Annual Groundwater Monitoring Report

Southwestern Electric Power Company
Flint Creek Power Plant
Primary Bottom Ash Pond CCR Unit
Gentry, Arkansas

January 2025

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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 a formerly existing, now closed, 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. The CCR unit was closed on December 27, 2024, and this annual report is the final such report for the Flint Creek primary bottom ash pond.

In general, the following activities were completed:

- The CCR unit was in detection monitoring at the beginning of 2024 and until its closure in 2024;
- Groundwater samples were collected on April 15, 2024, then again on August 19-20, 2024 and November 19, 2024, 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 samples were collected on February 5-6, 2024, March 4-5, 2024, April 15-16, 2024, and August 20, 2024 and analyzed for Appendix IV constituents as specified in 40 CFR 257.102(c);
- Groundwater monitoring data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Appendix III constituents were compared to prediction limits (intervals for pH) established from background data established previously. Statistical comparisons to background were made for samples collected on March 6-7, 2023, September 18-19, 2023, December 27, 2023, April 15, 2024, August 19-20, 2024, and November 19, 2024 at all monitoring wells;
- The statistical evaluation of the data collected on March 6-7, 2023 and September 18, 2023, completed on January 5, 2024, concluded that there were potential statistically significant increases (SSIs) over background of four Appendix III constituents (boron, chloride, sulfate and total dissolved solids) at monitoring well AP-58A and two Appendix III constituents (sulfate and total dissolved solids) at AP-59. Statistical evaluation of data collected on September 19, 2023 and December 27, 2023, completed April 2, 2024, concluded that there were potential SSIs over background of two Appendix III constituents (boron and chloride) at monitoring well AP-58A and two Appendix III constituents (sulfate and total dissolved solids) at AP-59. Statistical evaluation of data collected on April 15, 2024 and August 19, 2024, completed November 20, 2024, concluded that there were potential SSIs over background of two Appendix III constituents (boron and chloride) at monitoring well AP-58A and one Appendix III constituent (pH) at AP-59. Statistical evaluation of data collected on August 20, 2024 and November 19, 2024, completed

December 24, 2024, concluded that there were potential SSIs over background of two Appendix III constituents (boron and chloride) at monitoring well AP-58A.;

- Because potential SSIs over background of Appendix III constituents were detected at the Flint Creek Plant's PBAP during the March 6-7, 2023 initial sampling, the corresponding September 18, 2023 resampling, and statistical analysis completed on January 5, 2024, an alternative source demonstration (ASD) study was conducted resulting in an April 3, 2024 ASD report. Because potential SSIs over background of Appendix III constituents were detected at the Flint Creek Plant's PBAP from the September 19, 2023 initial sampling, the corresponding December 27, 2023 resampling, and statistical analysis completed on April 2, 2024, an ASD study was conducted resulting in a June 28, 2024 ASD report. Because potential SSIs over background of Appendix III constituents were detected at the Flint Creek Plant's PBAP from the April 15, 2024 initial sampling, the corresponding August 19, 2024 resampling, and statistical analysis completed on November 20, 2024, an ASD study was conducted resulting in a December 19, 2024 ASD report. Because potential SSIs over background of Appendix III constituents were detected at the Flint Creek Plant's PBAP from the August 20, 2024 initial sampling, the corresponding November 19, 2024 resampling, and statistical analysis completed on December 24, 2024, an ASD study was conducted resulting in a December 27, 2024 ASD report;
- Statistical analysis of Appendix IV data from samples collected in April 2024 to facilitate potential closure of the CCR unit in accordance with 40 CFR 257.102(c) was completed on October 17, 2024. This report was revised on January 27, 2025 to correct two significant typographical errors. Statistical analysis of Appendix IV data from samples collected in August 2024 to facilitate potential closure of the CCR unit in accordance with 40 CFR 257.102(c) was completed on December 19, 2024.
- Statistical analysis of the April 2024 and August 2024 Appendix IV data to facilitate potential closure of the CCR unit in accordance with 40 CFR 257.102(c) determined that no statistically significant levels (SSLs) above groundwater protection standards (GWPSs) were detected.
- No ASDs relative to Appendix IV potential SSLs above the corresponding GWPS were necessary, and thus not conducted.

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

- A map, aerial photograph or a drawing showing the CCR unit(s), all groundwater monitoring wells and monitoring well identification numbers;
- All of the monitoring data collected, including the rate and direction of groundwater flow, plus a summary showing the number of samples collected per monitoring well, the dates

the samples were collected and whether the sample was collected as part of detection monitoring or assessment monitoring programs is included in Appendix 1;

- Statistical comparison of monitoring data to determine if there have been one or more potential SSIs over background levels or any potential SSLs above the GWPSs (Attached as Appendix 2, where applicable);
- A discussion of whether any alternate source demonstrations were performed, and the conclusions (Attached as Appendix 3, where applicable);
- A summary of any transition between monitoring programs, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring (Notices attached as Appendix 4, where applicable);
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement regarding the rationale for the installation/decommission (Attached as Appendix 5, where applicable); and
- Other information required to be included in the annual report such as alternate monitoring frequency or assessment of corrective measures, if applicable.

In addition, this report summarizes key actions completed, and where applicable, describes any problems encountered and actions taken to resolve those problems. The report includes no projection of key activities for the upcoming year because all CCR has been removed from CCR unit, no areas were affected by releases from the CCR unit, all Appendix IV concentrations in groundwater have been documented to be below the corresponding GWPS for two consecutive sampling events using the statistical procedures in 40 CFR 257.93(g), and the CCR unit is therefore closed by removal of CCR in accordance with 40 CFR 257.102(c).

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	Former AP-58/and AP-58A
AP-53	AP-59
AP-54	AP-60

III. Monitoring Wells Installed or Decommissioned

There were no monitoring wells installed or decommissioned in 2024. The network design, as summarized in the *Groundwater Monitoring Network Design Report Revision 2* (2023) 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

Appendix 1 contains tables showing the groundwater quality data collected during the establishment of background quality, detection monitoring, and compliance/assessment monitoring to demonstrate qualification for CCR unit closure. 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

The first semiannual detection monitoring event of 2023 occurred on March 6-7, 2023. In response to potential SSIs in the concentrations of boron, chloride, pH, sulfate, and total dissolved solids detected in groundwater samples at monitoring well AP-58A, and sulfate and total dissolved solids at monitoring well AP-59, resamples for these constituents were collected at the wells on September 18, 2023, and statistical analyses were completed on January 5, 2024. A memorandum with the results of the statistical evaluation is provided in Appendix 2. The resampling and statistical analyses eliminated the increase in pH at AP-58A as a statistical false positive but indicated potential SSIs in the concentrations of the other parameters at the corresponding well. Thus, an ASD study was conducted resulting in an April 3, 2024 ASD report, which is provided in Appendix 3.

The second semiannual detection monitoring event of 2023 occurred on September 18-19, 2023. In response to potential SSIs in the concentrations of boron, chloride, sulfate, and total dissolved solids in monitoring well AP-58A and the concentrations of sulfate and total dissolved solids in AP-59, resamples for these constituents were collected at the corresponding wells on December 27, 2023, and statistical analyses were completed on April 2, 2024. A memorandum with the results of the statistical evaluation is provided in Appendix 2. The resampling and statistical analyses eliminated the increases in sulfate and total dissolved solids at AP-58A as statistical false positives but indicated potential SSIs for the remaining parameters at the corresponding wells. Thus, an ASD study was conducted resulting in a June 28, 2024 ASD report, which is provided in Appendix 3.

As required by 40 CFR 257.94, groundwater samples were collected and analyzed for all Appendix III constituents during a first semiannual sampling event on April 15-16, 2024. In response to potential SSIs in the concentrations of boron and chloride in monitoring well AP-58A, the concentrations of chloride, pH (a potential statistically significant decrease), and sulfate in AP-59, and the concentration of calcium in AP-60, resamples for these constituents were collected at the corresponding wells on August 19, 2024, and statistical analyses were completed on November 20, 2024. A memorandum with the results of the statistical evaluation is provided in Appendix 2. The resampling and statistical analyses eliminated the increases in chloride and sulfate at AP-59 and the increase in calcium at AP-60 as statistical false positives but indicated potential SSIs for the remaining parameters at the corresponding wells (including the statistically significant decrease in pH at AP-59). Thus, an ASD study was conducted resulting in a December 19, 2024 ASD report, which is provided in Appendix 3.

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 August 19-20, 2024. In response to potential SSIs in the concentrations of boron and chloride in monitoring well AP-58A, and a statistically significant decrease in pH at AP-59, resamples for these constituents were collected at the corresponding wells on November 19, 2024, and statistical analyses were completed on December 24, 2024. A memorandum with the results of the statistical evaluation is provided in Appendix 2. The resampling and statistical analyses eliminated the statistically significant decrease in pH at AP-59 as a statistical false positive but indicated potential SSIs for boron and chloride at AP-58A. Thus, an ASD study was conducted resulting in a December 27, 2024 ASD report, which is provided in Appendix 3.

The process of closure by removal of CCR continued in 2023 with all CCR removed from the unit as of August 20, 2023. As required by 40 CFR 257.102(c), groundwater samples were collected and analyzed for all Appendix IV constituents to determine suitability for final CCR unit closure. A total of seven statistically independent samples were collected between September 2023 and April 2024 to obtain a suitably current background dataset for determination of statistical confidence limits to compare to GWPSs established pursuant to 40 CFR 257.95(h) in accordance with the USEPA Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance (the USEPA Unified Guidance) and 40 CFR 257.102(c). As required by 40 CFR 257.102(c), groundwater samples were collected and analyzed for all Appendix IV constituents to document whether or not groundwater monitoring concentrations exceed the GWPS throughout the CCR unit area.

The first Appendix IV sampling event to determine suitability for closure of the CCR unit occurred on April 15-16, 2024. All monitoring wells were sampled for all Appendix IV constituents. The monitoring data were subjected to statistical analysis and GWPSs were established for each constituent in accordance with 40 CFR 257.95(h) and the USEPA Unified Guidance. Confidence limits were calculated for each Appendix IV parameter at each compliance well and compared to the corresponding GWPS to assess whether any concentrations were present at SSLs above the GWPS resulting in a statistical analysis summary completed on October 17, 2024 and revised to correct two significant typographical errors on January 27, 2025. No SSLs were identified. The statistical analysis summary of the Appendix IV parameter analyses for this first such sampling event at the CCR unit is provided in Appendix 2.

The second Appendix IV sampling event to determine suitability for closure of the CCR unit occurred on August 20, 2024. All monitoring wells were sampled for all Appendix IV constituents. The monitoring data were subjected to statistical analysis and GWPSs were established for each constituent in accordance with 40 CFR 257.95(h) and the USEPA Unified Guidance. Confidence limits were calculated for each Appendix IV parameter at each compliance well and compared to the corresponding GWPS to assess whether any concentrations were present at SSLs above the GWPS resulting in a statistical analysis summary completed on December 19, 2024. No SSLs were identified. The statistical analysis summary of the Appendix IV parameter analyses for this sampling event at the CCR unit is provided in Appendix 2.

VI. Alternative Source Demonstration

Because potential SSIs over background of Appendix III constituents were detected at the Flint Creek Plant's PBAP during the March 6-7, 2023 initial sampling, the corresponding September 18, 2023 resampling at monitoring wells AP-58A and AP-59, and statistical analysis completed on January 5, 2024, an ASD study was conducted resulting in an April 3, 2024 ASD report. The report concluded that the SSIs were not due to a release from the Flint Creek PBAP but were instead attributed to sampling issues at monitoring well AP-58A and natural variation in the underlying geology at AP-59. This report is provided in Appendix 3.

Because potential SSIs over background of Appendix III constituents were detected at the Flint Creek Plant's PBAP during the September 18-19, 2023 initial sampling, the corresponding resampling at monitoring wells AP-58A and AP-59 collected on December 27, 2023, and statistical analyses completed on April 2, 2024, an ASD study was conducted resulting in a June 28, 2024 ASD report. The report concluded that the SSIs were not due to a release from the Flint Creek PBAP but were instead attributed to natural variation or sampling issues. This report is provided in Appendix 3.

Because potential SSIs over background of Appendix III constituents (and a potential statistically significant decrease in pH at monitoring well AP-59) were detected at the Flint Creek Plant's PBAP during the April 15-16, 2024 initial sampling, the corresponding resampling at monitoring wells AP-58A and AP-59 collected on August 19, 2024, and statistical analyses completed on November 20, 2024, an ASD study was conducted resulting in a December 19, 2024 ASD report. The report concluded that the SSIs were not due to a release from the Flint Creek PBAP but were instead attributed to sampling issues. This report is provided in Appendix 3.

Because potential SSIs over background of Appendix III constituents were detected at the Flint Creek Plant's PBAP during the August 19-20, 2024 initial sampling, the corresponding resampling at monitoring well AP-58A collected on November 19, 2024, and statistical analyses completed on December 24, 2024, an ASD study was conducted resulting in a December 27, 2024 ASD report. The report concluded that the SSIs were not due to a release from the Flint Creek PBAP but were instead attributed to sampling issues. This report is provided in Appendix 3.

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

No transition between monitoring requirements occurred in 2024; the CCR unit was in detection monitoring at the beginning of 2024 and throughout its closure. A statement to this effect is provided in Appendix 4.

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

VIII. Other Information Required

All required information has been included in this annual groundwater monitoring report, and the Flint Creek plant's primary bottom ash pond CCR unit is now closed. All CCR were removed from CCR unit as of August 20, 2023, no areas were affected by releases from the CCR unit, all Appendix IV concentrations in groundwater have been documented to be below the corresponding GWPS for two consecutive sampling events using the statistical procedures in 40 CFR 257.93(g), and the CCR unit is therefore closed by removal of CCR in accordance with 40 CFR 257.102(c).

IX. Description of Any Problems Encountered in 2024 and Actions Taken

No significant problems were encountered in 2024. 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

There are no key activities for 2025 because the Flint Creek primary bottom ash pond CCR unit has been closed in accordance with 40 CFR 257.102(c).

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
5/24/2016	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
3/7/2017	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
6/16/2017	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
3/14/2022	Detection	--	--	--	--	5.7	--	--
3/15/2022	Detection	< 0.009 U1	8.06	11.6	0.03 J1	--	0.14 J1	110
9/20/2022	Detection	--	--	--	--	5.7	--	--
9/21/2022	Detection	< 0.009 U1	7.89	11.6	0.04 J1	--	0.99	120
3/6/2023	Detection	--	--	--	--	6.0	--	--
3/7/2023	Detection	< 0.009 U1	9.39	10.2	0.03 J1	--	1.08	70
9/18/2023	Detection	--	--	--	--	5.5	--	--
9/19/2023	Detection	< 0.007 U1	7.67	9.84	0.04 J1	--	0.4 J1	140
4/15/2024	Detection	--	--	--	--	5.0	--	--
4/16/2024	Detection	0.007 J1	7.54	10.9	0.04 J1	--	0.2 J1	90 H2
8/19/2024	Detection	--	--	--	--	5.7	--	--
8/20/2024	Detection	< 0.007 U1	8.02	10.9	0.03 J1	--	0.2 J1	80

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

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	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
3/7/2017	Background	7	< 1.05 U1	95	0.355243 J1	0.128375 J1	2	5	1.310	< 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
6/16/2017	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
9/19/2023	*	0.036 J1	0.58	118	0.373	0.057	1.47	6.62	1.52	0.04 J1	0.96	0.00248	0.183	0.1 J1	1.24	0.07 J1
10/10/2023	*	0.011 J1	0.18	115	0.326	0.055	1.02	1.58	14.16	0.04 J1	0.13 J1	0.00197	0.068	< 0.1 U1	0.62	0.05 J1
11/14/2023	*	< 0.008 U1	0.20	123	0.347	0.061	0.57	1.55	1.56	0.04 J1	0.13 J1	0.00217	0.013	< 0.1 U1	0.95	0.06 J1
12/13/2023	*	0.017 J1	0.22	114	0.347	0.066	0.87	2.79	3.16	0.03 J1	0.30	0.00202	0.004 J1	< 0.1 U1	0.53	0.08 J1
2/6/2024	*	< 0.008 U1	0.07 J1	119	0.320	0.069	0.66	0.969	1.24	0.04 J1	< 0.05 U1	0.00198	0.006	< 0.1 U1	0.24 J1	0.05 J1
3/5/2024	*	0.010 J1	0.14	123	0.370	0.068	0.45	1.69	1.74	0.04 J1	0.22	0.00202	0.019	< 0.1 U1	0.36 J1	0.05 J1
4/16/2024	*/Closure	< 0.008 U1	0.14	123	0.368	0.064	0.47	0.930	1.86	0.04 J1	0.09 J1	0.00204	< 0.002 U1	< 0.1 U1	0.33 J1	0.05 J1
8/20/2024	Closure	0.014 J1	0.26	124	0.393	0.159	0.84	1.27	2.53	0.03 J1	0.28	0.00235	0.044	< 0.1 U1	0.66	0.07 J1

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
5/24/2016	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
3/7/2017	Background	0.137	3.85	13	< 0.083 U1	5.0	47	112
4/26/2017	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
6/16/2017	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
3/15/2022	Detection	0.077	17.0	17.6	0.11	5.8	62.3	160
9/21/2022	Detection	0.10	5.65	13.9	0.06	5.8	44.1	110
3/7/2023	Detection	0.044 J1	4.13	14.7	0.04 J1	5.6	18.1	90
9/19/2023	Detection	0.181	16.9	16.1	0.07	6.1	77.8	200
4/15/2024	Detection	0.114	22.1	18.7	0.15	6.3	53.5	190 H2
8/20/2024	Detection	0.234	14.2	17.8	0.14	6.3	41.5	140

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

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	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
3/7/2017	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
4/26/2017	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
6/16/2017	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
9/19/2023	*	0.012 J1	0.40	114	0.082	0.045	0.83	0.633	1.38	0.07	< 0.05 U1	0.00058	0.013	< 0.1 U1	2.67	0.08 J1
10/9/2023	*	0.014 J1	0.57	109	0.064	0.034	0.59	0.701	14.86	0.08	< 0.05 U1	0.00050	0.013	< 0.1 U1	2.95	0.08 J1
11/13/2023	*	0.015 J1	0.52	93.2	0.051	0.027	0.33	2.03	2.48	0.11	< 0.05 U1	0.00045	0.010	< 0.1 U1	2.61	0.09 J1
12/12/2023	*	0.014 J1	0.35	80.1	0.036 J1	0.015 J1	0.34	1.84	2.28	0.12	< 0.05 U1	0.00032	0.010	0.1 J1	1.12	0.09 J1
2/5/2024	*	0.013 J1	0.29	83.1	0.045 J1	0.019 J1	0.38	1.17	1.59	0.13	< 0.05 U1	0.00033	0.005	0.1 J1	0.86	0.07 J1
3/5/2024	*	0.012 J1	0.28	85.3	0.049 J1	0.020	0.32	1.01	1.07	0.13	< 0.05 U1	0.00029 J1	0.005	0.1 J1	1.04	0.07 J1
4/15/2024	*/Closure	0.014 J1	0.45	83.2	0.048 J1	0.027	0.35	1.28	1.08	0.15	< 0.05 U1	0.00025 J1	0.009	0.2 J1	1.09	0.08 J1
8/20/2024	Closure	0.022 J1	1.71	63.3	0.100	0.038	0.67	3.15	2.02	0.14	0.12 J1	0.00048	0.018	0.7	1.13	0.12 J1

Table 1. Groundwater Data Summary: AP-54
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
5/24/2016	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
3/7/2017	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
6/16/2017	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
3/15/2022	Detection	0.168	19.7	15.1	0.07	5.7	64.3	160
9/21/2022	Detection	0.157	18.8	14.8	0.07	5.9	57.7	150
9/19/2023	Detection	0.166	15.4	13.9	0.06	6.4	52.5	140
4/15/2024	Detection	0.182	20.4	17.0	0.08	5.9	53.0	190 H2
8/20/2024	Detection	0.176	21.4	17.1	0.07	6.5	49.8	170

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

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	< 0.93 U1	< 1.05 U1	35	0.177109 J1	< 0.07 U1	0.485517 J1	7	1.000	< 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
3/7/2017	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
6/16/2017	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
9/19/2023	*	0.009 J1	0.28	39.5	0.043 J1	0.092	0.76	4.42	1.30	0.06	0.11 J1	0.00020 J1	0.004 J1	< 0.1 U1	1.04	0.02 J1
10/9/2023	*	0.008 J1	0.33	41.2	0.025 J1	0.015 J1	0.50	5.32	4.68	0.07	< 0.05 U1	0.00018 J1	0.004 J1	< 0.1 U1	1.39	0.02 J1
11/13/2023	*	0.011 J1	0.47	44.6	0.028 J1	0.010 J1	0.76	1.80	1.59	0.08	0.05 J1	0.00017 J1	0.003 J1	< 0.1 U1	2.32	0.06 J1
12/12/2023	*	0.021 J1	0.24	39.9	0.243	0.008 J1	0.62	1.61	2.40	0.06	0.63	0.00021 J1	0.003 J1	0.7	0.92	0.07 J1
2/5/2024	*	0.010 J1	0.26	42.2	0.020 J1	0.010 J1	0.56	1.82	1.32	0.08	< 0.05 U1	0.00013 J1	0.002 J1	< 0.1 U1	0.87	0.07 J1
3/5/2024	*	0.013 J1	0.28	45.7	0.022 J1	0.035	0.59	2.50	1.32	0.08	0.08 J1	0.00013 J1	0.003 J1	< 0.1 U1	0.84	0.07 J1
4/15/2024	*/Closure	0.011 J1	0.34	41.0	0.021 J1	0.011 J1	0.42	3.20	1.13	0.08	< 0.05 U1	0.00013 J1	< 0.002 U1	< 0.1 U1	0.93	0.06 J1
8/20/2024	Closure	0.010 J1	0.32	42.1	0.027 J1	0.048	0.46	2.34	2.49	0.07	< 0.05 U1	0.00018 J1	0.002 J1	< 0.1 U1	1.00	0.07 J1

Table 1. Groundwater Data Summary: AP-58/AP-58A
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
5/24/2016	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
10/5/2016	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
4/26/2017	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
6/16/2017	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
3/14/2022	Detection	--	--	--	--	6.8	--	--
3/15/2022	Detection	0.182	67.0	6.25	0.32	--	40.9	240
12/12/2022	Detection	1.23	20.6	22.1	0.59	8.9	164	400
3/6/2023	Detection	1.20	--	18.6	--	9.0	134	410 P1
3/7/2023	Detection	1.27	16.7	23.4	0.58	9.0	152	400
9/18/2023	Detection	1.03	--	26.2	--	7.6	144	400
9/19/2023	Detection	1.03	22.6	26.7	0.54	7.6	146	370
12/27/2023	Detection	0.653	--	20.3	--	7.6	83.4	300
4/15/2024	Detection	0.623	19.0	21.2	0.45	7.0	82.6	290 H2
8/19/2024	Detection	0.566	--	20.8	--	7.0	--	--
8/20/2024	Detection	0.579	19.1	20.4	0.42	7.1	59.8	270
11/19/2024	Detection	0.592	--	21.0	--	7.7	--	--

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

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
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
10/5/2016	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
4/26/2017	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
6/16/2017	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
9/19/2023	*	0.416	9.01	28.1	0.008 J1	0.013 J1	0.58	0.304	0.60	0.54	0.18 J1	0.00537	0.006	36.1	0.21 J1	< 0.02 U1
10/9/2023	*	0.261	8.87	25.8	< 0.007 U1	0.013 J1	0.38	0.241	20.75	0.52	0.11 J1	0.00447	0.006	26.9	0.15 J1	< 0.02 U1
11/13/2023	*	0.195	8.94	25.9	< 0.007 U1	0.005 J1	0.31	0.251	0.58	0.50	0.09 J1	0.00497	0.005	23.9	0.12 J1	< 0.02 U1
12/12/2023	*	0.162	8.18	24.9	< 0.007 U1	0.006 J1	0.33	0.234	1.65	0.48	0.07 J1	0.00478	0.003 J1	20.8	0.13 J1	< 0.02 U1
2/5/2024	*	0.143	8.13	27.7	< 0.007 U1	0.012 J1	0.35	0.216	1.55	0.47	0.10 J1	0.00403	0.003 J1	21.0	0.23 J1	< 0.02 U1
3/4/2024	*	0.100	7.04	26.1	< 0.007 U1	0.010 J1	0.27 J1	0.164	0.35	0.47	0.06 J1	0.00350	0.003 J1	16.9	0.10 J1	< 0.02 U1
4/15/2024	*/Closure	0.090 J1	6.22	27.6	< 0.007 U1	0.014 J1	0.35	0.168	0.46	0.45	0.06 J1	0.00324	< 0.002 U1	16.7	0.15 J1	< 0.02 U1
8/20/2024	Closure	0.059 J1	6.24	28.6	< 0.007 U1	< 0.004 U1	0.73	0.156	1.21	0.42	< 0.05 U1	0.00322	0.003 J1	15.4	0.08 J1	< 0.02 U1

Table 1. Groundwater Data Summary: AP-59
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
5/24/2016	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
10/5/2016	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
4/26/2017	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
6/16/2017	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
3/14/2022	Detection	0.202	48.0	16.0	0.47	6.5	51.5	220
8/15/2022	Detection	--	--	--	--	6.9	62.0	--
9/20/2022	Detection	0.336	41.7	15.4	0.48	7.1	53.9	250
12/12/2022	Detection	--	--	--	--	7.3	--	--
3/6/2023	Detection	--	--	--	--	7.0	77.7	--
3/7/2023	Detection	0.368	46.5	17.7	0.47	7.0	78.7	280
9/18/2023	Detection	--	--	--	--	7.1	69.6	300
9/19/2023	Detection	0.301	51.6	14.6	0.42	7.1	68.3	290
12/27/2023	Detection	--	--	--	--	7.0	55.1	270
4/15/2024	Detection	0.220	47.5	18.3	0.40	6.5	50.5	240 H2
8/19/2024	Detection	--	--	18.0	--	6.2	30.5	--
8/20/2024	Detection	0.300	44.4	17.9	0.41	6.2	30.0	230
11/19/2024	Detection	--	--	--	--	6.9	--	--

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

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
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
10/5/2016	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
4/26/2017	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
6/16/2017	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
9/19/2023	*	0.029 J1	3.40	78.1	0.008 J1	0.028	0.38	2.52	1.68	0.42	0.19 J1	0.00027 J1	< 0.002 U1	5.1	0.05 J1	0.14 J1
10/9/2023	*	0.025 J1	2.97	74.0	< 0.007 U1	0.011 J1	0.26 J1	2.33	27.80	0.42	0.16 J1	0.00027 J1	< 0.002 U1	5.0	0.10 J1	0.15 J1
11/13/2023	*	0.031 J1	2.90	64.3	0.009 J1	0.017 J1	0.41	2.22	2.11	0.47	0.28	0.00028 J1	< 0.002 U1	5.9	0.12 J1	0.15 J1
12/12/2023	*	0.024 J1	2.54	56.0	< 0.007 U1	0.01 J1	0.32	1.70	2.23	0.45	0.11 J1	0.00024 J1	< 0.002 U1	5.6	< 0.04 U1	0.13 J1
2/5/2024	*	0.027 J1	2.37	58.2	< 0.007 U1	0.020	0.23 J1	1.67	0.72	0.42	0.13 J1	0.00022 J1	< 0.002 U1	5.9	0.07 J1	0.13 J1
3/4/2024	*	0.022 J1	2.11	60.4	< 0.007 U1	0.027	0.39	1.54	1.42	0.40	0.07 J1	0.00020 J1	< 0.002 U1	4.7	0.06 J1	0.11 J1
4/15/2024	*/Closure	0.020 J1	1.96	57.2	< 0.007 U1	0.013 J1	0.30	1.48	0.60	0.40	0.06 J1	0.00020 J1	< 0.002 U1	4.7	0.06 J1	0.10 J1
8/20/2024	Closure	0.026 J1	2.67	58.5	0.007 J1	0.021	0.36	2.05	3.03	0.41	0.14 J1	0.00024 J1	< 0.002 U1	6.0	0.08 J1	0.12 J1

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
3/29/2017	Background	1.14	43	13	< 0.083 U1	8.4	140	368
4/26/2017	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
6/16/2017	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
3/14/2022	Detection	0.151	2.20	6.69	0.14	8.6	58.5	240
9/20/2022	Detection	0.756	54.3	11.9	0.59	8.7	118	330
3/6/2023	Detection	--	0.47	--	--	9.1	--	--
3/7/2023	Detection	0.870	8.43	6.82	0.17	9.1	56.8	280
9/18/2023	Detection	0.697	40.6	11.0	0.17	7.9	63.7	260
4/15/2024	Detection	0.345	55.0	12.0	0.20	7.1	93.3	320 H2
8/19/2024	Detection	--	43.5	--	--	6.8	--	--
8/20/2024	Detection	0.545	46.4	17.0	0.32	6.8	78.3	270

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

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
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
3/29/2017	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
4/26/2017	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
6/16/2017	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
9/18/2023	*	0.138	2.84	47.5	< 0.007 U1	0.006 J1	0.36	0.511	1.70	0.17	0.06 J1	0.0138	< 0.002 U1	8.3	0.13 J1	0.08 J1
10/9/2023	*	0.079 J1	4.36	36.2	< 0.007 U1	0.006 J1	0.27 J1	0.352	26.46	0.28	0.13 J1	0.00598	< 0.002 U1	15.4	0.09 J1	0.03 J1
11/13/2023	*	10.1	9.66	53.0	8.70	4.73	21.3	5.66	2.66	0.38	22.8	0.0381	< 0.002 U1	34.8	36.9	5.49
12/12/2023	*	0.055 J1	4.58	27.2	< 0.007 U1	< 0.004 U1	0.25 J1	0.387	1.93	0.42	0.10 J1	0.00464	< 0.002 U1	18.6	0.07 J1	0.06 J1
2/5/2024	*	0.172	1.98	51.7	< 0.007 U1	0.011 J1	0.57	1.41	1.31	0.27	0.07 J1	0.0443	< 0.002 U1	12.3	0.11 J1	0.08 J1
3/4/2024	*	0.092 J1	3.44	37.8	< 0.007 U1	0.007 J1	0.34	0.438	1.55	0.36	0.08 J1	0.0124	< 0.002 U1	14.3	< 0.04 U1	0.08 J1
4/15/2024	*/Closure	0.070 J1	0.90	42.1	< 0.007 U1	0.009 J1	0.31	0.501	1.01	0.20	< 0.05 U1	0.0209	< 0.002 U1	5.4	0.04 J1	0.17 J1
8/20/2024	Closure	0.065 J1	4.24	33.2	< 0.007 U1	0.005 J1	0.35	0.509	2.61	0.32	0.09 J1	0.00448	< 0.002 U1	14.2	0.06 J1	0.09 J1

Table 1. Groundwater Data Summary
Flint Creek - PBAP

Notes:
1. Combined radium values were calculated from the sum of the reported radium-226 and radium-228 results.
Radium data quality flags were not included. Reported negative radium-226 or radium-228 results were replaced with zero.
2. AP-58 was found irreparably damaged during the September 2022 event and was replaced by AP-58A.
--: Not analyzed
*: Sample was collected for Appendix IV constituents to update the background dataset prior to closure determination under 40 CFR 257.102(c).
<: 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.
H2: Sample analysis performed past holding time.
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.
mg/L: milligrams per liter
P1: The precision between duplicate results was above acceptance limits.
pCi/L: picocuries per liter
SU: standard unit
µg/L: micrograms per liter

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

			2024-02[5]		**2024-03**		**2024-04**		**2024-08**		**2024-08[5]**		**2024-11[5]**	
CCR Management Unit	Monitoring Well	Well Diameter (inches)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	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	88	0.7	74	0.8	81	0.8	81	0.8	NC	NC	77	0.8
	AP-53 [1]	2.0	346	0.2	375	0.2	315	0.2	338	0.2	NC	NC	323	0.2
	AP-54 [1]	2.0	390	0.2	429	0.1	462	0.1	495	0.1	NC	NC	544	0.1
	AP-58A [2],[4]	2.0	275	0.2	278	0.2	284	0.2	321	0.2	324	0.2	308	0.2
	AP-59 [2]	2.0	511	0.1	508	0.1	498	0.1	568	0.1	568	0.1	605	0.1
	AP-60 [2],[3]	2.0	267	0.2	267	0.2	260	0.2	271	0.2	259	0.2	276	0.2

Notes:
[1] - Background Well
[2] - Downgradient Well
[3] - AP-52 was replaced with AP-60 in December 2016
[4] - AP-58 was found damaged in September 2022 and replaced with AP-58A in December 2022
[5] - Only select wells were gauged as part of two-of-two verification sampling
NC - No calculation was performed

Legend

⯐	Monitoring Wells
—	Groundwater Contour Elevation
→	Groundwater Flow Direction

Notes
- Monitoring well coordinates and water level data were collected March 4, 2024, provided by AEP.
- AP-58 was irreparably damaged and was replaced by well AP-58A.
- 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.
- Well locations resurveyed on February 2 and 3, 2023 (Datum: AR SP North NAD27).
- Aerial basemap provided by ESRI, dated April 23, 2023.

200 100 0 200 Feet

Potentiometric Surface Map
Uppermost Aquifer - March 2024

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

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Columbus, Ohio

2024/05/07

Figure
1

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Legend

⊕ Monitoring Wells

— Groundwater Contour Elevation

→ Groundwater Flow Direction

- - Groundwater Contour Elevation (Inferred)

Notes
1. Monitoring well coordinates and water level data were collected April 15, 2024, provided by AEP.
2. AP-58 was irreparably damaged and was replaced by well AP-58A.
3. Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2017) provided by AEP.
4. Groundwater elevation units are feet above mean sea level (ft amsl).
5. Well locations resurveyed on February 2 and 3, 2023 (Datum: AR SP North NAD27, NGVD29).
6. Aerial basemap provided by ESRI, dated April 23, 2023.

250 125 0 250 Feet

Potentiometric Surface Map
Uppermost Aquifer - April 2024

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

Geosyntec
consultants

Columbus, Ohio

2024/07/22

Figure
2

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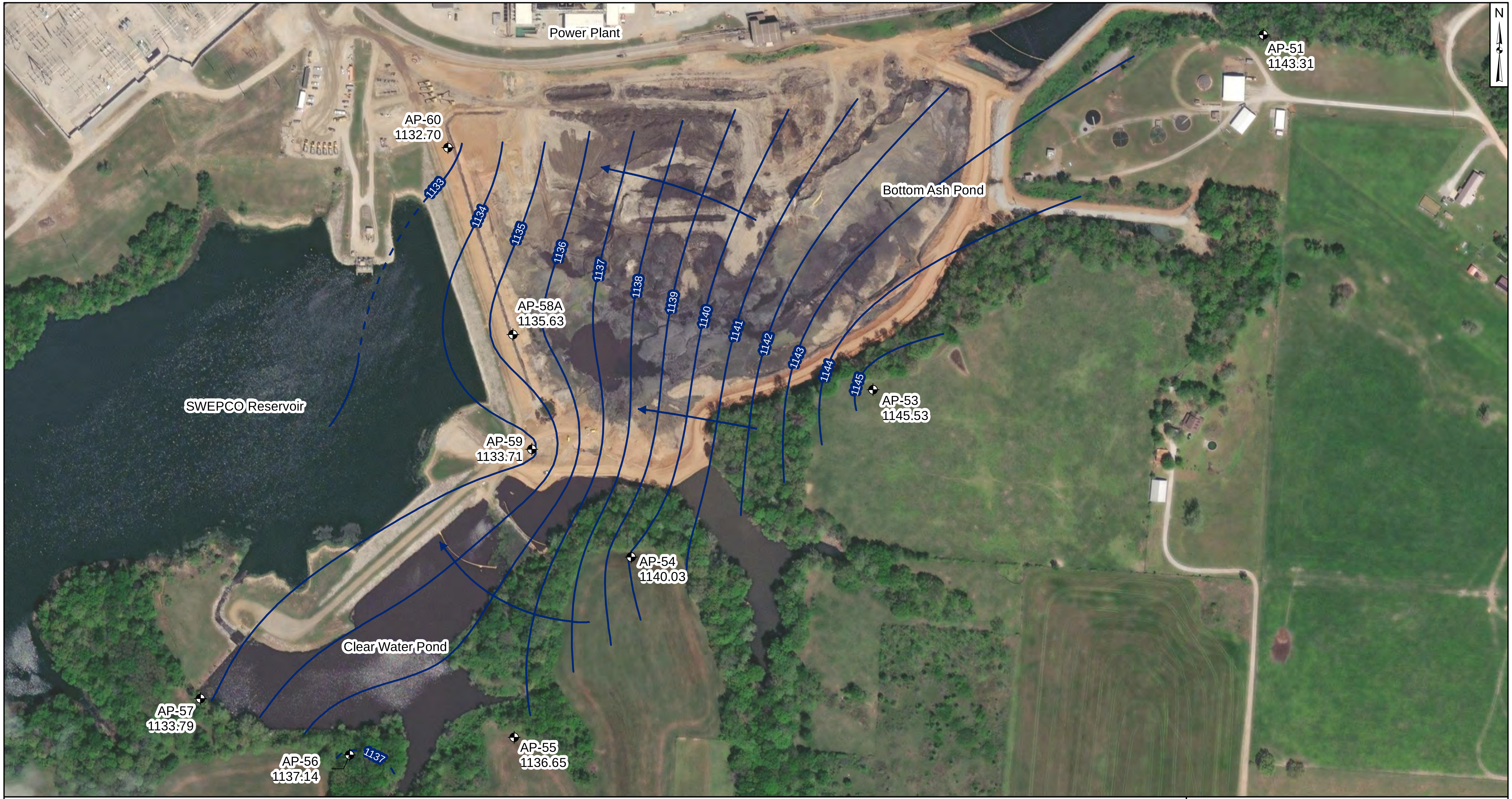

Legend

⊕ Monitoring Wells

— Groundwater Contour Elevation

→ Groundwater Flow Direction

- - - Groundwater Contour Elevation (Inferred)

Notes

1. Monitoring well coordinates and water level data were collected August19 and 20, 2024, provided by AEP.
2. AP-58 was irreparably damaged and was replaced by well AP-58A.
3. Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2017) provided by AEP.
4. Groundwater elevation units are feet above mean sea level (ft amsl).
5. Well locations resurveyed on February 2 and 3, 2023 (Datum: AR SP North NAD27, NGVD29).
6. Aerial basemap provided by ESRI, dated April 23, 2023.

250 125 0 250 Feet

Potentiometric Surface Map
Uppermost Aquifer - August 2024

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

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Columbus, Ohio

2024/11/06

Figure

3

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APPENDIX 2 - Statistical Analyses

The following statistical analysis reports, all completed in 2024, are included in this appendix:

- The January 5, 2024 memorandum summarizing the results of statistical evaluations of the first semiannual detection monitoring event of 2023;
- The April 2, 2024 memorandum summarizing the results of statistical evaluations of the second semiannual detection monitoring event of 2023;
- The November 20, 2024 memorandum summarizing the results of statistical evaluations of the first semiannual detection monitoring event of 2024;
- The December 24, 2024 memorandum summarizing the results of statistical evaluations of the second semiannual detection monitoring event of 2024;
- The January 27, 2025 memorandum (revision 1) summarizing the results of statistical evaluations of the first Appendix IV sampling event to determine suitability for closure of the CCR unit;
- The December 19, 2024 memorandum summarizing the results of statistical evaluations of the second Appendix IV sampling event to determine suitability for closure of the CCR unit.

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Memorandum

Date: January 4, 2024

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 United States Environmental Protection Agency (USEPA) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257 Subpart D, "CCR rule"), the first semiannual detection monitoring event of 2023 at the Primary Bottom Ash Pond (PBAP), an existing CCR unit at the Flint Creek Power Plant in Gentry, Arkansas, was completed on March 7, 2023. Based on these results, verification sampling was completed on September 18, 2023.

Background values for the PBAP were previously calculated in January 2018 and March 2020. 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 January 10, 2022.

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 below.

- Boron concentrations exceeded the intrawell UPL of 0.276 mg/L in both the initial (1.27 mg/L) and second (1.03 mg/L) samples collected at AP-58A. Therefore, an SSI over background is concluded for boron at AP-58A.

- Chloride concentrations exceeded the intrawell UPL of 10.2 mg/L in both the initial (23.4 mg/L) and second (26.2 mg/L) samples collected at AP-58A. Therefore, an SSI over background is concluded for chloride at AP-58A.

- Sulfate concentrations exceeded the intrawell UPL of 90.3 mg/L in both the initial (152 mg/L) and second (144 mg/L) samples collected at AP-58A and exceeded the intrawell UPL of 50.1 mg/L in both the initial (78.7 mg/L) and second (69.6 mg/L) samples collected at AP-59. Therefore, SSIs over background are concluded for sulfate at AP-58A and AP-59.

- Total dissolved solids (TDS) concentrations exceeded the intrawell UPL of 333 mg/L in both the initial (400 mg/L) and second (400 mg/L) samples collected at AP-58A and exceeded the intrawell UPL of 266 mg/L in both the initial (280 mg/L) and second (300 mg/L) samples collected at AP-59. Therefore, SSIs over background are concluded for TDS at AP-58A and AP-59.

In response to the exceedances noted, above, the Flint Creek PBAP CCR unit will either transition to assessment monitoring or an alternative source demonstration (ASD) for boron, chloride, sulfate, and TDS 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 Evaluation
Detection Summary Memorandum
Flint Creek, Primary Bottom Ash Pond

Analyte	Unit	Description	AP-58A		AP-59		AP-60
			3/7/2023	9/18/2023	3/7/2023	9/18/2023	3/7/2023
Boron	mg/L	Intrawell Background Value (UPL)	0.276		0.368		1.68
		Analytical Result	**1.27**	**1.03**	0.368	--	0.870
Calcium	mg/L	Intrawell Background Value (UPL)	86.8		53.9		49.9
		Analytical Result	16.7	--	46.5	--	8.43
Chloride	mg/L	Intrawell Background Value (UPL)	10.2		18.0		17.4
		Analytical Result	**23.4**	**26.2**	17.7	--	6.82
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00		0.765		0.681
		Analytical Result	0.58	--	0.47	--	0.17
pH	SU	Intrawell Background Value (UPL)	8.7		7.6		10.8
		Intrawell Background Value (LPL)	6.2		6.7		6.5
		Analytical Result	**8.95**	7.62	7.0	--	9.1
Sulfate	mg/L	Intrawell Background Value (UPL)	90.3		50.1		190
		Analytical Result	**152**	**144**	**78.7**	**69.6**	56.8
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	333		266		397
		Analytical Result	**400**	**400**	**280**	**300**	280

Notes:

1. Bold values exceed the background value.

2. Background values are shaded gray.

--: Not measured

LPL: lower prediction limit

mg/L: milligrams per liter

SU: standard units

UPL: upper prediction limit

ATTACHMENT A

Certification by a Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the January 10, 2022 *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
No. 15296

David Anthony Miller
Printed Name of Licensed Professional Engineer

David Anthony Miller
Signature

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Arkansas
Licensing State

01.05.2024
Date

Geosyntec consultants

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Memorandum

Date: March 31, 2024

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 United States Environmental Protection Agency (USEPA) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257 Subpart D, "CCR rule"), the second semiannual detection monitoring event of 2023 at the Primary Bottom Ash Pond (PBAP), an existing CCR unit at the Flint Creek Power Plant in Gentry, Arkansas, was completed on September 18-19, 2023. Based on these results, verification sampling was completed on December 27, 2023.

Background values for the PBAP were previously calculated in January 2018 and March 2020. 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 January 10, 2022.

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 below.

- Boron concentrations exceeded the intrawell UPL of 0.276 mg/L in both the initial (1.03 mg/L) and second (0.65 mg/L) samples collected at AP-58A. Therefore, an SSI over background is concluded for boron at AP-58A.

- Chloride concentrations exceeded the intrawell UPL of 10.2 mg/L in both the initial (26.7 mg/L) and second (20.3 mg/L) samples collected at AP-58A. Therefore, an SSI over background is concluded for chloride at AP-58A.

- Sulfate concentrations exceeded the intrawell UPL of 50.1 mg/L in both the initial (68.3 mg/L) and second (55.1 mg/L) samples collected at AP-59. Therefore, an SSI over background is concluded for sulfate at AP-59.

- Total dissolved solids (TDS) concentrations exceeded the intrawell UPL of 266 mg/L in both the initial (290 mg/L) and second (270 mg/L) samples collected at AP-59. Therefore, an SSI over background is concluded for TDS at AP-59.

In response to the exceedances noted, above, the Flint Creek PBAP CCR unit will either transition to assessment monitoring or an alternative source demonstration (ASD) for boron, chloride, sulfate, and TDS 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

Analyte	Unit	Description	AP-58A		AP-59		AP-60
			9/19/2023	12/27/2023	9/19/2023	12/27/2023	9/18/2023
Boron	mg/L	Intrawell Background Value (UPL)	0.276		0.368		1.68
		Analytical Result	**1.03**	**0.65**	0.301	--	0.697
Calcium	mg/L	Intrawell Background Value (UPL)	86.8		53.9		49.9
		Analytical Result	22.6	--	51.6	--	40.6
Chloride	mg/L	Intrawell Background Value (UPL)	10.2		18.0		17.4
		Analytical Result	**26.7**	**20.3**	14.6	--	11.0
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00		0.765		0.681
		Analytical Result	0.54	--	0.42	--	0.17
pH	SU	Intrawell Background Value (UPL)	8.7		7.6		10.8
		Intrawell Background Value (LPL)	6.2		6.7		6.5
		Analytical Result	7.6	--	7.1	--	7.9
Sulfate	mg/L	Intrawell Background Value (UPL)	90.3		50.1		190
		Analytical Result	**146**	83	**68.3**	**55.1**	63.7
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	333		266		397
		Analytical Result	**370**	300	**290**	**270**	260

Notes:

1. Bold values exceed the background value.

2. Background values are shaded gray.

--: not measured

LPL: lower prediction limit

mg/L: milligrams per liter

SU: standard units

UPL: upper prediction limit

ATTACHMENT A

Certification by a Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the January 10, 2022 *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
No. 15296

David Anthony Miller
Printed Name of Licensed Professional Engineer

David Anthony Miller
Signature

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Licensing State

04.02.2024
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Memorandum

Date: November 14, 2024

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 United States Environmental Protection Agency (USEPA) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257 Subpart D, "CCR rule"), the first semiannual detection monitoring event of 2024 at the Primary Bottom Ash Pond (PBAP), an existing CCR unit at the Flint Creek Power Plant in Gentry, Arkansas, was completed on April 15, 2024. Based on these results, verification sampling was completed on August 19, 2024.

Background values for the PBAP were previously calculated in January 2018 and March 2020 and are periodically updated as sufficient data becomes available. After a minimum of four additional detection monitoring events, the results of those events were compared to the existing background and the dataset was updated as appropriate. Revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the most recent calculation of the revised background values are described in Geosyntec's *Statistical Analysis Summary* report, dated January 10, 2022.

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 below.

- Boron concentrations exceeded the intrawell UPL of 0.276 mg/L in both the initial (0.623 mg/L) and second (0.566 mg/L) samples collected at AP-58A. Therefore, an SSI over background is concluded for boron at AP-58A.

- Chloride concentrations exceeded the intrawell UPL of 10.2 mg/L in both the initial (21.2 mg/L) and second (20.8 mg/L) samples collected at AP-58A. Therefore, an SSI over background is concluded for chloride at AP-58A.

- pH values were below the intrawell LPL of 6.7 SU in both the initial (6.5 SU) and second (6.2 SU) samples collected at AP-59. Therefore, an SSI is concluded for pH at AP-59.

In response to the exceedances noted, above, the Flint Creek PBAP CCR unit will either transition to assessment monitoring or an alternative source demonstration (ASD) for boron, chloride, and pH 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
Detection Summary Memorandum
Flint Creek Plant – Primary Bottom Ash Pond

Analyte	Unit	Description	AP-58A		AP-59		AP-60	
			4/15/2024	8/19/2024	4/15/2024	8/19/2024	4/15/2024	8/19/2024
Boron	mg/L	Intrawell Background Value (UPL)	0.276		0.368		1.68	
		Analytical Result	**0.623**	**0.566**	0.220	--	0.345	--
Calcium	mg/L	Intrawell Background Value (UPL)	86.8		53.9		49.9	
		Analytical Result	19.0	--	47.5	--	**55.0**	43.5
Chloride	mg/L	Intrawell Background Value (UPL)	10.2		18.0		17.4	
		Analytical Result	**21.2**	**20.8**	**18.3**	18.0	12.0	--
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00		0.765		0.681	
		Analytical Result	0.450	--	0.40	--	0.20	--
pH	SU	Intrawell Background Value (UPL)	8.7		7.6		10.8	
		Intrawell Background Value (LPL)	6.2		6.7		6.5	
		Analytical Result	7.0	--	**6.5**	**6.2**	7.1	--
Sulfate	mg/L	Intrawell Background Value (UPL)	90.3		50.1		190	
		Analytical Result	82.6	--	**50.5**	30.5	93.3	--
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	333		266		397	
		Analytical Result	290	--	240	--	320	--

Notes:

1. Bold values exceed the background value.

2. Background values are shaded gray.

--: not measured

LPL: lower prediction limit

UPL: upper prediction limit

ATTACHMENT A

Certification by a Qualified Professional Engineer

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I certify that the selected statistical method, described above and in the January 10, 2022 *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
No. 15296

David Anthony Miller
Printed Name of Licensed Professional Engineer

David Anthony Miller
Signature

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Licensing State

11.20.2024
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Memorandum

Date: December 24, 2024

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 United States Environmental Protection Agency (USEPA) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257 Subpart D, "CCR rule"), the second semiannual detection monitoring event of 2024 at the Primary Bottom Ash Pond (PBAP), an existing CCR unit at the Flint Creek Power Plant in Gentry, Arkansas, was completed on August 20, 2024. Based on these results, verification sampling was completed on November 19, 2024.

Background values for the PBAP were previously calculated in January 2018 and March 2020 and are periodically updated as sufficient data becomes available. After a minimum of four additional detection monitoring events, the results of those events were compared to the existing background and the dataset was updated as appropriate. Revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the most recent calculation of the revised background values are described in Geosyntec's *Statistical Analysis Summary* report, dated January 10, 2022.

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 below.

- Boron concentrations exceeded the intrawell UPL of 0.276 mg/L in both the initial (0.579 mg/L) and second (0.592 mg/L) samples collected at AP-58A. Therefore, an SSI over background is concluded for boron at AP-58A.

- Chloride concentrations exceeded the intrawell UPL of 10.2 mg/L in both the initial (20.4 mg/L) and second (21.0 mg/L) samples collected at AP-58A. Therefore, an SSI over background is concluded for chloride at AP-58A.

In response to the exceedances noted, above, the Flint Creek PBAP CCR unit will either transition to assessment monitoring or an alternative source demonstration (ASD) for boron and chloride 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

Analyte	Unit	Description	AP-58A		AP-59		AP-60
			8/20/2024	11/19/2024	8/20/2024	11/19/2024	8/20/2024
Boron	mg/L	Intrawell Background Value (UPL)	0.276		0.368		1.68
		Analytical Result	**0.579**	**0.592**	0.300	--	0.545
Calcium	mg/L	Intrawell Background Value (UPL)	86.8		53.9		49.9
		Analytical Result	19.1	--	44.4	--	46.4
Chloride	mg/L	Intrawell Background Value (UPL)	10.2		18.0		17.4
		Analytical Result	**20.4**	**21.0**	17.9	--	17.0
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00		0.765		0.681
		Analytical Result	0.42	--	0.41	--	0.32
pH	SU	Intrawell Background Value (UPL)	8.7		7.6		10.8
		Intrawell Background Value (LPL)	6.2		6.7		6.5
		Analytical Result	7.1	--	**6.2**	6.9	6.8
Sulfate	mg/L	Intrawell Background Value (UPL)	90.3		50.1		190
		Analytical Result	59.8	--	30.0	--	78.3
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	333		266		397
		Analytical Result	270	--	230	--	270

Notes:

1. Bold values exceed the background value.

2. Background values are shaded gray.

--: not measured

LPL: lower prediction limit

mg/L: milligrams per liter

SU: standard units

UPL: upper prediction limit

ATTACHMENT A

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CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the January 10, 2022 *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

LICENSED PROFESSIONAL ENGINEER
No. 15296
DAVID ANTHONY MILLER

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License Number

Arkansas
Licensing State

12.24.2024
Date

Geosyntec consultants

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www.geosyntec.com

January 24, 2025

Bill Smith
American Electric Power
wrsmith@aep.com

Subject: **Flint Creek Primary Bottom Ash Storage Pond Statistical Analysis Summary Report Revisions**

Dear Mr. Smith:

Geosyntec Consultants, Inc. (Geosyntec) previously prepared the *Statistical Analysis Summary – Appendix IV Analyses* report for the Flint Creek Plant Primary Bottom Ash Pond on behalf of American Electric Power (AEP), which was certified on October 17, 2024. The purpose of this report was to identify where any concentrations of Appendix IV constituents statistically exceeded the site-specific groundwater protection standards in accordance with 40 CFR 257 Subpart D (the "CCR Rule").

Following certification, it was noted that the certification page provided in Attachment A incorrectly referenced 40 CFR 257.102(c) instead of 40 CFR 257.95(f) and 40 CFR 257.95(g). It was also noted that an incorrect value of 0.004 milligrams per liter (mg/L) was used as the site-specific groundwater protection standard (GWPS) for lithium. Per 40 CFR 257.95(h)(2)(iii), the correct rule-specified GWPS for lithium should be 0.040 mg/L when higher than the calculated background concentration. The statistical outcome documented in the report is unchanged, as no exceedances of the site-specific GWPS for lithium were observed when using the incorrect, lower value for lithium or the corrected value of 0.040 mg/L.

A revised report which includes an updated certification page in Attachment A is provided with this letter. Table 2 of the report and Appendices E and F of Attachment B were revised to reflect the correct GWPS for lithium. A record of revisions is provided as Attachment C of the revised report.

Sincerely,

Allison Kreinberg
Project Manager

Geosyntec consultants

engineers | scientists | innovators

AMERICAN ELECTRIC POWER

STATISTICAL ANALYSIS SUMMARY APPENDIX IV ANALYSES – REVISION1

PRIMARY BOTTOM ASH POND

Flint Creek Plant

Gentry, Arkansas

Prepared for

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

Prepared by

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

Project Number: CHA8500B

Rev. 0. October 2024
Rev. 1. January 2025

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LIST OF ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
CCR	coal combustion residual
CFR	Code of Federal Regulations
GWPS	groundwater protection standard
PBAP	Primary Bottom Ash Pond
QA/QC	quality assurance/quality control
SSL	statistically significant level

1. EXECUTIVE SUMMARY

Groundwater monitoring has been conducted at the Primary Bottom Ash Pond (PBAP), an existing coal combustions residuals (CCR) unit at the Flint Creek Power Plant in Gentry, Arkansas, in accordance with United States Environmental Protection Agency regulations regarding the disposal of CCR in landfills and surface impoundments (Code of Federal Regulations [CFR] Title 40, Section 257, Subpart D). In accordance with 40 CFR 257.102, regarding the closure of CCR units by removal, recent groundwater monitoring results were used to identify whether any concentrations of Appendix IV constituents statistically exceed the site-specific groundwater protection standards (GWPSs).

Closure of the PBAP was initiated in November 2022, and removal of CCR materials was completed in August 2023 (American Electric Power [AEP] 2024). Groundwater samples were collected between September 2023 and April 2024 for the Appendix IV constituents to support an evaluation of whether closure by removal is complete. Before the statistical analyses were conducted, the groundwater data underwent several validation tests, including those for completeness, sample tracking accuracy, transcription errors, and consistent use of measurement units. No data quality issues that would impact data usability were identified.

The monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. GWPSs were established for the Appendix IV parameters. Confidence intervals were calculated for Appendix IV constituent data at the compliance wells to assess whether any were present at statistically significant levels (SSLs) above the corresponding GWPS. No SSLs were identified. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

2. PRIMARY BOTTOM ASH POND EVALUATION

2.1 Data Validation and QA/QC

Seven background and detection monitoring events were conducted between September 2023 and April 2024. Samples were collected from each background and compliance well and analyzed for all Appendix III and Appendix IV parameters. A summary of data used in statistical analyses may be found in Table 1.

Chemical analysis was completed by a National Environmental Laboratory Accreditation Program-certified analytical laboratory. The laboratory completed analysis of quality assurance and quality control (QA/QC) samples such as laboratory reagent blanks, continuing calibration verification samples, and laboratory fortified blanks.

The analytical data were imported into a Microsoft Access database, where checks were completed to assess the accuracy of sample location identification and analyte identification. Where necessary, unit conversions were applied to standardize reported units across all sampling events. Exported data files were created for use with the Sanitas™ v.10.0.20 statistics software. The export file was checked against the analytical data for transcription errors and completeness.

2.2 Statistical Analysis

Statistical analyses for the PBAP were conducted in accordance with the October 2020 Statistical Analysis Plan (Geosyntec 2020). Time series plots and results for all completed statistical tests are provided in Attachment B. The data collected from September 2023 through April 2024 were screened for potential outliers. Outliers were identified for combined radium and lead at various wells. Values below their respective maximum contaminant level were not flagged. The following outliers were flagged and removed from the background dataset:

- Combined radium at AP-51 (10/10/2023) and at AP-53 (10/9/2023).

The radium-226 value at AP-53 during the October 9, 2023 sample was flagged P1: the precision between duplicate results was above acceptance limits. Removal of these anomalously high values resulted in the calculation of background values with more stable datasets.

2.2.1 Establishment of GWPSs

A GWPS was established for each Appendix IV parameter in accordance with 40 CFR 257.95(h) and the Statistical Analysis Plan (Geosyntec 2020). The established GWPS was set to whichever was greater of the background concentration and the maximum contaminant level for each Appendix IV parameter. To determine background concentrations, an upper tolerance limit was calculated using data that were pooled from the background wells and collected during the background monitoring and assessment monitoring events. Tolerance limits were calculated parametrically with 95% coverage and 95% confidence for arsenic, cadmium, chromium, cobalt, fluoride, selenium, and thallium. Nonparametric tolerance limits were calculated for antimony, barium, beryllium, combined radium, lithium, and mercury, due to apparent nonnormal distributions, and for lead and molybdenum, due to a high nondetect frequency. Upper tolerance limits and the final GWPSs are summarized in Table 2.

2.2.2 Evaluation of Potential Appendix IV SSLs

A confidence interval was constructed for each Appendix IV parameter at each compliance well using data collected from September 2023 through April 2024. Confidence limits were generally calculated parametrically ($\alpha = 0.01$), but nonparametric confidence limits were calculated in some cases (e.g., when the data did not appear to be normally distributed or when the nondetect frequency was too high). An SSL was concluded if the lower confidence limit was above the GWPS (i.e., if the entire confidence interval was above the GWPS). The calculated confidence limits (Attachment B) were compared to the GWPS provided in Table 2.

No SSLs were identified at the Flint Creek PBAP.

2.3 Conclusions

Groundwater monitoring and statistical analyses of Appendix IV parameters were conducted in accordance with the CCR Rule to support an evaluation of closure progress. The laboratory and field data were reviewed prior to statistical analysis, with no QA/QC issues identified that prevented data usage. A review of outliers identified potential outliers in the data collected from September 2023 through April 2024. Two outliers were flagged and removed from the background dataset. GWPSs were established for Appendix IV parameters. A confidence interval was constructed at each compliance well for each Appendix IV parameter; SSLs were concluded if the entire confidence interval was above the GWPS. No SSLs were identified.

3. REFERENCES

AEP. 2024. *Annual Groundwater Monitoring Report – Flint Creek Power Plant, Primary Bottom Ash Pond CCR Management Unit, Gentry, Arkansas.* American Electric Power. January.

Geosyntec. 2020. *Statistical Analysis Plan – Flint Creek Plant.* Geosyntec Consultants, Inc. October.

Geosyntec. 2024. Statistical Analysis Summary – Appendix IV Analyses. Primary Bottom Ash Pond. Flint Creek Plant. Gentry, Arkansas. October.[1]

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[1] This report is a revised version of the referenced document. A record of revisions is provided in **Attachment C**.

TABLES

Table 1. Groundwater Data Summary
Statistical Analysis Summary
Flint Creek Plant – Primary Bottom Ash Pond

Parameter	Unit	AP-51							AP-53						
		Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance
		9/19/2023	10/10/2023	11/14/2023	12/13/2023	2/6/2024	3/5/2024	4/16/2024	9/19/2023	10/9/2023	11/13/2023	12/12/2023	2/5/2024	3/5/2024	4/15/2024
Antimony	µg/L	0.036 J1	0.011 J1	0.1 U1	0.017 J1	0.1 U1	0.01 J1	0.1 U1	0.012 J1	0.014 J1	0.015 J1	0.014 J1	0.013 J1	0.012 J1	0.014 J1
Arsenic	µg/L	0.58	0.18	0.20	0.22	0.07 J1	0.14	0.14	0.40	0.57	0.52	0.35	0.29	0.28	0.45
Barium	µg/L	118	115	123	114	119	123	123	114	109	93.2	80.1	83.1	85.3	83.2
Beryllium	µg/L	0.373	0.326	0.347	0.347	0.320	0.37	0.368	0.082	0.064	0.051	0.036 J1	0.045 J1	0.049 J1	0.048 J1
Cadmium	µg/L	0.057	0.055	0.061	0.066	0.069	0.068	0.064	0.045	0.034	0.027	0.015 J1	0.019 J1	0.02	0.027
Chromium	µg/L	1.47	1.02	0.57	0.87	0.66	0.45	0.47	0.83	0.59	0.33	0.34	0.38	0.32	0.35
Cobalt	µg/L	6.62	1.58	1.55	2.79	0.969	1.69	0.930	0.633	0.701	2.03	1.84	1.17	1.01	1.28
Combined Radium	pCi/L	1.52	14.16	1.56	3.16	1.24	1.74	1.86	1.38	14.86	2.48	2.28	1.59	1.07	1.08
Fluoride	mg/L	0.04 J1	0.04 J1	0.04 J1	0.03 J1	0.04 J1	0.04 J1	0.04 J1	0.07	0.08	0.11	0.12	0.13	0.13	0.15
Lead	µg/L	0.96	0.13 J1	0.13 J1	0.30	0.2 U1	0.22	0.09 J1	0.2 U1	0.2 U1	0.2 U1	0.2 U1	0.2 U1	0.2 U1	0.2 U1
Lithium	mg/L	0.00248	0.00197	0.00217	0.00202	0.00198	0.00202	0.00204	0.00058	0.00050	0.00045	0.00032	0.00033	0.00029 J1	0.00025 J1
Mercury	µg/L	0.183	0.068	0.013	0.004 J1	0.006	0.019	0.005 U1	0.013	0.013	0.010	0.010	0.005	0.005	0.009
Molybdenum	µg/L	0.1 J1	0.5 U1	0.5 U1	0.5 U1	0.5 U1	0.5 U1	0.5 U1	0.5 U1	0.5 U1	0.5 U1	0.1 J1	0.1 J1	0.1 J1	0.2 J1
Selenium	µg/L	1.24	0.62	0.95	0.53	0.24 J1	0.36 J1	0.33 J1	2.67	2.95	2.61	1.12	0.86	1.04	1.09
Thallium	µg/L	0.07 J1	0.05 J1	0.06 J1	0.08 J1	0.05 J1	0.05 J1	0.05 J1	0.08 J1	0.08 J1	0.09 J1	0.09 J1	0.07 J1	0.07 J1	0.08 J1

Parameter	Unit	AP-54							AP-58A						
		Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance
		9/19/2023	10/9/2023	11/13/2023	12/12/2023	2/5/2024	3/5/2024	4/15/2024	9/19/2023	10/9/2023	11/13/2023	12/12/2023	2/5/2024	3/4/2024	4/15/2024
Antimony	µg/L	0.009 J1	0.008 J1	0.011 J1	0.021 J1	0.010 J1	0.013 J1	0.011 J1	0.416	0.261	0.195	0.162	0.143	0.1	0.090 J1
Arsenic	µg/L	0.28	0.33	0.47	0.24	0.26	0.28	0.34	9.01	8.87	8.94	8.18	8.13	7.04	6.22
Barium	µg/L	39.5	41.2	44.6	39.9	42.2	45.7	41.0	28.1	25.8	25.9	24.9	27.7	26.1	27.6
Beryllium	µg/L	0.043 J1	0.025 J1	0.028 J1	0.243	0.020 J1	0.022 J1	0.021 J1	0.008 J1	0.05 U1	0.05 U1	0.05 U1	0.05 U1	0.05 U1	0.05 U1
Cadmium	µg/L	0.092	0.015 J1	0.010 J1	0.008 J1	0.010 J1	0.035	0.011 J1	0.013 J1	0.013 J1	0.005 J1	0.006 J1	0.012 J1	0.01 J1	0.014 J1
Chromium	µg/L	0.76	0.50	0.76	0.62	0.56	0.59	0.42	0.58	0.38	0.31	0.33	0.35	0.27 J1	0.35
Cobalt	µg/L	4.42	5.32	1.80	1.61	1.82	2.5	3.20	0.304	0.241	0.251	0.234	0.216	0.164	0.168
Combined Radium	pCi/L	1.3	4.68	1.59	2.4	1.32	1.32	1.13	0.6	20.75	0.58	1.65	1.55	0.35	0.46
Fluoride	mg/L	0.06	0.07	0.08	0.06	0.08	0.08	0.08	0.54	0.52	0.50	0.48	0.47	0.47	0.45
Lead	µg/L	0.11 J1	0.2 U1	0.05 J1	0.63	0.2 U1	0.08 J1	0.2 U1	0.18 J1	0.11 J1	0.09 J1	0.07 J1	0.10 J1	0.06 J1	0.06 J1
Lithium	mg/L	0.00020 J1	0.00018 J1	0.00017 J1	0.00021 J1	0.00013 J1	0.00013 J1	0.00013 J1	0.00537	0.00447	0.00497	0.00478	0.00403	0.0035	0.00324
Mercury	µg/L	0.004 J1	0.004 J1	0.003 J1	0.003 J1	0.002 J1	0.003 J1	0.005 U1	0.006	0.006	0.005	0.003 J1	0.003 J1	0.003 J1	0.005 U1
Molybdenum	µg/L	0.5 U1	0.5 U1	0.5 U1	0.7	0.5 U1	0.5 U1	0.5 U1	36.1	26.9	23.9	20.8	21.0	16.9	16.7
Selenium	µg/L	1.04	1.39	2.32	0.92	0.87	0.84	0.93	0.21 J1	0.15 J1	0.12 J1	0.13 J1	0.23 J1	0.1 J1	0.15 J1
Thallium	µg/L	0.02 J1	0.02 J1	0.06 J1	0.07 J1	0.07 J1	0.07 J1	0.06 J1	0.2 U1	0.2 U1	0.2 U1	0.2 U1	0.2 U1	0.2 U1	0.2 U1

Table 1. Groundwater Data Summary
Statistical Analysis Summary
Flint Creek Plant – Primary Bottom Ash Pond

Parameter	Unit	AP-59							AP-60						
		Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance
		9/19/2023	10/9/2023	11/13/2023	12/12/2023	2/5/2024	3/4/2024	4/15/2024	9/18/2023	10/9/2023	11/13/2023	12/12/2023	2/5/2024	3/4/2024	4/15/2024
Antimony	µg/L	0.029 J1	0.025 J1	0.031 J1	0.024 J1	0.027 J1	0.022 J1	0.020 J1	0.138	0.079 J1	10.1	0.055 J1	0.172	0.092 J1	0.070 J1
Arsenic	µg/L	3.40	2.97	2.90	2.54	2.37	2.11	1.96	2.84	4.36	9.66	4.58	1.98	3.44	0.90
Barium	µg/L	78.1	74.0	64.3	56.0	58.2	60.4	57.2	47.5	36.2	53.0	27.2	51.7	37.8	42.1
Beryllium	µg/L	0.008 J1	0.05 U1	0.009 J1	0.05 U1	0.05 U1	0.05 U1	0.05 U1	0.05 U1	0.05 U1	8.70	0.05 U1	0.05 U1	0.05 U1	0.05 U1
Cadmium	µg/L	0.028	0.011 J1	0.017 J1	0.01 J1	0.020	0.027	0.013 J1	0.006 J1	0.006 J1	4.73	0.02 U1	0.011 J1	0.007 J1	0.009 J1
Chromium	µg/L	0.38	0.26 J1	0.41	0.32	0.23 J1	0.39	0.30	0.36	0.27 J1	21.3	0.25 J1	0.57	0.34	0.31
Cobalt	µg/L	2.52	2.33	2.22	1.70	1.67	1.54	1.48	0.511	0.352	5.66	0.387	1.41	0.438	0.501
Combined Radium	pCi/L	1.68	27.8	2.11	2.23	0.72	1.42	0.6	1.7	26.46	2.66	1.93	1.31	1.55	1.01
Fluoride	mg/L	0.42	0.42	0.47	0.45	0.42	0.40	0.40	0.17	0.28	0.38	0.42	0.27	0.36	0.20
Lead	µg/L	0.19 J1	0.16 J1	0.28	0.11 J1	0.13 J1	0.07 J1	0.06 J1	0.06 J1	0.13 J1	22.8	0.10 J1	0.07 J1	0.08 J1	0.2 U1
Lithium	mg/L	0.00027 J1	0.00027 J1	0.00028 J1	0.00024 J1	0.00022 J1	0.0002 J1	0.00020 J1	0.0138	0.00598	0.0381	0.00464	0.0443	0.0124	0.0209
Mercury	µg/L	0.005 U1	0.005 U1	0.005 U1	0.005 U1	0.005 U1	0.005 U1	0.005 U1	0.005 U1	0.005 U1	0.005 U1	0.005 U1	0.005 U1	0.005 U1	0.005 U1
Molybdenum	µg/L	5.1	5.0	5.9	5.6	5.9	4.7	4.7	8.3	15.4	34.8	18.6	12.3	14.3	5.4
Selenium	µg/L	0.05 J1	0.10 J1	0.12 J1	0.5 U1	0.07 J1	0.06 J1	0.06 J1	0.13 J1	0.09 J1	36.9	0.07 J1	0.11 J1	0.5 U1	0.04 J1
Thallium	µg/L	0.14 J1	0.15 J1	0.15 J1	0.13 J1	0.13 J1	0.11 J1	0.10 J1	0.08 J1	0.03 J1	5.49	0.06 J1	0.08 J1	0.08 J1	0.17 J1

Notes:
--: Not analyzed
J1: Estimated value. Parameter was detected in concentrations below the reporting limit.
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U1: Non-detect value. For statistical analysis, parameters that were not detected were replaced with the reporting limit.
µg/L: micrograms per liter

Table 2. Appendix IV Groundwater Protection Standards
Statistical Analysis Summary
Flint Creek Plant – Primary Bottom Ash Pond

Constituent Name	MCL	CCR-Rule Specified	Calculated UTL	GWPS
Antimony, Total (mg/L)	0.00600		0.0000500	0.00600
Arsenic, Total (mg/L)	0.0100		0.000651	0.0100
Barium, Total (mg/L)	2.00		0.123	2.00
Beryllium, Total (mg/L)	0.00400		0.000373	0.00400
Cadmium, Total (mg/L)	0.00500		0.0000982	0.00500
Chromium, Total (mg/L)	0.100		0.00133	0.100
Cobalt, Total (mg/L)	n/a	0.00600	0.00630	0.00630
Combined Radium, Total (pCi/L)	5.00		4.68	5.00
Fluoride, Total (mg/L)	4.00		0.159	4.00
Lead, Total (mg/L)	n/a	0.0150	0.000960	0.0150
Lithium, Total (mg/L)	n/a	0.0400	0.00248	0.0400
Mercury, Total (mg/L)	0.00200		0.000183	0.00200
Molybdenum, Total (mg/L)	n/a	0.100	0.000700	0.100
Selenium, Total (mg/L)	0.0500		0.00341	0.0500
Thallium, Total (mg/L)	0.00200		0.000109	0.00200

Notes:

1. Calculated UTL (upper tolerance limit) represents site-specific background values.
2. Grey cells indicate the GWPS is based on the calculated UTL. Either the UTL is higher than the MCL or an MCL does not exist.

GWPS: groundwater protection standard

MCL: maximum contaminant level

mg/L: milligrams per liter

n/a: not applicable

pCi/L: picocuries per liter

ATTACHMENT A

Certification by Qualified Professional Engineer

Certification by Qualified Professional Engineer

I certify that selected and above described statistical method 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 257.93(f) and 40 CFR 257.93(g) for Appendix IV constituents have been met.

DAVID ANTHONY MILLER
No. 15296

David Anthony Miller

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature

15296	Arkansas	01.27.2025
License Number	Licensing State	Date

ATTACHMENT B

Statistical Analysis Output

GROUNDWATER STATS
CONSULTING

October 16, 2024

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
500 W. Wilson Bridge Road, Ste. #250
Worthington, OH 43085

Re: Flint Creek Bottom Ash Pond (BAP)
Assessment Monitoring Summary – March & April 2024

Dear Ms. Kreinberg,

Groundwater Stats Consulting (GSC), formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the Assessment Monitoring statistical analysis of groundwater data through April 2024 at American Electric Power (AEP) Company's Flint Creek BAP. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals (CCR) from Electric Utilities (CCR Rule, 2015) as well as with the United States Environmental Protection Agency (USEPA) Unified Guidance (2009).

Sampling began at the site for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, consists of the following:

- **Upgradient wells:** AP-51, AP-53, and AP-54
- **Downgradient wells:** AP-58A, AP-59, and AP-60

Data were sent electronically, and the statistical analysis was conducted according to the Statistical Analysis Plan and original screening evaluation prepared by GSC and approved by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to GSC The statistical analysis was reviewed by Dr. Jim Loftis, Civil & Environmental Engineering professor emeritus at Colorado State University and Senior Advisor to Groundwater Stats Consulting.

The CCR program consists of the following constituents:

- **Appendix IV** (Assessment Monitoring) **–** antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, combined radium 226 + 228, fluoride, lead, lithium, mercury, molybdenum, selenium, and thallium

For all constituents, a substitution of the most recent reporting limit is used for non-detect data. Note that when there are no detections present in downgradient wells for a given constituent, statistical analyses are not required. A summary of well/constituent pairs containing 100% non-detects follows this letter.

Time series and box plots for Appendix IV parameters are provided for all wells and constituents; and are used to evaluate concentrations over the entire record (Figures A and B, respectively). Values in background which have previously been flagged as outliers may be seen in a lighter font and disconnected symbol on the graphs. Additionally, a summary of flagged values follows this letter (Figure C).

Note that AEP collected an additional seven samples following initiation/completion of closure construction activities, and these observations are evaluated in this report.

Summary of Statistical Methods – Appendix IV Parameters

Parametric tolerance limits are utilized when the screened historical data follow a normal or transformed-normal distribution. When data cannot be normalized or the majority of data are non-detects, a nonparametric test is utilized. The distribution of data is tested using the Shapiro-Wilk/Shapiro-Francia test for normality. After testing for normality and performing any adjustments as discussed below (USEPA, 2009), data are analyzed using either parametric or non-parametric tolerance limits as appropriate.

- No statistical analyses are required on wells and analytes containing 100% non-detects (USEPA Unified Guidance, 2009, Chapter 6).
- When data contain <15% non-detects, simple substitution of one-half the reporting limit is utilized in the statistical analysis. The reporting limit utilized for non-detects is the most recent practical quantification limit (PQL) as reported by the laboratory.
- When data contain between 15-50% non-detects, the Kaplan-Meier non-detect adjustment is applied to the background data for parametric limits. This technique adjusts the mean and standard deviation of the historical concentrations to account for concentrations below the reporting limit.

- Nonparametric tolerance limits are used on data containing greater than 50% non-detects.

Background Update

Background (upgradient) data sets were evaluated for Appendix IV constituents for the purpose of updating statistical limits through April 2024. Time series plots and Tukey's outlier test were used to identify potential outliers. Data were also screened for extreme trending patterns that would lead to artificially elevated statistical limits; however, reported measurements in upgradient wells appear stable over time or contained low-level detections which did not exceed the established Maximum Contaminant Limits (MCLs); therefore, trend testing was not required.

Downgradient well data through April 2024 were also screened through visual screening using time series graphs. Since the downgradient well data are used to construct confidence intervals, values that are marginally high relative to the rest of the data are retained unless there is particular justification for excluding them. High measurements are flagged only when the concentrations are distinctly different from remaining measurements within a given well. When preceding and subsequent measurements to a single high reported concentration are significantly lower and similar, the assumption is that the increase in a single measurement is spurious and not representative of the true population of groundwater quality. Flagging those measurements as outliers reduces the variance which reduces the width of parametric confidence intervals, as well as reduces the overall mean and thus lowers the entire interval. The intent is to better represent the true mean of the population in downgradient wells. A summary of the update results is included below.

Outlier Analysis

Prior to evaluating Appendix IV parameters, upgradient well data were screened through both visual screening and Tukey's outlier test for potential outliers and extreme trending patterns that would lead to artificially elevated statistical limits. All flagged values may be seen on the Outlier Summary following this letter (Figure C).

Tukey's outlier test identified an outlier for lead in upgradient wells; however, this measurement was not flagged as an outlier since the concentration is lower than the established MCL and has no impact on the Groundwater Protection Standard.

While Tukey's test did not identify the highest measurements of combined radium in upgradient wells, it was noted that the laboratory flagged the highest reported measurement in upgradient well AP-53 with “P1” to indicate the precision between the duplicate results was above acceptance limits. Additionally, while the highest measurement in upgradient well AP-51 did not have a “P1” flag, the measurement is similar to the flagged measurement in upgradient well AP-53 and is also substantially elevated above remaining measurements upgradient of the facility. Therefore, both measurements were flagged as outliers in the database and deselected prior to construction of interwell tolerance limits to use stable concentrations. While the combined radium values for the same sample event in wells AP-58A, AP-59, and AP-60 are elevated as well, those measurements are not flagged because the concentrations occur in downgradient wells, as discussed earlier. High values for several constituents were measured for the November 2023 sample event at downgradient well AP-60 but, similarly, were not flagged. No measurements among downgradient wells were flagged as outliers.

Interwell Upper Tolerance Limits

Upper tolerance limits were used to calculate background limits from pooled upgradient well data through April 2024 for Appendix IV parameters (Figure D). These limits are updated on an annual basis and will be updated again during the Fall 2025 sample event analysis. Parametric tolerance limits are calculated, with a target of 95% confidence and 95% coverage, when data follow a normal or transformed-normal distribution. When data contained greater than 50% non-detects or did not follow a normal or transformed-normal distribution, non-parametric tolerance limits were constructed using the highest background measurement. The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples.

Groundwater Protection Standards

The upper tolerance limits were compared to the Maximum Contaminant Levels (MCLs) and CCR-Rule Specified limits in the Groundwater Protection Standard (GWPS) table following this letter to determine the highest limit for use as the GWPS in the Confidence Interval comparisons (Figure E).

Evaluation of Appendix IV Parameters – April 2024

Confidence intervals were constructed with data through April 2024 on downgradient wells for each of the Appendix IV parameters and compared to the GWPS (i.e., the highest limit of the MCL or background limit as discussed above). When data followed a normal or transformed-normal distribution, parametric confidence intervals were used for Appendix IV parameters. Nonparametric confidence intervals, which use the largest and smallest order statistics depending on the sample size as interval limits, were constructed when data did not follow a normal or transformed-normal distribution or when there were greater than 50% non-detects. The lower confidence limit, which is constructed with 99% confidence for parametric confidence intervals, is compared to the GWPS prepared as described above. The confidence level associated with nonparametric confidence intervals is dependent upon the number samples available.

Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. No exceedances were noted for any of the well/constituent pairs. A summary of the confidence interval results follows this letter (Figure F).

<u>Trend Test Evaluation – Appendix IV</u>

When confidence interval exceedances are identified in downgradient wells, data are further evaluated using the Sen's Slope/Mann Kendall trend test to determine whether concentrations are statistically increasing, decreasing, or stable at the 95% confidence level. Utilizing the 95% confidence level for trend tests readily identifies significant trends and is more sensitive than the 99% confidence level without drastically increasing the false negative rate. Upgradient wells are included in the trend analyses for all parameters found to exceed their confidence interval in downgradient wells. When similar patterns exist upgradient of the site, it is an indication of variability in groundwater which may be unrelated to practices at the site. Since no exceedances were identified, no trend tests were required.

Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Flint Creek Bottom Ash Pond. If you have any questions or comments, please feel free to contact us.

For Groundwater Stats Consulting,

Kristina Rayner

A Collins

Kristina Rayner
Senior Statistician

Andrew T. Collins
Project Manager

100% Non-Detects

Analysis Run 8/14/2024 10:14 AM   View: Confidence Intervals
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

Mercury (ug/L)
AP-59, AP-60

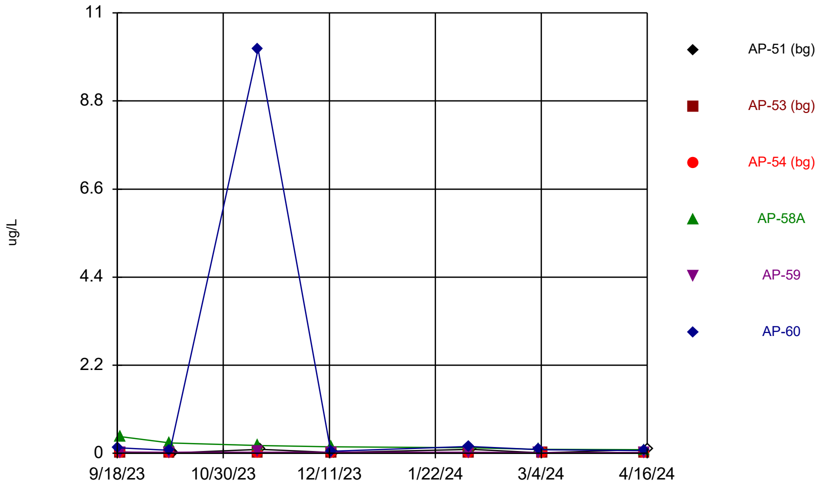
Thallium (ug/L)
AP-58A

FIGURE A

Time Series

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

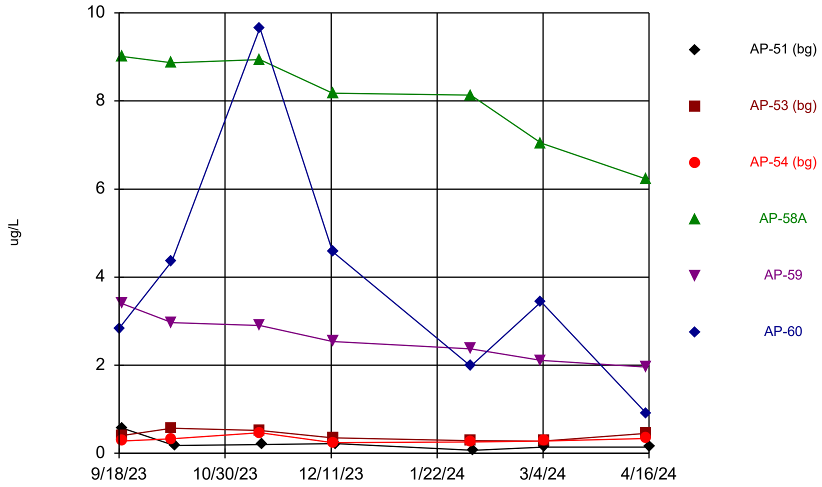
Time Series



Constituent: Antimony Analysis Run 8/14/2024 11:23 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG

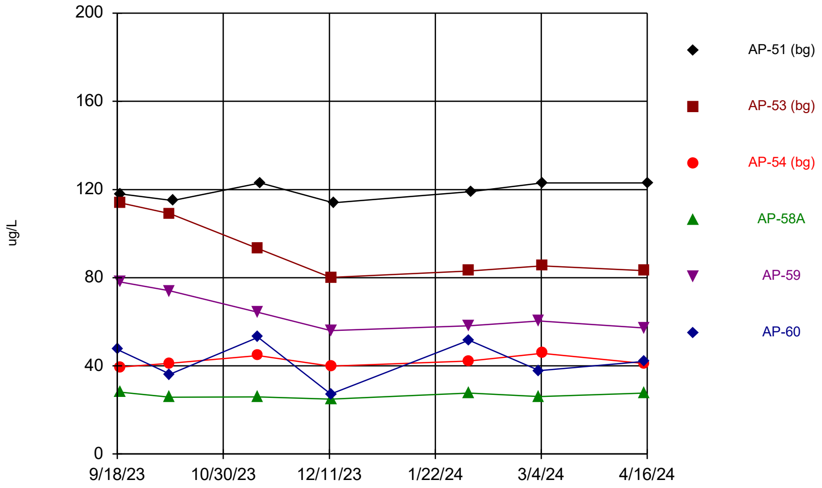
Time Series



Constituent: Arsenic Analysis Run 8/14/2024 11:23 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG

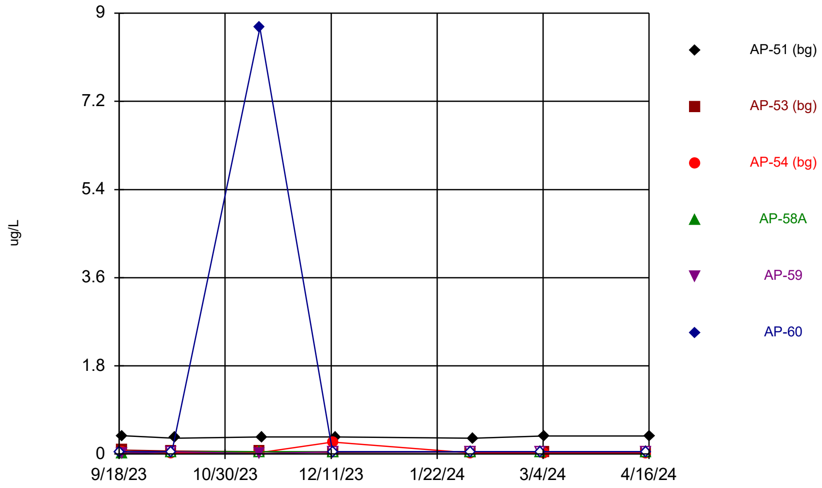
Time Series



Constituent: Barium Analysis Run 8/14/2024 11:23 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

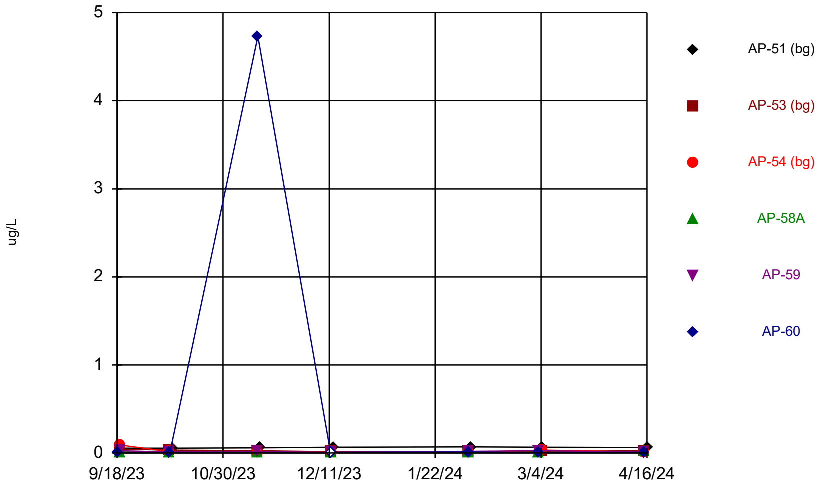
Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



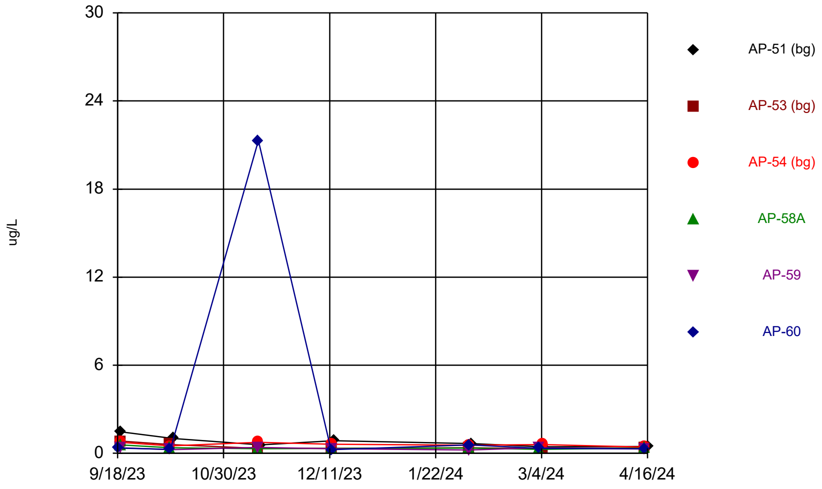
Constituent: Beryllium Analysis Run 8/14/2024 11:23 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.


Time Series

Constituent: Cadmium Analysis Run 8/14/2024 11:23 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG


Time Series

Constituent: Chromium Analysis Run 8/14/2024 11:23 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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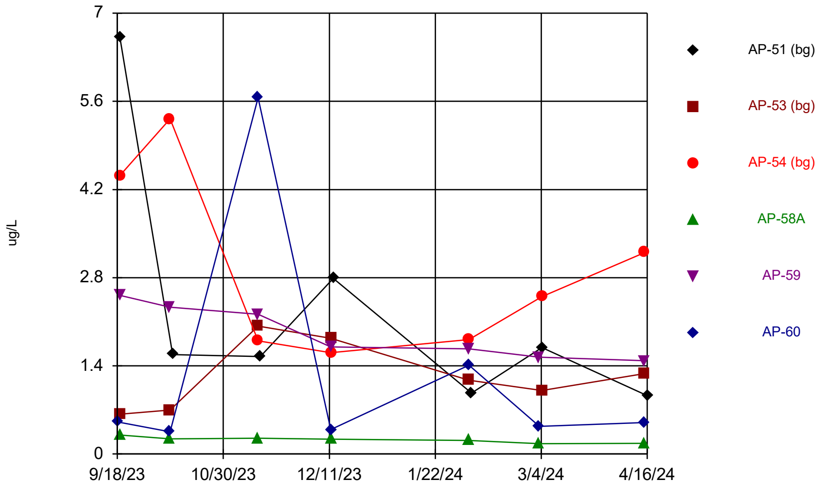
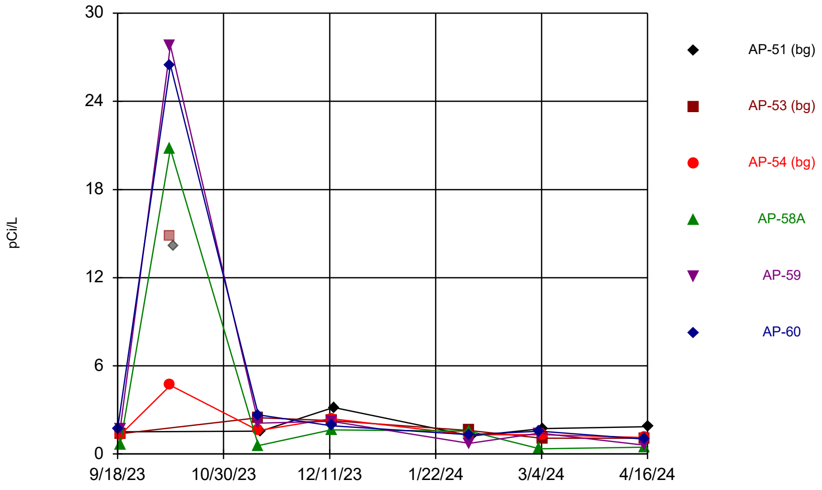

Time Series

Constituent: Cobalt Analysis Run 8/14/2024 11:23 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG


Time Series

Constituent: Combined Radium 226 + 228 Analysis Run 8/14/2024 11:23 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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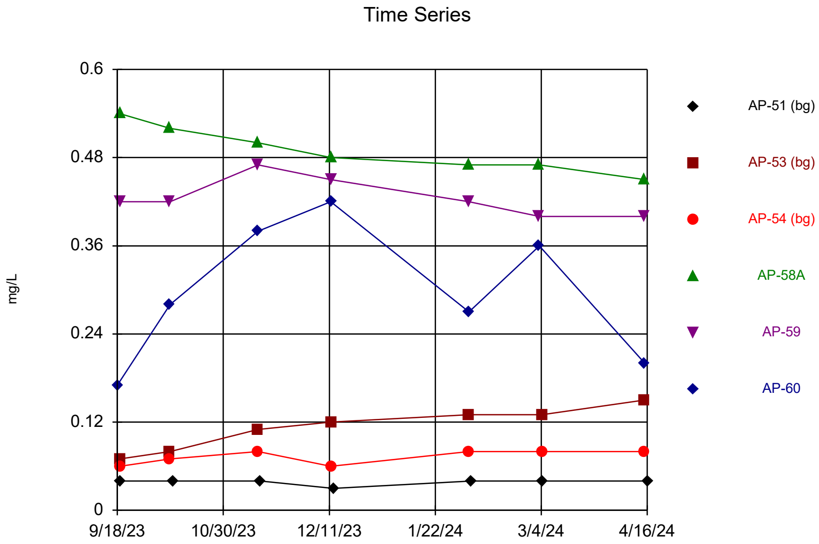
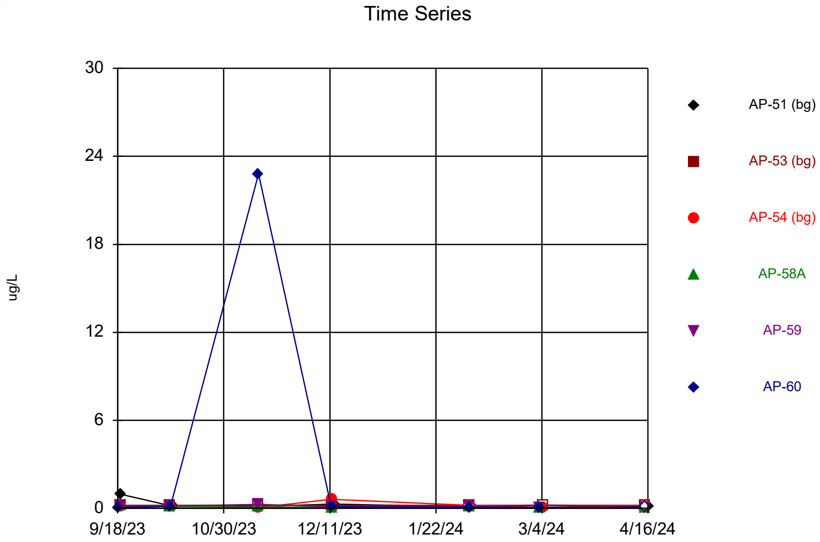


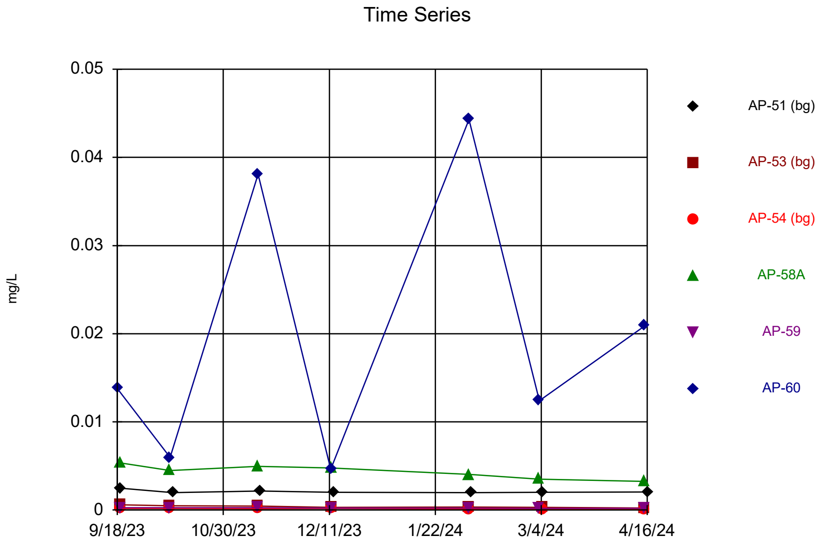
Constituent: Fluoride Analysis Run 8/14/2024 11:23 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



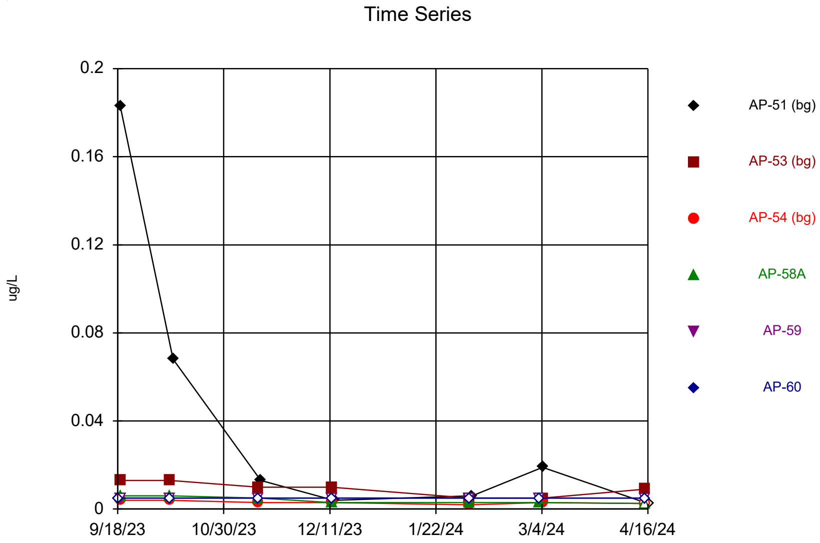
Constituent: Lead Analysis Run 8/14/2024 11:23 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG



Constituent: Lithium Analysis Run 8/14/2024 11:23 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

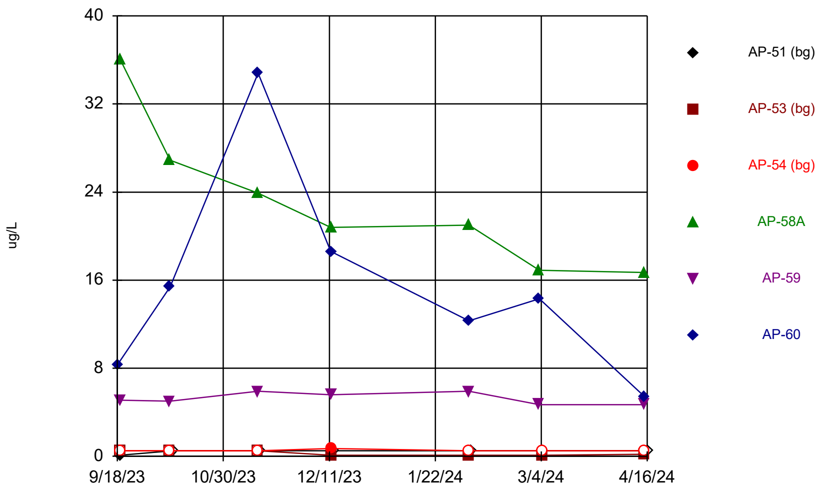
Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Mercury Analysis Run 8/14/2024 11:23 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



Constituent: Molybdenum Analysis Run 8/14/2024 11:23 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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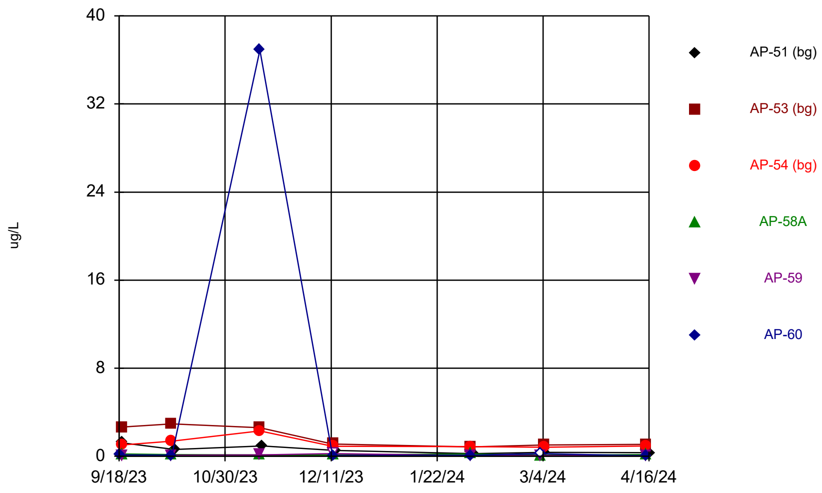
Hollow symbols indicate censored values.

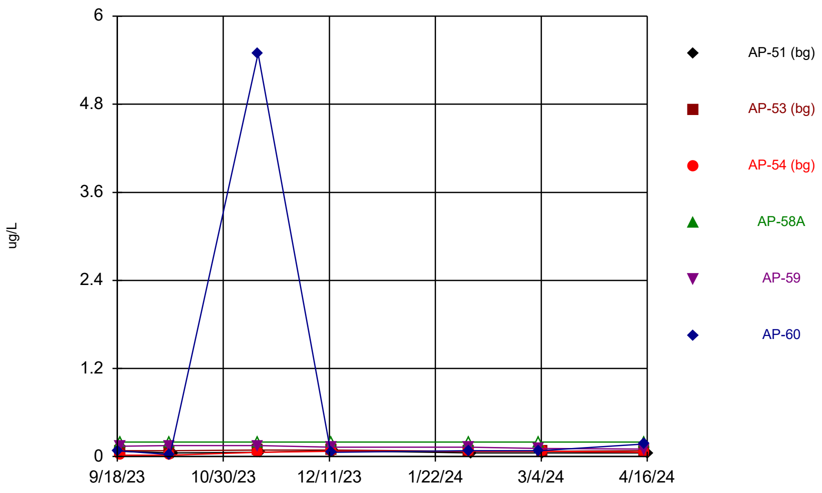
Time Series



Constituent: Selenium Analysis Run 8/14/2024 11:23 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



Constituent: Thallium Analysis Run 8/14/2024 11:24 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

FIGURE B

Box Plots

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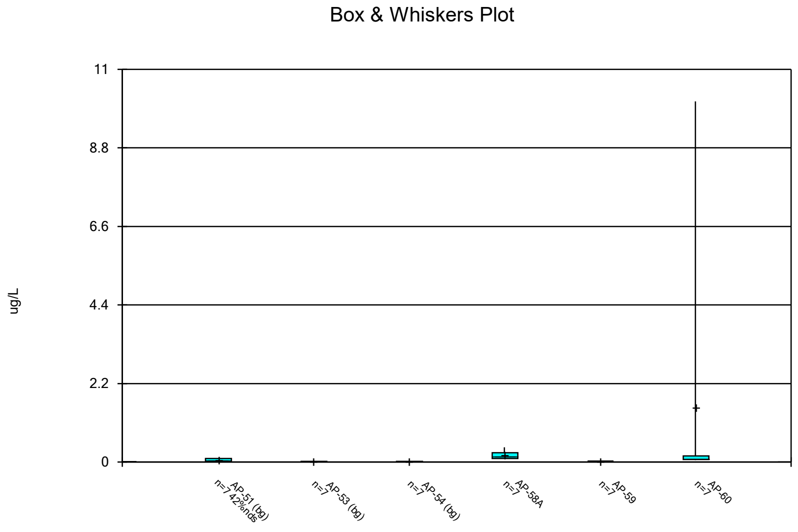

Constituent: Antimony Analysis Run 8/14/2024 11:31 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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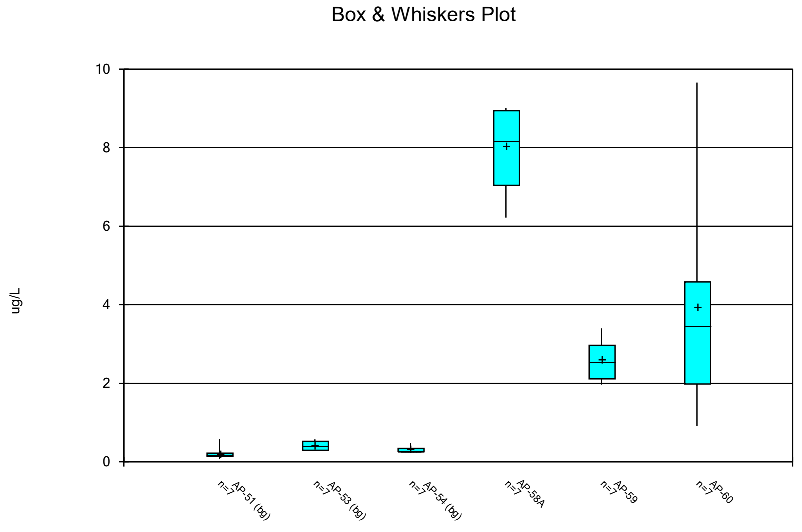

Constituent: Arsenic Analysis Run 8/14/2024 11:31 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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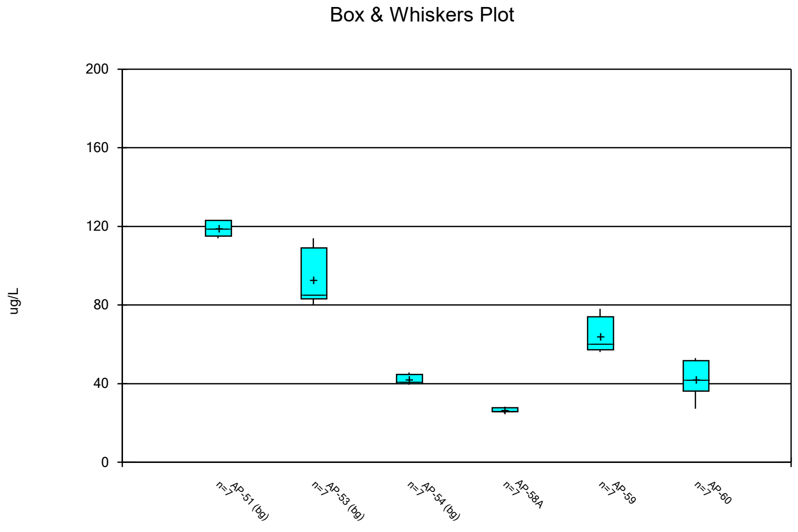
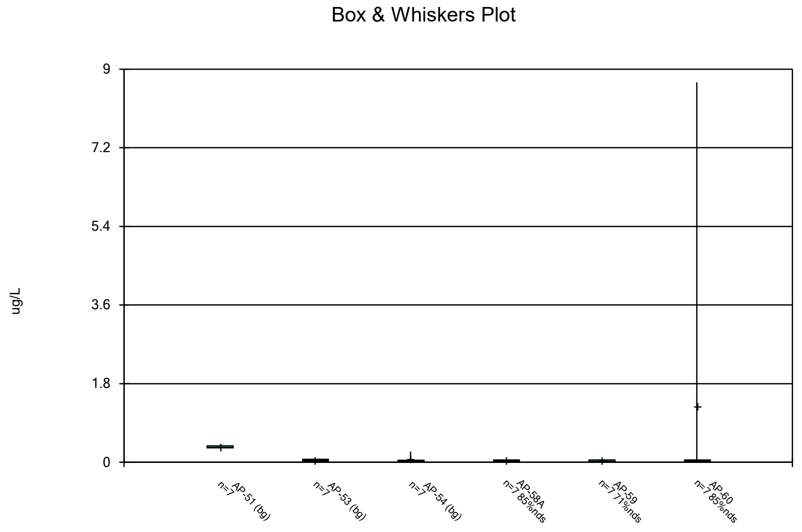


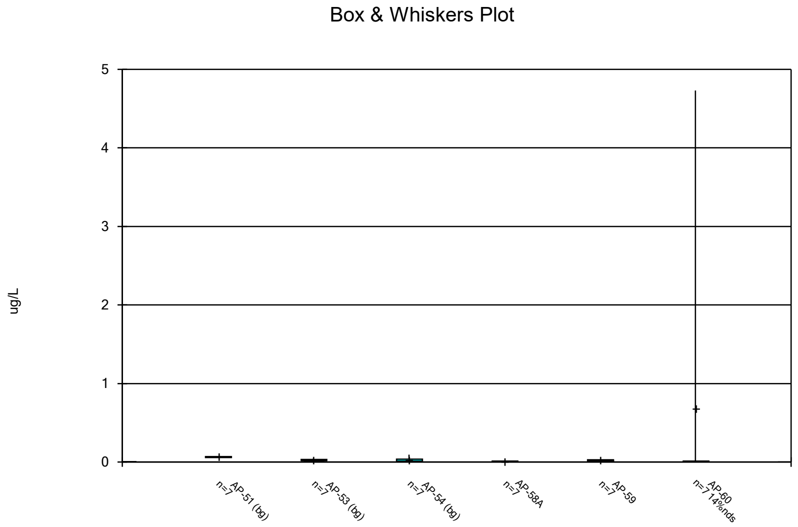
Constituent: Barium Analysis Run 8/14/2024 11:31 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG



Constituent: Beryllium Analysis Run 8/14/2024 11:31 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG



Constituent: Cadmium   Analysis Run 8/14/2024 11:31 AM   View: Descriptive
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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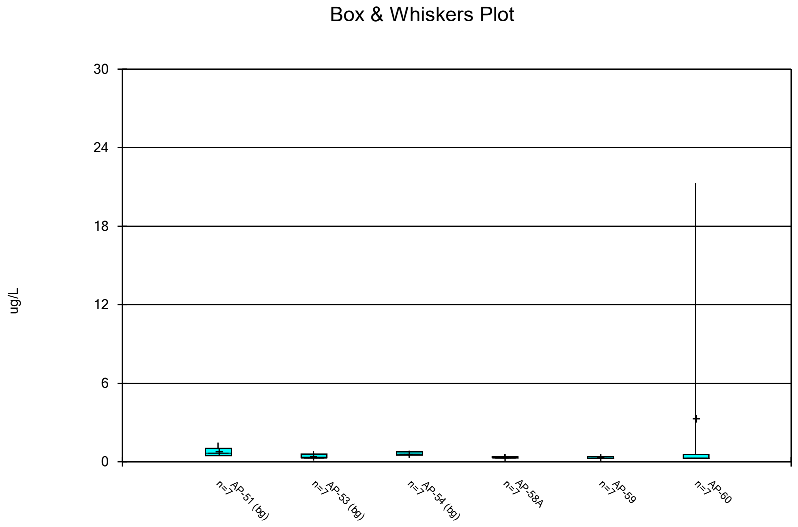
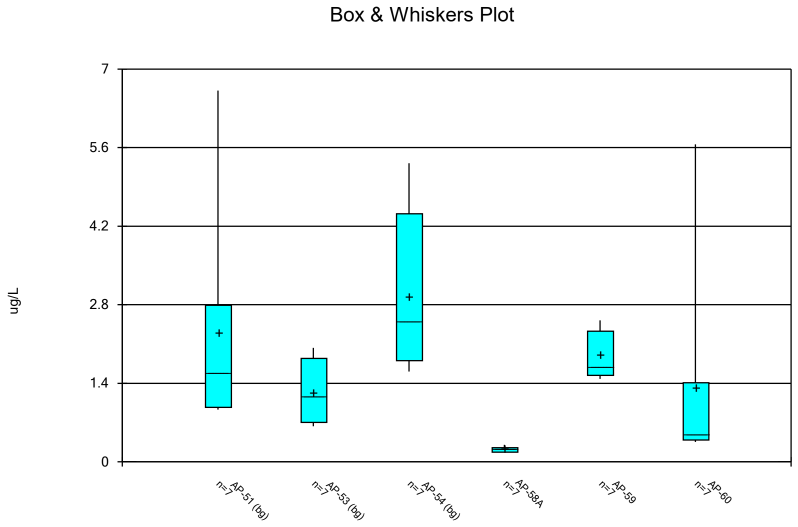


Constituent: Chromium   Analysis Run 8/14/2024 11:31 AM   View: Descriptive
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG



Constituent: Cobalt   Analysis Run 8/14/2024 11:31 AM   View: Descriptive
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG

Constituent: Combined Radium 226 + 228   Analysis Run 8/14/2024 11:31 AM   View: Descriptive
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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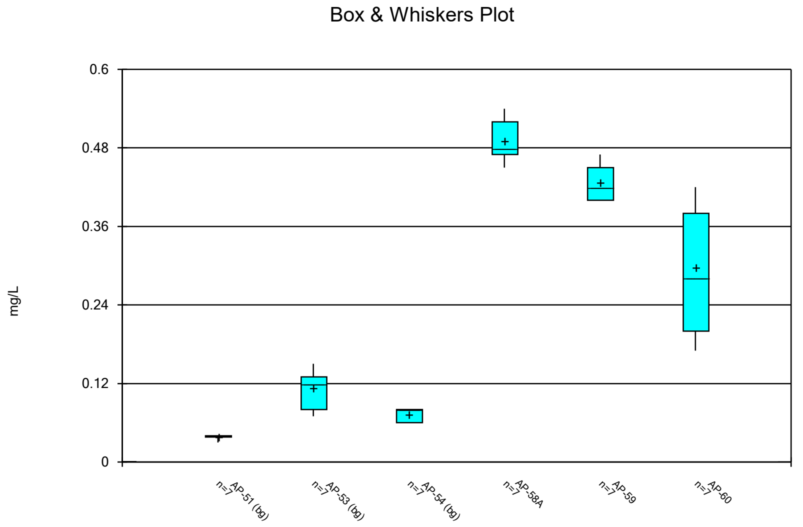
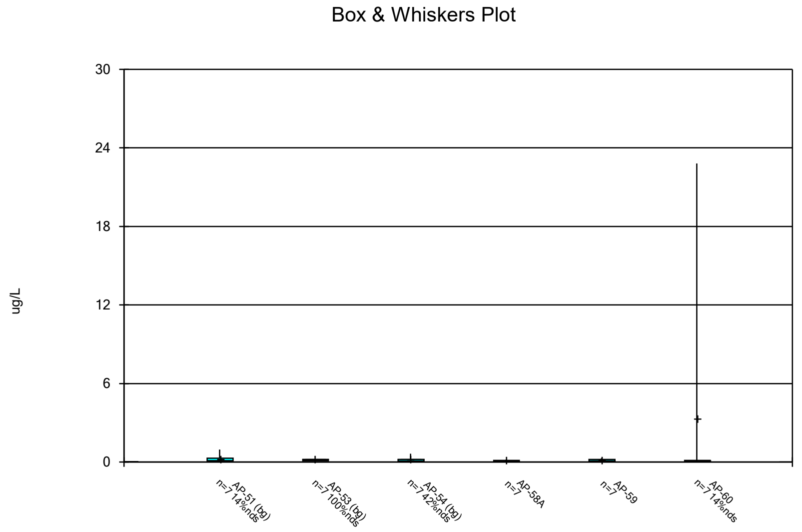


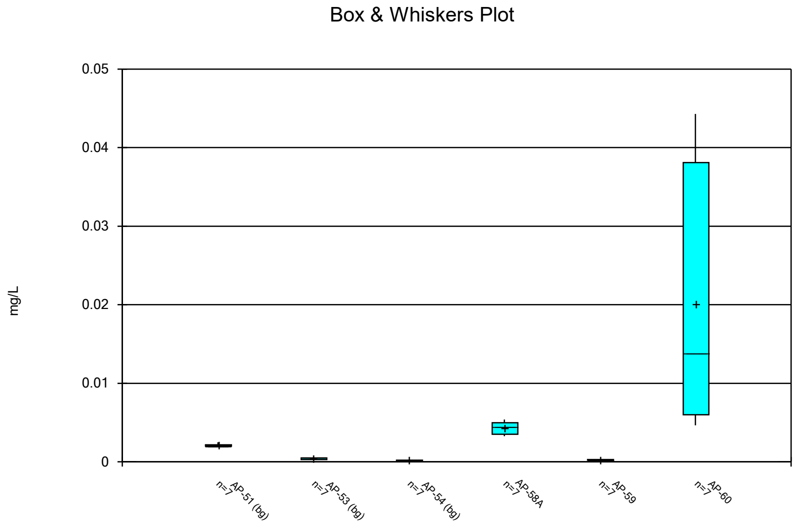
Constituent: Fluoride Analysis Run 8/14/2024 11:31 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG



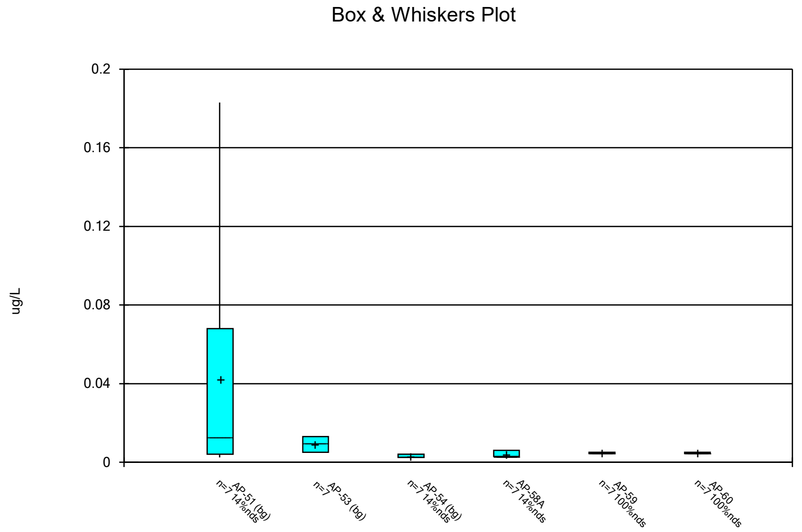
Constituent: Lead Analysis Run 8/14/2024 11:31 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG



Constituent: Lithium Analysis Run 8/14/2024 11:31 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG



Constituent: Mercury Analysis Run 8/14/2024 11:31 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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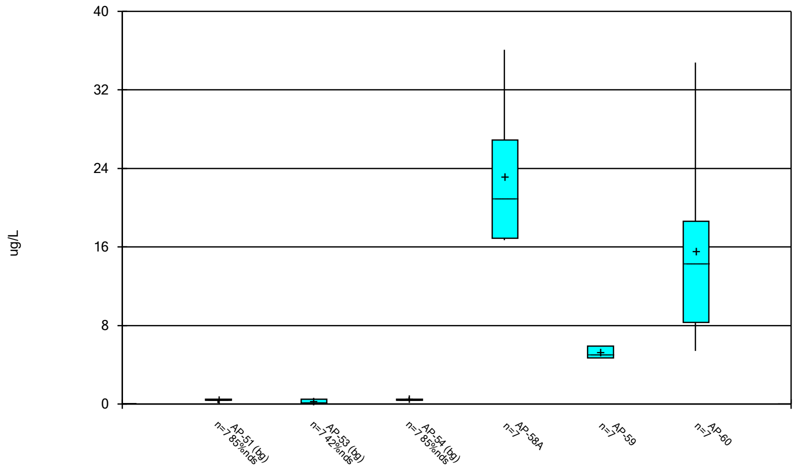
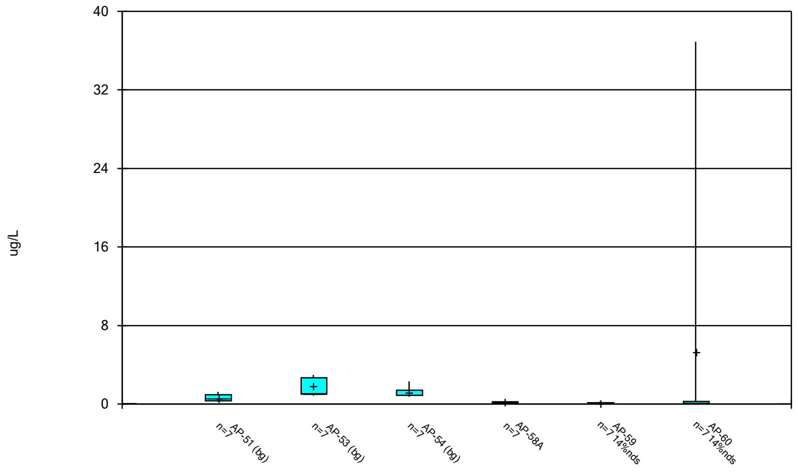
Box & Whiskers Plot



Constituent: Molybdenum   Analysis Run 8/14/2024 11:31 AM   View: Descriptive
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG

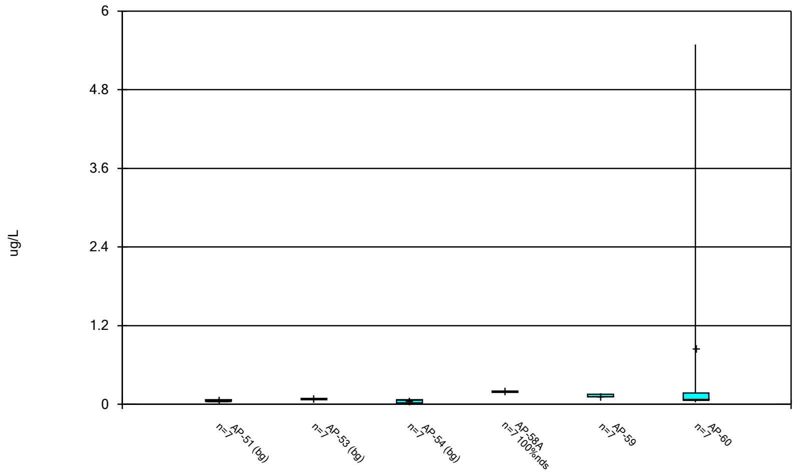
Box & Whiskers Plot



Constituent: Selenium   Analysis Run 8/14/2024 11:31 AM   View: Descriptive
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG

Box & Whiskers Plot



Constituent: Thallium   Analysis Run 8/14/2024 11:31 AM   View: Descriptive
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

FIGURE C

Outlier Summary and Tukey’s Outlier Test

Outlier Summary

Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP Printed 8/14/2024, 11:22 AM

	AP-51 Combined Radium 226 + 228 (pCi/L)	AP-53 Combined Radium 226 + 228 (pCi/L)
10/9/2023		14.86 (o)
10/10/2023	14.16 (o)	

Outlier Summary (Upgradient Wells) - Significant Results

Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP   Printed 8/14/2024, 10:45 AM

Constituent	Well	Outlier	Value(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Lead (ug/L)	**AP-51,AP-53,AP-54**	**Yes**	**0.96**	**NP**	**NaN**	**21**	**0.2333**	**0.202**	**ln(x)**	**ShapiroWilk**

Outlier Summary (Upgradient Wells) - All Results

Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP   Printed 8/14/2024, 10:45 AM

Constituent	Well	Outlier	Value(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Antimony (ug/L)	AP-51,AP-53,AP-54	No	n/a	NP	NaN	21	0.0191	0.01417	ln(x)	ShapiroWilk
Arsenic (ug/L)	AP-51,AP-53,AP-54	No	n/a	NP	NaN	21	0.3138	0.142	sqrt(x)	ShapiroWilk
Barium (ug/L)	AP-51,AP-53,AP-54	No	n/a	NP	NaN	21	84.62	33.76	x^2	ShapiroWilk
Beryllium (ug/L)	AP-51,AP-53,AP-54	No	n/a	NP	NaN	21	0.1537	0.15	ln(x)	ShapiroWilk
Cadmium (ug/L)	AP-51,AP-53,AP-54	No	n/a	NP	NaN	21	0.03848	0.02517	x^(1/3)	ShapiroWilk
Chromium (ug/L)	AP-51,AP-53,AP-54	No	n/a	NP	NaN	21	0.6124	0.2762	ln(x)	ShapiroWilk
Cobalt (ug/L)	AP-51,AP-53,AP-54	No	n/a	NP	NaN	21	2.165	1.56	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	AP-51,AP-53,AP-54	No	n/a	NP	NaN	21	3.034	3.908	ln(x)	ShapiroWilk
Fluoride (mg/L)	AP-51,AP-53,AP-54	No	n/a	NP	NaN	21	0.07476	0.0353	ln(x)	ShapiroWilk
Lead (ug/L)	**AP-51,AP-53,AP-54**	**Yes**	**0.96**	**NP**	**NaN**	**21**	**0.2333**	**0.202**	**ln(x)**	**ShapiroWilk**
Lithium (mg/L)	AP-51,AP-53,AP-54	No	n/a	NP	NaN	21	0.0008833	0.0008928	ln(x)	ShapiroWilk
Mercury (ug/L)	AP-51,AP-53,AP-54	No	n/a	NP	NaN	21	0.01819	0.04031	ln(x)	ShapiroWilk
Molybdenum (ug/L)	AP-51,AP-53,AP-54	No	n/a	NP	NaN	21	0.419	0.1778	x^2	ShapiroWilk
Selenium (ug/L)	AP-51,AP-53,AP-54	No	n/a	NP	NaN	21	1.187	0.7844	ln(x)	ShapiroWilk
Thallium (ug/L)	AP-51,AP-53,AP-54	No	n/a	NP	NaN	21	0.06381	0.0191	x^2	ShapiroWilk

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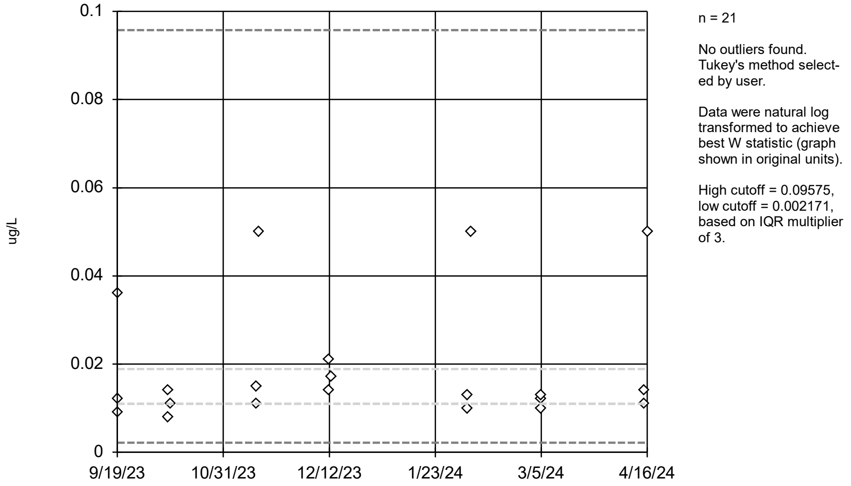
Tukey's Outlier Screening, Pooled Background

AP-51,AP-53,AP-54



n = 21

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.09575, low cutoff = 0.002171, based on IQR multiplier of 3.

Constituent: Antimony Analysis Run 8/14/2024 10:43 AM View: Tukey's
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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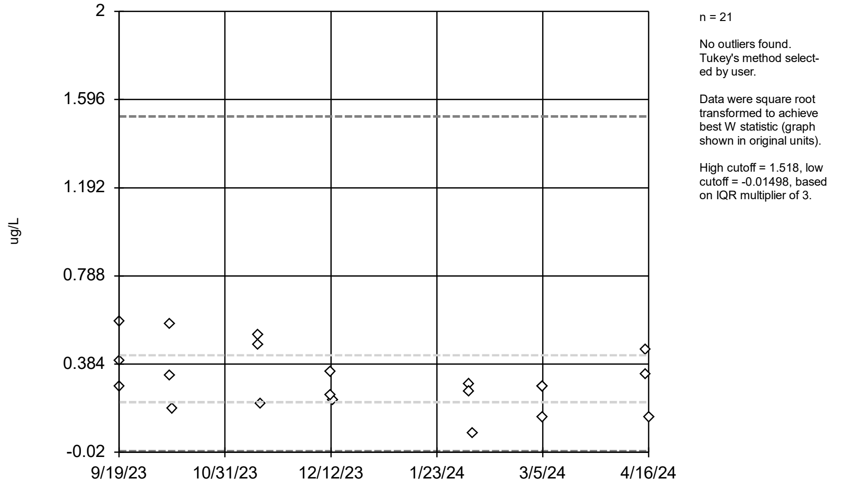
Tukey's Outlier Screening, Pooled Background

AP-51,AP-53,AP-54



n = 21

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 1.518, low cutoff = -0.01498, based on IQR multiplier of 3.

Constituent: Arsenic Analysis Run 8/14/2024 10:43 AM View: Tukey's
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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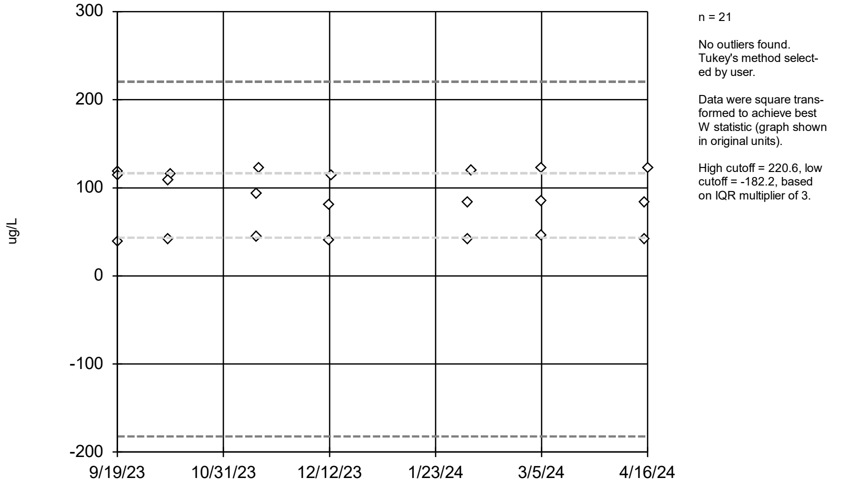
Tukey's Outlier Screening, Pooled Background

AP-51,AP-53,AP-54



n = 21

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 220.6, low cutoff = -182.2, based on IQR multiplier of 3.

Constituent: Barium Analysis Run 8/14/2024 10:43 AM View: Tukey's
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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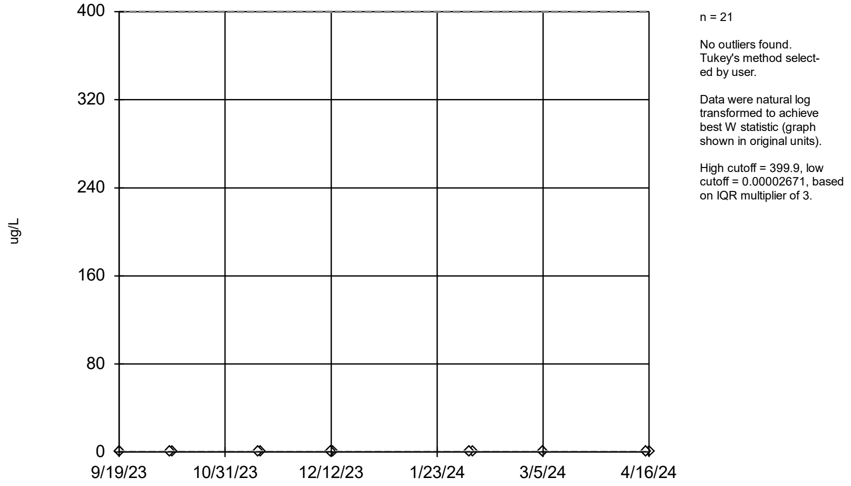
Tukey's Outlier Screening, Pooled Background

AP-51,AP-53,AP-54



n = 21

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 399.9, low cutoff = 0.00002671, based on IQR multiplier of 3.

Constituent: Beryllium Analysis Run 8/14/2024 10:43 AM View: Tukey's
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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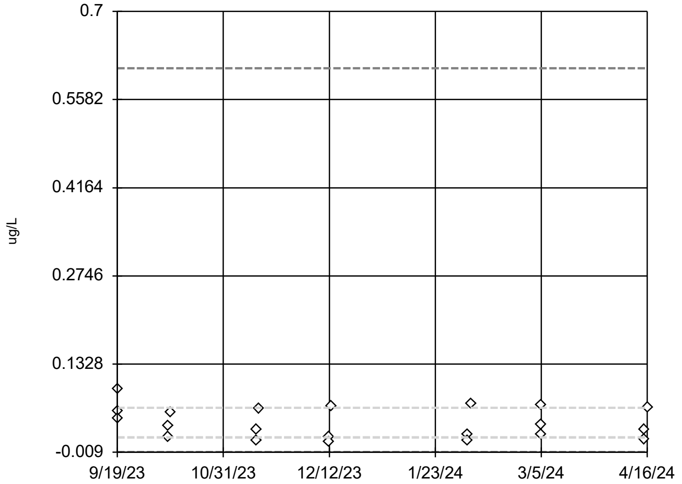
Tukey's Outlier Screening, Pooled Background

AP-51,AP-53,AP-54



n = 21

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.6086, low cutoff = -0.008488, based on IQR multiplier of 3.

Constituent: Cadmium Analysis Run 8/14/2024 10:43 AM View: Tukey's

Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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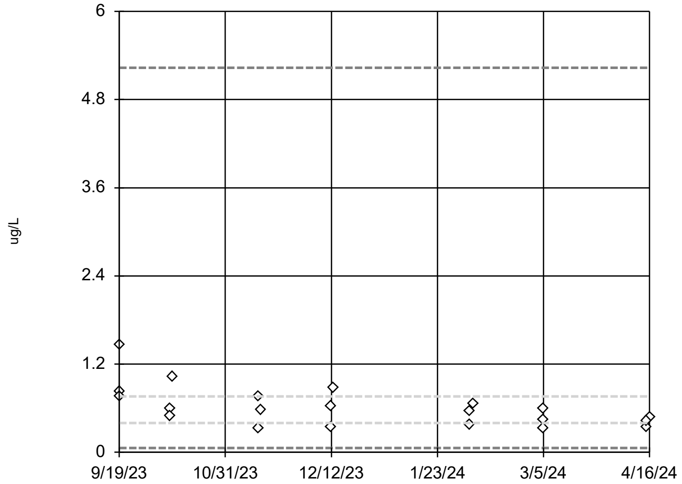
Tukey's Outlier Screening, Pooled Background

AP-51,AP-53,AP-54



n = 21

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 5.232, low cutoff = 0.05803, based on IQR multiplier of 3.

Constituent: Chromium Analysis Run 8/14/2024 10:43 AM View: Tukey's

Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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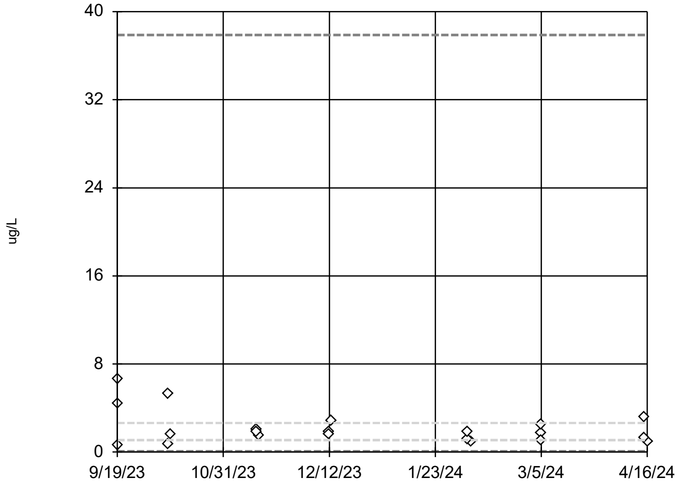
Tukey's Outlier Screening, Pooled Background

AP-51,AP-53,AP-54



n = 21

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 37.87, low cutoff = 0.07581, based on IQR multiplier of 3.

Constituent: Cobalt Analysis Run 8/14/2024 10:43 AM View: Tukey's

Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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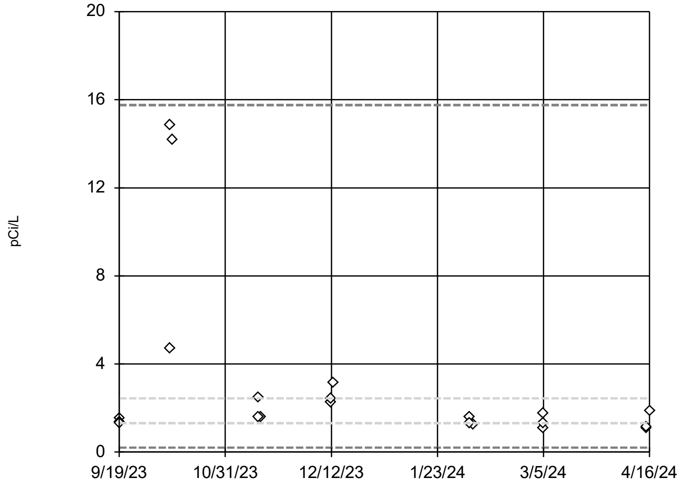
Tukey's Outlier Screening, Pooled Background

AP-51,AP-53,AP-54



n = 21

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 15.76, low cutoff = 0.2028, based on IQR multiplier of 3.

Constituent: Combined Radium 226 + 228 Analysis Run 8/14/2024 10:43 AM View: Tukey's

Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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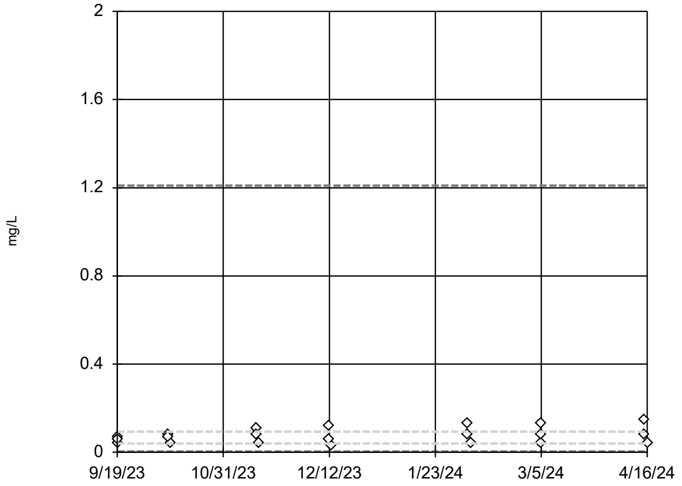
Tukey's Outlier Screening, Pooled Background

AP-51,AP-53,AP-54



n = 21

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 1.21, low cutoff = 0.003101, based on IQR multiplier of 3.

Constituent: Fluoride Analysis Run 8/14/2024 10:43 AM View: Tukey's
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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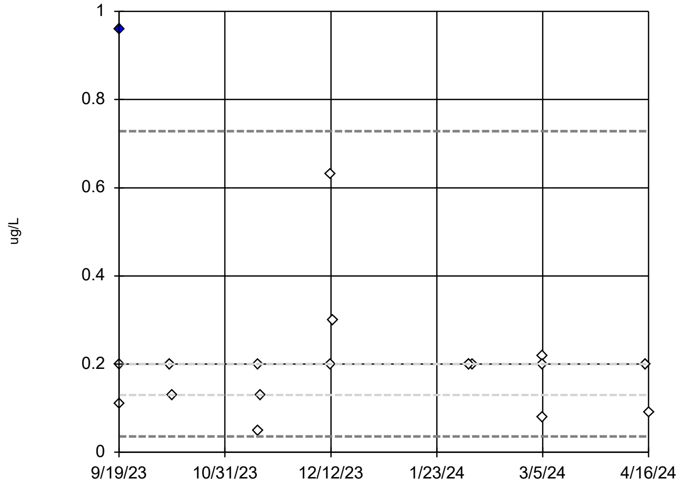
Tukey's Outlier Screening, Pooled Background

AP-51,AP-53,AP-54



n = 21

Outlier is drawn as solid. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.7283, low cutoff = 0.0357, based on IQR multiplier of 3.

Constituent: Lead Analysis Run 8/14/2024 10:43 AM View: Tukey's
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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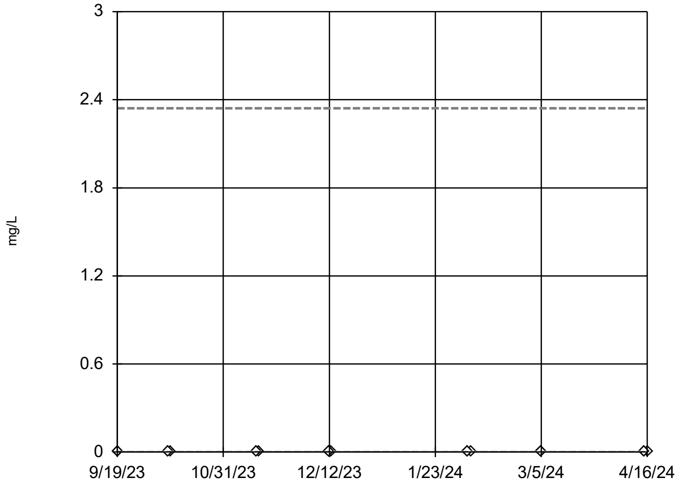
Tukey's Outlier Screening, Pooled Background

AP-51,AP-53,AP-54



n = 21

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 2.342, low cutoff = 1.6e-7, based on IQR multiplier of 3.

Constituent: Lithium Analysis Run 8/14/2024 10:43 AM View: Tukey's
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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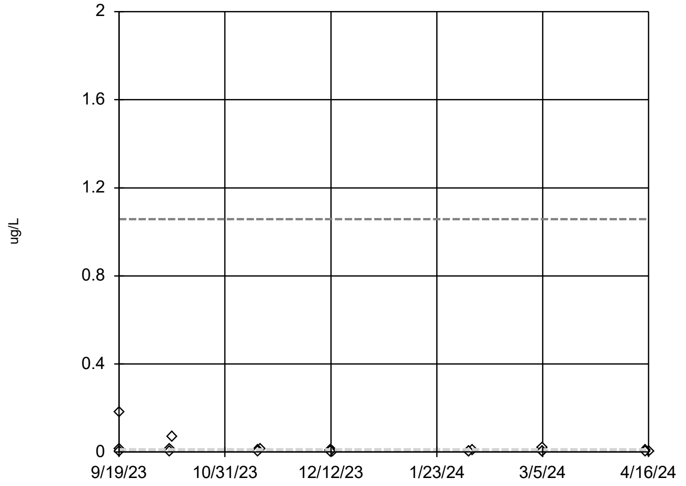
Tukey's Outlier Screening, Pooled Background

AP-51,AP-53,AP-54



n = 21

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 1.058, low cutoff = 0.00003687, based on IQR multiplier of 3.

Constituent: Mercury Analysis Run 8/14/2024 10:43 AM View: Tukey's
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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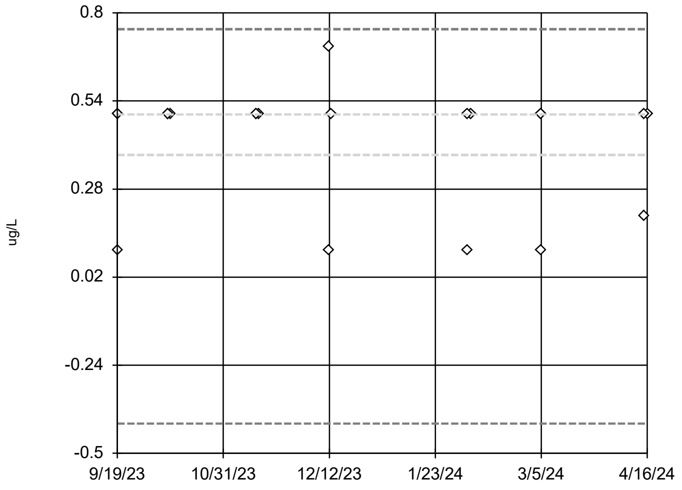
Tukey's Outlier Screening, Pooled Background

AP-51,AP-53,AP-54



n = 21

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.7517, low cutoff = -0.4123, based on IQR multiplier of 3.

Constituent: Molybdenum Analysis Run 8/14/2024 10:44 AM View: Tukey's
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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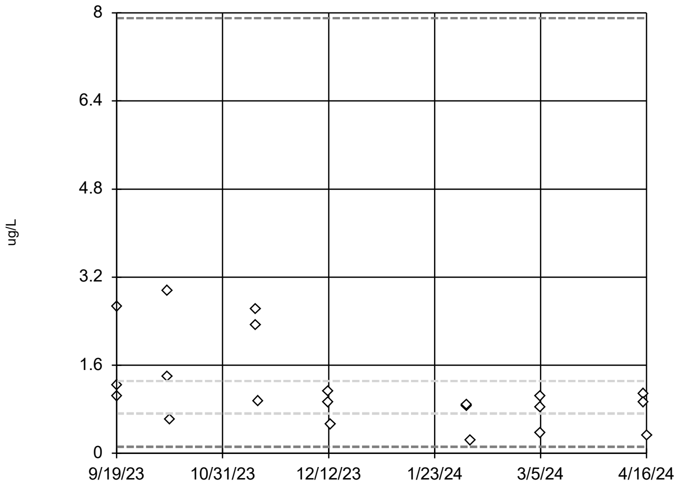
Tukey's Outlier Screening, Pooled Background

AP-51,AP-53,AP-54



n = 21

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 7.904, low cutoff = 0.1199, based on IQR multiplier of 3.

Constituent: Selenium Analysis Run 8/14/2024 10:44 AM View: Tukey's
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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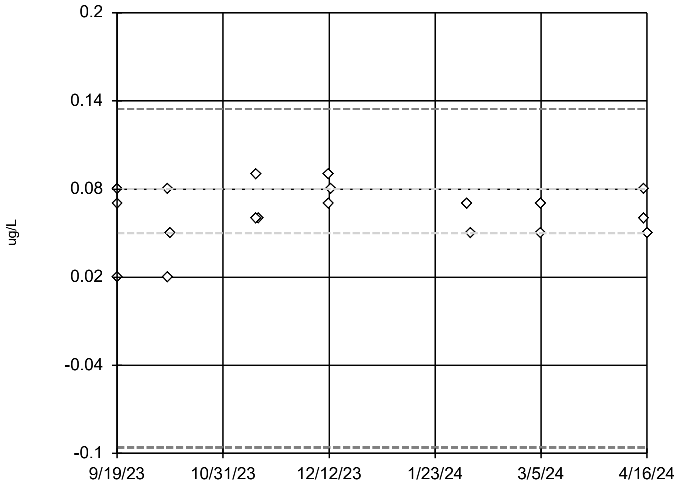
Tukey's Outlier Screening, Pooled Background

AP-51,AP-53,AP-54



n = 21

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.1345, low cutoff = -0.09592, based on IQR multiplier of 3.

Constituent: Thallium Analysis Run 8/14/2024 10:44 AM View: Tukey's
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

FIGURE D
UTLs

Tolerance Limit Appendix IV

Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP   Printed 8/14/2024, 10:57 AM

Constituent	Upper Lim.	Lower Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony (ug/L)	0.05	n/a	21	n/a	n/a	14.29	n/a	n/a	0.3406	NP Inter(normality)
Arsenic (ug/L)	0.6506	n/a	21	0.3138	0.142	0	None	No	0.05	Inter
Barium (ug/L)	123	n/a	21	n/a	n/a	0	n/a	n/a	0.3406	NP Inter(normality)
Beryllium (ug/L)	0.373	n/a	21	n/a	n/a	0	n/a	n/a	0.3406	NP Inter(normality)
Cadmium (ug/L)	0.09815	n/a	21	0.03848	0.02517	0	None	No	0.05	Inter
Chromium (ug/L)	1.327	n/a	21	0.7663	0.1626	0	None	sqrt(x)	0.05	Inter
Cobalt (ug/L)	6.304	n/a	21	1.398	0.4692	0	None	sqrt(x)	0.05	Inter
Combined Radium 226 + 228 (pCi/L)	4.68	n/a	19	n/a	n/a	0	n/a	n/a	0.3774	NP Inter(normality)
Fluoride (mg/L)	0.1585	n/a	21	0.07476	0.0353	0	None	No	0.05	Inter
Lead (ug/L)	0.96	n/a	21	n/a	n/a	52.38	n/a	n/a	0.3406	NP Inter(NDs)
Lithium (mg/L)	0.00248	n/a	21	n/a	n/a	0	n/a	n/a	0.3406	NP Inter(normality)
Mercury (ug/L)	0.183	n/a	21	n/a	n/a	9.524	n/a	n/a	0.3406	NP Inter(normality)
Molybdenum (ug/L)	0.7	n/a	21	n/a	n/a	71.43	n/a	n/a	0.3406	NP Inter(NDs)
Selenium (ug/L)	3.411	n/a	21	1.037	0.3415	0	None	sqrt(x)	0.05	Inter
Thallium (ug/L)	0.1091	n/a	21	0.06381	0.0191	0	None	No	0.05	Inter

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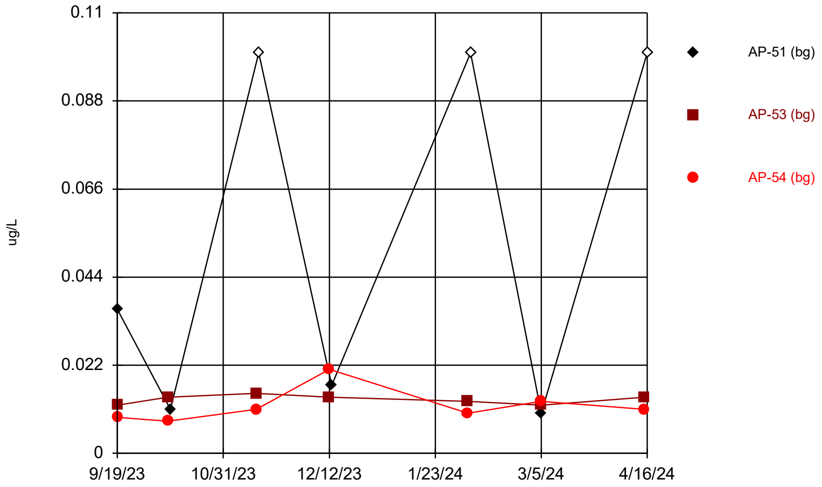
Hollow symbols indicate censored values.

Time Series



Constituent: Antimony Analysis Run 8/14/2024 10:57 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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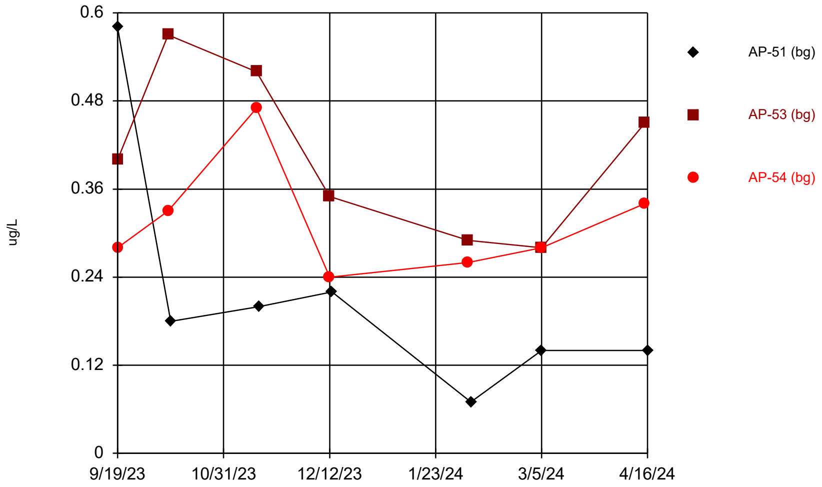
Time Series



Constituent: Arsenic Analysis Run 8/14/2024 10:57 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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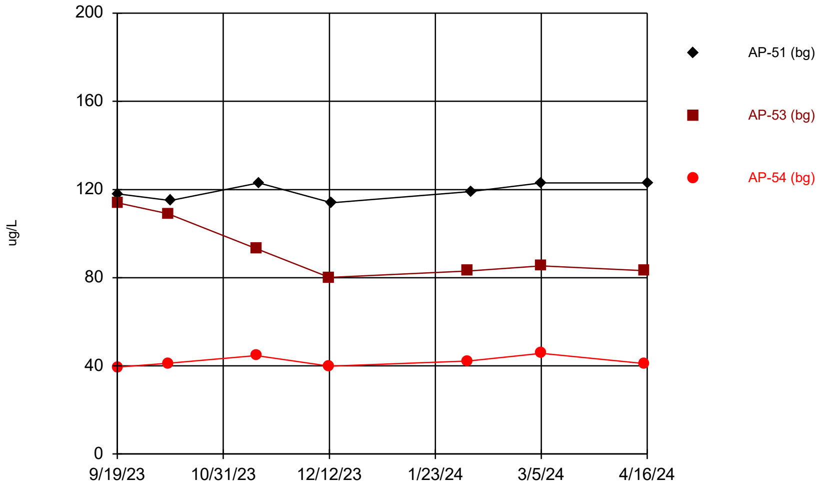
Time Series



Constituent: Barium Analysis Run 8/14/2024 10:57 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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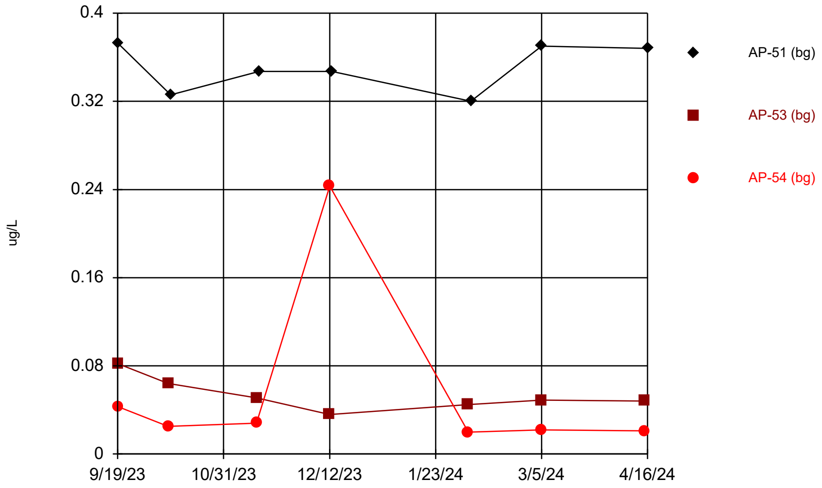
Time Series



Constituent: Beryllium Analysis Run 8/14/2024 10:57 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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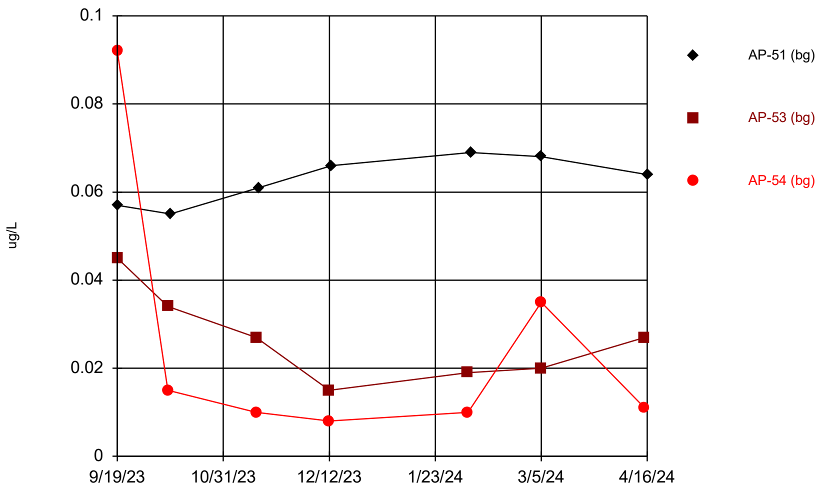
Time Series



Constituent: Cadmium   Analysis Run 8/14/2024 10:57 AM   View: Upper Tolerance Limits
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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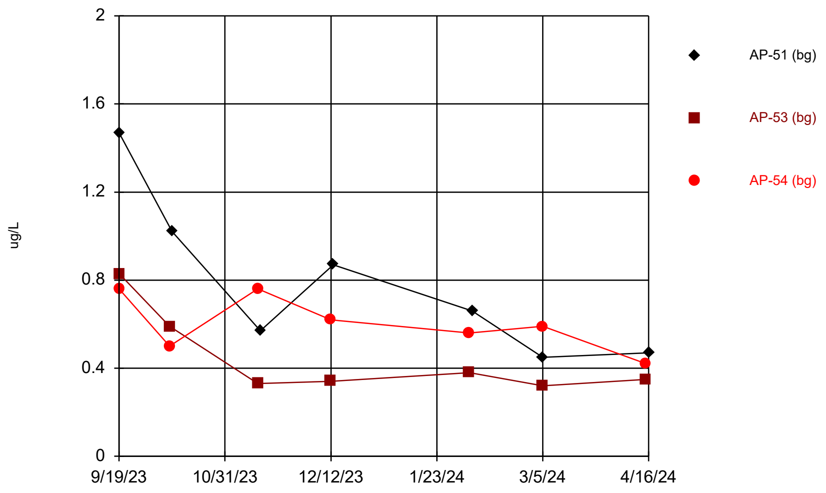
Time Series



Constituent: Chromium   Analysis Run 8/14/2024 10:57 AM   View: Upper Tolerance Limits
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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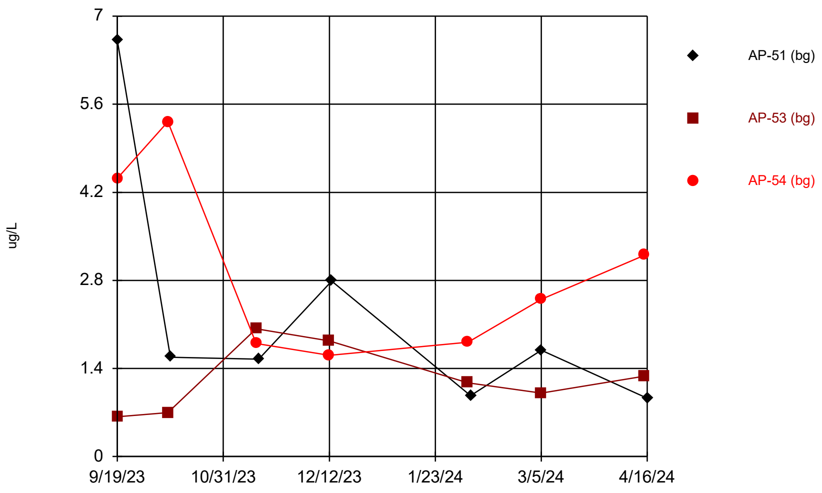
Time Series



Constituent: Cobalt   Analysis Run 8/14/2024 10:57 AM   View: Upper Tolerance Limits
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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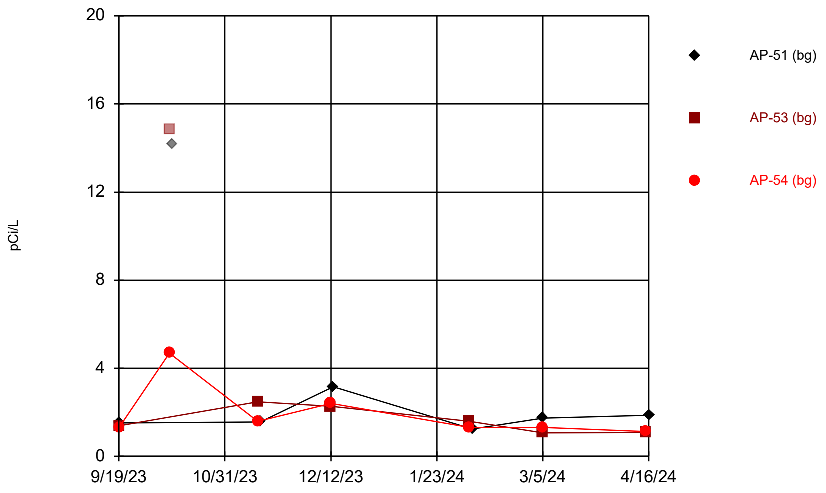
Time Series



Constituent: Combined Radium 226 + 228   Analysis Run 8/14/2024 10:57 AM   View: Upper Tolerance Limit
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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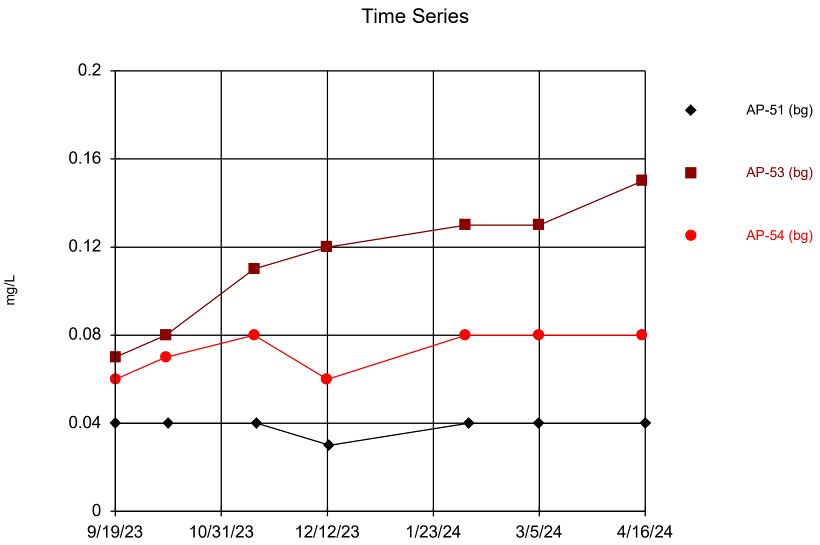

Constituent: Fluoride Analysis Run 8/14/2024 10:57 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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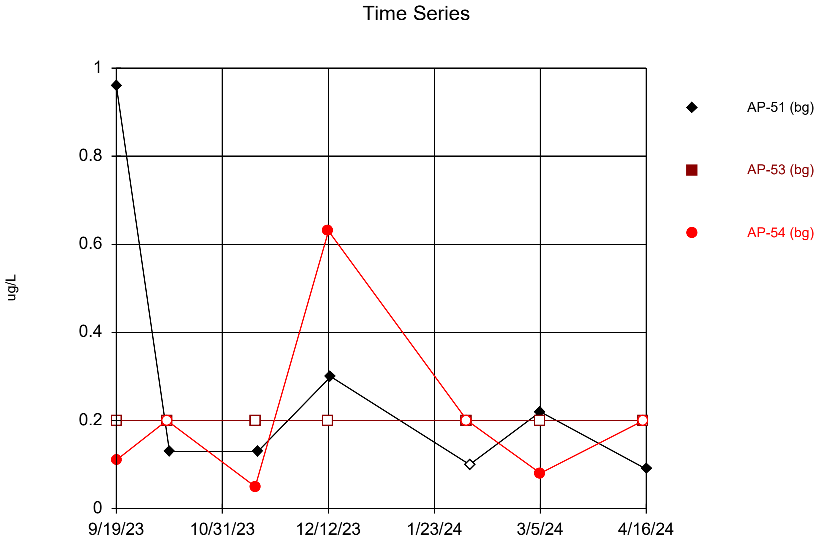
Hollow symbols indicate censored values.



Constituent: Lead Analysis Run 8/14/2024 10:57 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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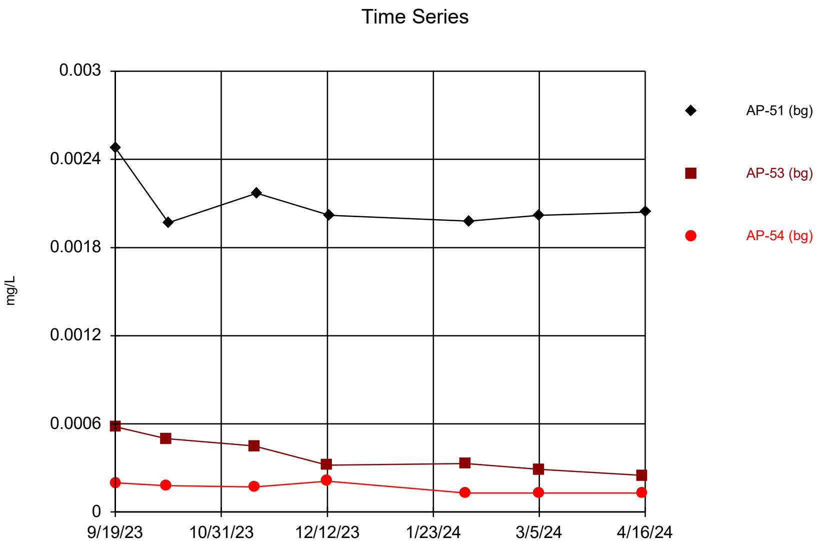

Constituent: Lithium Analysis Run 8/14/2024 10:57 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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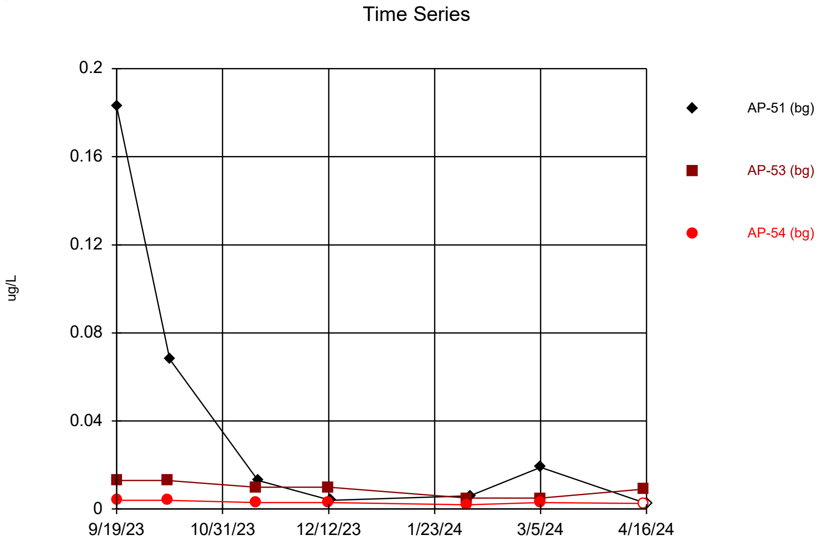
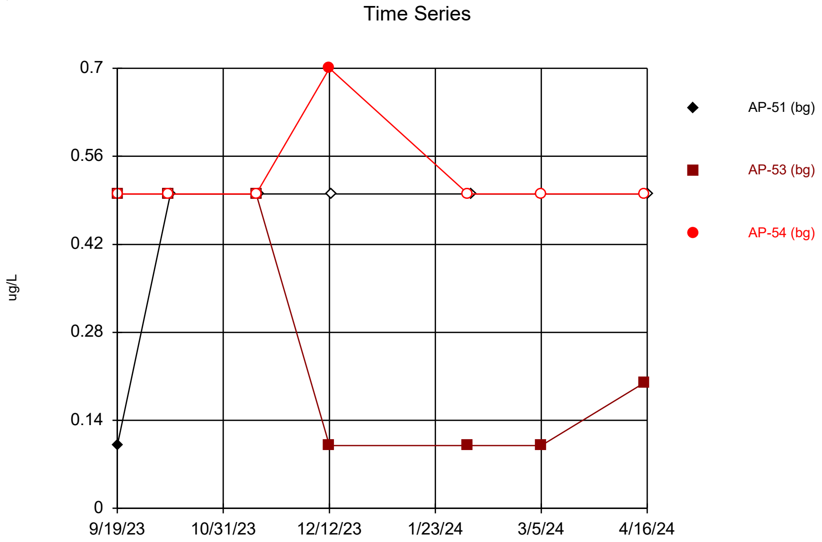
Hollow symbols indicate censored values.



Constituent: Mercury Analysis Run 8/14/2024 10:57 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.


Time Series

Constituent: Molybdenum Analysis Run 8/14/2024 10:57 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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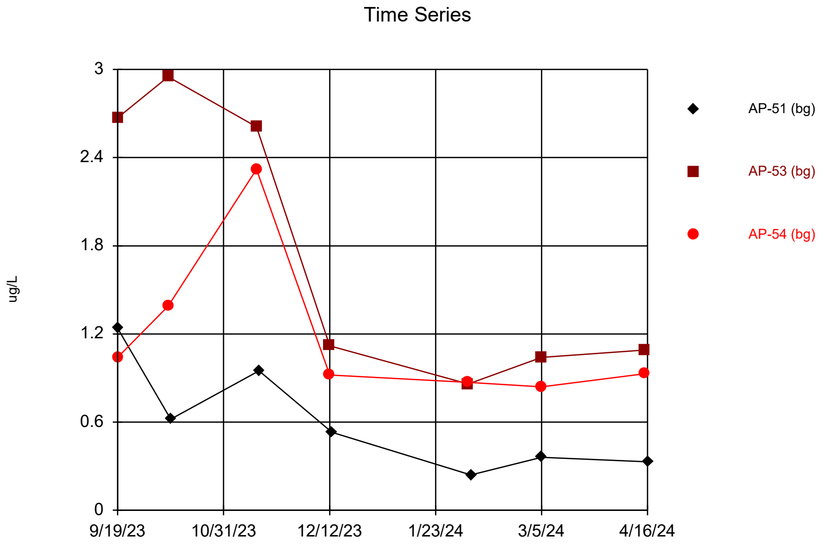
Time Series

Constituent: Selenium Analysis Run 8/14/2024 10:57 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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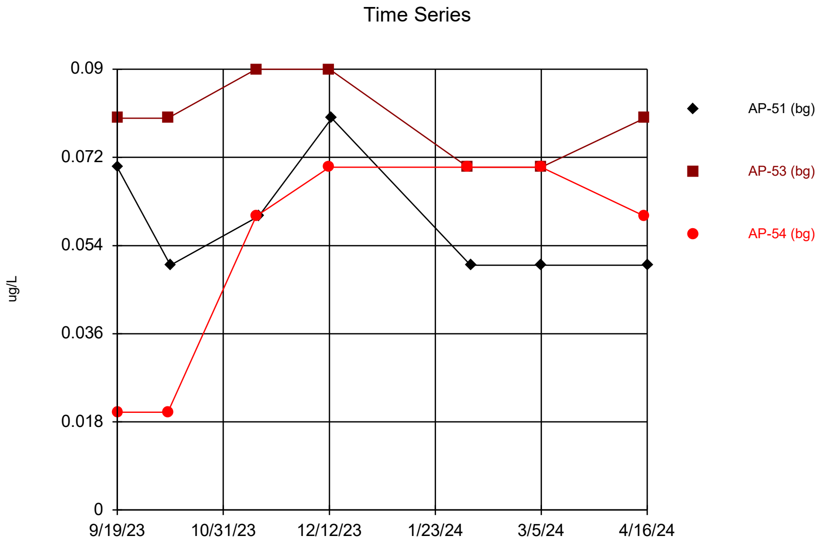
Time Series

Constituent: Thallium Analysis Run 8/14/2024 10:57 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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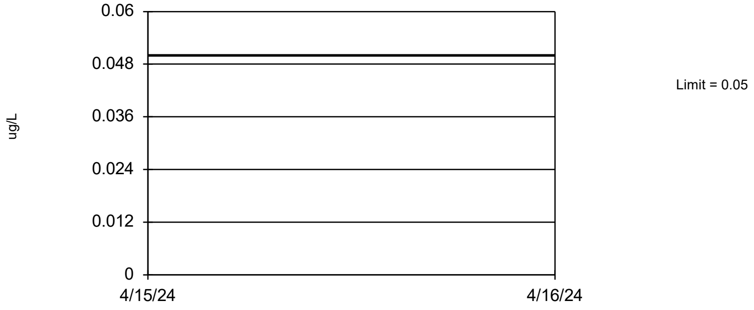
Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 21 background values. 14.29% NDs. 80.27% coverage at alpha=0.01; 86.52% coverage at alpha=0.05; 96.68% coverage at alpha=0.5. Report alpha = 0.3406.

Constituent: Antimony   Analysis Run 8/14/2024 10:54 AM   View: Upper Tolerance Limits
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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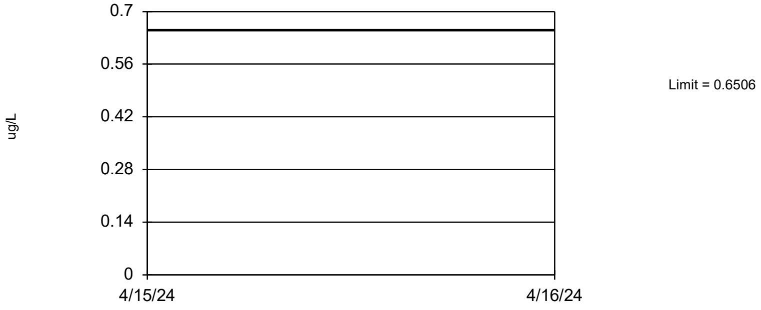
Tolerance Limit

Interwell Parametric



95% coverage. Background Data Summary: Mean=0.3138, Std. Dev.=0.142, n=21. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9622, critical = 0.873. Report alpha = 0.05.

Constituent: Arsenic   Analysis Run 8/14/2024 10:54 AM   View: Upper Tolerance Limits
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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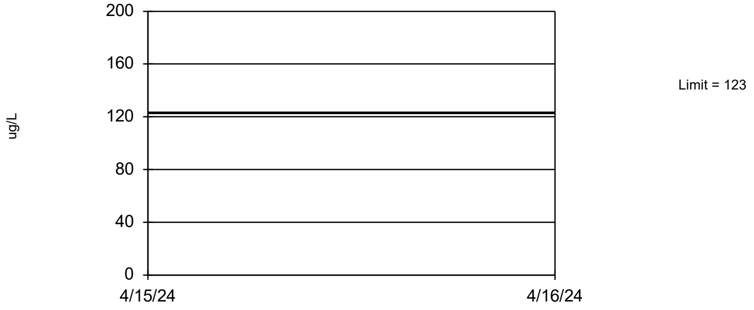
Tolerance Limit

Interwell Non-parametric



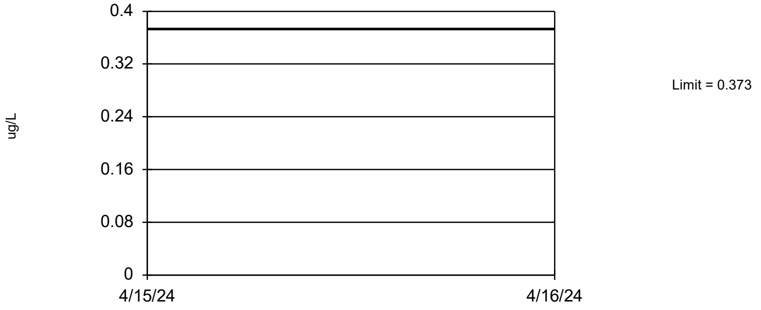
Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 21 background values. 80.27% coverage at alpha=0.01; 86.52% coverage at alpha=0.05; 96.68% coverage at alpha=0.5. Report alpha = 0.3406.

Constituent: Barium   Analysis Run 8/14/2024 10:54 AM   View: Upper Tolerance Limits
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 21 background values. 80.27% coverage at alpha=0.01; 86.52% coverage at alpha=0.05; 96.68% coverage at alpha=0.5. Report alpha = 0.3406.

Constituent: Beryllium   Analysis Run 8/14/2024 10:54 AM   View: Upper Tolerance Limits
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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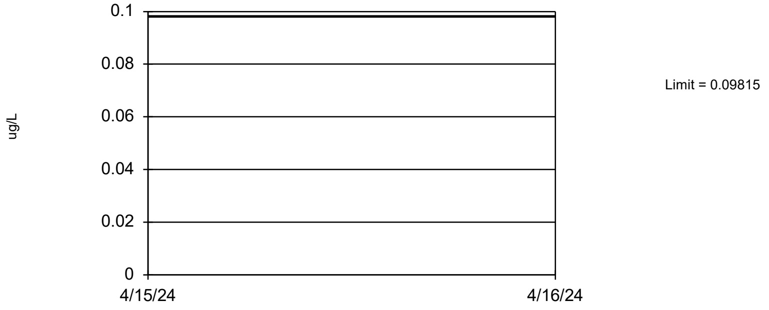
Tolerance Limit

Interwell Parametric



95% coverage. Background Data Summary: Mean=0.03848, Std. Dev.=0.02517, n=21. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9118, critical = 0.873. Report alpha = 0.05.

Constituent: Cadmium Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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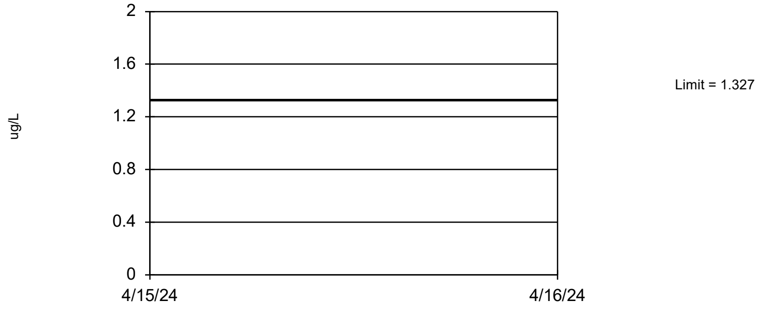
Tolerance Limit

Interwell Parametric



95% coverage. Background Data Summary (based on square root transformation): Mean=0.7663, Std. Dev.=0.1626, n=21. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9258, critical = 0.873. Report alpha = 0.05.

Constituent: Chromium Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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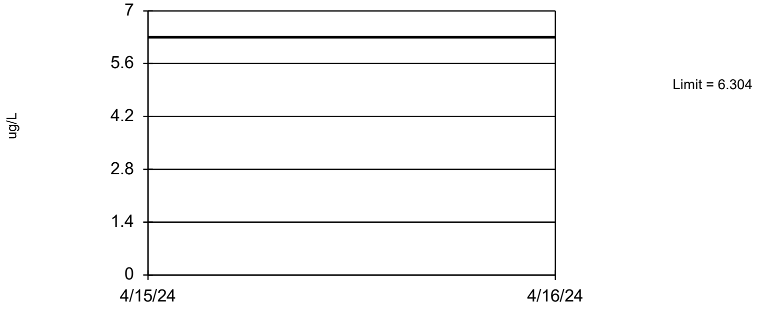
Tolerance Limit

Interwell Parametric



95% coverage. Background Data Summary (based on square root transformation): Mean=1.398, Std. Dev.=0.4692, n=21. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8998, critical = 0.873. Report alpha = 0.05.

Constituent: Cobalt Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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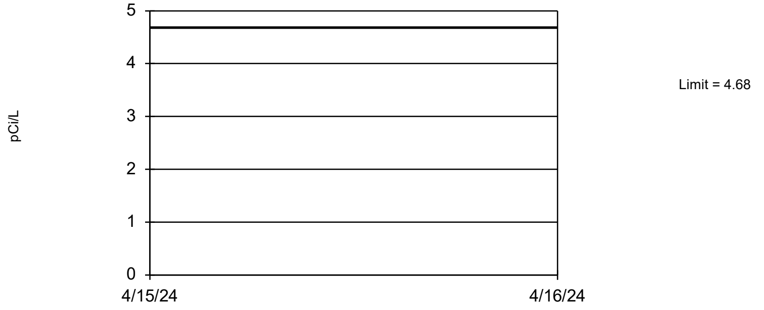
Tolerance Limit

Interwell Non-parametric



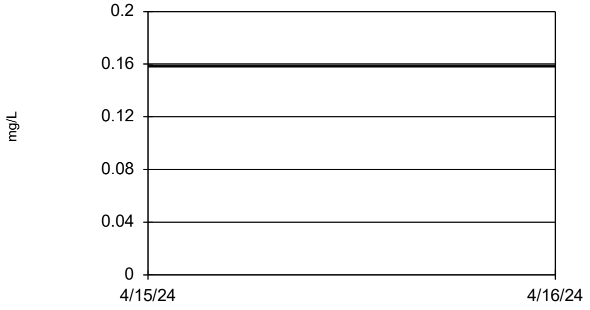
Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 19 background values. 78.32% coverage at alpha=0.01; 85.35% coverage at alpha=0.05; 96.29% coverage at alpha=0.5. Report alpha = 0.3774.

Constituent: Combined Radium 226 + 228 Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limit
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG

Tolerance Limit

Interwell Parametric



Limit = 0.1585

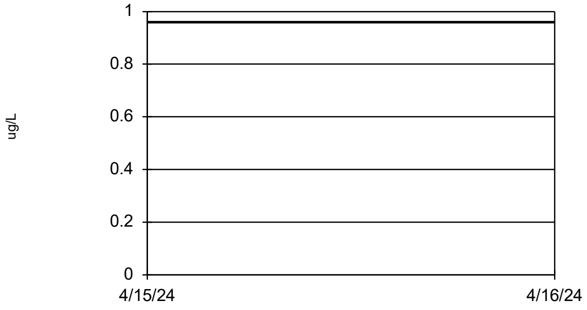
95% coverage. Background Data Summary: Mean=0.07476, Std. Dev.=0.0353, n=21. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8977, critical = 0.873. Report alpha = 0.05.

Constituent: Fluoride Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG

Tolerance Limit

Interwell Non-parametric



Limit = 0.96

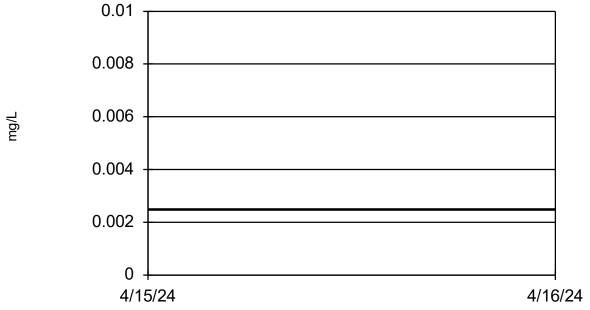
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Limit is highest of 21 background values. 52.38% NDs. 80.27% coverage at alpha=0.01; 86.52% coverage at alpha=0.05; 96.68% coverage at alpha=0.5. Report alpha = 0.3406.

Constituent: Lead Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG

Tolerance Limit

Interwell Non-parametric



Limit = 0.00248

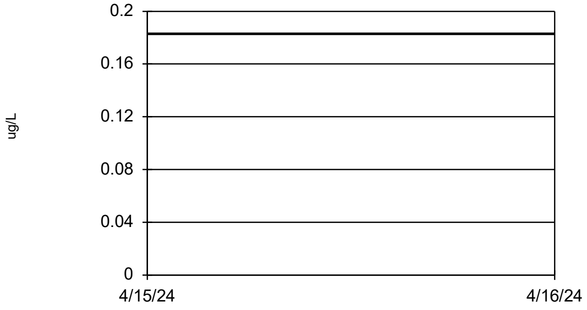
Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 21 background values. 80.27% coverage at alpha=0.01; 86.52% coverage at alpha=0.05; 96.68% coverage at alpha=0.5. Report alpha = 0.3406.

Constituent: Lithium Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG

Tolerance Limit

Interwell Non-parametric

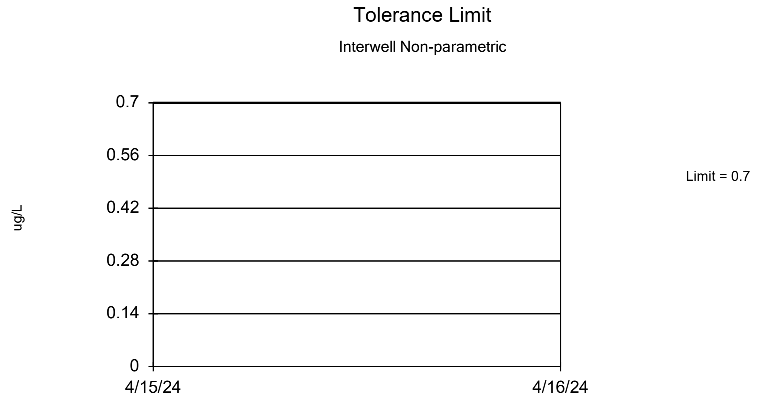


Limit = 0.183

Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 21 background values. 9.524% NDs. 80.27% coverage at alpha=0.01; 86.52% coverage at alpha=0.05; 96.68% coverage at alpha=0.5. Report alpha = 0.3406.

Constituent: Mercury Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

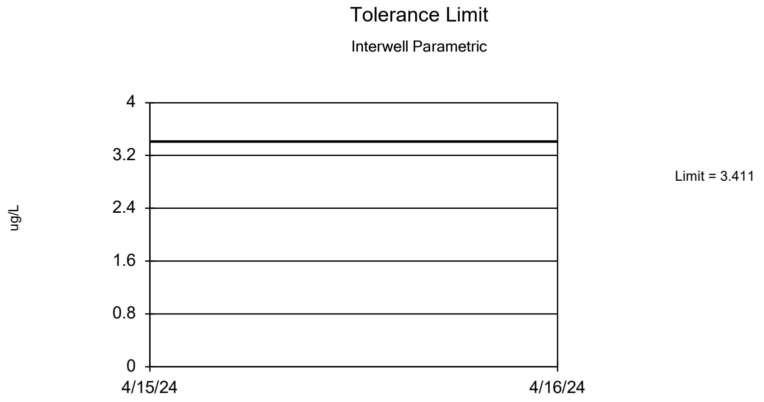
Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Limit is highest of 21 background values. 71.43% NDs. 80.27% coverage at alpha=0.01; 86.52% coverage at alpha=0.05; 96.68% coverage at alpha=0.5. Report alpha = 0.3406.

Constituent: Molybdenum Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

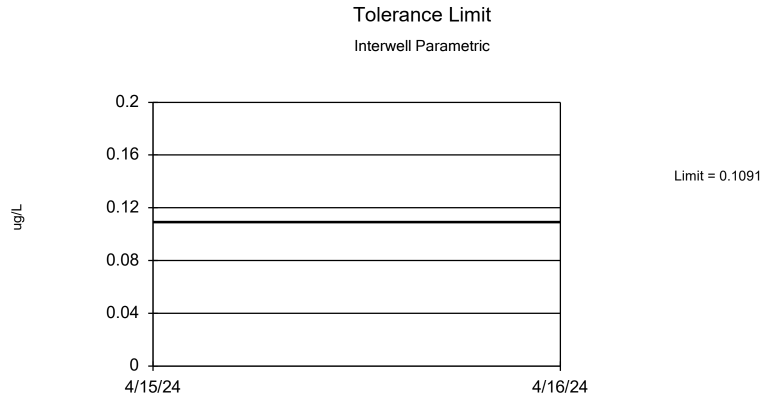
Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG



95% coverage. Background Data Summary (based on square root transformation): Mean=1.037, Std. Dev.=0.3415, n=21. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9155, critical = 0.873. Report alpha = 0.05.

Constituent: Selenium Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.20 Software licensed to Groundwater Stats Consulting. UG



95% coverage. Background Data Summary: Mean=0.06381, Std. Dev.=0.0191, n=21. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8931, critical = 0.873. Report alpha = 0.05.

Constituent: Thallium Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

FIGURE E

GWPS

FLINT CREEK PBAP GWPS				
Constituent Name	**MCL**	**CCR-Rule Specified**	**Background Limit**	**GWPS**
Antimony, Total (ug/L)	6		0.05	6
Arsenic, Total (ug/L)	10		0.65	10
Barium, Total (ug/L)	2000		123	2000
Beryllium, Total (ug/L)	4		0.37	4
Cadmium, Total (ug/L)	5		0.098	5
Chromium, Total (ug/L)	100		1.33	100
Cobalt, Total (ug/L)	n/a	6	6.3	6.3
Combined Radium, Total (pCi/L)	5		4.68	5
Fluoride, Total (mg/L)	4		0.16	4
Lead, Total (ug/L)	n/a	15	0.96	15
Lithium, Total (mg/L)	n/a	0.04	0.0025	0.04
Mercury, Total (ug/L)	2		0.18	2
Molybdenum, Total (ug/L)	n/a	100	0.7	100
Selenium, Total (ug/L)	50		3.41	50
Thallium, Total (ug/L)	2		0.11	2

**Grey cell indicates background limit is higher than MCL or CCR-Rule Specified level*

**GWPS = Groundwater Protection Standard*

**MCL = Maximum Contaminant Level*

**CCR = Coal Combustion Residual*

FIGURE F

Confidence Intervals

Confidence Interval Summary Table - All Results (No Significant)

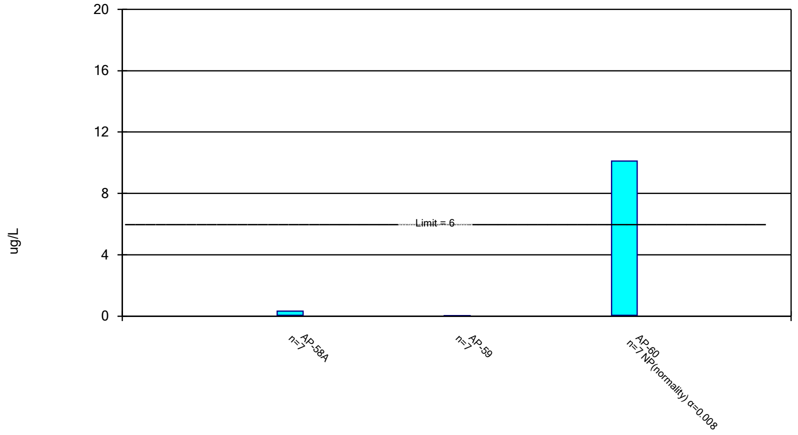
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP Printed 1/13/2025, 8:22 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony (ug/L)	AP-58A	0.3299	0.06069	6	No	7	0.1953	0.1133	0	None	No	0.01	Param.
Antimony (ug/L)	AP-59	0.03002	0.02084	6	No	7	0.02543	0.003867	0	None	No	0.01	Param.
Antimony (ug/L)	AP-60	10.1	0.055	6	No	7	1.529	3.779	0	None	No	0.008	NP (normality)
Arsenic (ug/L)	AP-58A	9.318	6.793	10	No	7	8.056	1.063	0	None	No	0.01	Param.
Arsenic (ug/L)	AP-59	3.215	1.999	10	No	7	2.607	0.512	0	None	No	0.01	Param.
Arsenic (ug/L)	AP-60	7.32	0.6116	10	No	7	3.966	2.824	0	None	No	0.01	Param.
Barium (ug/L)	AP-58A	28.02	25.15	2000	No	7	26.59	1.206	0	None	No	0.01	Param.
Barium (ug/L)	AP-59	74.38	53.68	2000	No	7	64.03	8.715	0	None	No	0.01	Param.
Barium (ug/L)	AP-60	53.22	31.21	2000	No	7	42.21	9.268	0	None	No	0.01	Param.
Beryllium (ug/L)	AP-58A	0.05	0.008	4	No	7	0.044	0.01587	85.71	None	No	0.008	NP (NDs)
Beryllium (ug/L)	AP-59	0.05	0.008	4	No	7	0.03814	0.02025	71.43	None	No	0.008	NP (NDs)
Beryllium (ug/L)	AP-60	8.7	0.05	4	No	7	1.286	3.269	85.71	None	No	0.008	NP (NDs)
Cadmium (ug/L)	AP-58A	0.0147	0.006154	5	No	7	0.01043	0.003599	0	None	No	0.01	Param.
Cadmium (ug/L)	AP-59	0.02673	0.009271	5	No	7	0.018	0.007348	0	None	No	0.01	Param.
Cadmium (ug/L)	AP-60	4.73	0.006	5	No	7	0.6827	1.785	14.29	None	No	0.008	NP (normality)
Chromium (ug/L)	AP-58A	0.4785	0.2637	100	No	7	0.3671	0.1001	0	None	x^(1/3)	0.01	Param.
Chromium (ug/L)	AP-59	0.4088	0.2455	100	No	7	0.3271	0.06873	0	None	No	0.01	Param.
Chromium (ug/L)	AP-60	21.3	0.25	100	No	7	3.343	7.919	0	None	No	0.008	NP (normality)
Cobalt (ug/L)	AP-58A	0.2834	0.1674	6.3	No	7	0.2254	0.04883	0	None	No	0.01	Param.
Cobalt (ug/L)	AP-59	2.424	1.422	6.3	No	7	1.923	0.4217	0	None	No	0.01	Param.
Cobalt (ug/L)	AP-60	5.66	0.352	6.3	No	7	1.323	1.947	0	None	No	0.008	NP (normality)
Combined Radium 226 + 228 (pCi/L)	AP-58A	20.75	0.35	5	No	7	3.706	7.534	0	None	No	0.008	NP (normality)
Combined Radium 226 + 228 (pCi/L)	AP-59	27.8	0.6	5	No	7	5.223	9.975	0	None	No	0.008	NP (normality)
Combined Radium 226 + 228 (pCi/L)	AP-60	26.46	1.01	5	No	7	5.231	9.375	0	None	No	0.008	NP (normality)
Fluoride (mg/L)	AP-58A	0.5276	0.4524	4	No	7	0.49	0.03162	0	None	No	0.01	Param.
Fluoride (mg/L)	AP-59	0.4563	0.3952	4	No	7	0.4257	0.02573	0	None	No	0.01	Param.
Fluoride (mg/L)	AP-60	0.4083	0.186	4	No	7	0.2971	0.09358	0	None	No	0.01	Param.
Lead (ug/L)	AP-58A	0.1456	0.04586	15	No	7	0.09571	0.04198	0	None	No	0.01	Param.
Lead (ug/L)	AP-59	0.2332	0.05247	15	No	7	0.1429	0.0761	0	None	No	0.01	Param.
Lead (ug/L)	AP-60	22.8	0.06	15	No	7	3.334	8.584	14.29	None	No	0.008	NP (normality)
Lithium (mg/L)	AP-58A	0.005267	0.003407	0.04	No	7	0.004337	0.0007831	0	None	No	0.01	Param.
Lithium (mg/L)	AP-59	0.0002806	0.0001994	0.04	No	7	0.00024	0.00003416	0	None	No	0.01	Param.
Lithium (mg/L)	AP-60	0.03847	0.001567	0.04	No	7	0.02002	0.01553	0	None	No	0.01	Param.
Mercury (ug/L)	AP-58A	0.006	0.0025	2	No	7	0.004071	0.001539	14.29	None	No	0.008	NP (normality)
Molybdenum (ug/L)	AP-58A	31.2	15.17	100	No	7	23.19	6.747	0	None	No	0.01	Param.
Molybdenum (ug/L)	AP-59	5.895	4.648	100	No	7	5.271	0.5251	0	None	No	0.01	Param.
Molybdenum (ug/L)	AP-60	26.93	4.238	100	No	7	15.59	9.553	0	None	No	0.01	Param.
Selenium (ug/L)	AP-58A	0.2122	0.09922	50	No	7	0.1557	0.04756	0	None	No	0.01	Param.
Selenium (ug/L)	AP-59	0.1736	0.04012	50	No	7	0.1014	0.0701	14.29	None	x^(1/3)	0.01	Param.
Selenium (ug/L)	AP-60	36.9	0.04	50	No	7	5.37	13.9	14.29	None	No	0.008	NP (normality)
Thallium (ug/L)	AP-59	0.1527	0.1073	2	No	7	0.13	0.01915	0	None	No	0.01	Param.
Thallium (ug/L)	AP-60	5.49	0.03	2	No	7	0.8557	2.044	0	None	No	0.008	NP (normality)

Sanitas™ v.10.0.24 Software licensed to Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

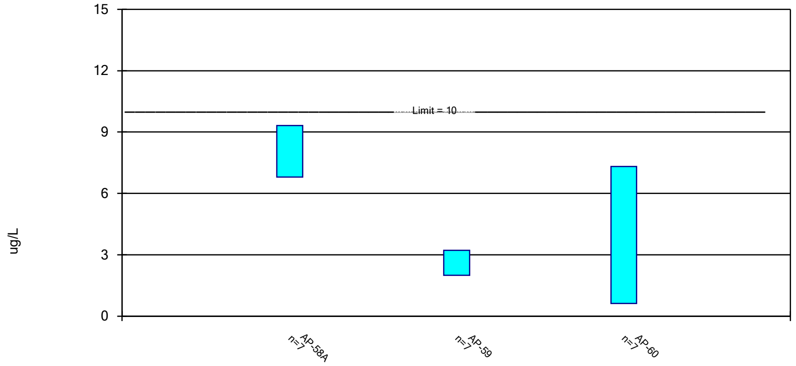


Constituent: Antimony   Analysis Run 1/13/2025 8:20 AM   View: Confidence Intervals
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

Sanitas™ v.10.0.24 Software licensed to Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Arsenic   Analysis Run 1/13/2025 8:20 AM   View: Confidence Intervals
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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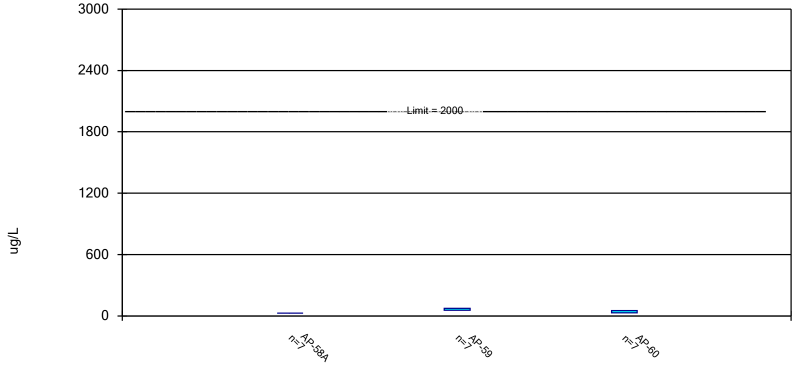
Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Barium   Analysis Run 1/13/2025 8:20 AM   View: Confidence Intervals
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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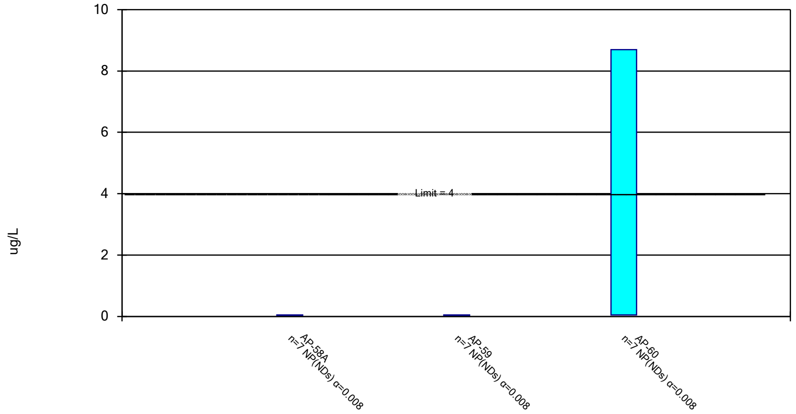
Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Beryllium   Analysis Run 1/13/2025 8:20 AM   View: Confidence Intervals
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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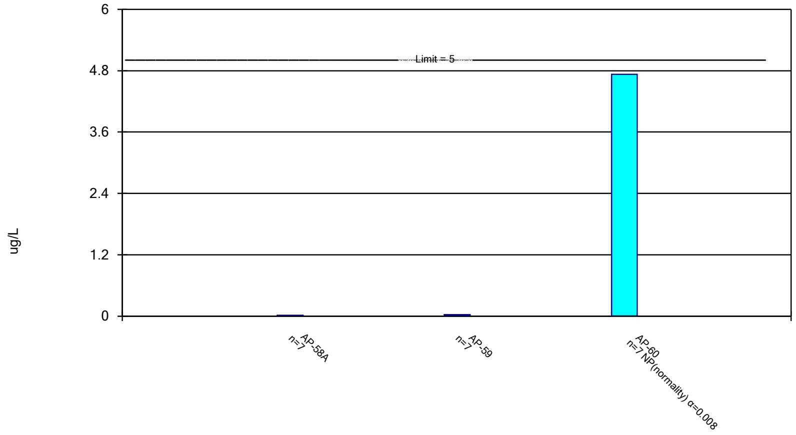
Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



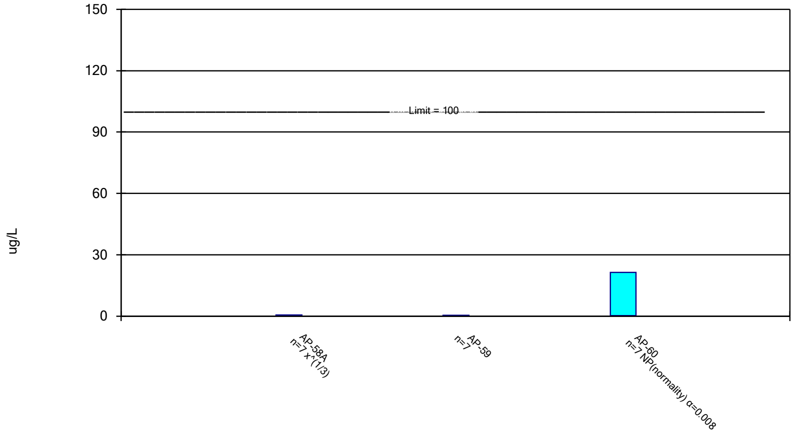
Constituent: Cadmium Analysis Run 1/13/2025 8:20 AM View: Confidence Intervals

Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.24 Software licensed to Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Chromium Analysis Run 1/13/2025 8:20 AM View: Confidence Intervals

Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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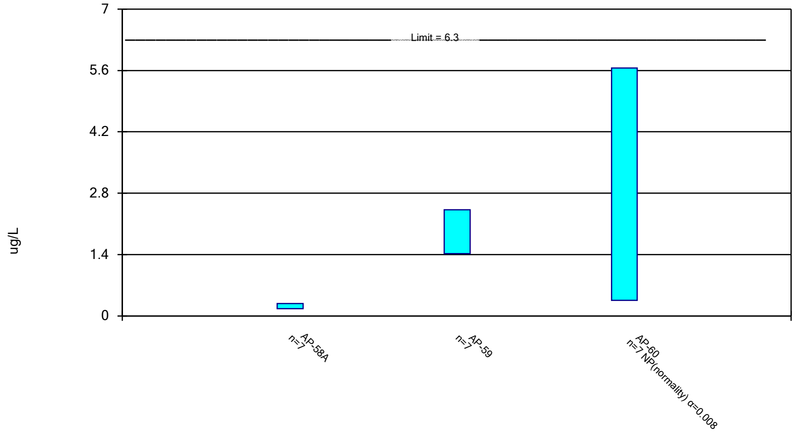
Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Cobalt Analysis Run 1/13/2025 8:20 AM View: Confidence Intervals

Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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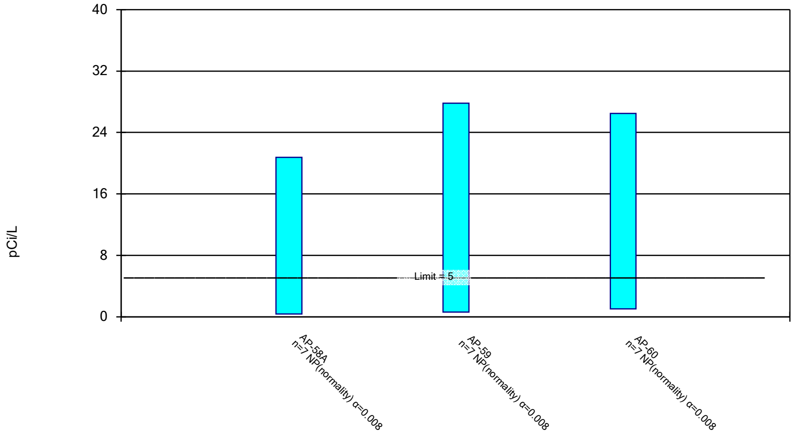
Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Combined Radium 226 + 228 Analysis Run 1/13/2025 8:20 AM View: Confidence Intervals

Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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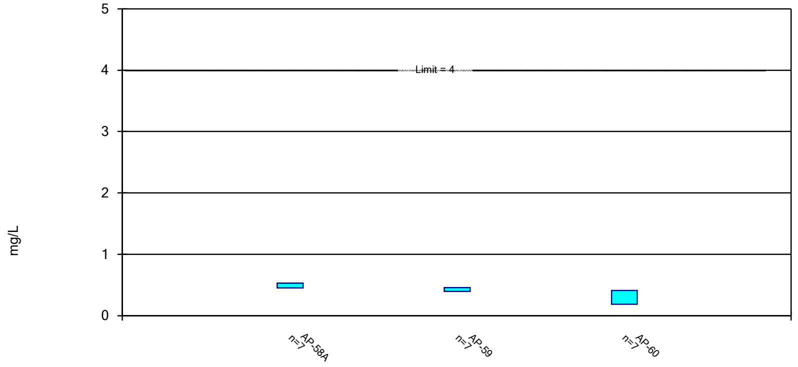
Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Fluoride Analysis Run 1/13/2025 8:20 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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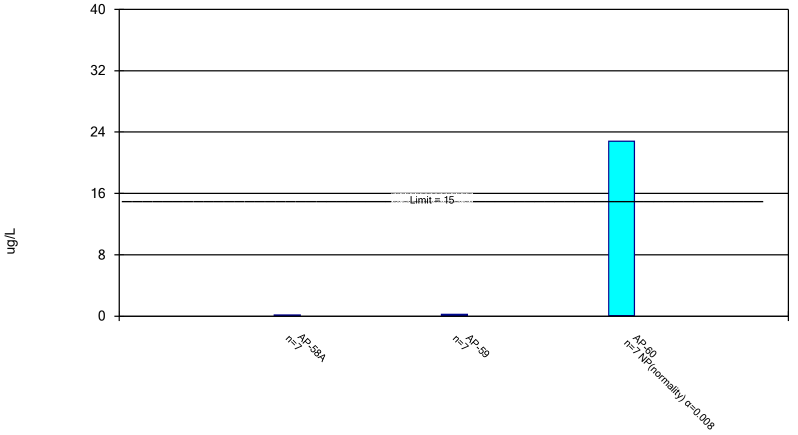
Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

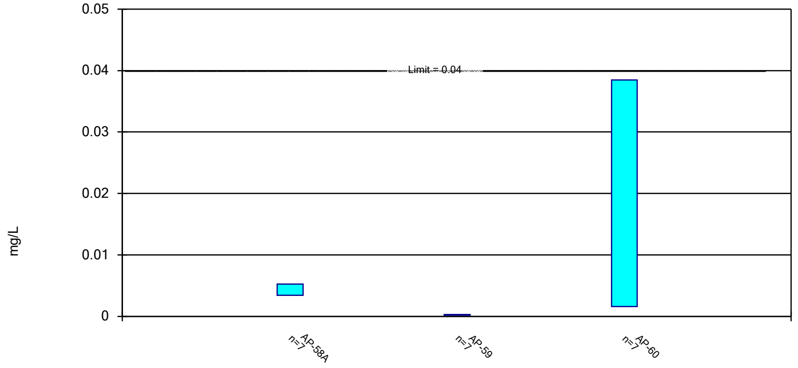


Constituent: Lead Analysis Run 1/13/2025 8:20 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.24 Software licensed to Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

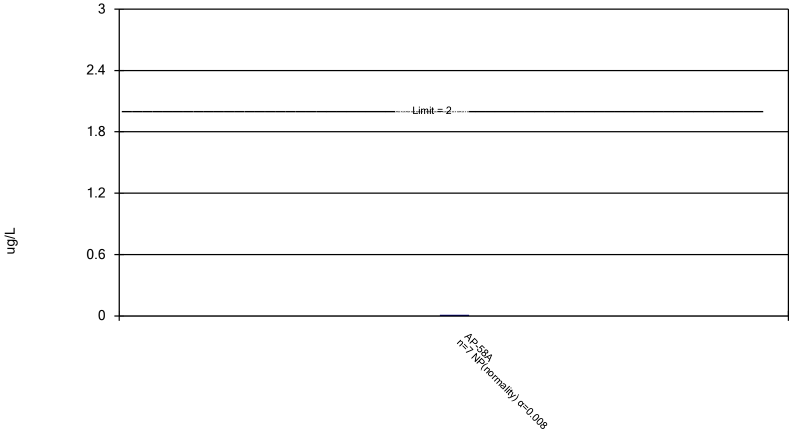


Constituent: Lithium Analysis Run 1/13/2025 8:20 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.24 Software licensed to Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

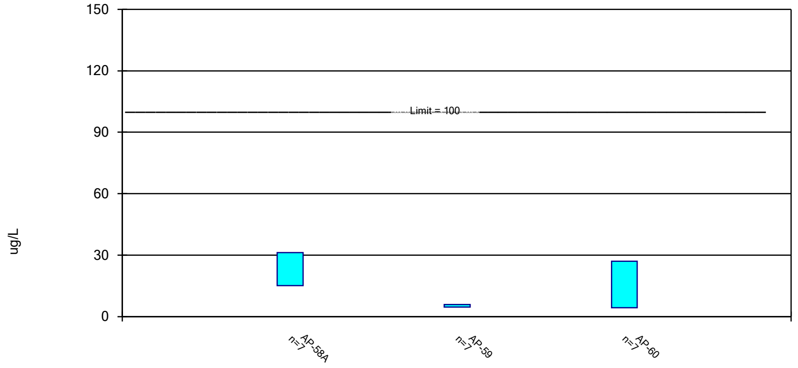


Constituent: Mercury Analysis Run 1/13/2025 8:20 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.24 Software licensed to Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

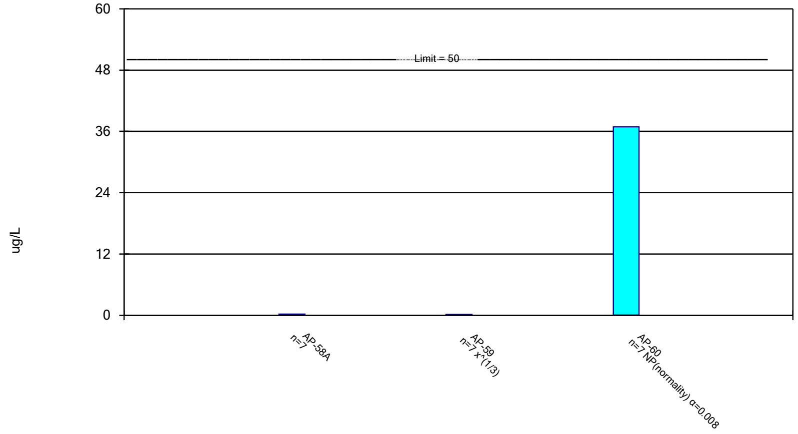


Constituent: Molybdenum   Analysis Run 1/13/2025 8:20 AM   View: Confidence Intervals
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

Sanitas™ v.10.0.24 Software licensed to Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

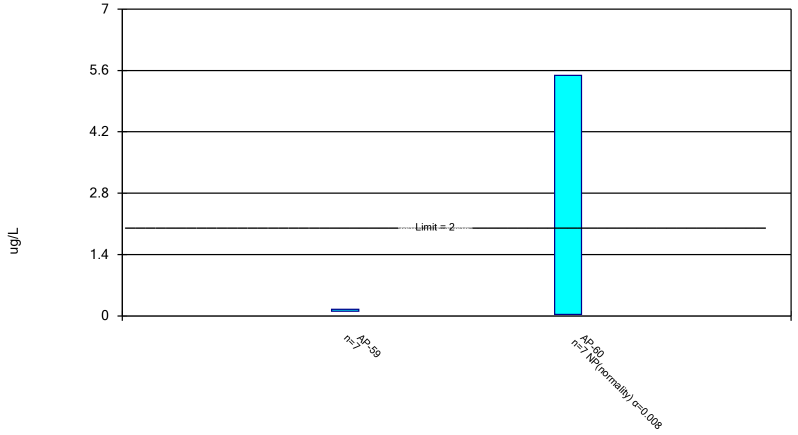


Constituent: Selenium   Analysis Run 1/13/2025 8:20 AM   View: Confidence Intervals
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

Sanitas™ v.10.0.24 Software licensed to Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Thallium   Analysis Run 1/13/2025 8:20 AM   View: Confidence Intervals
Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

ATTACHMENT C

Record of Revisions

SOUTHWESTERN ELECTRIC POWER COMPANY (SWEPCO)

Flint Creek Plant

Statistical Analysis Summary – Appendix IV Analyses
Primary Bottom Ash Pond

Revision 1 – January 2025

Record of Plan Revisions		
Revision Number	Date	Revision Description
1	January 2025	Table 2 – Revised the lithium groundwater protection standard from 0.004 milligrams per liter (mg/L) to 0.0400 mg/L. Attachment A – Revised certification language to reference 40 CFR 257.93(f) and 40 CFR 257.95(g) instead of 40 CFR 257.102(c). Attachment B – Revised Figure E and Figure F to use a lithium groundwater protection standard of 0.0400 mg/L.

STATISTICAL ANALYSIS SUMMARY APPENDIX IV ANALYSES PRIMARY BOTTOM ASH POND

Flint Creek Plant

Gentry, Arkansas

Prepared for

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

Prepared by

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

Project Number: CHA8500B

December 19, 2024

TABLE OF CONTENTS

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LIST OF ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
CCR	coal combustion residual
CFR	Code of Federal Regulations
GWPS	groundwater protection standard
mg/L	milligrams per liter
PBAP	Primary Bottom Ash Pond
QA/QC	quality assurance/quality control
SSL	statistically significant level

1. EXECUTIVE SUMMARY

Groundwater monitoring has been conducted at the Primary Bottom Ash Pond (PBAP), an existing coal combustions residuals (CCR) unit at the Flint Creek Power Plant in Gentry, Arkansas, in accordance with United States Environmental Protection Agency regulations regarding the disposal of CCR in landfills and surface impoundments (Code of Federal Regulations [CFR] Title 40, Section 257, Subpart D). In accordance with 40 CFR 257.102, regarding the closure of CCR units by removal, recent groundwater monitoring results were used to identify concentrations of Appendix IV constituents that may be above site-specific groundwater protection standards (GWPSs).

Closure of the PBAP was initiated in November 2022, and removal of CCR materials was completed in August 2023 (American Electric Power [AEP] 2024). Seven groundwater sampling events were completed between September 2023 and April 2024 to support an evaluation of whether closure by removal was complete. The results of these seven events were used to construct confidence intervals for the Appendix IV constituents to compare to site-specific GWPS, with no exceedances identified. Groundwater samples were collected in August 2024 for the Appendix IV constituents to support an evaluation of whether closure by removal is complete. The results of the August 2024 sampling event are documented in this report.

Before the statistical analyses were conducted, the groundwater data underwent several validation tests, including those for completeness, sample tracking accuracy, transcription errors, and consistent use of measurement units. No data quality issues that would impact data usability were identified.

The monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. Confidence intervals were calculated for Appendix IV constituent data at the compliance wells to assess whether any were present at statistically significant levels (SSLs) above the corresponding GWPS. No SSLs were identified. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

2. PRIMARY BOTTOM ASH POND EVALUATION

2.1 Data Validation and QA/QC

One set of samples was collected for analysis in August 2024. Samples were collected from each background and compliance well and analyzed for all Appendix III and Appendix IV parameters. A summary of data used in the statistical analyses may be found in Table 1.

Chemical analysis was completed by a National Environmental Laboratory Accreditation Program-certified analytical laboratory. The laboratory completed analysis of quality assurance and quality control (QA/QC) samples such as laboratory reagent blanks, continuing calibration verification samples, and laboratory fortified blanks.

The analytical data were imported into a Microsoft Access database, where checks were completed to assess the accuracy of sample location identification and analyte identification. Where necessary, unit conversions were applied to standardize reported units across all sampling events. Exported data files were created for use with the Sanitas™ v.10.0.23a statistics software. The export file was checked against the analytical data for transcription errors and completeness.

2.2 Statistical Analysis

Statistical analyses for the PBAP were conducted in accordance with the October 2020 Statistical Analysis Plan (Geosyntec 2020). Time series plots and results for all completed statistical tests are provided in Attachment B. The data collected in August 2024 were screened for potential outliers. No outliers were identified for this event. Outliers associated with previous sampling events were discussed in the prior statistical evaluation (Geosyntec 2024).

2.2.1 Evaluation of Potential Appendix IV SSLs

A confidence interval was constructed for each Appendix IV parameter at each compliance well. Confidence limits were generally calculated parametrically ($\alpha = 0.01$), but nonparametric confidence limits were calculated in some cases (e.g., when the data did not appear to be normally distributed or when the nondetect frequency was too high). An SSL was concluded if the lower confidence limit was above the GWPS (i.e., if the entire confidence interval was above the GWPS). The calculated confidence limits (Attachment B) were compared to the GWPS provided in Table 2. The GWPSs were established during a previous statistical analysis as either (a) the background concentration or (b) the maximum contaminant level and risk-based levels specified in 40 CFR 957.95(h)(2), whichever was greater (Geosyntec 2024).

No SSLs were identified at the Flint Creek PBAP.

2.3 Conclusions

Groundwater monitoring and statistical analyses of Appendix IV parameters were conducted in accordance with the CCR Rule to support an evaluation of closure progress. The laboratory and field data were reviewed prior to statistical analysis, with no QA/QC issues identified that prevented data usage. No outliers were identified for this event. A confidence interval was constructed at each compliance well for each Appendix IV parameter; SSLs were concluded if the entire confidence interval was above the GWPS. No SSLs were identified.

3. REFERENCES

AEP. 2024. *Annual Groundwater Monitoring Report – Flint Creek Power Plant, Primary Bottom Ash Pond CCR Management Unit, Gentry, Arkansas.* American Electric Power. January.

Geosyntec. 2020. *Statistical Analysis Plan – Flint Creek Plant.* Geosyntec Consultants, Inc. October.

Geosyntec. 2024. *Statistical Analysis Summary, Appendix IV Analyses – Primary Bottom Ash Pond, Flint Creek Plant, Gentry, Arkansas.* Geosyntec Consultants, Inc. October.

TABLES

Table 1. Groundwater Data Summary
Statistical Analysis Summary
Flint Creek Plant - Primary Bottom Ash Pond

Parameter	Unit	AP-51		AP-53	AP-54	AP-58A	AP-59	AP-60
		8/19/2024	8/20/2024	8/20/2024	8/20/2024	8/20/2024	8/20/2024	8/20/2024
Antimony	µg/L	--	0.014 J1	0.022 J1	0.010 J1	0.059 J1	0.026 J1	0.065 J1
Arsenic	µg/L	--	0.26	1.71	0.32	6.24	2.67	4.24
Barium	µg/L	--	124	63.3	42.1	28.6	58.5	33.2
Beryllium	µg/L	--	0.393	0.100	0.027 J1	0.05 U1	0.007 J1	0.05 U1
Boron	mg/L	--	0.05 U1	0.234	0.176	0.579	0.300	0.545
Cadmium	µg/L	--	0.159	0.038	0.048	0.02 U1	0.021	0.005 J1
Calcium	mg/L	--	8.02	14.2	21.4	19.1	44.4	46.4
Chloride	mg/L	--	10.9	17.8	17.1	20.4	17.9	17.0
Chromium	µg/L	--	0.84	0.67	0.46	0.73	0.36	0.35
Cobalt	µg/L	--	1.27	3.15	2.34	0.156	2.05	0.509
Combined Radium	pCi/L	--	2.53	2.02	2.49	1.21	3.03	2.61
Fluoride	mg/L	--	0.03 J1	0.14	0.07	0.42	0.41	0.32
Lead	µg/L	--	0.28	0.12 J1	0.2 U1	0.2 U1	0.14 J1	0.09 J1
Lithium	mg/L	--	0.00235	0.00048	0.00018 J1	0.00322	0.00024 J1	0.00448
Mercury	µg/L	--	0.044	0.018	0.002 J1	0.003 J1	0.005 U1	0.005 U1
Molybdenum	µg/L	--	0.5 U1	0.7	0.5 U1	15.4	6.0	14.2
Selenium	µg/L	--	0.66	1.13	1.00	0.08 J1	0.08 J1	0.06 J1
Sulfate	mg/L	--	0.2 J1	41.5	49.8	59.8	30.0	78.3
Thallium	µg/L	--	0.07 J1	0.12 J1	0.07 J1	0.2 U1	0.12 J1	0.09 J1
Total Dissolved Solids	mg/L	--	80	140	170	270	230	270
pH	SU	5.7	--	6.3	6.5	7.1	6.2	6.8

Notes:

--: not sampled

J1: estimated value. Parameter was detected in concentrations below the reporting limit.

mg/L: milligrams per liter

pCi/L: picocuries per liter

SU: standard unit

U1: non-detect value. For statistical analysis, parameters which were not detected were replaced with the reporting limit.

µg/L: micrograms per liter

Table 2. Appendix IV Groundwater Protection Standards
Statistical Analysis Summary
Flint Creek Plant – Primary Bottom Ash Pond

Constituent Name	MCL	CCR-Rule Specified	Calculated UTL	GWPS
Antimony, Total (mg/L)	0.00600		0.0000500	0.00600
Arsenic, Total (mg/L)	0.0100		0.000651	0.0100
Barium, Total (mg/L)	2.00		0.123	2.00
Beryllium, Total (mg/L)	0.00400		0.000373	0.00400
Cadmium, Total (mg/L)	0.00500		0.0000982	0.00500
Chromium, Total (mg/L)	0.100		0.00133	0.100
Cobalt, Total (mg/L)	n/a	0.00600	0.00630	0.00630
Combined Radium, Total (pCi/L)	5.00		4.68	5.00
Fluoride, Total (mg/L)	4.00		0.159	4.00
Lead, Total (mg/L)	n/a	0.0150	0.000960	0.0150
Lithium, Total (mg/L)	n/a	0.0400	0.00248	0.0400
Mercury, Total (mg/L)	0.00200		0.000183	0.00200
Molybdenum, Total (mg/L)	n/a	0.100	0.000700	0.100
Selenium, Total (mg/L)	0.0500		0.00341	0.0500
Thallium, Total (mg/L)	0.00200		0.000109	0.00200

Notes:

1. Calculated UTL (upper tolerance limit) represents site-specific background values.
2. Grey cells indicate the GWPS is based on the calculated UTL. Either the UTL is higher than the MCL or an MCL does not exist.

GWPS: groundwater protection standard

MCL: maximum contaminant level

mg/L: milligrams per liter

n/a: not applicable

pCi/L: picocuries per liter

ATTACHMENT A

Certification by Qualified Professional Engineer

Certification by Qualified Professional Engineer

I certify that the selected and above described statistical method 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 257.93(f) and 40 CFR 257.93(g) for Appendix IV constituents have been met.

DAVID ANTHONY MILLER
No. 15296

David Anthony Miller
Printed Name of Licensed Professional Engineer

David Anthony Miller
Signature

15296
License Number

Arkansas
Licensing State

12.19.2024
Date

ATTACHMENT B

Statistical Analysis Output

GROUNDWATER STATS
CONSULTING

November 14, 2024

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
500 W. Wilson Bridge Road, Ste. #250
Worthington, OH 43085

Re: Flint Creek Bottom Ash Pond (BAP)
Assessment Monitoring Summary – August 2024

Dear Ms. Kreinberg,

Groundwater Stats Consulting (GSC), formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the Assessment Monitoring statistical analysis of groundwater data through August 2024 at American Electric Power (AEP) Company's Flint Creek BAP. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals (CCR) from Electric Utilities (CCR Rule, 2015) as well as with the United States Environmental Protection Agency (USEPA) Unified Guidance (2009).

Sampling began at the site for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, consists of the following:

o **Upgradient wells:**	AP-51, AP-53, and AP-54
o **Downgradient wells:**	AP-58A, AP-59, and AP-60

Data were sent electronically, and the statistical analysis was conducted according to the Statistical Analysis Plan and original screening evaluation prepared by GSC and approved by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to GSC. The statistical analysis was reviewed by Dr. Jim Loftis, Civil & Environmental Engineering professor emeritus at Colorado State University and Senior Advisor to Groundwater Stats Consulting.

The CCR program consists of the following constituents:

- **Appendix IV** (Assessment Monitoring) – antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, combined radium 226 + 228, fluoride, lead, lithium, mercury, molybdenum, selenium, and thallium

For all constituents, a substitution of the most recent reporting limit is used for non-detect data. Note that when there are no detections present in downgradient wells for a given constituent, statistical analyses are not required. A summary of well/constituent pairs containing 100% non-detects follows this letter.

Time series and box plots for Appendix IV parameters are provided for all wells and constituents; and are used to evaluate concentrations over the entire record (Figures A and B, respectively). Values in background which have previously been flagged as outliers may be seen in a lighter font and disconnected symbol on the graphs. Additionally, a summary of flagged values follows this letter (Figure C).

Note that AEP collected an additional eight samples following initiation/completion of closure construction activities, and these observations are evaluated in this report.

Summary of Statistical Methods – Appendix IV Parameters

The overall statistical approach involves a comparison of downgradient water quality against upgradient background water quality limits or regulatory limits. The comparison is made using confidence intervals constructed on individual downgradient well-constituent pairs. The lower confidence limit is compared against a Groundwater Protection Standard (GWPS), which is defined by the higher of either the background water quality limits or regulatory limits.

To determine upgradient background water quality limits, parametric tolerance limits are utilized when the screened historical data follow a normal or transformed-normal distribution. When data cannot be normalized or the majority of data are non-detects, a nonparametric test is utilized. The distribution of data is tested using the Shapiro-Wilk/Shapiro-Francia test for normality. After testing for normality and performing any adjustments as discussed below (USEPA, 2009), data are analyzed using either parametric or non-parametric tolerance limits as appropriate.

- No statistical analyses are required on wells and analytes containing 100% non-detects (USEPA Unified Guidance, 2009, Chapter 6).
- When data contain <15% non-detects, simple substitution of one-half the reporting limit is utilized in the statistical analysis. The reporting limit utilized for

non-detects is the most recent practical quantification limit (PQL) as reported by the laboratory.
- When data contain between 15-50% non-detects, the Kaplan-Meier non-detect adjustment is applied to the background data for parametric limits. This technique adjusts the mean and standard deviation of the historical concentrations to account for concentrations below the reporting limit.
- Nonparametric tolerance limits are used on data containing greater than 50% non-detects.

Parametric tolerance limits are calculated, with a target of 95% confidence and 95% coverage, when data follow a normal or transformed-normal distribution. When data contained greater than 50% non-detects or did not follow a normal or transformed-normal distribution, non-parametric tolerance limits were constructed using the highest background measurement. The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples.

When data followed a normal or transformed-normal distribution, parametric confidence intervals were used for Appendix IV parameters and compared to GWPS to assess compliance. Nonparametric confidence intervals, which use the largest and smallest order statistics depending on the sample size as interval limits, were constructed when data did not follow a normal or transformed-normal distribution or when there were greater than 50% non-detects. The lower confidence limit, which is constructed with 99% confidence for parametric confidence intervals, is compared to the GWPS prepared as described above. The confidence level associated with nonparametric confidence intervals is dependent upon the number samples available.

Background Update – April 2024

Background (upgradient) data sets were evaluated for Appendix IV constituents for the purpose of updating statistical limits through April 2024. Time series plots and Tukey's outlier test were used to identify potential outliers. Data were also screened for extreme trending patterns that would lead to artificially elevated statistical limits; however, reported measurements in upgradient wells appear stable over time or contained low-level detections which did not exceed the established Maximum Contaminant Limits (MCLs). Therefore, trend testing was not required.

Downgradient well data through April 2024 were also screened through visual screening using time series graphs. Since the downgradient well data are used to construct confidence intervals, values that are marginally high relative to the rest of the data are retained unless there is particular justification for excluding them. High measurements are flagged only when the concentrations are distinctly different from remaining measurements within a given well. When preceding and subsequent measurements to a single high reported concentration are significantly lower and similar, the assumption is that the increase in a single measurement is spurious and not representative of the true population of groundwater quality. Flagging those measurements as outliers reduces the variance which reduces the width of parametric confidence intervals, as well as reduces the overall mean and thus lowers the entire interval. The intent is to better represent the true mean of the population in downgradient wells. A summary of the update results is included below.

Outlier Analysis

Prior to evaluating Appendix IV parameters, pooled upgradient well data were screened through both visual screening and Tukey's outlier test for potential outliers and extreme trending patterns that would lead to artificially elevated statistical limits. All flagged values may be seen on the Outlier Summary following this letter (Figure C).

Tukey's outlier test identified an outlier for lead in upgradient wells; however, this measurement was not flagged as an outlier since the concentration is lower than the established MCL and has no impact on the Groundwater Protection Standard.

While Tukey's test did not identify the highest measurements of combined radium in upgradient wells, it was noted that the laboratory flagged the highest reported measurement in upgradient well AP-53 with "P1" to indicate the precision between the duplicate results was above acceptance limits. Additionally, while the highest measurement in upgradient well AP-51 did not have a "P1" flag, the measurement is similar to the flagged measurement in upgradient well AP-53 and is also substantially elevated above remaining measurements upgradient of the facility. Therefore, both measurements were flagged as outliers in the database and deselected prior to construction of interwell tolerance limits to use stable concentrations. While the combined radium values for the same sample event in wells AP-58A, AP-59, and AP-60 are elevated as well, those measurements are not flagged because the concentrations occur in downgradient wells, as discussed earlier. High values for several constituents were measured for the November 2023 sample event at downgradient well AP-60 but, similarly, were not flagged. No measurements among downgradient wells were flagged as outliers.

Interwell Upper Tolerance Limits

Upper tolerance limits were used to calculate background limits from pooled upgradient well data through April 2024 for Appendix IV parameters (Figure D).

Groundwater Protection Standards

The upper tolerance limits were compared to the Maximum Contaminant Levels (MCLs) and CCR-Rule Specified limits in the Groundwater Protection Standard (GWPS) table following this letter to determine the highest limit for use as the GWPS in the Confidence Interval comparisons (Figure E).

Evaluation of Appendix IV Parameters – August 2024

Confidence intervals were constructed with data through August 2024 on downgradient wells for each of the Appendix IV parameters and compared to the GWPS (i.e., the highest limit of the MCL or background limit as discussed above). Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. A summary of the confidence interval results follows this letter (Figure F) and no exceedances were identified.

Trend Test Evaluation – Appendix IV

When confidence interval exceedances are identified in downgradient wells, data are further evaluated using the Sen's Slope/Mann Kendall trend test to determine whether concentrations are statistically increasing, decreasing, or stable at the 95% confidence level. Utilizing the 95% confidence level for trend tests readily identifies significant trends and is more sensitive than the 99% confidence level without drastically increasing the false negative rate. Upgradient wells are included in the trend analyses for all parameters found to exceed their confidence interval in downgradient wells. When similar patterns exist upgradient of the site, it is an indication of spatial variability in groundwater which may be unrelated to practices at the site. Since no exceedances were identified, no trend tests were required.

Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Flint Creek Bottom Ash Pond. If you have any questions or comments, please feel free to contact us.

For Groundwater Stats Consulting,

A Collins

Andrew Collins
Project Manager

Kristina Rayner

Kristina Rayner
Senior Statistician

100% Non-Detects

Analysis Run 10/29/2024 9:17 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

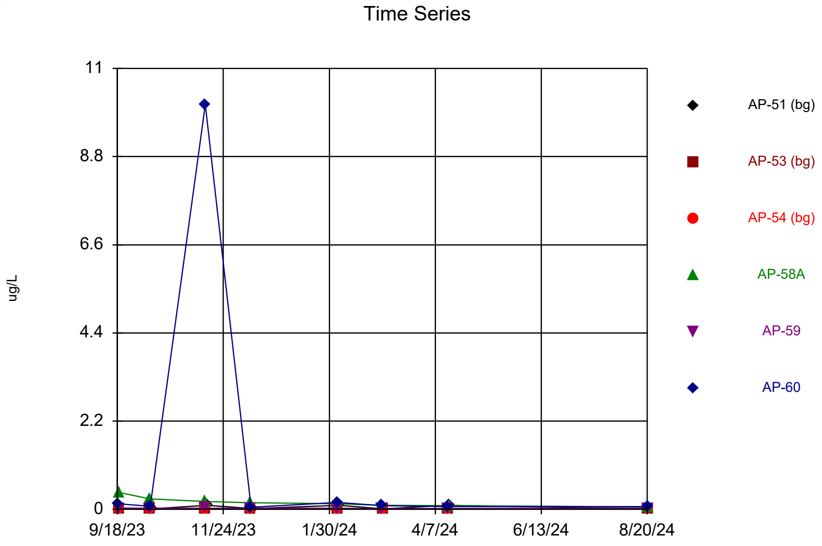
Mercury (ug/L)
AP-59, AP-60

Thallium (ug/L)
AP-58A

FIGURE A

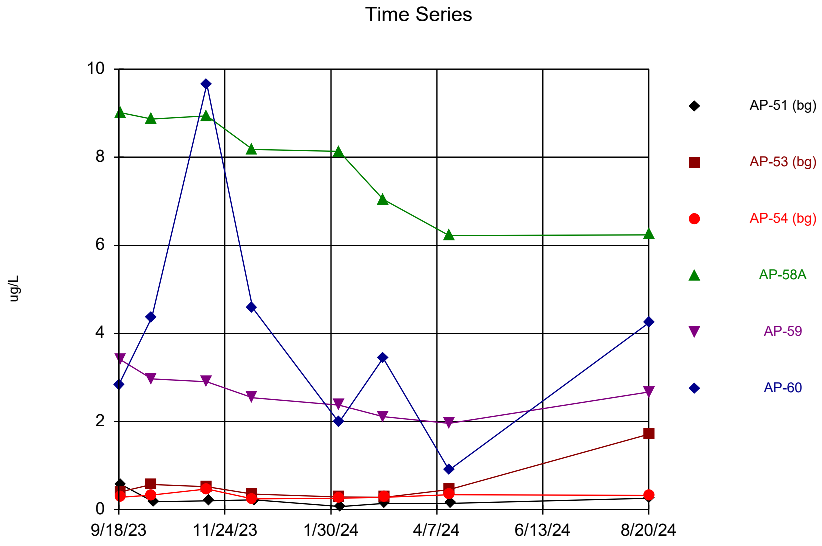
Time Series

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



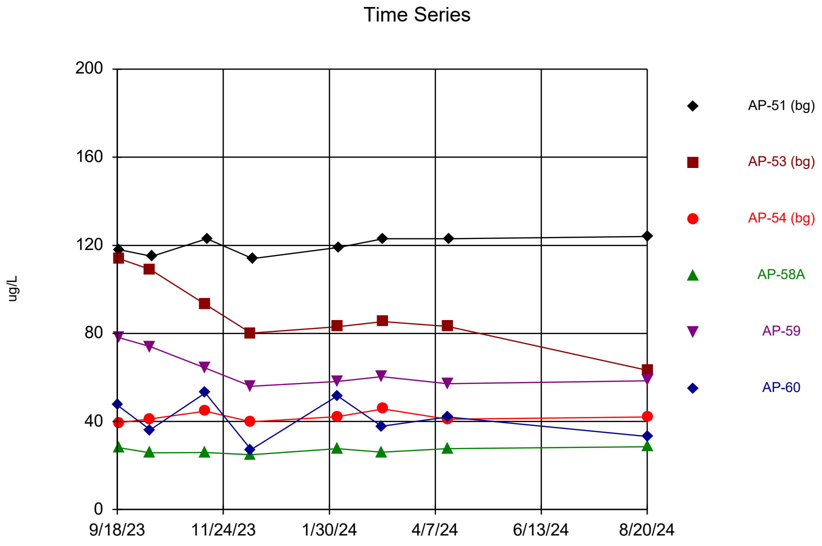
Constituent: Antimony Analysis Run 10/29/2024 9:15 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG



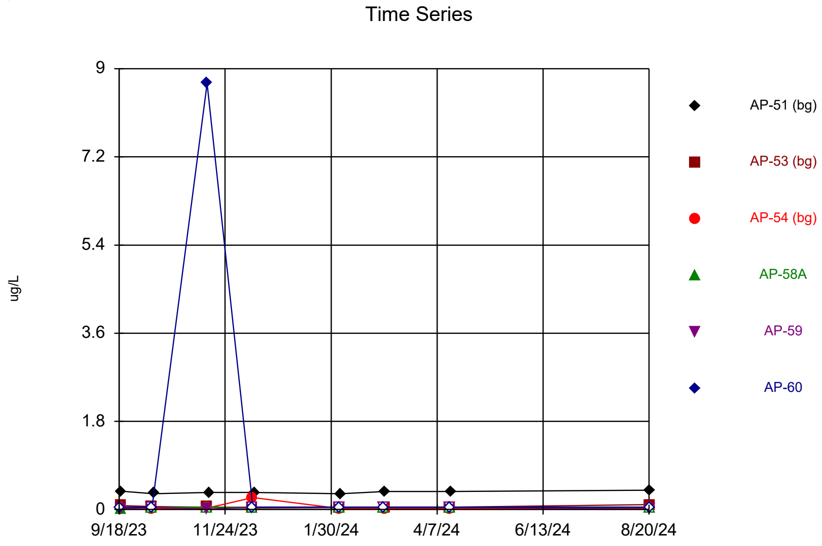
Constituent: Arsenic Analysis Run 10/29/2024 9:15 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG



Constituent: Barium Analysis Run 10/29/2024 9:15 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

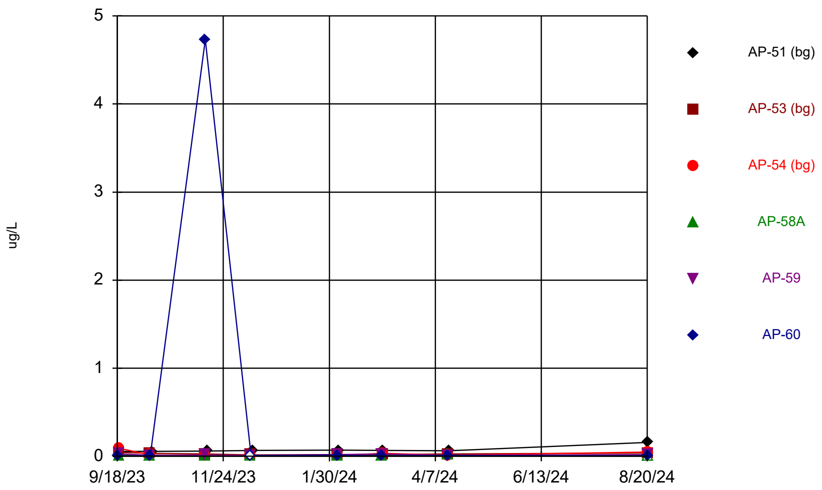
Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Beryllium Analysis Run 10/29/2024 9:15 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



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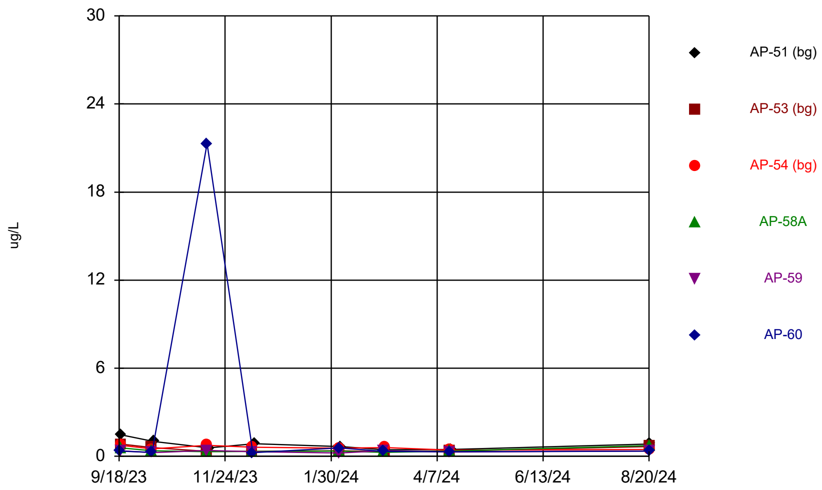
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG

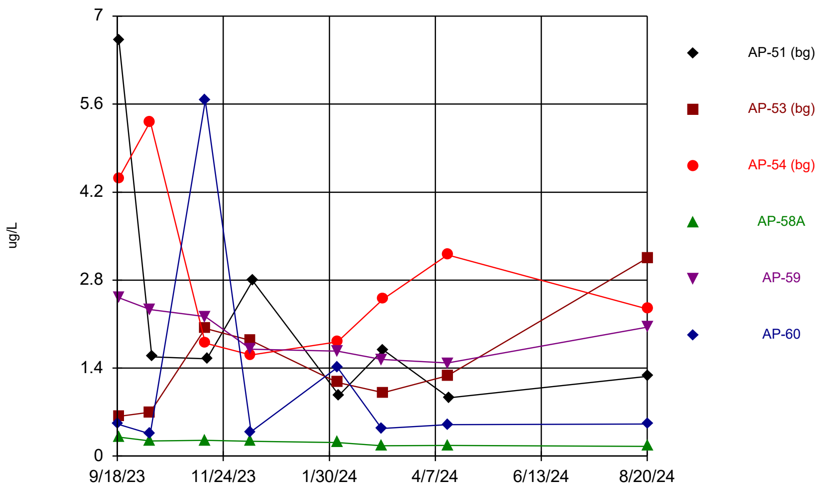
Time Series



Constituent: Chromium Analysis Run 10/29/2024 9:15 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG

Time Series



Constituent: Cobalt Analysis Run 10/29/2024 9:15 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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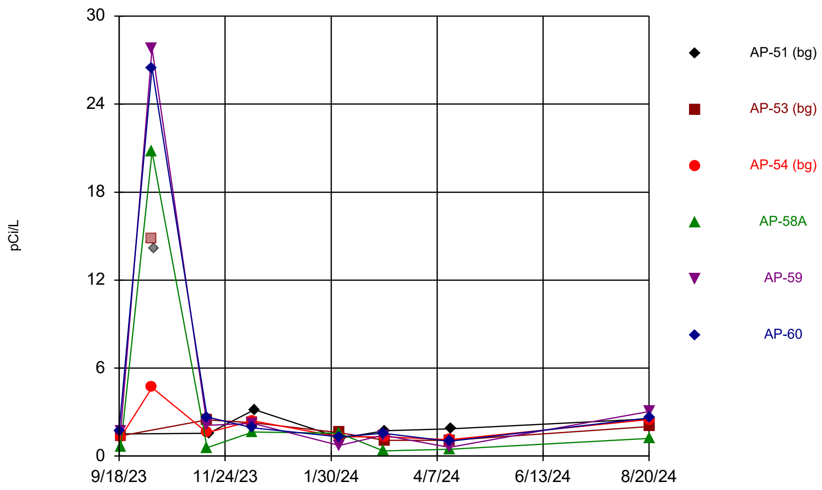
Time Series



Constituent: Combined Radium 226 + 228 Analysis Run 10/29/2024 9:15 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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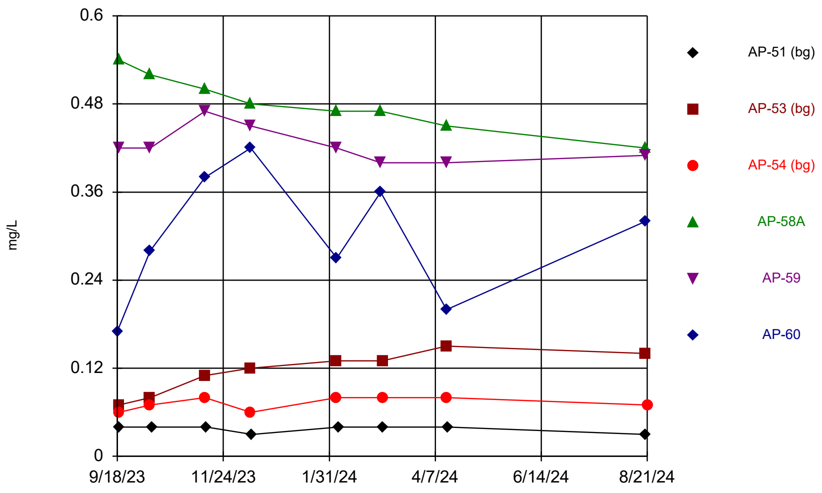
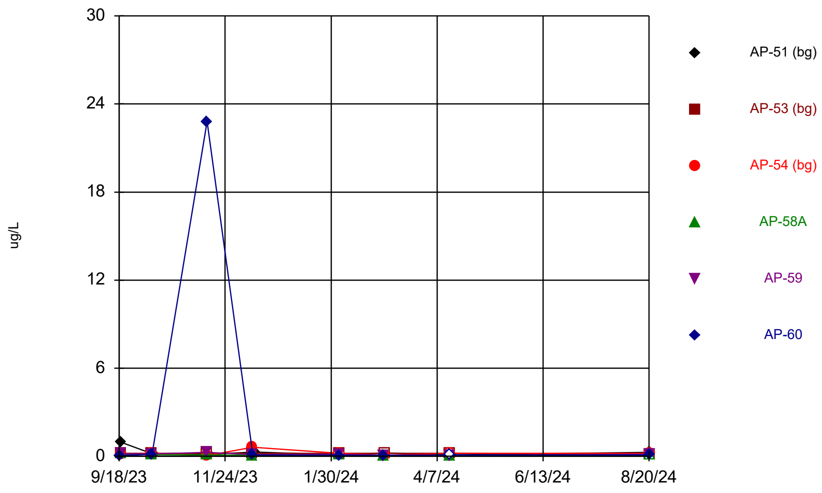
Time Series



Constituent: Fluoride Analysis Run 10/29/2024 9:15 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



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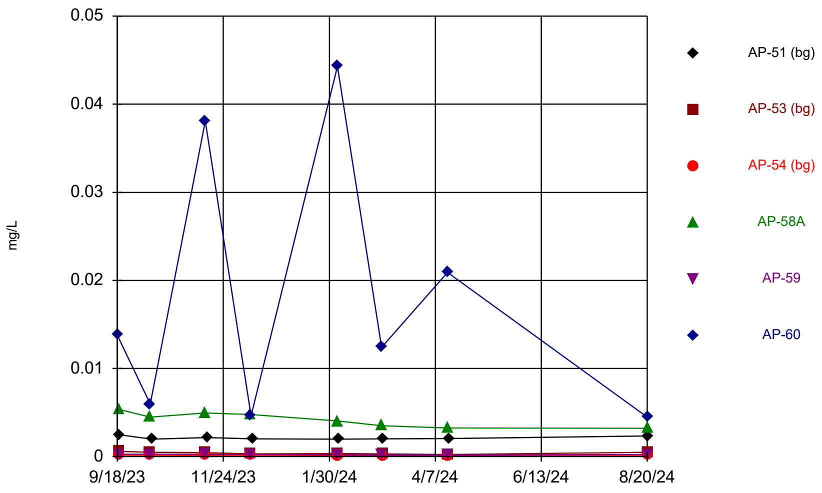
Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG

Time Series



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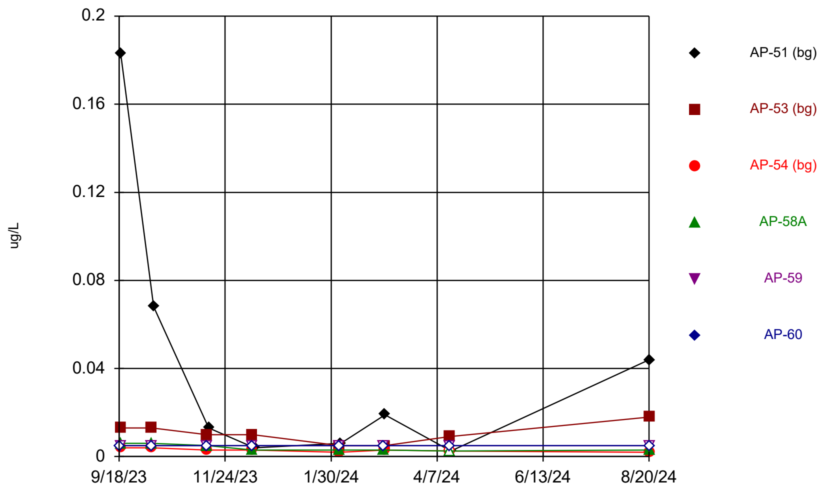
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

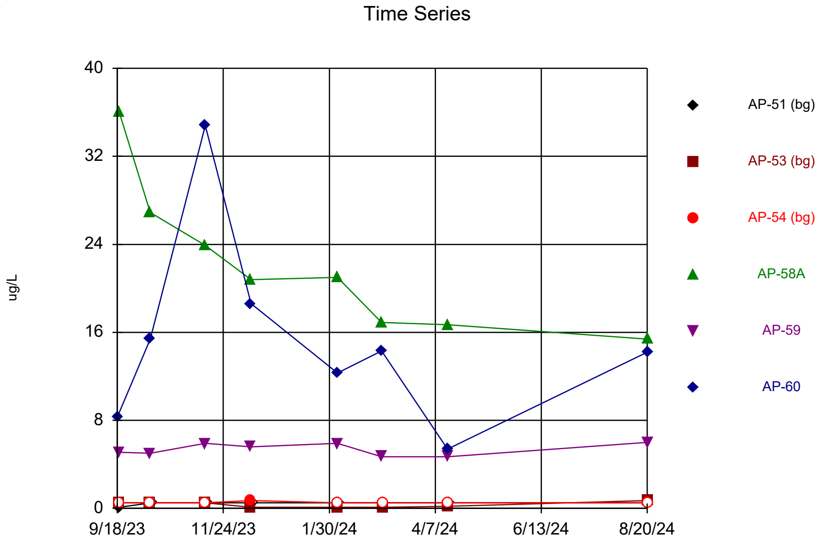
Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



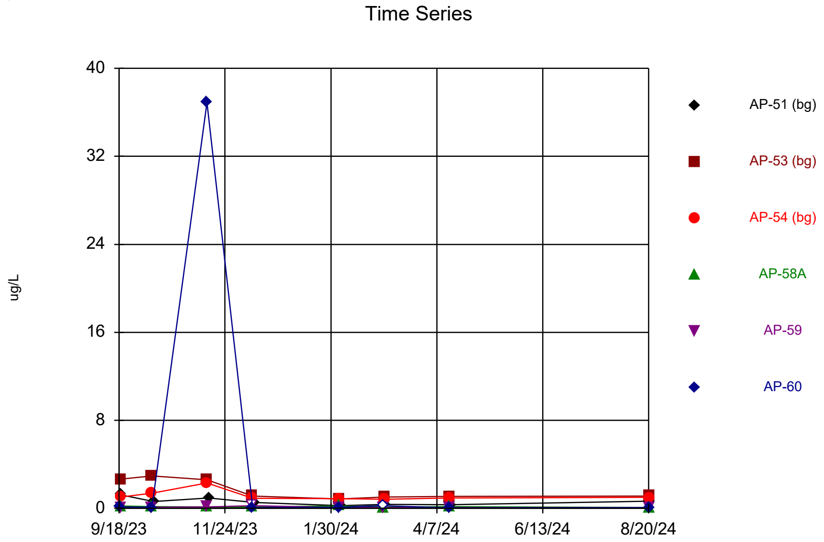
Constituent: Mercury Analysis Run 10/29/2024 9:15 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



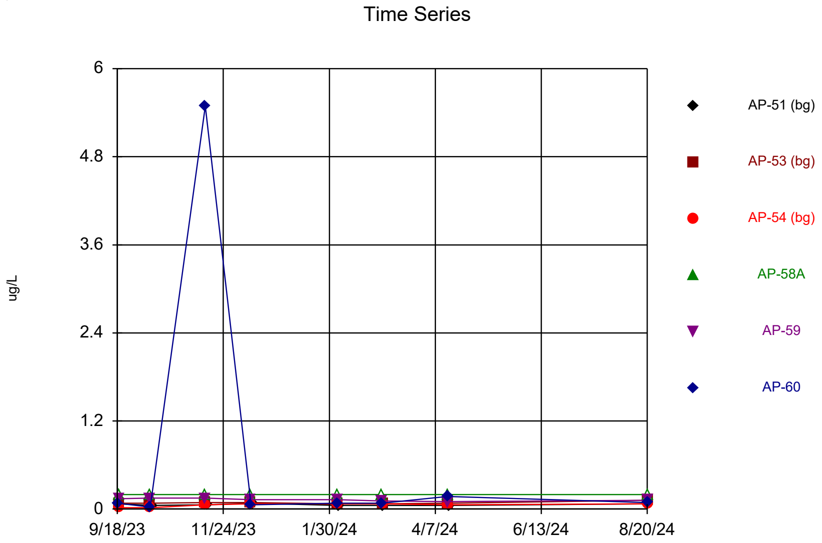
Constituent: Molybdenum Analysis Run 10/29/2024 9:15 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Selenium Analysis Run 10/29/2024 9:15 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Thallium Analysis Run 10/29/2024 9:15 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

FIGURE B

Box Plots

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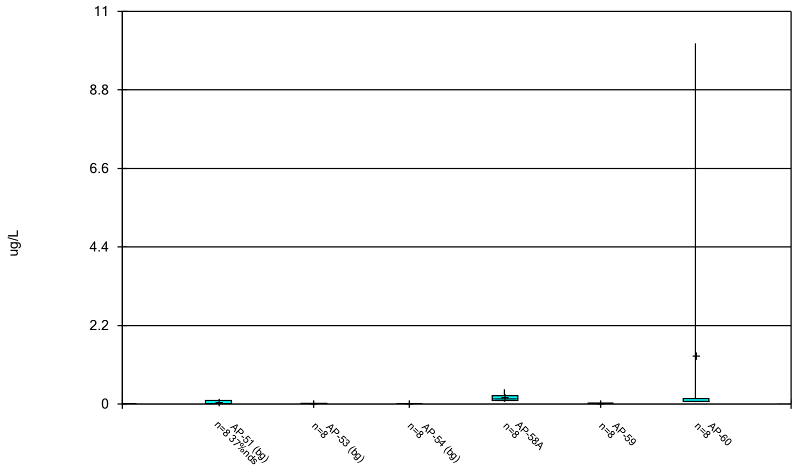
Box & Whiskers Plot

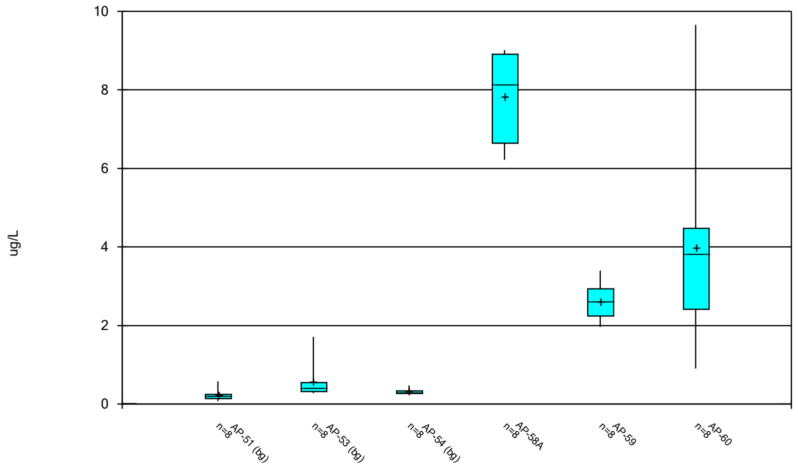


Constituent: Antimony   Analysis Run 10/29/2024 9:16 AM   View: Descriptive

Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG

Box & Whiskers Plot

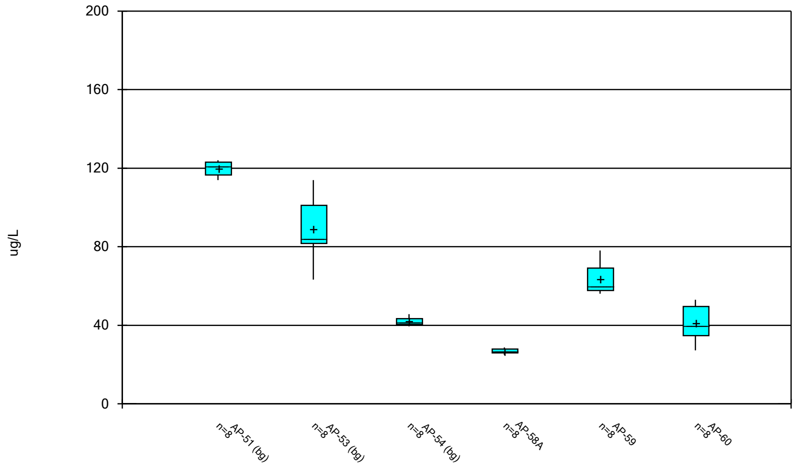


Constituent: Arsenic   Analysis Run 10/29/2024 9:16 AM   View: Descriptive

Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG

Box & Whiskers Plot

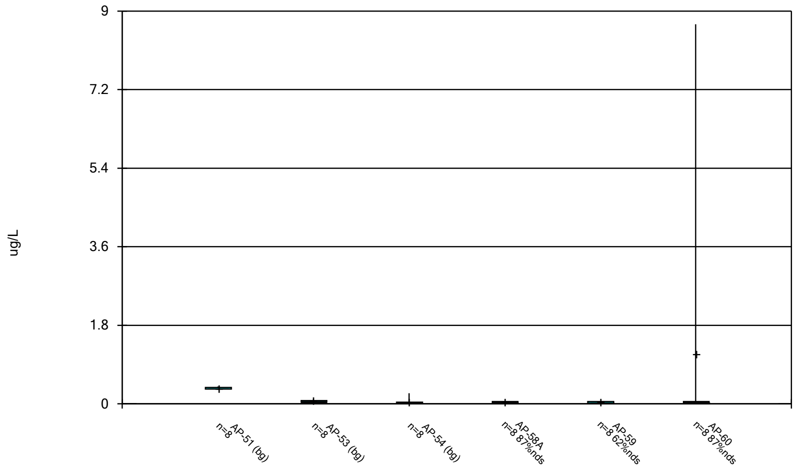


Constituent: Barium   Analysis Run 10/29/2024 9:16 AM   View: Descriptive

Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG

Box & Whiskers Plot

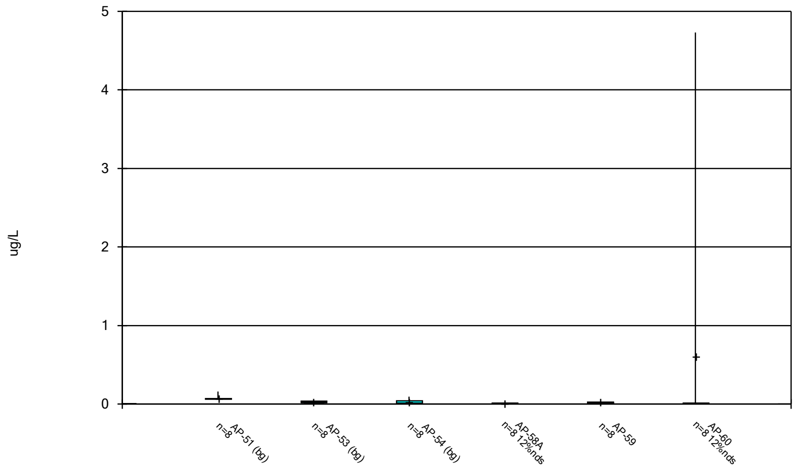


Constituent: Beryllium   Analysis Run 10/29/2024 9:16 AM   View: Descriptive

Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG

Box & Whiskers Plot



Constituent: Cadmium   Analysis Run 10/29/2024 9:16 AM   View: Descriptive

Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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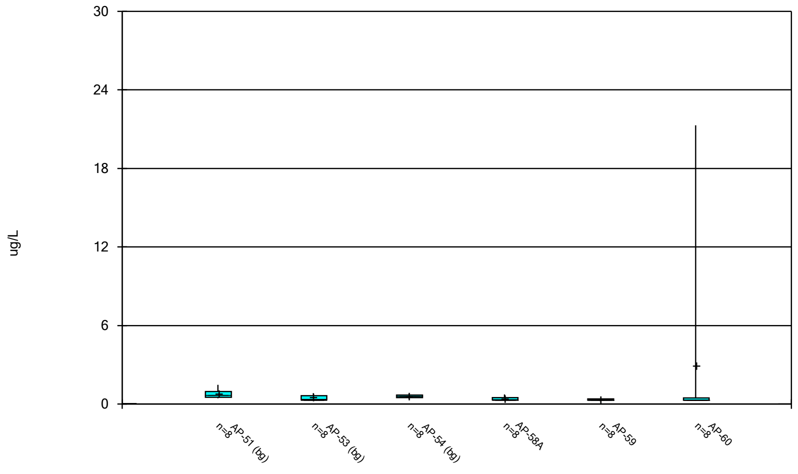
Box & Whiskers Plot



Constituent: Chromium   Analysis Run 10/29/2024 9:16 AM   View: Descriptive

Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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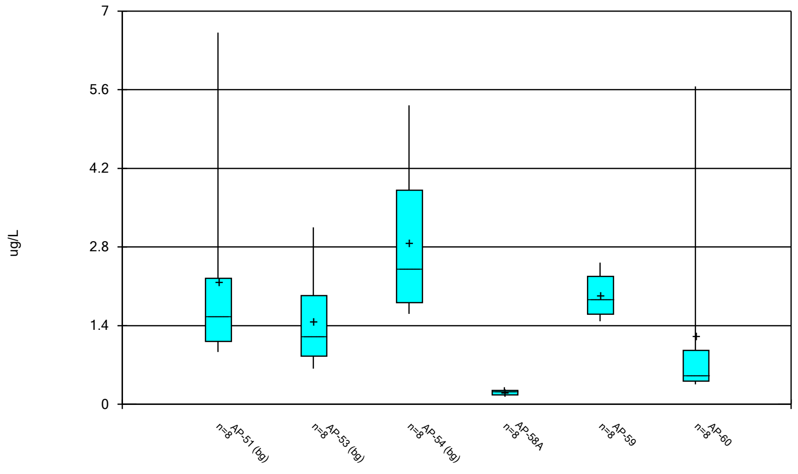
Box & Whiskers Plot



Constituent: Cobalt   Analysis Run 10/29/2024 9:16 AM   View: Descriptive

Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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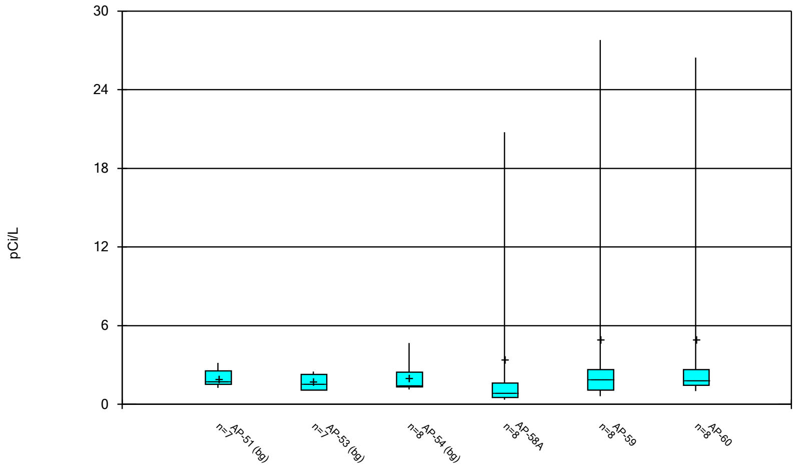
Box & Whiskers Plot



Constituent: Combined Radium 226 + 228   Analysis Run 10/29/2024 9:16 AM   View: Descriptive

Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP

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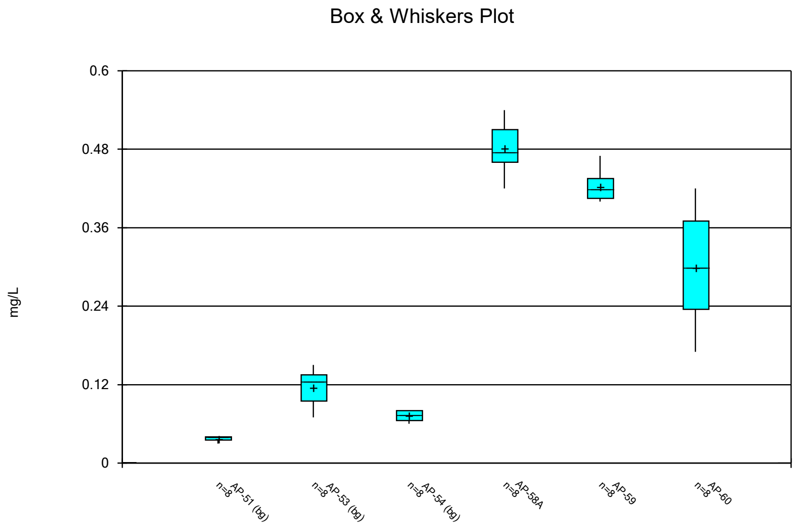
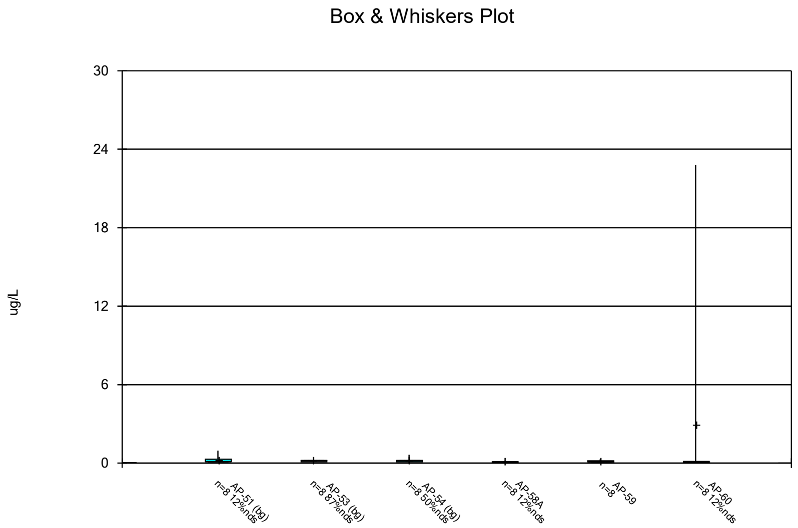


Constituent: Fluoride Analysis Run 10/29/2024 9:16 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG



Constituent: Lead Analysis Run 10/29/2024 9:16 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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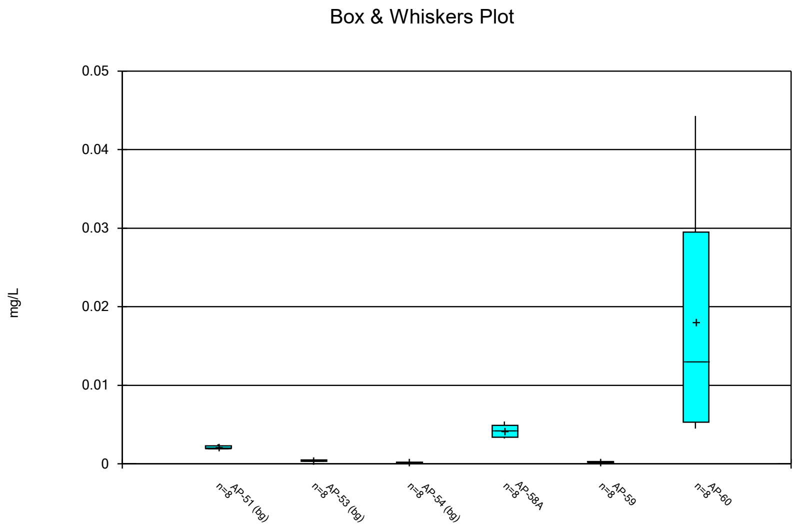
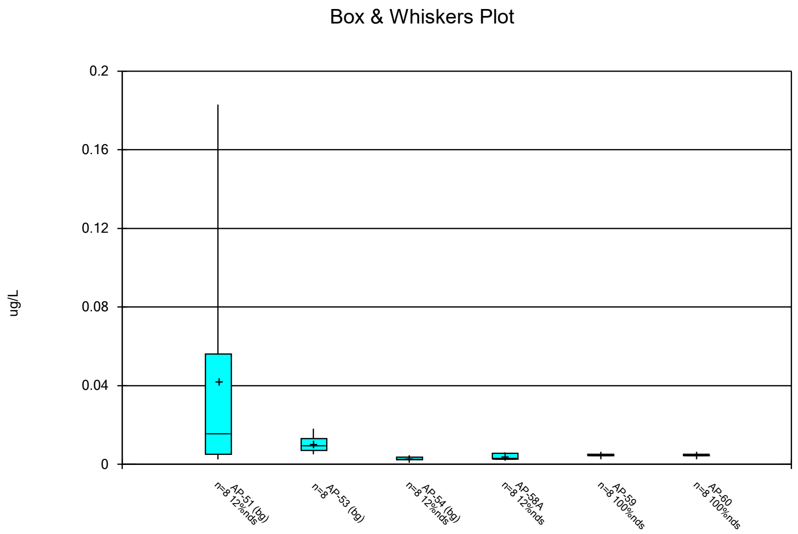


Constituent: Lithium Analysis Run 10/29/2024 9:16 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG



Constituent: Mercury Analysis Run 10/29/2024 9:16 AM View: Descriptive
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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Constituent: Molybdenum Analysis Run 10/29/2024 9:16 AM View: Descriptive

Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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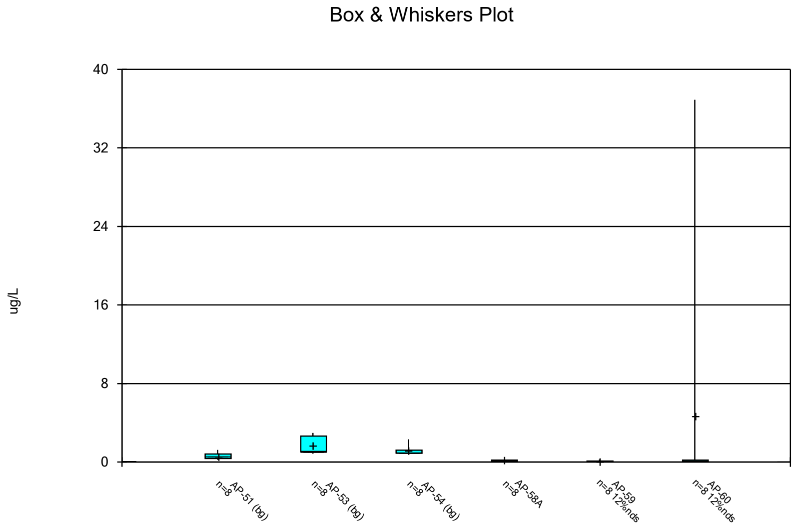

Constituent: Selenium Analysis Run 10/29/2024 9:16 AM View: Descriptive

Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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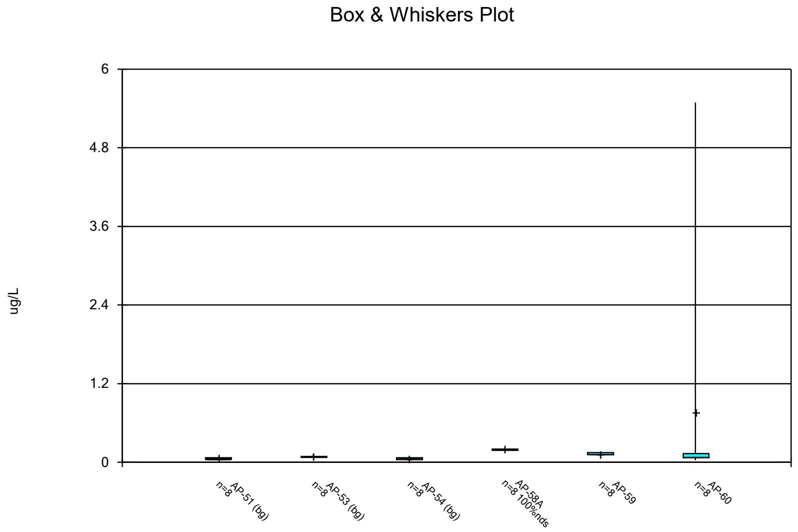

Constituent: Thallium Analysis Run 10/29/2024 9:16 AM View: Descriptive

Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

FIGURE C

Outlier Summary

Outlier Summary

Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP   Printed 10/29/2024, 9:17 AM

	AP-51 Combined Radium 226 + 228 (pCi/L)	AP-53 Combined Radium 226 + 228 (pCi/L)
10/9/2023		14.86 (o)
10/10/2023	14.16 (o)	

FIGURE D

UTLs

Tolerance Limit Appendix IV

Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP   Printed 8/14/2024, 10:57 AM

Constituent	Upper Lim.	Lower Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony (ug/L)	0.05	n/a	21	n/a	n/a	14.29	n/a	n/a	0.3406	NP Inter(normality)
Arsenic (ug/L)	0.6506	n/a	21	0.3138	0.142	0	None	No	0.05	Inter
Barium (ug/L)	123	n/a	21	n/a	n/a	0	n/a	n/a	0.3406	NP Inter(normality)
Beryllium (ug/L)	0.373	n/a	21	n/a	n/a	0	n/a	n/a	0.3406	NP Inter(normality)
Cadmium (ug/L)	0.09815	n/a	21	0.03848	0.02517	0	None	No	0.05	Inter
Chromium (ug/L)	1.327	n/a	21	0.7663	0.1626	0	None	sqrt(x)	0.05	Inter
Cobalt (ug/L)	6.304	n/a	21	1.398	0.4692	0	None	sqrt(x)	0.05	Inter
Combined Radium 226 + 228 (pCi/L)	4.68	n/a	19	n/a	n/a	0	n/a	n/a	0.3774	NP Inter(normality)
Fluoride (mg/L)	0.1585	n/a	21	0.07476	0.0353	0	None	No	0.05	Inter
Lead (ug/L)	0.96	n/a	21	n/a	n/a	52.38	n/a	n/a	0.3406	NP Inter(NDs)
Lithium (mg/L)	0.00248	n/a	21	n/a	n/a	0	n/a	n/a	0.3406	NP Inter(normality)
Mercury (ug/L)	0.183	n/a	21	n/a	n/a	9.524	n/a	n/a	0.3406	NP Inter(normality)
Molybdenum (ug/L)	0.7	n/a	21	n/a	n/a	71.43	n/a	n/a	0.3406	NP Inter(NDs)
Selenium (ug/L)	3.411	n/a	21	1.037	0.3415	0	None	sqrt(x)	0.05	Inter
Thallium (ug/L)	0.1091	n/a	21	0.06381	0.0191	0	None	No	0.05	Inter

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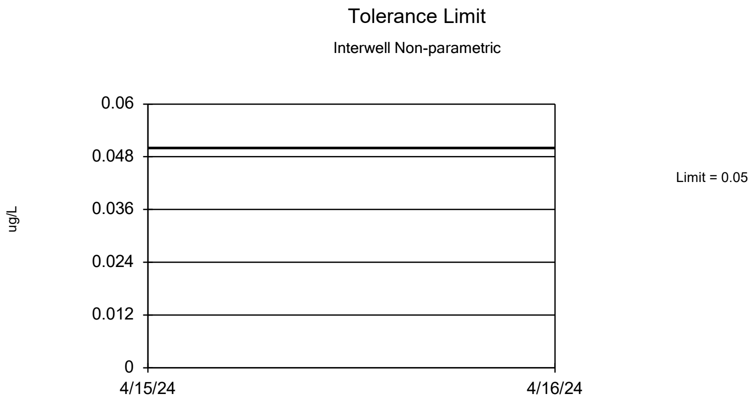

Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 21 background values. 14.29% NDs. 80.27% coverage at alpha=0.01; 86.52% coverage at alpha=0.05; 96.68% coverage at alpha=0.5. Report alpha = 0.3406.

Constituent: Antimony Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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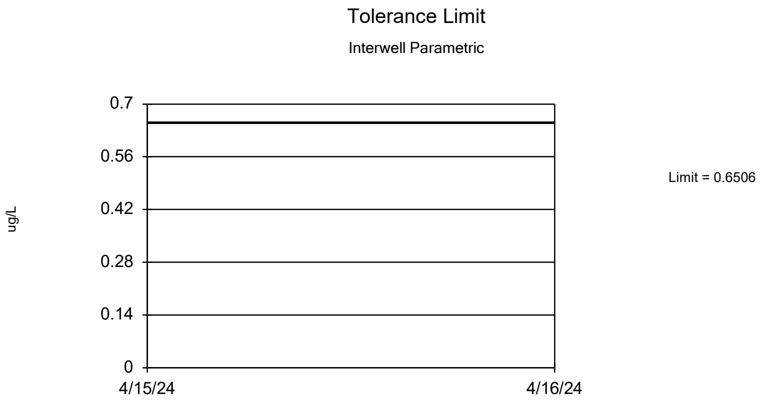

95% coverage. Background Data Summary: Mean=0.3138, Std. Dev.=0.142, n=21. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9622, critical = 0.873. Report alpha = 0.05.

Constituent: Arsenic Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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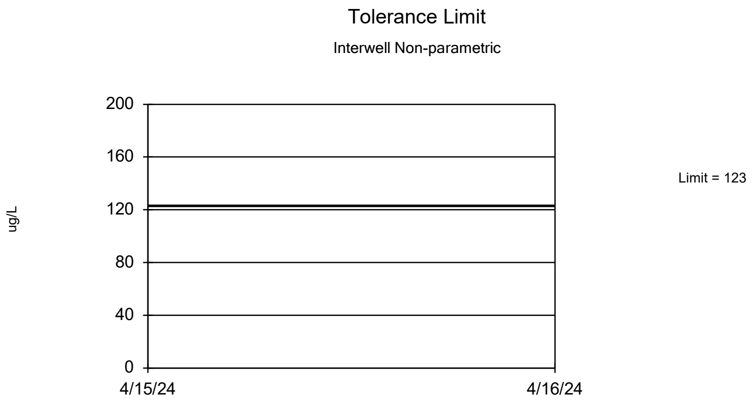

Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 21 background values. 80.27% coverage at alpha=0.01; 86.52% coverage at alpha=0.05; 96.68% coverage at alpha=0.5. Report alpha = 0.3406.

Constituent: Barium Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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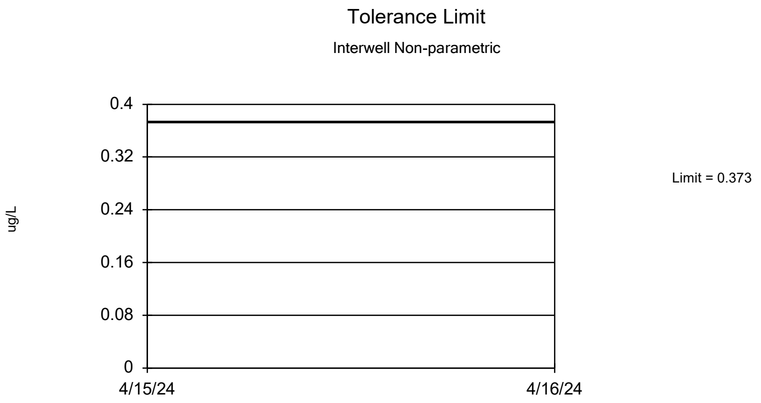

Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 21 background values. 80.27% coverage at alpha=0.01; 86.52% coverage at alpha=0.05; 96.68% coverage at alpha=0.5. Report alpha = 0.3406.

Constituent: Beryllium Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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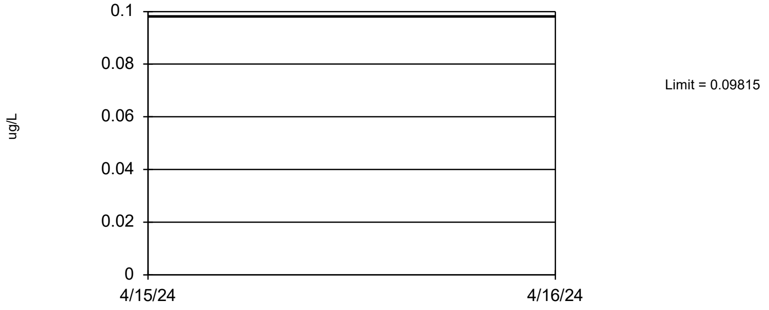
Tolerance Limit

Interwell Parametric



95% coverage. Background Data Summary: Mean=0.03848, Std. Dev.=0.02517, n=21. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9118, critical = 0.873. Report alpha = 0.05.

Constituent: Cadmium Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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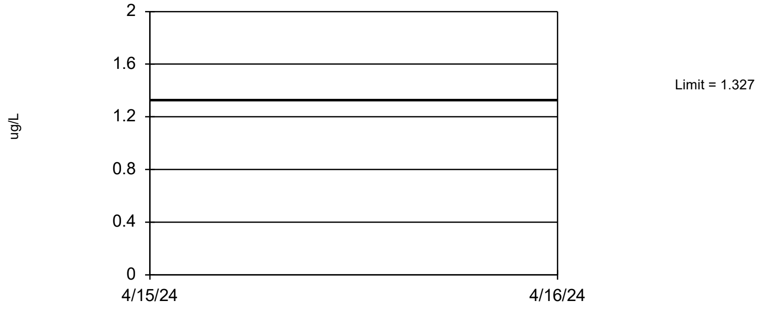
Tolerance Limit

Interwell Parametric



95% coverage. Background Data Summary (based on square root transformation): Mean=0.7663, Std. Dev.=0.1626, n=21. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9258, critical = 0.873. Report alpha = 0.05.

Constituent: Chromium Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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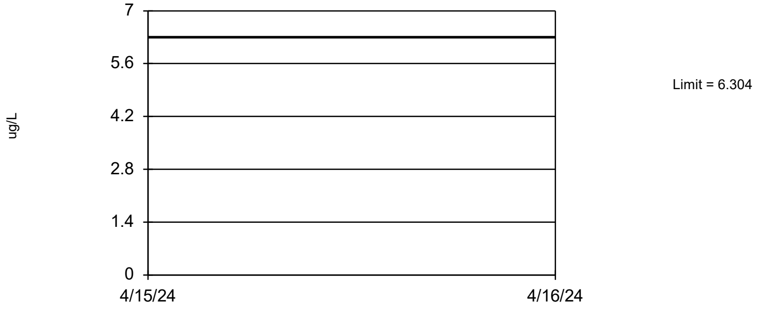
Tolerance Limit

Interwell Parametric



95% coverage. Background Data Summary (based on square root transformation): Mean=1.398, Std. Dev.=0.4692, n=21. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8998, critical = 0.873. Report alpha = 0.05.

Constituent: Cobalt Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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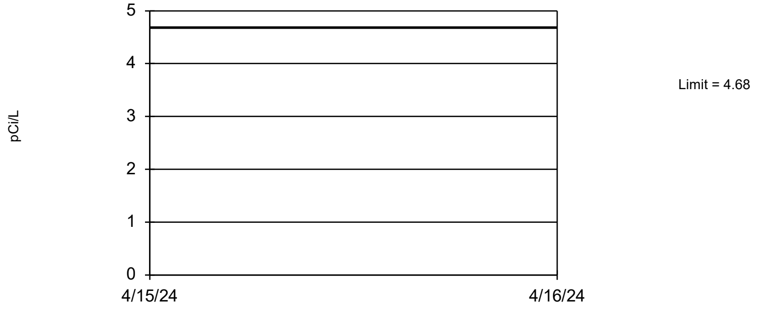
Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 19 background values. 78.32% coverage at alpha=0.01; 85.35% coverage at alpha=0.05; 96.29% coverage at alpha=0.5. Report alpha = 0.3774.

Constituent: Combined Radium 226 + 228 Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limit
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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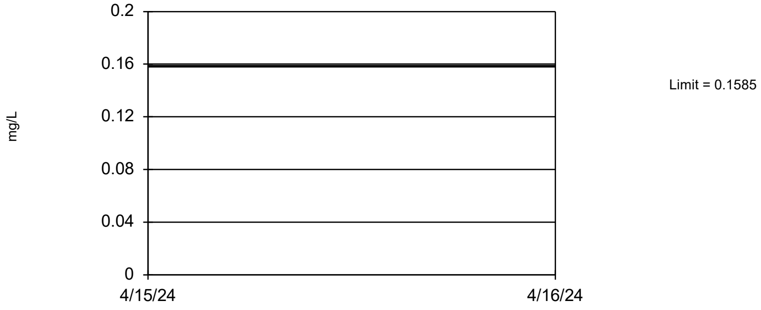
Tolerance Limit

Interwell Parametric



95% coverage. Background Data Summary: Mean=0.07476, Std. Dev.=0.0353, n=21. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8977, critical = 0.873. Report alpha = 0.05.

Constituent: Fluoride Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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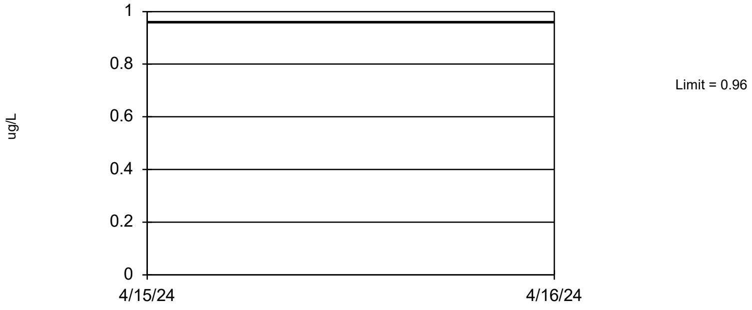
Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Limit is highest of 21 background values. 52.38% NDs. 80.27% coverage at alpha=0.01; 86.52% coverage at alpha=0.05; 96.68% coverage at alpha=0.5. Report alpha = 0.3406.

Constituent: Lead Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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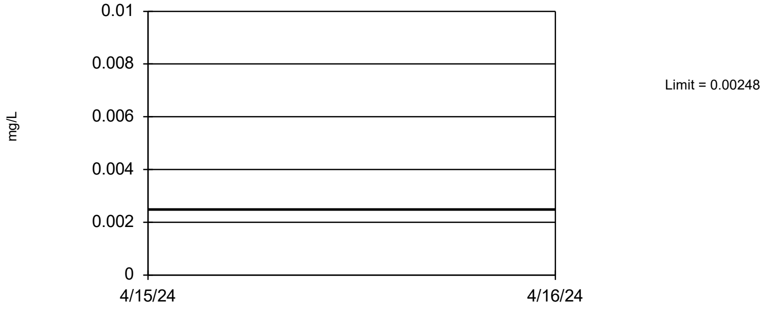
Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 21 background values. 80.27% coverage at alpha=0.01; 86.52% coverage at alpha=0.05; 96.68% coverage at alpha=0.5. Report alpha = 0.3406.

Constituent: Lithium Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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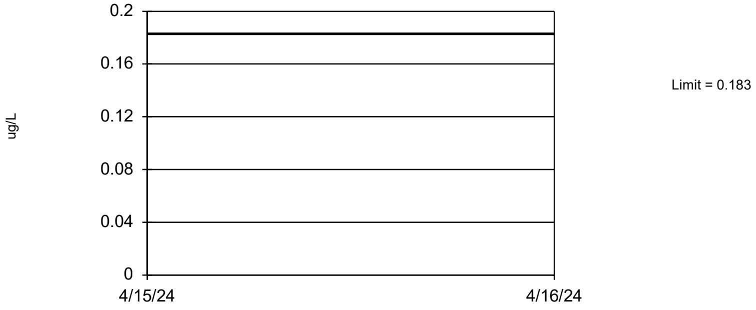
Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 21 background values. 9.524% NDs. 80.27% coverage at alpha=0.01; 86.52% coverage at alpha=0.05; 96.68% coverage at alpha=0.5. Report alpha = 0.3406.

Constituent: Mercury Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Tolerance Limit

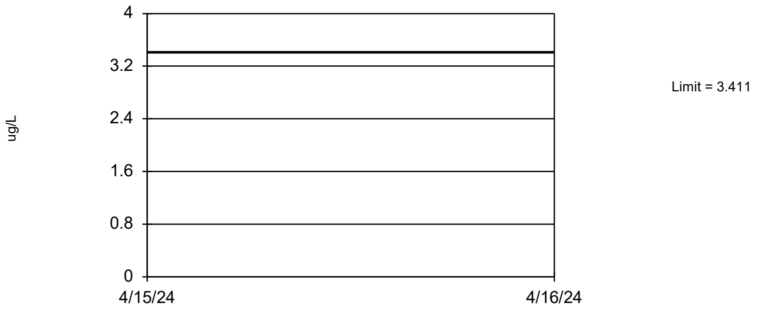
Interwell Non-parametric

Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Limit is highest of 21 background values. 71.43% NDs. 80.27% coverage at alpha=0.01; 86.52% coverage at alpha=0.05; 96.68% coverage at alpha=0.5. Report alpha = 0.3406.

Constituent: Molybdenum Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Tolerance Limit

Interwell Parametric

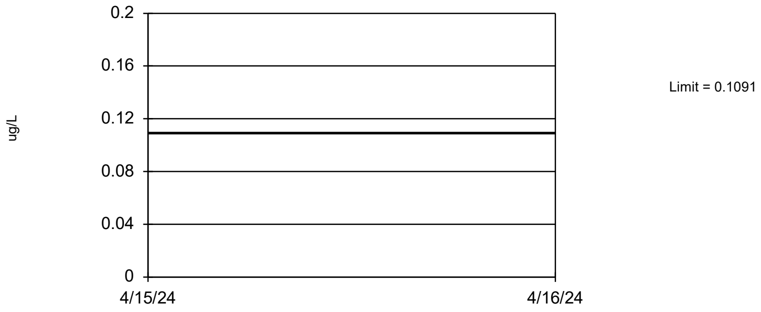


95% coverage. Background Data Summary (based on square root transformation): Mean=1.037, Std. Dev.=0.3415, n=21. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9155, critical = 0.873. Report alpha = 0.05.

Constituent: Selenium Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Tolerance Limit

Interwell Parametric



95% coverage. Background Data Summary: Mean=0.06381, Std. Dev.=0.0191, n=21. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8931, critical = 0.873. Report alpha = 0.05.

Constituent: Thallium Analysis Run 8/14/2024 10:54 AM View: Upper Tolerance Limits
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

FIGURE E
GWPS

FLINT CREEK PBAP GWPS				
Constituent Name	**MCL**	**CCR-Rule Specified**	**Background Limit**	**GWPS**
Antimony, Total (ug/L)	6		0.05	6
Arsenic, Total (ug/L)	10		0.65	10
Barium, Total (ug/L)	2000		123	2000
Beryllium, Total (ug/L)	4		0.37	4
Cadmium, Total (ug/L)	5		0.098	5
Chromium, Total (ug/L)	100		1.33	100
Cobalt, Total (ug/L)	n/a	6	6.3	6.3
Combined Radium, Total (pCi/L)	5		4.68	5
Fluoride, Total (mg/L)	4		0.16	4
Lead, Total (ug/L)	n/a	15	0.96	15
Lithium, Total (mg/L)	n/a	0.04	0.0025	0.04
Mercury, Total (ug/L)	2		0.18	2
Molybdenum, Total (ug/L)	n/a	100	0.7	100
Selenium, Total (ug/L)	50		3.41	50
Thallium, Total (ug/L)	2		0.11	2

**Grey cell indicates background limit is higher than MCL or CCR-Rule Specified level*

**GWPS = Groundwater Protection Standard*

**MCL = Maximum Contaminant Level*

**CCR = Coal Combustion Residual*

FIGURE F

Confidence Intervals

Confidence Interval Summary Table - All Results (No Significant)

Flint Creek BAP   Client: Geosyntec   Data: Flint Creek PBAP   Printed 11/14/2024, 10:03 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony (ug/L)	AP-58A	0.3006	0.05589	6	No	8	0.1783	0.1154	0	None	No	0.01	Param.
Antimony (ug/L)	AP-59	0.0293	0.0217	6	No	8	0.0255	0.003586	0	None	No	0.01	Param.
Antimony (ug/L)	AP-60	10.1	0.055	6	No	8	1.346	3.537	0	None	No	0.004	NP (normality)
Arsenic (ug/L)	AP-58A	9.025	6.599	10	No	8	7.829	1.175	0	None	x^2	0.01	Param.
Arsenic (ug/L)	AP-59	3.118	2.112	10	No	8	2.615	0.4745	0	None	No	0.01	Param.
Arsenic (ug/L)	AP-60	6.773	1.227	10	No	8	4	2.616	0	None	No	0.01	Param.
Barium (ug/L)	AP-58A	28.24	25.43	2000	No	8	26.84	1.324	0	None	No	0.01	Param.
Barium (ug/L)	AP-59	78.1	56	2000	No	8	63.34	8.302	0	None	No	0.004	NP (normality)
Barium (ug/L)	AP-60	50.79	31.39	2000	No	8	41.09	9.153	0	None	No	0.01	Param.
Beryllium (ug/L)	AP-58A	0.05	0.008	4	No	8	0.04475	0.01485	87.5	None	No	0.004	NP (NDs)
Beryllium (ug/L)	AP-59	0.05	0.007	4	No	8	0.03425	0.02174	62.5	None	No	0.004	NP (NDs)
Beryllium (ug/L)	AP-60	8.7	0.05	4	No	8	1.131	3.058	87.5	None	No	0.004	NP (NDs)
Cadmium (ug/L)	AP-58A	0.01391	0.00684	5	No	8	0.01037	0.003335	12.5	None	No	0.01	Param.
Cadmium (ug/L)	AP-59	0.02567	0.01108	5	No	8	0.01838	0.006886	0	None	No	0.01	Param.
Cadmium (ug/L)	AP-60	4.73	0.005	5	No	8	0.598	1.67	12.5	None	No	0.004	NP (normality)
Chromium (ug/L)	AP-58A	0.558	0.2737	100	No	8	0.4125	0.1583	0	None	ln(x)	0.01	Param.
Chromium (ug/L)	AP-59	0.3998	0.2627	100	No	8	0.3313	0.06468	0	None	No	0.01	Param.
Chromium (ug/L)	AP-60	21.3	0.25	100	No	8	2.969	7.408	0	None	No	0.004	NP (normality)
Cobalt (ug/L)	AP-58A	0.2713	0.1622	6.3	No	8	0.2168	0.05144	0	None	No	0.01	Param.
Cobalt (ug/L)	AP-59	2.355	1.522	6.3	No	8	1.939	0.393	0	None	No	0.01	Param.
Cobalt (ug/L)	AP-60	5.66	0.352	6.3	No	8	1.221	1.826	0	None	No	0.004	NP (normality)
Combined Radium 226 + 228 (pCi/L)	AP-58A	20.75	0.35	5	No	8	3.394	7.031	0	None	No	0.004	NP (normality)
Combined Radium 226 + 228 (pCi/L)	AP-59	27.8	0.6	5	No	8	4.949	9.268	0	None	No	0.004	NP (normality)
Combined Radium 226 + 228 (pCi/L)	AP-60	26.46	1.01	5	No	8	4.904	8.729	0	None	No	0.004	NP (normality)
Fluoride (mg/L)	AP-58A	0.5219	0.4406	4	No	8	0.4813	0.03834	0	None	No	0.01	Param.
Fluoride (mg/L)	AP-59	0.4497	0.3978	4	No	8	0.4238	0.02446	0	None	No	0.01	Param.
Fluoride (mg/L)	AP-60	0.3922	0.2078	4	No	8	0.3	0.08701	0	None	No	0.01	Param.
Lead (ug/L)	AP-58A	0.1351	0.05916	15	No	8	0.09625	0.03889	12.5	None	sqrt(x)	0.01	Param.
Lead (ug/L)	AP-59	0.2172	0.06782	15	No	8	0.1425	0.07046	0	None	No	0.01	Param.
Lead (ug/L)	AP-60	22.8	0.06	15	No	8	2.929	8.029	12.5	None	No	0.004	NP (normality)
Lithium (mg/L)	AP-58A	0.005073	0.003322	0.04	No	8	0.004198	0.0008257	0	None	No	0.01	Param.
Lithium (mg/L)	AP-59	0.0002735	0.0002065	0.04	No	8	0.00024	0.00003162	0	None	No	0.01	Param.
Lithium (mg/L)	AP-60	0.03348	0.004209	0.04	No	8	0.01808	0.01539	0	None	sqrt(x)	0.01	Param.
Mercury (ug/L)	AP-58A	0.006	0.0025	2	No	8	0.003937	0.001474	12.5	None	No	0.004	NP (normality)
Molybdenum (ug/L)	AP-58A	29.45	14.98	100	No	8	22.21	6.826	0	None	No	0.01	Param.
Molybdenum (ug/L)	AP-59	5.946	4.779	100	No	8	5.363	0.5502	0	None	No	0.01	Param.
Molybdenum (ug/L)	AP-60	24.19	7.189	100	No	8	15.41	8.858	0	None	sqrt(x)	0.01	Param.
Selenium (ug/L)	AP-58A	0.2009	0.09163	50	No	8	0.1463	0.05153	0	None	No	0.01	Param.
Selenium (ug/L)	AP-59	0.149	0.04977	50	No	8	0.09875	0.06534	12.5	None	ln(x)	0.01	Param.
Selenium (ug/L)	AP-60	36.9	0.04	50	No	8	4.706	13.01	12.5	None	No	0.004	NP (normality)
Thallium (ug/L)	AP-59	0.1479	0.1096	2	No	8	0.1288	0.01808	0	None	No	0.01	Param.
Thallium (ug/L)	AP-60	5.49	0.03	2	No	8	0.76	1.912	0	None	No	0.004	NP (normality)

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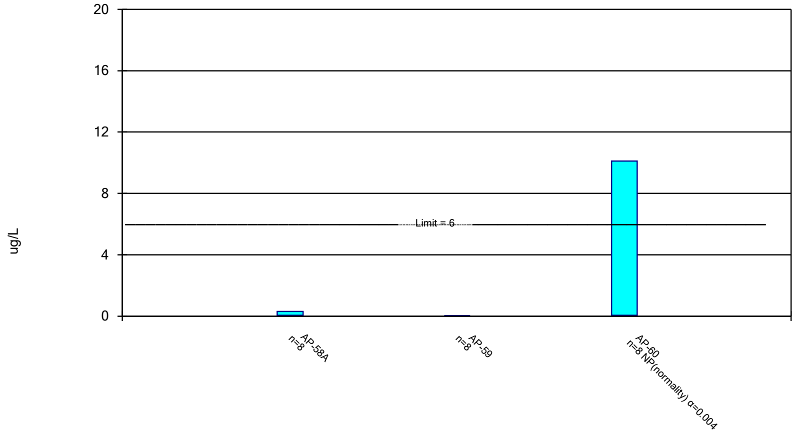
Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Antimony Analysis Run 11/14/2024 10:02 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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Parametric Confidence Interval

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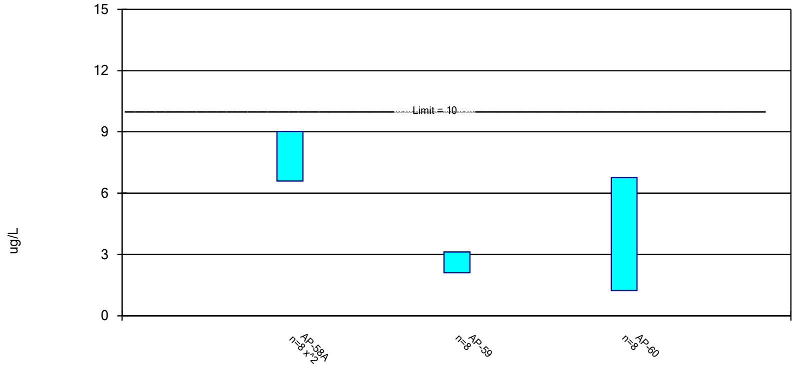

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Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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Parametric and Non-Parametric (NP) Confidence Interval

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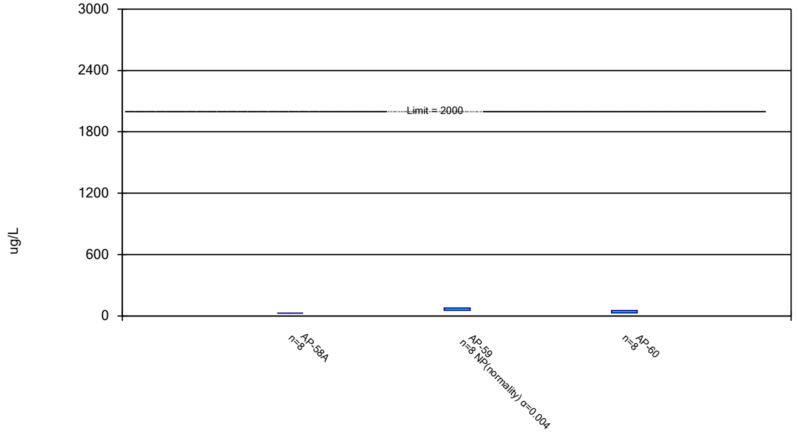
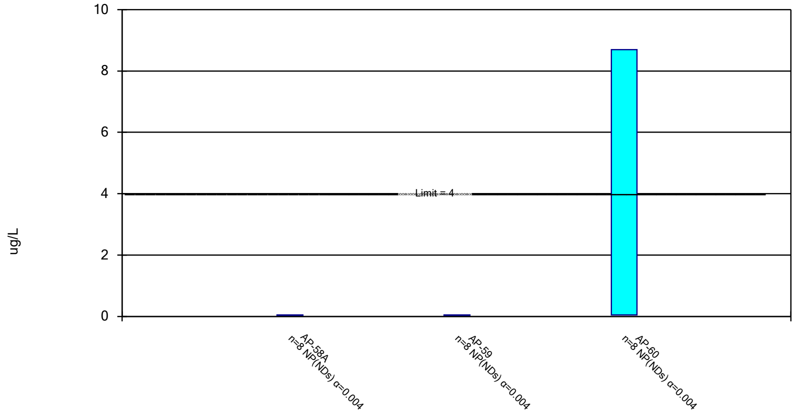


Constituent: Barium Analysis Run 11/14/2024 10:02 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Sanitas™ v.10.0.23a Software licensed to Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Beryllium Analysis Run 11/14/2024 10:02 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Parametric and Non-Parametric (NP) Confidence Interval

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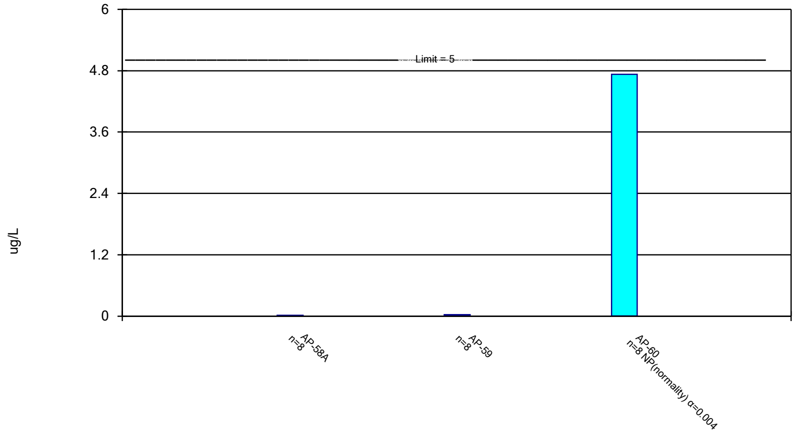

Constituent: Cadmium Analysis Run 11/14/2024 10:02 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Parametric and Non-Parametric (NP) Confidence Interval

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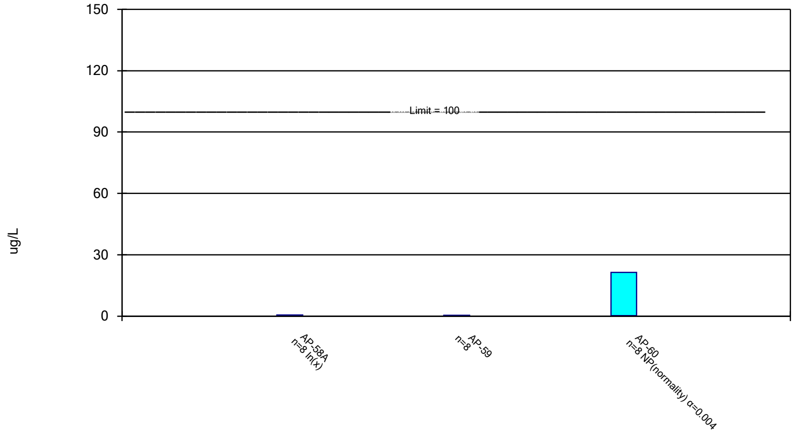

Constituent: Chromium Analysis Run 11/14/2024 10:02 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Parametric and Non-Parametric (NP) Confidence Interval

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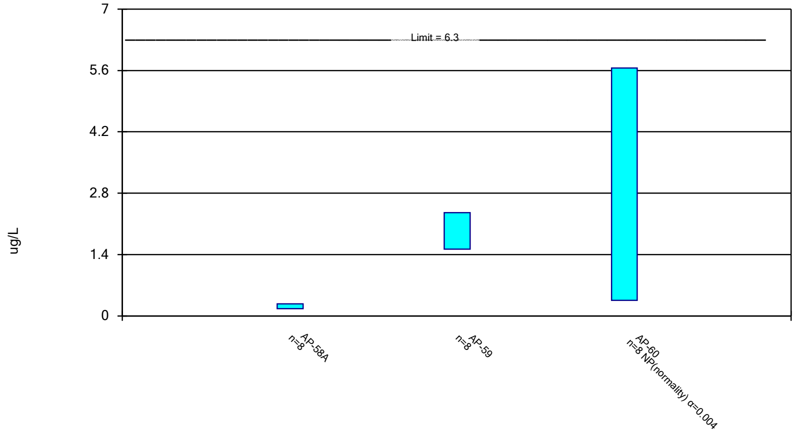

Constituent: Cobalt Analysis Run 11/14/2024 10:02 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Non-Parametric Confidence Interval

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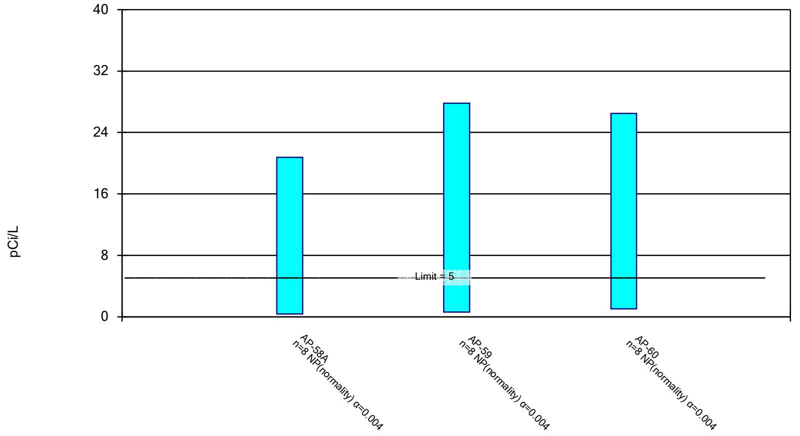

Constituent: Combined Radium 226 + 228 Analysis Run 11/14/2024 10:02 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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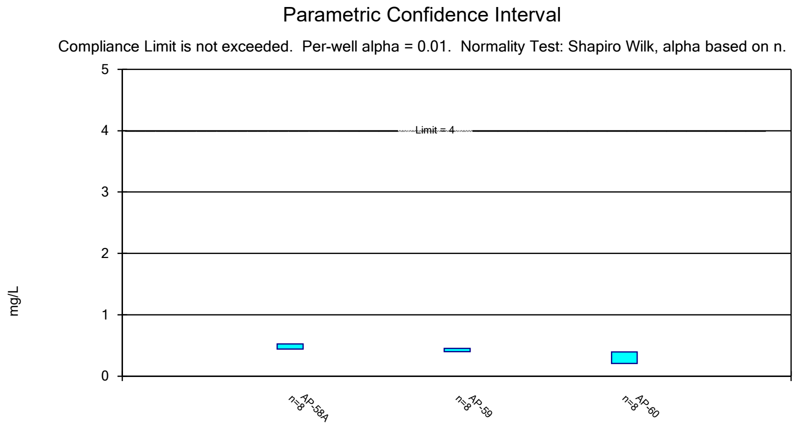
Parametric Confidence Interval

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Constituent: Fluoride Analysis Run 11/14/2024 10:02 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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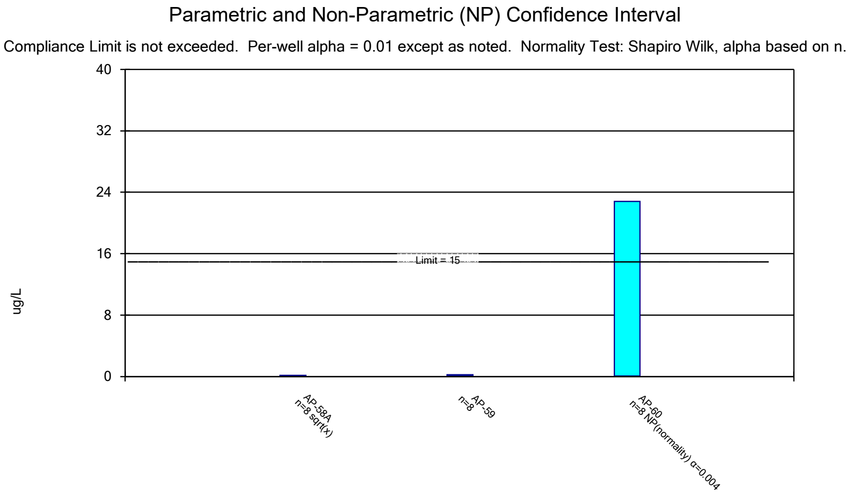
Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

Constituent: Lead Analysis Run 11/14/2024 10:02 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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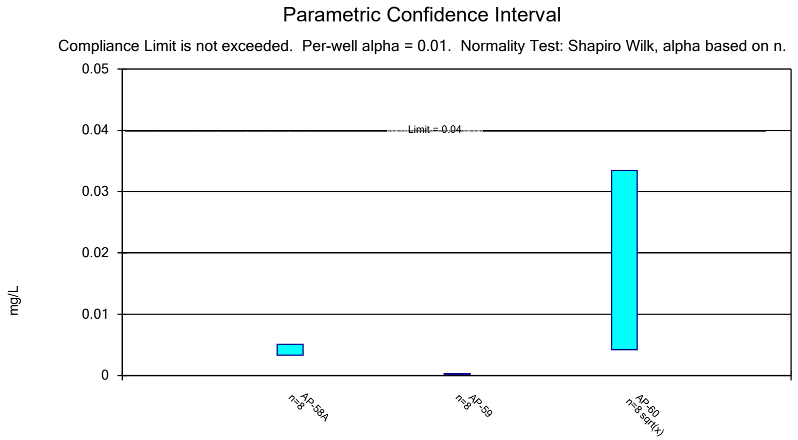
Parametric Confidence Interval

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Constituent: Lithium Analysis Run 11/14/2024 10:02 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

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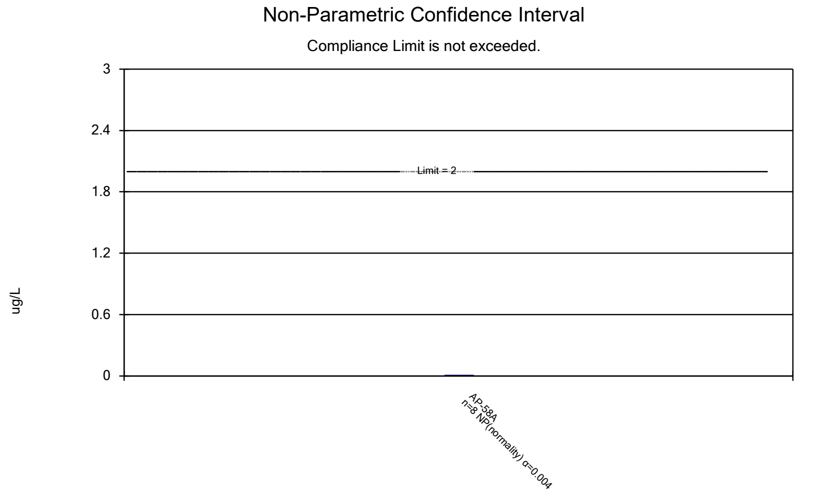
Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

Constituent: Mercury Analysis Run 11/14/2024 10:02 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Parametric Confidence Interval

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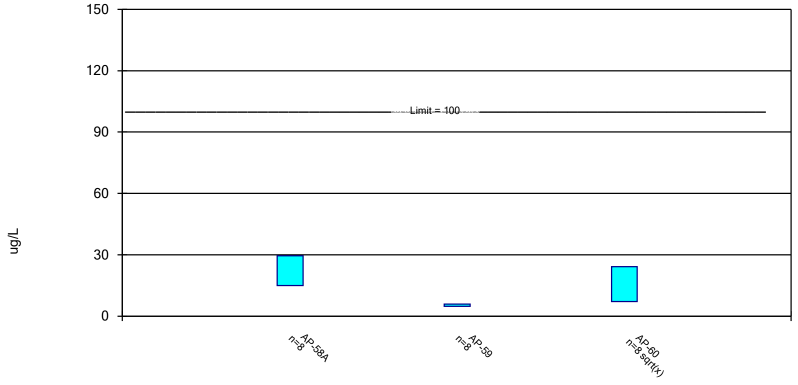

Constituent: Molybdenum Analysis Run 11/14/2024 10:02 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Parametric and Non-Parametric (NP) Confidence Interval

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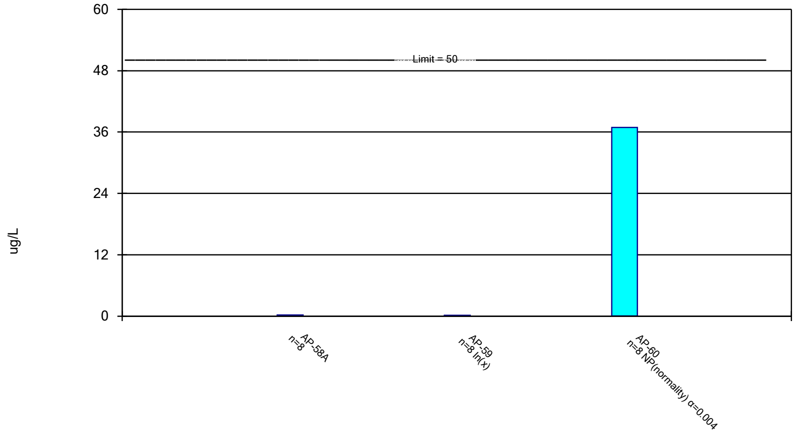

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Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

Parametric and Non-Parametric (NP) Confidence Interval

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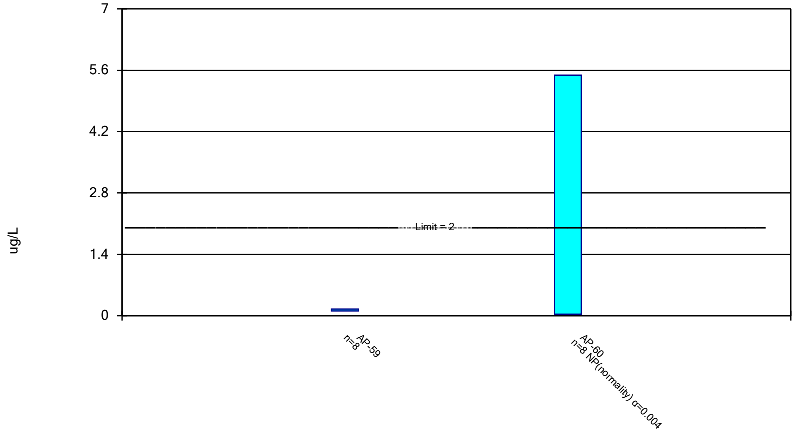

Constituent: Thallium Analysis Run 11/14/2024 10:03 AM View: Confidence Intervals
Flint Creek BAP Client: Geosyntec Data: Flint Creek PBAP

APPENDIX 3 – Alternative Source Demonstrations

The following ASD reports, all completed in 2024, are included in this appendix:

- The April 3, 2024 report concluding that the potential SSIs associated with the first semiannual detection monitoring event of 2023 were not due to a release from the Flint Creek PBAP;
- The June 28, 2024 report concluding that the potential SSIs associated with the second semiannual detection monitoring event of 2023 were not due to a release from the Flint Creek PBAP;
- The December 19, 2024 report concluding that the potential SSIs associated with the first semiannual detection monitoring event of 2024 were not due to a release from the Flint Creek PBAP;
- The December 27, 2024 report concluding that the potential SSIs associated with the second semiannual detection monitoring event of 2024 were not due to a release from the Flint Creek PBAP.

ALTERNATIVE SOURCE DEMONSTRATION REPORT

FEDERAL CCR RULE

Flint Creek Power Plant

Primary Bottom Ash Pond

Gentry, Arkansas

Prepared for

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

Prepared by

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

Project CHA8495B

April 2024

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Attachment D: Surface Water Samples Laboratory Analytical Report

Attachment E: Certification by a Qualified Professional Engineer

ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	alternative source demonstration
bgs	below ground surface
CCR	coal combustion residuals
CFR	Code of Federal Regulations
EPRI	Electric Power Research Institute
LPL	lower prediction limit
mg/L	milligrams per liter
PBAP	Primary Bottom Ash Pond
redox	oxidation-reduction
SSI	statistically significant increase
TDS	total dissolved solids
UPL	upper prediction limit
USEPA	United States Environmental Protection Agency

1. INTRODUCTION AND SUMMARY

This alternative source demonstration (ASD) report has been prepared to address statistically significant increases (SSIs) for boron, chloride, sulfate, and total dissolved solids (TDS) in the groundwater monitoring network at the Flint Creek Power Plant Primary Bottom Ash Pond (PBAP) in Gentry, Arkansas, following the first semiannual detection monitoring event of 2023. The Flint Creek Power Plant has two coal combustion residuals (CCR) storage units, including the PBAP.

Background groundwater values for the PBAP were originally calculated in January 2018 and have been updated intermittently in accordance with the *Statistical Analysis Plan* prepared for the Flint Creek Plant (Geosyntec Consultants, Inc. [Geosyntec] 2020a). For the most recent update in January 2022, revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values (Geosyntec 2022a). Prediction limits were calculated based on a one-of-two retesting procedure in accordance with the Unified Guidance (United States Environmental Protection Agency [USEPA] 2009) and the statistical analysis plan developed for the site. With this procedure, an SSI is concluded only if both an initial sample and a resample have reported results above the UPL or, in the case of pH, below the lower prediction limit (LPL). In practice, if the initial result was not above the UPL or was not below the LPL, a resample was not collected or analyzed.

The first semiannual detection monitoring event of 2023 at the PBAP was conducted in March (initial sampling event), and the results were compared to the calculated prediction limits. Where initial exceedances were identified, resampling was completed in September 2023. Following resampling, SSIs were identified for boron, chloride, sulfate, and TDS at downgradient compliance well AP-58A and for sulfate and TDS at downgradient compliance well AP-59 using intrawell analyses. No other SSIs were identified. A summary of the Appendix III analytical results for the downgradient compliance wells and the calculated prediction limits to which they were compared is provided in **Table 1**.

1.1 CCR Rule Requirements

USEPA regulations regarding detection monitoring programs for CCR landfills and surface impoundments provide owners and operators with the option to make an ASD when an SSI is identified:

> *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. (Code of Federal Regulations [CFR] Title 40, Section 257.94(e)(2)).

Pursuant to 40 CFR 257.94(e)(2), Geosyntec has prepared this ASD report to document that the identified SSIs at AP-58A and AP-59 should not be attributed to a release from the PBAP.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess alternative sources to which the identified SSI could be attributed. Alternative sources were identified from among 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
- ASD Type V: Alternative Sources

A demonstration was conducted to show that the SSIs identified for boron, chloride, sulfate, and TDS at well AP-58A were based on a Type I cause (sampling issues) and not by a direct release from the PBAP. A demonstration was conducted to show that the SSIs identified for sulfate and TDS at well AP-59 were based on Type IV causes (natural variation) and not by a direct release from the PBAP.

2. SUMMARY OF SITE CONDITIONS

Descriptions of the Flint Creek PBAP design and construction, regional geology and site hydrogeology, and groundwater monitoring systems and flow conditions are presented below.

2.1 PBAP Design and Construction

As described by Terracon (2023), the PBAP is a 42.8-acre CCR surface impoundment located south of the power plant. It was constructed from 1974 to 1978 with an approximately 820-foot long cross-valley dam consisting of compacted clayey soil. While it was operational as a bottom ash pond, it was used primarily to manage bottom ash. The PBAP ceased receipt of CCR on November 30, 2022, and commenced closure by removal of CCR materials in accordance with the certified closure plan (American Electric Power [AEP] 2022). CCR material removal from the PBAP was completed on August 20, 2023. A photograph showing the condition of the PBAP shortly before completion of CCR removal is provided in **Figure 1**.

2.2 Regional Geology / Site Hydrogeology

As described by Terracon (2017), the PBAP is in an area of the Ozark Plateaus Province that has undergone regional-scale uplift followed by significant incision by rivers, resulting in hilly topography. It is underlain by the Mississippian-aged Boone Formation, which consists primarily of limestone and chert. Locally, the stratigraphy consists of a 30- to 50-foot-thick weathered residuum of the Boone Formation, consisting of heavily-weathered limestone with chert nodules and iron-rich clay, and the underlying massive cherty limestone of the Boone Formation.

The Boone Formation is underlain by the Mississippian-aged St. Joe Member, which is a light-grey crystalline limestone that has not experienced significant physical or chemical weathering and is distinct from the Boone Formation due to its lack of chert and clay.

The Boone residuum, the underlying Boone Formation cherty limestone, and the underlying St. Joe Member collectively comprise a single hydrostatic unit known as the Boone–St. Joe Aquifer. This aquifer is underlain by the Chattanooga Shale, a black, fissile shale that acts as a barrier to vertical flow from the aquifer unit above.

Geologic cross sections near the PBAP presented by Terracon (2023) are provided as **Attachment A**. These cross sections show the Boone residuum (described as a silty clay on the cross sections) and cherty limestone Boone Formation underlying the clayey berm of the PBAP.

Three distinct zones of groundwater flow have been identified within the Boone–St. Joe Aquifer at the site: Uppermost, Intermediate, and Deep (AEP 2023). Perched groundwater is occasionally present within upper unconsolidated soils but is not continuous throughout the site and does not constitute an aquifer unit. All monitoring wells in the PBAP monitoring well network monitor the uppermost aquifer, which is defined as the upper portion of the Boone Formation (Terracon 2023).

2.3 Groundwater Monitoring Systems and Flow Conditions

The current monitoring well network (**Figure 2**) includes three background wells that are upgradient of the PBAP (AP-51, AP-53, and AP-54) and three downgradient compliance wells (AP-58A, AP-59, and AP-60).

Monitoring well AP-59 is screened entirely within competent limestone, as was monitoring well AP-58 (see cross sections in **Attachment A** and on the boring log and well construction diagrams provided in **Attachment B**). Monitoring well AP-58 was found to be irreparably damaged during a sampling event in September 2022 and was replaced in November 2022 by AP-58A. Following the discovery of damage to the AP-58 well casing, the well was plugged and monitoring well AP-58A was installed approximately 10 feet south of AP-58's location and screened at the same interval (AP-58 was screened from 58.45 to 68.45 feet below ground surface [bgs], and AP-58A is screened from 61.30 to 71.30 feet bgs) (**Attachment B**). One thin fracture/void was noted at 22 feet bgs within the screened interval of AP-59. No structural features were noted within the screened intervals of AP-58 or AP-58A.

Potentiometric maps showing groundwater flow contours for the Uppermost Aquifer during the March 2023 initial sampling and September 2023 resampling events are provided as **Attachment C**. The groundwater flow direction is generally to the west and northwest. Groundwater flow direction was anomalous during the March 2023 sampling event due to the effect of closure activities but returned to more representative behavior in September 2023. Hydraulic connectivity within the Uppermost Aquifer was determined by Terracon (2023) to be related to multiple factors including lithology, rock type, layer thickness, and degree of bedrock fracture. Seasonal variability in the groundwater flow direction and hydraulic gradient has not been observed since the monitoring well network was installed.

3. ALTERNATIVE SOURCE DEMONSTRATION

The methods used to assess possible alternative sources of the SSIs for boron, chloride, sulfate, and TDS at AP-58A and the SSIs for sulfate and TDS at AP-59 and the proposed alternative sources for these SSIs are described below.

3.1 Proposed Alternative Source

3.1.1 Monitoring Well AP-58A

An initial review of groundwater sampling field forms identified an alternative source for the boron, chloride, sulfate, and TDS SSIs at AP-58A due to Type I (sampling) issues. As discussed in Section 2.3, well AP-58A was installed in November 2022 after it was discovered in September 2022 that well AP-58 was irreparably damaged. Boring logs and well construction diagrams for both AP-58 and AP-58A are provided in **Attachment B**. Well AP-58A is located approximately 10 feet south of previous well AP-58 and screened at approximately the same elevation. Thus, groundwater collected from AP-58A should reflect conditions previously observed at former well AP-58.

A Piper diagram, which represents the relative concentrations of major cations and anions in the groundwater, was created to visualize groundwater geochemistry at both AP-58 and AP-58A (**Figure 3**). The diagram indicates that groundwater samples from AP-58 did not begin to show consistency within major ion chemistry until around August 2019 (as indicated by the solid red symbols on the Piper diagram), at which point the monitoring well had equilibrated with the aquifer for approximately 3.5 years since it was installed in February 2016. The groundwater composition for the first two samples collected from AP-58A (December 2022 and March 2023) appears similar to AP-58 during the sampling event completed in the first year after its installation in February 2016 (October 2016 and January 2017). These results suggest that both AP-58 and AP-58A require(d) time after installation to equilibrate with the aquifer before the collected samples are representative of stable geochemical conditions. These findings suggest that geochemical trends at AP-58A consistent with those observed at AP-58 are expected to continue to occur over the next one to two years. Using all available data from AP-58A through December 2023, similar trends after installation have been observed for boron, chloride, sulfate, and TDS at AP-58 and AP-58A to date (**Figures 4 and 5**).

A comparison of concentrations of relevant parameters from various PBAP samples to both groundwater concentrations at AP-58A and the established intrawell UPLs supports the position that the SSIs observed at AP-58A should not be attributed to the PBAP. Two surface water samples with sample IDs of ‘BAP’ and ‘BAP – Near Stop Log’ were collected from the PBAP in March 2020. The PBAP was undergoing dewatering and CCR removal during the timeframe of interest and thus a sample of pond water could not be collected. Therefore, the 2020 surface water samples are a fair basis of comparison for 2023 monitoring event groundwater conditions. The laboratory analytical report for the March 2020 surface water sampling event is provided as **Attachment D**. Reported values of boron, chloride, sulfate, and TDS from the PBAP samples are shown compared to the AP-58A UPL and recent samples from AP-58A (**Table 2**). Boron, chloride, sulfate, and TDS concentrations were greater in AP-58A groundwater samples than in both samples collected from the PBAP. This provides further support that the PBAP is not a source of the apparent elevated concentrations of boron, chloride, sulfate, and TDS in AP-58A groundwater.

3.1.2 Monitoring Well AP-59

An initial review of groundwater sampling field forms, site geochemistry, site historical data, and laboratory and statistical analyses did not identify alternative sources for sulfate and TDS at AP-59 due to Type I (sampling causes), Type II (laboratory causes), or Type III (statistical evaluation causes) issues. Further, an initial review of site geochemistry did not identify evidence of any Type V (alternative) impacts. As described below, the SSIs observed at monitoring well AP-59 have been attributed to natural variation within the underlying geology, which is a Type IV cause. The specific source of naturally occurring sulfate at AP-59 is oxidative dissolution of pyrite within the aquifer material at the site, as described in previous ASDs prepared for sulfate at AP-59 (Geosyntec 2023a, Geosyntec 2023b).

Sulfate concentrations at background wells AP-53 and AP-54, which are located upgradient of the PBAP and AP-59, have historically been similar to or greater than those observed at AP-59 (**Figure 6**). Sulfate concentrations from the following sampling event completed in September 2023 at AP-53 (77.9 milligrams per liter [mg/L]) and AP-54 (52.5 mg/L) are both comparable to concentrations reported for AP-59 in March (78.7 mg/L) and September (69.6 mg/L)[1]. Both upgradient wells and AP-59 have demonstrated considerable variability in sulfate concentrations since monitoring began in 2016 (**Figure 6**), suggesting that aqueous sulfate concentrations fluctuate over time across the site and these fluctuations should not be attributed to the PBAP.

Regional groundwater quality of the Boone–St. Joe Limestone Aquifer in Benton County, Arkansas (the county in which the PBAP is located) has previously been studied (Ogden 1979). A total of 253 groundwater samples from wells in Benton County screened within the Boone–St. Joe Aquifer were sampled and analyzed as part of the study. These samples revealed variability in sulfate concentrations, with many wells containing greater sulfate concentrations than those observed within the PBAP monitoring network.

Ogden (1979) identified a positive correlation between sulfate and calcium concentrations in groundwater. This relationship was also observed in AP-59 groundwater data since monitoring began in 2016 (**Figure 7**). Ogden hypothesized that this relationship is likely a product of iron-sulfide mineral oxidation. Oxidation of pyrite within the Boone–St. Joe Aquifer would yield sulfuric acid as a reaction product, the dissociation of which would result in an increase in aqueous sulfate and hydrogen ions (decrease in groundwater pH) which would in turn cause dissolution of the calcite that makes up the limestone aquifer. Oxidation-reduction (redox) conditions of AP-59 groundwater favor the thermodynamic stability of iron oxyhydroxides (**Figure 8**), indicating that iron sulfide minerals, if present in aquifer solids, would be expected to undergo this oxidation reaction. The AP-59 groundwater Eh value (a measurement of redox conditions) from the March 2023 monitoring event was greater than average (more oxygenated), which would thermodynamically favor greater amounts of dissolution of existing pyrite in aquifer materials. The dissolution of this pyrite would contribute aqueous sulfate ions to groundwater via the mechanism described above.

---

[1] The sulfate concentration at background well AP-53 in March 2023 was anomalously low, likely due to the effect of ongoing closure activities. Background well AP-54 could not be sampled in March 2023 due to insufficient water.

Limestone lithologies present at compliance monitoring wells were evaluated to develop the geologic conceptual site model for previous ASD reports and geochemical investigations (Geosyntec 2020b; included in AEP 2021). Limestone at downgradient well locations was determined to be unpassivated and capable of buffering incoming acidic waters via dissolution of calcite (Geosyntec 2018, Geosyntec 2019, Geosyntec 2021a, Geosyntec 2021b, Geosyntec 2022b). This illustrated conceptual site model is shown on **Figure 9**. If iron sulfide oxidation reactions were occurring in the limestone near AP-59, increases in aqueous sulfate and calcium would be expected. Increases in calcium are occasionally observed at AP-59, as documented in previous ASD reports for this well (Geosyntec 2021b).

A comparison of sulfate concentrations measured in surface water samples collected in March 2020 from locations within the PBAP also supports the position that the recent elevated concentrations of sulfate at AP-59 should not be attributed to the PBAP (**Attachment D**). Reported sulfate concentrations were 39.5 mg/L (sample ID – BAP) and 16.2 mg/L (sample ID – BAP Near Stop Log) for the samples collected from the PBAP prior to CCR removal (**Table 3**). Both of these samples contain sulfate concentrations lower than the UPL for sulfate at AP-59 (50.1 mg/L) and the two samples from the recent detection monitoring event for the PBAP that triggered the SSI (78.7 mg/L and 69.6 mg/L) (**Table 3**). Lower concentrations of sulfate in the PBAP water than in groundwater at downgradient compliance well AP-59 indicate that the PBAP is not anticipated to act as a source for the recent elevated sulfate concentrations in groundwater.

In addition to sulfate, an SSI for TDS was identified at monitoring well AP-59. TDS concentrations at well AP-59 are displayed on **Figure 10**. TDS is the summation of all ions in a water sample, with major ions comprising the majority of TDS in most natural waters (Boyd, 2019). Sulfate comprises an average of 21% of the TDS mass at AP-59; for the March 2023 initial sample, 78.7 mg/L of sulfate contributed more than 25% of the total mass of 280 mg/L of TDS which was reported. As shown on **Figure 10**, recent increases in sulfate concentrations coincide with recent increases in TDS levels within the well. TDS concentrations at AP-59 appear to be at least partially driven by sulfate concentrations, which are likely associated with the aquifer solids as discussed above. Therefore, the SSI identified for TDS is likely also associated with the increase in aqueous sulfate concentrations from the aquifer solids and not due to a release from the PBAP.

3.2 Sampling Requirements

The ASD described above supports the position that the identified SSIs for boron, chloride, sulfate, and TDS at downgradient well AP-58A are due to sampling issues, that the identified SSIs for sulfate and TDS at downgradient well AP-59 are a product of natural variation within the uppermost aquifer, and that none of the identified SSIs are due to a release from the Flint Creek PBAP. Therefore, the unit will remain in the detection monitoring program. Groundwater at the unit will continue to be sampled for Appendix III parameters.

4. 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 SSIs for boron, chloride, sulfate, and TDS at AP-58A and for sulfate and TDS at AP-59 during the first semiannual detection monitoring event of 2023 should be attributed to sampling issues or natural variation, respectively, and not 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 E**.

5. REFERENCES

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TABLES

Table 1. Detection Monitoring Data Evaluation
Detection Summary Memorandum
Flint Creek, Primary Bottom Ash Pond

Analyte	Unit	Description	AP-58A		AP-59		AP-60
			3/7/2023	9/18/2023	3/7/2023	9/18/2023	3/7/2023
Boron	mg/L	Intrawell Background Value (UPL)	0.276		0.368		1.68
		Analytical Result	**1.27**	**1.03**	0.368	--	0.870
Calcium	mg/L	Intrawell Background Value (UPL)	86.8		53.9		49.9
		Analytical Result	16.7	--	46.5	--	8.43
Chloride	mg/L	Intrawell Background Value (UPL)	10.2		18.0		17.4
		Analytical Result	**23.4**	**26.2**	17.7	--	6.82
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00		0.765		0.681
		Analytical Result	0.58	--	0.47	--	0.17
pH	SU	Intrawell Background Value (UPL)	8.7		7.6		10.8
		Intrawell Background Value (LPL)	6.2		6.7		6.5
		Analytical Result	**8.95**	7.62	7.0	--	9.1
Sulfate	mg/L	Intrawell Background Value (UPL)	90.3		50.1		190
		Analytical Result	**152**	**144**	**78.7**	**69.6**	56.8
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	333		266		397
		Analytical Result	**400**	**400**	**280**	**300**	280

Notes:

1. Bold values exceed the background value.

2. Background values are shaded gray.

3. AP-58A analytical results are compared to intrawell prediction limits calculated using AP-58 background data, as insufficient data is available from AP-58A to calculate prediction limits at this time.

--: Not measured

LPL: Lower prediction limit

mg/L: milligrams per liter

SU: standard units

UPL: Upper prediction limit

Table 2. AP-58A Relevant Parameter Comparison
Flint Creek - Primary Bottom Ash Pond

Source	Sample Date	Parameter			
		Boron	Chloride	Sulfate	TDS
AP-58A UPL	N/A	0.276	10.2	90.3	333
BAP	2/25/2020	0.246	11.0	39.5	217
BAP Near Stop Log	2/25/2020	0.0688	7.92	16.2	155
AP-58A	3/7/2023	1.27	23.4	152	400
AP-58A	9/18/2023	1.03	26.2	144	400

Notes:

1. All parameters are shown in units of milligrams per liter.
2. Results greater than the AP-58A UPL are highlighted in red and results lower than the AP-58A UPL are highlighted in green.
3. AP-58A analytical results are compared to intrawell prediction limits calculated using AP-58 background data, as insufficient data is available from AP-58A to calculate prediction limits at this time.

BAP: Bottom Ash Pond
TDS: total dissolved solids
UPL: upper prediction limit

Table 3. AP-59 Relevant Parameter Comparison
Flint Creek - Primary Bottom Ash Pond

Source	**Sample Date**	**Parameter**	
		Sulfate	**TDS**
AP-59 UPL	N/A	50.1	266
BAP	2/25/2020	39.5	217
BAP Near Stop Log	2/25/2020	16.2	155
AP-59	3/7/2023	78.7	280
AP-59	9/18/2023	69.6	300

Notes:

1. All results are shown in milligrams per liter (mg/L).
2. Results greater than the AP-59 UPL are highlighted in red and results lower than the AP-59 UPL are highlighted in green.

BAP: Bottom Ash Pond
TDS: total dissolved solids
UPL: upper prediction limit

FIGURES

Notes:

1. Photograph taken looking southwest on July 25, 2023 prior to the completion of CCR removal.
2. AP-58A is located on the center dike shown in the photograph.

PBAP Site Photograph

Flint Creek Primary Bottom Ash Pond

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Columbus, Ohio

March 2024

Figure 1

Legend

⌖ Monitoring Wells

Notes
1. Monitoring well coordinates were collected December 12, 2022; data provided by AEP.
2. AP-58 had irreparable damage and was replaced by well AP-58A.
3. Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon 2017) provided by AEP.
4. Aerial basemap provided by ESRI (April 2023).

200 100 0 200
Feet

Site Layout

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

Geosyntec
consultants

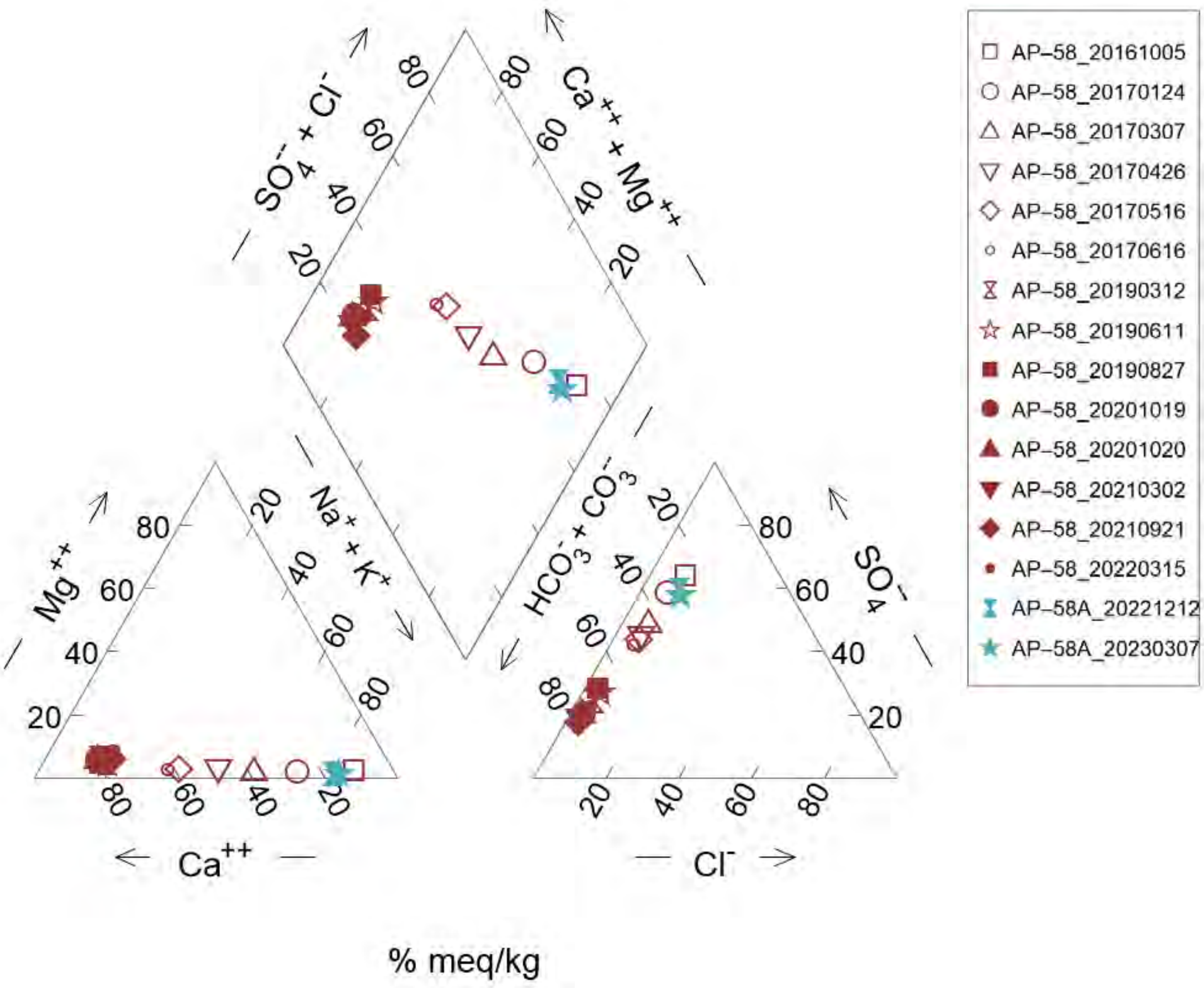
Columbus, Ohio

April 2024

Figure

2

\\annarbor-01\Data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2022\Flint Creek PBAP Site Layout_ASD.mxd. ASoltero. 3/28/2024. CHA8423/01/08.



Notes:

1. Samples from AP-58 and AP-58A that were analyzed for all major ions are shown on the Piper diagram in units of percentage of milliequivalents per kilogram (% meq/kg) for major cations (bottom left triangle) and major anions (bottom right triangle).

Piper Diagram

Flint Creek Primary Bottom Ash Pond

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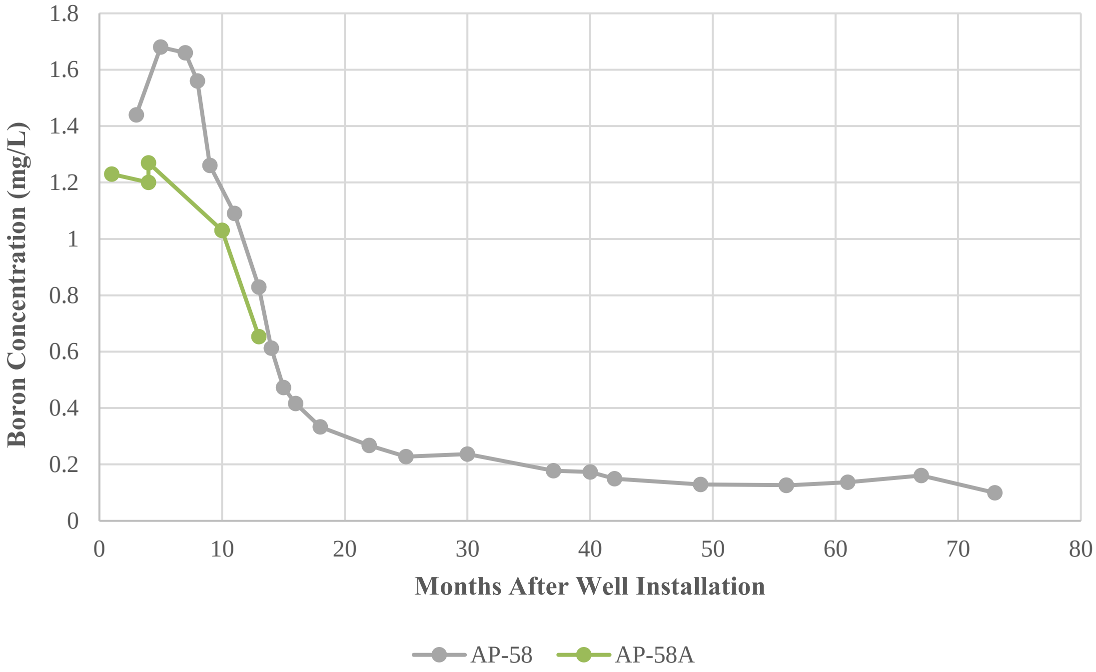
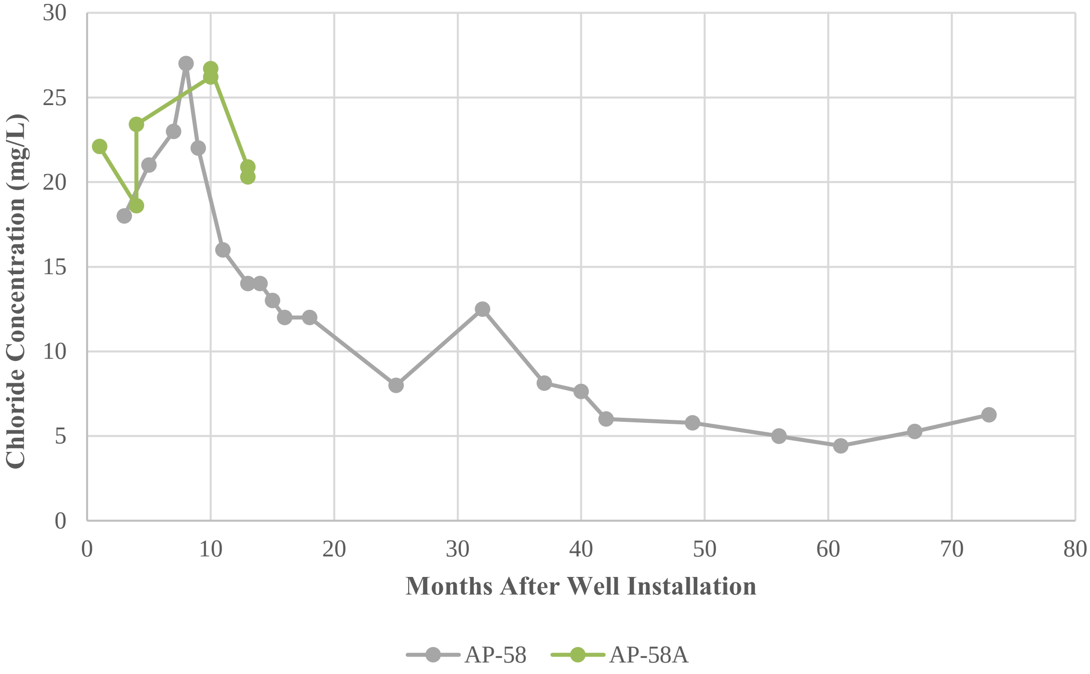
Figure

3

Columbus, Ohio

April 2024





Notes:
1. Boron and chloride concentrations are shown in milligrams per liter (mg/L).
2. Monitoring well AP-58 was installed in February 2016 and ceased use in September 2022 after it sustained irreparable damage.
3. AP-58A was installed in November 2022 to replace AP-58.

AP-58 and AP-58A Boron and Chloride Comparison

Flint Creek Primary Bottom Ash Pond

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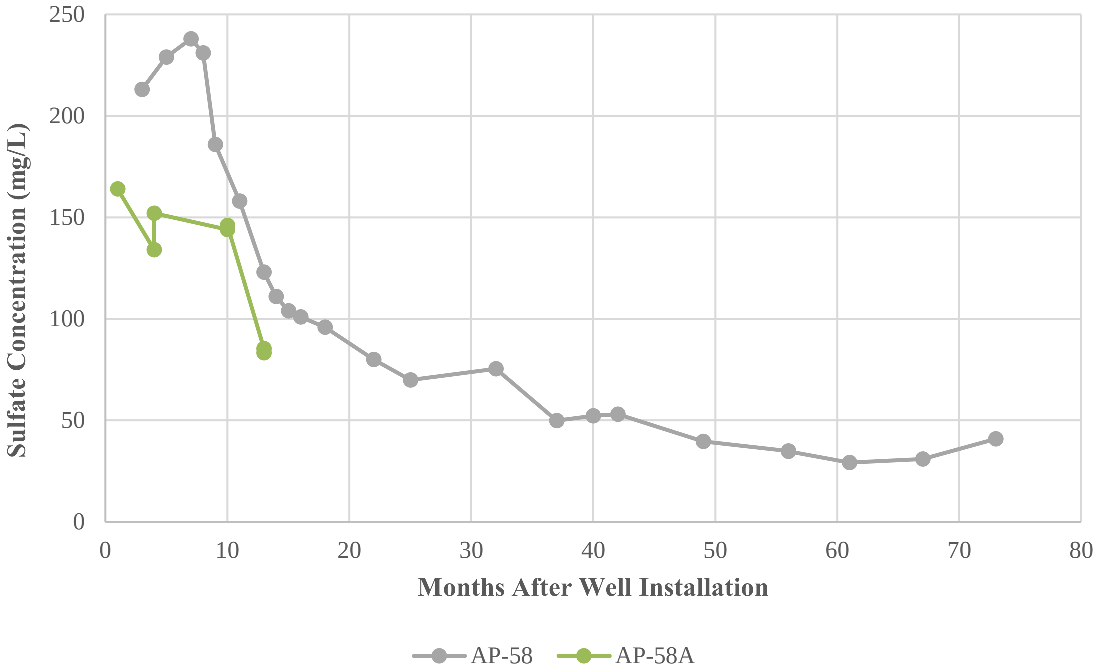
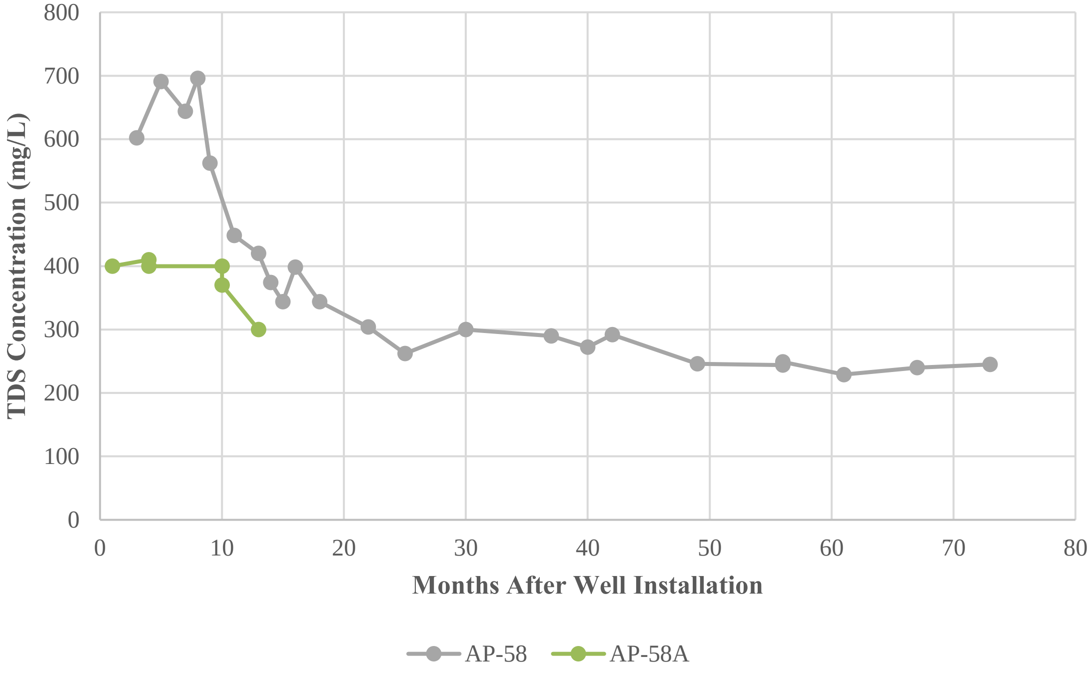
Figure
4

Columbus, Ohio

April 2024





Notes:

1. Sulfate and total dissolved solids (TDS) concentrations are shown in milligrams per liter (mg/L).
2. Monitoring well AP-58 was installed in February 2016 and ceased use in September 2022 after it sustained irreparable damage.
3. AP-58A was installed in November 2022 to replace AP-58.

AP-58 and AP-58A Sulfate and TDS Comparison

Flint Creek Primary Bottom Ash Pond

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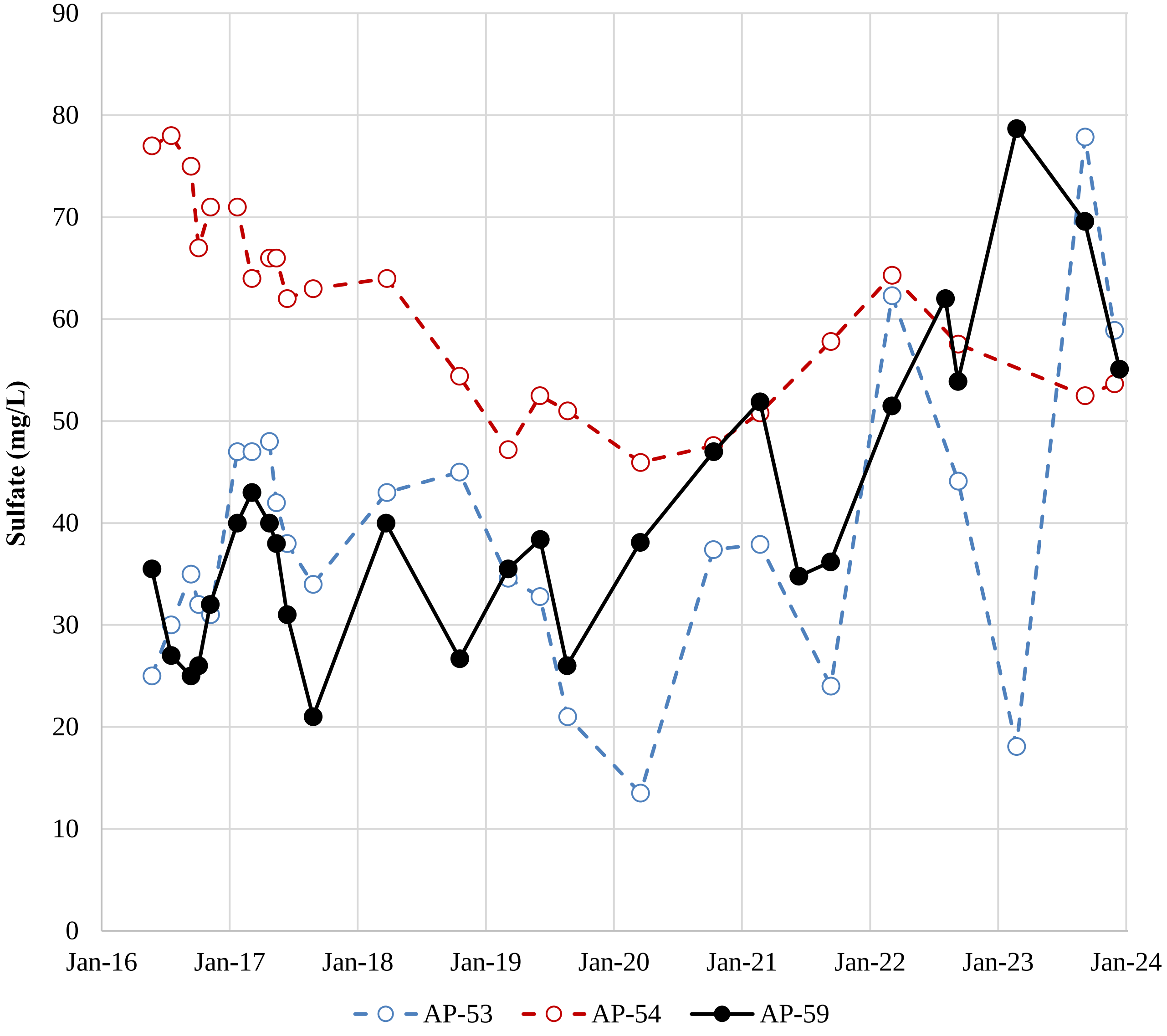
Figure

5

Columbus, Ohio

April 2024



Notes:

1. Total sulfate concentrations are shown for compliance well AP-59 and upgradient background wells AP-53 and AP-54.

mg/L: milligrams per liter

Sulfate Comparison to Background Monitoring Wells

Flint Creek Primary Bottom Ash Pond

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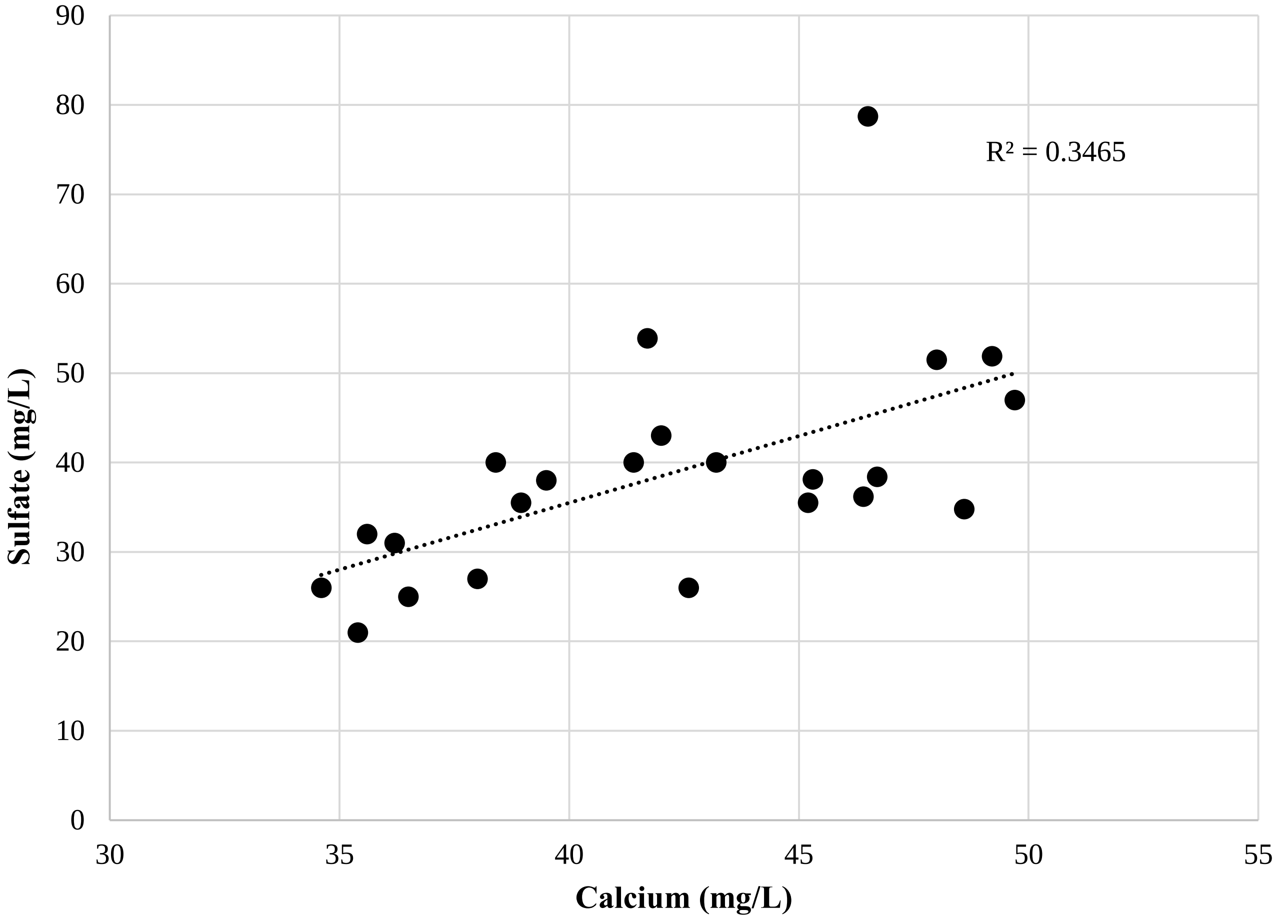
Columbus, Ohio

April 2024

Figure

6



Notes:

1. Total calcium and sulfate concentrations from individual sampling events are displayed.

mg/L: milligrams per liter

AP-59 Calcium vs. Sulfate Scatter Plot

Flint Creek Primary Bottom Ash Pond

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Figure

7

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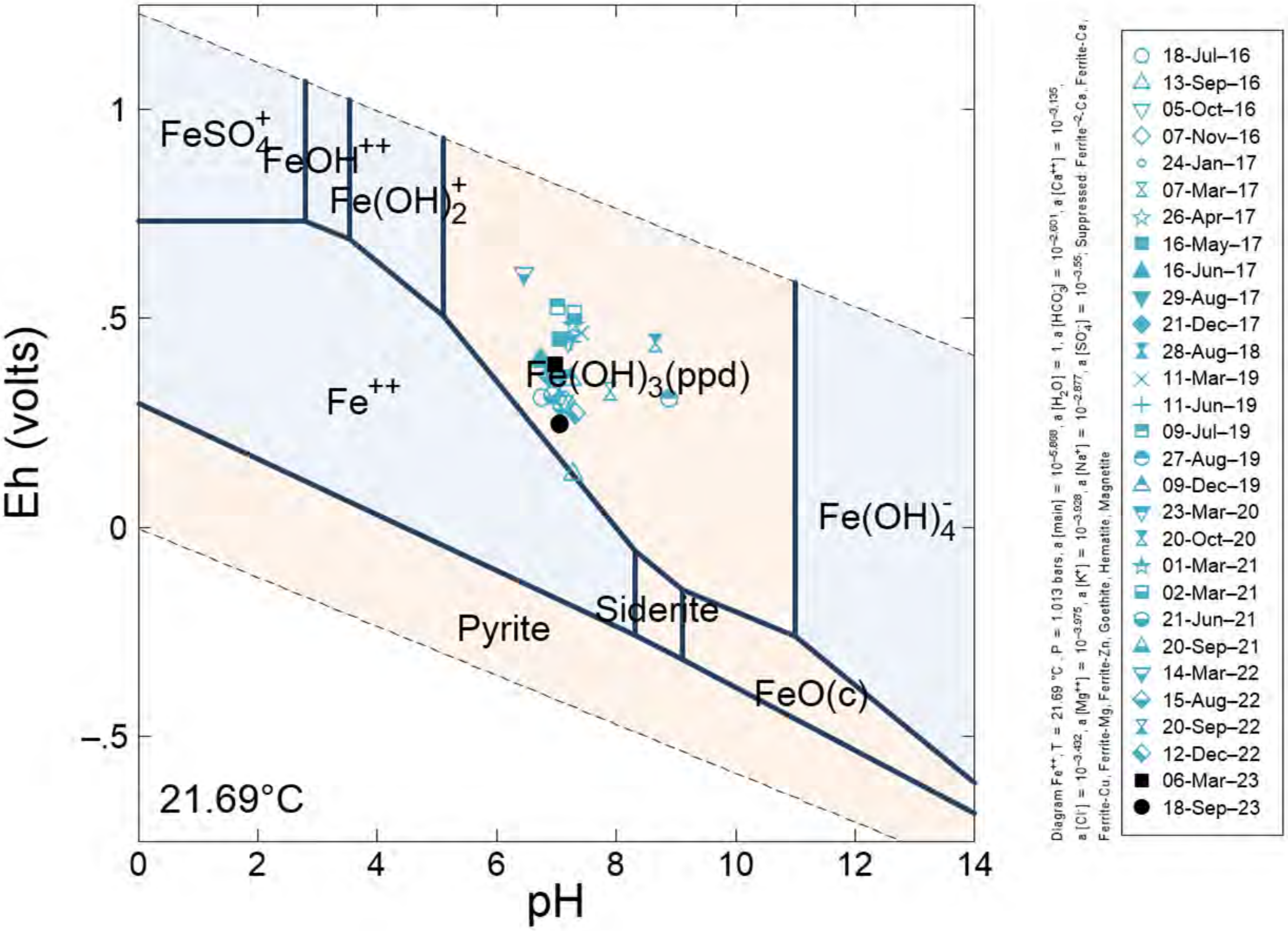
April 2024



Notes:

1.Average groundwater temperature and concentrations of major cations and anions at AP-59 since monitoring began in 2016 were used to establish baseline conditions for the diagram.

2. Eh and pH values for sampling dates at AP-59 are shown on the diagram.

3. Crystalline iron oxyhydroxide phases hematite, goethite, magnetite, and ferrite are less likely to form and are suppressed in the diagram to show the stability field of amorphous iron oxyhydroxide $Fe(OH)_3$(ppd).

AP-59 Iron Eh-pH Diagram

Flint Creek Primary Bottom Ash Pond

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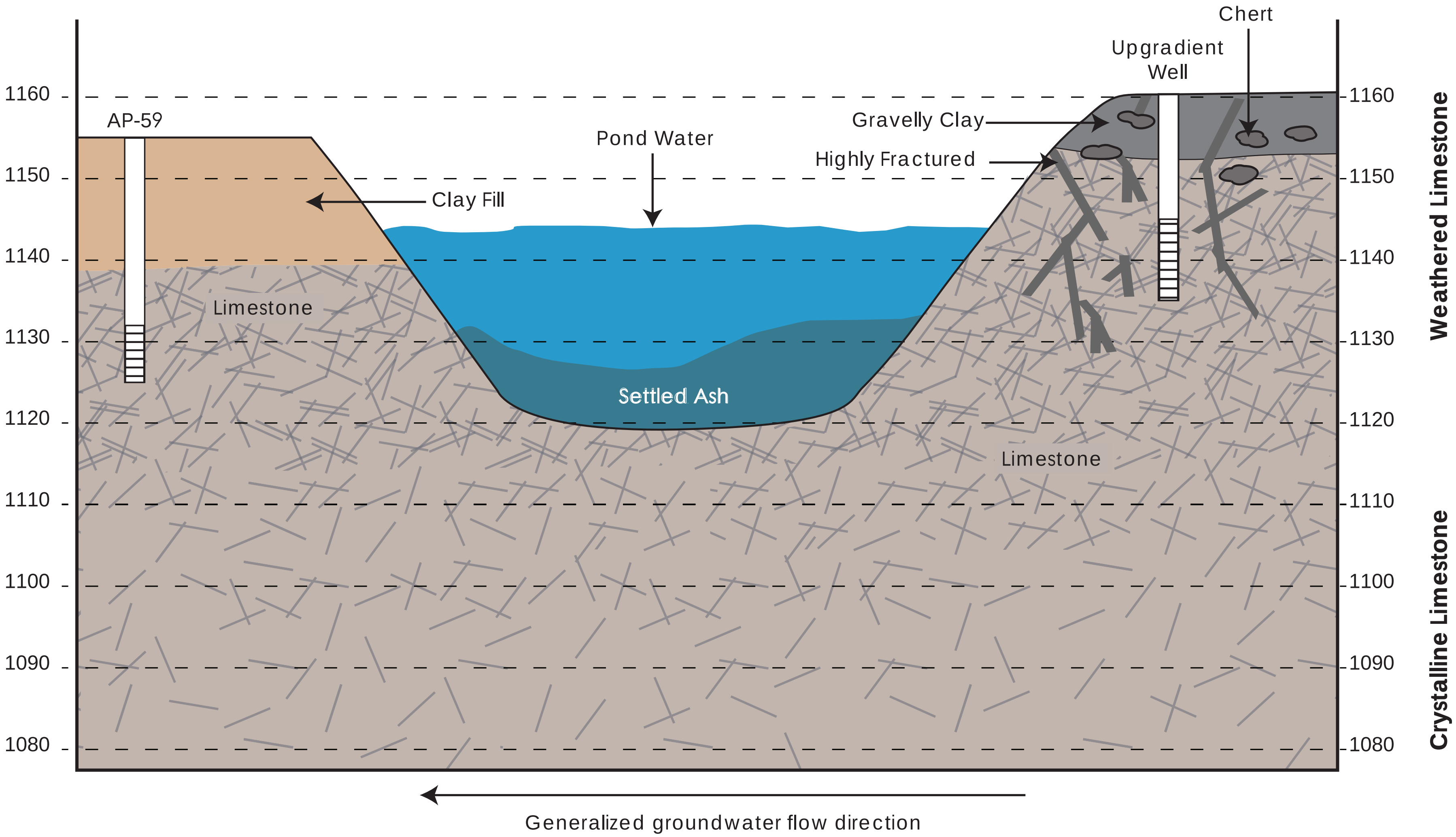
Figure

8

Columbus, Ohio

April 2024



Not to Scale

Site Geology Illustration
Flint Creek Primary Bottom Ash Pond

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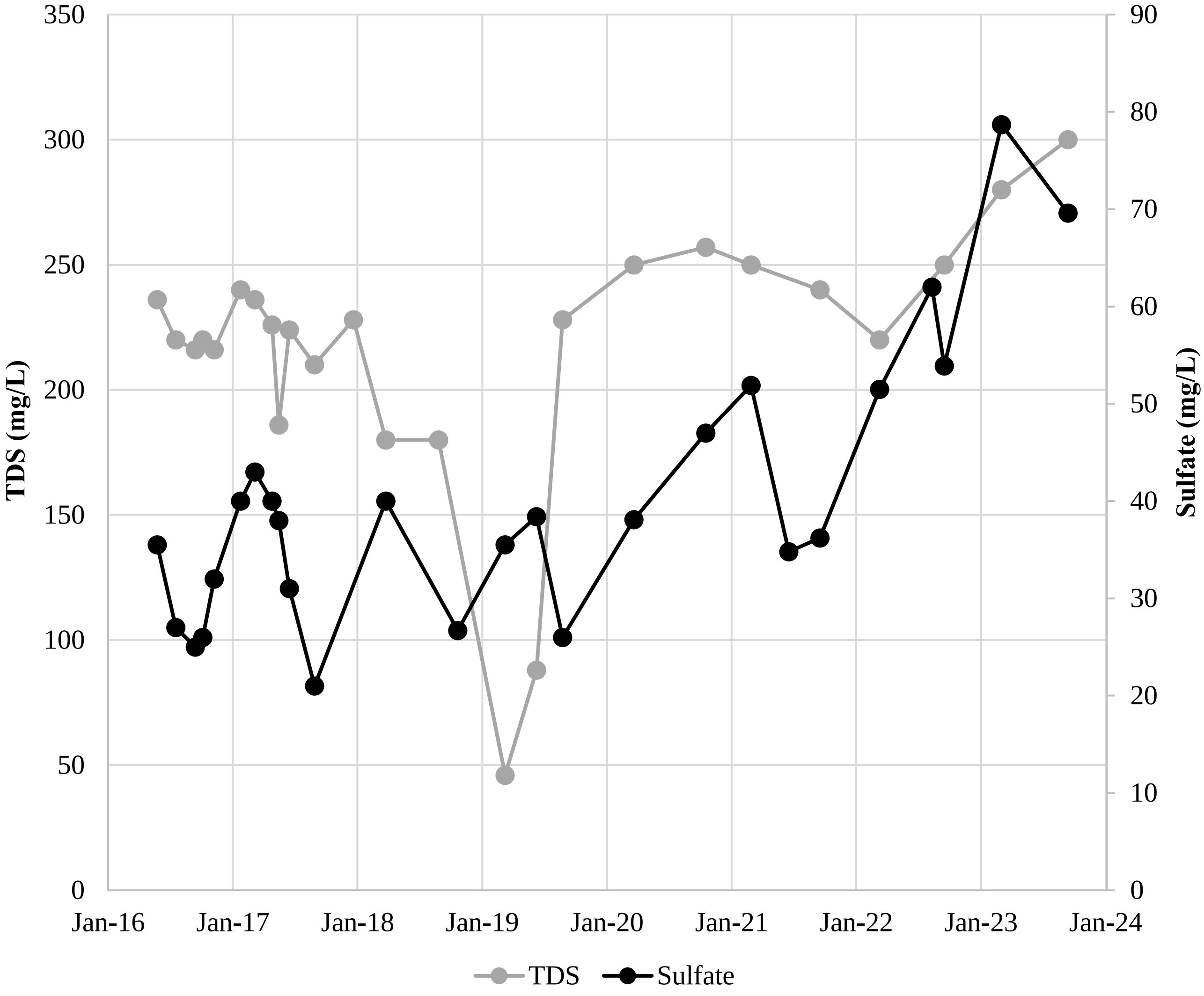
Figure
9

Columbus, Ohio

April 2024

FlintCreekIllustration_July2021_CHA8495.ai



Notes:

1. Total dissolved solids (TDS) and total sulfate concentrations are shown for compliance well AP-59

mg/L: milligrams per liter

AP-59 TDS and Sulfate Time Series

Flint Creek Primary Bottom Ash Pond

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Figure

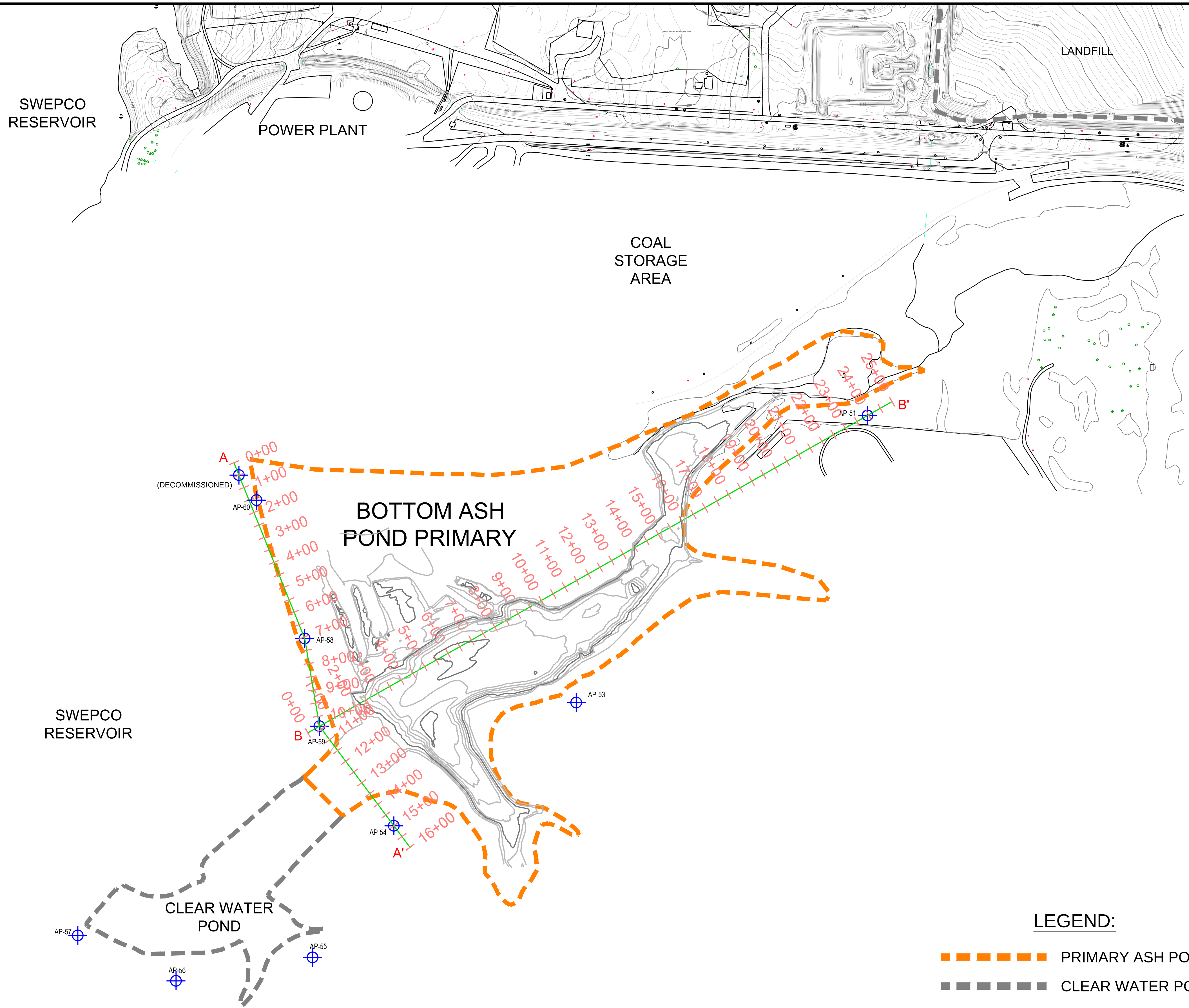
10

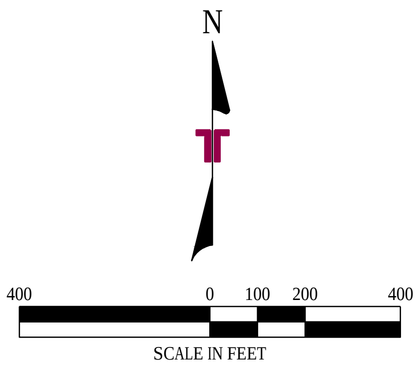
Columbus, Ohio

April 2024

ATTACHMENT A

Geologic Cross Sections





NOTE:
CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WERE TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
SURVEY PROVIDED BY AEP, AND IS A COMPOSITE OF AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED APRIL 30, 2015 AND A HYDROGRAPHIC SURVEY PERFORMED BY AEP, DATED AUGUST 12, 2004.

UPPERMOST AQUIFER:
DATA FROM SAMPLING EVENTS PERFORMED BY TERRACON CONSULTANTS, INC., DATING FROM JUNE 8, 2011 THROUGH MARCH 15, 2016.

WELL AP-52 WAS DECOMMISSIONED IN DECEMBER OF 2016 AND REPLACED WITH AP-60.

LEGEND:

▬ ▬ ▬	PRIMARY ASH POND BOUNDARY (THIS REPORT)
▬ ▬ ▬	CLEAR WATER POND/LANDFILL BOUNDARY (NEARBY OTHERS)
──	CROSS SECTION LOCATION
⌖	MONITORING WELL

SHEET 1

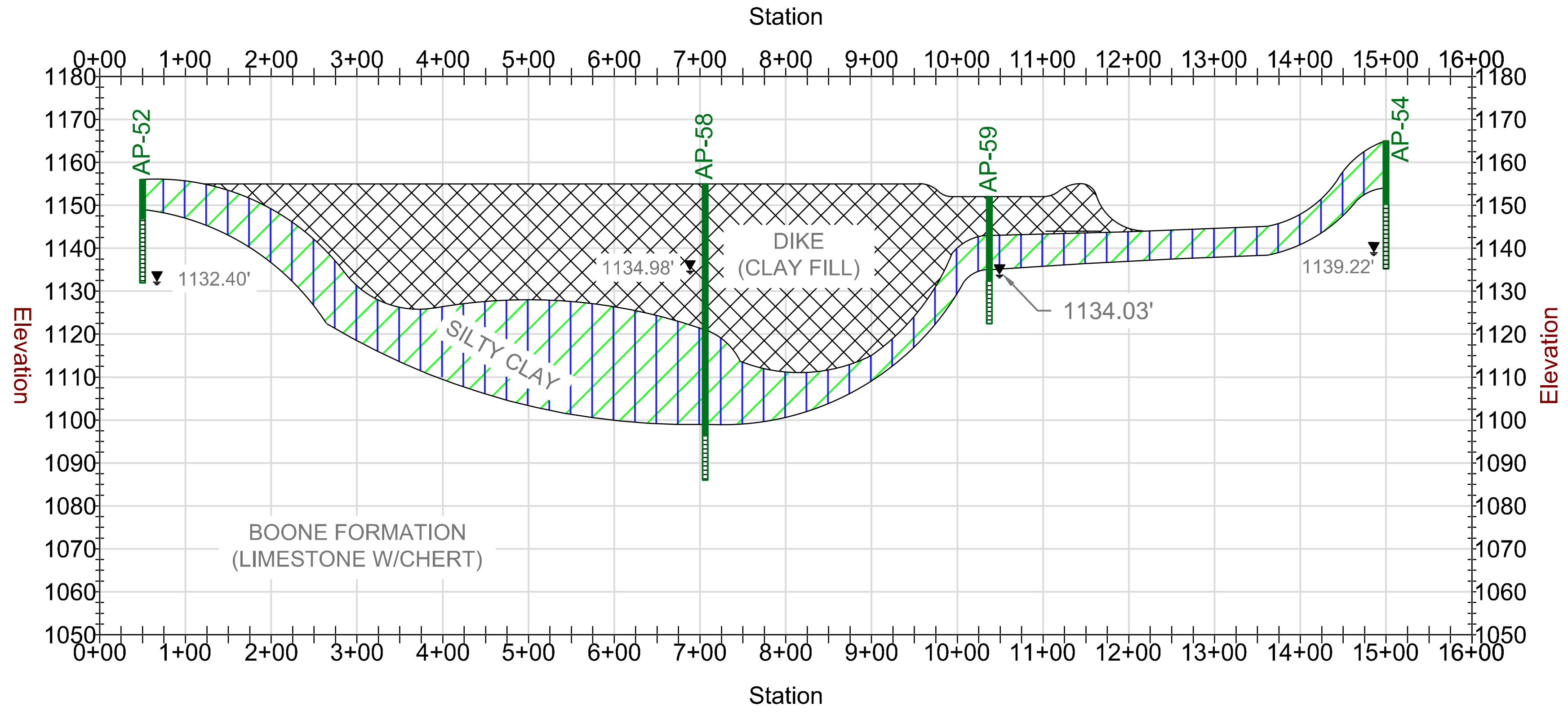
DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	001
SHEET NO.:	1 OF 2

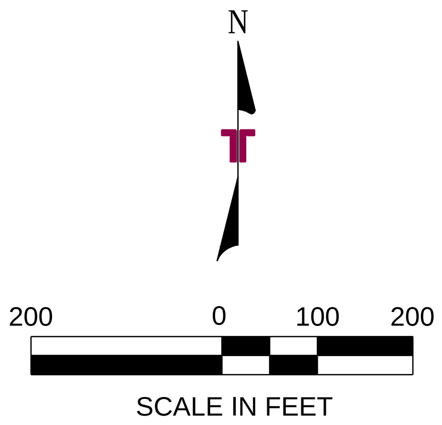
CROSS SECTION LOCATION MAP
GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTPONDOM ASH
GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9292 FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

ALIGN- A-A'



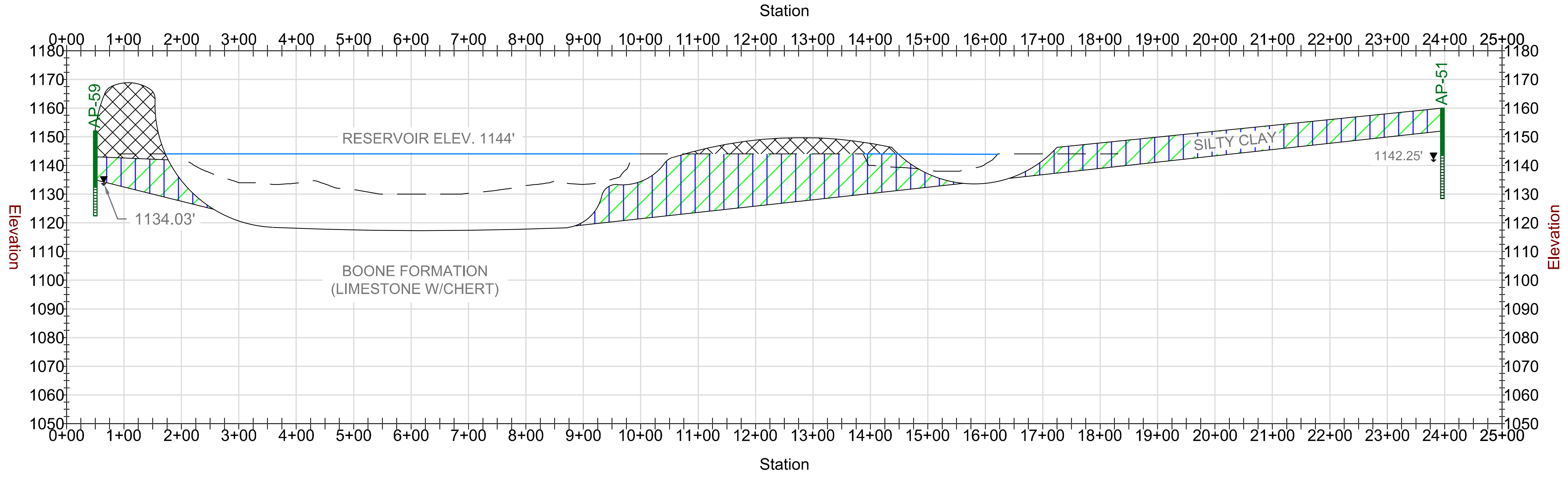


LEGEND:

▨ DIKE (CLAY FILL)

▨ SILTY CLAY

ALIGN- B-B'



SHEET 2

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	001
SHEET NO.:	2 OF 2

CROSS SECTION A-A' & B-B'

GROUNDWATER MONITORING NETWORK EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT BOTTPONDOM ASH

GENTRY ARKANSAS

Terracon

Consulting Engineers and Scientists

25809 I-30 SOUTH BRYANT, AR 72022

PH. (501) 847-9292 FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

ATTACHMENT B

AP-58, AP-58A, and AP-59 Boring Logs and Well Construction Diagrams

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: AP-58 PAGE: 1 of 2

TOTAL DEPTH: 69 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-002	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER	DRILLER: GARY MOYERS
DATE DRILLED: 2/16/2016	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY

SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

Depth BGS	N: N/A E: N/A G.S. ELEV. N/A DESCRIPTION	Litho. Symbol	Remarks
			Flush - mounted boring
0	0'-15' SILTY CLAY - FILL brown and red, poor sample return		
5			
10			
15	15'-56' SILTY CLAY red, moist zones at 30' - 40' and 45' - 50'		
20			
25			
30			

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Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

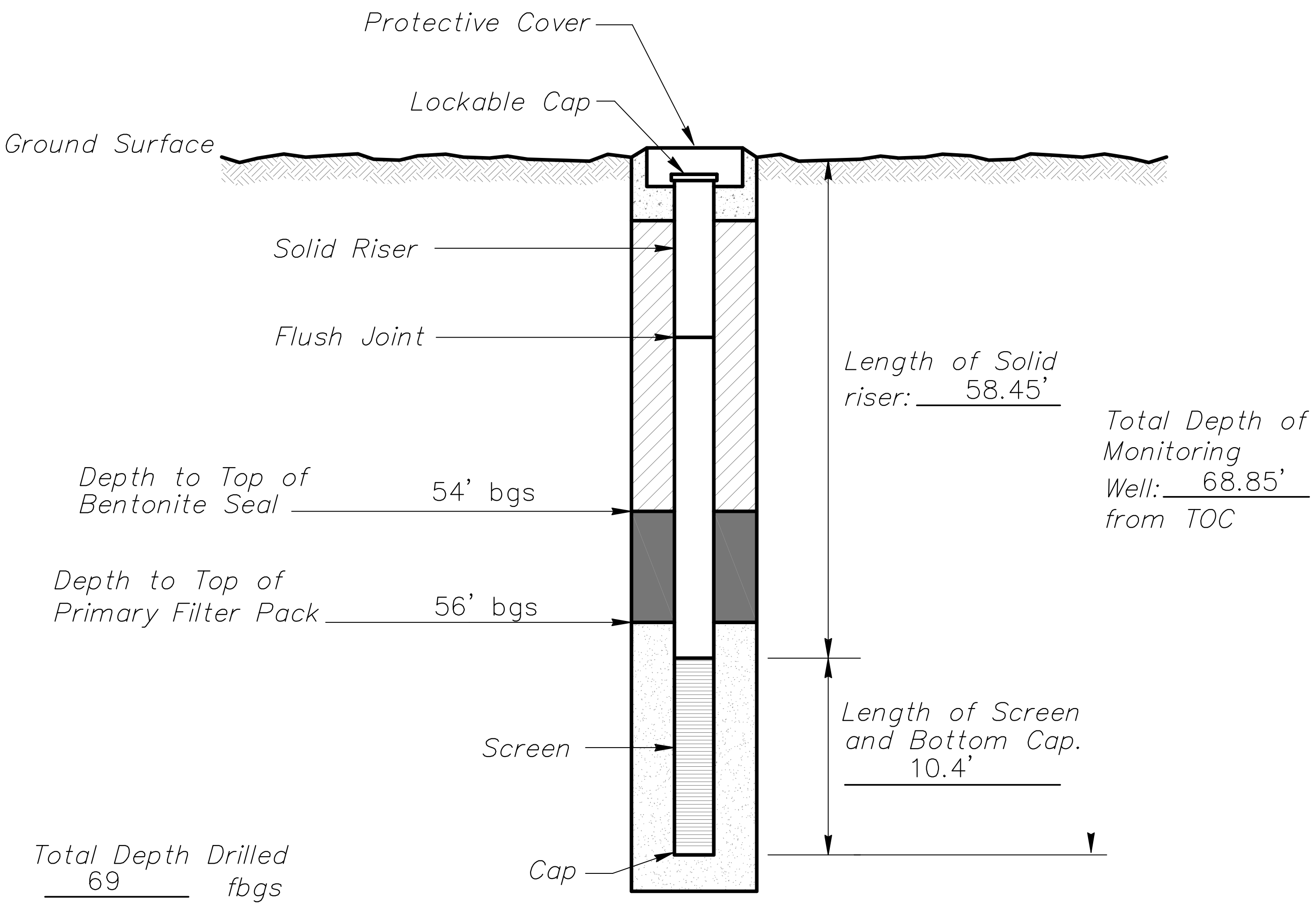
BORING NO.: AP-58 PAGE: 2 of 2

TOTAL DEPTH: 69 FEET BELOW GROUND SURFACE (BGS

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
40 45 50 55	15'-56' <u>SILTY CLAY</u> red, moist zones at 30' - 40' and 45' - 50'	▨	
60 65	56'-69' <u>LIMESTONE</u> gray, crystalline	▦	56' - 59' bgs logged by cuttings
70 75	Total Depth of Boring at 69' bgs		

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION Well Number AP–58
Job Number 35157182 Installation Date 2/16/2016 Location AEP–FLINT CREEK –GENTRY, AR.
Datum Elevation NA Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16–30 SAND Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



Length of Solid riser: 58.45'

Total Depth of Monitoring Well: 68.85' from TOC

Depth to Top of Bentonite Seal 54' bgs

Depth to Top of Primary Filter Pack 56' bgs

Length of Screen and Bottom Cap. 10.4'

Total Depth Drilled 69 fbgs

▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

(Not to Scale)

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35157182
WELL NUMBER: AP–58
DRAWING NUMBER: 006 CHECKED BY: MR

FIELD BORING LOG

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BORING NO.: AP-58A PAGE: 1 of 2

TOTAL DEPTH: 71.7' FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35237104-001	DRILLING CO.: SUNBELT
LOGGED BY: JOSH RAY	DRILLER: NEAL FARRAR AR License #C001451
DATE DRILLED: 11/21/2022	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY

SAMPLING METHOD: 5' CONTINUOUS SAMPLER / AIR ROTARY

N: 707805.248 E: 1255854.857 G.S. ELEV. 1155.71

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-15' <u>SILTY CLAY</u> - FILL brown and red, poor sample return	▨	
5		▨	
10		▨	
15	15'-55' <u>SILTY CLAY</u> red, moist zones at 40'	▨	
20		▨	
25		▨	
30		▨	

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FIELD BORING LOG

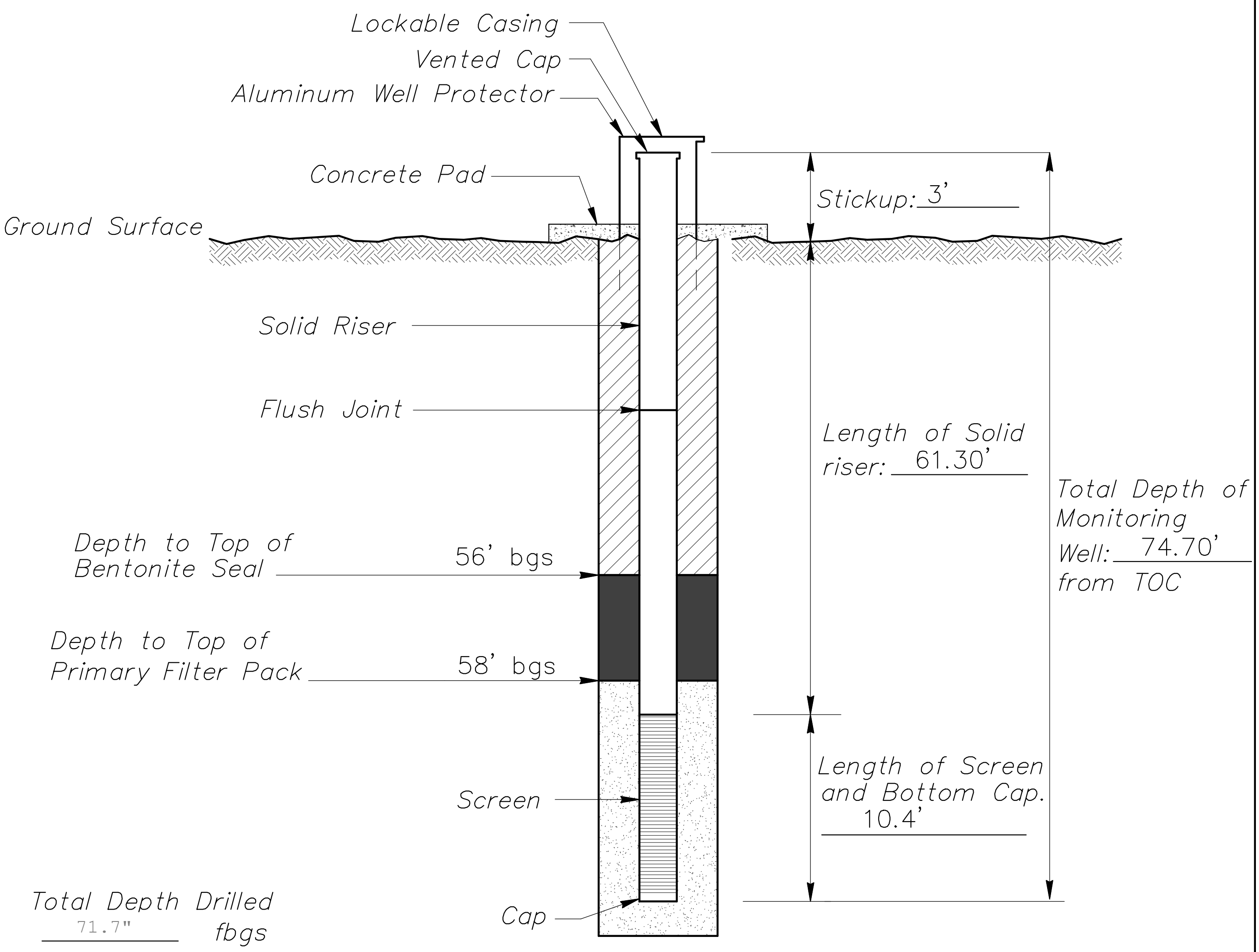
BORING NO.: AP-58A PAGE: 2 of 2

TOTAL DEPTH: 71.7' FEET BELOW GROUND SURFACE (BGS

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
40 45 50	15'-55' SILTY CLAY red, moist zones at 40'	▨	Groundwater encountered above bedrock, and rose to static level of 20.90' below TOC
55 60 65	55'-70' LIMESTONE gray, crystalline	▦	55' - 70' bgs logged by cuttings, wet
70	Total Depth of Boring at 71.7' bgs		
75			

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION Well Number AP–58A
Job Number 35237104 Installation Date 11/21/2022 Location AEP–FLINT CREEK–GENTRY, AR.
Datum Elevation 1158.57 ' NGVD29 Vertical Datum Surface Elevation 1155.71' NGVD29 Vertical Datum
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010 "
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16–30 SAND Terracon Representative JOSH RAY
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor SUNBELT



▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

(Not to Scale)

Terracon

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35237104
WELL NUMBER: AP–58A
DRAWING NUMBER: 002 CHECKED BY: MR

Consulting Engineers and Scientists

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BRYANT, AR. 72022
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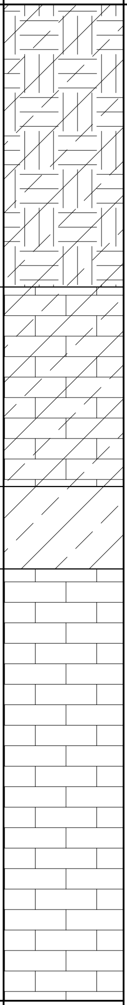
FIELD BORING LOG

BORING NO.: AP-59
PAGE: 1 of 1
TOTAL DEPTH: 30 FEET BELOW GROUND SURFACE (BGS)

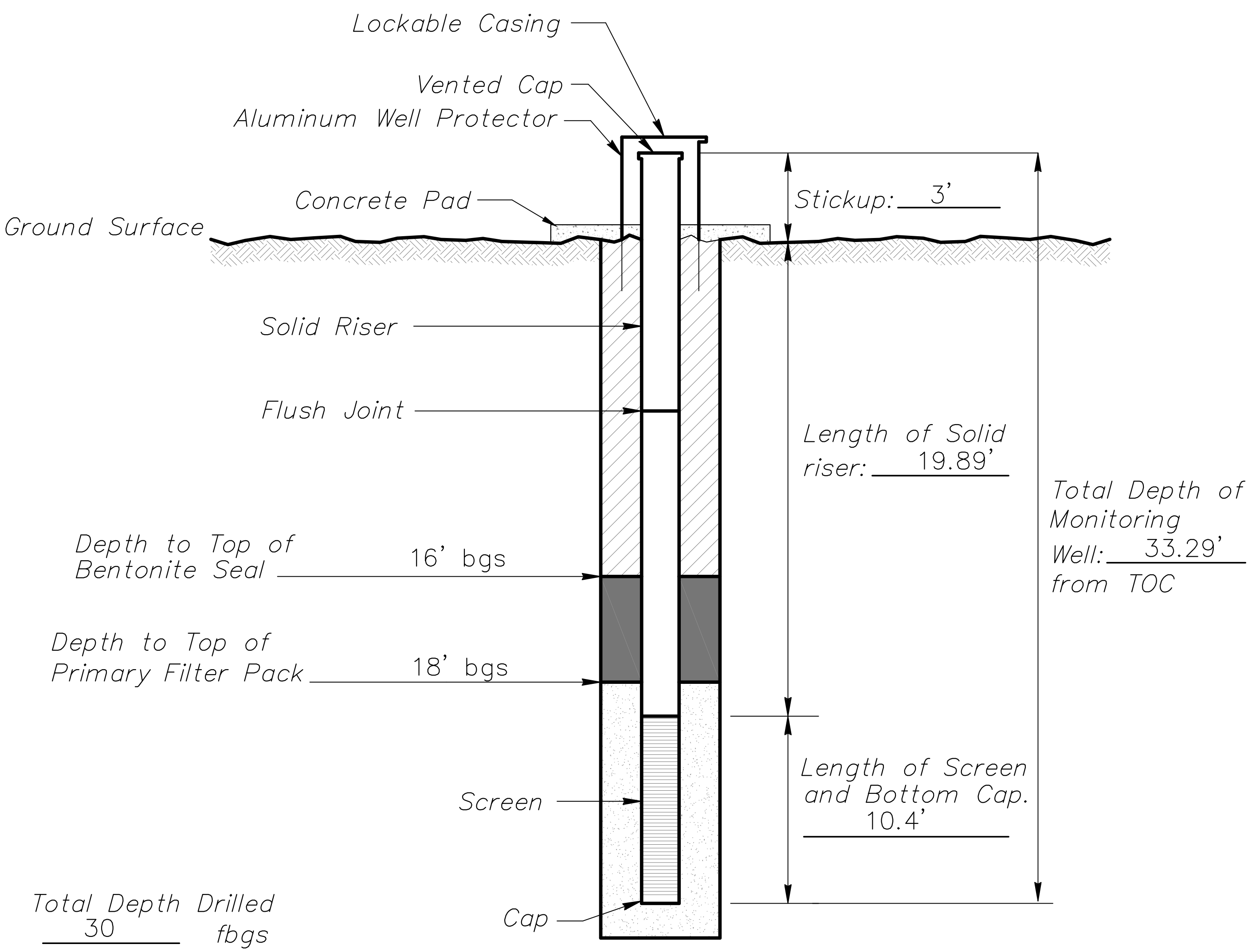
CLIENT: AMERICAN ELECTRIC POWER
PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-001
DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER
DRILLER: GARY MOYERS
DATE DRILLED: 2/3/2016
RIG TYPE: CME 75 BUGGY
DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY
SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS



Depth BGS	N: N/A E: N/A G.S. ELEV. N/A DESCRIPTION	Litho. Symbol	Remarks
0	0'-8.5' SILTY CLAY - FILL red and brown		
5			
10	8.5'-14.5' LIMESTONE and SILTY CLAY hard while drilling		
15	14.5'-17' SILTY CLAY red		
	17'-30' LIMESTONE light gray, crystalline, thin fracture/void at 22' bgs		Moisture at top of rock at 17' bgs
20			
	▽		Water at 22' bgs 17' - 30' Logged by cuttings
25			
30	Total Depth of Boring at 30' bgs		

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION
Well Number AP–59
Job Number 35157182
Installation Date 2/4/2016
Location AEP–FLINT CREEK –GENTRY, AR.
Datum Elevation NA
Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC
Slot Size 0.010
Riser Diameter & Material 2" PVC
Borehole Diameter 8"
Granular Backfill Material 16–30 SAND
Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY
Drilling Contractor ANDERSON ENGINEERING



Stickup: 3'

Length of Solid riser: 19.89'

Total Depth of Monitoring Well: 33.29' from TOC

Depth to Top of Bentonite Seal 16' bgs

Depth to Top of Primary Filter Pack 18' bgs

Length of Screen and Bottom Cap. 10.4'

Total Depth Drilled 30 fbgs

▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

(Not to Scale)

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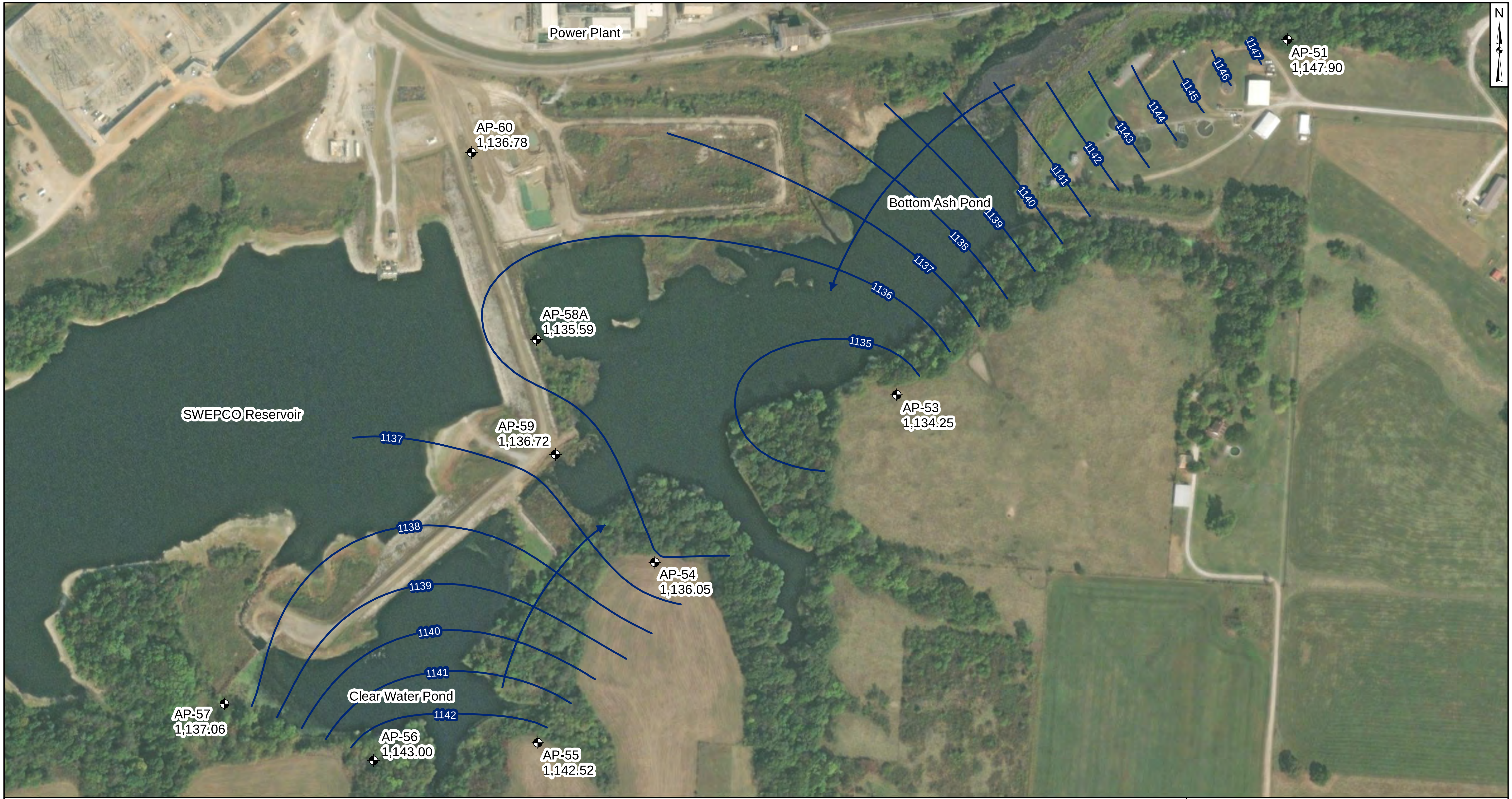
MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35157182
WELL NUMBER: AP–59
DRAWING NUMBER: 005
CHECKED BY: MR

ATTACHMENT C

Potentiometric Surface Maps, Uppermost Aquifer
March 2023 and September 2023

Map was previously provided in AEP. 2024. Annual Groundwater Monitoring Report - Southwestern Electric Power Company, Flint Creek Power Plant, Primary Bottom Ash CCR Management Unit. American Electric Power. January.



Legend

⊕ Monitoring Wells

— Groundwater Contour Elevation

→ Groundwater Flow Direction

Notes
- Monitoring well coordinates and water level data were collected March 6 and 7, 2023, provided by AEP.
- AP-58 was irreparably damaged and was replaced by well AP-58A.
- 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.
- Well locations resurveyed on February 2 and 3, 2023 (Datum: AR SP North NAD27).

200 100 0 200
Feet

Potentiometric Surface Map
Uppermost Aquifer - March 2023

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

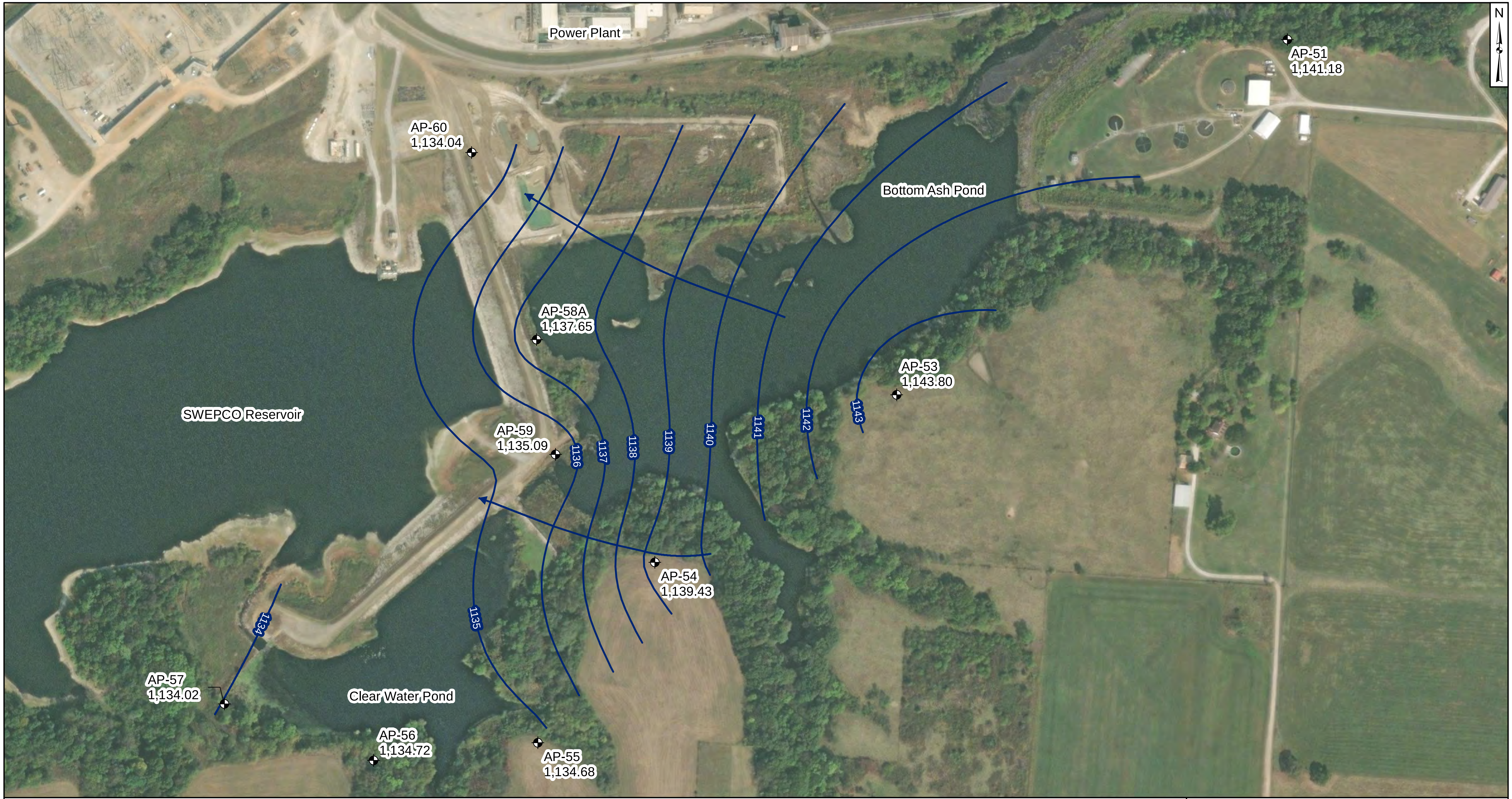
Geosyntec consultants

Columbus, Ohio | April 2024

Figure
C-1

\\annarbor-01\Data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2023\AEP-Flint Creek_GW_BAP_Mar2023.mxd. ASoltero. 5/16/2023. CHA8423/01/08.

Map was previously provided in AEP. 2024. Annual Groundwater Monitoring Report - Southwestern Electric Power Company, Flint Creek Power Plant, Primary Bottom Ash CCR Management Unit. American Electric Power. January.



Legend

⊕ Monitoring Wells

— Groundwater Contour Elevation

→ Groundwater Flow Direction

Notes
- Monitoring well coordinates and water level data were collected September 18, 2023, provided by AEP.
- AP-58 was irreparably damaged and was replaced by well AP-58A.
- 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.
- Well locations resurveyed on February 2 and 3, 2023 (Datum: AR SP North NAD27).

200 100 0 200
Feet

Potentiometric Surface Map
Uppermost Aquifer - September 2023

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

Geosyntec
consultants

Columbus, Ohio

April 2024

Figure

C-2

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2023\AEP-Flint Creek_GW_BAP_Sept2023.mxd. ASoltero. 9/29/2023. CHA8423/01/08.

ATTACHMENT D
Surface Water Samples
Laboratory Analytical Report

Dolan Chemical Laboratory (DCL)
4001 Bixby Road
Groveport, Ohio 43125
Contacts: **Michael Ohlinger (614-836-4184)**
Dave Conover (614-836-4219)

Chain of Custody Record

Program: Coal Combustion Residuals (CCR)

Site Contact:

Date:

For Lab Use Only:
COC/Order #:

Project Name: CCR
Contact Name:
Contact Phone:
Sampler(s): Ivaunna Neigler Nicole Morrall

Analysis Turnaround Time (in Calendar Days)
● Routine (28 days for Monitoring Wells)

Shipping confirmation sent to recipients below:
nmorrall@aep.com
ipneigler@aep.com
cmhubbell@aep.com

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Sampler(s) Initials	250 mL bottle, pH<2, HNO3 B, Ca, Li, Sb, As, Ba, Be, Cd, Cr, Co, Pb, Mo, Se, TL and Na, K, Mg, Sr	~~Three (six every 10th*) 1L bottles, pH<2, HNO3~~ ~~Ra-226, Ra-228~~	1 L + 250 mL bottles, Cool, 0-6C TDS, F, Cl, SO4, and Br, Alkalinity	~~40 mL Glass vial or 250 mL PTFE lined bottle, HCL**, pH<2~~ ~~Hg~~	~~Field-filter 250 mL bottle then pH<2, HNO3~~ ~~dissolved Fe and dissolved Mn~~		*Contains extra parameters*	Sample Specific Notes:
Low Volume Waste Outlet Combined	2/25/20	13:03	G	GW	2	NM	X		X					<4°C
Bottom Ash Pond	2/25/20	13:14	G	W	2	NM	X		X					<4°C
BAP near Stop Log	2/25/20	13:29	G	W	2	NM	X		X					<4°C
SWEPCO Lake	2/25/20	13:23	G	W	2	NM	X		X					<4°C
Field Blank	2/25/20	13:44	G	W	1	NM/IPN			X					<4°C
Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _______; F = filter in field							4	4	1	2	F 4			

** Six 1L Bottles must be collected for Radium for every 10th sample.*

*** HCl must be Trace Metal Grade for Mercury analysis when samples cannot be delivered to the laboratory within 48 hours of sampling.*

Special Instructions/QC Requirements & Comments:

Relinquished by: Nicole Morrall	Company: AEP	Date/Time: 2/25/20 14:00	Received by:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Date/Time:

Form REP-703
Rev. 1, 11/2013

AEP AMERICAN ELECTRIC POWER

Dolan Chemical Laboratory
4001 Bixby Road
Groveport, OH 43125
T: 614-836-4221, Audinet 210-4221
F: 614-836-4168, Audinet 210-4168
http://aepenv/labs

Water Analysis

Location: Flint Creek PS ***Report Date: 3/20/2020***

Low Volume Waste Outlet Combined

Sample Number: 200633-001 **Date Collected: 02/25/2020 13:03** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.07	ug/L	J	0.1	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.78	ug/L		0.1	0.03	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Barium, Ba	119	ug/L		0.2	0.05	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	< 0.01	ug/L	U	0.05	0.01	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.460	ug/L		0.2	0.04	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.127	ug/L		0.05	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.2	ug/L	J	0.2	0.05	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	2.63	ug/L		2	0.4	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.4	ug/L		0.2	0.03	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Boron, B	0.076	mg/L		0.05	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	35.1	mg/L		0.3	0.1	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000381	mg/L		0.0002	0.00005	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	2.83	mg/L		0.1	0.02	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.69	mg/L		1	0.2	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Sodium, Na	11.4	mg/L		0.5	0.1	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.175	mg/L		0.01	0.002	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	102	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	7.92	mg/L		0.04	0.01	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.08	mg/L		0.06	0.01	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	183	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	17.8	mg/L		0.4	0.06	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0

pH = 6.30 2/25/2020 13:03 ipn

Bottom Ash Pond

Sample Number: 200633-002 **Date Collected: 02/25/2020 13:15** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.11	ug/L		0.1	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Arsenic, As	1.03	ug/L		0.1	0.03	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Barium, Ba	199	ug/L		0.2	0.05	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	0.03	ug/L	J	0.05	0.01	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	2.98	ug/L		0.2	0.04	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.193	ug/L		0.05	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.275	ug/L		0.2	0.05	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	5.81	ug/L		2	0.4	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Selenium, Se	1.8	ug/L		0.2	0.03	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Boron, B	0.246	mg/L		0.05	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	40.5	mg/L		0.3	0.1	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.00111	mg/L		0.0002	0.00005	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	3.14	mg/L		0.1	0.02	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Potassium, K	5.61	mg/L		1	0.2	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Sodium, Na	22.7	mg/L		0.5	0.1	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.498	mg/L		0.01	0.002	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	116	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	11.0	mg/L		0.04	0.01	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.18	mg/L		0.06	0.01	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	217	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	39.5	mg/L		0.4	0.06	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0

pH = 8.70 2/25/2020 13:14 ipn

Location: Flint Creek PS ***Report Date: 3/20/2020***

BAP Near Stop Log

Sample Number: **200633-003** **Date Collected:** **02/25/2020 13:29** **Date Received:** **2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.07	ug/L	J	0.1	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.71	ug/L		0.1	0.03	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Barium, Ba	79.5	ug/L		0.2	0.05	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	< 0.01	ug/L	U	0.05	0.01	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.1	ug/L	J	0.2	0.04	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.056	ug/L		0.05	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.06	ug/L	J	0.2	0.05	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	1	ug/L	J	2	0.4	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.3	ug/L		0.2	0.03	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Boron, B	0.068	mg/L		0.05	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	34.4	mg/L		0.3	0.1	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000205	mg/L		0.0002	0.00005	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	2.75	mg/L		0.1	0.02	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.87	mg/L		1	0.2	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Sodium, Na	11.7	mg/L		0.5	0.1	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.147	mg/L		0.01	0.002	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	101	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	7.92	mg/L		0.04	0.01	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.08	mg/L		0.06	0.01	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	155	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	16.2	mg/L		0.4	0.06	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0

pH= 7.23 2/25/2020 13:29 ipn

pH= 8.31 2/25/2020 13:23 ipn

Swepco Lake SWEPCO Lake

Sample Number: **200633-004** **Date Collected:** **02/25/2020 13:23** **Date Received:** **2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.08	ug/L	J	0.1	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.70	ug/L		0.1	0.03	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Barium, Ba	113	ug/L		0.2	0.05	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	0.01	ug/L	J	0.05	0.01	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.619	ug/L		0.2	0.04	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.144	ug/L		0.05	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.1	ug/L	J	0.2	0.05	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	2	ug/L	J	2	0.4	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.7	ug/L		0.2	0.03	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Boron, B	0.102	mg/L		0.05	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	38.0	mg/L		0.3	0.1	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000527	mg/L		0.0002	0.00005	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	3.04	mg/L		0.1	0.02	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.94	mg/L		1	0.2	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Sodium, Na	20.7	mg/L		0.5	0.1	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.224	mg/L		0.01	0.002	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	99.8	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	11.7	mg/L		0.04	0.01	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.12	mg/L		0.06	0.01	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	206	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	35.0	mg/L		0.4	0.06	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0

Field Blank

Sample Number: **200633-005** **Date Collected:** **02/25/2020 13:44** **Date Received:** **2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Alkalinity, as CaCO3	< 5	mg/L	U	20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	< 0.01	mg/L	U	0.04	0.01	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Fluoride, F	< 0.01	mg/L	U	0.06	0.01	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	< 20	mg/L	U	50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	< 0.06	mg/L	U	0.4	0.06	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0

Location: Flint Creek PS **Report Date: 3/20/2020**

U: Analyte was analyzed and not detected at or above adjusted Method Detection Limit
J: Analyte was positively identified, though the quantitation was below Reporting Limit.

Michael S Ohlinger

Michael Ohlinger, Chemist

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THIS TEST REPORT RELATES ONLY TO THE ITEMS TESTED AND SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT WRITTEN APPROVAL OF THE LABORATORY. ALL TEST RESULTS MEET ALL OF THE REQUIREMENTS OF THE ACCREDITING AUTHORITY, UNLESS OTHERWISE NOTED.

ATTACHMENT E

Certification by a Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the 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
No. 9846

Beth Ann Gross
Printed Name of Licensed Professional Engineer

Beth Ann Gross
Signature

Geosyntec Consultants
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Arkansas Firm Certificate of
Authorization No. 52
Exp. 12/31/2024

9864	Arkansas	4/3/2024
License Number	Licensing State	Date

GEOSYNTEC CONSULTANTS
No. 52

ALTERNATIVE SOURCE DEMONSTRATION REPORT

FEDERAL CCR RULE

Flint Creek Power Plant
Primary Bottom Ash Pond
Gentry, Arkansas

Prepared for

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

Prepared by

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

Project CHA8495B

June 2024

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ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	alternative source demonstration
bgs	below ground surface
CCR	coal combustion residuals
CFR	Code of Federal Regulations
EPRI	Electric Power Research Institute
LPL	lower prediction limit
mg/L	milligrams per liter
PBAP	Primary Bottom Ash Pond
redox	oxidation-reduction
SSI	statistically significant increase
TDS	total dissolved solids
UPL	upper prediction limit
USEPA	United States Environmental Protection Agency

1. INTRODUCTION AND SUMMARY

This alternative source demonstration (ASD) report has been prepared to address statistically significant increases (SSIs) for boron, chloride, sulfate, and total dissolved solids (TDS) in the groundwater monitoring network for the Plant Primary Bottom Ash Pond (PBAP), located at the Flint Creek Power in Gentry, Arkansas, following the second semiannual detection monitoring event of 2023. The Flint Creek Power Plant has two coal combustion residuals (CCR) storage units, including the PBAP, which was certified as having all contained CCR removed by August 2023 and is now operated as a non-CCR wastewater pond.

Background groundwater values for the PBAP were originally calculated in January 2018 and have been updated intermittently in accordance with the *Statistical Analysis Plan* prepared for the Flint Creek Plant (Geosyntec Consultants, Inc. [Geosyntec] 2020a). For the most recent update in January 2022, revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values (Geosyntec 2022a). Prediction limits were calculated based on a one-of-two retesting procedure in accordance with the Unified Guidance (United States Environmental Protection Agency [USEPA] 2009) and the statistical analysis plan developed for the site. With this procedure, an SSI is concluded only if both an initial sample and a resample reported results above the UPL or, in the case of pH, below the lower prediction limit (LPL). In practice, if the initial result was not above the UPL or was not below the LPL, a resample was not collected or analyzed.

The second semiannual detection monitoring event of 2023 at the PBAP was conducted in September (initial sampling event), and the results were compared to the calculated prediction limits. Where initial exceedances were identified, resampling was completed in December 2023. Following resampling, SSIs were identified for boron and chloride at downgradient compliance well AP-58A and for sulfate and TDS at downgradient compliance well AP-59 using intrawell analyses. No other SSIs were identified. A summary of the Appendix III analytical results for the downgradient compliance wells and the calculated prediction limits to which they were compared is provided in **Table 1**.

1.1 CCR Rule Requirements

USEPA regulations regarding detection monitoring programs for CCR landfills and surface impoundments provide owners and operators with the option to make an ASD when an SSI is identified:

> *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. (Code of Federal Regulations [CFR] Title 40, Section 257.94(e)(2)).

Pursuant to 40 CFR 257.94(e)(2), Geosyntec has prepared this ASD report to document that the identified SSIs at AP-58A and AP-59 should not be attributed to a release from the PBAP.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess alternative sources to which the identified SSI could be attributed. Alternative sources were identified from among 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
- ASD Type V: Alternative Sources

A demonstration was conducted to show that the SSIs identified for boron and chloride at well AP-58A were based on a Type I cause (sampling issues) and not by a direct release from the PBAP. A demonstration was conducted to show that the SSI identified for sulfate and TDS at well AP-59 were based on Type IV causes (natural variation) and not by a direct release from the PBAP.

2. SUMMARY OF SITE CONDITIONS

Descriptions of the Flint Creek PBAP design and construction, regional geology and site hydrogeology, and groundwater monitoring systems and flow conditions are presented below.

2.1 PBAP Design and Construction

As described by Terracon (2023), the PBAP is a 42.8-acre CCR surface impoundment located south of the power plant which was formerly operated as a CCR ash pond. It was constructed from 1974 to 1978 with an approximately 820-foot long cross-valley dam consisting of compacted clayey soil. While it was operational as a CCR surface impoundment, it was used primarily to manage bottom ash. The PBAP ceased receipt of CCR on November 30, 2022, and commenced closure by removal of CCR materials in accordance with the certified closure plan (American Electric Power [AEP] 2022). CCR material removal from the PBAP was completed on August 20, 2023. A photograph showing the condition of the PBAP shortly before completion of CCR removal is provided in **Figure 1**.

2.2 Regional Geology / Site Hydrogeology

As described by Terracon (2017), the PBAP is positioned in an area of the Ozark Plateaus Province that has undergone regional-scale uplift followed by significant incision by rivers, resulting in hilly topography. It is underlain by the Mississippian-aged Boone Formation, which consists primarily of limestone and chert. Locally, the stratigraphy consists of a 30- to 50-foot-thick weathered residuum of the Boone Formation, consisting of heavily-weathered limestone with chert nodules and iron-rich clay, and the underlying massive cherty limestone of the Boone Formation.

The Boone Formation is underlain by the Mississippian-aged St. Joe Member, which is a light-grey crystalline limestone that has not experienced significant physical or chemical weathering and is distinct from the Boone Formation due to its lack of chert and clay.

The Boone residuum, the underlying Boone Formation cherty limestone, and the underlying St. Joe Member collectively comprise a single hydrostatic unit known as the Boone–St. Joe Aquifer. This aquifer is underlain by the Chattanooga Shale, a black, fissile shale that acts as a barrier to vertical flow from the aquifer unit above.

Geologic cross sections near the PBAP presented by Terracon (2023) are provided as **Attachment A**. These cross sections show the Boone residuum (described as a silty clay on the cross sections) and cherty limestone Boone Formation underlying the clayey berm of the PBAP.

Three distinct zones of groundwater flow have been identified within the Boone–St. Joe Aquifer at the site: Uppermost, Intermediate, and Deep (AEP 2023). Perched groundwater is occasionally present within upper unconsolidated soils but is not continuous throughout the site and does not constitute an aquifer unit. All monitoring wells in the PBAP monitoring well network monitor the uppermost aquifer, which is defined as the upper portion of the Boone Formation (Terracon 2023).

2.3 Groundwater Monitoring Systems and Flow Conditions

The monitoring well network (**Figure 2**) includes three upgradient background wells (AP-51, AP-53, and AP-54) and three downgradient compliance wells (AP-58A, AP-59, and AP-60).

Monitoring well AP-59 is screened entirely within competent limestone, as was monitoring well AP-58 (see cross sections in **Attachment A** and on the boring log and well construction diagrams provided in **Attachment B**). Monitoring well AP-58 was found to be irreparably damaged during a sampling event in September 2022 and was replaced in November 2022 by AP-58A. Following the discovery of damage to the AP-58 well casing, the well was plugged and monitoring well AP-58A was installed approximately 10 feet south of AP-58's location and screened at the same interval (AP-58 was screened from 58.45 to 68.45 feet below ground surface [bgs], and AP-58A is screened from 61.30 to 71.30 feet bgs) (**Attachment B**). One thin fracture/void was noted at 22 feet bgs within the screened interval of AP-59. No structural features were noted within the screened intervals of AP-58 or AP-58A.

Potentiometric maps showing groundwater flow contours for the Uppermost Aquifer during the September 2023 initial sampling and December 2023 resampling events are provided as **Attachment C**. The groundwater flow direction is generally to the west and northwest. Hydraulic connectivity within the Uppermost Aquifer was determined by Terracon (2023) to be related to multiple factors including lithology, rock type, layer thickness, and degree of bedrock fracture. Seasonal variability in the groundwater flow direction and hydraulic gradient has not been observed since the monitoring well network was installed.

3. ALTERNATIVE SOURCE DEMONSTRATION

The methods used to assess possible alternative sources of the SSIs for boron and chloride at AP-58A and the SSIs for sulfate and TDS at AP-59 and the proposed alternative sources for these SSIs are described below.

3.1 Proposed Alternative Source

3.1.1 Monitoring Well AP-58A

An initial review of groundwater sampling field forms identified an alternative source for the boron and chloride SSIs at AP-58A due to Type I (sampling) issues. As discussed in Section 2.3, well AP-58A was installed in November 2022 after it was discovered in September 2022 that well AP-58 was irreparably damaged. Boring logs and well construction diagrams for both AP-58 and AP-58A are provided in **Attachment B**. Well AP-58A is located approximately 10 feet south of previous well AP-58 and screened at approximately the same elevation. Thus, groundwater collected from AP-58A should reflect conditions previously observed at former well AP-58.

A Piper diagram, which represents the relative concentrations of major cations and anions in the groundwater, was created to visualize groundwater geochemistry at both AP-58 and AP-58A (**Figure 3**). The diagram indicates that groundwater samples from AP-58 did not begin to show consistency within major ion chemistry until around August 2019 (as indicated by the solid red symbols on the Piper diagram), at which point the monitoring well had equilibrated with the aquifer approximately 3.5 years after it was installed in February 2016. The groundwater composition for the first three samples collected from AP-58A (December 2022 through September 2023) appears similar to AP-58 during the first sampling event completed after its installation in February 2016 (October 2016). The relative concentration of anions in the December 2023 sample collected from AP-58A (one year after well installation) are nearly identical to samples collected from AP-58 one year after installation of the well but before the groundwater had equilibrated (March 2017 through June 2019, **Figure 3**). These results suggest that both AP-58 and AP-58A require(d) time after installation to equilibrate with the aquifer before the collected samples are representative of stable geochemical conditions. These findings suggest that geochemical trends at AP-58A consistent with those observed at AP-58 are expected to continue to occur over the next one to two years. Similar trends after installation have been observed for boron and chloride at AP-58 and AP-58A to date (**Figure 4**).

A comparison of concentrations of relevant parameters from various PBAP samples to both groundwater concentrations at AP-58A and the established intrawell UPLs supports the position that the SSIs observed at AP-58A should not be attributed to the PBAP. Two surface water samples with sample IDs of ‘BAP’ and ‘BAP – Near Stop Log’ were collected from the PBAP in March 2020. The PBAP was dewatered and removal of CCR from the PBAP was completed prior to the September and December 2023 sampling events associated with the second semiannual detection monitoring event of 2023. Therefore, the 2020 surface water samples are a fair basis of comparison for 2023 monitoring event groundwater conditions. The laboratory analytical report for the March 2020 surface water sampling event is provided as **Attachment D**. Reported values of boron and chloride from the PBAP samples are shown compared to the AP-58A UPL and recent samples from AP-58A (**Table 2**). Boron and chloride concentrations were greater in AP-58A groundwater samples than in both samples collected from the PBAP. This provides further support that the

PBAP is not a source of the apparent elevated concentrations of boron and chloride in AP-58A groundwater.

3.1.2 Monitoring Well AP-59

An initial review of groundwater sampling field forms, site geochemistry, site historical data, and laboratory and statistical analyses did not identify alternative sources for sulfate and TDS at AP-59 due to Type I (sampling causes), Type II (laboratory causes), or Type III (statistical evaluation causes) issues. Further, an initial review of site geochemistry did not identify evidence of any Type V (alternative) impacts. As described below, the SSIs observed at monitoring well AP-59 have been attributed to natural variation within the underlying geology, which is a Type IV cause. The specific source of naturally occurring sulfate at AP-59 is oxidative dissolution of pyrite within the aquifer material at the site, as described in previous ASDs prepared for sulfate at AP-59 (Geosyntec 2023a, Geosyntec 2023b, Geosyntec 2024).

Sulfate concentrations at background wells AP-53 and AP-54, which are located upgradient of the PBAP and AP-59, have historically been similar to or greater than those observed at AP-59 (**Figure 5**). Sulfate concentrations from the most recent sampling event completed in September 2023 at AP-53 (58.9 milligrams per liter [mg/L]) and AP-54 (53.6 mg/L) are both comparable to concentrations reported for AP-59 (55.1 mg/L). Both upgradient wells and AP-59 have demonstrated considerable variability in sulfate concentrations since monitoring began in 2016 (**Figure 5**), suggest that aqueous sulfate concentrations fluctuate over time across the site and these fluctuations should not be attributed to the PBAP.

Regional groundwater quality of the Boone–St. Joe Limestone Aquifer in Benton County, Arkansas (the county in which the PBAP is located) has previously been studied (Ogden 1979). A total of 253 groundwater samples from wells in Benton County screened within the Boone–St. Joe Aquifer were sampled and analyzed as part of the study. These samples revealed variability in sulfate concentrations, with many wells containing greater sulfate concentrations than those observed within the PBAP monitoring network.

Ogden (1979) identified a positive correlation between sulfate and calcium concentrations in groundwater. This relationship was also observed in AP-59 groundwater data since monitoring began in 2016 (**Figure 6**). Ogden hypothesized that this relationship is likely a product of iron-sulfide mineral oxidation. Oxidation of pyrite within the Boone–St. Joe Aquifer would yield sulfuric acid as a reaction product, the dissociation of which would result in an increase in aqueous sulfate and hydrogen ions (decrease in groundwater pH) which would in turn cause dissolution of the calcite that makes up the limestone aquifer. Oxidation-reduction (redox) conditions of AP-59 groundwater favor the thermodynamic stability of iron oxyhydroxides (**Figure 7**), indicating that iron sulfide minerals, if present in aquifer solids, would be expected to undergo this oxidation reaction. AP-59 groundwater Eh values (a measurement of redox conditions) from recent monitoring events have been greater than average (more oxygenated), which would thermodynamically favor greater amounts of dissolution of existing pyrite in aquifer materials. The dissolution of this pyrite would contribute aqueous sulfate ions to groundwater via the mechanism described above.

Limestone lithologies present at compliance monitoring wells were evaluated to develop the geologic conceptual site model for previous ASD reports and geochemical investigations (Geosyntec 2020b; included in AEP 2021). Limestone at downgradient well locations was determined to be unpassivated and capable of buffering incoming acidic waters via dissolution of calcite (Geosyntec 2018, Geosyntec 2019, Geosyntec 2021a, Geosyntec 2021b, Geosyntec 2022b). This illustrated conceptual site model is shown on **Figure 8**. If iron sulfide oxidation reactions were occurring in the limestone near AP-59, increases in aqueous sulfate and calcium would be expected. Increases in calcium are occasionally observed at AP-59, as documented in previous ASD reports for this well (Geosyntec 2021b).

A comparison of sulfate concentrations measured in surface water samples collected in March 2020 from locations within the PBAP also supports the position that the recent elevated concentrations of sulfate at AP-59 should not be attributed to the PBAP (**Attachment D**). Reported sulfate concentrations were 39.5 mg/L (sample ID – BAP) and 16.2 mg/L (sample ID – BAP Near Stop Log) for the samples collected from the PBAP prior to CCR removal (**Table 3**). Both of these samples contain sulfate concentrations lower than the UPL for sulfate at AP-59 (50.1 mg/L) and the two samples from the recent detection monitoring event for the PBAP that triggered the SSI (68.3 mg/L and 55.1 mg/L) (**Table 3**). Lower concentrations of sulfate in the PBAP water than in groundwater at downgradient compliance well AP-59 indicate that the PBAP is not anticipated to act as a source for the recent elevated sulfate concentrations in groundwater.

In addition to sulfate, an SSI for TDS was identified at monitoring well AP-59. TDS concentrations at well AP-59 are displayed on **Figure 9**. TDS is the summation of all ions in a water sample, with major ions comprising the majority of TDS in most natural waters (Boyd, 2019). Sulfate comprises an average of 21% of the TDS mass at AP-59; for the December 2023 sample, 55.1 mg/L of sulfate contributed 20% of the total mass of 270 mg/L of TDS which was reported. The December 2023 sample contained 4 mg/L TDS greater than the intrawell UPL of 266 mg/L (**Table 1**), which can be accounted for by variations in the sulfate component. As shown on **Figure 9**, recent increases in sulfate concentrations coincide with recent increases in TDS levels within the well. TDS concentrations at AP-59 appear to be at least partially driven by sulfate concentrations, which are likely associated with the aquifer solids as discussed above. Therefore, the SSI identified for TDS is likely also associated with the increase in aqueous sulfate concentrations from the aquifer solids and not due to a release from the PBAP.

3.2 Sampling Requirements

The ASD described above supports the position that the identified SSIs for boron and chloride at downgradient well AP-58A are due to sampling issues, that the identified SSIs for sulfate and TDS at downgradient well AP-59 are a product of natural variation within the uppermost aquifer, and that none of the identified SSIs are due to a release from the Flint Creek PBAP. Therefore, the unit will remain in the detection monitoring program. Groundwater at the unit will continue to be sampled for Appendix III parameters.

4. 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 SSIs for boron and chloride at AP-58A and for sulfate and TDS at AP-59 during the second semiannual detection monitoring event of 2023 should be attributed to natural variation or sampling issues and not 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 E**.

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TABLES

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

Analyte	Unit	Description	AP-58A		AP-59		AP-60
			9/19/2023	12/27/2023	9/19/2023	12/27/2023	9/18/2023
Boron	mg/L	Intrawell Background Value (UPL)	0.276		0.368		1.68
		Analytical Result	**1.03**	**0.65**	0.301	--	0.697
Calcium	mg/L	Intrawell Background Value (UPL)	86.8		53.9		49.9
		Analytical Result	22.6	--	51.6	--	40.6
Chloride	mg/L	Intrawell Background Value (UPL)	10.2		18.0		17.4
		Analytical Result	**26.7**	**20.3**	14.6	--	11.0
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00		0.765		0.681
		Analytical Result	0.54	--	0.42	--	0.17
pH	SU	Intrawell Background Value (UPL)	8.7		7.6		10.8
		Intrawell Background Value (LPL)	6.2		6.7		6.5
		Analytical Result	7.6	--	7.1	--	7.9
Sulfate	mg/L	Intrawell Background Value (UPL)	90.3		50.1		190
		Analytical Result	**146**	83	**68.3**	**55.1**	63.7
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	333		266		397
		Analytical Result	**370**	300	**290**	**270**	260

Notes:

1. Bold values exceed the background value.

2. Background values are shaded gray.

3. AP-58A analytical results are compared to intrawell prediction limits calculated using AP-58 background data, as insufficient data is available from AP-58A to calculate prediction limits at this time.

--: not measured

LPL: lower prediction limit

mg/L: milligrams per liter

SU: standard units

UPL: upper prediction limit

Table 2. AP-58A Relevant Parameter Comparison
Flint Creek - Primary Bottom Ash Pond

Source	**Sample Date**	**Parameter**	
		Boron	**Chloride**
AP-58A UPL	N/A	0.276	10.2
BAP	2/25/2020	0.246	11.0
BAP Near Stop Log	2/25/2020	0.0688	7.92
AP-58A	9/19/2023	1.03	26.7
AP-58A	12/27/2023	0.65	20.3

Notes:

1. All parameters are shown in units of milligrams per liter.
2. Results greater than the AP-58A UPL are highlighted in red and results lower than the AP-58A UPL are highlighted in green.
3. AP-58A analytical results are compared to intrawell prediction limits calculated using AP-58 background data, as insufficient data is available from AP-58A to calculate prediction limits at this time.

BAP: Bottom Ash Pond

UPL: upper prediction limit

Table 3. AP-59 Relevant Parameter Comparison
Flint Creek - Primary Bottom Ash Pond

Source	Sample Date	Parameter	
		Sulfate	TDS
AP-59 UPL	N/A	50.1	266
BAP	2/25/2020	39.5	217
BAP Near Stop Log	2/25/2020	16.2	155
AP-59	9/19/2023	68.3	290
AP-59	12/27/2023	55.1	270

Notes:

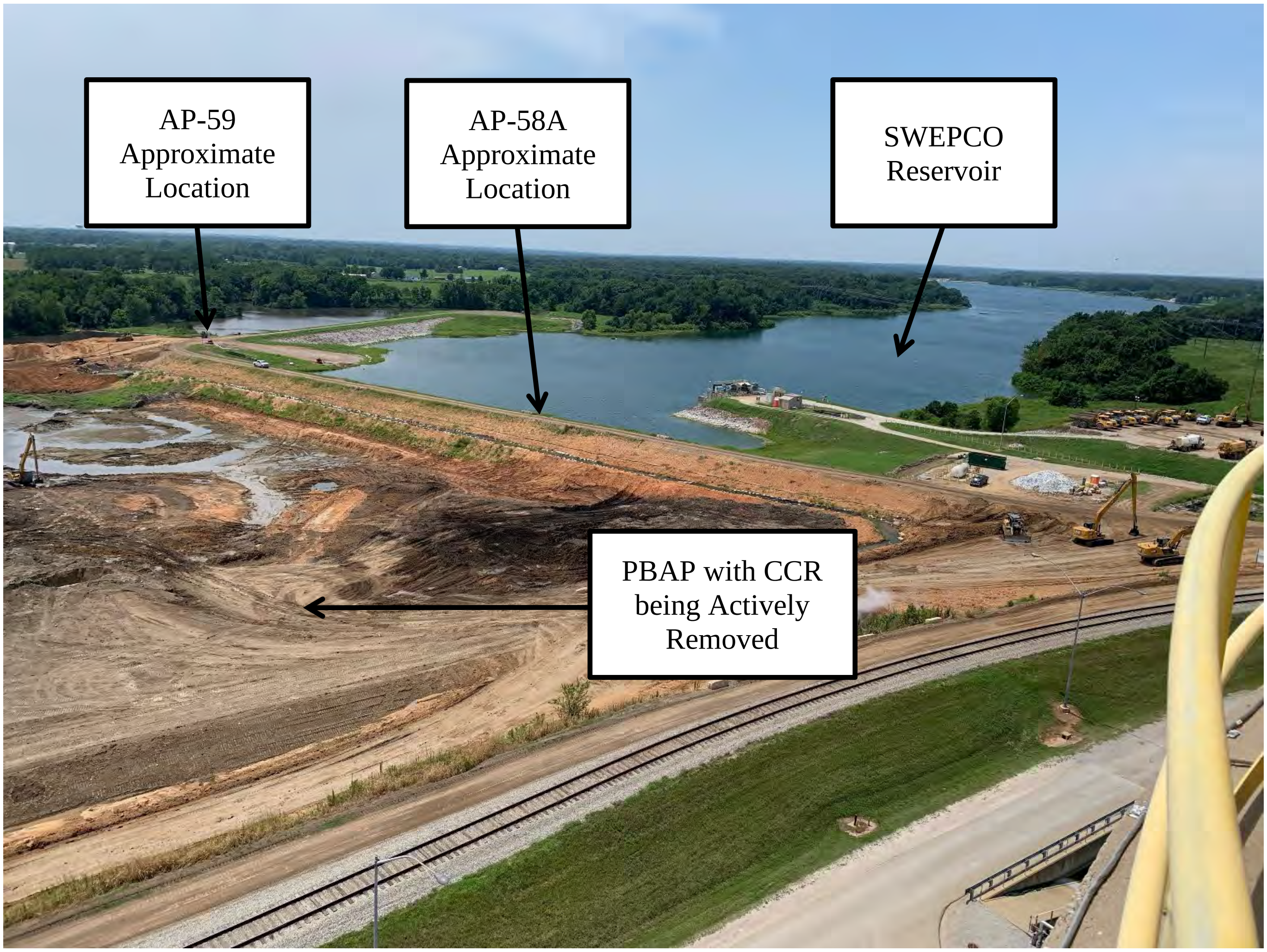
1. All results are shown in milligrams per liter (mg/L).
2. Results greater than the AP-59 UPL are highlighted in red and results lower than the AP-59 UPL are highlighted in green.

BAP: Bottom Ash Pond

TDS: total dissolved solids

UPL: upper prediction limit

FIGURES



Notes:

1. Photograph taken looking southwest on July 25, 2023 prior to the completion of CCR removal.
2. AP-58A is located on the center dike shown in the photograph.

PBAP Site Photograph

Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

AMERICAN ELECTRIC POWER

Columbus, Ohio

June 2024

Figure 1

Legend

⌖ Monitoring Wells

Notes
1. Monitoring well coordinates were collected December 12, 2022; data provided by AEP.
2. AP-58 had irreparable damage and was replaced by well AP-58A.
3. Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon 2017) provided by AEP.
4. Aerial basemap provided by ESRI (April 2023).

Site Layout

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

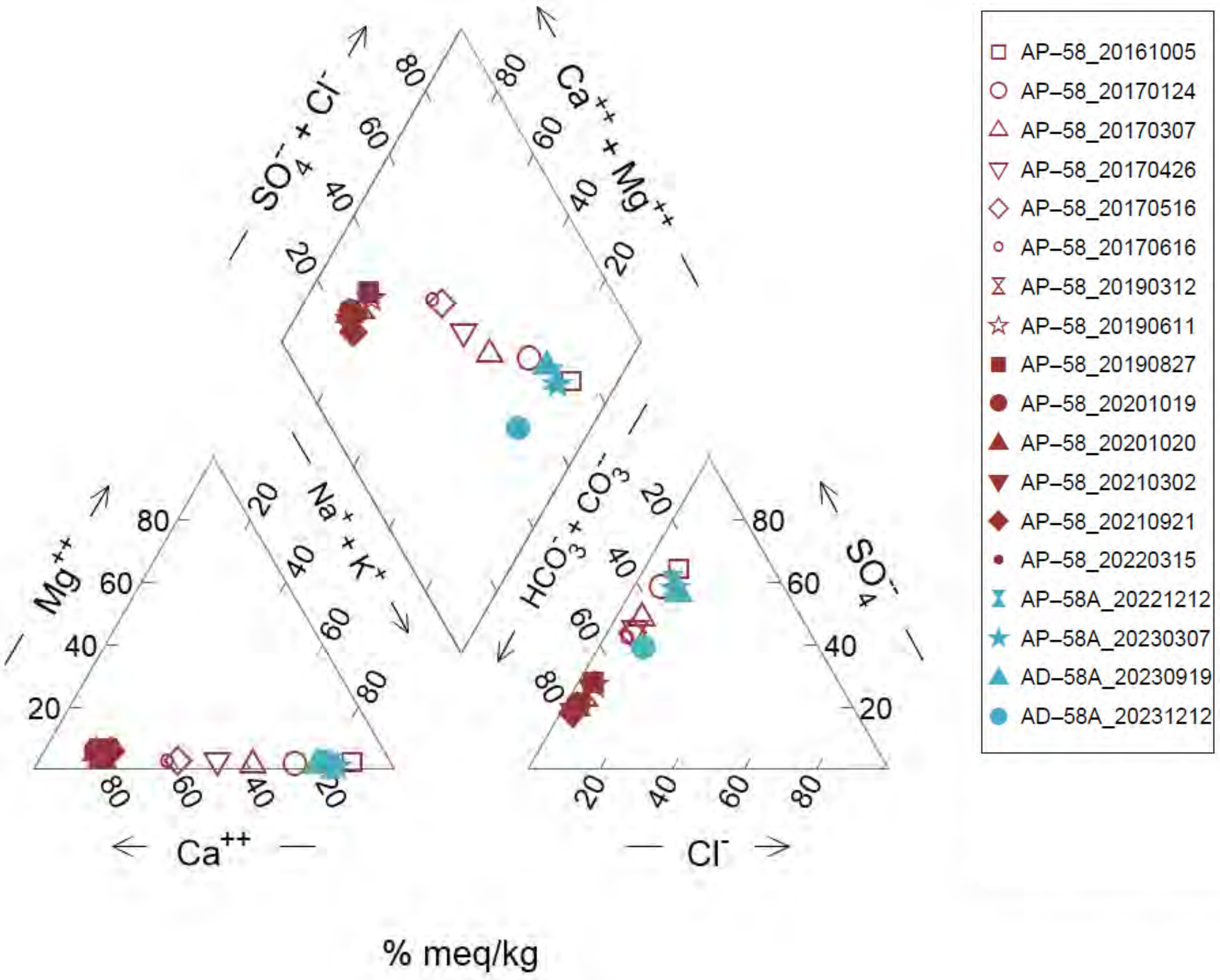
Geosyntec consultants

Columbus, Ohio

June 2024

Figure 2

\\annarbor-01\Data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2022\Flint Creek PBAP Site Layout_ASD.mxd. ASoltero. 3/28/2024. CHA8423/01/08.



Notes:
1. Samples from AP-58 and AP-58A that were analyzed for all major ions are shown on the Piper diagram in units of percentage of milliequivalents per kilogram (% meq/kg) for major cations (bottom left triangle) and major anions (bottom right triangle).

Piper Diagram

Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

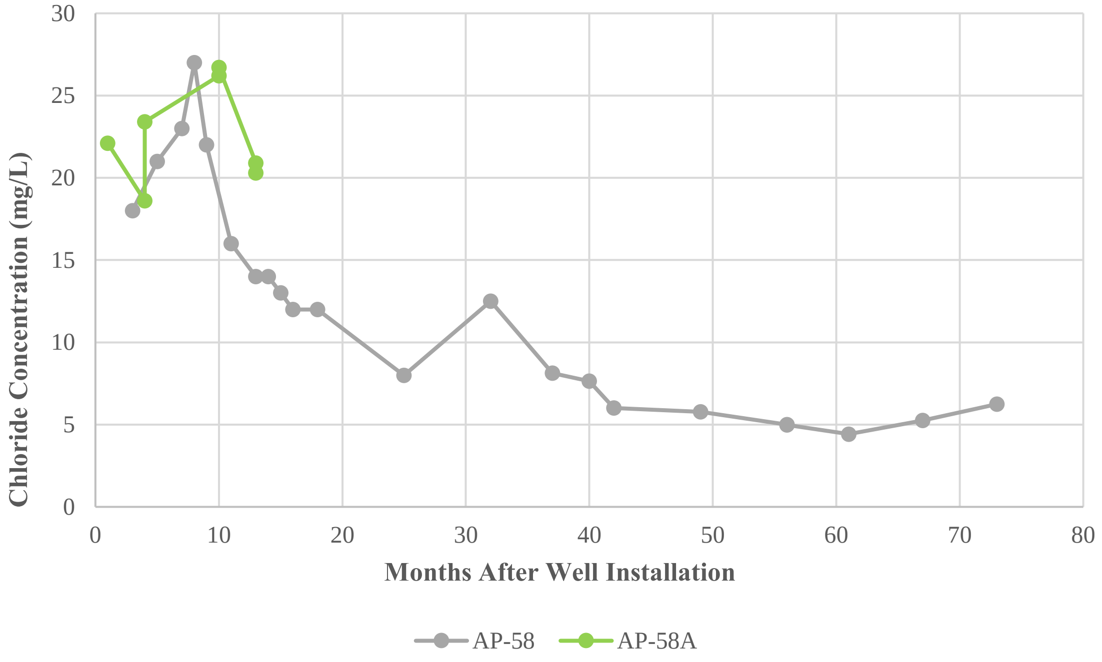
AMERICAN ELECTRIC POWER

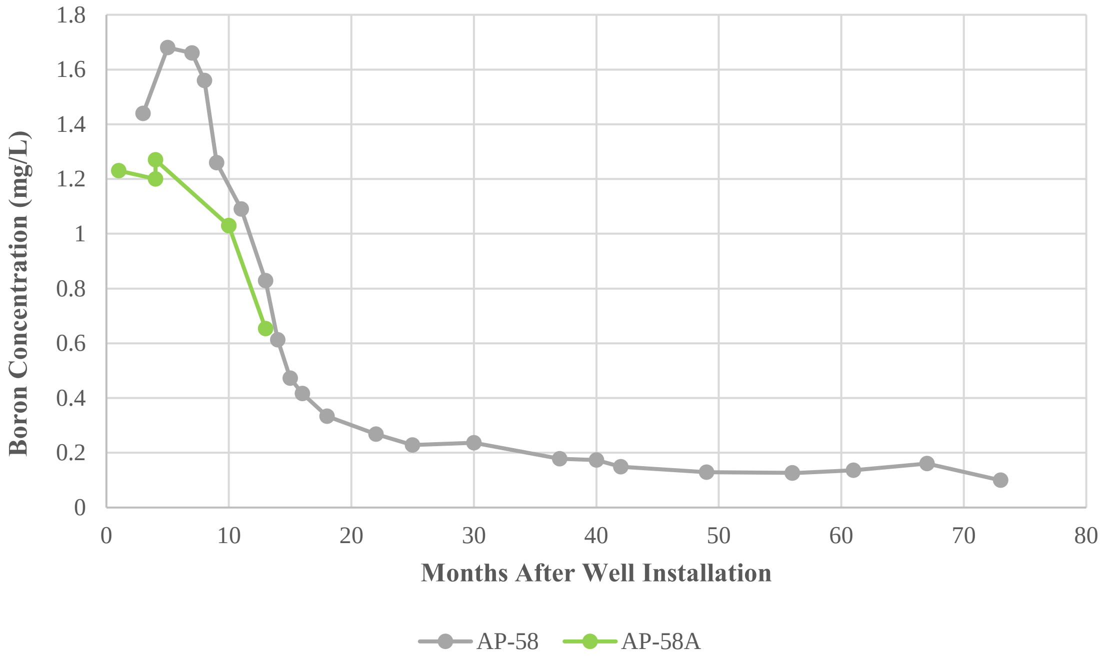
Figure

3

Columbus, Ohio

June 2024





Notes:

1. Boron and chloride concentrations are shown in milligrams per liter (mg/L).
2. Monitoring well AP-58 was installed in February 2016 and ceased use in September 2022 after it sustained irreparable damage.
3. AP-58A was installed in November 2022 to replace AP-58.

AP-58 and AP-58A Boron and Chloride Comparison

Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

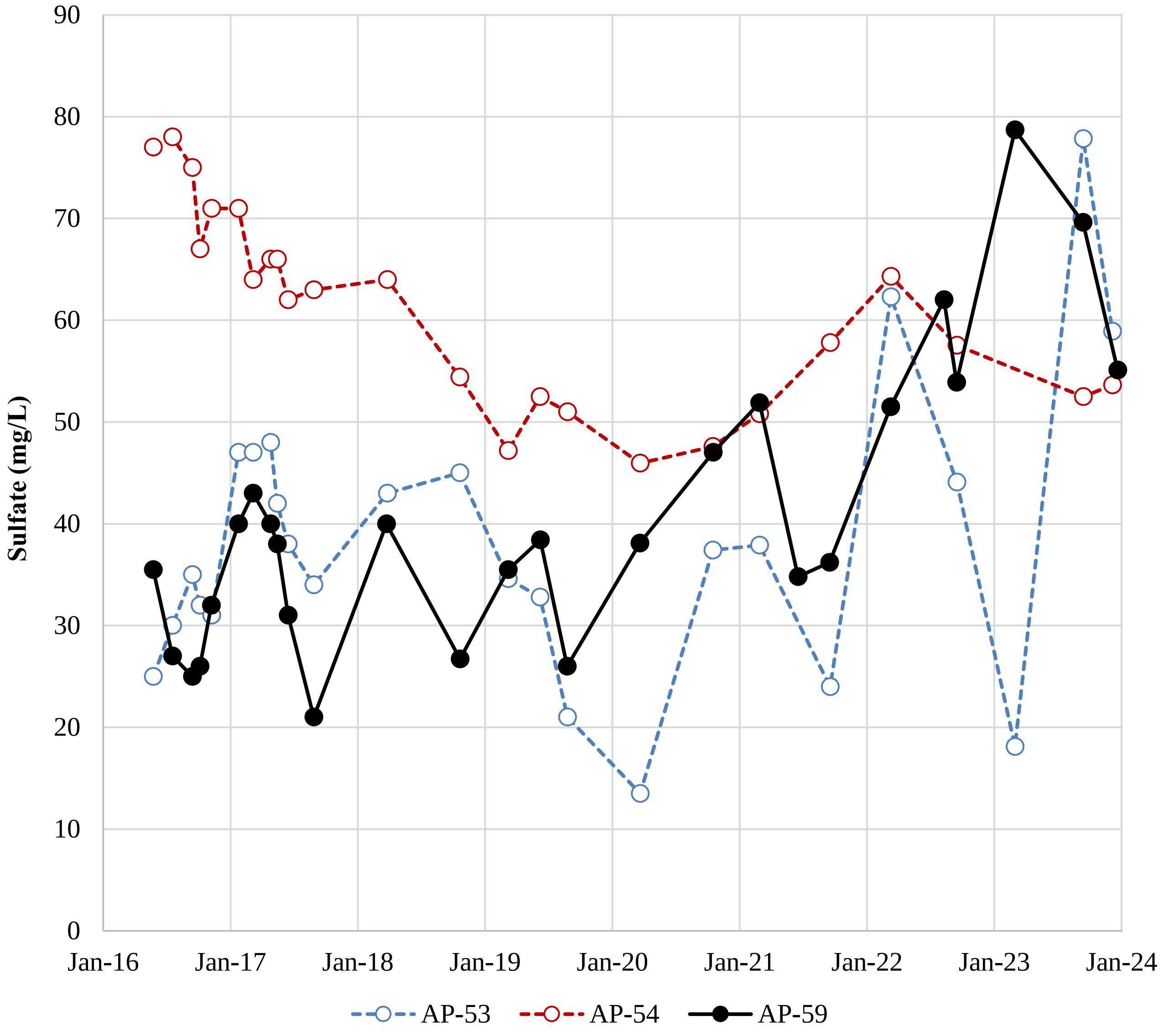
AMERICAN ELECTRIC POWER

Figure

4

Columbus, Ohio

June 2024



Notes:

1. Total sulfate concentrations are shown for compliance well AP-59 and upgradient background wells AP-53 and AP-54.

mg/L: milligrams per liter

Sulfate Comparison to Background Monitoring Wells

Flint Creek Primary Bottom Ash Pond

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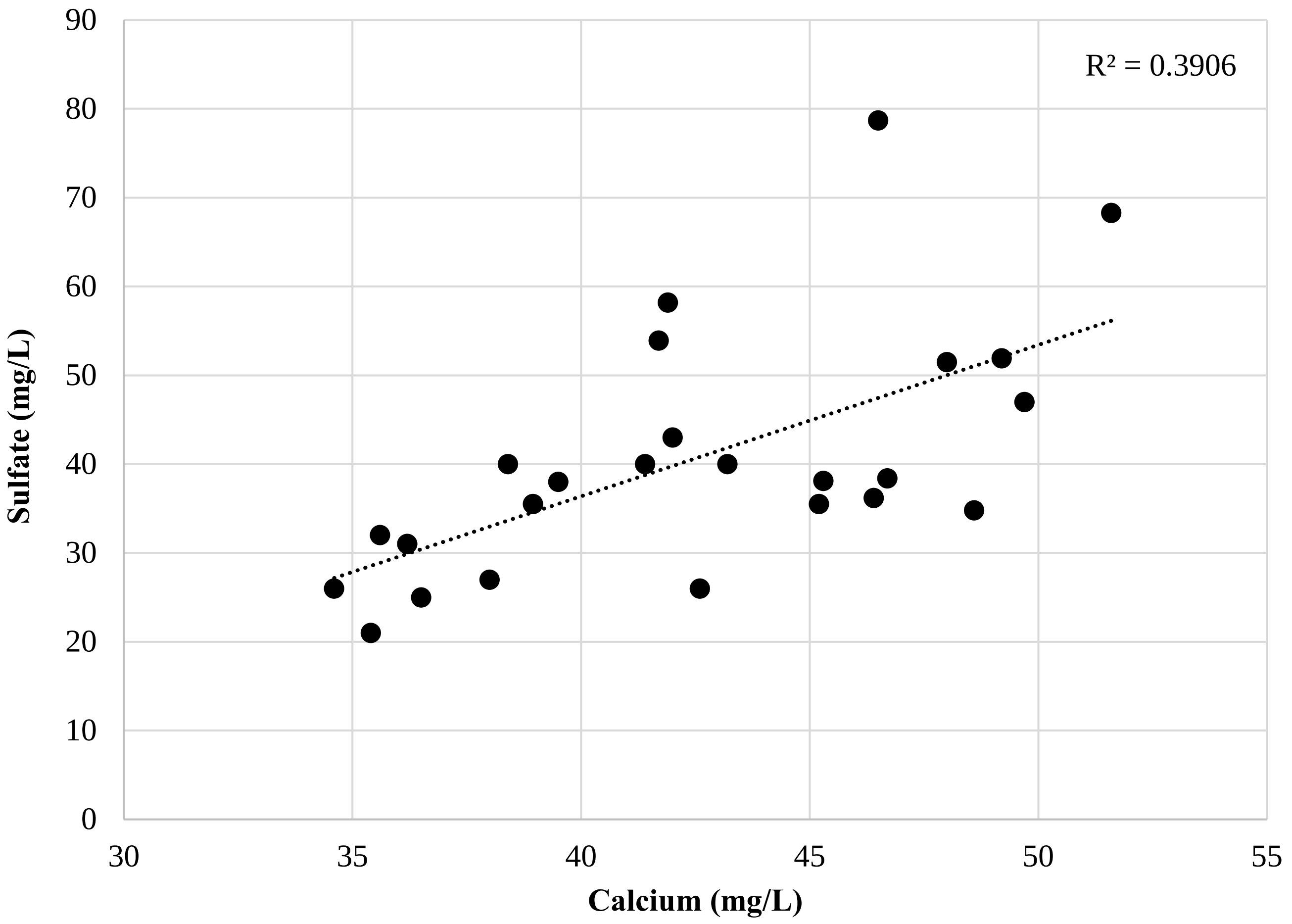
Figure

5

Columbus, Ohio

June 2024



Notes:
1. Total calcium and sulfate concentrations from individual sampling events are displayed.

mg/L: milligrams per liter

AP-59 Calcium vs. Sulfate Scatter Plot

Flint Creek Primary Bottom Ash Pond

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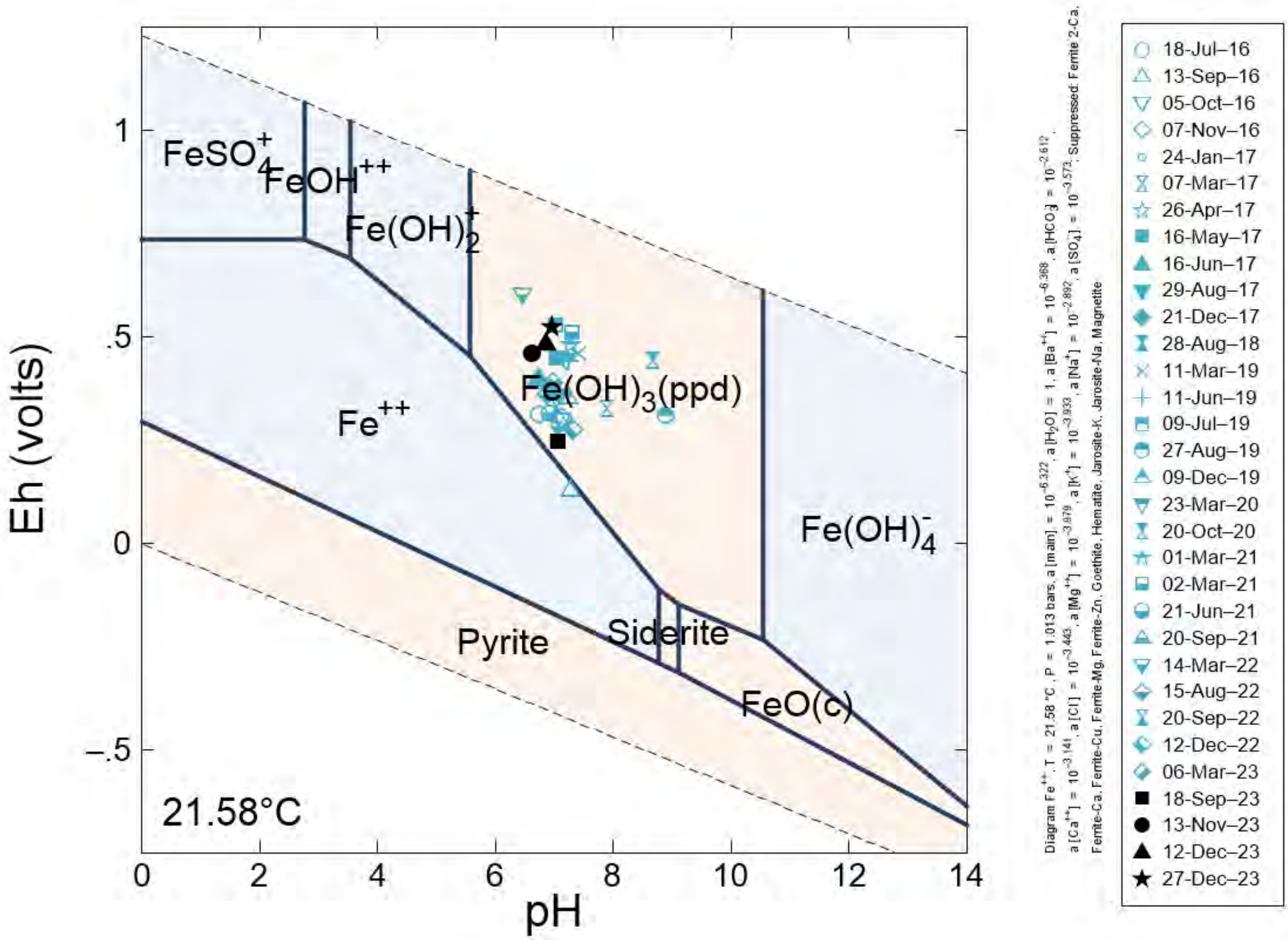
AMERICAN ELECTRIC POWER

Columbus, Ohio

June 2024

Figure 6



Notes:
1.Average groundwater temperature and concentrations of major cations and anions at AP-59 since monitoring began in 2016 were used to establish baseline conditions for the diagram.
2. Eh and pH values for sampling dates at AP-59 are shown on the diagram.
3. Crystalline iron oxyhydroxide phases hematite, goethite, magnetite, and ferrite are less likely to form and are suppressed in the diagram to show the stability field of amorphous iron oxyhydroxide Fe(OH)3(ppd).

AP-59 Iron Eh-pH Diagram
Flint Creek Primary Bottom Ash Pond

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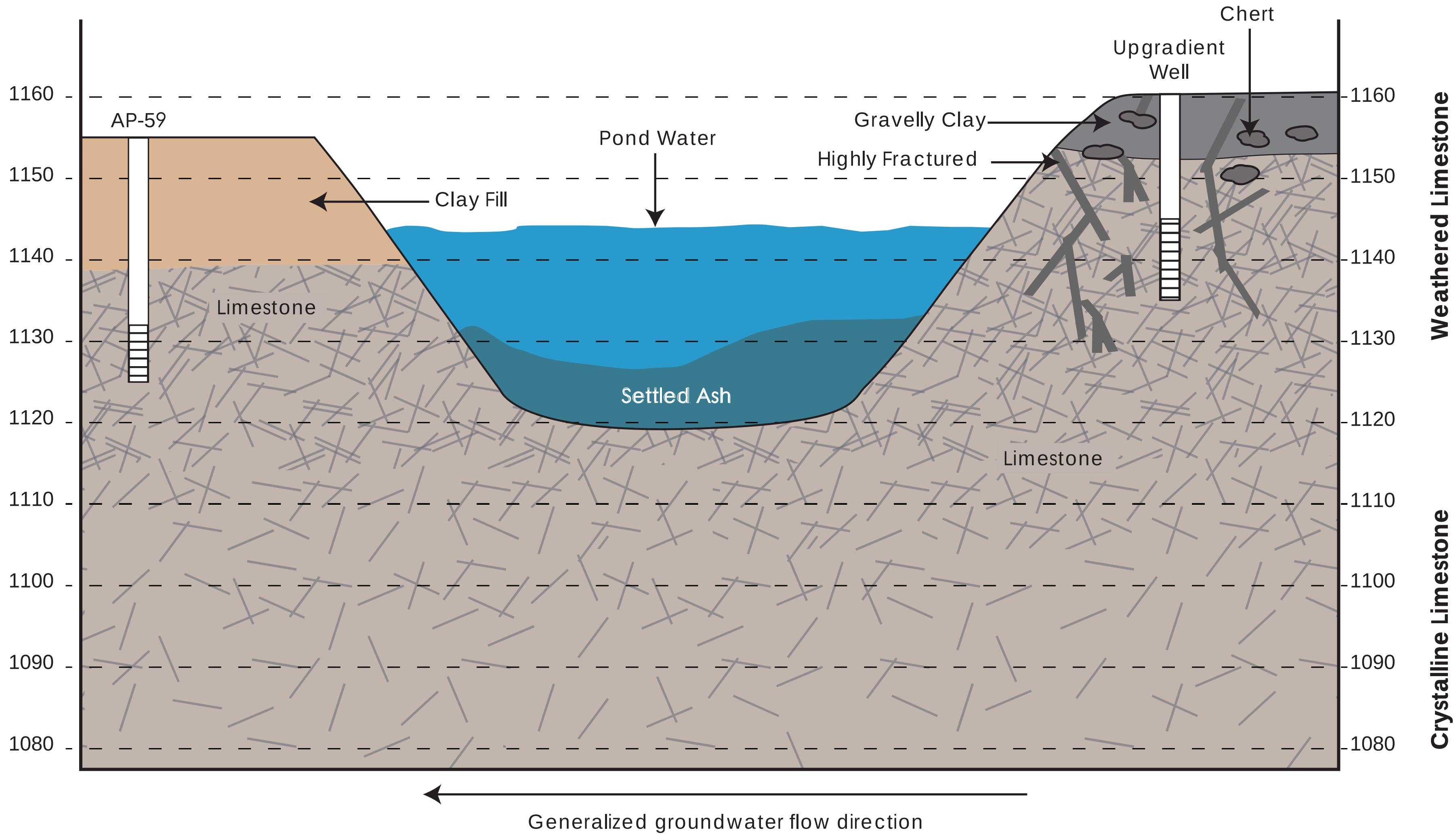
AMERICAN ELECTRIC POWER

Figure

7

Columbus, Ohio

June 2024



Not to Scale

Site Geology Illustration
Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

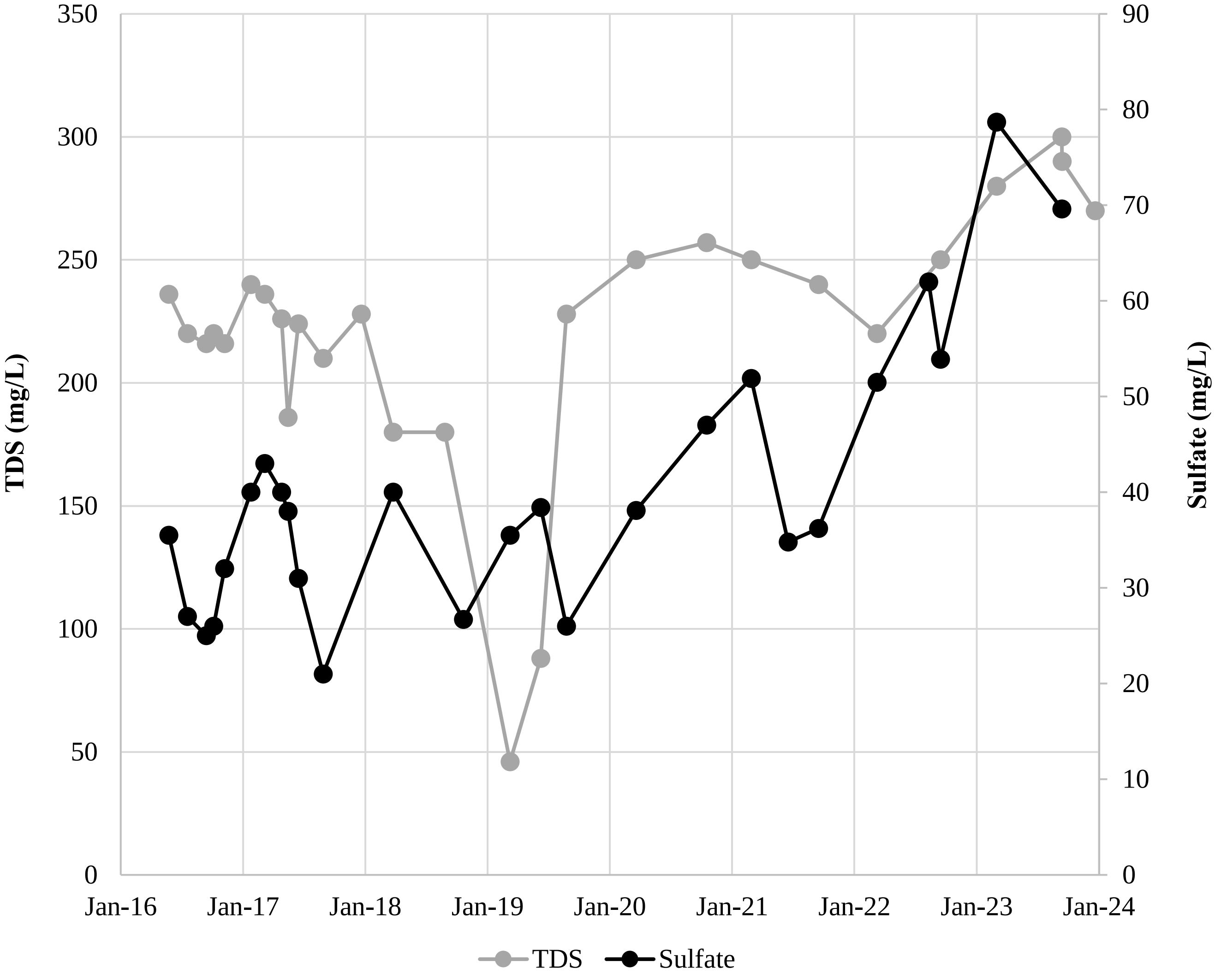
AMERICAN ELECTRIC POWER

Columbus, Ohio

June 2024

Figure
8

FlintCreekIllustration_July2021_CHA8495.ai



Notes:

1. Total dissolved solids (TDS) and total sulfate concentrations are shown for compliance well AP-59

mg/L: milligrams per liter

AP-59 TDS and Sulfate Time Series

Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

AMERICAN ELECTRIC POWER

Figure

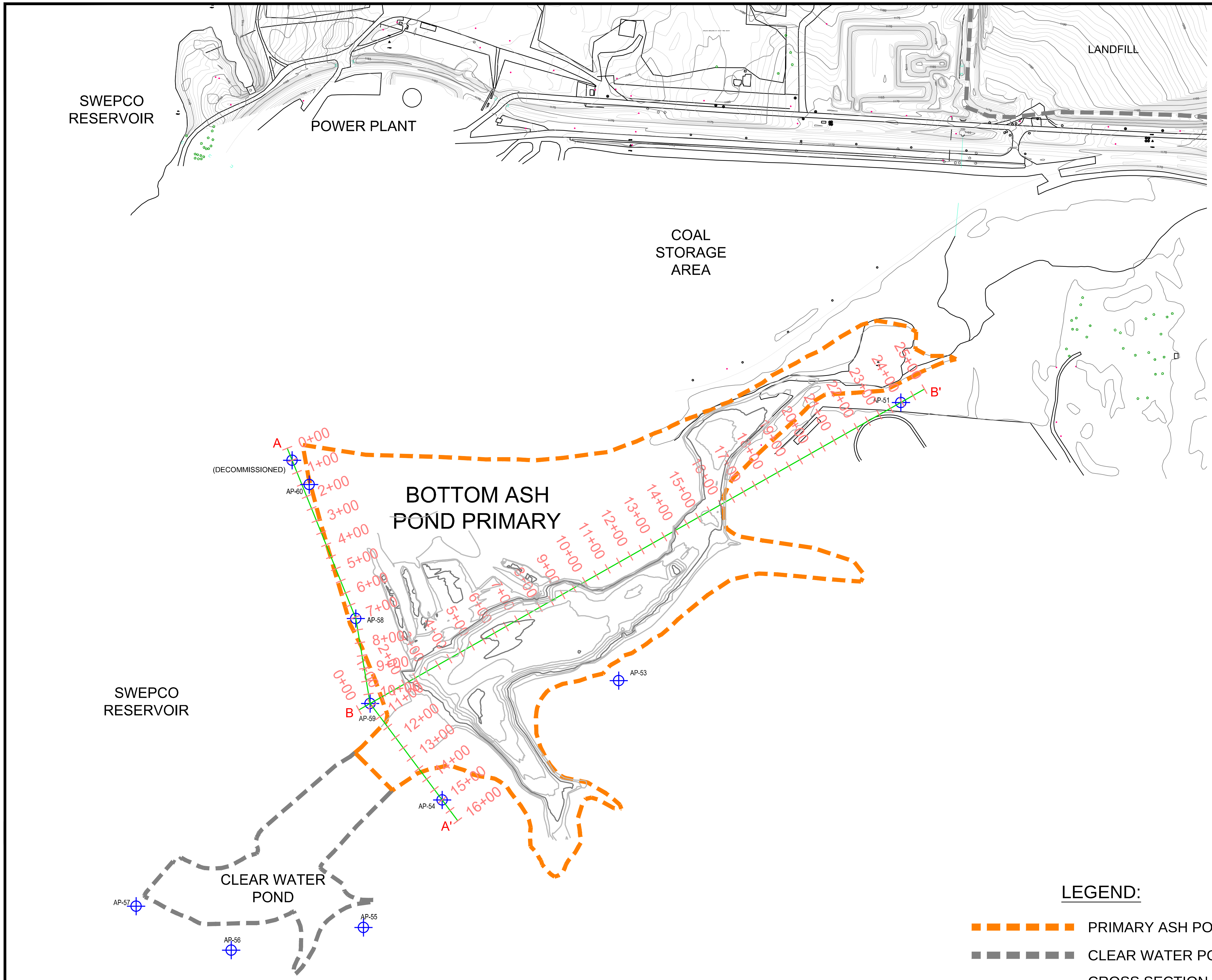
9

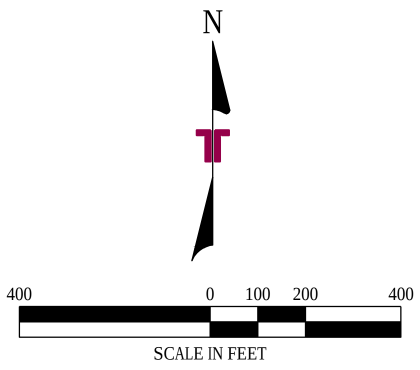
Columbus, Ohio

June 2024

ATTACHMENT A

Geologic Cross Sections





NOTE:
CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WERE TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
SURVEY PROVIDED BY AEP, AND IS A COMPOSITE OF AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED APRIL 30, 2015 AND A HYDROGRAPHIC SURVEY PERFORMED BY AEP, DATED AUGUST 12, 2004.

UPPERMOST AQUIFER:
DATA FROM SAMPLING EVENTS PERFORMED BY TERRACON CONSULTANTS, INC., DATING FROM JUNE 8, 2011 THROUGH MARCH 15, 2016.

WELL AP-52 WAS DECOMMISSIONED IN DECEMBER OF 2016 AND REPLACED WITH AP-60.

LEGEND:

▬ ▬ ▬	PRIMARY ASH POND BOUNDARY (THIS REPORT)
▬ ▬ ▬	CLEAR WATER POND/LANDFILL BOUNDARY (NEARBY OTHERS)
───	CROSS SECTION LOCATION
⊕	MONITORING WELL

SHEET 1

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	001
SHEET NO.:	1 OF 2

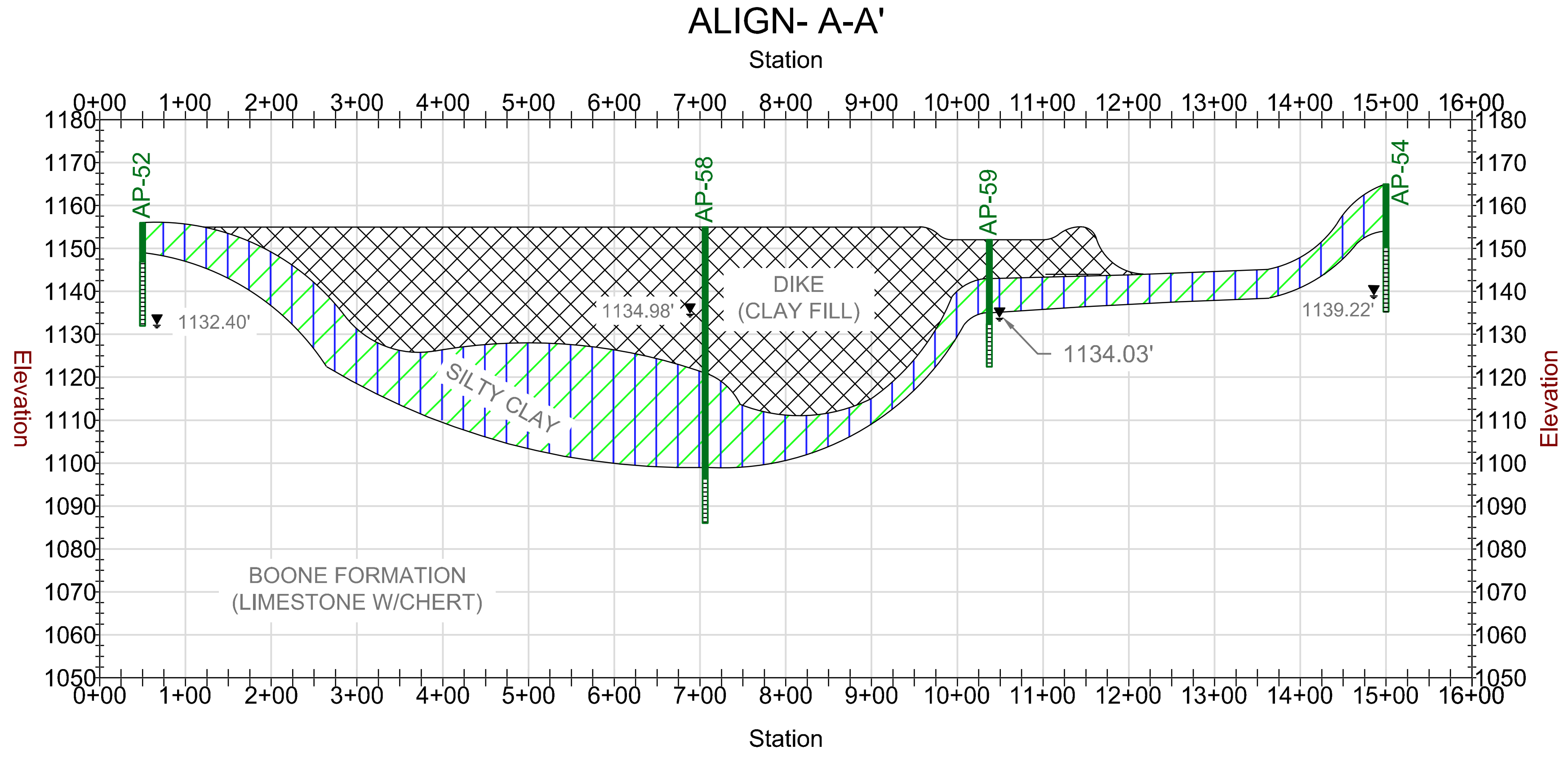
CROSS SECTION LOCATION MAP

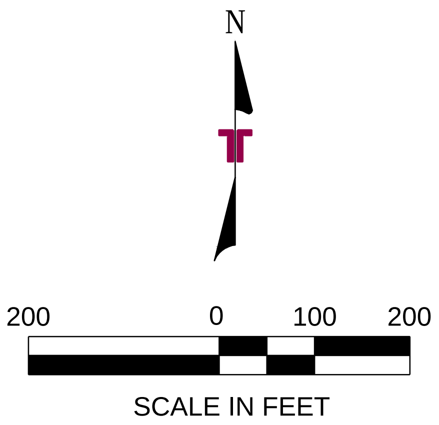
GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTPONDOM ASH
GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH
BRYANT, AR 72022
PH. (501) 847-9292
FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

ALIGN- A-A'

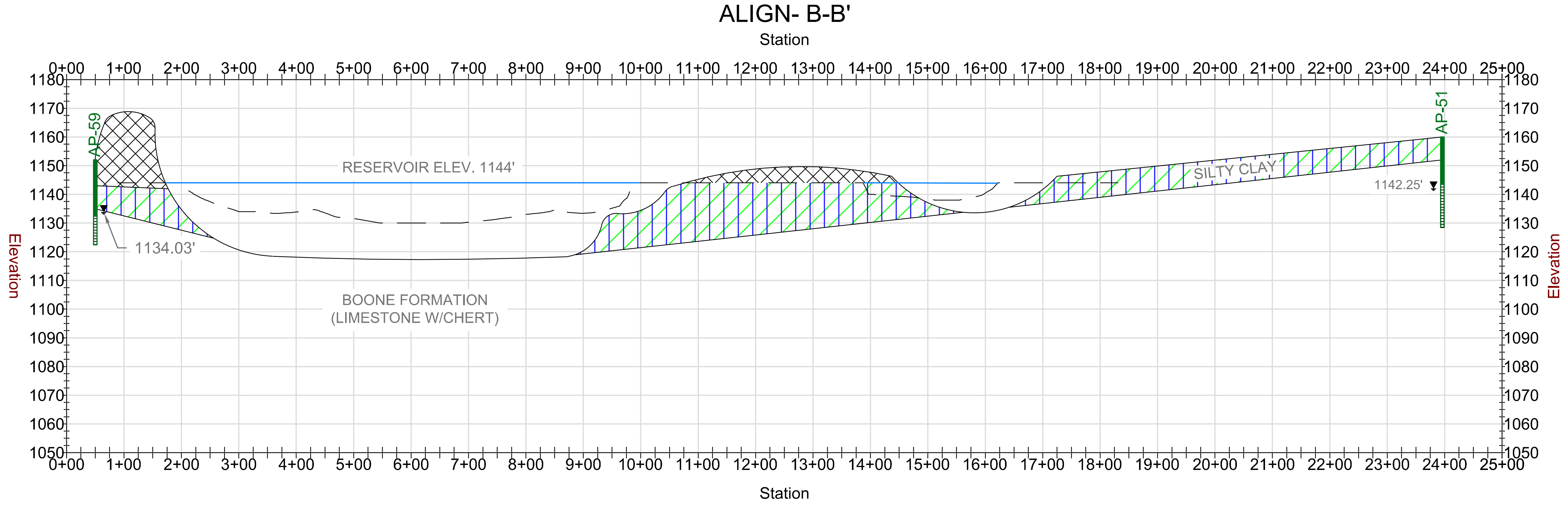




LEGEND:

▨	DIKE (CLAY FILL)
▨	SILTY CLAY

ALIGN- B-B'



REV.	DATE	BY	DESCRIPTION

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Consulting Engineers and Scientists
25809 I-30 SOUTH
BRYANT, AR 72022
PH. (501) 847-9292
FAX. (501) 847-9210

CROSS SECTION A-A' & B-B'

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTPONDOM ASH
GENTRY
ARKANSAS

SHEET 2

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	001
SHEET NO.:	2 OF 2

ATTACHMENT B

AP-58, AP-58A, and AP-59 Boring Logs and Well Construction Diagrams

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Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: AP-58 PAGE: 1 of 2

TOTAL DEPTH: 69 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: FLINT CREEK - CCR WELL INSTALLATION

JOB NO.: 216-001-35157182-002

DRILLING CO.: ANDERSON ENGINEERING

LOGGED BY: ADAM HOOPER

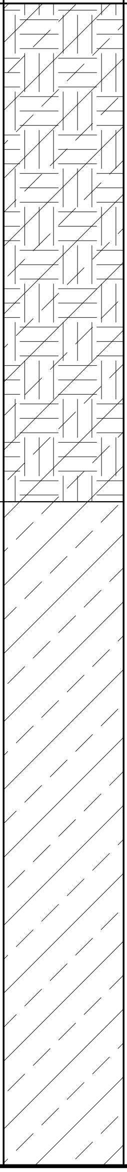
DRILLER: GARY MOYERS

DATE DRILLED: 2/16/2016

RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY

SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

Depth BGS	N: N/A E: N/A G.S. ELEV. N/A DESCRIPTION	Litho. Symbol	Remarks
			Flush - mounted boring
0	0'-15' SILTY CLAY - FILL brown and red, poor sample return		
5			
10			
15	15'-56' SILTY CLAY red, moist zones at 30' - 40' and 45' - 50'		
20			
25			
30			

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FIELD BORING LOG

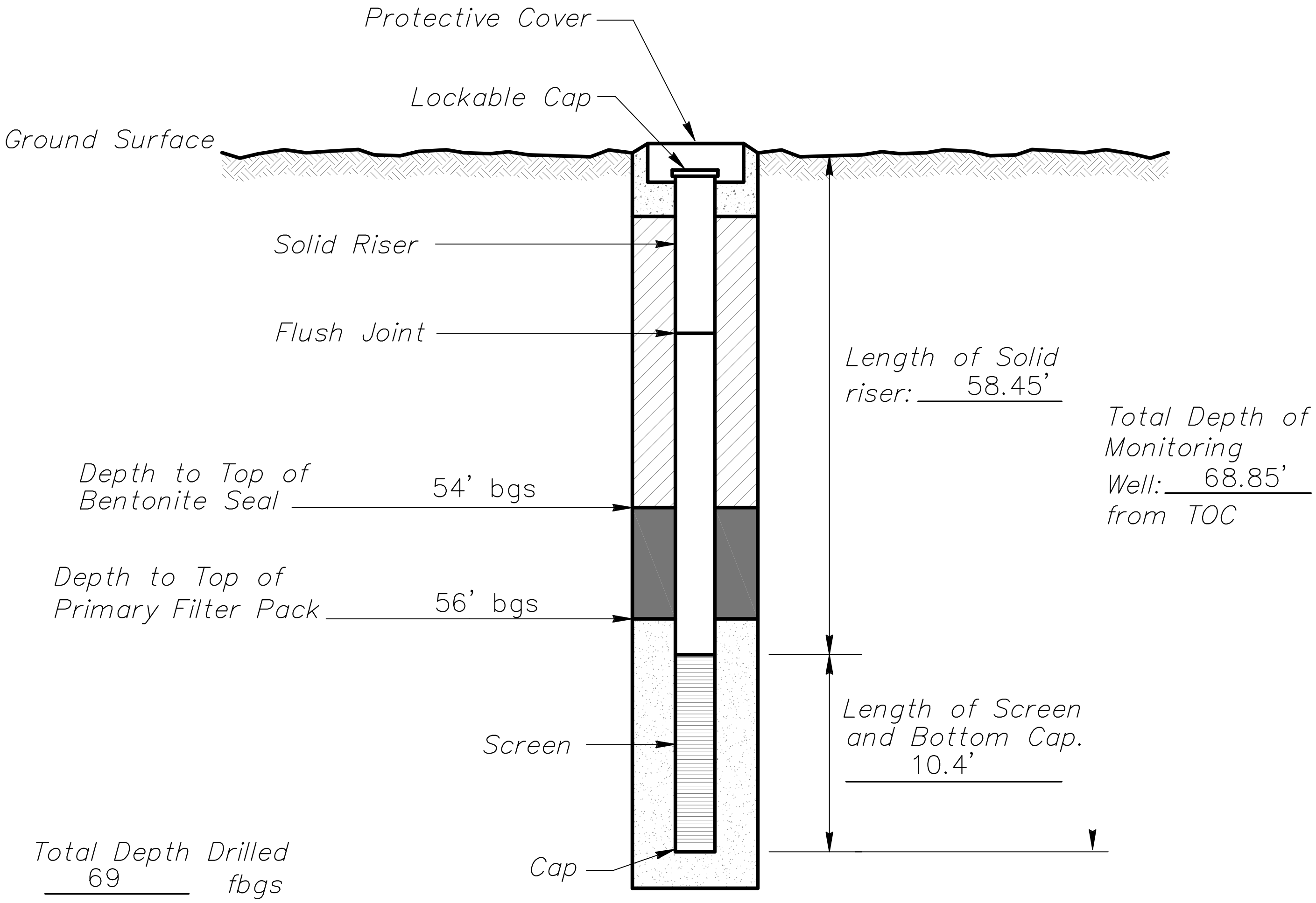
BORING NO.: AP-58
PAGE: 2 of 2

TOTAL DEPTH: 69 FEET BELOW GROUND SURFACE (BGS)

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
	15'-56' SILTY CLAY red, moist zones at 30' - 40' and 45' - 50'	▨	
40			
45			
50			
55			
	56'-69' LIMESTONE gray, crystalline	▦	56' - 59' bgs logged by cuttings
60			
65			
	Total Depth of Boring at 69' bgs		
70			
75			

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION Well Number AP–58
Job Number 35157182 Installation Date 2/16/2016 Location AEP–FLINT CREEK –GENTRY, AR.
Datum Elevation NA Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16–30 SAND Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



Length of Solid riser: 58.45'

Total Depth of Monitoring Well: 68.85' from TOC

Depth to Top of Bentonite Seal 54' bgs

Depth to Top of Primary Filter Pack 56' bgs

Length of Screen and Bottom Cap. 10.4'

Total Depth Drilled 69 fbgs

▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

(Not to Scale)

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PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35157182
WELL NUMBER: AP–58
DRAWING NUMBER: 006 CHECKED BY: MR

25809 Interstate 30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

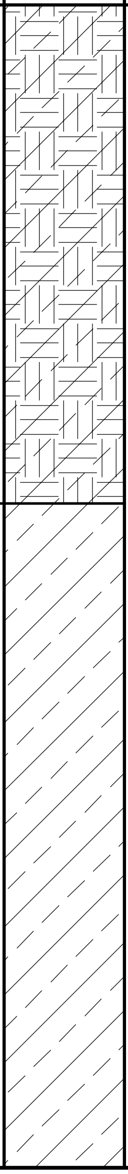
FIELD BORING LOG

BORING NO.: AP-58A PAGE: 1 of 2
TOTAL DEPTH: 71.7' FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER
PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35237104-001
DRILLING CO.: SUNBELT
LOGGED BY: JOSH RAY
DRILLER: NEAL FARRAR AR License #C001451
DATE DRILLED: 11/21/2022
RIG TYPE: CME 75 BUGGY
DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY
SAMPLING METHOD: 5' CONTINUOUS SAMPLER / AIR ROTARY

N: 707805.248 E: 1255854.857 G.S. ELEV. 1155.71

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-15' <u>SILTY CLAY</u> - FILL brown and red, poor sample return		
5			
10			
15	15'-55' <u>SILTY CLAY</u> red, moist zones at 40'		
20			
25			
30			



25809 Interstate 30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

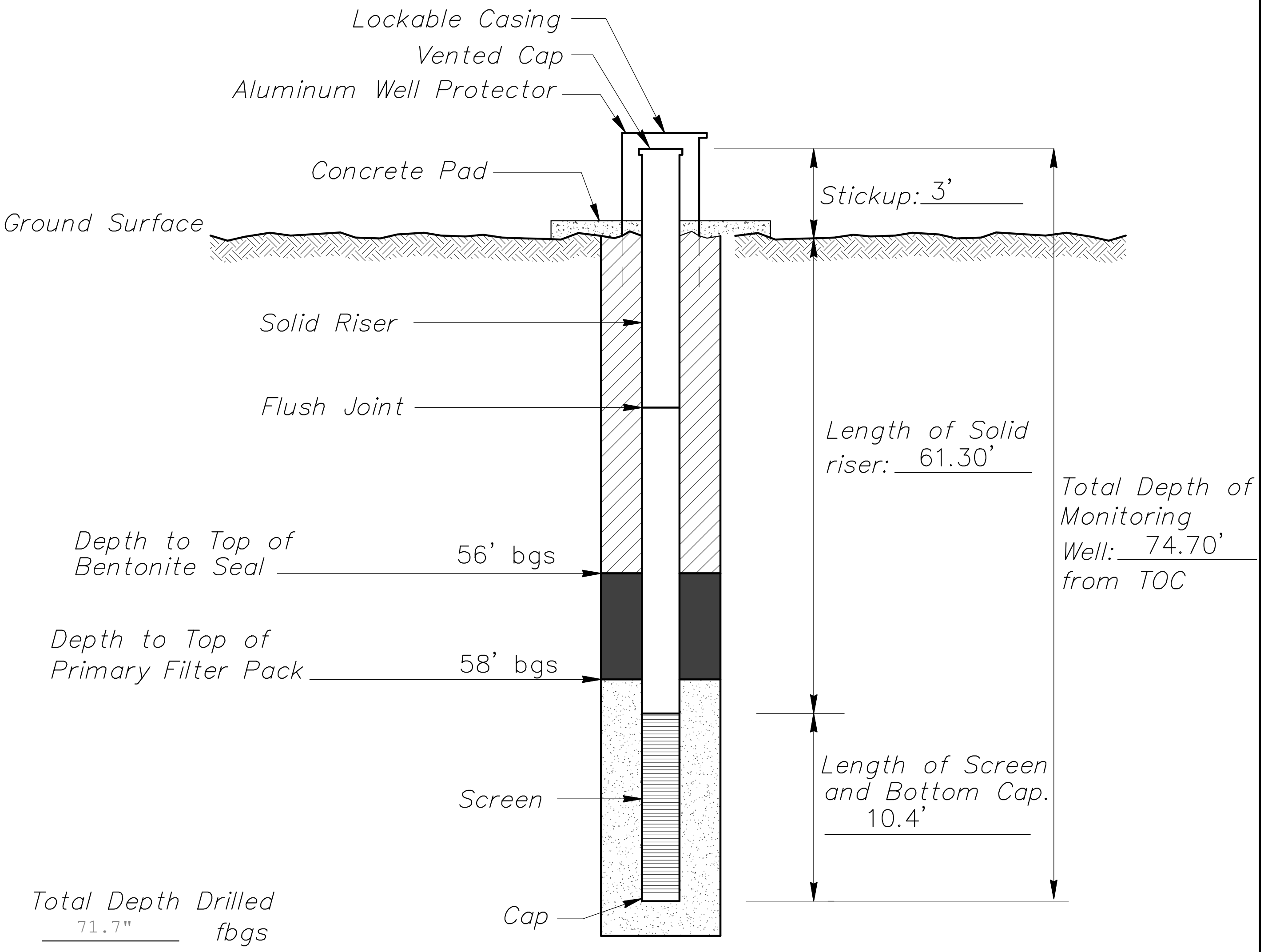
BORING NO.: AP-58A PAGE: 2 of 2

TOTAL DEPTH: 71.7' FEET BELOW GROUND SURFACE (BGS

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
	15'-55' SILTY CLAY red, moist zones at 40'	▨	
40		▨	
45		▨	
50		▨	Groundwater encountered above bedrock, and rose to static level of 20.90' below TOC
55	55'-70' LIMESTONE gray, crystalline	▦	55' - 70' bgs logged by cuttings, wet
60		▦	
65		▦	
70	Total Depth of Boring at 71.7' bgs		
75			

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION Well Number AP–58A
Job Number 35237104 Installation Date 11/21/2022 Location AEP–FLINT CREEK–GENTRY, AR.
Datum Elevation 1158.57 ' NGVD29 Vertical Datum Surface Elevation 1155.71' NGVD29 Vertical Datum
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010 "
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16–30 SAND Terracon Representative JOSH RAY
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor SUNBELT



Stickup: 3'

Length of Solid riser: 61.30'

Total Depth of Monitoring Well: 74.70' from TOC

Depth to Top of Bentonite Seal 56' bgs

Depth to Top of Primary Filter Pack 58' bgs

Length of Screen and Bottom Cap. 10.4'

Total Depth Drilled 71.7" fbgs

▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

(Not to Scale)

Terracon

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35237104
WELL NUMBER: AP–58A
DRAWING NUMBER: 002 CHECKED BY: MR

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Consulting Engineers and Scientists

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BRYANT, AR. 72022
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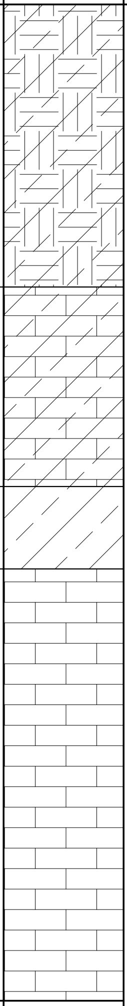
FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: AP-59
PAGE: 1 of 1
TOTAL DEPTH: 30 FEET BELOW GROUND SURFACE (BGS)

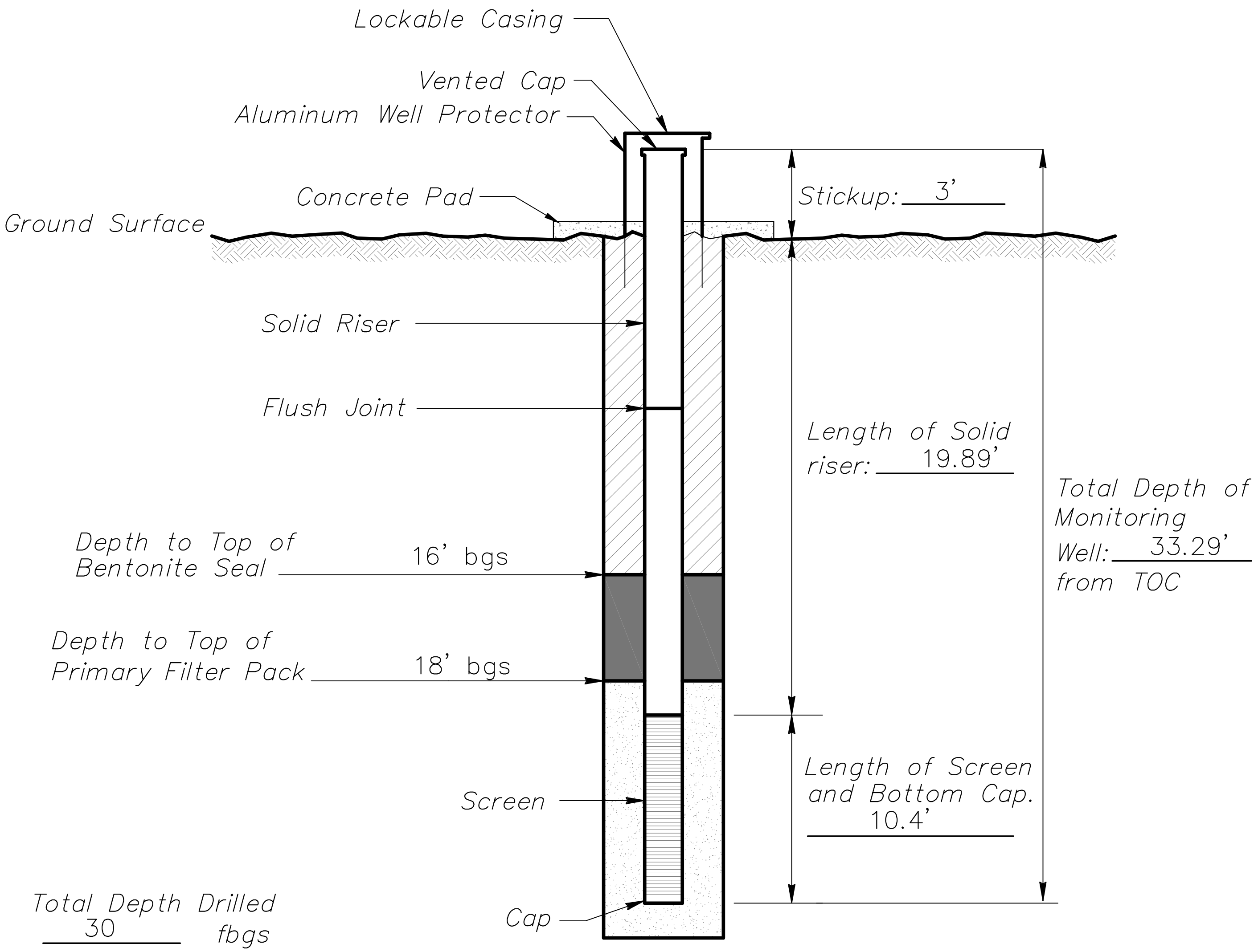
CLIENT: AMERICAN ELECTRIC POWER
PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-001
DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER
DRILLER: GARY MOYERS
DATE DRILLED: 2/3/2016
RIG TYPE: CME 75 BUGGY
DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY
SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

N: N/A
E: N/A
G.S. ELEV. N/A

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0 5	0'-8.5' SILTY CLAY - FILL red and brown		
10	8.5'-14.5' LIMESTONE and SILTY CLAY hard while drilling		
15	14.5'-17' SILTY CLAY red		
20 25	17'-30' LIMESTONE light gray, crystalline, thin fracture/void at 22' bgs ▽		Moisture at top of rock at 17' bgs Water at 22' bgs 17' - 30' Logged by cuttings
30	Total Depth of Boring at 30' bgs		

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION
Well Number AP–59
Job Number 35157182
Installation Date 2/4/2016
Location AEP–FLINT CREEK –GENTRY, AR.
Datum Elevation NA
Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC
Slot Size 0.010
Riser Diameter & Material 2" PVC
Borehole Diameter 8"
Granular Backfill Material 16–30 SAND
Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY
Drilling Contractor ANDERSON ENGINEERING



Stickup: 3'

Length of Solid riser: 19.89'

Total Depth of Monitoring Well: 33.29' from TOC

Depth to Top of Bentonite Seal 16' bgs

Depth to Top of Primary Filter Pack 18' bgs

Length of Screen and Bottom Cap. 10.4'

Total Depth Drilled 30 fbgs

▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

(Not to Scale)

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

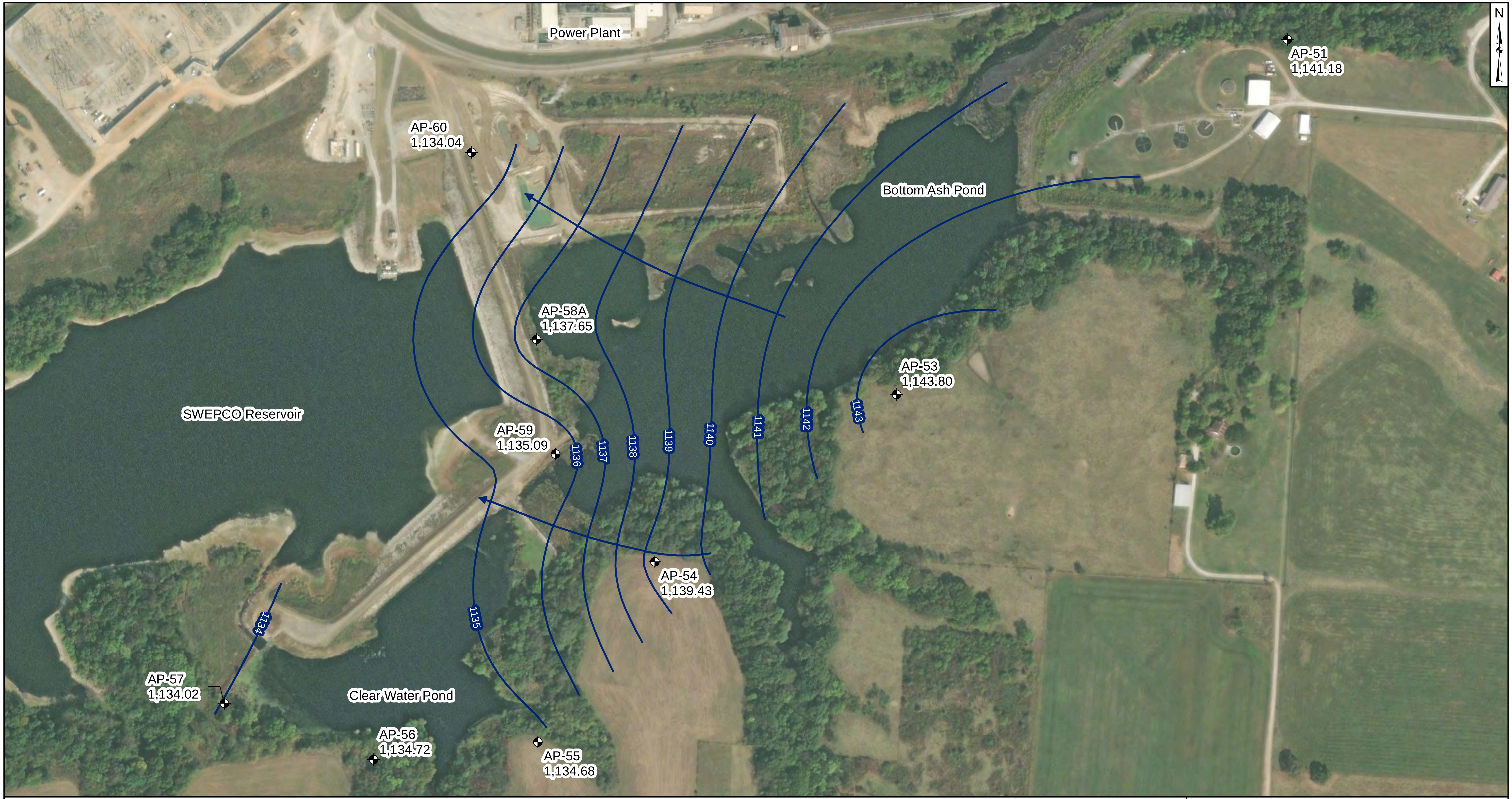
MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216–001–35157182
WELL NUMBER: AP–59
DRAWING NUMBER: 005
CHECKED BY: MR

ATTACHMENT C

Potentiometric Surface Maps, Uppermost Aquifer
September 2023 and December 2023

Map was previously provided in AEP. 2024. Annual Groundwater Monitoring Report - Southwestern Electric Power Company, Flint Creek Power Plant, Primary Bottom Ash CCR Management Unit. American Electric Power. January.



Legend

⊕ Monitoring Wells

— Groundwater Contour Elevation

→ Groundwater Flow Direction

Notes
- Monitoring well coordinates and water level data were collected September 18, 2023, provided by AEP.
- AP-58 was irreparably damaged and was replaced by well AP-58A.
- 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.
- Well locations resurveyed on February 2 and 3, 2023 (Datum: AR SP North NAD27).

200 100 0 200 Feet

Potentiometric Surface Map
Uppermost Aquifer - September 2023

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

Geosyntec consultants

Columbus, Ohio

2023/09/29

Figure

C-1

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2023\AEP-Flint Creek_GW_BAP_Sept2023.mxd. ASoltero. 9/29/2023. CHA8423/01/08.

Map was previously provided in AEP. 2024. Annual Groundwater Monitoring Report - Southwestern Electric Power Company, Flint Creek Power Plant, Primary Bottom Ash CCR Management Unit. American Electric Power. January.

Legend

⊕ Monitoring Wells

— Groundwater Contour Elevation

→ Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data were collected December 27, 2023, provided by AEP.
- Only wells AP-58A and AP-59 were gauged during the December 2023 verification event. Groundwater contours based on September 2023 sampling event.
- AP-58 was irreparably damaged and was replaced by well AP-58A.
- 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.
- Well locations resurveyed on February 2 and 3, 2023 (Datum: AR SP North NAD27).

200 100 0 200 Feet

Potentiometric Surface Map
Uppermost Aquifer - December 2023

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

Geosyntec consultants

Columbus, Ohio

2024/01/23

Figure

C-2

\\annarbor-01\Data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2023\AEP-Flint Creek_GW_BAP_Dec2023_ver.mxd. ASoltero. 1/23/2024. CHA8423/01/08.

ATTACHMENT D
Surface Water Samples
Laboratory Analytical Report

Dolan Chemical Laboratory (DCL)
4001 Bixby Road
Groveport, Ohio 43125
Contacts: **Michael Ohlinger (614-836-4184)**
Dave Conover (614-836-4219)

Chain of Custody Record

Program: Coal Combustion Residuals (CCR)

Project Name: CCR

Contact Name:

Contact Phone:

Sampler(s): Ivaunna Neigler
Nicole Morrall

Analysis Turnaround Time (in Calendar Days)

● Routine (28 days for Monitoring Wells)

Site Contact:

Date:

For Lab Use Only:

COC/Order #:

Shipping confirmation sent to recipients below:
nmorrall@aep.com
ipneigler@aep.com
cmhubbell@aep.com

							250 mL bottle, pH<2, HNO3	~~Three (six every 10th*) 1L bottles, pH<2, HNO3~~	1 L + 250 mL bottles, Cool, 0-6C	~~40 mL Glass vial or 250 mL PTFE lined bottle, HCL**, pH<2~~	~~Field-filter 250 mL bottle then pH<2, HNO3~~			
Sample Identification	**Sample Date**	**Sample Time**	**Sample Type (C=Comp, G=Grab)**	**Matrix**	**# of Cont.**	**Sampler(s) Initials**	B, Ca, Li, Sb, As, Ba, Be, Cd, Cr, Co, Pb, Mo, Se, TL and Na, K, Mg, Sr	~~Ra-226, Ra-228~~	TDS, F, Cl, SO4, and Br, Alkalinity	~~Hg~~	~~dissolved Fe and dissolved Mn~~		*Contains extra parameters*	**Sample Specific Notes:**
Low Volume Waste Outlet Combined	2/25/20	13:03	G	GW	2	NM	X		X					<4°C
Bottom Ash Pond	2/25/20	13:14	G	W	2	NM	X		X					<4°C
BAP near Stop Log	2/25/20	13:29	G	W	2	NM	X		X					<4°C
SWEPCO Lake	2/25/20	13:23	G	W	2	NM	X		X					<4°C
Field Blank	2/25/20	13:44	G	W	1	NM/IPN			X					<4°C
Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ________; F = filter in field							4	4	1	2	F 4			

* *Six 1L Bottles must be collected for Radium for every 10th sample.*

** *HCl must be Trace Metal Grade for Mercury analysis when samples cannot be delivered to the laboratory within 48 hours of sampling.*

Special Instructions/QC Requirements & Comments:

Relinquished by: Nicole Morrall	Company: AEP	Date/Time: 2/25/20 14:00	Received by:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Date/Time:

Form COC-04, AEP Chain of Custody (COC) Record for Coal Combustion Residual (CCR) Sampling - Dolan extra parameters, Rev. 3.1, 12/01/16

Form REP-703
Rev. 1, 11/2013

AEP
AMERICAN ELECTRIC POWER

Dolan Chemical Laboratory
4001 Bixby Road
Groveport, OH 43125
T: 614-836-4221, Audinet 210-4221
F: 614-836-4168, Audinet 210-4168
http://aepenv/labs

Water Analysis

Location: Flint Creek PS

Report Date: 3/20/2020

Low Volume Waste Outlet Combined

Sample Number: 200633-001 **Date Collected: 02/25/2020 13:03** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.07	ug/L	J	0.1	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.78	ug/L		0.1	0.03	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Barium, Ba	119	ug/L		0.2	0.05	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	< 0.01	ug/L	U	0.05	0.01	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.460	ug/L		0.2	0.04	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.127	ug/L		0.05	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.2	ug/L	J	0.2	0.05	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	2.63	ug/L		2	0.4	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.4	ug/L		0.2	0.03	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Boron, B	0.076	mg/L		0.05	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	35.1	mg/L		0.3	0.1	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000381	mg/L		0.0002	0.00005	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	2.83	mg/L		0.1	0.02	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.69	mg/L		1	0.2	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Sodium, Na	11.4	mg/L		0.5	0.1	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.175	mg/L		0.01	0.002	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	102	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	7.92	mg/L		0.04	0.01	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.08	mg/L		0.06	0.01	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	183	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	17.8	mg/L		0.4	0.06	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0

pH = 6.30 2/25/2020 13:03 ipn

Location: Flint Creek PS

Report Date: 3/20/2020

Bottom Ash Pond

Sample Number: 200633-002

Date Collected: 02/25/2020 13:15

Date Received: 2/26/2020

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.11	ug/L		0.1	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Arsenic, As	1.03	ug/L		0.1	0.03	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Barium, Ba	199	ug/L		0.2	0.05	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	0.03	ug/L	J	0.05	0.01	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	2.98	ug/L		0.2	0.04	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.193	ug/L		0.05	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.275	ug/L		0.2	0.05	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	5.81	ug/L		2	0.4	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Selenium, Se	1.8	ug/L		0.2	0.03	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Boron, B	0.246	mg/L		0.05	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	40.5	mg/L		0.3	0.1	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.00111	mg/L		0.0002	0.00005	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	3.14	mg/L		0.1	0.02	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Potassium, K	5.61	mg/L		1	0.2	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Sodium, Na	22.7	mg/L		0.5	0.1	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.498	mg/L		0.01	0.002	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	116	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	11.0	mg/L		0.04	0.01	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.18	mg/L		0.06	0.01	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	217	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	39.5	mg/L		0.4	0.06	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0

pH = 8.70 2/25/2020 13:14 ipn

Location: Flint Creek PS **Report Date: 3/20/2020**

BAP Near Stop Log

Sample Number: 200633-003 **Date Collected:** 02/25/2020 13:29 **Date Received:** 2/26/2020

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.07	ug/L	J	0.1	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.71	ug/L		0.1	0.03	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Barium, Ba	79.5	ug/L		0.2	0.05	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	< 0.01	ug/L	U	0.05	0.01	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.1	ug/L	J	0.2	0.04	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.056	ug/L		0.05	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.06	ug/L	J	0.2	0.05	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	1	ug/L	J	2	0.4	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.3	ug/L		0.2	0.03	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Boron, B	0.068	mg/L		0.05	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	34.4	mg/L		0.3	0.1	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000205	mg/L		0.0002	0.00005	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	2.75	mg/L		0.1	0.02	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.87	mg/L		1	0.2	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Sodium, Na	11.7	mg/L		0.5	0.1	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.147	mg/L		0.01	0.002	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	101	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	7.92	mg/L		0.04	0.01	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.08	mg/L		0.06	0.01	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	155	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	16.2	mg/L		0.4	0.06	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0

pH = 7.23 2/25/2020 13:29 ipn

pH= 8.31 2/25/2020 13:23 ipn

Swepco Lake SWEPCO Lake

Sample Number: 200633-004 **Date Collected:** 02/25/2020 13:23 **Date Received:** 2/26/2020

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.08	ug/L	J	0.1	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.70	ug/L		0.1	0.03	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Barium, Ba	113	ug/L		0.2	0.05	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	0.01	ug/L	J	0.05	0.01	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.619	ug/L		0.2	0.04	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.144	ug/L		0.05	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.1	ug/L	J	0.2	0.05	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	2	ug/L	J	2	0.4	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.7	ug/L		0.2	0.03	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Boron, B	0.102	mg/L		0.05	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	38.0	mg/L		0.3	0.1	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000527	mg/L		0.0002	0.00005	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	3.04	mg/L		0.1	0.02	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.94	mg/L		1	0.2	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Sodium, Na	20.7	mg/L		0.5	0.1	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.224	mg/L		0.01	0.002	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	99.8	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	11.7	mg/L		0.04	0.01	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.12	mg/L		0.06	0.01	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	206	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	35.0	mg/L		0.4	0.06	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0

Field Blank

Sample Number: 200633-005 **Date Collected:** 02/25/2020 13:44 **Date Received:** 2/26/2020

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Alkalinity, as CaCO3	< 5	mg/L	U	20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	< 0.01	mg/L	U	0.04	0.01	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Fluoride, F	< 0.01	mg/L	U	0.06	0.01	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	< 20	mg/L	U	50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	< 0.06	mg/L	U	0.4	0.06	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0

U: Analyte was analyzed and not detected at or above adjusted Method Detection Limit
J: Analyte was positively identified, though the quantitation was below Reporting Limit.

Michael S Ohlinger

Michael Ohlinger, Chemist

Email msohlinger@aep.com *Tel.*

Fax 614-836-4168 *Audinet 8-210-*

THIS TEST REPORT RELATES ONLY TO THE ITEMS TESTED AND SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT WRITTEN APPROVAL OF THE LABORATORY. ALL TEST RESULTS MEET ALL OF THE REQUIREMENTS OF THE ACCREDITING AUTHORITY, UNLESS OTHERWISE NOTED.

ATTACHMENT E

Certification by a Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the 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

No. 9846
BETH ANN GROSS

Geosyntec Consultants
2039 Centre Pointe Blvd, Suite 103
Tallahassee, Florida 32308

Arkansas Firm Certificate of
Authorization No. 52
Exp. 12/31/2024

9864
License Number

Arkansas
Licensing State

June/28/2024
Date

GEOSYNTEC
CONSULTANTS
No. 52

Geosyntec consultants

engineers | scientists | innovators

AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY

ALTERNATIVE SOURCE DEMONSTRATION REPORT

2024 1st SEMIANNUAL EVENT
FEDERAL CCR RULE

Flint Creek Power Plant
Primary Bottom Ash Pond
Gentry, Arkansas

Prepared for

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

Prepared by

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

Project CHA8495B

December 2024

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Attachment D: Surface Water Samples Laboratory Analytical Report

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Attachment F: Certification by a Qualified Professional Engineer

ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	alternative source demonstration
bgs	below ground surface
CCR	coal combustion residuals
CFR	Code of Federal Regulations
EPRI	Electric Power Research Institute
LPL	lower prediction limit
PBAP	Primary Bottom Ash Pond
redox	oxidation-reduction
SSI	statistically significant increase
SU	standard units
UPL	upper prediction limit
USEPA	United States Environmental Protection Agency

1. INTRODUCTION AND SUMMARY

This alternative source demonstration (ASD) report has been prepared to address statistically significant increases (SSIs) for boron, chloride, and pH in the groundwater monitoring network for the former Primary Bottom Ash Pond (PBAP), located at the Flint Creek Power Plant in Gentry, Arkansas, following the first semiannual detection monitoring event of 2024. The Flint Creek Power Plant has two coal combustion residuals (CCR) storage units, including the former PBAP. The PBAP was certified as having all contained CCR removed by August 2023 and is now operated as a non-CCR wastewater pond (**Figure 1**).

Background groundwater values for the PBAP were originally calculated in January 2018 and have been updated intermittently in accordance with the *Statistical Analysis Plan* prepared for the Flint Creek Plant (Geosyntec Consultants, Inc. [Geosyntec] 2020a). For the most recent update in January 2022, revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values (Geosyntec 2022a). Prediction limits were calculated based on a one-of-two retesting procedure in accordance with the Unified Guidance (United States Environmental Protection Agency [USEPA] 2009) and the statistical analysis plan developed for the site. With this procedure, an SSI is concluded only if both an initial sample and a resample reported results above the UPL or, in the case of pH, below the lower prediction limit (LPL). In practice, if the initial result was not above the UPL or was not below the LPL, a resample was not collected or analyzed.

The first semiannual detection monitoring event of 2024 at the former PBAP was conducted in April (initial sampling event), and the results were compared to the calculated prediction limits. Where initial exceedances were identified, resampling was completed in August 2024. Following resampling, SSIs were identified for boron and chloride at downgradient compliance well AP-58A and for pH (value lower than the LPL) at downgradient compliance well AP-59 using intrawell analyses. No other SSIs were identified. A summary of the Appendix III analytical results for the downgradient compliance wells and the calculated prediction limits to which they were compared is provided in **Table 1**.

1.1 CCR Rule Requirements

USEPA regulations regarding detection monitoring programs for CCR landfills and surface impoundments provide owners and operators with the option to make an ASD when an SSI is identified:

> *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. (Code of Federal Regulations [CFR] Title 40, Section 257.94(e)(2) [40 CFR 257.94(e)(2)]).

Pursuant to 40 CFR 257.94(e)(2), Geosyntec has prepared this ASD report to document that the identified SSIs at AP-58A and AP-59 should not be attributed to a release from the PBAP.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess alternative sources to which the identified SSI could be attributed. Alternative sources were identified from among 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
- ASD Type V: Anthropogenic Sources

A demonstration was conducted to show that the SSIs identified for boron and chloride at well AP-58A and for pH at well AP-59 were based on a Type I cause (sampling issues) and not by a direct release from the PBAP.

2. SUMMARY OF SITE CONDITIONS

Descriptions of the Flint Creek PBAP design and construction, regional geology and site hydrogeology, and groundwater monitoring systems and flow conditions are presented below.

2.1 PBAP Design and Construction

As described by Terracon (2023), the former PBAP was a 42.8-acre CCR surface impoundment located south of the power plant that was formerly operated as a CCR ash pond. It was constructed from 1974 to 1978 with an approximately 820-foot long cross-valley dam consisting of compacted clayey soil. While it was operational as a CCR surface impoundment, it was used primarily to manage bottom ash.

A Closure Plan for the PBAP was developed in September 2016 and revised in October 2023 (AEP 2023a). This document detailed the closure activities which were to take place throughout the closure of the PBAP. AEP submitted a certified notification that the PBAP ceased receipt of CCR on November 30, 2022, and commenced closure by removal of CCR materials in accordance with the certified closure plan (American Electric Power [AEP] 2022). CCR material removal from the PBAP was completed on August 20, 2023. A photograph showing the condition of the PBAP shortly before completion of CCR removal is provided in **Figure 2**.

2.2 Regional Geology / Site Hydrogeology

As described by Terracon (2023), the PBAP is positioned in an area of the Ozark Plateaus Province that has undergone regional-scale uplift followed by significant incision by rivers, resulting in hilly topography. It is underlain by the Mississippian-aged Boone Formation, which consists primarily of limestone and chert. Locally, the stratigraphy consists of a 30- to 50-foot-thick weathered residuum of the Boone Formation, consisting of heavily-weathered limestone with chert nodules and iron-rich clay, and the underlying massive cherty limestone of the Boone Formation.

The Boone Formation is underlain by the Mississippian-aged St. Joe Member, which is a light-grey crystalline limestone that has not experienced significant physical or chemical weathering and is distinct from the Boone Formation due to its lack of chert and clay.

The Boone residuum, the underlying Boone Formation cherty limestone, and the underlying St. Joe Member collectively comprise a single hydrostatic unit known as the Boone–St. Joe Aquifer. This aquifer is underlain by the Chattanooga Shale, a black, fissile shale that acts as a barrier to vertical flow from the aquifer unit above.

Geologic cross sections near the PBAP presented by Terracon (2023) are provided as **Attachment A**. These cross sections show the Boone residuum (described as a silty clay on the cross sections) and cherty limestone Boone Formation underlying the clayey berm of the PBAP.

Three distinct zones of groundwater flow have been identified within the Boone–St. Joe Aquifer at the site: Uppermost, Intermediate, and Deep (AEP 2023b). Perched groundwater is occasionally present within upper unconsolidated soils but is not continuous throughout the site and does not constitute an aquifer unit. All monitoring wells in the PBAP monitoring well network monitor the uppermost aquifer, which is defined as the upper portion of the Boone Formation (Terracon 2023).

2.3 Groundwater Monitoring Systems and Flow Conditions

The monitoring well network (**Figure 1**) includes three upgradient background wells (AP-51, AP-53, and AP-54) and three downgradient compliance wells (AP-58A, AP-59, and AP-60).

Monitoring well AP-59 is screened entirely within competent limestone, as was monitoring well AP-58 (see cross sections in **Attachment A** and on the boring log and well construction diagrams provided in **Attachment B**). Monitoring well AP-58 was found to be irreparably damaged during a sampling event in September 2022 and was replaced in November 2022 by AP-58A. Following the discovery of damage to the AP-58 well casing, the well was plugged and monitoring well AP-58A was installed approximately 10 feet south of AP-58's location and screened at the same interval (AP-58 was screened from 58.45 to 68.45 feet below ground surface [bgs], and AP-58A is screened from 61.30 to 71.30 feet bgs) (**Attachment B**). One thin fracture/void was noted at 22 feet bgs within the screened interval of AP-59. No structural features were noted within the screened intervals of AP-58 or AP-58A.

Potentiometric maps showing groundwater flow contours for the Uppermost Aquifer during the April 2024 initial sampling and August 2024 resampling events are provided as **Attachment C**. The groundwater flow direction is generally to the west and northwest. Hydraulic connectivity within the Uppermost Aquifer was determined by Terracon (2023) to be related to multiple factors including lithology, rock type, layer thickness, and degree of bedrock fracture. Seasonal variability in the groundwater flow direction and hydraulic gradient has not been observed since the monitoring well network was installed.

3. ALTERNATIVE SOURCE DEMONSTRATION

The methods used to assess possible alternative sources of the SSIs for boron and chloride at AP-58A and the SSI for pH at AP-59 as well as the proposed alternative sources for these SSIs are described below.

3.1 Proposed Alternative Source

3.1.1 Monitoring Well AP-58A

A review of groundwater sampling field forms identified an alternative source for the boron and chloride SSIs at AP-58A due to Type I (sampling) issues. As discussed in Section 2.3, well AP-58A was installed in November 2022 after it was discovered in September 2022 that well AP-58 was irreparably damaged. Boring logs and well construction diagrams for both AP-58 and AP-58A are provided in **Attachment B**. Well AP-58A is located approximately 10 feet south of previous well AP-58 and screened at approximately the same elevation. Thus, groundwater collected from AP-58A should reflect conditions previously observed at former well AP-58.

A Piper diagram, which represents the relative concentrations of major cations and anions in the groundwater, was created to visualize groundwater geochemistry at both AP-58 and AP-58A (**Figure 3**). The diagram indicates that groundwater samples from AP-58 did not begin to show consistency within major ion chemistry until around August 2019 (as indicated by the solid red symbols on the Piper diagram), at which point the monitoring well had equilibrated with the aquifer approximately 3.5 years after it was installed in February 2016. The relative proportion of anions in the April and August 2024 samples collected from AP-58A (1.5 years after well installation) are nearly identical to samples collected from AP-58 1.5 years after installation of the well but before the groundwater had equilibrated (March 2019 through June 2019, **Figure 3**).

These results suggest that both AP-58 and AP-58A require(d) time after installation to equilibrate with the aquifer before the collected samples are representative of stable geochemical conditions. These findings suggest that geochemical trends at AP-58A are consistent with those observed at AP-58 following installation, and further shifts in geochemistry are expected to occur gradually over the next one to two years. This is generally consistent with guidance from USEPA, which has noted that time should be allowed for equilibration of a newly installed well after installation and "there may be a period (i.e., days to months) during which water quality near the [installed well] may be distinctly different from that in the formation" due to the disturbance of ambient conditions (USEPA 2015). This is particularly true for drilling techniques, such as the air-rotary technology used to install AP-58A, compared to direct-push technologies.

Similar post-installation trends have been observed for boron concentrations at AP-58 and AP-58A to date (**Figure 4**), providing further evidence of gradual equilibration. While concentrations of chloride at AP-58A have not decreased at the same rate as AP-58 (**Figure 5**), comparisons of potassium and sodium concentrations at AP-58 and AP-58A show similar trends after installation (**Figure 6**). Based on the geochemical trends associated with gradual equilibration at AP-58, AP-58A chloride concentrations are expected to continue to decrease over the next one to two years.

A comparison of concentrations of relevant parameters from various PBAP samples to both groundwater concentrations at AP-58A and the established intrawell UPLs supports the position that the SSIs observed at AP-58A should not be attributed to the PBAP. Two surface water samples with sample IDs of ‘BAP’ and ‘BAP – Near Stop Log’ were collected from the PBAP in March 2020. The PBAP was dewatered and removal of CCR from the PBAP was completed by August 2023, prior to the April and August 2024 sampling events associated with the first semiannual detection monitoring event of 2024. Therefore, no updated PBAP water samples can be collected, and the 2020 surface water samples are the best existing approximation of CCR-influenced material which may potentially impacting compliance monitoring wells. The laboratory analytical report for the March 2020 surface water sampling event is provided as **Attachment D**. Reported values of boron and chloride from the PBAP samples are shown compared to the AP-58A UPL and recent samples from AP-58A (**Table 2**). Boron and chloride concentrations were notably greater in AP-58A groundwater samples than in both samples collected from the PBAP. This provides further support that the PBAP is not a source of the apparent elevated concentrations of boron and chloride in AP-58A groundwater.

3.1.2 Monitoring Well AP-59

A review of groundwater sampling field forms identified an alternative source for the pH SSI at AP-59 due to Type I (sampling) issues.

A comparison of pH values from both AP-59 samples to pH values from BAP surface water sample, upgradient wells, and the established intrawell prediction limits supports the position that the SSI observed at AP-59 should not be attributed to the PBAP (**Table 3**). The pH value from surface water sample ‘BAP’ (collected from the PBAP in February 2020) was greater than the intrawell UPL for AP-59, meaning that physical mixing of CCR-influenced BAP water with downgradient groundwater would result in an increase to groundwater pH levels. Therefore, the decrease in pH should not be attributed to the PBAP.

A review of the field forms shows that well AP-59 was purged for only 15 minutes during both the initial and verification resampling events (**Attachment E**). At the recorded flow rate of 220 milliliters per minute, less than one well volume was purged from AP-59 prior to sampling. During both sampling events, the field-measured pH values did not stabilize within 0.1 standard units (SU), which is the target stabilization criterion for pH from both USEPA guidance and the *Groundwater Sampling and Analysis Plan* for the Site (AEP 2018). The field-measured pH values were continuing to increase at the time of sample collection. Based on the pH trends in the stabilization data, pH values at AP-59 were likely higher in the aquifer groundwater than recorded on the sampling form and were potentially within the LPL and UPL range. Therefore, the SSI identified for pH is likely due to Type I (sampling) issues and not due to a release from the PBAP. This is further supported by an additional field reading collected in November 2024 during the resampling for the second semiannual event of 2024. The recorded pH value at AP-59 during the November 2024 sampling event was 6.9 SU (**Attachment E**), which is above the intrawell LPL of 6.7 SU and below the intrawell UPL of 7.6 SU (Table 1), indicating that pH values in groundwater at AP-59 did not undergo a long-term change.

4. 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 SSIs for boron and chloride at AP-58A and for pH at AP-59 during the first semiannual detection monitoring event of 2024 should be attributed to sampling issues and not to a release from the Flint Creek PBAP. Therefore, no further action is warranted. Certification of this ASD by a qualified professional engineer is provided in **Attachment F**.

5. REFERENCES

AEP. 2018. *A Groundwater Sampling and Analysis Plan for Flint Creek Plant. Part of the Coal Combustion Residuals Rule Compliance Approach.* American Electric Power. February.

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Terracon. 2023. *Groundwater Monitoring Network for CCR Compliance. SWEPCO – Flint Creek Primary Bottom Ash Pond*. October.

USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance*. United States Environmental Protection Agency. EPA 530/R-09-007.

USEPA. 2015. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*. United States Environmental Protection Agency. EPA 540/S-95/504. April.

TABLES

Table 1. Detection Monitoring Data Summary
Flint Creek Plant – Primary Bottom Ash Pond

Analyte	Unit	Description	AP-58A		AP-59		AP-60	
			4/15/2024	8/19/2024	4/15/2024	8/19/2024	4/15/2024	8/19/2024
Boron	mg/L	Intrawell Background Value (UPL)	0.276		0.368		1.68	
		Analytical Result	**0.623**	**0.566**	0.220	--	0.345	--
Calcium	mg/L	Intrawell Background Value (UPL)	86.8		53.9		49.9	
		Analytical Result	19.0	--	47.5	--	**55.0**	43.5
Chloride	mg/L	Intrawell Background Value (UPL)	10.2		18.0		17.4	
		Analytical Result	**21.2**	**20.8**	**18.3**	18.0	12.0	--
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00		0.765		0.681	
		Analytical Result	0.450	--	0.40	--	0.20	--
pH	SU	Intrawell Background Value (UPL)	8.7		7.6		10.8	
		Intrawell Background Value (LPL)	6.2		6.7		6.5	
		Analytical Result	7.0	--	**6.5**	**6.2**	7.1	--
Sulfate	mg/L	Intrawell Background Value (UPL)	90.3		50.1		190	
		Analytical Result	82.6	--	**50.5**	30.5	93.3	--
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	333		266		397	
		Analytical Result	290	--	240	--	320	--

Notes:

1. Bold values exceed the background value.

2. Background values are shaded gray.

--: not measured

LPL: lower prediction limit

mg/L: milligrams per liter

SU: standard units

UPL: upper prediction limit

Table 2. AP-58A and PBAP Water Boron and Chloride Data
Flint Creek Plant – Primary Bottom Ash Pond

Source	Sample Date	Parameter	
		Boron	Chloride
AP-58A UPL	N/A	0.276	10.2
BAP	2/25/2020	0.246	11.0
BAP Near Stop Log	2/25/2020	0.0688	7.92
AP-58A	4/15/2024	0.623	21.2
AP-58A	8/19/2024	0.566	20.8

Notes:

1. All parameters are shown in units of milligrams per liter.
2. Results greater than the AP-58A UPL are highlighted in red and results lower than the AP-58A UPL are highlighted in green.
3. Samples collected from the PBAP were labeled as 'BAP', as shown in the table and in the data provided in Attachment D.
4. AP-58A analytical results are compared to intrawell prediction limits calculated using AP-58 background data, as insufficient data is available from AP-58A to calculate prediction limits at this time.

N/A: not applicable

UPL: upper prediction limit

Table 3. AP-59 and PBAP Water pH Data
Flint Creek - Primary Bottom Ash Pond

Source	Sample Date	Parameter
		pH
AP-59 UPL	N/A	7.6
AP-59 LPL	N/A	6.7
BAP	2/25/2020	8.7
AP-59	4/15/2024	6.5
AP-59	8/19/2024	6.2

Notes:

1. All results are shown in standard units (SU).
2. Results greater than the AP-59 UPL are highlighted in red and results below the AP-59 LPL are highlighted in yellow.
3. Samples collected from the PBAP were labeled as 'BAP', as shown in the table above and in the data provided in Attachment D.

N/A: not applicable

LPL: lower prediction limit

UPL: upper prediction limit

FIGURES

Legend

⌖ Monitoring Wells

▭ Approximate Unit Boundary

Notes

1. Monitoring well coordinates were provided by AEP; wells locations were resurveyed on February 2 and 3, 2023 (Datum: AR SP North NAD27, NGVD29).
2. AP-58 was irreparably damaged and was replaced by well AP-58A.
3. Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon 2023) provided by AEP.
4. Aerial basemap provided by the Northwestern Arkansas Regional Planning Commission (2024).

Site Layout

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

Geosyntec consultants

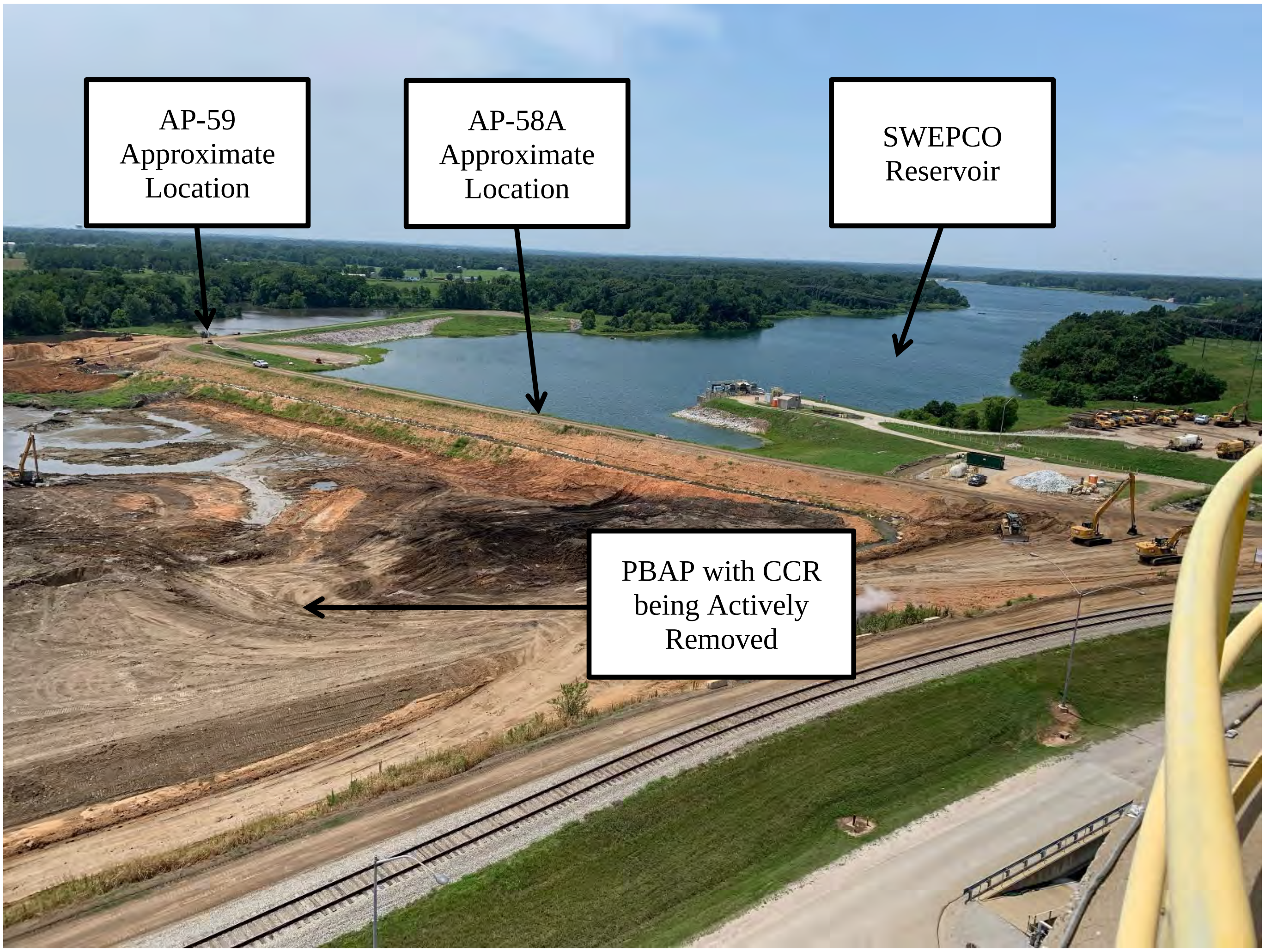
Columbus, Ohio

2024/12/13

Figure

1

\\annarbor-01\Data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2024\Flint Creek PBAP Site Layout_ASD.mxd. ASoltero. 12/13/2024. CHA8423/01/08.



Notes:
1. Photograph taken looking southwest on July 25, 2023 prior to the completion of CCR removal.
2. AP-58A is located on the center dike shown in the photograph.

PBAP Site Photograph
Flint Creek Primary Bottom Ash Pond

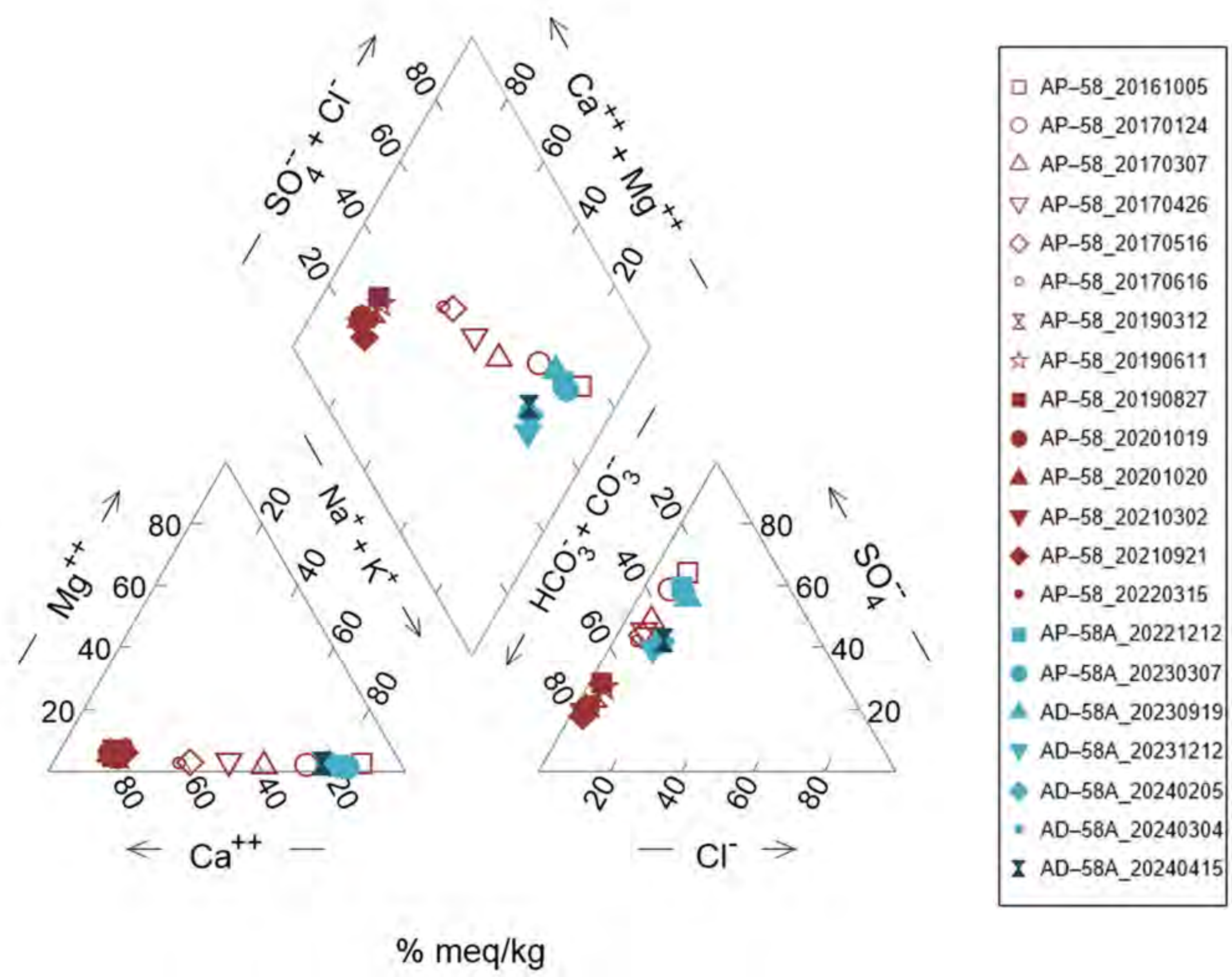
Geosyntec consultants

AMERICAN ELECTRIC POWER

Figure
2

Columbus, Ohio

December 2024



Notes:
1. Samples from AP-58 and AP-58A that were analyzed for all major ions are shown on the Piper diagram in units of percentage of milliequivalents per kilogram (% meq/kg) for major cations (bottom left triangle) and major anions (bottom right triangle).

Piper Diagram

Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

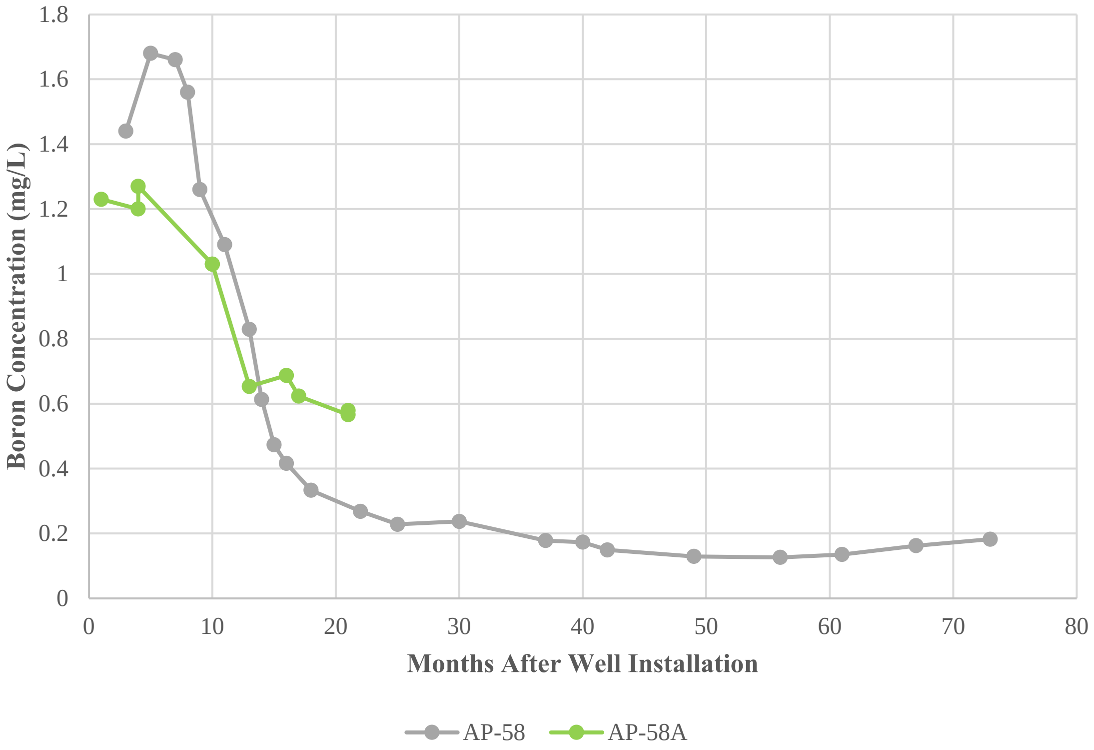
AMERICAN ELECTRIC POWER

Figure

3

Columbus, Ohio

December 2024



Notes:

1. Boron concentrations are shown in milligrams per liter (mg/L).
2. Monitoring well AP-58 was installed in February 2016 and ceased use in September 2022 after it sustained irreparable damage.
3. AP-58A was installed in November 2022 to replace AP-58.

AP-58 and AP-58A Boron Comparison

Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

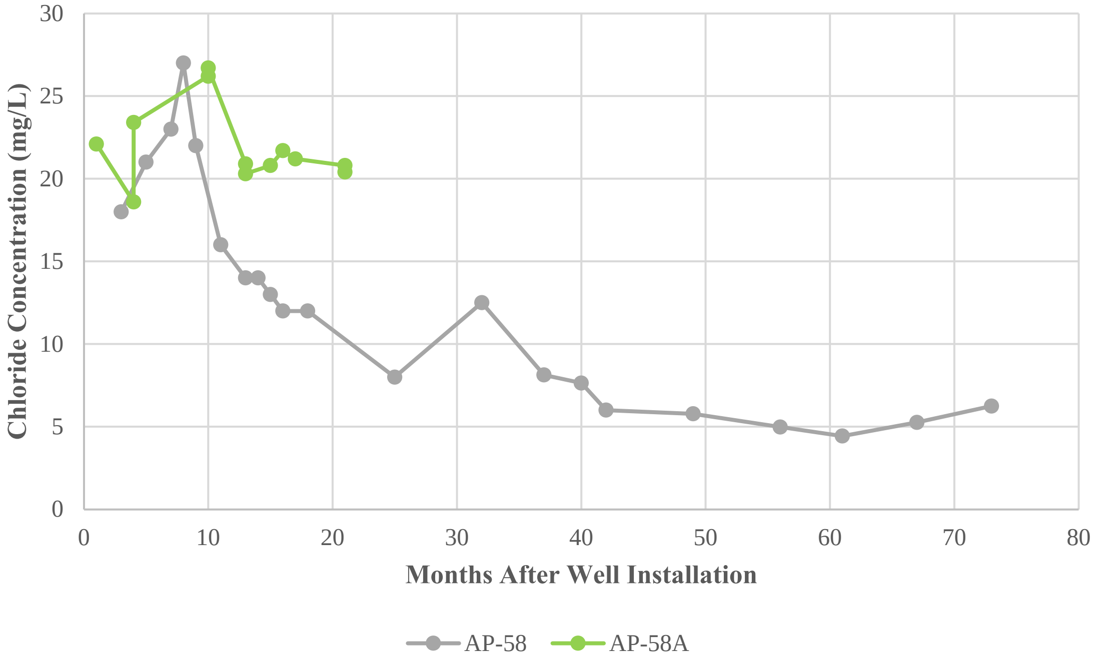
AMERICAN ELECTRIC POWER

Figure

4

Columbus, Ohio

December 2024



Notes:

1. Chloride concentrations are shown for in milligrams per liter (mg/L).
2. Monitoring well AP-58 was installed in February 2016 and ceased use in September 2022 after it sustained irreparable damage.
3. AP-58A was installed in November 2022 to replace AP-58.

AP-58 and AP-58A Chloride Comparison

Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

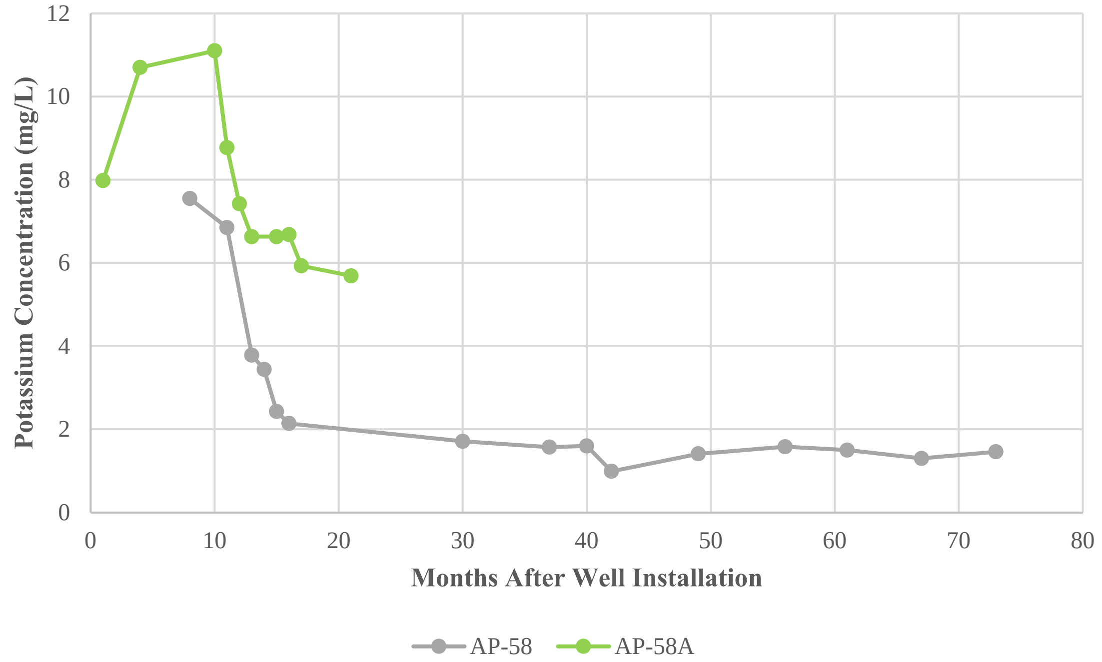
AMERICAN ELECTRIC POWER

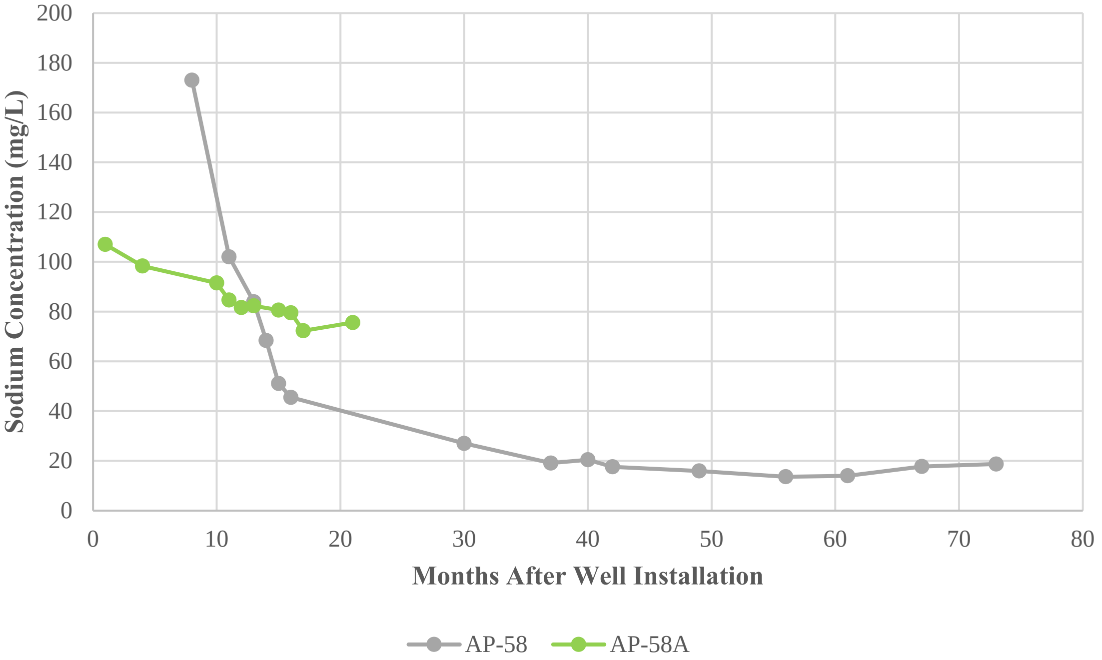
Columbus, Ohio

December 2024

Figure

5





Notes:

1. Potassium and sodium concentrations are shown for in milligrams per liter (mg/L).
2. Monitoring well AP-58 was installed in February 2016 and ceased use in September 2022 after it sustained irreparable damage.
3. AP-58A was installed in November 2022 to replace AP-58.

AP-58 and AP-58A Potassium and Sodium Comparison

Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

AMERICAN ELECTRIC POWER

Figure

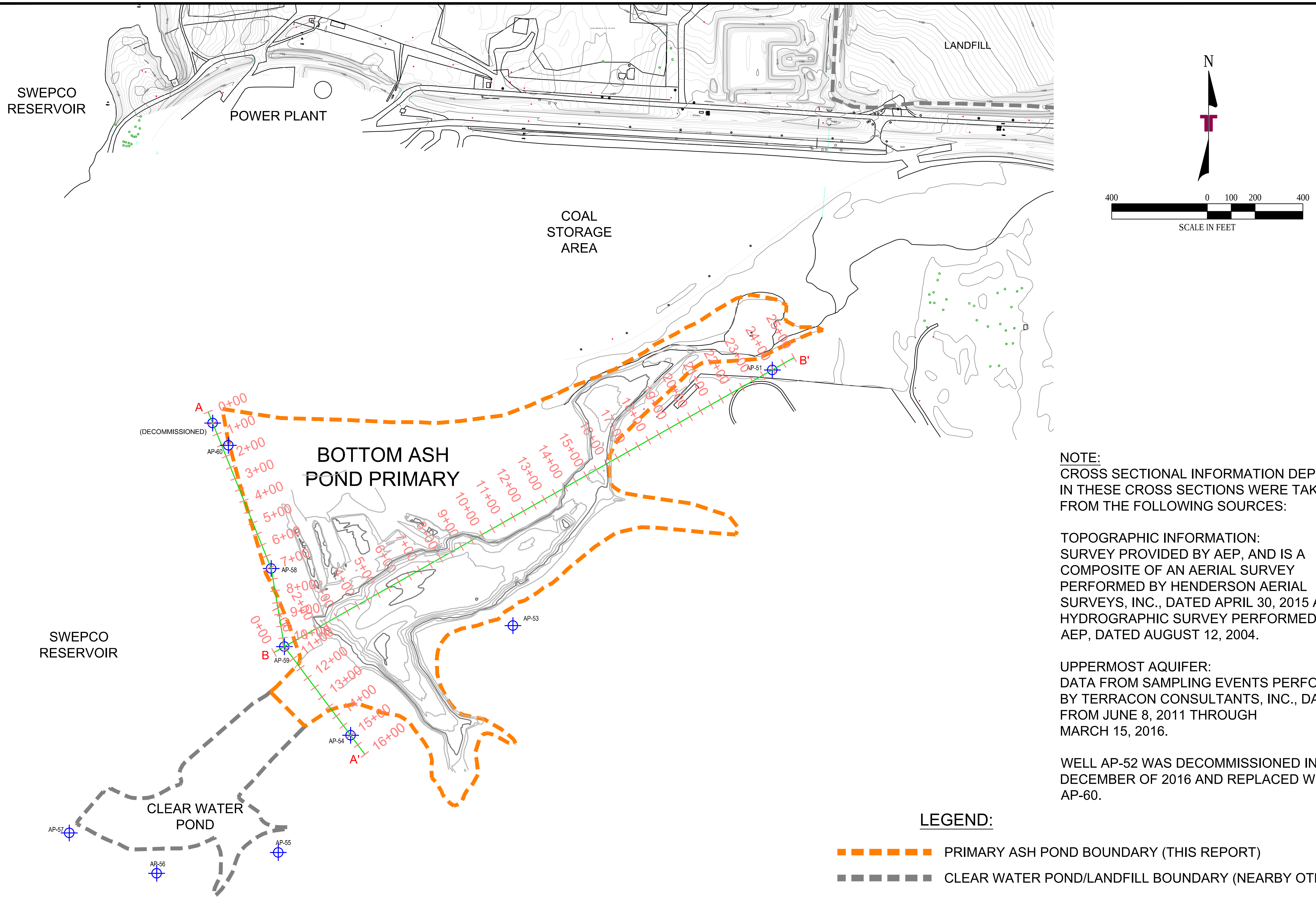
6

Columbus, Ohio

December 2024

ATTACHMENT A

Geologic Cross Sections



NOTE:
CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WERE TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
SURVEY PROVIDED BY AEP, AND IS A COMPOSITE OF AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED APRIL 30, 2015 AND A HYDROGRAPHIC SURVEY PERFORMED BY AEP, DATED AUGUST 12, 2004.

UPPERMOST AQUIFER:
DATA FROM SAMPLING EVENTS PERFORMED BY TERRACON CONSULTANTS, INC., DATING FROM JUNE 8, 2011 THROUGH MARCH 15, 2016.

WELL AP-52 WAS DECOMMISSIONED IN DECEMBER OF 2016 AND REPLACED WITH AP-60.

LEGEND:

▬ ▬ ▬	PRIMARY ASH POND BOUNDARY (THIS REPORT)
▬ ▬ ▬	CLEAR WATER POND/LANDFILL BOUNDARY (NEARBY OTHERS)
──	CROSS SECTION LOCATION
⊕	MONITORING WELL

REV.	DATE	BY	DESCRIPTION

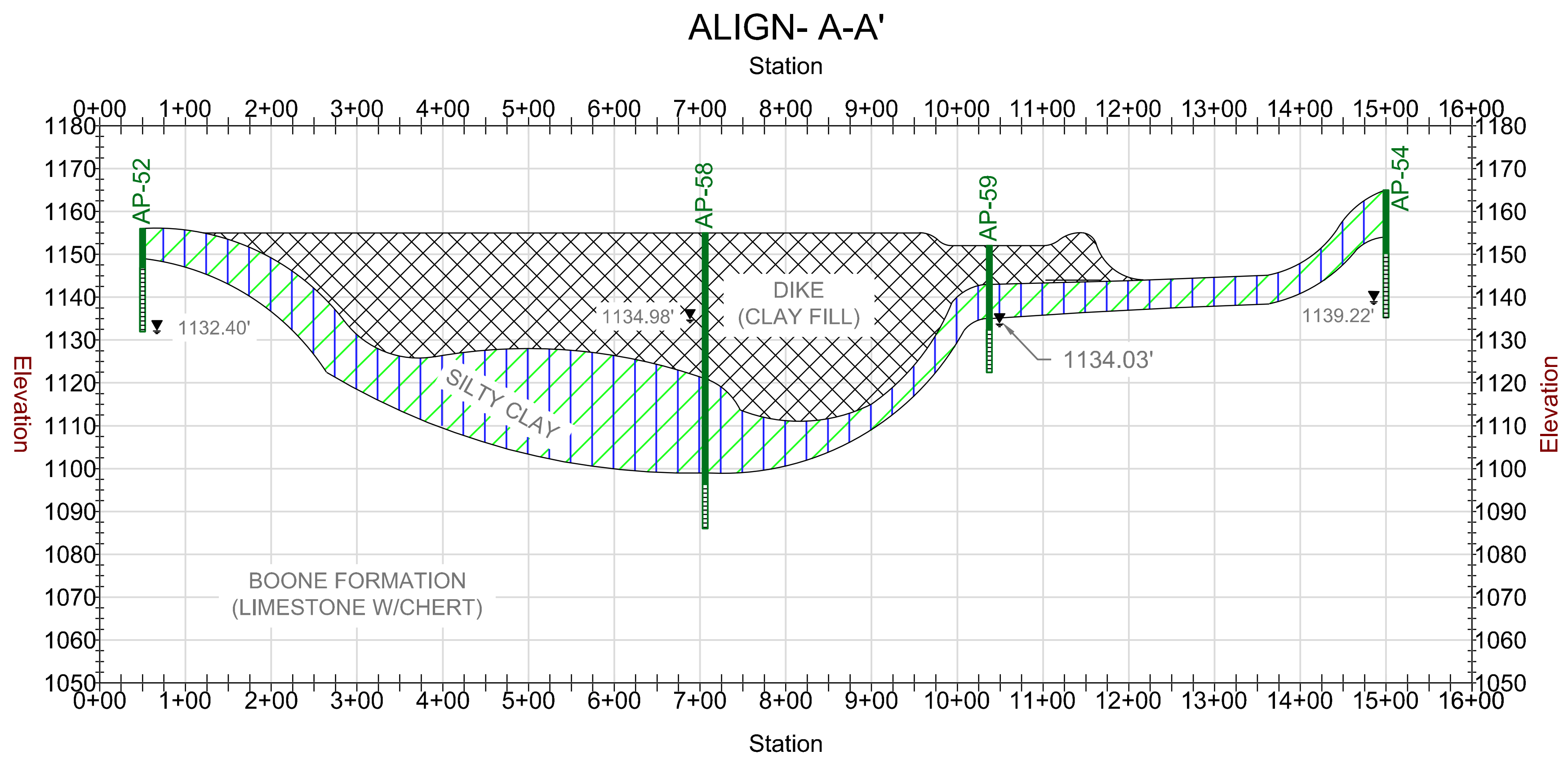
Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH
BRYANT, AR 72022
PH. (501) 847-9292
FAX. (501) 847-9210

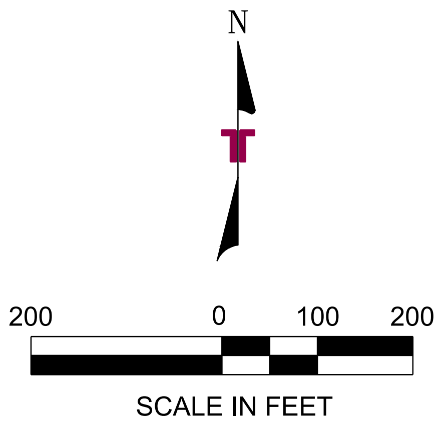
CROSS SECTION LOCATION MAP

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTPONDOM ASH
GENTRY
ARKANSAS

SHEET 1

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	001
SHEET NO.:	1 OF 2

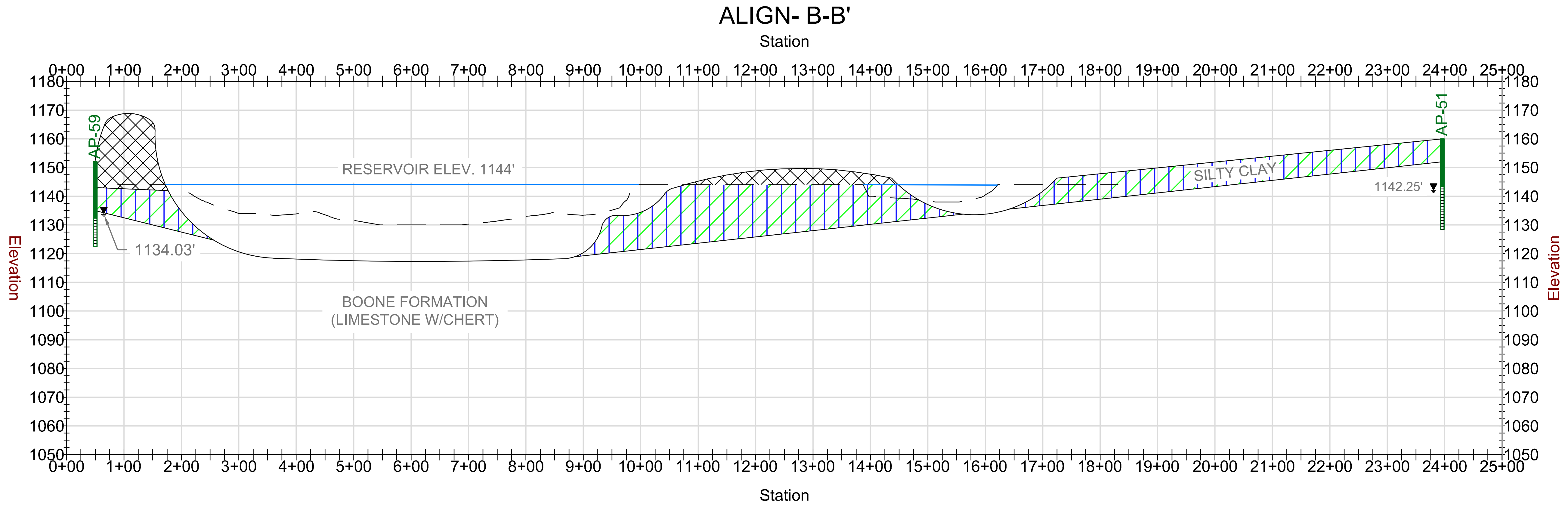




LEGEND:

▨ DIKE (CLAY FILL)

▨ SILTY CLAY



SHEET 2

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	001
SHEET NO.:	2 OF 2

CROSS SECTION A-A' & B-B'

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTPONDOM ASH
GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists

25809 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9292 FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

ATTACHMENT B

AP-58, AP-58A, and AP-59 Boring Logs and Well Construction Diagrams

Terracon
Consulting Engineers and Scientists

25809 I-30 South
BRYANT, AR. 72022
PH. (501) 847-9292
FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: AP-58
PAGE: 1 of 2
TOTAL DEPTH: 69 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-002	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER	DRILLER: GARY MOYERS
DATE DRILLED: 2/16/2016	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY

SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

N: N/A
E: N/A
G.S. ELEV. N/A

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
			Flush - mounted boring
0	0'-15' SILTY CLAY - FILL brown and red, poor sample return	▨	
5		▨	
10		▨	
15	15'-56' SILTY CLAY red, moist zones at 30' - 40' and 45' - 50'	▨	
20		▨	
25		▨	
30		▨	

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FIELD BORING LOG

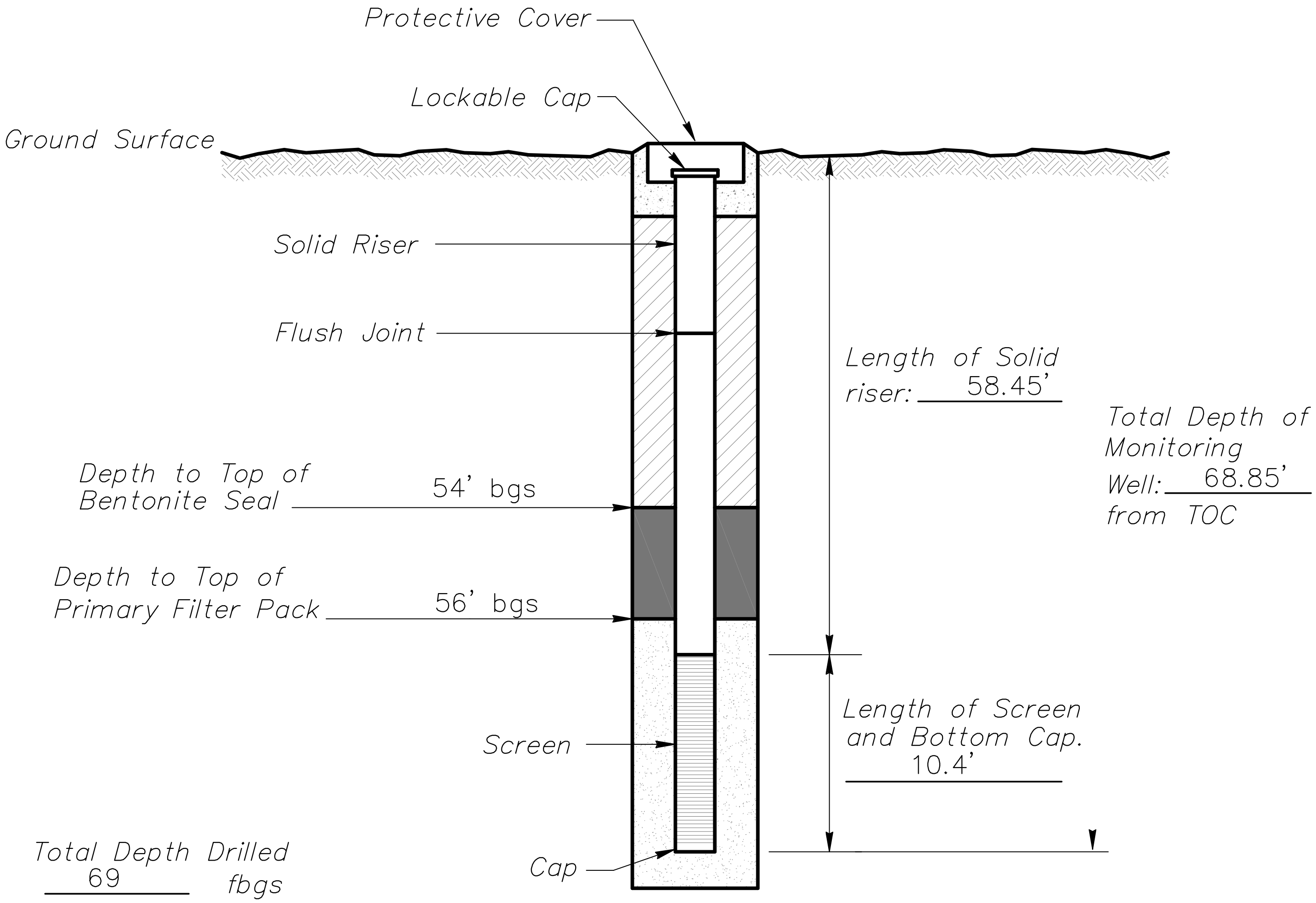
BORING NO.: AP-58 PAGE: 2 of 2

TOTAL DEPTH: 69 FEET BELOW GROUND SURFACE (BGS

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
	15'-56' SILTY CLAY red, moist zones at 30' - 40' and 45' - 50'	▨	
40		▨	
45		▨	
50		▨	
55		▨	
	56'-69' LIMESTONE gray, crystalline	▦	56' - 59' bgs logged by cuttings
60		▦	
65		▦	
	Total Depth of Boring at 69' bgs		
70			
75			

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION Well Number AP–58
Job Number 35157182 Installation Date 2/16/2016 Location AEP–FLINT CREEK –GENTRY, AR.
Datum Elevation NA Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16–30 SAND Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

(Not to Scale)

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35157182
WELL NUMBER: AP–58
DRAWING NUMBER: 006 CHECKED BY: MR

Terracon
25809 Interstate 30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: AP-58A PAGE: 1 of 2
TOTAL DEPTH: 71.7' FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35237104-001	DRILLING CO.: SUNBELT
LOGGED BY: JOSH RAY	DRILLER: NEAL FARRAR AR License #C001451
DATE DRILLED: 11/21/2022	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY
SAMPLING METHOD: 5' CONTINUOUS SAMPLER / AIR ROTARY

N: 707805.248 E: 1255854.857 G.S. ELEV. 1155.71

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-15' SILTY CLAY - FILL brown and red, poor sample return		
5			
10			
15	15'-55' SILTY CLAY red, moist zones at 40'		
20			
25			
30			

Terracon

25809 Interstate 30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

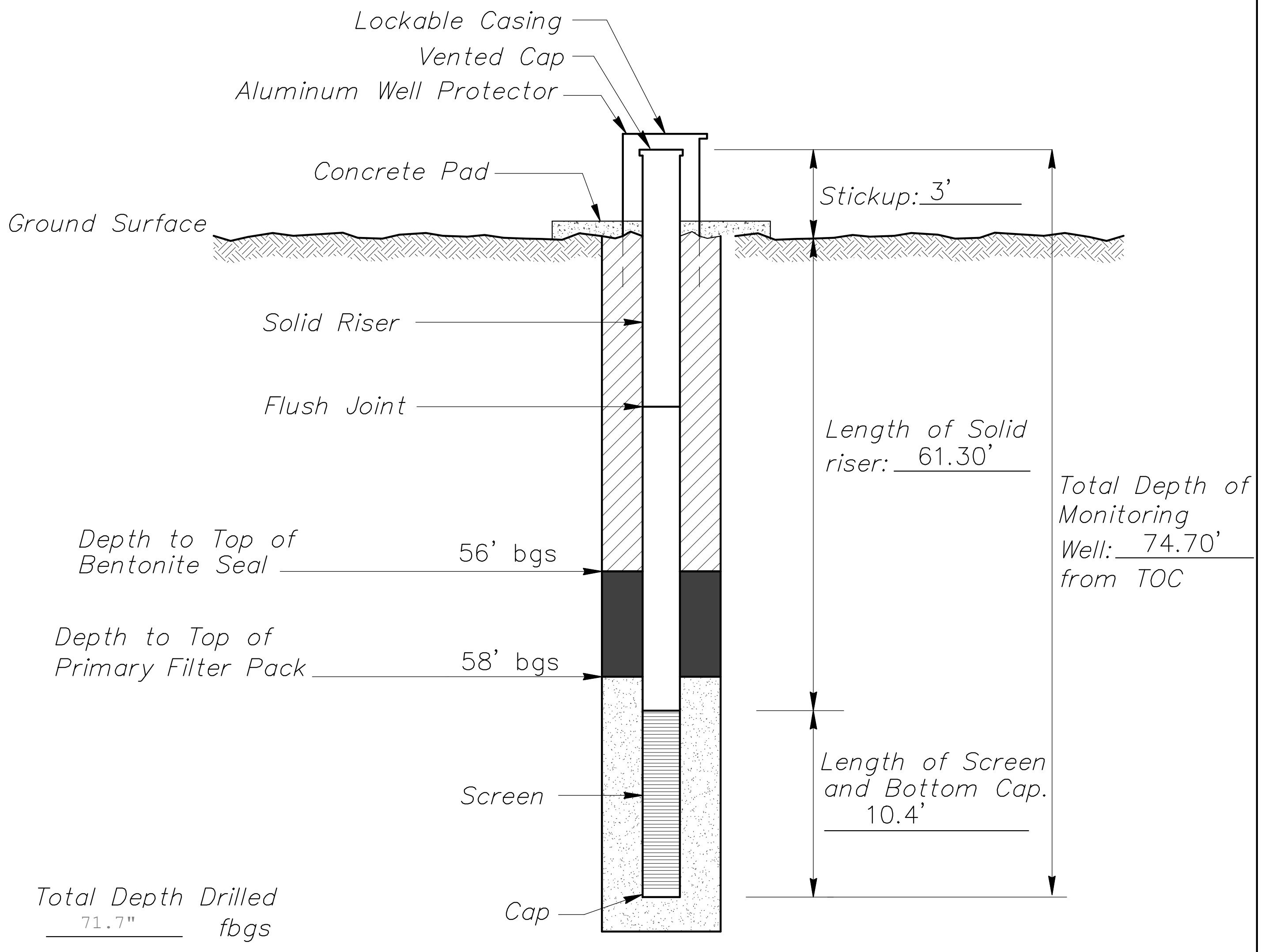
BORING NO.: AP-58A PAGE: 2 of 2

TOTAL DEPTH: 71.7' FEET BELOW GROUND SURFACE (BGS

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
	15'-55' <u>SILTY CLAY</u> red, moist zones at 40'	▨	
40		▨	
45		▨	
50		▨	Groundwater encountered above bedrock, and rose to static level of 20.90' below TOC
55	55'-70' <u>LIMESTONE</u> gray, crystalline	▦	55' - 70' bgs logged by cuttings, wet
60		▦	
65		▦	
70	Total Depth of Boring at 71.7' bgs		
75			

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION Well Number AP–58A
Job Number 35237104 Installation Date 11/21/2022 Location AEP–FLINT CREEK–GENTRY, AR.
Datum Elevation 1158.57 ' NGVD29 Vertical Datum Surface Elevation 1155.71' NGVD29 Vertical Datum
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010 "
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16–30 SAND Terracon Representative JOSH RAY
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor SUNBELT



▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

(Not to Scale)

Terracon

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35237104
WELL NUMBER: AP–58A
DRAWING NUMBER: 002 CHECKED BY: MR

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

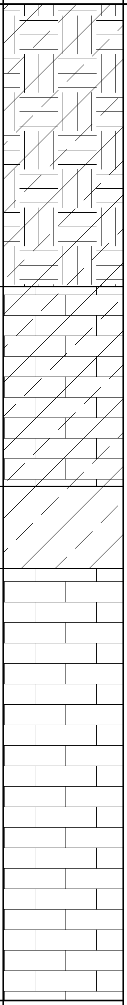
FIELD BORING LOG

BORING NO.: AP-59 PAGE: 1 of 1
TOTAL DEPTH: 30 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-001	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER	DRILLER: GARY MOYERS
DATE DRILLED: 2/3/2016	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY
SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

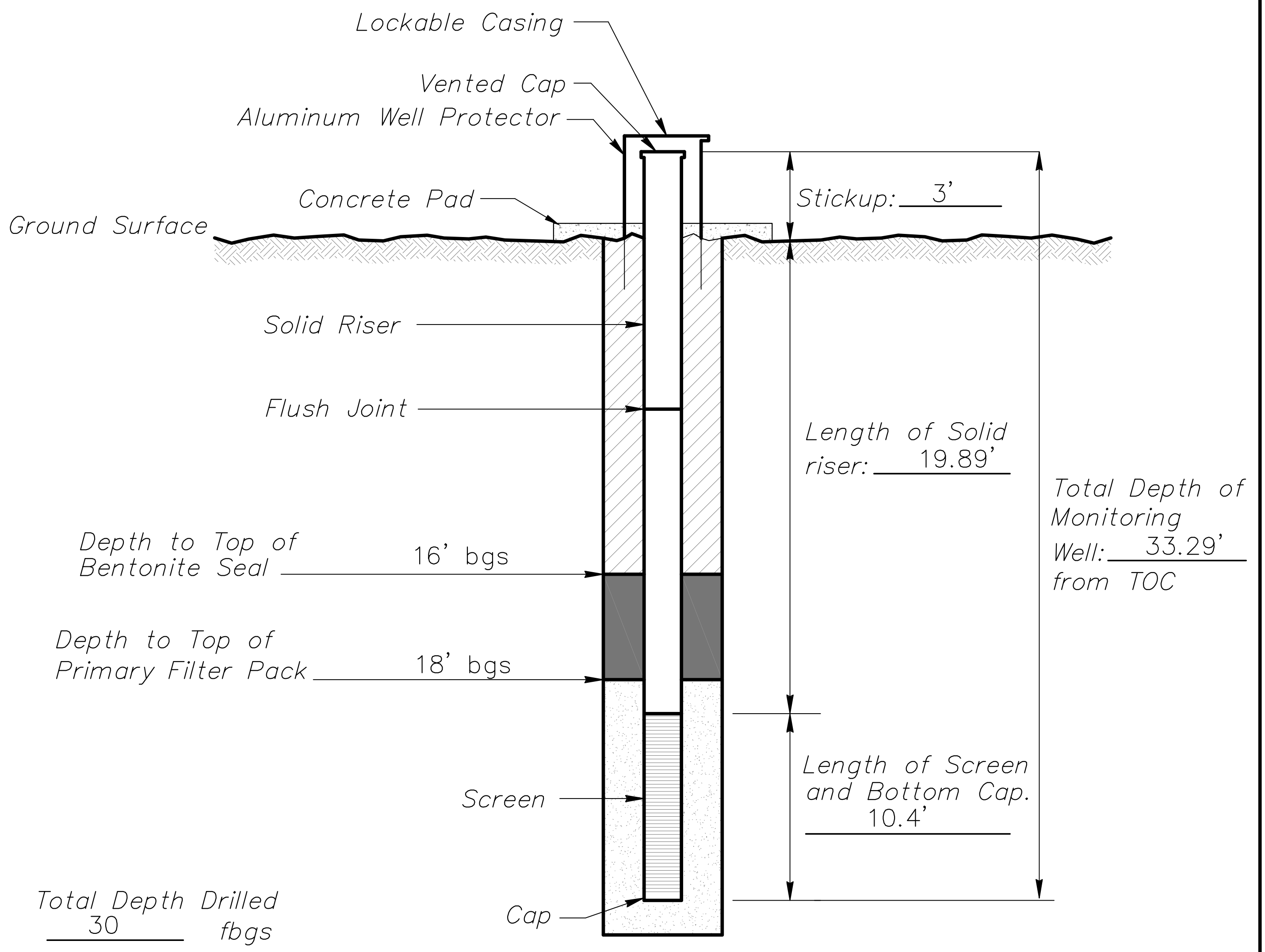
N: N/A E: N/A G.S. ELEV. N/A



Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-8.5' SILTY CLAY - FILL red and brown		
5			
10	8.5'-14.5' LIMESTONE and SILTY CLAY hard while drilling		
15	14.5'-17' SILTY CLAY red		
	17'-30' LIMESTONE light gray, crystalline, thin fracture/void at 22' bgs		Moisture at top of rock at 17' bgs
20	▽		Water at 22' bgs 17' - 30' Logged by cuttings
25			
30	Total Depth of Boring at 30' bgs		

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION Well Number AP–59
Job Number 35157182 Installation Date 2/4/2016 Location AEP–FLINT CREEK –GENTRY, AR.
Datum Elevation NA Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16–30 SAND Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



Stickup: 3'

Length of Solid riser: 19.89'

Total Depth of Monitoring Well: 33.29' *from TOC*

Depth to Top of Bentonite Seal 16' bgs

Depth to Top of Primary Filter Pack 18' bgs

Length of Screen and Bottom Cap. 10.4'

Total Depth Drilled 30 *fbgs*

▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

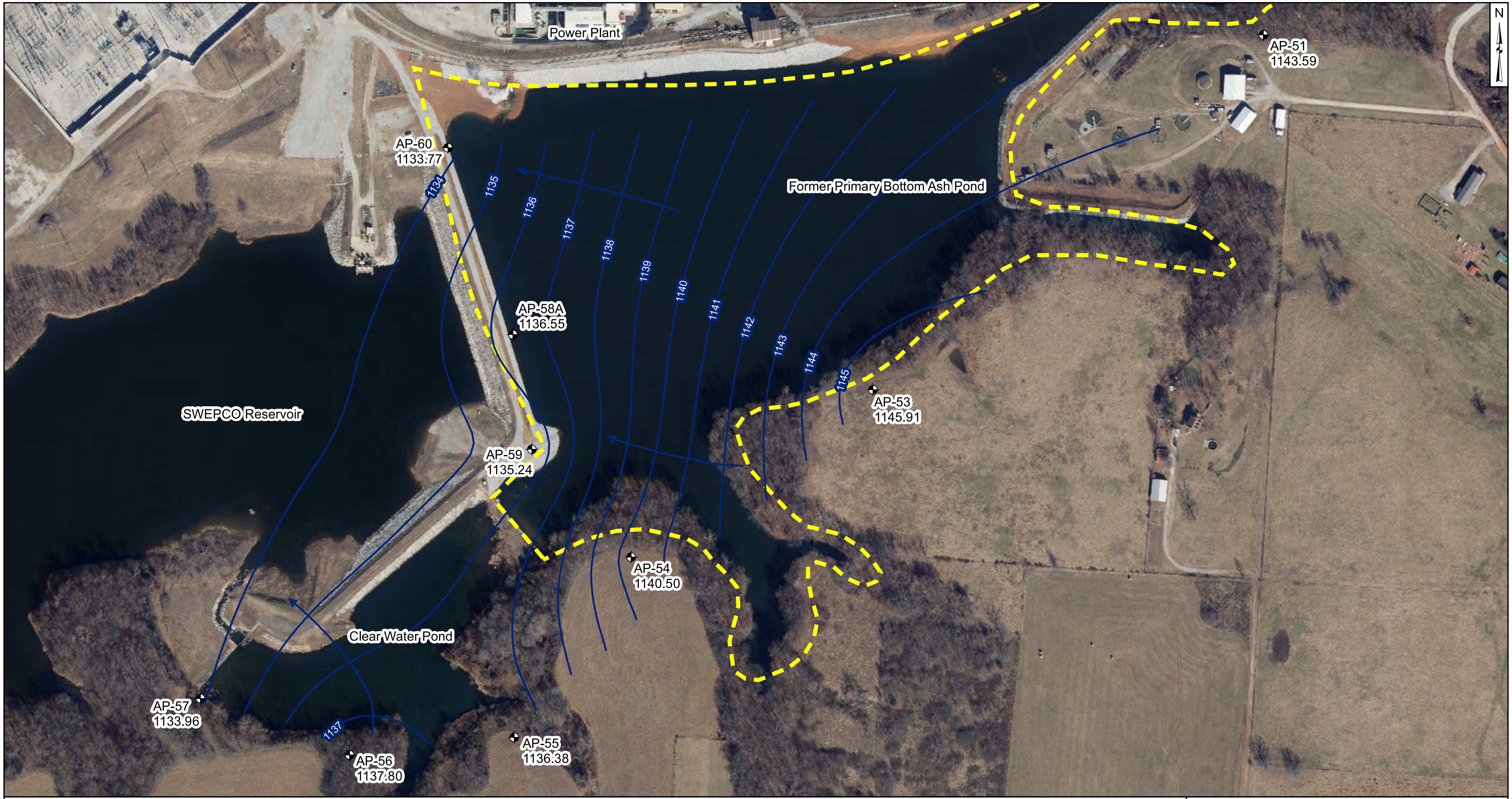
(Not to Scale)

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35157182
WELL NUMBER: AP–59
DRAWING NUMBER: 005 CHECKED BY: MR

ATTACHMENT C

Potentiometric Surface Maps, Uppermost Aquifer
April 2024 and August 2024



Legend

⊕	Monitoring Wells
—	Groundwater Contour Elevation
→	Groundwater Flow Direction
- - -	Groundwater Contour Elevation (Inferred)
▭	Approximate Unit Boundary

Notes

1. Monitoring well water level data were collected April 15, 2024; data provided by AEP.
2. AP-58 was irreparably damaged and was replaced by well AP-58A.
3. Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2023) provided by AEP.
4. Groundwater elevation units are feet above mean sea level (ft amsl).
5. Well locations resurveyed on February 2 and 3, 2023 (Datum: AR SP North NAD27, NGVD29).
6. Aerial basemap provided by the Northwestern Arkansas Regional Planning Commission (2024).

Beth Ann Gross No. 9846

Beth Ann Gross

12/19/2024

250 125 0 250
Feet

Geosyntec Consultants No. 52

Potentiometric Surface Map
Uppermost Aquifer - April 2024

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

Geosyntec
consultants

Figure
C-1

Columbus, Ohio
2024/12/13

\\annarbor-01\Data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2024\AEP-Flint Creek_GW_BAP_Apr2024.mxd. ASoltero. 12/13/2024. CHA8423/01/08.

Legend

- ⊕ Monitoring Wells
- — Groundwater Contour Elevation
- → Groundwater Flow Direction
- - - Groundwater Contour Elevation (Inferred)
- ▭ Approximate Unit Boundary

Notes

1. Monitoring well water level data were collected August 19 and 20, 2024; data provided by AEP.
2. AP-58 was irreparably damaged and was replaced by well AP-58A.
3. Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2023) provided by AEP.
4. Groundwater elevation units are feet above mean sea level (ft amsl).
5. Well locations resurveyed on February 2 and 3, 2023 (Datum: AR SP North NAD27, NGVD29).
6. Aerial basemap provided by the Northwestern Arkansas Regional Planning Commission (2024).

BETH ANN GROSS
No. 9846

Beth Ann Gross
12/19/2024

250 125 0 250
Feet

GEOSYNTEC CONSULTANTS
No. 52

Potentiometric Surface Map
Uppermost Aquifer - August 2024

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

Geosyntec consultants

Columbus, Ohio
2024/12/13

Figure
C-2

\\annarbor-01\Data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2024\AEP-Flint Creek_GW_BAP_Aug2024.mxd. ASoltero. 12/13/2024. CHA8423/01/08.

ATTACHMENT D
Surface Water Samples
Laboratory Analytical Report

Dolan Chemical Laboratory (DCL)
4001 Bixby Road
Groveport, Ohio 43125
Contacts: **Michael Ohlinger (614-836-4184)**
Dave Conover (614-836-4219)

Chain of Custody Record

Program: Coal Combustion Residuals (CCR)

Site Contact:

Date:

For Lab Use Only:
COC/Order #:

Shipping confirmation sent to recipients below:
nmorrall@aep.com
ipneigler@aep.com
cmhubbell@aep.com

Project Name: CCR
Contact Name:
Contact Phone:
Sampler(s): Ivaunna Neigler Nicole Morrall

Analysis Turnaround Time (in Calendar Days)
● Routine (28 days for Monitoring Wells)

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Sampler(s) Initials	250 mL bottle, pH<2, HNO3 B, Ca, Li, Sb, As, Ba, Be, Cd, Cr, Co, Pb, Mo, Se, TL and Na, K, Mg, Sr	~~Three (six every 10th*) 1L bottles, pH<2, HNO3~~ ~~Ra-226, Ra-228~~	1 L + 250 mL bottles, Cool, 0-6C TDS, F, Cl, SO4, and Br, Alkalinity	~~40 mL Glass vial or 250 mL PTFE lined bottle, HCL**, pH<2~~ ~~Hg~~	~~Field-filter 250 mL bottle, then pH<2, HNO3~~ ~~dissolved Fe and dissolved Mn~~		*Contains extra parameters*	Sample Specific Notes:
Low Volume Waste Outlet Combined	2/25/20	13:03	G	GW	2	NM	X		X					<4°C
Bottom Ash Pond	2/25/20	13:14	G	W	2	NM	X		X					<4°C
BAP near Stop Log	2/25/20	13:29	G	W	2	NM	X		X					<4°C
SWEPCO Lake	2/25/20	13:23	G	W	2	NM	X		X					<4°C
Field Blank	2/25/20	13:44	G	W	1	NM/IPN			X					<4°C
Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ________; F = filter in field							4	4	1	2	F 4			

** Six 1L Bottles must be collected for Radium for every 10th sample.*

*** HCl must be Trace Metal Grade for Mercury analysis when samples cannot be delivered to the laboratory within 48 hours of sampling.*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
Nicole Morrall	AEP	2/25/20 14:00		
Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Date/Time:

Form REP-703
Rev. 1, 11/2013

Dolan Chemical Laboratory
4001 Bixby Road
Groveport, OH 43125
T: 614-836-4221, Audinet 210-4221
F: 614-836-4168, Audinet 210-4168
http://aepenv/labs

Water Analysis

Location: Flint Creek PS

Report Date: 3/20/2020

Low Volume Waste Outlet Combined

Sample Number: 200633-001

Date Collected: 02/25/2020 13:03

Date Received: 2/26/2020

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.07	ug/L	J	0.1	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.78	ug/L		0.1	0.03	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Barium, Ba	119	ug/L		0.2	0.05	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	< 0.01	ug/L	U	0.05	0.01	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.460	ug/L		0.2	0.04	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.127	ug/L		0.05	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.2	ug/L	J	0.2	0.05	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	2.63	ug/L		2	0.4	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.4	ug/L		0.2	0.03	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Boron, B	0.076	mg/L		0.05	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	35.1	mg/L		0.3	0.1	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000381	mg/L		0.0002	0.00005	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	2.83	mg/L		0.1	0.02	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.69	mg/L		1	0.2	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Sodium, Na	11.4	mg/L		0.5	0.1	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.175	mg/L		0.01	0.002	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	102	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	7.92	mg/L		0.04	0.01	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.08	mg/L		0.06	0.01	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	183	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	17.8	mg/L		0.4	0.06	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0

pH = 6.30   2/25/2020   13:03   ipn

Location: Flint Creek PS **Report Date: 3/20/2020**

Bottom Ash Pond

Sample Number: 200633-002 **Date Collected: 02/25/2020 13:15** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.11	ug/L		0.1	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Arsenic, As	1.03	ug/L		0.1	0.03	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Barium, Ba	199	ug/L		0.2	0.05	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	0.03	ug/L	J	0.05	0.01	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	2.98	ug/L		0.2	0.04	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.193	ug/L		0.05	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.275	ug/L		0.2	0.05	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	5.81	ug/L		2	0.4	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Selenium, Se	1.8	ug/L		0.2	0.03	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Boron, B	0.246	mg/L		0.05	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	40.5	mg/L		0.3	0.1	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.00111	mg/L		0.0002	0.00005	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	3.14	mg/L		0.1	0.02	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Potassium, K	5.61	mg/L		1	0.2	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Sodium, Na	22.7	mg/L		0.5	0.1	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.498	mg/L		0.01	0.002	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	116	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	11.0	mg/L		0.04	0.01	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.18	mg/L		0.06	0.01	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	217	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	39.5	mg/L		0.4	0.06	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0

pH = 8.70 2/25/2020 13:14 ipn

Location: Flint Creek PS *Report Date: 3/20/2020*

BAP Near Stop Log

Sample Number: 200633-003 **Date Collected: 02/25/2020 13:29** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.07	ug/L	J	0.1	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.71	ug/L		0.1	0.03	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Barium, Ba	79.5	ug/L		0.2	0.05	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	< 0.01	ug/L	U	0.05	0.01	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.1	ug/L	J	0.2	0.04	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.056	ug/L		0.05	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.06	ug/L	J	0.2	0.05	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	1	ug/L	J	2	0.4	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.3	ug/L		0.2	0.03	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Boron, B	0.068	mg/L		0.05	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	34.4	mg/L		0.3	0.1	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000205	mg/L		0.0002	0.00005	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	2.75	mg/L		0.1	0.02	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.87	mg/L		1	0.2	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Sodium, Na	11.7	mg/L		0.5	0.1	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.147	mg/L		0.01	0.002	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	101	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	7.92	mg/L		0.04	0.01	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.08	mg/L		0.06	0.01	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	155	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	16.2	mg/L		0.4	0.06	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0

pH= 7.23 2/25/2020 13:29 ipn

pH= 8.31 2/25/2020 13:23 ipn

Swepco Lake SWEPCO Lake

Sample Number: 200633-004 **Date Collected:** 02/25/2020 13:23 **Date Received:** 2/26/2020

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.08	ug/L	J	0.1	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.70	ug/L		0.1	0.03	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Barium, Ba	113	ug/L		0.2	0.05	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	0.01	ug/L	J	0.05	0.01	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.619	ug/L		0.2	0.04	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.144	ug/L		0.05	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.1	ug/L	J	0.2	0.05	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	2	ug/L	J	2	0.4	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.7	ug/L		0.2	0.03	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Boron, B	0.102	mg/L		0.05	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	38.0	mg/L		0.3	0.1	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000527	mg/L		0.0002	0.00005	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	3.04	mg/L		0.1	0.02	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.94	mg/L		1	0.2	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Sodium, Na	20.7	mg/L		0.5	0.1	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.224	mg/L		0.01	0.002	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	99.8	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	11.7	mg/L		0.04	0.01	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.12	mg/L		0.06	0.01	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	206	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	35.0	mg/L		0.4	0.06	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0

Field Blank

Sample Number: 200633-005 **Date Collected:** 02/25/2020 13:44 **Date Received:** 2/26/2020

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Alkalinity, as CaCO3	< 5	mg/L	U	20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	< 0.01	mg/L	U	0.04	0.01	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Fluoride, F	< 0.01	mg/L	U	0.06	0.01	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	< 20	mg/L	U	50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	< 0.06	mg/L	U	0.4	0.06	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0

Location: Flint Creek PS **Report Date: 3/20/2020**

U: Analyte was analyzed and not detected at or above adjusted Method Detection Limit
J: Analyte was positively identified, though the quantitation was below Reporting Limit.

Michael S Ohlinger

Michael Ohlinger, Chemist

Email msohlinger@aep.com *Tel.*

Fax 614-836-4168 *Audinet 8-210-*

THIS TEST REPORT RELATES ONLY TO THE ITEMS TESTED AND SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT WRITTEN APPROVAL OF THE LABORATORY. ALL TEST RESULTS MEET ALL OF THE REQUIREMENTS OF THE ACCREDITING AUTHORITY, UNLESS OTHERWISE NOTED.

ATTACHMENT E

AP-59 Field Forms

Facility Name	AEP Flint Creek PP
Sample by	Matt Hamilton

Sample Location ID	AP-59

Depth to water, feet (TOC)	20.37
Measured Total Depth, feet (TOC)	33.11

Depth to water date	4/15/2024
Purge Date	4/15/2024

Purge Stabilization Data

Time	Water Depth (from TOC)	Flow Rate (mL/min)	pH (S.U.)	Spec Cond (µS/cm)	Turbidity (N.T.U)	D.O. (mg/L)	ORP (mV)	Temperature (°C)		
1404	20.67	220	5.47	491	142.0	5.00	328	22.21		
1409	20.68	220	6.21	423	48.7	1.07	288	21.04		
1414	20.68	220	6.42	420	5.1	0.95	421	20.71		
1419	20.68	220	6.46	419	5.7	0.90	272	20.63		

Total volume purged	
Sample appearance	Clear
Sample time	1421
Sample date	4/15/2024

Facility Name	AEP Flint Creek PP
Sample by	Matt Hamilton

Sample Location ID	AP-59

Depth to water, feet (TOC)	21.86
Measured Total Depth, feet (TOC)	33.11

Depth to water date	8/19/2024
Purge Date	8/19/2024

Purge Stabilization Data

Time	Water Depth (from TOC)	Flow Rate (mL/min)	pH (S.U.)	Spec Cond (µS/cm)	Turbidity (N.T.U)	D.O. (mg/L)	ORP (mV)	Temperature (°C)		
1409	22.18	220	5.40	453	5.0	1.21	334	27.77		
1414	22.18	220	5.97	419	0.0	0.53	323	24.23		
1419	22.18	220	6.14	410	0.0	0.45	314	23.57		
1424	22.18	220	6.18	407	0.0	0.40	310	23.34		

Total volume purged	
Sample appearance	Clear
Sample time	1426
Sample date	8/19/2024

Resample
pH, Sulfate, Chloride

Facility Name	AEP Flint Creek PP
Sample by	Matt Hamilton

Sample Location ID	AP-59

Depth to water, feet (TOC)	22.54
Measured Total Depth, feet (TOC)	33.11

Depth to water date	11/19/2024
Purge Date	11/19/2024

Purge Stabilization Data

Time	Water Depth (from TOC)	Flow Rate (mL/min)	pH (S.U.)	Spec Cond (µS/cm)	Turbidity (N.T.U)	D.O. (mg/L)	ORP (mV)	Temperature (°C)		
1744	22.87	220	7.01	427	4.9	1.92	376	20.24		
1749	22.87	220	6.97	419	1.2	0.95	350	19.99		
1754	22.87	220	6.93	414	0.0	0.84	348	19.85		
1759	22.87	220	6.92	413	0.0	0.79	344	19.83		

Total volume purged	
Sample appearance	
Sample time	
Sample date	

Resample
pH

ATTACHMENT F

Certification by a Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

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

No. 9846
BETH ANN GROSS

Beth Ann Gross
Printed Name of Licensed Professional Engineer

Beth Ann Gross
Signature

Geosyntec Consultants
2039 Centre Pointe Blvd, Suite 103
Tallahassee, Florida 32308

Arkansas Firm Certificate of
Authorization No. 52
Exp. 12/31/2024

9864	Arkansas	December 19, 2024
License Number	Licensing State	Date

GEOSYNTEC CONSULTANTS
No. 52

ALTERNATIVE SOURCE DEMONSTRATION REPORT

2024 2ND SEMIANNUAL EVENT
FEDERAL CCR RULE

Flint Creek Power Plant
Primary Bottom Ash Pond
Gentry, Arkansas

Prepared for

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

Prepared by

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

Project CHA8495B

December 2024

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ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	alternative source demonstration
bgs	below ground surface
CCR	coal combustion residuals
CFR	Code of Federal Regulations
EPRI	Electric Power Research Institute
LPL	lower prediction limit
PBAP	Primary Bottom Ash Pond
SSI	statistically significant increase
SU	standard units
UPL	upper prediction limit
USEPA	United States Environmental Protection Agency

1. INTRODUCTION AND SUMMARY

This alternative source demonstration (ASD) report has been prepared to address statistically significant increases (SSIs) for boron and chloride in the groundwater monitoring network for the former Primary Bottom Ash Pond (PBAP), located at the Flint Creek Power Plant in Gentry, Arkansas, following the second semiannual detection monitoring event of 2024. The Flint Creek Power Plant has two coal combustion residuals (CCR) storage units, including the former PBAP. The PBAP was certified as having all contained CCR removed by August 2023 and is now operated as a non-CCR wastewater pond (**Figure 1**).

Background groundwater values for the PBAP were originally calculated in January 2018 and have been updated intermittently in accordance with the *Statistical Analysis Plan* prepared for the Flint Creek Plant (Geosyntec Consultants, Inc. [Geosyntec] 2020). For the most recent update in January 2022, revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values (Geosyntec 2022). Prediction limits were calculated based on a one-of-two retesting procedure in accordance with the Unified Guidance (United States Environmental Protection Agency [USEPA] 2009) and the statistical analysis plan developed for the site. With this procedure, an SSI is concluded only if both an initial sample and a resample reported results above the UPL or, in the case of pH, below the lower prediction limit (LPL). In practice, if the initial result was not above the UPL or, for pH, was not below for LPL, a resample was not collected or analyzed.

The second semiannual detection monitoring event of 2024 at the former PBAP was conducted in August (initial sampling event), and the results were compared to the calculated prediction limits. Where initial exceedances were identified, resampling was completed in November 2024. Following resampling, SSIs were identified for boron and chloride at downgradient compliance well AP-58A. No other SSIs were identified. A summary of the Appendix III analytical results for the downgradient compliance wells and the calculated prediction limits to which they were compared is provided in **Table 1**.

1.1 CCR Rule Requirements

USEPA regulations regarding detection monitoring programs for CCR landfills and surface impoundments provide owners and operators with the option to make an ASD when an SSI is identified:

> *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. (Code of Federal Regulations [CFR] Title 40, Section 257.94(e)(2) [40 CFR 257.94(e)(2)]).

Pursuant to 40 CFR 257.94(e)(2), Geosyntec has prepared this ASD report to document that the identified SSIs at AP-58A should not be attributed to a release from the former PBAP.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess alternative sources to which the identified SSI could be attributed. Alternative sources were identified from among 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
- ASD Type V: Anthropogenic Sources

A demonstration was conducted to show that the SSIs identified for boron and chloride at well AP-58A were based on a Type I cause (sampling issues) and not by a direct release from the former PBAP.

2. SUMMARY OF SITE CONDITIONS

Descriptions of the former Flint Creek PBAP design and construction, regional geology and site hydrogeology, and groundwater monitoring systems and flow conditions are presented below.

2.1 PBAP Design and Construction

As described by Terracon (2023), the former PBAP was a 42.8-acre CCR surface impoundment located south of the power plant that was formerly operated as a CCR ash pond. It was constructed from 1974 to 1978 with an approximately 820-foot long cross-valley dam consisting of compacted clayey soil. While it was operational as a CCR surface impoundment, it was used primarily to manage bottom ash.

A Closure Plan for the PBAP was developed in September 2016 and revised in October 2023 (AEP 2023a). This document detailed the closure activities which were to take place throughout the closure of the PBAP. AEP submitted a certified notification that the PBAP ceased receipt of CCR on November 30, 2022, and commenced closure by removal of CCR materials in accordance with the certified closure plan (American Electric Power [AEP] 2022). CCR material removal from the PBAP was completed on August 20, 2023. A photograph showing the condition of the PBAP shortly before completion of CCR removal is provided in **Figure 2**.

2.2 Regional Geology / Site Hydrogeology

As described by Terracon (2023), the PBAP is positioned in an area of the Ozark Plateaus Province that has undergone regional-scale uplift followed by significant incision by rivers, resulting in hilly topography. It is underlain by the Mississippian-aged Boone Formation, which consists primarily of limestone and chert. Locally, the stratigraphy consists of a 30- to 50-foot-thick weathered residuum of the Boone Formation, consisting of heavily-weathered limestone with chert nodules and iron-rich clay, and the underlying massive cherty limestone of the Boone Formation.

The Boone Formation is underlain by the Mississippian-aged St. Joe Member, which is a light-grey crystalline limestone that has not experienced significant physical or chemical weathering and is distinct from the Boone Formation due to its lack of chert and clay.

The Boone residuum, the underlying Boone Formation cherty limestone, and the underlying St. Joe Member collectively comprise a single hydrostatic unit known as the Boone–St. Joe Aquifer. This aquifer is underlain by the Chattanooga Shale, a black, fissile shale that acts as a barrier to vertical flow from the aquifer unit above.

Geologic cross sections near the PBAP presented by Terracon (2023) are provided as **Attachment A**. These cross sections show the Boone residuum (described as a silty clay on the cross sections) and cherty limestone Boone Formation underlying the clayey berm of the PBAP.

Three distinct zones of groundwater flow have been identified within the Boone–St. Joe Aquifer at the site: Uppermost, Intermediate, and Deep (AEP 2023b). Perched groundwater is occasionally present within upper unconsolidated soils but is not continuous throughout the site and does not constitute an aquifer unit. All monitoring wells in the PBAP monitoring well network monitor the uppermost aquifer, which is defined as the upper portion of the Boone Formation (Terracon 2023).

2.3 Groundwater Monitoring Systems and Flow Conditions

The monitoring well network (**Figure 1**) includes three upgradient background wells (AP-51, AP-53, and AP-54) and three downgradient compliance wells (AP-58A, AP-59, and AP-60).

Monitoring well AP-58 was screened entirely within competent limestone (see cross sections in **Attachment A** and on the boring log and well construction diagrams provided in **Attachment B**). Monitoring well AP-58 was found to be irreparably damaged during a sampling event in September 2022 and was replaced in November 2022 by AP-58A. Following the discovery of damage to the AP-58 well casing, the well was plugged and monitoring well AP-58A was installed approximately 10 feet south of AP-58's location and screened at the same interval (AP-58 was screened from 58.45 to 68.45 feet below ground surface [bgs], and AP-58A is screened from 61.30 to 71.30 feet bgs) (**Attachment B**). No structural features were noted within the screened intervals of AP-58 or AP-58A.

Potentiometric maps showing groundwater flow contours for the Uppermost Aquifer during the August 2024 initial sampling and November 2024 resampling events are provided as **Attachment C**. The groundwater flow direction is generally to the west and northwest. Hydraulic connectivity within the Uppermost Aquifer was determined by Terracon (2023) to be related to multiple factors including lithology, rock type, layer thickness, and degree of bedrock fracture. Seasonal variability in the groundwater flow direction and hydraulic gradient has not been observed since the monitoring well network was installed.

3. ALTERNATIVE SOURCE DEMONSTRATION

The methods used to assess possible alternative sources of the SSIs for boron and chloride at AP-58A as well as the proposed alternative source for these SSIs are described below.

3.1 Proposed Alternative Source

3.1.1 Monitoring Well AP-58A

A review of groundwater sampling field forms identified an alternative source for the boron and chloride SSIs at AP-58A due to Type I (sampling) issues. As discussed in Section 2.3, well AP-58A was installed in November 2022 after it was discovered in September 2022 that well AP-58 was irreparably damaged. Boring logs and well construction diagrams for both AP-58 and AP-58A are provided in **Attachment B**. Well AP-58A is located approximately 10 feet south of previous well AP-58 and screened at approximately the same elevation. Thus, groundwater collected from AP-58A should reflect conditions previously observed at former well AP-58.

A Piper diagram, which represents the relative concentrations of major cations and anions in the groundwater, was created to visualize groundwater geochemistry at both AP-58 and AP-58A (**Figure 3**). The diagram indicates that groundwater samples from AP-58 did not begin to show consistency within major ion chemistry until around August 2019 (as indicated by the solid red symbols on the Piper diagram), at which point the monitoring well had equilibrated with the aquifer approximately 3.5 years after it was installed in February 2016. Changes in both the cation and anion composition of AP-58 groundwater was observed over time following installation. While the cationic composition of groundwater at AP-58A is generally stable over time, the change in anionic composition since installation is similar between AP-58 and AP-58A. The relative proportion of anions in the August 2024 sample collected from AP-58A (two years after well installation) is nearly identical to samples collected from AP-58 two years after installation of the well but before the groundwater had equilibrated (March 2019 sample, **Figure 3**).

These results suggest that both AP-58 and AP-58A require(d) time after installation to equilibrate with the aquifer before the collected samples are representative of stable geochemical conditions. These findings suggest that geochemical trends at AP-58A are consistent with those observed at AP-58 following installation, and further shifts in geochemistry are expected to occur gradually over the next one to two years. This is generally consistent with guidance from USEPA, which has noted that time should be allowed for equilibration of a newly installed well after installation and "there may be a period (i.e., days to months) during which water quality near the [installed well] may be distinctly different from that in the formation" due to the disturbance of ambient conditions (USEPA 2015). This is particularly true for drilling techniques, such as the air-rotary technology used to install AP-58A, compared to direct-push technologies.

Similar post-installation trends have been observed for boron concentrations at AP-58 and AP-58A to date (**Figure 4**), providing further evidence of gradual equilibration. While concentrations of chloride at AP-58A have not decreased at the same rate as AP-58 (**Figure 5**), comparisons of potassium and sodium concentrations at AP-58 and AP-58A show similar trends after installation (**Figure 6**). Based on the geochemical trends associated with gradual equilibration at AP-58, AP-58A chloride concentrations are expected to continue to decrease over the next one to two years.

A comparison of concentrations of relevant parameters from various PBAP samples to both groundwater concentrations at AP-58A and the established intrawell UPLs supports the position that the SSIs observed at AP-58A should not be attributed to the PBAP. Two surface water samples with sample IDs of ‘BAP’ and ‘BAP – Near Stop Log’ were collected from the PBAP in March 2020. The PBAP was dewatered and removal of CCR from the PBAP was completed by August 2023, prior to the August and November 2024 sampling events associated with the second semiannual detection monitoring event of 2024. Therefore, no updated PBAP water samples can be collected, and the 2020 surface water samples are the best existing approximation of CCR-influenced material which may potentially impacting compliance monitoring wells. The laboratory analytical report for the March 2020 surface water sampling event is provided as **Attachment D**. Reported values of boron and chloride from the PBAP samples are shown compared to the AP-58A UPL and recent samples from AP-58A (**Table 2**). Boron and chloride concentrations were notably greater in AP-58A groundwater samples than in both samples collected from the PBAP. This provides further support that the PBAP is not a source of the apparent elevated concentrations of boron and chloride in AP-58A groundwater.

4. 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 SSIs for boron and chloride at AP-58A during the second semiannual detection monitoring event of 2024 should be attributed to sampling issues and not to a release from the Flint Creek PBAP. Therefore, no further action is warranted. Certification of this ASD by a qualified professional engineer is provided in **Attachment E**.

5. REFERENCES

AEP. 2022. *Notification of Intent to Close a CCR Unit. Flint Creek Plant – Primary Bottom Ash Pond*. American Electric Power. November.

AEP. 2023a. *Closure Plan. Flint Creek Plant – Primary Bottom Ash Pond*. American Electric Power. October.

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Terracon. 2023. *Groundwater Monitoring Network for CCR Compliance. SWEPCO – Flint Creek Primary Bottom Ash Pond*. October.

USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance*. United States Environmental Protection Agency. EPA 530/R-09-007.

USEPA. 2015. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*. United States Environmental Protection Agency. EPA 540/S-95/504. April.

TABLES

Table 1. Detection Monitoring Data Summary
Flint Creek – Primary Bottom Ash Pond

Analyte	Unit	Description	AP-58A		AP-59		AP-60
			8/20/2024	11/19/2024	8/20/2024	11/19/2024	8/20/2024
Boron	mg/L	Intrawell Background Value (UPL)	0.276		0.368		1.68
		Analytical Result	**0.579**	**0.592**	0.300	--	0.545
Calcium	mg/L	Intrawell Background Value (UPL)	86.8		53.9		49.9
		Analytical Result	19.1	--	44.4	--	46.4
Chloride	mg/L	Intrawell Background Value (UPL)	10.2		18.0		17.4
		Analytical Result	**20.4**	**21.0**	17.9	--	17.0
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00		0.765		0.681
		Analytical Result	0.42	--	0.41	--	0.32
pH	SU	Intrawell Background Value (UPL)	8.7		7.6		10.8
		Intrawell Background Value (LPL)	6.2		6.7		6.5
		Analytical Result	7.1	--	**6.2**	6.9	6.8
Sulfate	mg/L	Intrawell Background Value (UPL)	90.3		50.1		190
		Analytical Result	59.8	--	30.0	--	78.3
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	333		266		397
		Analytical Result	270	--	230	--	270

Notes:

1. Bold values exceed the background value.

2. Background values are shaded gray.

--: not measured

LPL: lower prediction limit

mg/L: milligrams per liter

SU: standard units

UPL: upper prediction limit

Table 2. AP-58A and PBAP Water Boron and Chloride Data
Flint Creek Plant – Primary Bottom Ash Pond

Source	Sample Date	Parameter	
		Boron	Chloride
AP-58A UPL	N/A	0.276	10.2
BAP	2/25/2020	0.246	11.0
BAP Near Stop Log	2/25/2020	0.0688	7.92
AP-58A	8/20/2024	0.579	20.4
AP-58A	11/19/2024	0.592	21.0

Notes:

1. All parameters are shown in units of milligrams per liter.
2. Results greater than the AP-58A UPL are highlighted in red and results lower than the AP-58A UPL are highlighted in green.
3. Samples collected from the PBAP were labeled as 'BAP', as shown in the table and in the data provided in Attachment D.
4. AP-58A analytical results are compared to intrawell prediction limits calculated using AP-58 background data, as insufficient data is available from AP-58A to calculate prediction limits at this time.

N/A: not applicable

UPL: upper prediction limit

FIGURES

Legend

⊕ Monitoring Wells

▭ Approximate Unit Boundary

Notes

1. Monitoring well coordinates were collected December 12, 2022; data provided by AEP.
2. AP-58 had irreparable damage and was replaced by well AP-58A.
3. Site features are based on information available in the Groundwater Monitoring Well NetworkEvaluation (Terracon 2023) provided by AEP.
4. Aerial basemap provided by the Northwestern Arkansas Regional Planning Commision (2024).

200 100 0 200 Feet

Site Layout

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

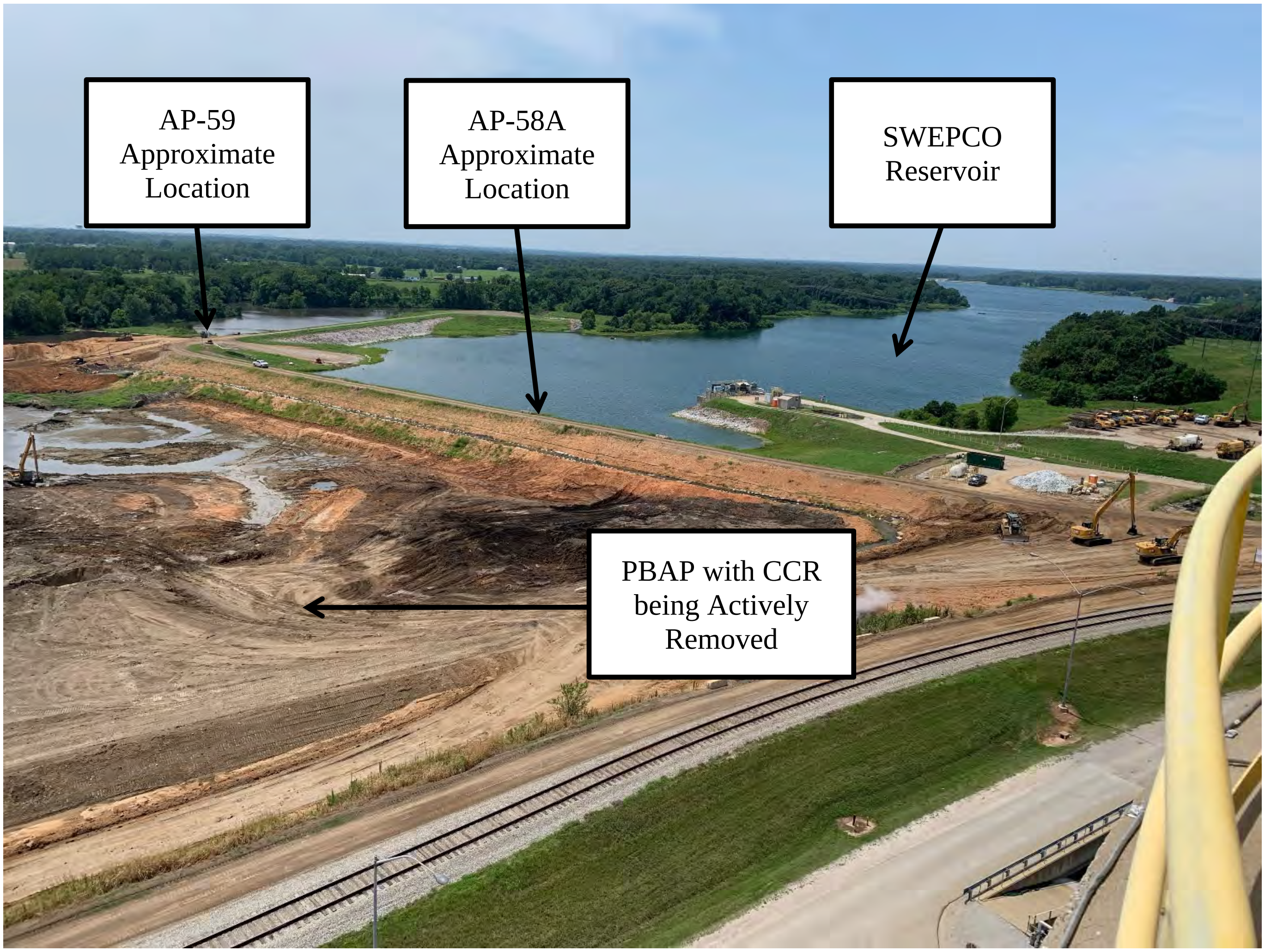
Geosyntec consultants

Columbus, Ohio | 2024/12/13

Figure

1

\\annarbor-01\Data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2024\Flint Creek PBAP Site Layout_ASD.mxd. ASoltero. 12/13/2024. CHA8423/01/08.



Notes:

1. Photograph taken looking southwest on July 25, 2023 prior to the completion of CCR removal.
2. AP-58A is located on the center dike shown in the photograph.

PBAP Site Photograph

Flint Creek Primary Bottom Ash Pond

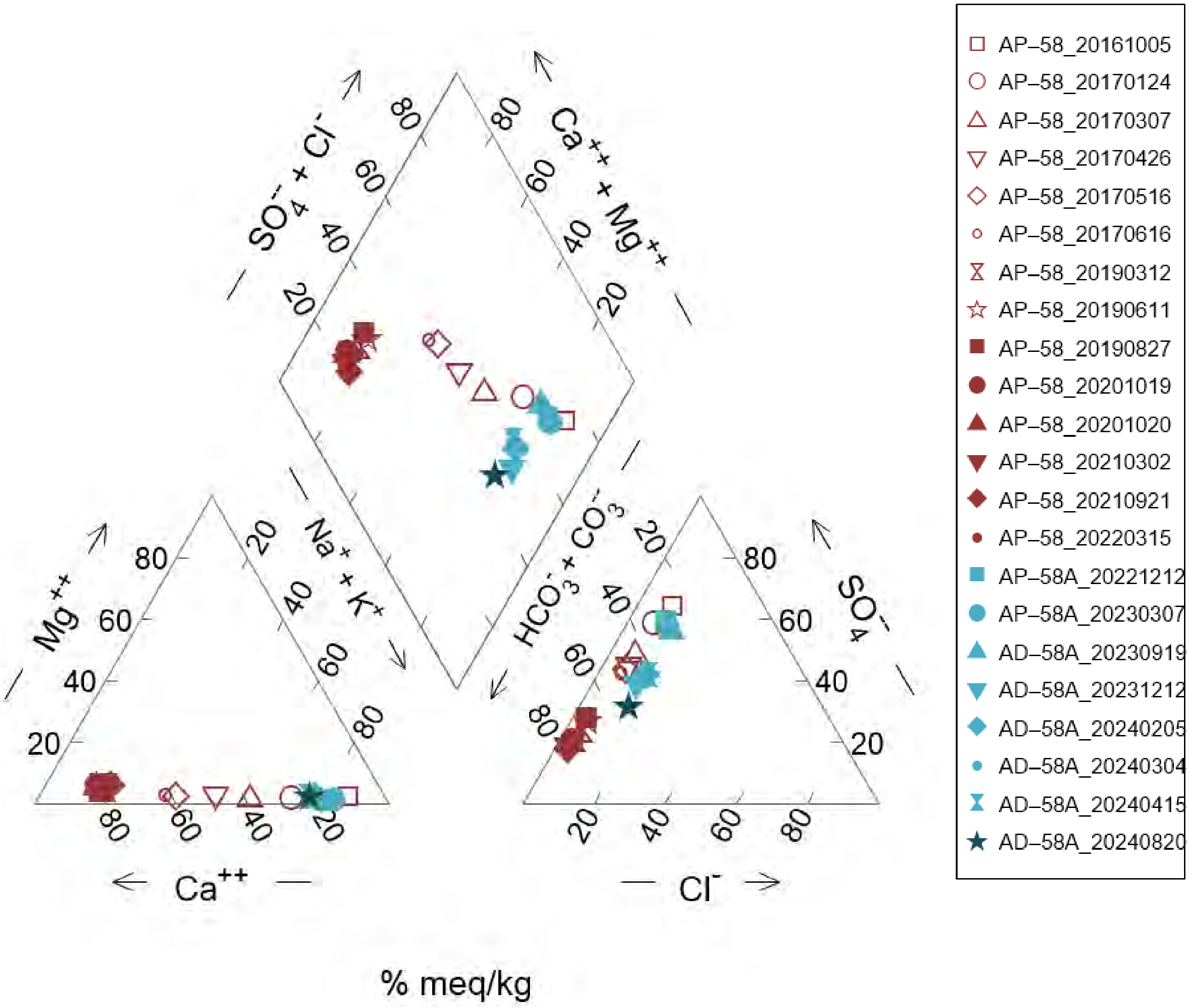
Geosyntec consultants

AMERICAN ELECTRIC POWER

Columbus, Ohio

December 2024

Figure **2**



Notes:
1. Samples from AP-58 and AP-58A that were analyzed for all major ions are shown on the Piper diagram in units of percentage of milliequivalents per kilogram (% meq/kg) for major cations (bottom left triangle) and major anions (bottom right triangle).

Piper Diagram

Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

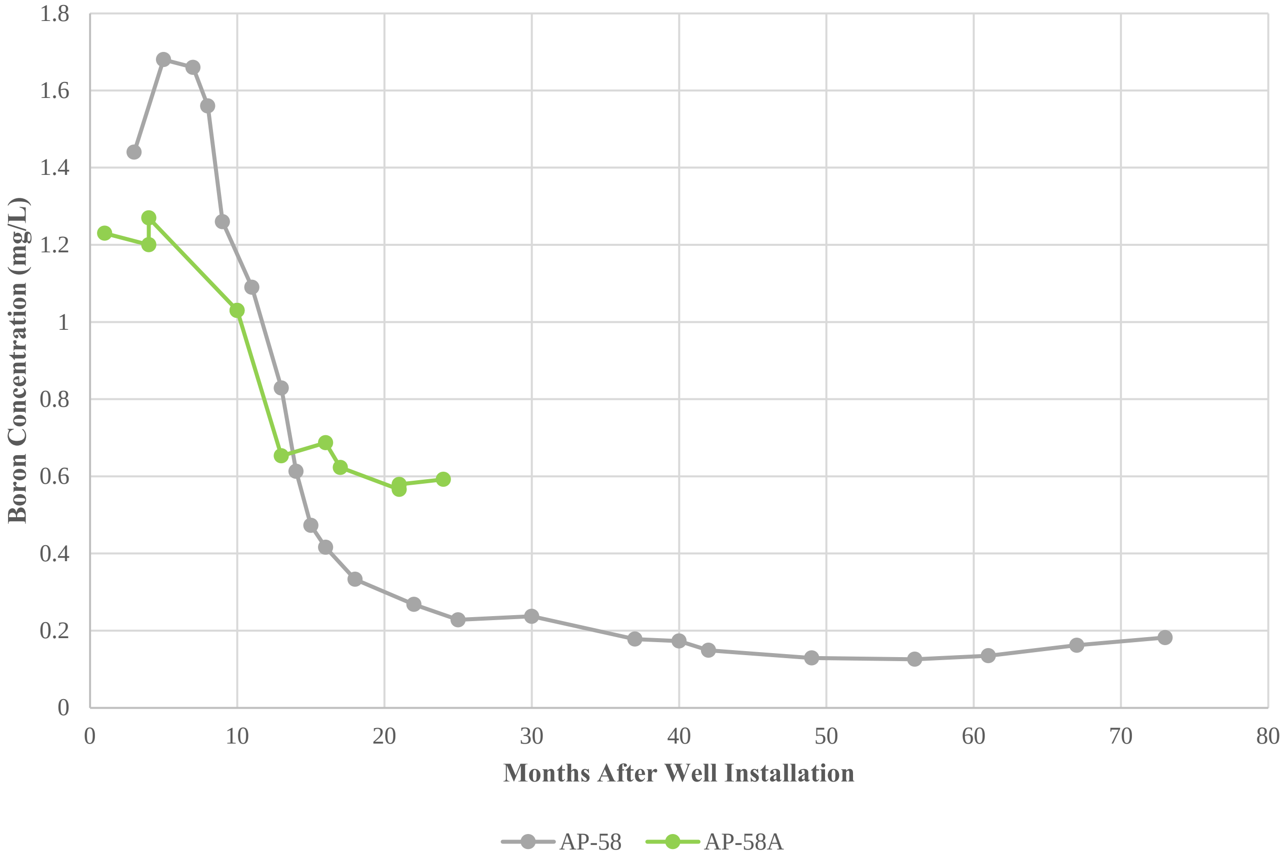
AMERICAN ELECTRIC POWER

Columbus, Ohio

December 2024

Figure

3



Notes:

1. Boron concentrations are shown in milligrams per liter (mg/L).
2. Monitoring well AP-58 was installed in February 2016 and ceased use in September 2022 after it sustained irreparable damage.
3. AP-58A was installed in November 2022 to replace AP-58.

AP-58 and AP-58A Boron Comparison

Flint Creek Primary Bottom Ash Pond

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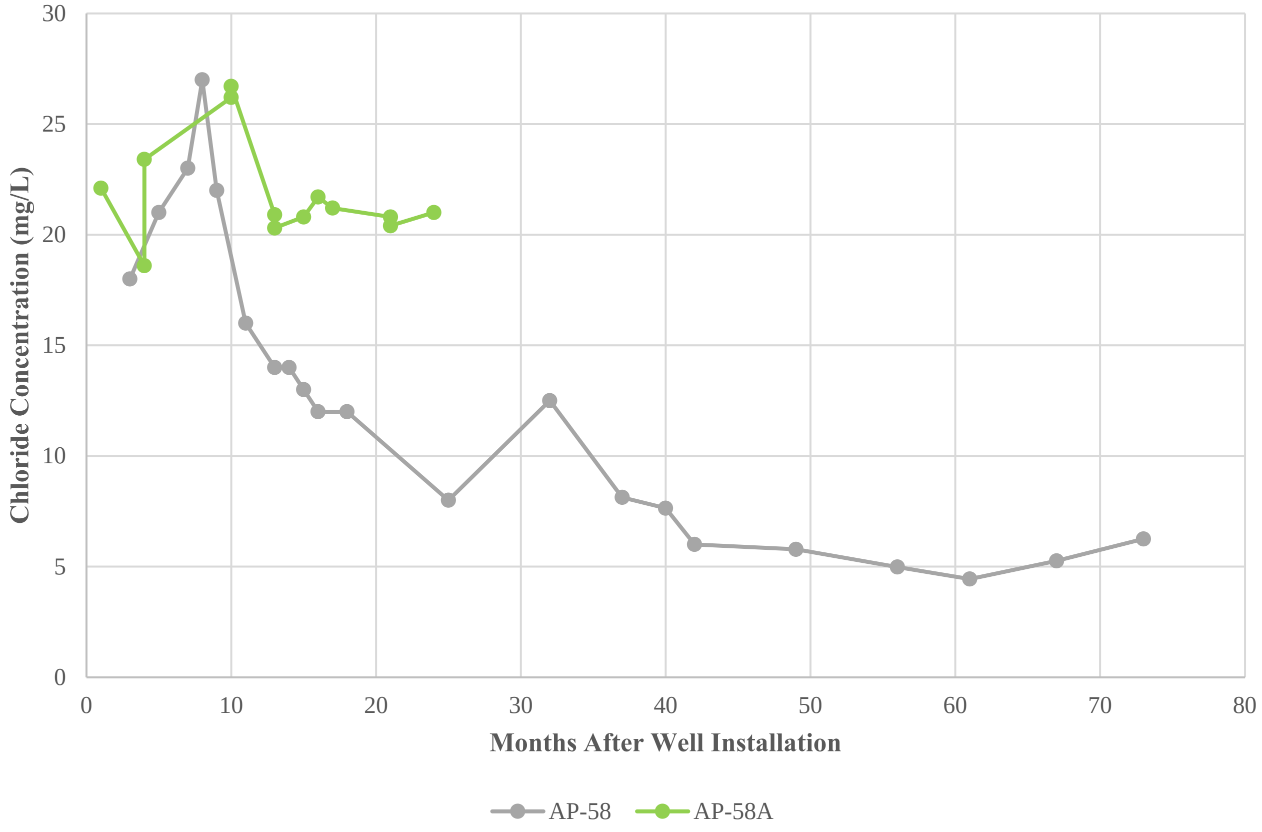
AMERICAN ELECTRIC POWER

Figure

4

Columbus, Ohio

December 2024



Notes:
1. Chloride concentrations are shown for in milligrams per liter (mg/L).
2. Monitoring well AP-58 was installed in February 2016 and ceased use in September 2022 after it sustained irreparable damage.
3. AP-58A was installed in November 2022 to replace AP-58.

AP-58 and AP-58A Chloride Comparison

Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

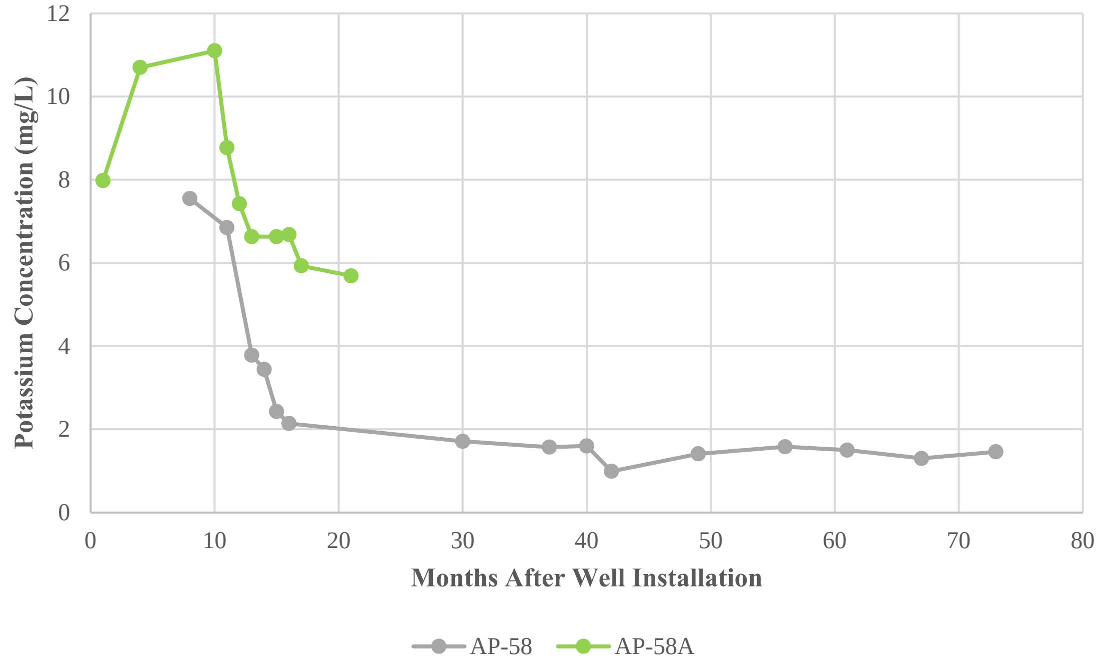
AMERICAN ELECTRIC POWER

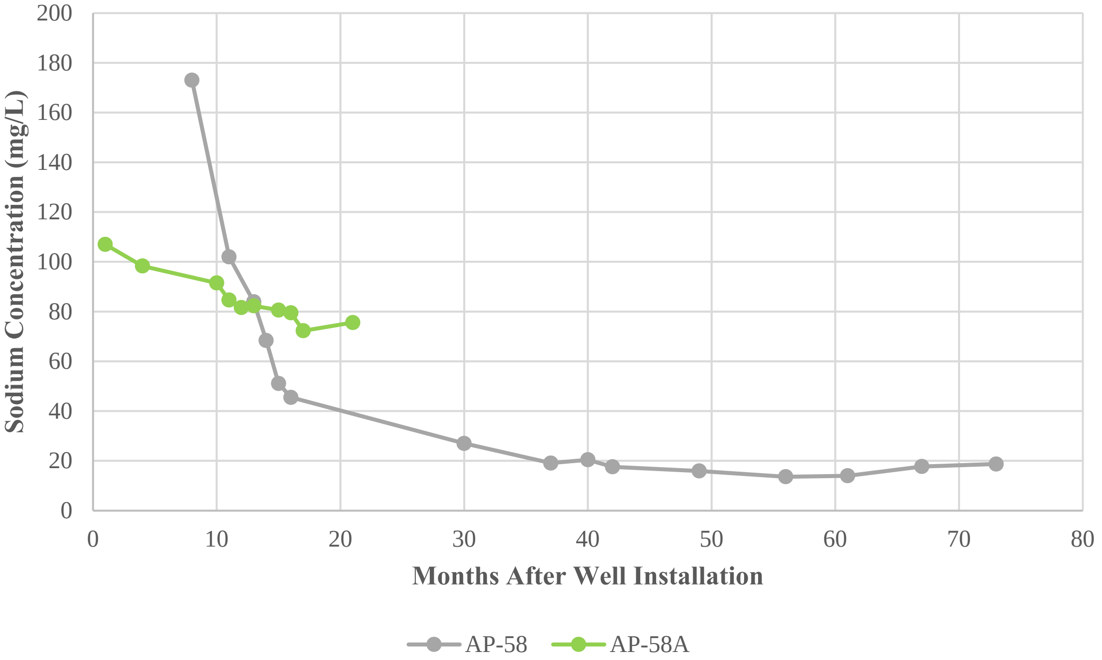
Figure

5

Columbus, Ohio

December 2024





Notes:

1. Potassium and sodium concentrations are shown for in milligrams per liter (mg/L).
2. Monitoring well AP-58 was installed in February 2016 and ceased use in September 2022 after it sustained irreparable damage.
3. AP-58A was installed in November 2022 to replace AP-58.

AP-58 and AP-58A Potassium and Sodium Comparison

Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

AMERICAN ELECTRIC POWER

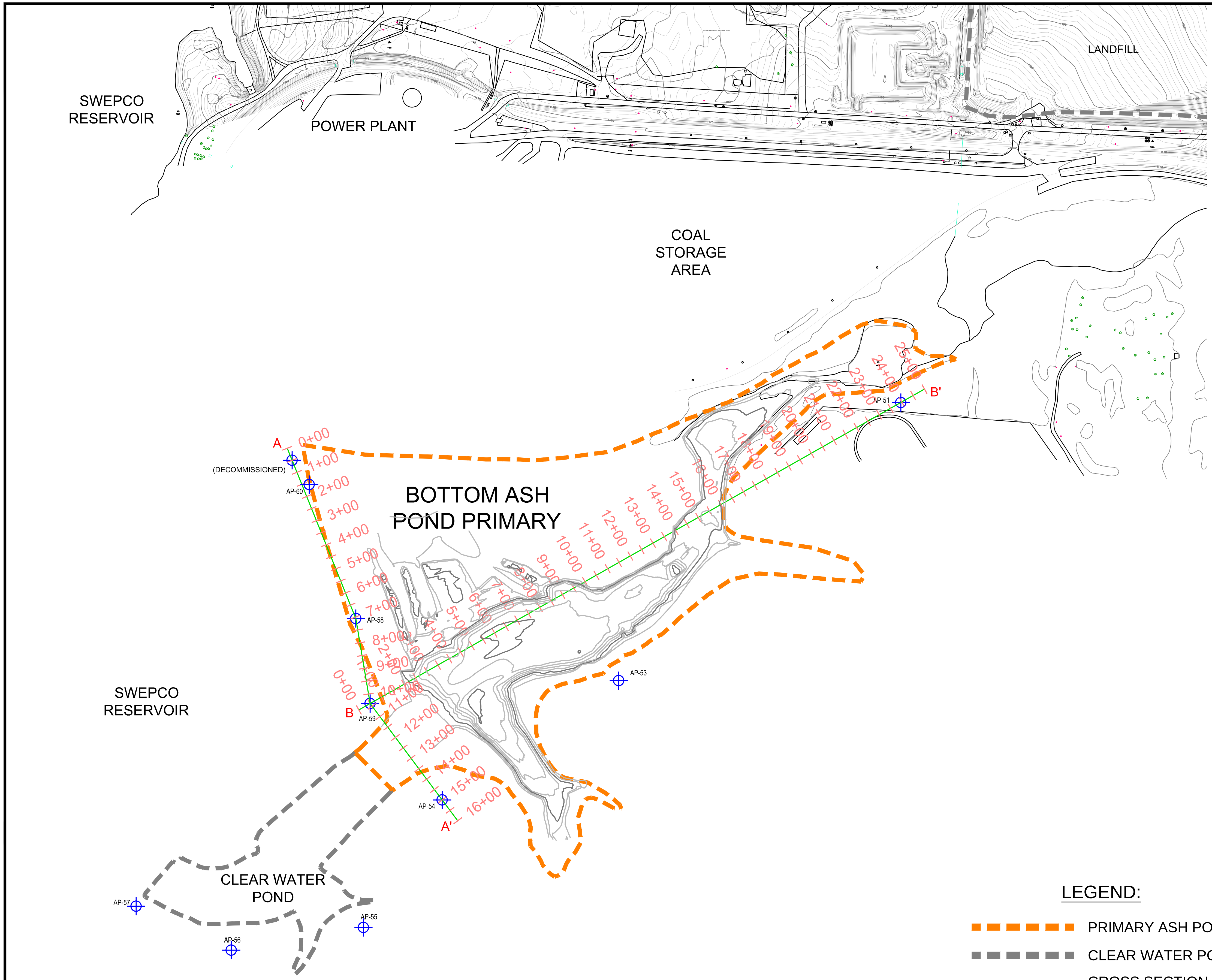
Figure

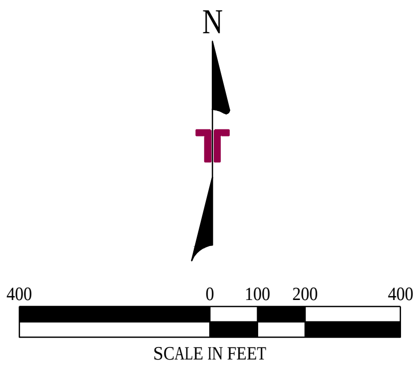
6

Columbus, Ohio

December 2024

ATTACHMENT A
Geologic Cross Sections





NOTE:
CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WERE TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
SURVEY PROVIDED BY AEP, AND IS A COMPOSITE OF AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED APRIL 30, 2015 AND A HYDROGRAPHIC SURVEY PERFORMED BY AEP, DATED AUGUST 12, 2004.

UPPERMOST AQUIFER:
DATA FROM SAMPLING EVENTS PERFORMED BY TERRACON CONSULTANTS, INC., DATING FROM JUNE 8, 2011 THROUGH MARCH 15, 2016.

WELL AP-52 WAS DECOMMISSIONED IN DECEMBER OF 2016 AND REPLACED WITH AP-60.

LEGEND:

▬ ▬ ▬ PRIMARY ASH POND BOUNDARY (THIS REPORT)
▬ ▬ ▬ CLEAR WATER POND/LANDFILL BOUNDARY (NEARBY OTHERS)
── CROSS SECTION LOCATION
⌖ MONITORING WELL

SHEET 1

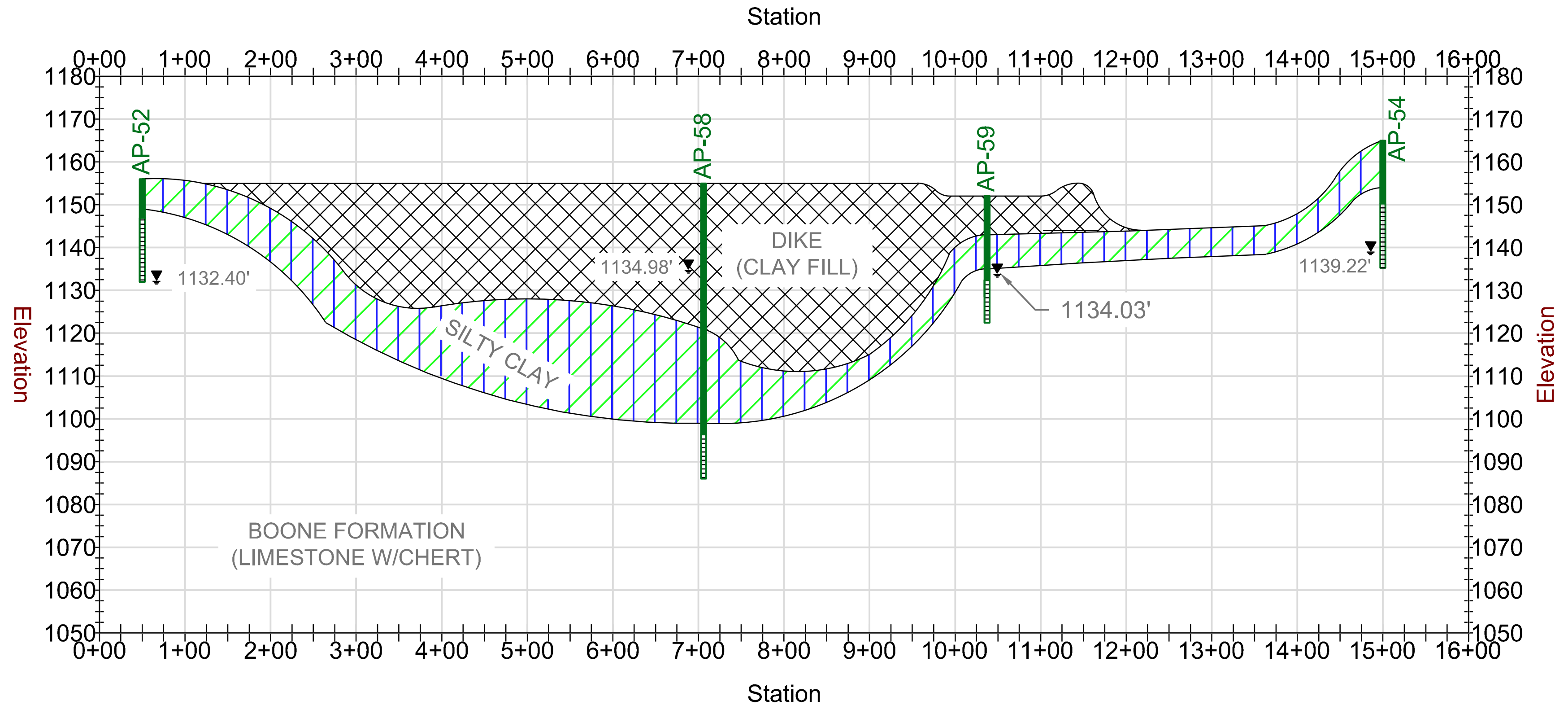
DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	001
SHEET NO.:	1 OF 2

CROSS SECTION LOCATION MAP
GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTPONDOM ASH
GENTRY ARKANSAS

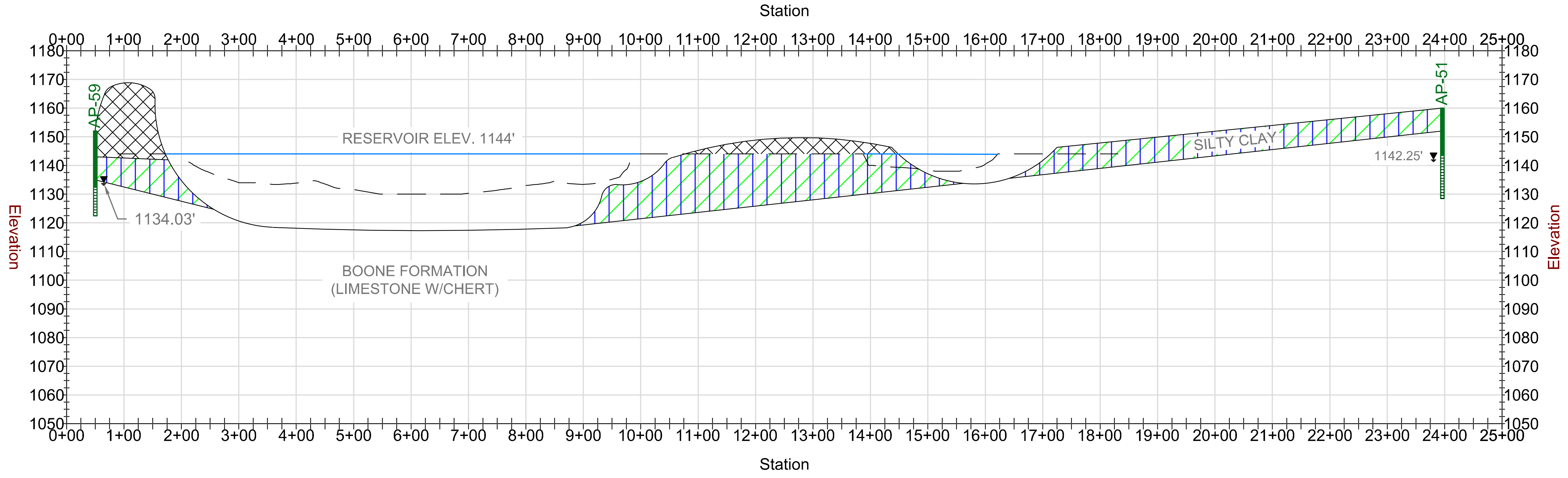
Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9292 FAX. (501) 847-9210

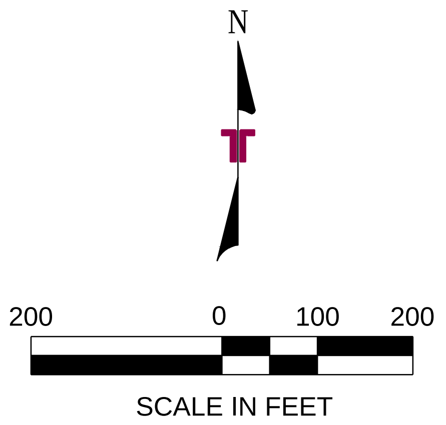
REV.	DATE	BY	DESCRIPTION

ALIGN- A-A'



ALIGN- B-B'





LEGEND:

▨	DIKE (CLAY FILL)
▨	SILTY CLAY

SHEET 2

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	001
SHEET NO.:	2 OF 2

CROSS SECTION A-A' & B-B'

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTPONDOM ASH
GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9292 FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

ATTACHMENT B

AP-58 and AP-58A Boring Logs and Well Construction Diagrams

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: AP-58 PAGE: 1 of 2

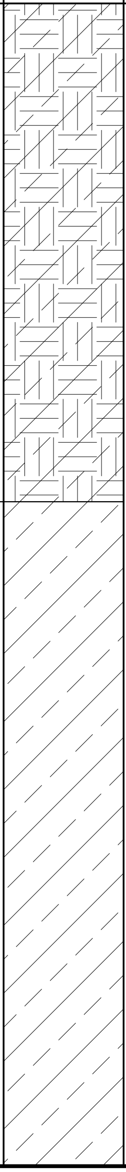
TOTAL DEPTH: 69 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-002	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER	DRILLER: GARY MOYERS
DATE DRILLED: 2/16/2016	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY

SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

N: N/A E: N/A G.S. ELEV. N/A

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
			Flush - mounted boring
0	0'-15' SILTY CLAY - FILL brown and red, poor sample return		
5			
10			
15	15'-56' SILTY CLAY red, moist zones at 30' - 40' and 45' - 50'		
20			
25			
30			

Terracon
Consulting Engineers and Scientists

25809 I-30 South
BRYANT, AR. 72022
PH. (501) 847-9292
FAX. (501) 847-9210

FIELD BORING LOG

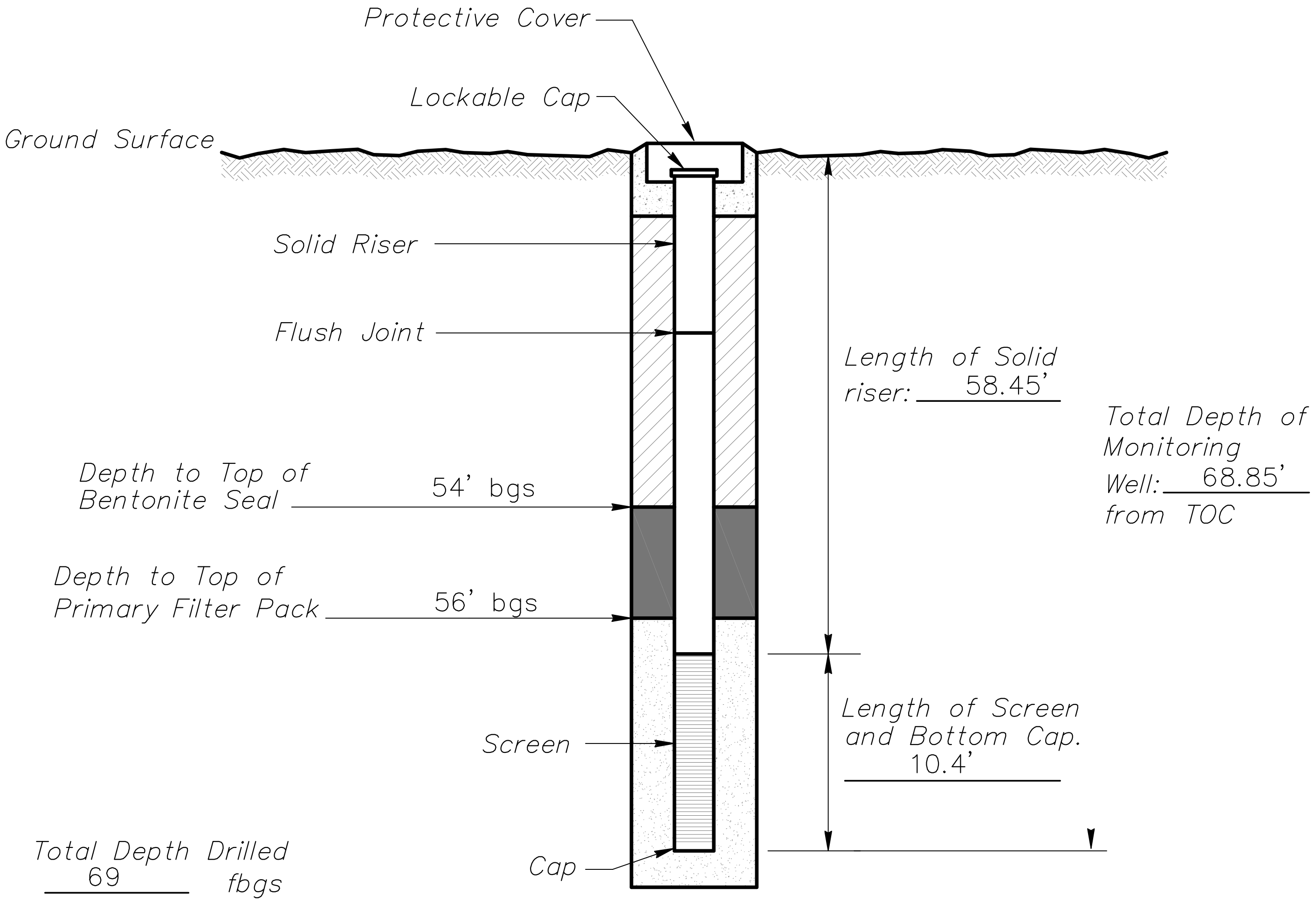
BORING NO.: AP-58 PAGE: 2 of 2

TOTAL DEPTH: 69 FEET BELOW GROUND SURFACE (BGS)

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
	15'-56' SILTY CLAY red, moist zones at 30' - 40' and 45' - 50'	▨	
40			
45			
50			
55			
	56'-69' LIMESTONE gray, crystalline	▦	56' - 59' bgs logged by cuttings
60			
65			
	Total Depth of Boring at 69' bgs		
70			
75			

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION
Well Number AP–58
Job Number 35157182
Installation Date 2/16/2016
Location AEP–FLINT CREEK –GENTRY, AR.
Datum Elevation NA
Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC
Slot Size 0.010
Riser Diameter & Material 2" PVC
Borehole Diameter 8"
Granular Backfill Material 16–30 SAND
Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY
Drilling Contractor ANDERSON ENGINEERING



Length of Solid riser: 58.45'

Total Depth of Monitoring Well: 68.85' from TOC

Depth to Top of Bentonite Seal 54' bgs

Depth to Top of Primary Filter Pack 56' bgs

Length of Screen and Bottom Cap. 10.4'

Total Depth Drilled 69 fbgs

▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

(Not to Scale)

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35157182
WELL NUMBER: AP–58
DRAWING NUMBER: 006
CHECKED BY: MR

25809 Interstate 30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: AP-58A PAGE: 1 of 2

TOTAL DEPTH: 71.7' FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: FLINT CREEK - CCR WELL INSTALLATION

JOB NO.: 216-001-35237104-001

DRILLING CO.: SUNBELT

LOGGED BY: JOSH RAY

DRILLER: NEAL FARRAR AR License #C001451

DATE DRILLED: 11/21/2022

RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY

SAMPLING METHOD: 5' CONTINUOUS SAMPLER / AIR ROTARY

N: 707805.248 E: 1255854.857 G.S. ELEV. 1155.71

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-15' SILTY CLAY - FILL brown and red, poor sample return	▦	
5		▦	
10		▦	
15	15'-55' SILTY CLAY red, moist zones at 40'	▨	
20		▨	
25		▨	
30		▨	

FIELD BORING LOG

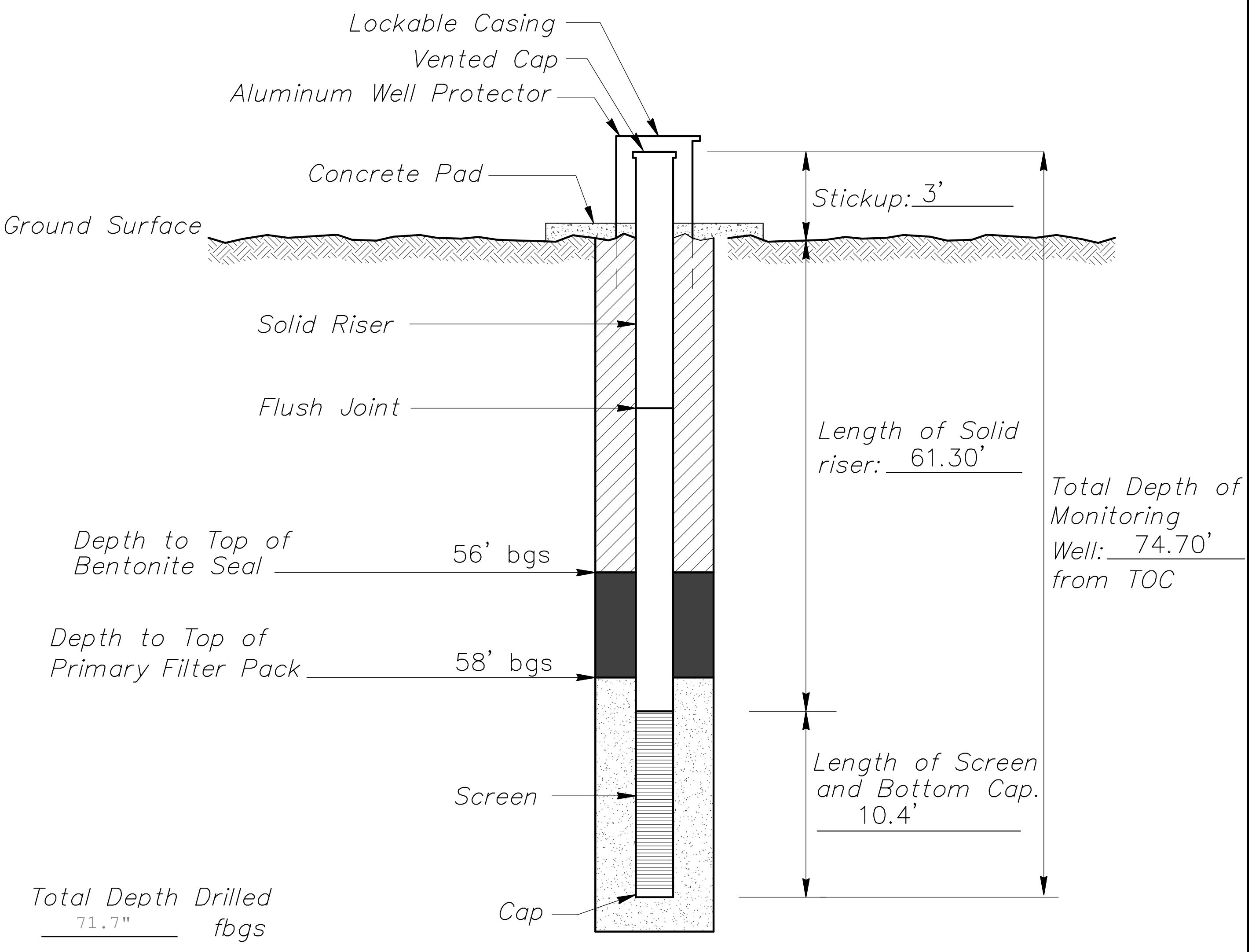
BORING NO.: AP-58A PAGE: 2 of 2

TOTAL DEPTH: 71.7' FEET BELOW GROUND SURFACE (BGS

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
	15'-55' SILTY CLAY red, moist zones at 40'	▨	
40		▨	
45		▨	
50		▨	Groundwater encountered above bedrock, and rose to static level of 20.90' below TOC
55	55'-70' LIMESTONE gray, crystalline	▦	55' - 70' bgs logged by cuttings, wet
60		▦	
65		▦	
70	Total Depth of Boring at 71.7' bgs		
75			

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION Well Number AP–58A
Job Number 35237104 Installation Date 11/21/2022 Location AEP–FLINT CREEK–GENTRY, AR.
Datum Elevation 1158.57 ' NGVD29 Vertical Datum Surface Elevation 1155.71' NGVD29 Vertical Datum
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010 "
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16–30 SAND Terracon Representative JOSH RAY
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor SUNBELT



▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

(Not to Scale)

Terracon

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35237104
WELL NUMBER: AP–58A
DRAWING NUMBER: 002 CHECKED BY: MR

ATTACHMENT C

Potentiometric Surface Maps, Uppermost Aquifer
August 2024 and November 2024

Legend

⊕ Monitoring Wells

— Groundwater Contour Elevation

→ Groundwater Flow Direction

- - - Groundwater Contour Elevation (Inferred)

▭ Approximate Unit Boundary

Notes

1. Monitoring well water level data were collected August 19 and 20, 2024; data provided by AEP.
2. AP-58 was irreparably damaged and was replaced by well AP-58A.
3. Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2023) provided by AEP.
4. Groundwater elevation units are feet above mean sea level (ft amsl).
5. Well locations resurveyed on February 2 and 3, 2023 (Datum: AR SP North NAD27, NGVD29).
6. Aerial basemap provided by the Northwestern Arkansas Regional Planning Commission (2024).

STATE OF ARKANSAS
LICENSED PROFESSIONAL ENGINEER
No. 9846
BETH ANN GROSS

Beth Ann Gross
12/19/2024

250 125 0 250
Feet

CERTIFICATE OF AUTHORIZATION
GEOSYNTEC CONSULTANTS
No. 52
ARKANSAS

Potentiometric Surface Map
Uppermost Aquifer - August 2024

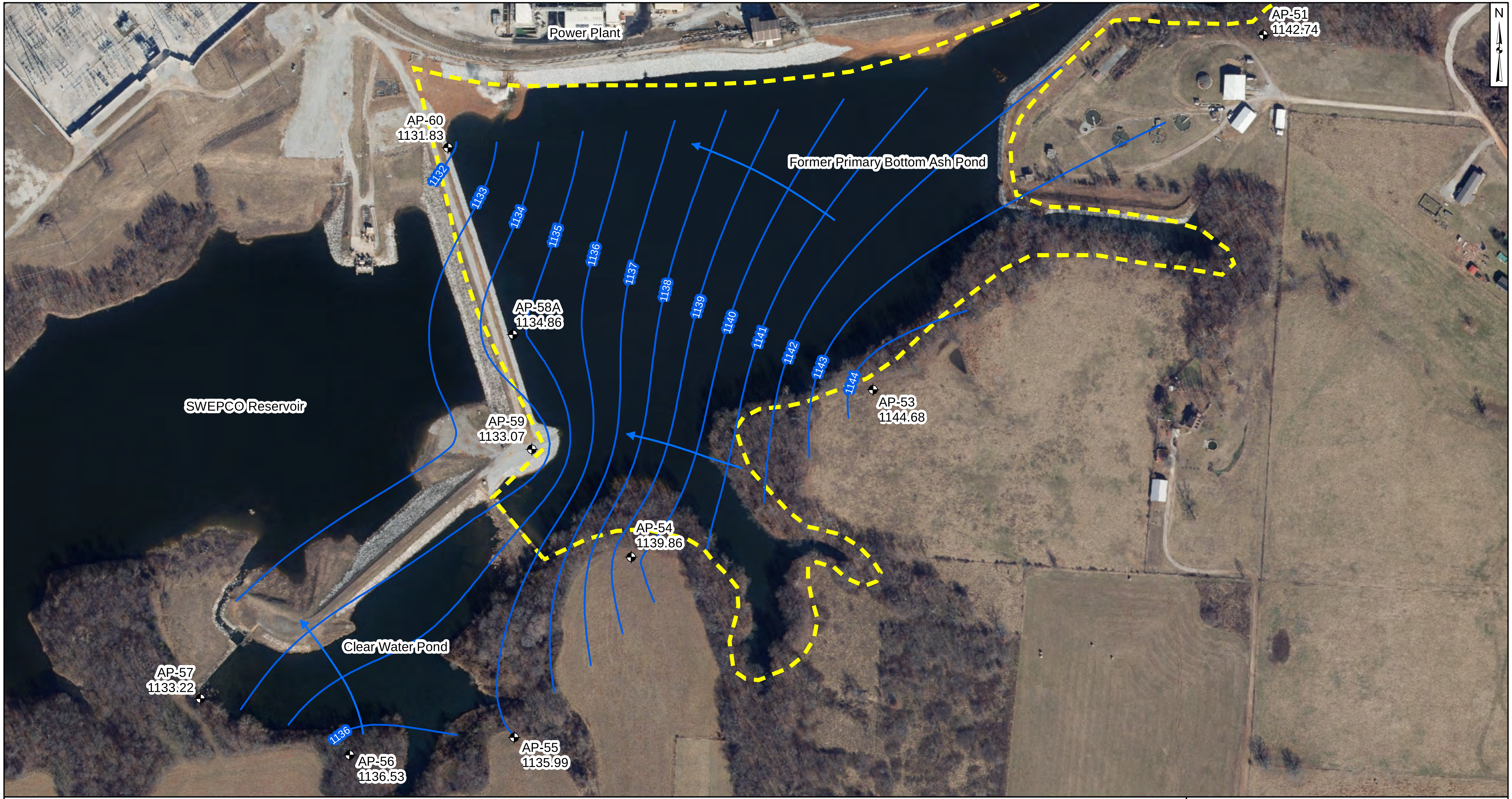
AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

Geosyntec
consultants

Figure
C-1

Columbus, Ohio
2024/12/13

\\annarbor-01\Data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2024\AEP-Flint Creek_GW_BAP_Aug2024.mxd. ASoltero. 12/13/2024. CHA8423/01/08.



Legend

⊕	Monitoring Wells
—	Groundwater Contour Elevation
→	Groundwater Flow Direction
▭	Approximate Unit Boundary

Notes

1. Monitoring well coordinates and water level data (water levels were collected November 19, 2024) provided by AEP.
2. AP-58 was irreparably damaged and was replaced by well AP-58A.
3. Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2023) provided by AEP.
4. Groundwater elevation units are feet above mean sea level (ft amsl).
5. Well locations resurveyed on February 2 and 3, 2023 (Datum: AR SP North NAD27, NGVD29).
6. Aerial basemap provided by the Northwestern Arkansas Regional Planning Commission (2024).

State of Arkansas Licensed Professional Engineer No. 9846 Beth Ann Gross

Beth Ann Gross
12/27/2024

250 125 0 250
Feet

Certificate of Authorization Geosyntec Consultants No. 52 Arkansas

Potentiometric Surface Map
Uppermost Aquifer - November 2024

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

Geosyntec
consultants

Columbus, Ohio
2024/12/23

Figure
C-2

A:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2024\AEP-Flint Creek_GW_BAP_Nov2024.mxd. Okiemute.Commander. 12/23/2024. CHA8423/01/08.

ATTACHMENT D

Surface Water Samples
Laboratory Analytical Report

Dolan Chemical Laboratory (DCL)
4001 Bixby Road
Groveport, Ohio 43125
Contacts: **Michael Ohlinger (614-836-4184)**
Dave Conover (614-836-4219)

Chain of Custody Record

Program: Coal Combustion Residuals (CCR)

Site Contact:

Date:

For Lab Use Only:
COC/Order #:

Project Name: CCR
Contact Name:
Contact Phone:
Sampler(s): Ivaunna Neigler Nicole Morrall

Analysis Turnaround Time (in Calendar Days)
● Routine (28 days for Monitoring Wells)

Shipping confirmation sent to recipients below:
nmorrall@aep.com
ipneigler@aep.com
cmhubbell@aep.com

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Sampler(s) Initials	250 mL bottle, pH<2, HNO3 B, Ca, Li, Sb, As, Ba, Be, Cd, Cr, Co, Pb, Mo, Se, TL and Na, K, Mg, Sr	~~Three (six every 10th*) 1L bottles, pH<2, HNO3~~ ~~Ra-226, Ra-228~~	1 L + 250 mL bottles, Cool, 0-6C TDS, F, Cl, SO4, and Br, Alkalinity	~~40 mL Glass vial or 250 mL PTFE lined bottle, HCL**, pH<2~~ ~~Hg~~	~~Field-filter 250 mL bottle, then pH<2, HNO3~~ ~~dissolved Fe and dissolved Mn~~		Contains extra parameters	Sample Specific Notes:
Low Volume Waste Outlet Combined	2/25/20	13:03	G	GW	2	NM	X		X					<4°C
Bottom Ash Pond	2/25/20	13:14	G	W	2	NM	X		X					<4°C
BAP near Stop Log	2/25/20	13:29	G	W	2	NM	X		X					<4°C
SWEPCO Lake	2/25/20	13:23	G	W	2	NM	X		X					<4°C
Field Blank	2/25/20	13:44	G	W	1	NM/IPN			X					<4°C
Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ________; F = filter in field							4	4	1	2	F 4			

** Six 1L Bottles must be collected for Radium for every 10th sample.*

*** HCl must be Trace Metal Grade for Mercury analysis when samples cannot be delivered to the laboratory within 48 hours of sampling.*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
Nicole Morrall	AEP	2/25/20 14:00		
Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Date/Time:

Form REP-703
Rev. 1, 11/2013

AEP
AMERICAN ELECTRIC POWER

Dolan Chemical Laboratory
4001 Bixby Road
Groveport, OH 43125
T: 614-836-4221, Audinet 210-4221
F: 614-836-4168, Audinet 210-4168
http://aepenv/labs

Water Analysis

Location: Flint Creek PS

Report Date: 3/20/2020

Low Volume Waste Outlet Combined

Sample Number: 200633-001 **Date Collected: 02/25/2020 13:03** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.07	ug/L	J	0.1	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.78	ug/L		0.1	0.03	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Barium, Ba	119	ug/L		0.2	0.05	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	< 0.01	ug/L	U	0.05	0.01	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.460	ug/L		0.2	0.04	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.127	ug/L		0.05	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.2	ug/L	J	0.2	0.05	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	2.63	ug/L		2	0.4	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.4	ug/L		0.2	0.03	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Boron, B	0.076	mg/L		0.05	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	35.1	mg/L		0.3	0.1	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000381	mg/L		0.0002	0.00005	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	2.83	mg/L		0.1	0.02	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.69	mg/L		1	0.2	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Sodium, Na	11.4	mg/L		0.5	0.1	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.175	mg/L		0.01	0.002	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	102	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	7.92	mg/L		0.04	0.01	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.08	mg/L		0.06	0.01	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	183	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	17.8	mg/L		0.4	0.06	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0

pH = 6.30 2/25/2020 13:03 ipn

Location: Flint Creek PS ***Report Date: 3/20/2020***

Bottom Ash Pond

Sample Number: 200633-002 **Date Collected: 02/25/2020 13:15** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.11	ug/L		0.1	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Arsenic, As	1.03	ug/L		0.1	0.03	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Barium, Ba	199	ug/L		0.2	0.05	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	0.03	ug/L	J	0.05	0.01	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	2.98	ug/L		0.2	0.04	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.193	ug/L		0.05	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.275	ug/L		0.2	0.05	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	5.81	ug/L		2	0.4	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Selenium, Se	1.8	ug/L		0.2	0.03	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Boron, B	0.246	mg/L		0.05	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	40.5	mg/L		0.3	0.1	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.00111	mg/L		0.0002	0.00005	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	3.14	mg/L		0.1	0.02	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Potassium, K	5.61	mg/L		1	0.2	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Sodium, Na	22.7	mg/L		0.5	0.1	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.498	mg/L		0.01	0.002	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	116	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	11.0	mg/L		0.04	0.01	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.18	mg/L		0.06	0.01	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	217	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	39.5	mg/L		0.4	0.06	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0

pH = 8.70 2/25/2020 13:14 ipn

Location: Flint Creek PS ***Report Date: 3/20/2020***

BAP Near Stop Log

Sample Number: 200633-003 **Date Collected: 02/25/2020 13:29** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.07	ug/L	J	0.1	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.71	ug/L		0.1	0.03	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Barium, Ba	79.5	ug/L		0.2	0.05	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	< 0.01	ug/L	U	0.05	0.01	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.1	ug/L	J	0.2	0.04	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.056	ug/L		0.05	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.06	ug/L	J	0.2	0.05	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	1	ug/L	J	2	0.4	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.3	ug/L		0.2	0.03	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Boron, B	0.068	mg/L		0.05	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	34.4	mg/L		0.3	0.1	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000205	mg/L		0.0002	0.00005	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	2.75	mg/L		0.1	0.02	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.87	mg/L		1	0.2	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Sodium, Na	11.7	mg/L		0.5	0.1	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.147	mg/L		0.01	0.002	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	101	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	7.92	mg/L		0.04	0.01	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.08	mg/L		0.06	0.01	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	155	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	16.2	mg/L		0.4	0.06	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0

pH = 7.23 2/25/2020 13:29 ipn

pH= 8.31 2/25/2020 13:23 ipn

Location: Flint Creek PS ***Report Date: 3/20/2020***

Swepco Lake SWEPCO Lake

Sample Number: 200633-004 **Date Collected:** 02/25/2020 13:23 **Date Received:** 2/26/2020

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.08	ug/L	J	0.1	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.70	ug/L		0.1	0.03	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Barium, Ba	113	ug/L		0.2	0.05	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	0.01	ug/L	J	0.05	0.01	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.619	ug/L		0.2	0.04	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.144	ug/L		0.05	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.1	ug/L	J	0.2	0.05	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	2	ug/L	J	2	0.4	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.7	ug/L		0.2	0.03	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Boron, B	0.102	mg/L		0.05	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	38.0	mg/L		0.3	0.1	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000527	mg/L		0.0002	0.00005	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	3.04	mg/L		0.1	0.02	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.94	mg/L		1	0.2	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Sodium, Na	20.7	mg/L		0.5	0.1	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.224	mg/L		0.01	0.002	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	99.8	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	11.7	mg/L		0.04	0.01	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.12	mg/L		0.06	0.01	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	206	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	35.0	mg/L		0.4	0.06	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0

Field Blank

Sample Number: 200633-005 **Date Collected:** 02/25/2020 13:44 **Date Received:** 2/26/2020

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Alkalinity, as CaCO3	< 5	mg/L	U	20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	< 0.01	mg/L	U	0.04	0.01	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Fluoride, F	< 0.01	mg/L	U	0.06	0.01	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	< 20	mg/L	U	50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	< 0.06	mg/L	U	0.4	0.06	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0

U: Analyte was analyzed and not detected at or above adjusted Method Detection Limit
J: Analyte was positively identified, though the quantitation was below Reporting Limit.

Michael S Ohlinger

Michael Ohlinger, Chemist

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Fax 614-836-4168	*Audinet 8-210-*

THIS TEST REPORT RELATES ONLY TO THE ITEMS TESTED AND SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT WRITTEN APPROVAL OF THE LABORATORY. ALL TEST RESULTS MEET ALL OF THE REQUIREMENTS OF THE ACCREDITING AUTHORITY, UNLESS OTHERWISE NOTED.

ATTACHMENT E

Certification by a Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

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

No. 9846
BETH ANN GROSS

Beth Ann Gross
Printed Name of Licensed Professional Engineer

Beth Ann Gross
Signature

Geosyntec Consultants
2039 Centre Pointe Blvd, Suite 103
Tallahassee, Florida 32308

Arkansas Firm Certificate of
Authorization No. 52
Exp. 12/31/2024

9864	Arkansas	December 27, 2024
License Number	Licensing State	Date

GEOSYNTEC CONSULTANTS
No. 52

APPENDIX 4 - Notices for Monitoring Program Transitions

No transition between monitoring requirements occurred in 2024; the CCR unit was in detection monitoring at the beginning of 2024 until its closure. Notices for monitoring program transitions are not applicable to this annual report.

APPENDIX 5 - Well Installation/Decommissioning Logs

No wells were installed or decommissioned in 2024. Well installation/decommissioning logs are not applicable to this annual report.