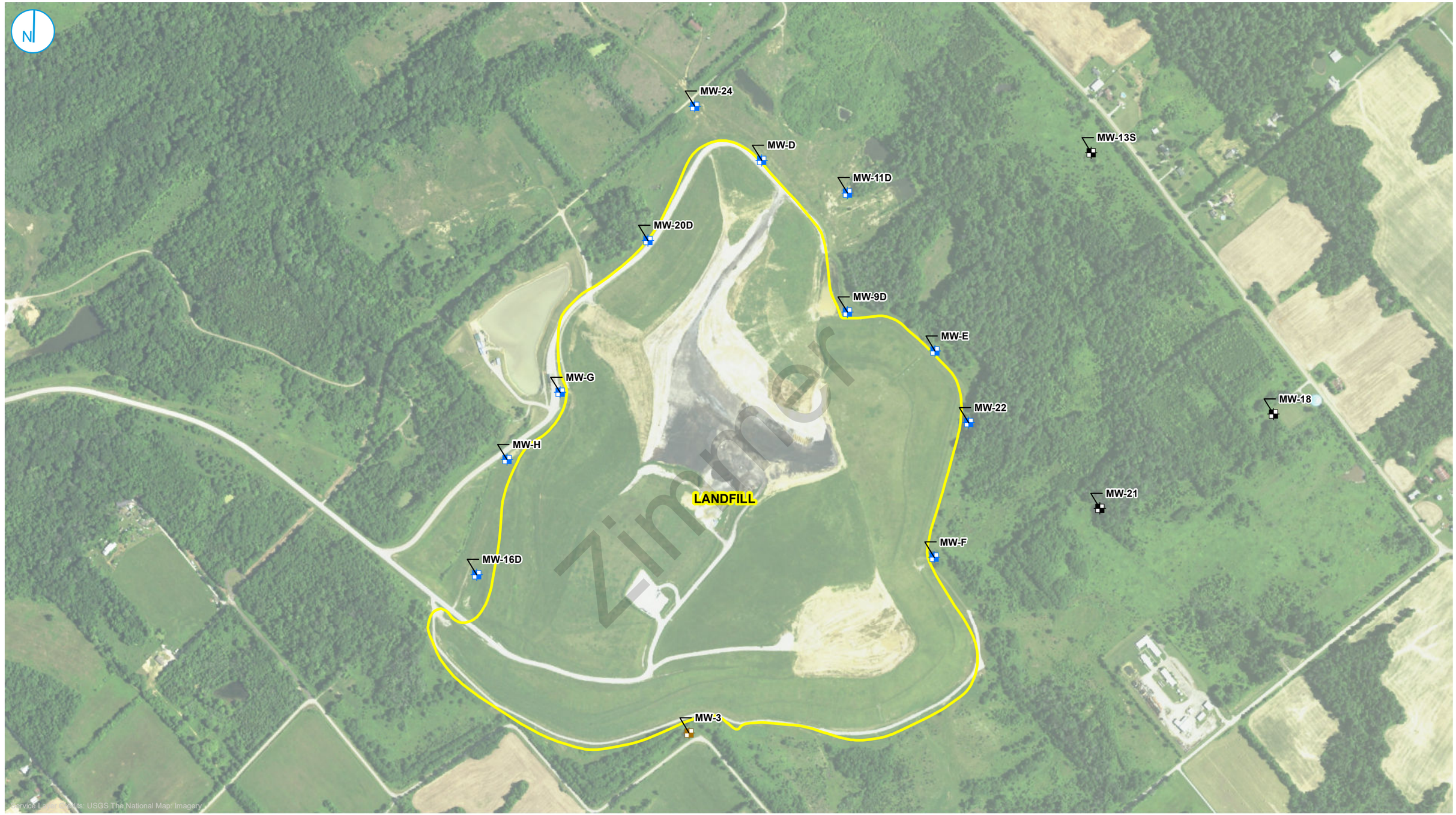

- UPGRADIENT MONITORING WELL LOCATION
- DOWNGRADIENT MONITORING WELL LOCATION
- BACKGROUND MONITORING WELL LOCATION
- CCR MONITORED UNIT

0 300 600 Feet

MONITORING WELL LOCATION MAP
ZIMMER LANDFILL
UNIT ID:122

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
VISTRA CCR RULE GROUNDWATER MONITORING
ZIMMER POWER STATION
MOSCOW, OHIO

FIGURE 1

O'BRIEN & GERE ENGINEERS, INC.
A RAMBOLL COMPANY

RAMBOLL

APPENDIX A
ALTERNATE SOURCE DEMONSTRATIONS

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION
ZIMMER LANDFILL
APRIL 8, 2019

April 8, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 257.95(g)(3)(ii) allows the owner or operator of a coal combustion residuals (CCR) unit 90 days from the date of determination of statistically significant levels (SSLs) over groundwater protection standards of groundwater constituents listed in Appendix IV of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSL(s), or that the SSL(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (alternate source demonstration [ASD]).

This ASD has been prepared on behalf of Dynegy Zimmer, LLC, by O'Brien & Gere Engineers, Inc., part of Ramboll, to provide pertinent information pursuant to 40 C.F.R. § 257.95(g)(3)(ii) for the Zimmer Landfill located near the Zimmer Power Station and Moscow, OH.

The first Assessment Monitoring sampling event was completed on May 7, 2018, and May 8, 2018. As stipulated in 40 C.F.R. § 257.95(d)(1), all wells were resampled on September 17, 2018, and September 18, 2018, for all Appendix III parameters and Appendix IV parameters detected during the first Assessment Monitoring sampling event. Due to shipping delays, samples from monitoring wells MW-18, MW-21, and MW-24 arrived at the analytical laboratory above the temperature allowable by the analysis method. These three wells were resampled on September 27, 2018 and submitted for analysis. Analytical data from all sampling events from December 2015 through the resampling event on September 27, 2018, were evaluated in accordance with the statistical analysis plan[1] to determine any statistically significant levels (SSLs) of Appendix IV parameters over the Groundwater Protection Standards (GWPSs) established in accordance with 40 C.F.R. § 257.95(h). That evaluation identified SSLs at downgradient monitoring wells as follows:

- Lithium at well MW-F

Pursuant to 40 C.F.R. § 257.95(g)(3)(ii), the following lines of evidence demonstrate that sources other than the Zimmer Landfill were the cause of the SSL listed above. This alternate source demonstration (ASD) was completed within 90 days of determination of the SSLs (January 7, 2019), as required by 40 C.F.R. § 257.95(g)(3)(ii).

ISOTOPIC EVALUATION

Isotopes are commonly used in age dating, provenance studies, and to differentiate between sources of groundwater. Multiple studies have shown that boron and strontium isotope ratios can be successfully used in identifying CCR impacts to groundwater[2-3]. When a material is altered, the mass of a given element in the resulting material may be conserved or reduced. Alteration processes, such as combustion, may also affect the isotopic ratios of a given element, referred to as fractionation. Isotopes that have minimal fractionation during the alteration process, such as boron and strontium isotopes, make good groundwater tracers. This ASD compares boron and strontium isotope ratios to published ranges for CCR impacted groundwater and CCR leachate.

Boron

Boron isotopes do not fractionate during coal combustion, meaning the isotopic ratio in the coal is preserved, regardless of the total boron in the coal and the combusted coal[2]. The isotopic ratio is also conserved when mobilized to water; thus, CCR-impacted groundwater will have similar isotopic ratios as the original coal and the CCR[2].

Because variations in boron isotope ratios are usually small, they are reported in parts per thousand or *per mil* variations, denoted ‰, from a standard.

$$\delta^{11}B = \left[\frac{(^{11}B/^{10}B)_{sample} - (^{11}B/^{10}B)_{std}}{(^{11}B/^{10}B)_{std}}\right] \times 1000$$

Strontium

One of the four stable isotopes (^{87}Sr) is subject to long-term radiogenic ingrowth by radioactive decay of rubidium (^{87}Rb). The isotopic ratio, $^{87}Sr/^{86}Sr$, is commonly used to trace the mixing of global reservoirs and to evaluate the environmental conditions in surface waters, oceans, and sediments. Strontium isotopes are very useful for provenance identification because the isotopic signature of rock is transferred to the soil, vegetation, and up the food web with minimal isotopic fractionation[4].

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

Lines of evidence (LOE) supporting this ASD include the following:

1. Strontium isotope ratios in groundwater are lower than the typical range for CCR impacted waters.
2. Boron isotope ratios in downgradient groundwater are not consistent with boron isotope ratios in CCR and CCR impacted waters.

These lines of evidence are described and supported in greater detail below.

LOE #1: STRONTIUM ISOTOPE RATIOS DOWNGRADIENT ARE LOWER THAN THE TYPICAL RANGE FOR CCR IMPACTED WATERS.

Strontium isotope ratios ($^{87}Sr/^{86}Sr$) for groundwater and leachate are plotted against total lithium in Figure 1. Strontium isotope ratios in coal, fly ash, and bottom ash impacted waters range from 0.7109 to 0.7126[2], indicated by the area shaded orange in Figure 1.

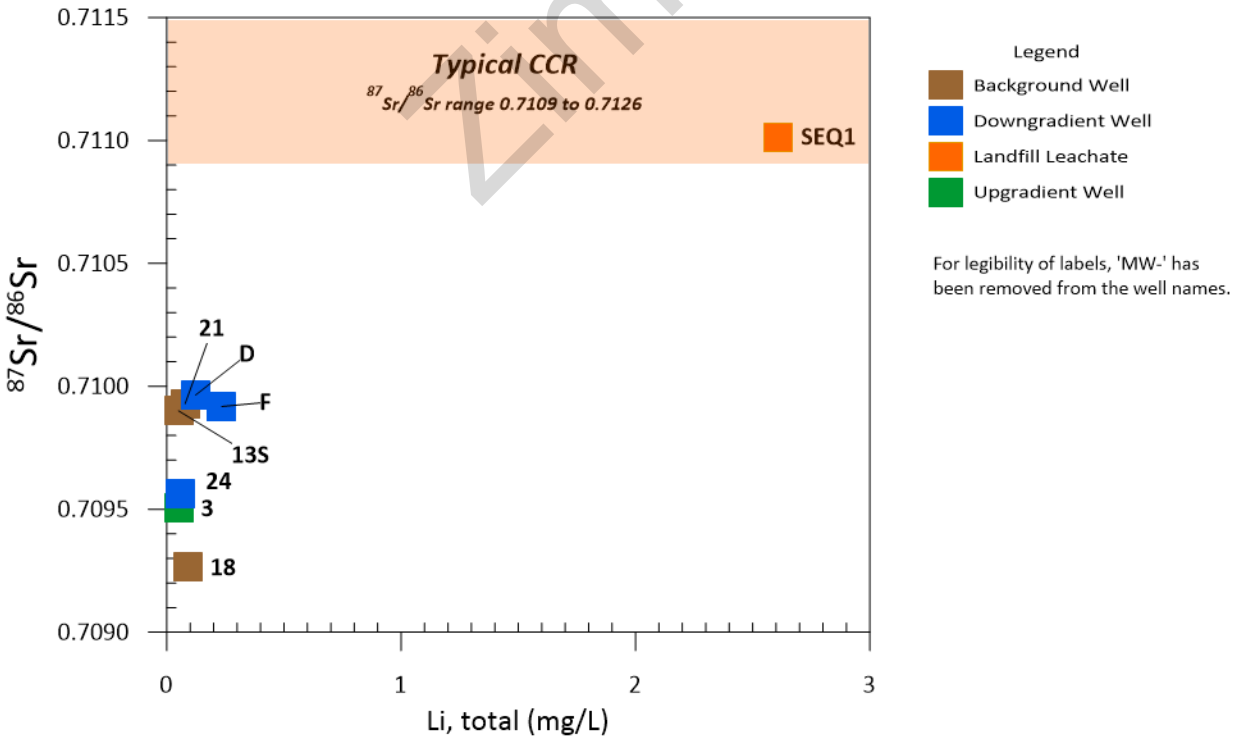

Figure 1. Strontium isotope ratio vs total lithium[2]

The groundwater results are within the typical groundwater range[2]. The leachate sample is within the typical $^{87}Sr/^{86}Sr$ range for CCR impacted waters[2]. Figure 2 shows that $^{87}Sr/^{86}Sr$ groundwater results are well grouped, and that the leachate is not mixing with the groundwater.

LOE #2: BORON ISOTOPE RATIOS DOWNGRADIENT ARE WITHIN THE TYPICAL RANGE FOR GROUNDWATER.

Total boron (B) for groundwater and leachate are plotted against boron isotope ratios ($\delta^{11}B$) in Figure 2. The $\delta^{11}B$ range for typical groundwater, shaded green, is 10‰ to 40‰ [5]. The area shaded orange represents $\delta^{11}B$ range for CCR impacted water, which has a distinctive negative $\delta^{11}B$ signature ranging from -70 ‰ to -1‰[2, 6].

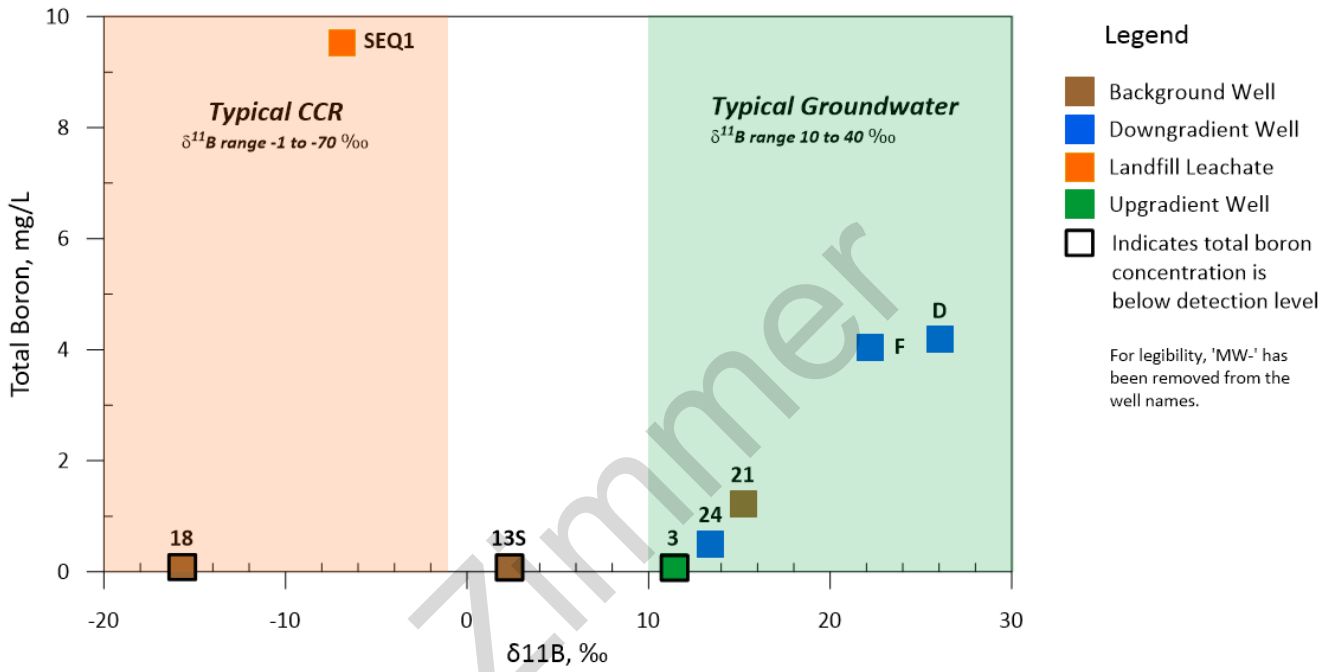

Figure 2. Total boron vs boron isotope ratio[2]

All groundwater results are within the typical $\delta^{11}B$ range for groundwater[2] at wells with total boron concentration above the detection limit. The leachate results, SEQ1, are within the typical negative $\delta^{11}B$ range for CCR leachates[2]. Figure 2 shows that $\delta^{11}B$ groundwater results are well grouped, except for background wells MW-13S and MW-18, which did not have detectable concentrations of total boron, and that the leachate is not mixing with the groundwater. The landfill is not influencing MW-13S and MW-18 as evidenced by groundwater flow shown on Figure 3.

Based on these two lines of evidence, it has been demonstrated that the Zimmer Landfill has not caused the Lithium SSL in MW-F.

This information serves as the written ASD, prepared in accordance with 40 C.F.R. § 257.95(g)(3)(ii), that the lithium SSL observed during the assessment monitoring program was not due to Zimmer Landfill. Therefore, a corrective measures assessment is not required, and the Zimmer Landfill will remain in assessment monitoring.

REFERENCES

1. Natural Resource Technology, Statistical Analysis Plan. 2017.
2. Ruhl, L. S.; Dwyer, G. S.; Hsu-Kim, H.; Hower, J. C.; Vengosh, A., Boron and Strontium Isotopic Characterization of Coal Combustion Residuals; Validation of New Environmental Tracers. *Environmental Science & Technology* **2014**, 9.
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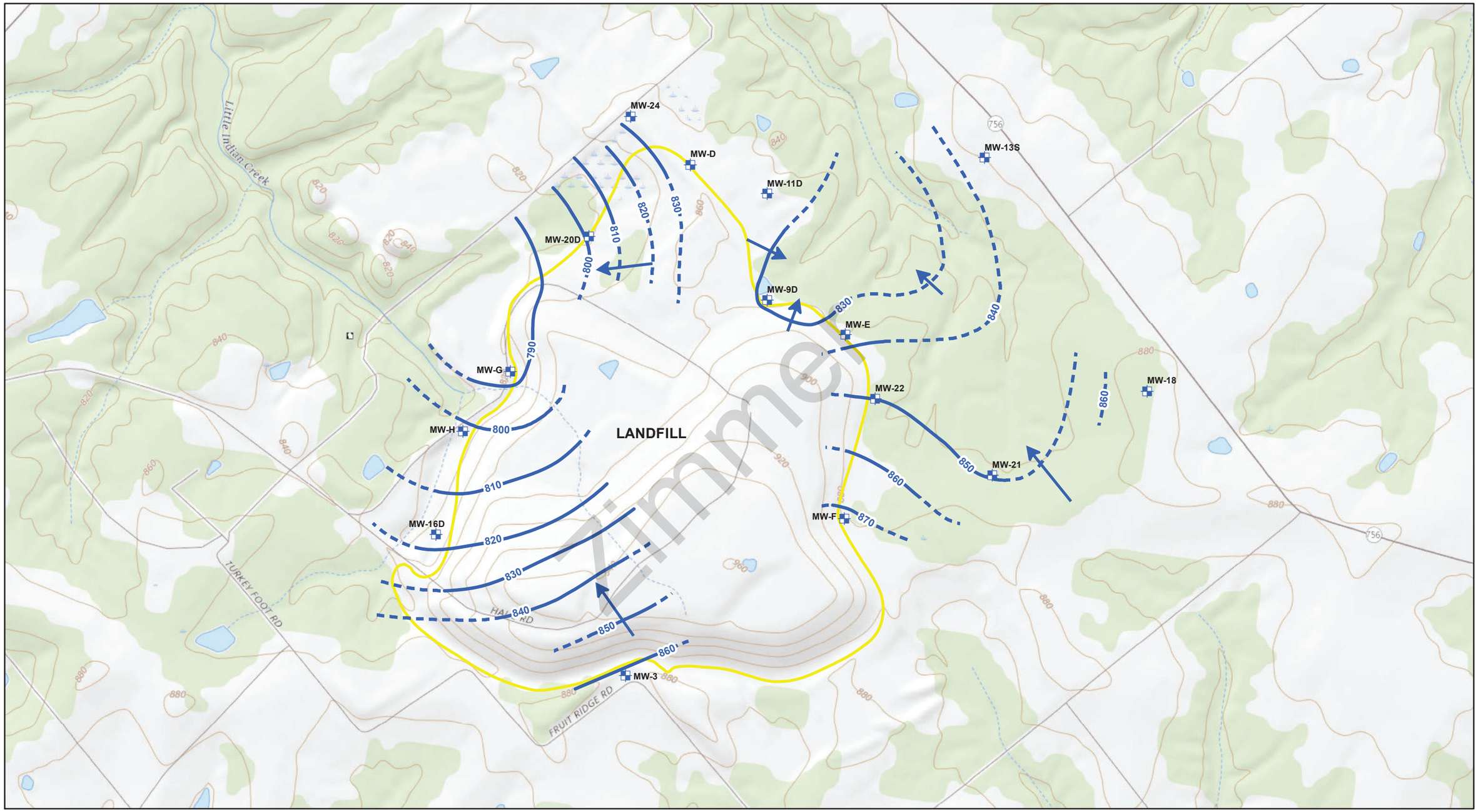
ATTACHMENTS

Figure 3 Groundwater Elevation Contour Map



LEGEND

CCR MONITORING WELL LOCATION

CCR MONITORED UNIT

VISTRA ENERGY
ZIMMER POWER STATION
MOSCOW, OHIO

0 175 350 700 1,050 1,400
Feet

N

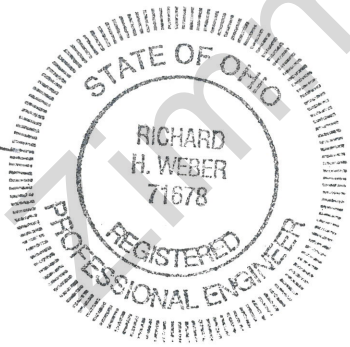
ZIMMER LANDFILL (UNIT ID: 122)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 14, 2017

O'BRIEN & GERE ENGINEERS, INC.

I, Nicole M. Pagano, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Nicole M. Pagano
Senior Managing Engineer
OBG, part of Ramboll
Date: April 8, 2019

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



Richard H. Weber
Qualified Professional Engineer
71678
Ohio
OBG, part of Ramboll
Date: April 8, 2019

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION
ZIMMER LANDFILL
OCTOBER 28, 2019

October 28, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 257.95(g)(3)(ii) allows the owner or operator of a coal combustion residuals (CCR) unit 90 days from the date of determination of statistically significant levels (SSLs) over groundwater protection standards of groundwater constituents listed in Appendix IV of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSL(s), or that the SSL(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (alternate source demonstration [ASD]).

This ASD has been prepared on behalf of Dynegy Zimmer, LLC, by O'Brien & Gere Engineers, Inc., part of Ramboll, to provide pertinent information pursuant to 40 C.F.R. § 257.95(g)(3)(ii) for the Zimmer Landfill located near the Zimmer Power Station and Moscow, OH.

The second Assessment Monitoring sampling event (A2) was completed on March 13, 2019 and analytical data were received on April 29, 2019. Analytical data from all sampling events, from December 2015 through A2, were evaluated in accordance with the Statistical Analysis Plan[1] to determine any Statistically Significant Increases (SSIs) of Appendix III parameters over background concentrations or SSLs of Appendix IV parameters over Groundwater Protection Standards (GWPSs). That evaluation identified SSLs at downgradient monitoring wells as follows:

- Lithium at well MW-F

Pursuant to 40 C.F.R. § 257.95(g)(3)(ii), the following lines of evidence demonstrate that sources other than the Zimmer Landfill were the cause of the SSL listed above. This alternate source demonstration (ASD) was completed within 90 days of determination of the SSLs (July 29, 2019), as required by 40 C.F.R. § 257.95(g)(3)(ii).

ISOTOPIC EVALUATION

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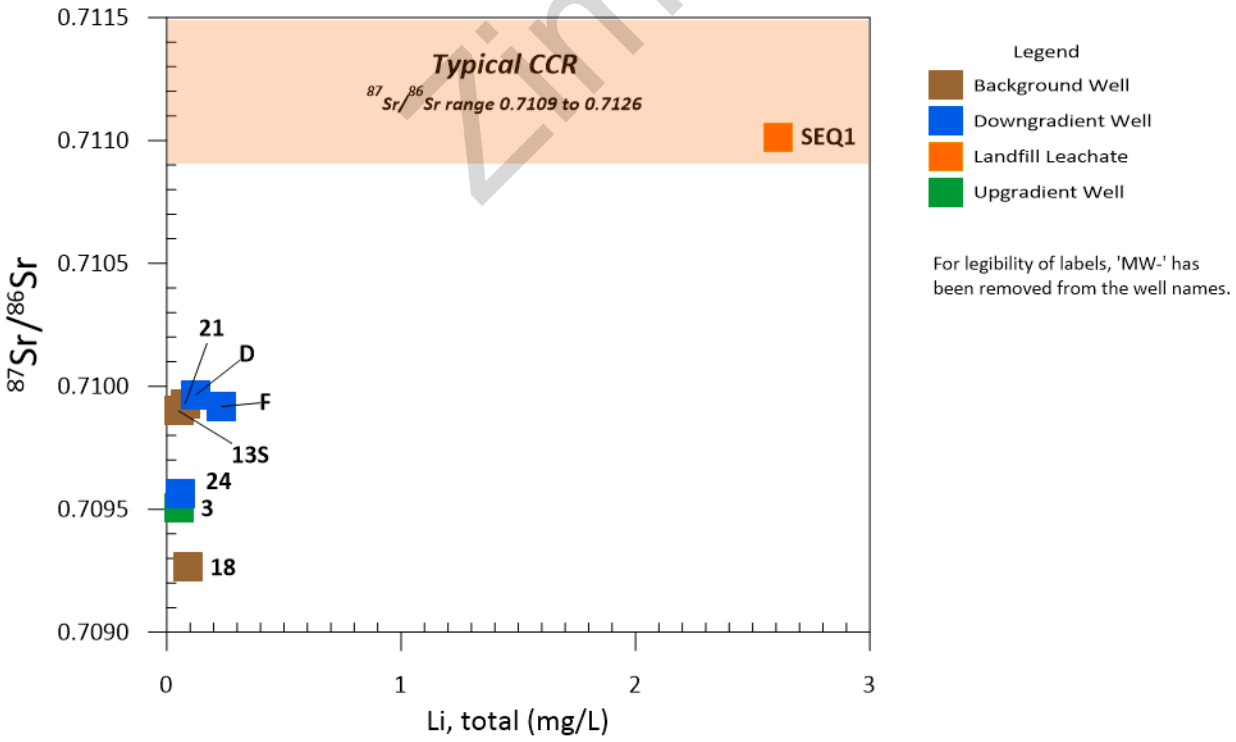

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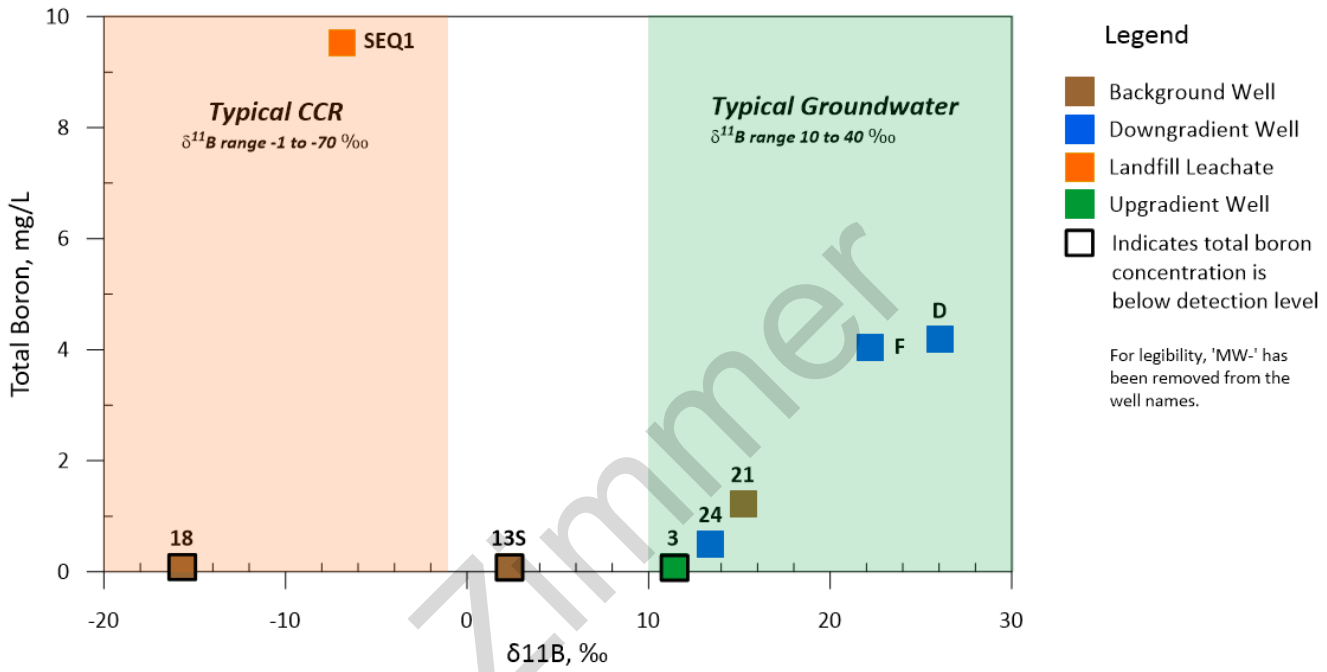

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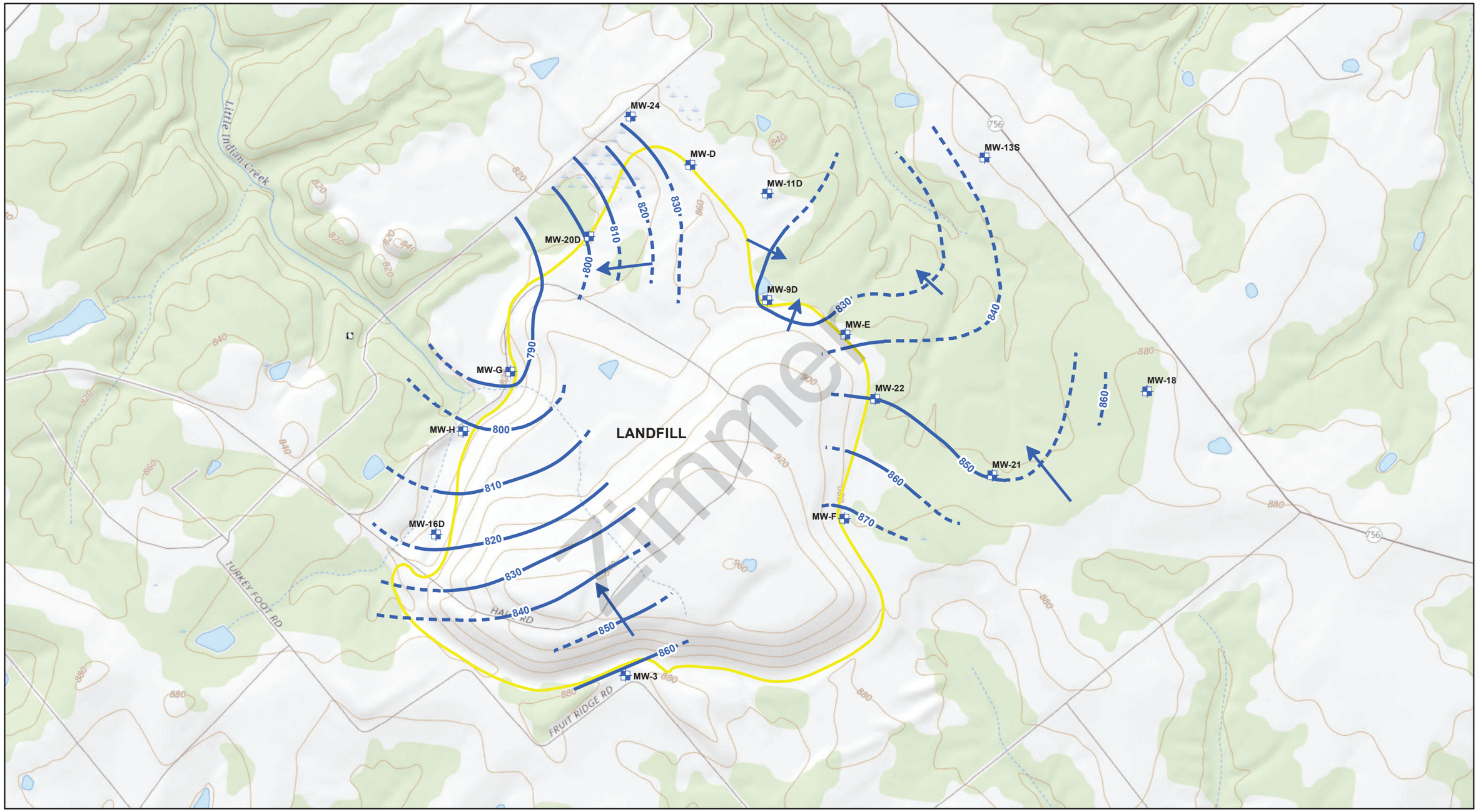

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Feet

N

ZIMMER LANDFILL (UNIT ID: 122)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 14, 2017

O'BRIEN & GERE ENGINEERS, INC.

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Date: October 28, 2019

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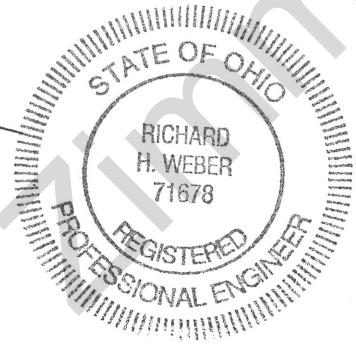

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