Annual Groundwater Monitoring Report

Southwestern Electric Power Company

Flint Creek Power Plant

Primary Bottom Ash Pond CCR Management Unit

Gentry, Arkansas

January 2022

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SOUTHWESTERN ELECTRIC POWER COMPANY℠

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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 an existing CCR unit at Southwestern Electric Power Company's, a wholly-owned subsidiary of American Electric Power Company (AEP), Flint Creek 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, 2022.

In general, the following activities were completed:

- The CCR unit was in Assessment monitoring at the beginning and end of 2021;
- Groundwater samples were collected on March 1, 2021 and March 2, 2021, then again on September 20, 2021 and September 21, 2021 and analyzed for Appendix III constituents, as specified in 40 CFR 257.94 *et seq.* and AEP's *Groundwater Sampling and Analysis Plan (2016)*;
- 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;
- The statistical evaluations concluded that there was a statistically significant increase (SSI) over background of one Appendix III constituent at one well (calcium at monitoring well AP-59);
- Because an SSI over background of an Appendix III constituent was detected at the Flint Creek Plant's PBAP, an alternative source demonstration (ASD) study was conducted resulting in an August 2021 ASD report;

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 management 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 is included in 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 demonstration 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 alternate source demonstration 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

The figure that follows depicts the PE-certified groundwater monitoring network, the monitoring well locations and their corresponding identification numbers.

PBAP Monitoring Wells	
Upgradient	Downgradient
AP-51	AP-58
AP-53	AP-59
AP-54	AP-60

III. Monitoring Wells Installed or Decommissioned

There were no monitoring wells installed or decommissioned in 2021. The network design, as summarized in the *Groundwater Monitoring Network Design Report Revision 1* (2017) and as posted at the CCR web site for the Flint Creek 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

In response to initially significant increases in concentrations of calcium and pH detected in groundwater samples at monitoring well AP-59 during the October 20, 2020 sampling event, resamples for these constituents were collected at the well on March 1, 2021. In response to initially significant increases in concentrations of calcium and sulfate detected in groundwater samples at monitoring well AP-59 on March 2, 2021, resamples for these constituents were collected at the well on June 21, 2021. 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

Statistical analysis of detection monitoring samples collected on October 19 and October 20, 2020 was completed on May 4, 2021. The evaluation concluded that an SSI of calcium over background levels was detected at monitoring well AP-59. Statistical analysis of detection monitoring samples collected on March 23 and March 24, 2021 was completed on September 8, 2021. The evaluation concluded that an SSI of calcium over background levels was detected at monitoring well AP-59. Memoranda with the results of the statistical evaluations are provided in Appendix 2.

As required by 40 CFR 257.94, groundwater samples were collected and analyzed for all Appendix III constituents during a second semiannual sampling event on September 20 and 21, 2021. A statistical evaluation of these results will be completed in 2022.

VI. Alternate Source Demonstration

Because an SSI over background of an Appendix III constituent was detected at the Flint Creek PBAP during the October 19 and 20, 2020 sampling event, an ASD study was conducted resulting in an August 2021 ASD report. The report concluded that the SSI was not due to a release from the Flint Creek PBAP, but was instead attributed to natural variation in groundwater quality. The report is provided in Appendix 3. An ASD study is being conducted in response to SSI detected

over background during the March 23 and March 24, 2021 sampling event. This study will be completed in 2022.

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

No transition between monitoring requirements occurred in 2021; the CCR unit remained in detection monitoring over the entire 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 Flint Creek PBAP 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 2021 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.

X. A Projection of Key Activities for the Upcoming Year

Key activities for 2022 year include the following:

- Detection monitoring on a semiannual schedule;
- Statistical evaluation of the detection monitoring results to determine any SSIs (or 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.

Table 1 - Groundwater Data Summary: AP-51
Flint Creek - PBAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/23/2016	Background	0.01	4.86	4	< 0.083 U1	4.6	2	61
7/18/2016	Background	0.01	5.07	6	< 0.083 U1	5.3	4	80
9/13/2016	Background	0.01	5.84	6	< 0.083 U1	5.3	3	64
10/5/2016	Background	0.00767833 J1	5.24	7	< 0.083 U1	5.0	4	80
11/8/2016	Background	0.01	5.23	7	< 0.083 U1	5.2	4	76
1/24/2017	Background	0.00849011 J1	5.43	5	< 0.083 U1	5.1	< 0.14 U1	80
3/6/2017	Background	0.01	5.05	5	< 0.083 U1	5.0	0.5139 J1	40
4/26/2017	Background	0.01475	4.21	6	0.28 J1	5.2	6	96
5/16/2017	Background	0.01135	5.55	6	< 0.083 U1	5.1	3	60
6/13/2017	Background	0.0186	5.61	7	< 0.083 U1	5.1	3	68
8/29/2017	Detection	0.01706	5.13	6	< 0.083 U1	4.8	3	50
3/28/2018	Detection	0.01519	11.1	2	< 0.083 U1	7.8	9	96
8/28/2018	Detection	0.011	6.69	--	--	7.7	--	74
10/22/2018	Detection	--	--	9.71	< 0.083 U1	--	2.14	--
3/11/2019	Detection	0.01 J1	6.20	7.84	0.04 J1	7.6	< 0.06 U1	70
6/10/2019	Detection	< 0.04 U1	13.1	7.79	0.05 J1	7.2	2.6	106
8/28/2019	Detection	< 0.02 U1	6.79	7	< 0.083 U1	6.0	1	56
3/24/2020	Detection	< 0.02 U1	9.90	8.48	0.04 J1	5.9	2.4	107
10/19/2020	Detection	< 0.02 U1	7.73	9.86	0.02 J1	4.5	< 0.06 U1	100
3/2/2021	Detection	< 0.02 U1	8.35	10.4	0.04 J1	5.8	0.1 J1	70
9/20/2021	Detection	--	--	--	--	5.3	--	--
9/21/2021	Detection	< 0.009 U1	8.3	10.9	0.03 J1	--	0.07 J1	100

Notes:
mg/L: milligrams per liter
SU: standard unit
<: 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.
- -: Not analyzed
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.
Due to limited groundwater volume, pH values for some sampling events were collected the day prior to collection of analytical samples for other analytes.

Table 1 - Groundwater Data Summary: AP-51
Flint Creek - PBAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

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
5/23/2016	Background	< 0.93 U1	< 1.05 U1	80	0.257631 J1	0.0935902 J1	0.258389 J1	0.434643 J1	1.063	< 0.083 U1	< 0.68 U1	< 0.00013 U1	0.01938 J1	0.92212 J1	1.24502 J1	< 0.86 U1
7/18/2016	Background	< 0.93 U1	< 1.05 U1	86	0.308658 J1	< 0.07 U1	1	2.39535 J1	--	< 0.083 U1	0.839767 J1	0.003	0.01329 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
9/13/2016	Background	< 0.93 U1	< 1.05 U1	128	0.373982 J1	< 0.07 U1	6	14	2.38	< 0.083 U1	3.72318 J1	0.005	0.00978 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
10/5/2016	Background	< 0.93 U1	< 1.05 U1	98	0.329677 J1	< 0.07 U1	2	5	1.656	< 0.083 U1	1.49287 J1	0.008	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
11/8/2016	Background	1.28923 J1	< 1.05 U1	105	0.453846 J1	0.226326 J1	4	9	1.387	< 0.083 U1	2.07767 J1	0.004	0.00949 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
1/24/2017	Background	< 0.93 U1	< 1.05 U1	103	0.366323 J1	< 0.07 U1	2	4.46068 J1	1.916	< 0.083 U1	< 0.68 U1	0.003	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
3/6/2017	Background	7	< 1.05 U1	95	0.355243 J1	0.128375 J1	2	5	1.31	< 0.083 U1	0.88397 J1	0.002	< 0.005 U1	0.586637 J1	< 0.99 U1	< 0.86 U1
4/26/2017	Background	< 0.93 U1	< 1.05 U1	62.43	0.24 J1	< 0.07 U1	1.96	4.08 J1	0.6089	0.28 J1	< 0.68 U1	0.00216	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
5/16/2017	Background	< 0.93 U1	< 1.05 U1	101	0.42 J1	0.1 J1	1.86	6.92	2.935	< 0.083 U1	< 0.68 U1	0.00315	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
6/13/2017	Background	< 0.93 U1	2.5 J1	88.87	0.27 J1	< 0.07 U1	0.89 J1	5.26	1.728	< 0.083 U1	< 0.68 U1	0.0024	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: 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.
- -: Not analyzed
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.

Table 1 - Groundwater Data Summary: AP-53
Flint Creek - PBAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/23/2016	Background	0.11	4.15	10	< 0.083 U1	4.7	25	80
7/18/2016	Background	0.109	3.49	12	< 0.083 U1	4.5	30	104
9/13/2016	Background	0.155	5.54	13	< 0.083 U1	4.7	35	104
10/5/2016	Background	0.121	3.39	13	0.205 J1	4.9	32	110
11/8/2016	Background	0.138	3.38	14	< 0.083 U1	5.0	31	118
1/24/2017	Background	0.158	3.87	14	< 0.083 U1	5.0	47	132
3/6/2017	Background	0.137	3.85	13	< 0.083 U1	5.0	47	112
4/25/2017	Background	0.124	3.89	15	< 0.083 U1	5.6	48	200
5/16/2017	Background	0.118	3.46	14	< 0.083 U1	4.5	42	90
6/13/2017	Background	0.122	3.39	14	< 0.083 U1	5.0	38	136
8/29/2017	Detection	0.114	2.82	11	< 0.083 U1	4.8	34	92
3/28/2018	Detection	0.115	3.51	12	< 0.083 U1	5.0	43	114
8/28/2018	Detection	0.124	3.37	--	--	5.6	--	120
10/22/2018	Detection	--	--	19.2	< 0.083 U1	--	45	--
3/11/2019	Detection	0.114	3.09	12.3	0.07 J1	5.2	34.6	130
6/10/2019	Detection	0.110	3.37	13.4	0.06	5.2	32.8	98
8/28/2019	Detection	0.083	3.11	8	< 0.083 U1	5.4	21	96
3/24/2020	Detection	0.055	3.20	9.40	0.05 J1	5.2	13.5	76
10/19/2020	Detection	0.139	3.81	12.3	0.05 J1	4.7	37.4	105
3/2/2021	Detection	0.091	4.06	12.5	0.07	5.4	37.9	94
9/21/2021	Detection	0.098	3.0	11.1	0.05 J1	5.1	24.0	80

Notes:
mg/L: milligrams per liter
SU: standard unit
<: 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.
- -: Not analyzed
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.

Table 1 - Groundwater Data Summary: AP-53
Flint Creek - PBAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

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
5/23/2016	Background	< 0.93 U1	6	142	1	0.585577 J1	37	12	3.55	< 0.083 U1	11	0.006	0.159	2.50374 J1	< 0.99 U1	< 0.86 U1
7/18/2016	Background	< 0.93 U1	2.79903 J1	76	0.473295 J1	0.0914021 J1	7	4.26267 J1	--	< 0.083 U1	1.07393 J1	0.004	0.046	0.344001 J1	1.20159 J1	< 0.86 U1
9/13/2016	Background	< 0.93 U1	24	258	3	1	94	27	5.93	< 0.083 U1	30	0.036	0.085	6	< 0.99 U1	0.981236 J1
10/5/2016	Background	< 0.93 U1	< 1.05 U1	63	0.289207 J1	< 0.07 U1	2	3.26642 J1	0.568	0.205 J1	< 0.68 U1	0.009	0.025	< 0.29 U1	< 0.99 U1	< 0.86 U1
11/8/2016	Background	< 0.93 U1	8	122	0.980287 J1	3	26	13	2.06	< 0.083 U1	8	0.01	0.118	1.0939 J1	< 0.99 U1	< 0.86 U1
1/24/2017	Background	1.37199 J1	3.86298 J1	97	0.663471 J1	0.0732158 J1	16	9	2.16	< 0.083 U1	3.91103 J1	0.006	0.183	0.821188 J1	< 0.99 U1	< 0.86 U1
3/6/2017	Background	1.45983 J1	7	110	0.851036 J1	0.485904 J1	21	15	1.915	< 0.083 U1	8	0.007	0.14	1.44927 J1	< 0.99 U1	< 0.86 U1
4/25/2017	Background	1.23 J1	4.82 J1	102	0.61 J1	0.22 J1	15.41	7.89	1.552	< 0.083 U1	4.13 J1	0.00623	< 0.005 U1	0.96 J1	2.14 J1	< 0.86 U1
5/16/2017	Background	1.95 J1	1.53 J1	64.08	0.33 J1	< 0.07 U1	3.01	2.9 J1	1.327	< 0.083 U1	< 0.68 U1	0.00228	0.04	0.31 J1	< 0.99 U1	< 0.86 U1
6/13/2017	Background	1.15 J1	3.1 J1	71.32	0.41 J1	< 0.07 U1	5.78	3 J1	2.139	< 0.083 U1	0.87 J1	0.00357	0.043	< 0.29 U1	< 0.99 U1	< 0.86 U1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: 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.
- -: Not analyzed
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.

Table 1 - Groundwater Data Summary: AP-54
Flint Creek - PBAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/23/2016	Background	0.249	10.4	14	< 0.083 U1	5.8	77	180
7/18/2016	Background	0.255	10	16	< 0.083 U1	5.8	78	178
9/13/2016	Background	0.266	10.6	16	< 0.083 U1	5.6	75	172
10/5/2016	Background	0.255	11.8	15	0.1943 J1	5.5	67	164
11/8/2016	Background	0.26	11.3	15	< 0.083 U1	5.7	71	168
1/24/2017	Background	0.284	11.2	14	< 0.083 U1	5.5	71	164
3/6/2017	Background	0.259	11.3	14	< 0.083 U1	5.4	64	150
4/26/2017	Background	0.256	10.8	15	< 0.083 U1	6.1	66	154
5/16/2017	Background	0.256	9.58	16	< 0.083 U1	5.1	66	136
6/13/2017	Background	0.249	7.53	15	< 0.083 U1	5.3	62	192
8/29/2017	Detection	0.259	11.3	13	< 0.083 U1	5.5	63	156
3/28/2018	Detection	0.223	5.61	13	< 0.083 U1	5.3	64	130
8/28/2018	Detection	0.240	15.5	--	--	5.9	--	168
10/22/2018	Detection	--	--	18.3	< 0.083 U1	--	54.4	--
3/11/2019	Detection	0.219	14.5	16.0	0.09 J1	6.4	47.2	160
6/10/2019	Detection	0.209	10.7	15.3	0.07	6.5	52.5	134
8/28/2019	Detection	0.213	12.2	12	< 0.083 U1	6.8	51	154
3/24/2020	Detection	0.202	7.08	13.2	0.05 J1	6.4	45.9	143
10/19/2020	Detection	0.214	8.39	12.8	0.04 J1	5.8	47.6	130
3/2/2021	Detection	0.199	9.72	12.5	0.06	5.6	50.8	127
9/21/2021	Detection	0.202	13.6	12.4	0.06	6.5	57.8	150

Notes:
mg/L: milligrams per liter
SU: standard unit
<: 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.
- -: Not analyzed
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.

Table 1 - Groundwater Data Summary: AP-54
Flint Creek - PBAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

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
5/23/2016	Background	< 0.93 U1	< 1.05 U1	35	0.177109 J1	< 0.07 U1	0.485517 J1	7	1	< 0.083 U1	< 0.68 U1	0.000736668 J1	0.02407 J1	< 0.29 U1	< 0.99 U1	1.05347 J1
7/18/2016	Background	< 0.93 U1	< 1.05 U1	58	0.294165 J1	< 0.07 U1	1	13	--	< 0.083 U1	< 0.68 U1	0.001	0.031	< 0.29 U1	< 0.99 U1	< 0.86 U1
9/13/2016	Background	< 0.93 U1	< 1.05 U1	38	0.0361596 J1	< 0.07 U1	0.470668 J1	7	3.37	< 0.083 U1	< 0.68 U1	0.000599096 J1	0.0122 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
10/5/2016	Background	< 0.93 U1	< 1.05 U1	35	0.175329 J1	< 0.07 U1	1	6	1.59	0.1943 J1	< 0.68 U1	0.006	0.02499 J1	< 0.29 U1	1.26436 J1	< 0.86 U1
11/8/2016	Background	< 0.93 U1	1.8333 J1	227	0.250807 J1	0.164026 J1	9	19	1.722	< 0.083 U1	1.30257 J1	0.002	0.049	1.06052 J1	< 0.99 U1	< 0.86 U1
1/24/2017	Background	< 0.93 U1	4.57372 J1	109	0.660002 J1	0.132116 J1	25	24	1.107	< 0.083 U1	7	0.006	0.082	3.34504 J1	< 0.99 U1	< 0.86 U1
3/6/2017	Background	< 0.93 U1	< 1.05 U1	96	0.164735 J1	< 0.07 U1	4	12	2.125	< 0.083 U1	< 0.68 U1	0.003	0.00568 J1	0.545312 J1	< 0.99 U1	< 0.86 U1
4/26/2017	Background	< 0.93 U1	< 1.05 U1	31.04	0.1 J1	< 0.07 U1	0.42 J1	4.4 J1	0.769	< 0.083 U1	< 0.68 U1	0.00048 J1	0.017 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
5/16/2017	Background	< 0.93 U1	< 1.05 U1	34.92	0.16 J1	< 0.07 U1	0.44 J1	5.33	1.222	< 0.083 U1	< 0.68 U1	0.00078 J1	0.02 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
6/13/2017	Background	5.57	1.65 J1	46.98	0.28 J1	< 0.07 U1	0.53 J1	7.14	1.325	< 0.083 U1	< 0.68 U1	0.00127	0.018 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: 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.
- -: Not analyzed
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.

Table 1 - Groundwater Data Summary: AP-58
Flint Creek - PBAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	1.44	24.9	18	0.8759 J1	7.1	213	602
7/18/2016	Background	1.68	27.4	21	0.8849 J1	8.4	229	691
9/13/2016	Background	1.66	17.5	23	0.7518 J1	8.3	238	644
10/4/2016	Background	1.56	18.9	27	0.8942 J1	8.8	231	696
11/7/2016	Background	1.26	30.5	22	0.5598 J1	7.8	186	562
1/24/2017	Background	1.09	34.4	16	< 0.083 U1	8.1	158	448
3/7/2017	Background	0.829	48.1	14	< 0.083 U1	7.0	123	420
4/25/2017	Background	0.613	59	14	0.53 J1	7.1	111	374
5/16/2017	Background	0.473	69.3	13	0.4677 J1	7.5	104	344
6/13/2017	Background	0.416	70.1	12	< 0.083 U1	6.0	101	398
8/29/2017	Detection	0.333	75.5	12	< 0.083 U1	7.8	96	344
12/21/2017	Detection	0.268	73.9	--	--	7.4	80	304
3/26/2018	Detection	0.228	77.2	8	< 0.083 U1	7.4	70	262
8/28/2018	Detection	0.237	75.9	--	--	6.9	--	300
10/23/2018	Detection	--	--	12.5	< 0.083 U1	--	75.5	--
3/12/2019	Detection	0.178	74.8	8.13	0.33	8.4	49.9	290
6/11/2019	Detection	0.173	78.3	7.64	0.36	7.6	52.2	272
8/27/2019	Detection	0.149	76.1	6	0.222 J1	7.5	53	292
3/24/2020	Detection	0.129	68.1	5.78	0.32	6.8	39.7	246
10/20/2020	Detection	0.126	67.9	4.98	0.28	6.6	34.8	249
3/1/2021	Detection	--	--	--	--	7.2	--	--
3/2/2021	Detection	0.135	62.0	4.44	0.33	--	29.3	232
9/20/2021	Detection	--	--	--	--	6.9	--	--
9/21/2021	Detection	0.162	64.6	5.26	0.34	--	31.0	240

Notes:
mg/L: milligrams per liter
SU: standard unit
<: 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.
- -: Not analyzed
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.
Due to limited groundwater volume, pH values for some sampling events were collected the day prior to collection of analytical samples for other analytes.

Table 1 - Groundwater Data Summary: AP-58
Flint Creek - PBAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

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
5/24/2016	Background	< 0.93 U1	5	37	0.105636 J1	< 0.07 U1	0.810009 J1	3.86496 J1	0.548	0.8759 J1	< 0.68 U1	< 0.00013 U1	0.032	62	< 0.99 U1	< 0.86 U1
7/18/2016	Background	< 0.93 U1	22	104	3	0.459763 J1	8	7	--	0.8849 J1	12	0.018	0.042	66	2.81093 J1	< 0.86 U1
9/13/2016	Background	0.971405 J1	25	39	0.162863 J1	< 0.07 U1	2	2.29869 J1	1.007	0.7518 J1	2.19582 J1	0.007	0.02274 J1	68	1.13435 J1	1.02461 J1
10/4/2016	Background	1.99545 J1	18	41	0.382276 J1	< 0.07 U1	3	2.68738 J1	0.787	0.8942 J1	1.93685 J1	0.017	< 0.005 U1	63	2.55318 J1	< 0.86 U1
11/7/2016	Background	< 0.93 U1	14	41	0.108253 J1	< 0.07 U1	1	1.28551 J1	1.65	0.5598 J1	< 0.68 U1	0.008	0.00775 J1	44	< 0.99 U1	< 0.86 U1
1/24/2017	Background	< 0.93 U1	11	56	0.0635907 J1	< 0.07 U1	2	1.8255 J1	1.896	< 0.083 U1	< 0.68 U1	0.009	0.00625 J1	39	< 0.99 U1	< 0.86 U1
3/7/2017	Background	< 0.93 U1	8	42	0.0245 J1	< 0.07 U1	1	1.05431 J1	0.938	< 0.083 U1	0.928114 J1	0.015	< 0.005 U1	26	< 0.99 U1	< 0.86 U1
4/25/2017	Background	< 0.93 U1	6.14	49.86	0.09 J1	< 0.07 U1	1.57	1.36 J1	1.163	0.53 J1	< 0.68 U1	0.01194	0.006 J1	16.9	< 0.99 U1	< 0.86 U1
5/16/2017	Background	< 0.93 U1	4.32 J1	43.08	0.03 J1	< 0.07 U1	0.75 J1	0.87 J1	0.663	0.4677 J1	< 0.68 U1	0.01188	< 0.005 U1	14.05	< 0.99 U1	< 0.86 U1
6/13/2017	Background	2.16 J1	2.71 J1	41.48	0.03 J1	< 0.07 U1	0.58 J1	0.57 J1	2.268	< 0.083 U1	< 0.68 U1	0.01182	< 0.005 U1	12.23	< 0.99 U1	< 0.86 U1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: 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.
- -: Not analyzed
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.

Table 1 - Groundwater Data Summary: AP-59
Flint Creek - PBAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.25	39.3	19	0.7409 J1	7.4	37	240
7/18/2016	Background	0.339	38	14	0.6517 J1	6.8	27	220
9/13/2016	Background	0.38	36.5	13	0.583 J1	7.3	25	216
10/4/2016	Background	0.347	34.6	14	0.7085 J1	7.1	26	220
11/7/2016	Background	0.323	35.6	15	0.5832 J1	7.2	32	216
1/24/2017	Background	0.317	38.4	13	< 0.083 U1	7.0	40	240
3/7/2017	Background	0.253	42	13	< 0.083 U1	7.9	43	236
4/25/2017	Background	0.222	41.4	15	0.61 J1	7.2	40	226
5/16/2017	Background	0.208	39.5	13	0.5762 J1	7.1	38	186
6/13/2017	Background	0.227	36.2	12	< 0.083 U1	6.7	31	224
8/29/2017	Detection	0.295	35.4	12	0.6463 J1	7.1	21	210
12/21/2017	Detection	0.279	46.8	--	--	6.9	--	228
3/26/2018	Detection	0.218	43.2	12	< 0.083 U1	7.0	40	180
8/28/2018	Detection	0.277	42.2	--	--	7.1	--	180
10/23/2018	Detection	--	--	19	0.548 J1	--	26.7	--
3/11/2019	Detection	0.221	45.2	15.0	0.59	7.4	35.5	46
6/11/2019	Detection	0.233	46.7	14.7	0.65	7.3	38.4	88
7/9/2019	Detection	--	45.3	--	--	7.0	--	--
8/27/2019	Detection	0.246	42.6	11	0.413 J1	8.9	26	228
12/9/2019	Detection	--	--	--	--	7.3	--	--
3/23/2020	Detection	0.228	45.3	12.3	0.61	7.2	38.1	250
10/20/2020	Detection	0.244	49.7	13.2	0.46	8.7	47.0	257
3/1/2021	Detection	--	49.4	--	--	7.3	--	--
3/2/2021	Detection	0.157	49.2	13.7	0.49	7.3	51.9	250
6/21/2021	Detection	--	48.6	--	--	6.9	34.8	--
9/20/2021	Detection	0.238	46.4	14.4	0.46	6.8	36.2	240

Notes:
mg/L: milligrams per liter
SU: standard unit
<: 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.
- -: Not analyzed
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.

Table 1 - Groundwater Data Summary: AP-59
Flint Creek - PBAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

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
5/24/2016	Background	< 0.93 U1	< 1.05 U1	67	< 0.02 U1	< 0.07 U1	0.583478 J1	2.01538 J1	0.711	0.7409 J1	< 0.68 U1	0.000378518 J1	0.029	7	< 0.99 U1	1.24044 J1
7/18/2016	Background	< 0.93 U1	< 1.05 U1	72	0.0339425 J1	< 0.07 U1	3	2.54042 J1	--	0.6517 J1	1.02999 J1	0.000590098 J1	0.035	9	< 0.99 U1	1.07757 J1
9/13/2016	Background	< 0.93 U1	< 1.05 U1	82	< 0.02 U1	< 0.07 U1	< 0.23 U1	2.3351 J1	1.288	0.583 J1	< 0.68 U1	0.000162193 J1	< 0.005 U1	9	< 0.99 U1	1.01454 J1
10/4/2016	Background	< 0.93 U1	< 1.05 U1	89	< 0.02 U1	< 0.07 U1	0.300781 J1	2.72689 J1	0.725	0.7085 J1	< 0.68 U1	0.011	< 0.005 U1	8	< 0.99 U1	1.63378 J1
11/7/2016	Background	< 0.93 U1	< 1.05 U1	93	< 0.02 U1	< 0.07 U1	< 0.23 U1	3.0738 J1	1.109	0.5832 J1	< 0.68 U1	0.00039204 J1	< 0.005 U1	8	< 0.99 U1	< 0.86 U1
1/24/2017	Background	< 0.93 U1	< 1.05 U1	107	< 0.02 U1	< 0.07 U1	< 0.23 U1	3.38517 J1	0.3279	< 0.083 U1	< 0.68 U1	0.000152708 J1	< 0.005 U1	8	< 0.99 U1	1.21456 J1
3/7/2017	Background	< 0.93 U1	< 1.05 U1	96	< 0.02 U1	< 0.07 U1	0.244944 J1	3.32152 J1	0.713	< 0.083 U1	< 0.68 U1	0.006	< 0.005 U1	7	< 0.99 U1	< 0.86 U1
4/25/2017	Background	< 0.93 U1	1.58 J1	104	< 0.02 U1	< 0.07 U1	< 0.23 U1	3.36 J1	1.319	0.61 J1	< 0.68 U1	0.00026 J1	< 0.005 U1	5.33	< 0.99 U1	< 0.86 U1
5/16/2017	Background	< 0.93 U1	< 1.05 U1	93.9	< 0.02 U1	< 0.07 U1	< 0.23 U1	3 J1	0.618	0.5762 J1	< 0.68 U1	0.00033 J1	0.006 J1	5.66	< 0.99 U1	1.09 J1
6/13/2017	Background	< 0.93 U1	1.96 J1	86.79	< 0.02 U1	< 0.07 U1	< 0.23 U1	2.83 J1	2.251	< 0.083 U1	< 0.68 U1	0.00021 J1	< 0.005 U1	6.4	< 0.99 U1	< 0.86 U1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: 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.
- -: Not analyzed
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.

Table 1 - Groundwater Data Summary: AP-60
Flint Creek - PBAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
12/19/2016	Background	1.4	16.7	14	0.0946 J1	8.9	165	369
1/24/2017	Background	1.12	33.2	13	< 0.083 U1	7.8	152	356
3/7/2017	Background	1.26	25.9	12	< 0.083 U1	8.1	145	340
3/27/2017	Background	1.14	43	13	< 0.083 U1	8.4	140	368
4/25/2017	Background	1.3	25	15	0.58 J1	7.6	160	340
5/16/2017	Background	1.41	16.3	14	0.558 J1	8.6	167	302
6/13/2017	Background	1.2	29.2	15	< 0.083 U1	7.8	152	368
6/28/2017	Background	1.35	17.7	16	0.5516 J1	7.5	166	368
8/29/2017	Detection	1.13	32.3	13	0.4518 J1	7.7	146	356
12/21/2017	Detection	0.857	46.2	--	--	7.2	128	332
3/26/2018	Detection	0.645	45.5	9	< 0.083 U1	8.6	113	284
8/28/2018	Detection	1.27	31.1	--	--	7.8	--	276
10/23/2018	Detection	--	--	15.7	< 0.083 U1	--	135	--
3/11/2019	Detection	0.728	21.2	11.0	0.31	10.9	114	310
6/11/2019	Detection	0.559	3.44	9.79	0.29	10.0	108	304
7/9/2019	Detection	--	--	--	--	7.7	--	--
8/27/2019	Detection	0.756	10.7	8	0.2 J1	10.9	99	330
12/9/2019	Detection	--	--	--	--	7.6	--	--
3/23/2020	Detection	--	--	10.9	0.36	9.8	167	370
3/24/2020	Detection	1.25	27.9	--	--	--	--	--
10/20/2020	Detection	0.301	9.22	7.52	0.15	10.0	80.7	280
3/1/2021	Detection	1.19	34.6	11.2	0.46	8.4	164	350
9/20/2021	Detection	0.176	11.7	6.83	0.13	8.6	63.9	250

Notes:
mg/L: milligrams per liter
SU: standard unit
<: 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.
- -: Not analyzed
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.

Table 1 - Groundwater Data Summary: AP-60
Flint Creek - PBAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

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
12/19/2016	Background	< 0.93 U1	9	17	0.0543046 J1	< 0.07 U1	2	1.92133 J1	1.176	0.0946 J1	0.742652 J1	0.001	< 0.005 U1	60	< 0.99 U1	< 0.86 U1
1/24/2017	Background	1.34724 J1	3.61807 J1	34	< 0.02 U1	< 0.07 U1	0.502321 J1	0.87237 J1	0.771	< 0.083 U1	< 0.68 U1	0.000637932 J1	< 0.005 U1	55	< 0.99 U1	< 0.86 U1
3/7/2017	Background	< 0.93 U1	9	15	< 0.02 U1	< 0.07 U1	0.297514 J1	0.458637 J1	1.121	< 0.083 U1	< 0.68 U1	0.003	< 0.005 U1	57	< 0.99 U1	< 0.86 U1
3/27/2017	Background	< 0.93 U1	7	41	0.023217 J1	< 0.07 U1	3	2.22346 J1	1.158	< 0.083 U1	1.84769 J1	0.002	0.00961 J1	53	< 0.99 U1	< 0.86 U1
4/25/2017	Background	< 0.93 U1	11.42	24.03	0.12 J1	< 0.07 U1	3.75	3.01 J1	0.429	0.58 J1	2.91 J1	0.00236	0.01 J1	56.38	< 0.99 U1	0.98 J1
5/16/2017	Background	1 J1	11.39	13.05	0.03 J1	< 0.07 U1	0.91 J1	0.66 J1	2.082	0.558 J1	< 0.68 U1	0.00048 J1	0.009 J1	62.09	< 0.99 U1	< 0.86 U1
6/13/2017	Background	< 0.93 U1	7.69	27.23	< 0.02 U1	< 0.07 U1	< 0.23 U1	0.42 J1	3.697	< 0.083 U1	< 0.68 U1	0.00063 J1	< 0.005 U1	54.18	< 0.99 U1	< 0.86 U1
6/28/2017	Background	< 0.93 U1	9.32	12.61	< 0.02 U1	< 0.07 U1	0.37 J1	0.37 J1	7.167	0.5516 J1	< 0.68 U1	0.00031 J1	0.006 J1	63.76	< 0.99 U1	< 0.86 U1

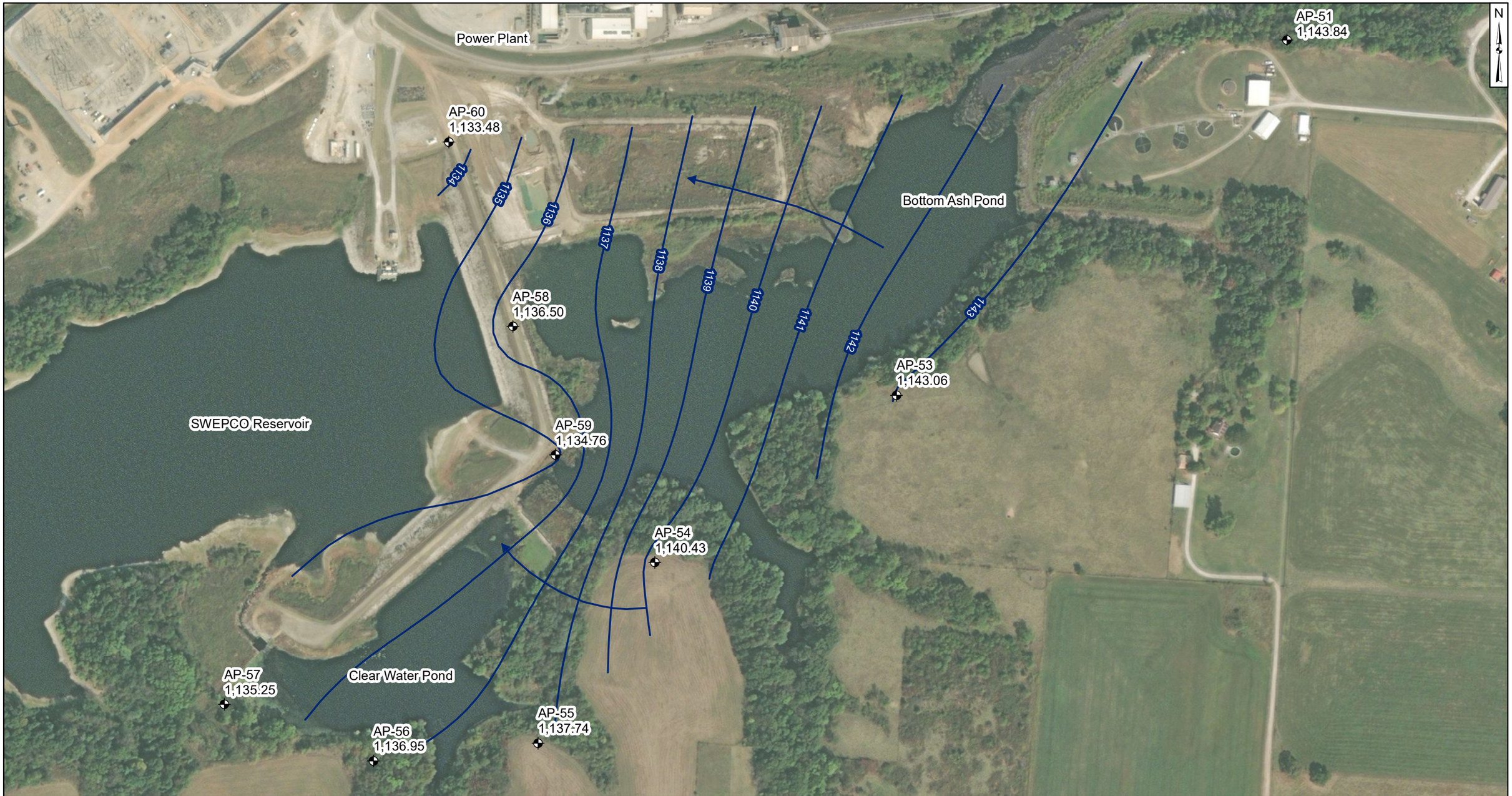
Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
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.

Table 1: Residence Time Calculation Summary
Flint Creek Primary Bottom Ash Pond

Geosyntec Consultants, Inc.

CCR Management Unit	Monitoring Well	Well Diameter (inches)	2021-03		2021-06		2021-09	
			Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Primary Bottom Ash Pond	AP-51 [1]	2.0	87	0.7	73	0.8	78	0.8
	AP-53 [1]	2.0	195	0.3	171	0.4	184	0.3
	AP-54 [1]	2.0	471	0.1	485	0.1	484	0.1
	AP-58 [2]	2.0	285	0.2	315	0.2	319	0.2
	AP-59 [2]	2.0	500	0.1	512	0.1	521	0.1
	AP-60 [2],[3]	2.0	245	0.2	281	0.2	288	0.2

Notes:
[1] - Background Well
[2] - Downgradient Well
[3] - AP-52 was replaced with AP-60 in December 2016



Legend

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

Notes

- Monitoring well coordinates and water level data were collected March 1. 2021 provided by AEP.
- Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2017) provided by AEP.
- Groundwater elevation units are feet above mean sea level.

200 100 0 200 Feet

Potentiometric Surface Map
Uppermost Aquifer - March 2021

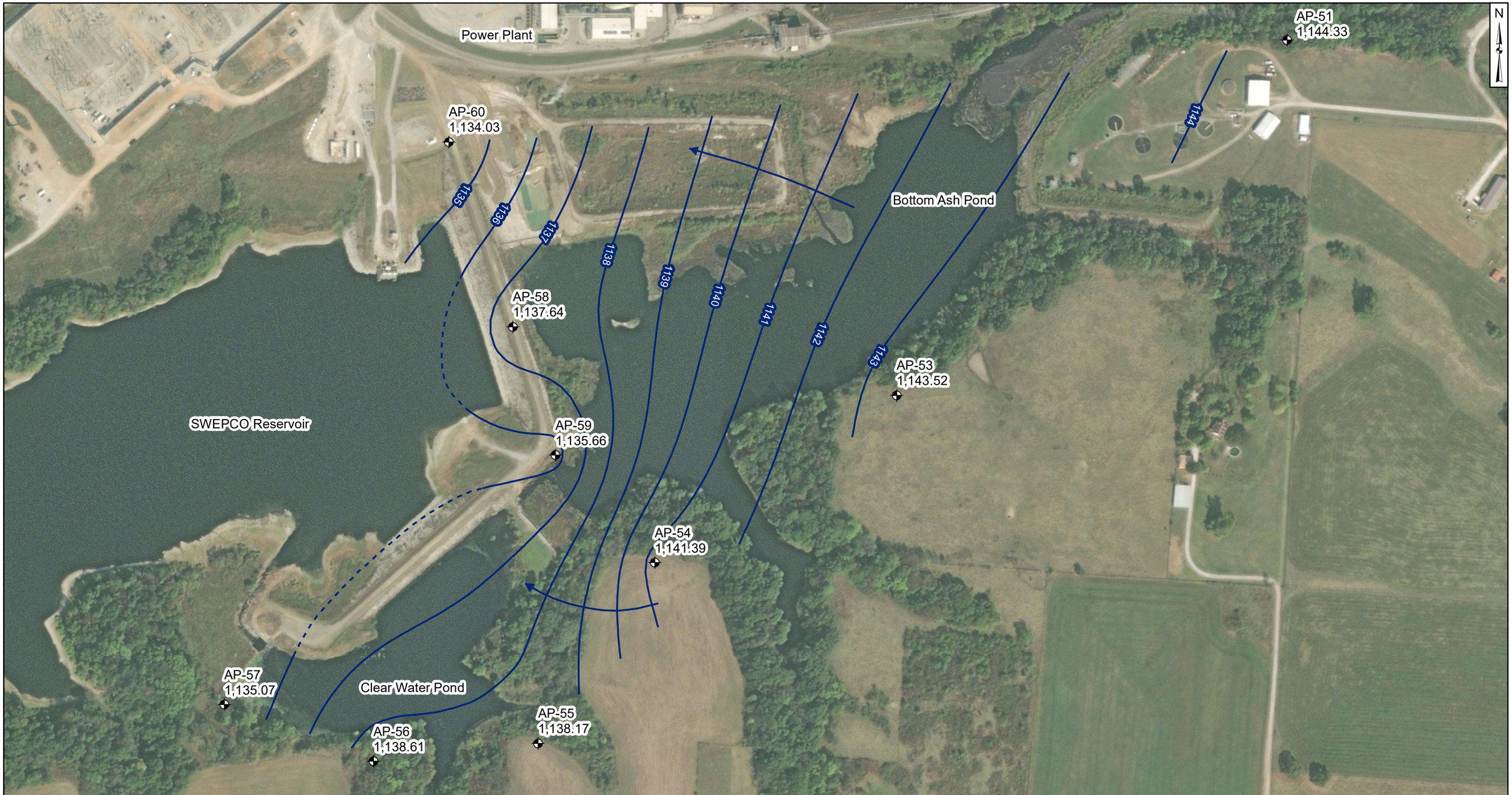
AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

Geosyntec consultants

Columbus, Ohio | 2021/08/03

Figure **2**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2021\AEP-Flint Creek_GW_BAP_March2021.mxd. ARevezzo. 8/3/2021. CHA8423/01/08.



Legend

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

Notes

- Monitoring well coordinates and water level data were collected June 21. 2021 provided by AEP.
- Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2017) provided by AEP.
- Groundwater elevation units are feet above mean sea level.

200 100 0 200 Feet

Potentiometric Surface Map
Uppermost Aquifer - June 2021

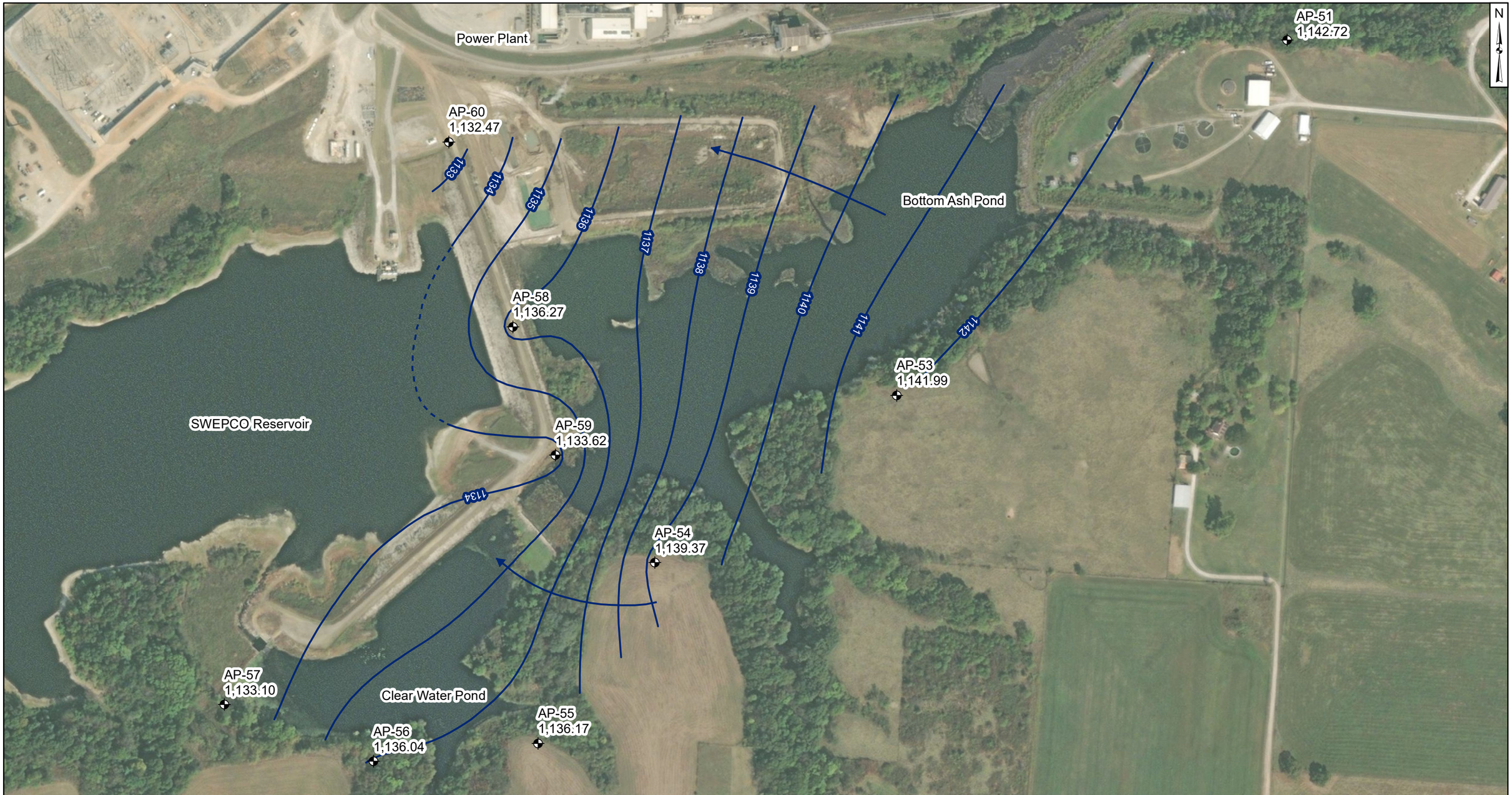
AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

Geosyntec consultants

Columbus, Ohio | 2022/01/25

Figure **3**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2021\AEP-Flint Creek_GW_BAP_June2021.mxd. ASoltero. 1/25/2022. CHA8423/01/08.



Legend

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

Notes

- Monitoring well coordinates and water level data were collected September 20 and 21. 2021 provided by AEP.
- Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2017) provided by AEP.
- Groundwater elevation units are feet above mean sea level.

200 100 0 200 Feet

Potentiometric Surface Map
Uppermost Aquifer - September 2021

AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

Geosyntec consultants

Columbus, Ohio | 2022/01/25

Figure **4**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2021\AEP-Flint Creek_GW_BAP_Sept2021.mxd. ASoltero. 1/25/2022. CHA8423/01/08.

APPENDIX 2 - Statistical Analyses

The memoranda summarizing the statistical evaluations for the October 2020 and March 2021 detection monitoring sampling events follow.

Geosyntec consultants

941 Chatham Lane, Suite 103
Columbus, Ohio 43212
PH 614.468.0415
FAX 614.468.0416
www.geosyntec.com

Memorandum

Date:	May 4, 2021
To:	David Miller (AEP)
Copies to:	Bill Smith (AEP)
From:	Allison Kreinberg (Geosyntec)
Subject:	Evaluation of Detection Monitoring Data at Flint Creek Plant's Primary Bottom Ash Pond (PBAP)

In accordance with the United States Environmental Protection Agency's (USEPA's) 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 at the Primary Bottom Ash Pond (PBAP), an existing CCR unit at the Flint Creek Power Plant located in Gentry, Arkansas, was completed on October 20, 2020. Based on the results, a two-of-two verification sampling was completed on March 1, 2021.

Background values for the PBAP were previously calculated in January 2018. After a minimum of four 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 calculation of these revised background values are described in Geosyntec's *Statistical Analysis Summary* report, dated March 12, 2020 and revised June 23, 2020.

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 exceeds 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 in the list below.

- Calcium concentrations exceeded the intrawell UPL of 47.1 mg/L in both the initial (49.7 mg/L) and second (49.4 mg/L) samples collected at AP-59. Thus, an SSI over background is concluded for calcium at AP-59.

In response to the exceedance noted above, the Flint Creek PBAP CCR unit will either transition to assessment monitoring or an alternative source demonstration (ASD) for calcium will be conducted in accordance with 40 CFR 257.94(e)(2). If the ASD is successful, the Flint Creek PBAP 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 Evalation
Flint Creek - Primary Bottom Ash Pond

Geosyntec Consultants

Analyte	Unit	Description	AP-58	AP-59		AP-60
			10/20/2020	10/20/2020	3/1/2021	10/20/2020
Boron	mg/L	Intrawell Background Value (UPL)	0.706	0.386		1.66
		Analytical Result	0.126	0.244	--	0.301
Calcium	mg/L	Intrawell Background Value (UPL)	85.1	47.1		51.3
		Analytical Result	67.9	**49.7**	**49.4**	9.22
Chloride	mg/L	Intrawell Background Value (UPL)	27.4	19.0		17.7
		Analytical Result	4.98	13.2	--	7.52
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00	1.00		0.791
		Analytical Result	0.28	0.46	--	0.15
pH	SU	Intrawell Background Value (UPL)	9.0	7.7		10.2
		Intrawell Background Value (LPL)	6.2	6.6		6.4
		Analytical Result	6.6	**8.7**	7.3	10.2
Sulfate	mg/L	Intrawell Background Value (UPL)	135	47.2		183
		Analytical Result	34.8	47.0	--	80.7
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	440	257		405
		Analytical Result	249	257	--	280

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.

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 June 23, 2020 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Flint Creek PBAP 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

David Anthony Miller

Signature

15296	ARKANSAS	05.04.21
License Number	Licensing State	Date

Geosyntec consultants

941 Chatham Lane, Suite 103
Columbus, Ohio 43212
PH 614.468.0415
FAX 614.468.0416
www.geosyntec.com

Memorandum

Date:	September 8, 2021
To:	David Miller (AEP)
Copies to:	Bill Smith (AEP)
From:	Allison Kreinberg (Geosyntec)
Subject:	Evaluation of Detection Monitoring Data at Flint Creek Plant's Primary Bottom Ash Pond (PBAP)

In accordance with the United States Environmental Protection Agency's (USEPA's) 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 2021 at the Primary Bottom Ash Pond (PBAP), an existing CCR unit at the Flint Creek Power Plant located in Gentry, Arkansas, was completed on March 1-2, 2021. Based on the results, a resample was collected on June 21, 2021.

Background values for the PBAP were previously calculated in January 2018. After a minimum of four 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 calculation of these revised background values are described in Geosyntec's *Statistical Analysis Summary* report, dated March 12, 2020 and revised June 23, 2020.

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 exceeds the UPL (or are below the LPL for pH).

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

- Calcium concentrations exceeded the intrawell UPL of 47.1 mg/L in both the initial (49.2 mg/L) and second (48.6 mg/L) samples collected at AP-59. Thus, an SSI over background is concluded for calcium at AP-59.

In response to the exceedance noted above, the Flint Creek PBAP CCR unit will either transition to assessment monitoring or an alternative source demonstration (ASD) for calcium will be conducted in accordance with 40 CFR 257.94(e)(2). If the ASD is successful, the Flint Creek PBAP 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 Evalation
Flint Creek - Primary Bottom Ash Pond

Geosyntec Consultants

Analyte	Unit	Description	AP-58	AP-59		AP-60
			3/2/2021	3/2/2021	6/21/2021	3/1/2021
Boron	mg/L	Intrawell Background Value (UPL)	0.706	0.386		1.66
		Analytical Result	0.135	0.157	--	1.19
Calcium	mg/L	Intrawell Background Value (UPL)	85.1	47.1		51.3
		Analytical Result	62.0	**49.2**	**48.6**	34.6
Chloride	mg/L	Intrawell Background Value (UPL)	27.4	19.0		17.7
		Analytical Result	4.44	13.7	--	11.2
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00	1.00		0.791
		Analytical Result	0.33	0.49	--	0.46
pH	SU	Intrawell Background Value (UPL)	9.0	7.7		10.2
		Intrawell Background Value (LPL)	6.2	6.6		6.4
		Analytical Result	7.2	7.3	--	8.4
Sulfate	mg/L	Intrawell Background Value (UPL)	135	47.2		183
		Analytical Result	29.3	**51.9**	34.8	164
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	440	257		405
		Analytical Result	232	250	--	350

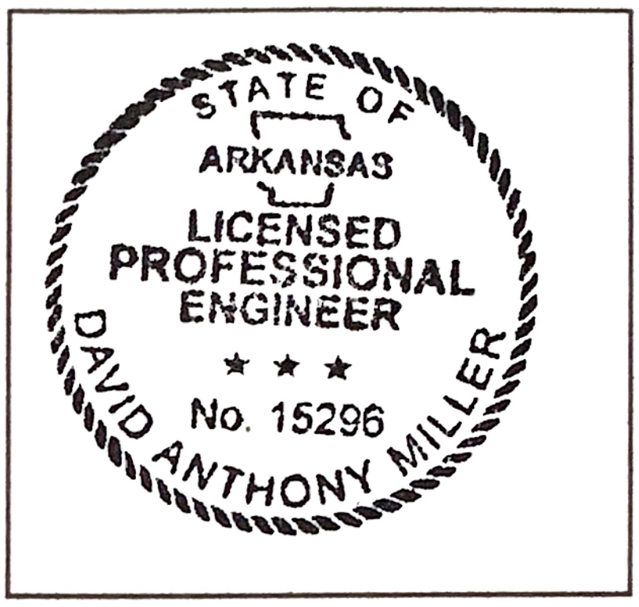
Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.

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 June 23, 2020 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Flint Creek PBAP 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

David Anthony Miller

Signature

15296	ARKANSAS	09.13.21
License Number	Licensing State	Date

APPENDIX 3 – Alternative Source Demonstrations

The August 2021 ASD report follows.

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

Flint Creek Power Plant
Primary Bottom Ash Pond
Gentry, Arkansas

Submitted to

AMERICAN ELECTRIC POWER

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
Suite 103
Columbus, OH 43221

August 2021

CHA8495

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LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EPRI	Electric Power Research Institute
LPL	Lower Prediction Limit
PBAP	Primary Bottom Ash Pond
QA	Quality Assurance
QC	Quality Control
SI	Saturation Index
SSI	Statistically Significant Increase
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency

SECTION 1

INTRODUCTION AND SUMMARY

This Alternative Source Demonstration (ASD) report has been prepared to address a statistically significant increase (SSI) for calcium in the groundwater monitoring network for the Primary Bottom Ash Pond (PBAP) at the Flint Creek Power Plant in Gentry, Arkansas, following the second semi-annual detection monitoring event of 2020.

Upper prediction limits (UPLs) were previously calculated for each Appendix III parameter to represent background values at the PBAP. A lower prediction limit (LPL) was also calculated for pH. Prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, an SSI is concluded only if both samples in a series of two exceed the UPL or, in the case of pH, are below the LPL. In practice, if the initial result did not exceed the UPL or fall below the LPL, a second sample was not collected or analyzed.

The second semi-annual detection monitoring event of 2020 was performed in October 2020 (initial sampling event), and the results were compared to the calculated prediction limits. Where initial exceedances were identified, verification resampling was completed in March 2021. An SSI was identified for calcium at well AP-59 by intrawell analysis. A summary of the detection monitoring analytical results and the calculated prediction limits to which they were compared is provided in **Table 1**.

1.1 CCR Rule Requirements

United States Environmental Protection Agency (USEPA) regulations (USEPA, 2015) regarding detection monitoring programs for coal combustion residuals (CCR) landfills and surface impoundments provide owners and operators with the option to make an ASD when an SSI is identified (40 CFR 257.94(e)(2)):

> *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.*

For well AP-59, calcium concentrations of 49.7 milligrams per liter (mg/L) and 49.4 mg/L were reported for the initial sampling and re-sampling events on October 10, 2020 and March 1, 2021, respectively. Both concentrations exceeded the UPL value for calcium of 47.1 mg/L. Pursuant to 40 CFR 257.94(e)(2) of the CCR Rule (40 CFR 257), Geosyntec Consultants, Inc. (Geosyntec)

has prepared this ASD report, which documents that the SSI for calcium at AP-59 should not be attributed to the Flint Creek PBAP.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess possible alternative sources to which the identified SSI could be attributed. Alternative sources were identified amongst five types, based on methodology provided by the Electric Power Research Institute (EPRI, 2017):

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

A demonstration was conducted to show that the increases in calcium concentrations at well AP-59 were based on a Type IV cause (natural variation) and not by a release from the Flint Creek PBAP.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

The method used to assess possible alternative sources of the SSI for calcium at AP-59 and the proposed alternative source are described below.

2.1 Proposed Alternative Source

An initial review of groundwater sampling field forms, site geochemistry, and site historical data did not identify alternative sources due to a Type I issue (sampling cause). A review of the laboratory and statistical analyses did not identify any Type II (laboratory) or Type III (statistical evaluation) issues. Further, an initial review of site geochemistry did not identify evidence of any Type V (anthropogenic) impacts. As described below, the SSI observed at monitoring well AP-59 is attributed to natural variation, which is a Type IV cause.

Geosyntec submitted a technical memorandum to AEP in December 2020 detailing the results of a geochemical investigation into increasing calcium trends within the PBAP monitoring well network (Geosyntec, 2020; included in AEP, 2021). This memo described the mineral-water interactions occurring between groundwater at the site and the limestone bedrock within which the monitoring wells are screened. Limestone lithologies at the well screen intervals differ between the upgradient and downgradient locations at the PBAP. Downgradient locations were characterized as crystalline, unweathered limestone bedrock, whereas weathered, passivated limestone was observed at upgradient locations. A conceptual site model illustrating upgradient and downgradient limestone conditions is provided as **Figure 1**.

Limestone passivation at the upgradient well locations occurs due to the precipitation of iron oxides on limestone surfaces as a side reaction to the limestone-acidic water buffering process. This proposed mechanism is described in more detail in a previously completed ASD for calcium (Geosyntec, 2018). Limestone passivation does not appear to be prevalent at the downgradient locations based on both the crystalline, competent appearance of the limestone and groundwater chemistry at these locations (Geosyntec, 2021). At location AP-59 and other downgradient monitoring wells, groundwater is interacting with unpassivated limestone capable of buffering incoming acidic waters via dissolution of calcite. A consequence of this buffering capability is higher concentrations of dissolved calcium and alkalinity at these downgradient monitoring wells as calcite dissolves to reach thermodynamic equilibrium with groundwater.

Figure 2 shows that calcium and alkalinity trends at AP-59 appear to be strongly correlated. Calcium and alkalinity (as carbonate, CO_3) comprise the mineral calcite ($CaCO_3$), which is the primary mineral component of limestone. Calcium and alkalinity concentrations in groundwater would both be expected to increase in response to calcite dissolution or decrease in response to calcite precipitation. Dissolution/precipitation of calcite can be evaluated using the saturation index (SI) for calcite. USGS software package PHREEQC was used to calculate calcite SIs for

well AP-59 from recent sampling events (**Figure 3**, **Table 2**). SIs for calcite at AP-59 groundwater fluctuate between supersaturation, equilibrium, and undersaturation. Thus, changes in calcium concentrations at AP-59 are likely associated with changes in calcite saturation instead of a release from the PBAP.

If the PBAP were impacting groundwater at AP-59, the concentrations of geochemically conservative parameters such as boron and chloride would be expected to increase proportionately. Boron and chloride are not significantly attenuated by geochemical processes during advective flow, making them useful indicators of CCR leachate. Time series graphs of boron and chloride concentrations at AP-59 (**Figure 4)** illustrate that boron and chloride concentrations at AP-59 are generally stable over time, and thus are not indicative of a release from the PBAP.

2.2 Sampling Requirements

The ASD described above supports the position that the identified SSI is a product of natural variation and not due to a release from the Flint Creek PBAP. Therefore, the unit will remain in the detection monitoring program. Groundwater at the unit will be sampled for Appendix III parameters on a semi-annual basis.

SECTION 3

CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.94(e)(2) and supports the position that the calcium SSI at AP-59 should be attributed to natural variation and is not due to a release from the Flint Creek PBAP. Therefore, no further action is warranted, and the Flint Creek PBAP will remain in the detection monitoring program. Certification of this ASD by a qualified professional engineer is provided in **Attachment A**.

SECTION 4

REFERENCES

AEP, 2021. Annual Groundwater Monitoring Report, Flint Creek Power Plant, Primary Bottom Ash Pond CCR Management Unit. January.

EPRI, 2017. Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites. 3002010920. October.

Geosyntec Consultants, 2018. Alternative Source Demonstration Report, Federal CCR Rule. Primary Bottom Ash Pond – Flint Creek Plant. April.

Geosyntec Consultants, 2020. Flint Creek PBAP Geochemical Investigation Results. December.

TABLES

Table 1: Detection Monitoring Data Evalation
Flint Creek - Primary Bottom Ash Pond

Geosyntec Consultants

Analyte	Unit	Description	AP-58	AP-59		AP-60
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Boron	mg/L	Intrawell Background Value (UPL)	0.706	0.386		1.66
		Analytical Result	0.126	0.244	--	0.301
Calcium	mg/L	Intrawell Background Value (UPL)	85.1	47.1		51.3
		Analytical Result	67.9	**49.7**	**49.4**	9.22
Chloride	mg/L	Intrawell Background Value (UPL)	27.4	19.0		17.7
		Analytical Result	4.98	13.2	--	7.52
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00	1.00		0.791
		Analytical Result	0.28	0.46	--	0.15
pH	SU	Intrawell Background Value (UPL)	9.0	7.7		10.2
		Intrawell Background Value (LPL)	6.2	6.6		6.4
		Analytical Result	6.6	**8.7**	7.3	10.2
Sulfate	mg/L	Intrawell Background Value (UPL)	135	47.2		183
		Analytical Result	34.8	47.0	--	80.7
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	440	257		405
		Analytical Result	249	257	--	280

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.

Table 2: AP-59 Calculated Calcite Saturation Indices
Flint Creek Primary Bottom Ash Pond

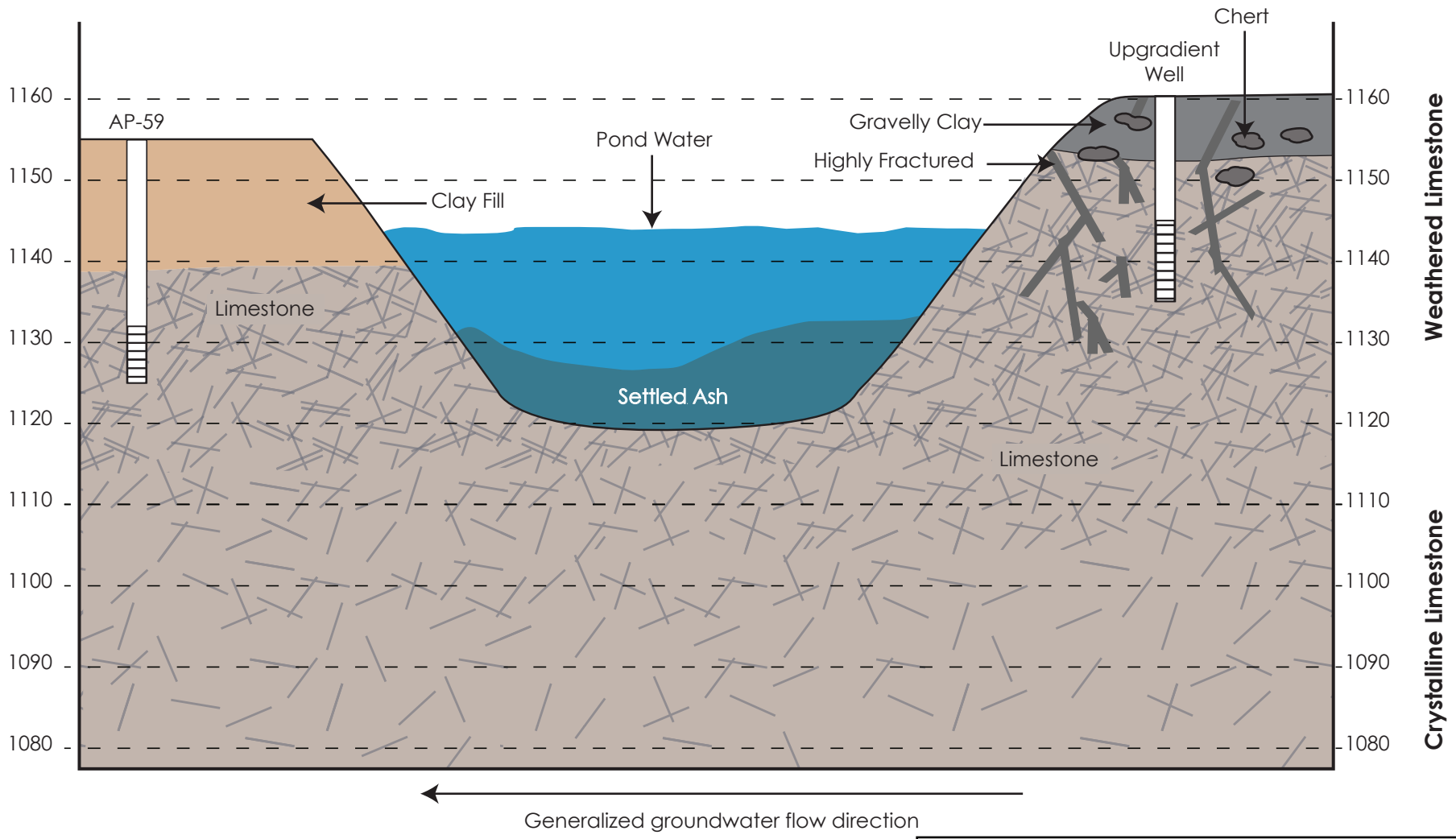
Date	Calcite ($CaCO_3$)
	SI
10/5/2016	-0.53
1/24/2017	-0.88
3/7/2017	0.15
4/26/2017	-0.47
5/16/2017	-0.66
6/16/2017	-1.00
3/11/2019	-0.18
6/11/2019	-0.36
8/27/2019	1.20
10/20/2020	1.02
3/2/2021	-0.30

Notes:

SI - Saturation Index

Calculated SIs greater than -0.2 suggest saturation or supersaturation of the mineral and are shaded in red with red text

FIGURES



Not to Scale

Site Geology Illustration
Flint Creek Primary Bottom Ash Pond

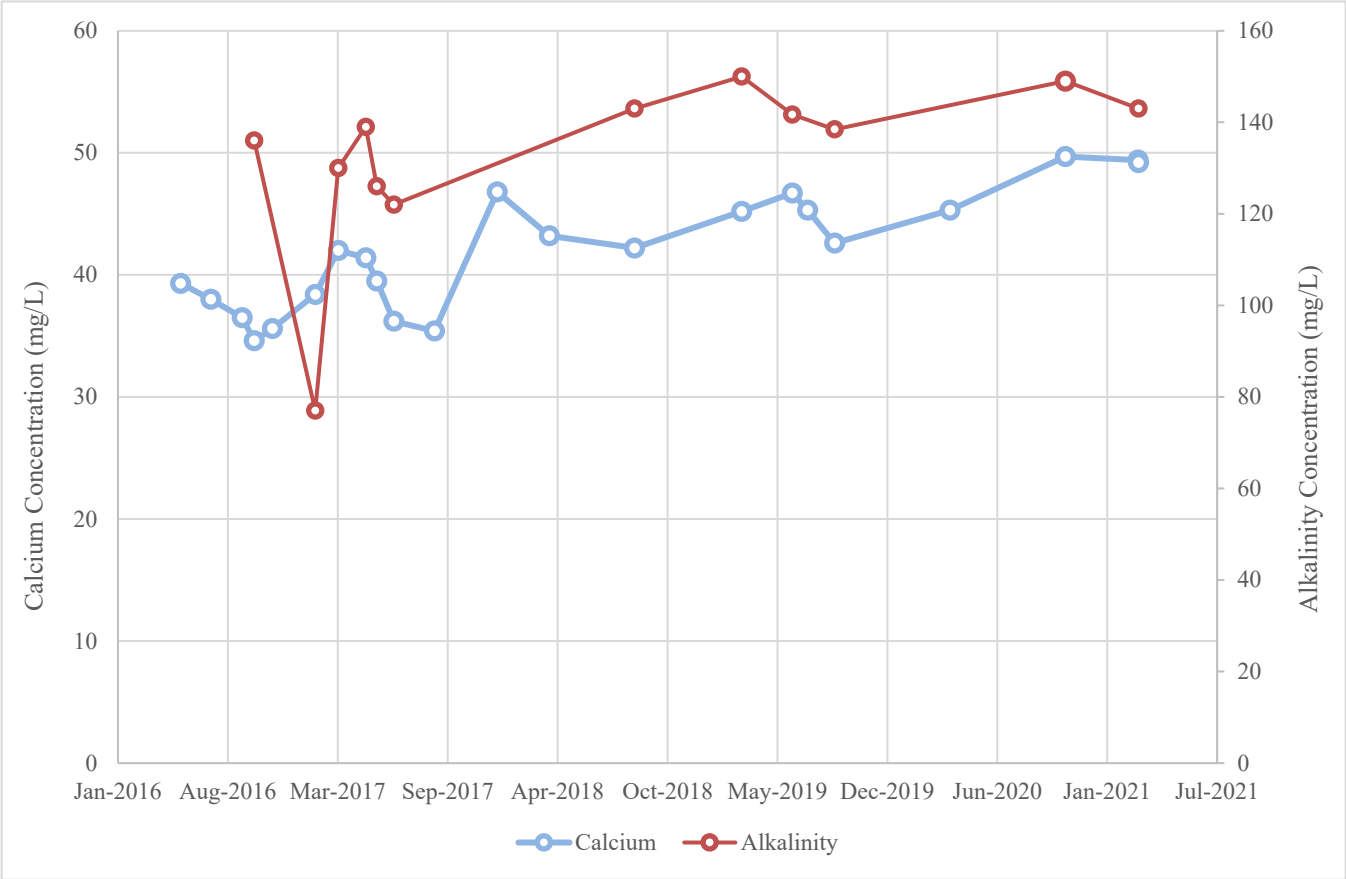
Geosyntec consultants

AMERICAN ELECTRIC POWER

Columbus, Ohio | July 2021

Figure **1**

FlintCreekIllustration_July2021_CHA8495.ai



Notes: Data for AP-59 was collected as part of the Federal CCR program.

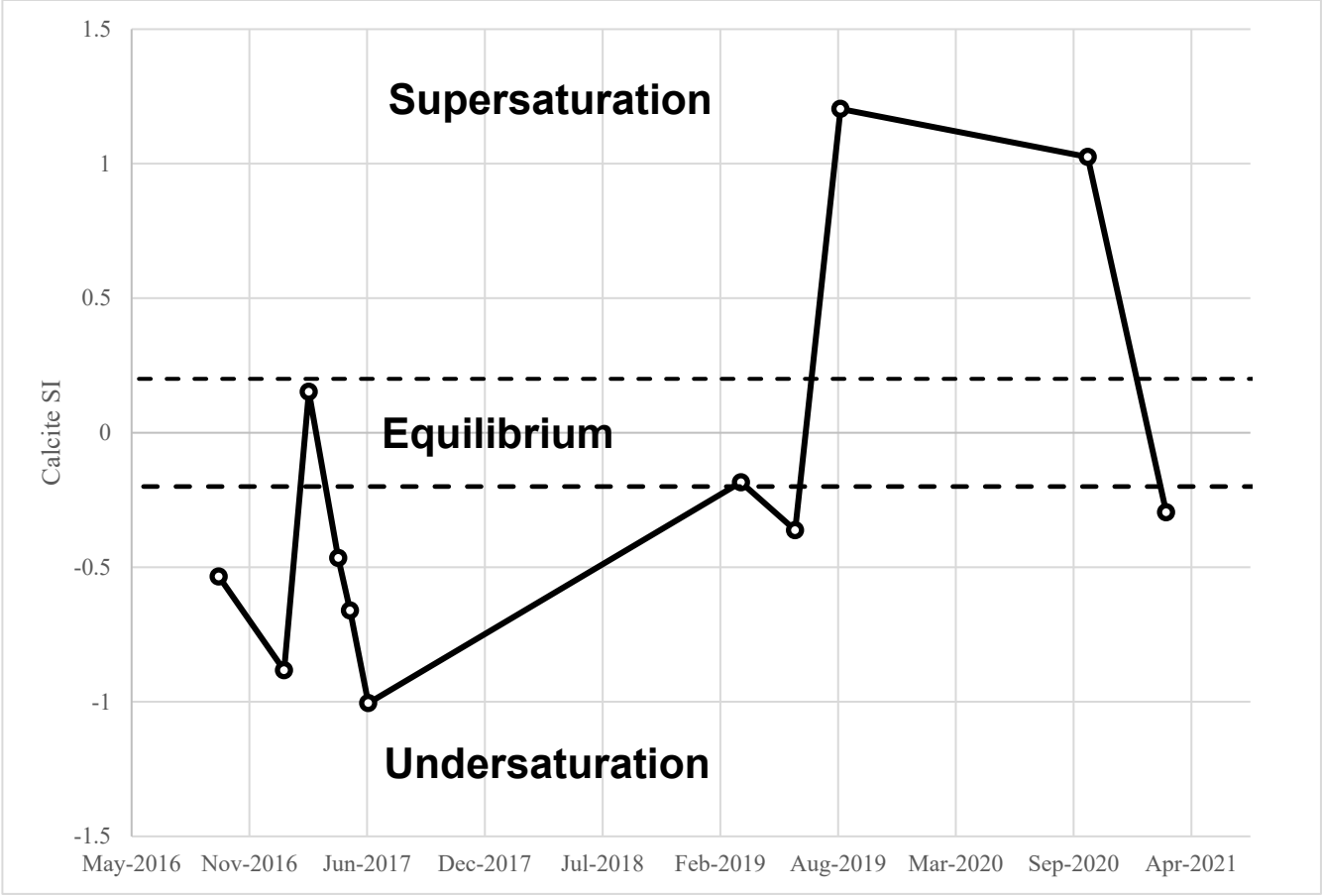
Calcium and Alkalinity Time Series
Flint Creek Primary Bottom Ash Pond

Geosyntec consultants | AMERICAN ELECTRIC POWER

Columbus, Ohio | July 2021

Figure **2**

internal info: path, date revised, author



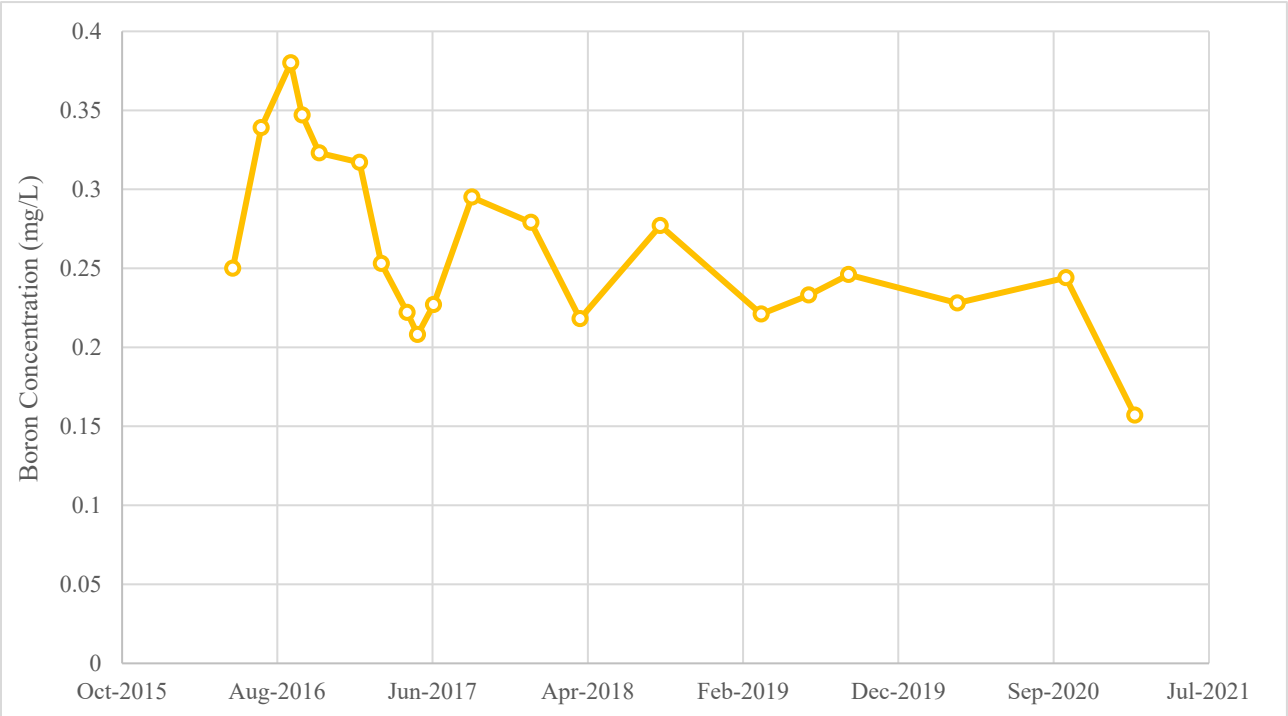
Notes: Calcite saturation indices were calculated using USGS software program PHREEQC. SIs between -0.2 and 0.2 suggest mineral saturation.

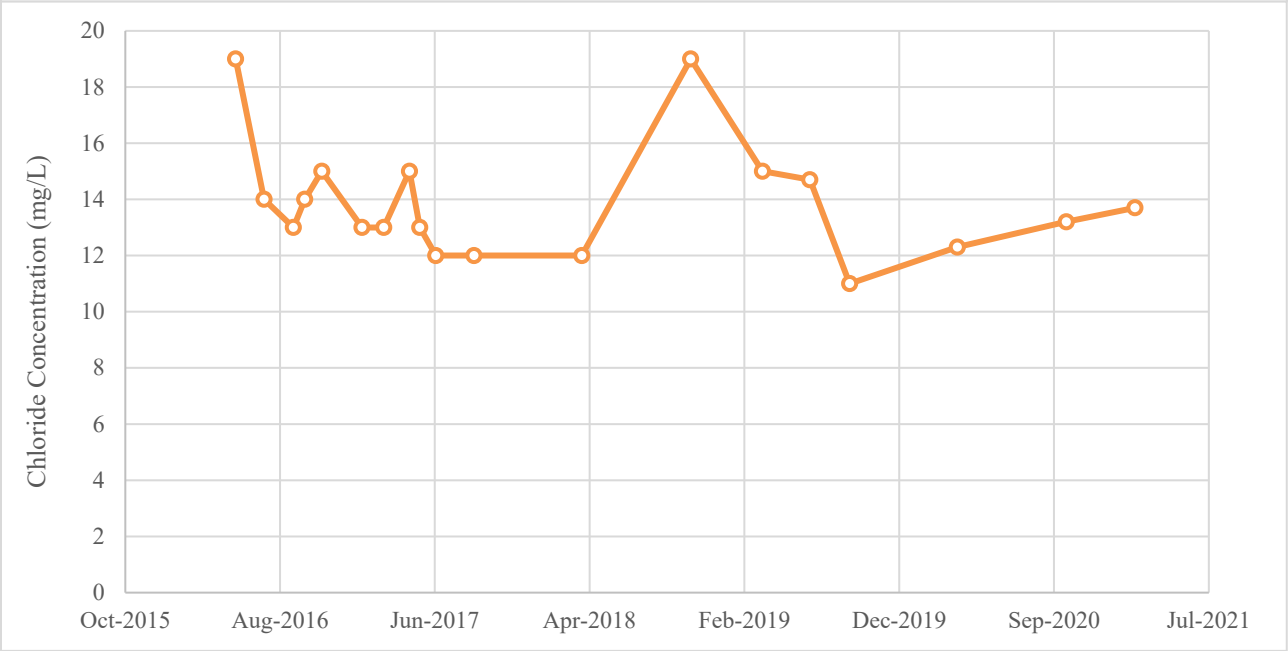
Calcite Saturation Index
Flint Creek Primary Bottom Ash Pond

Geosyntec consultants | AMERICAN ELECTRIC POWER | Figure 3

Columbus, Ohio | July 2021

internal info: path, date revised, author





Notes: Data for AP-59 was collected as part of the Federal CCR program.

Boron and Chloride Time Series Graphs
Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

AMERICAN ELECTRIC POWER

Figure **4**

Columbus, Ohio

July 2021

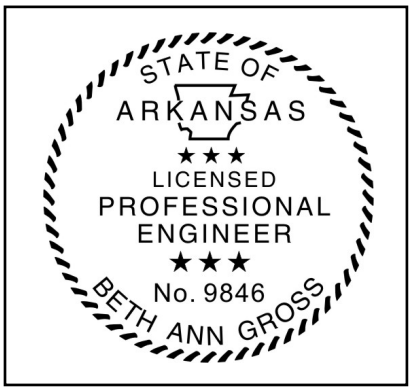
internal info: path, date revised, author

ATTACHMENT A

Certification by a Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected and above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Flint Creek Primary Bottom Ash Pond CCR management area and that the requirements of 40 CFR 257.94(e)(2) have been met.



Beth Ann Gross
Printed Name of Licensed Professional Engineer

Beth Ann Gross
Signature

Geosyntec Consultants
2039 Centre Point Blvd, Suite 103
Tallahassee, FL 32308

Arkansas Firm Certificate of
Authorization No. 52
Exp. 12/31/2022

9864	Arkansas	August 2, 2021
License Number	Licensing State	Date

APPENDIX 4 - Notices for Monitoring Program Transitions

No transition between monitoring requirements occurred in 2021; the CCR unit remained in detection monitoring. Notices for monitoring program transitions are not applicable at this time.

APPENDIX 5 - Well Installation/Decommissioning Logs

No monitoring wells installed or decommissioned in 2021. Well installation/decommissioning logs are not applicable at this time.