Annual Groundwater Monitoring Report

Southwestern Electric Power Company

H. W. Pirkey Power Plant

West Bottom Ash Pond CCR Management Unit

Hallsville, Texas

January 2020

Prepared by:
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SOUTHWESTERN ELECTRIC POWER COMPANY℠

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I. Overview

This *Annual Groundwater Monitoring Report* (Report) has been prepared to report the status of activities for the preceding year for an existing CCR unit at Southwestern Electric Power Company's, a wholly-owned subsidiary of American Electric Power Company (AEP), Pirkey 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, 2019.

In general, the following activities were completed:

- Groundwater samples were collected for AD-3, AD-12, AD-17, AD-18, AD-28, and AD-30 in February, May, and August 2019 and analyzed for Appendix III and Appendix IV constituents, as specified in 40 CFR 257.94 or 95 *et seq.* and AEP's *Groundwater Sampling and Analysis Plan (2016)*;
- Groundwater data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Assessment Monitoring sampling was initiated on April 3, 2018;
- Groundwater Monitoring Statistical Evaluation Reports to evaluate groundwater data were prepared and certified in accordance with 40 CFR 257.93. The statistical process was guided by USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* ("Unified Guidance", USEPA, 2009).
- Statistically significant level (SSLs) above the groundwater protection standard (GWPS) were determined for cobalt at wells AD-28 on December 26, 2018. An alternate source for cobalt was identified in a report (*Alternative Source Demonstration Report Federal CCR Rule*) on March 26, 2019.
- Statistically significant level (SSLs) above the groundwater protection standard (GWPS) were determined for cobalt at wells AD-28 on July 10, 2019. An alternate source was identified in a report (*Alternative Source Demonstration Report Federal CCR Rule*) on September 23, 2019.
- Statistically significant level (SSLs) above the groundwater protection standard (GWPS) were determined for cobalt at wells AD-28 on January 3, 2020. An investigation will be conducted to see if an alternate source can be identified in a report.
- The unit was in assessment monitoring and the beginning and the end of 2019.

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

- A map, aerial photograph or a drawing showing the CCR management unit(s), all groundwater monitoring wells and monitoring well identification numbers;

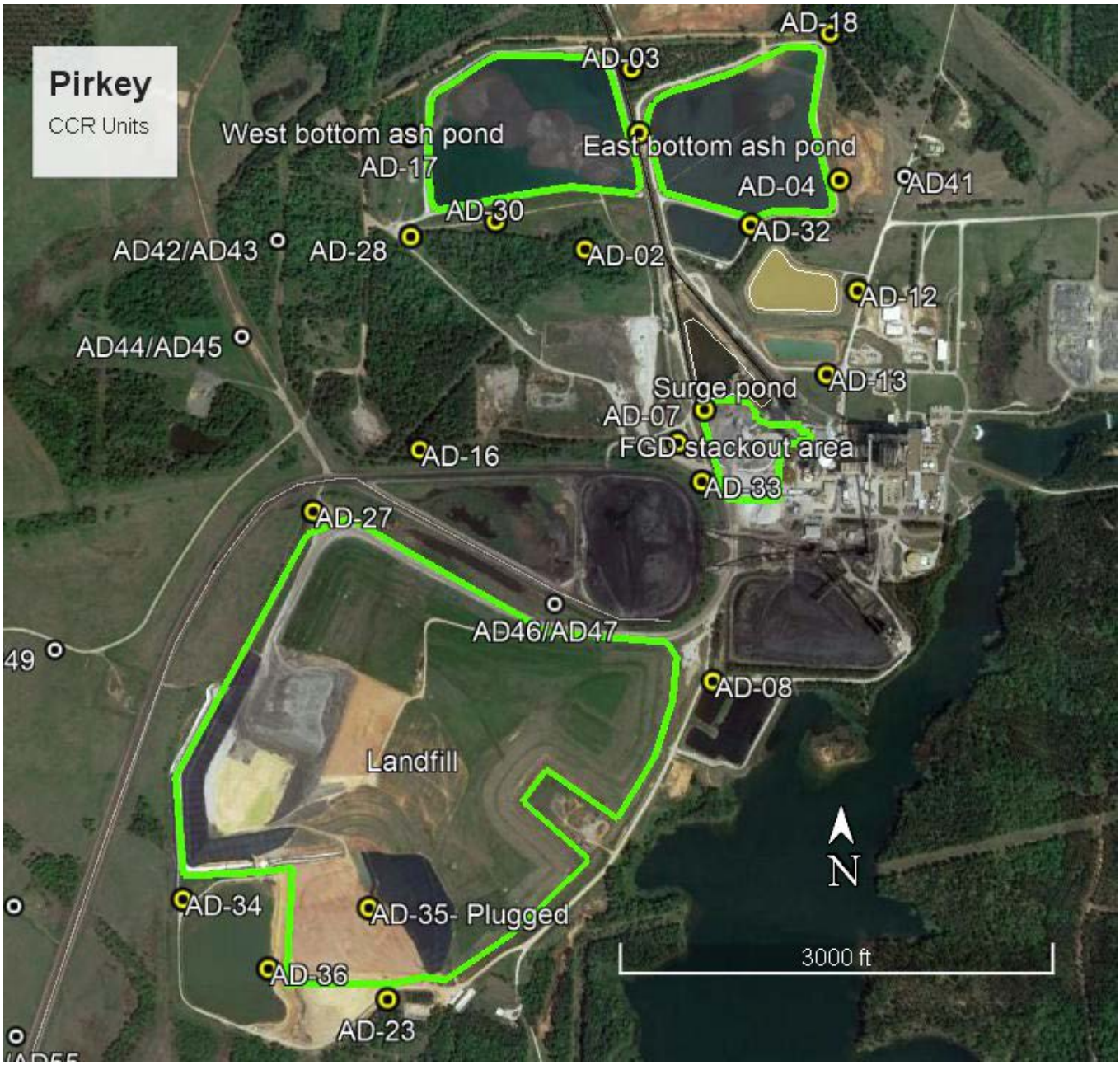
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement as to why that happened;
- All of the monitoring data collected, including the rate and direction of groundwater flow, plus a summary showing the number of samples collected 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 I;
- A summary of any transition between monitoring programs or an alternate monitoring frequency, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring, in addition to identifying the constituents detected at a statistically significant increase over background concentrations (Appendix IV).
- Other information required to be included in the annual report such as alternate source demonstration or assessment of corrective measures, if applicable.

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

II. Groundwater Monitoring Well Locations and Identification Numbers

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

West Bottom Ash Pond Monitoring Wells	
Up Gradient	Down Gradient
AD-3	AD-17
AD-12	AD-28
AD-18	AD-30



III. Monitoring Wells Installed or Decommissioned

Several monitoring wells were installed to better understand spatial variability of constituents across the site, groundwater flow, and groundwater chemistry in mine spoils. Please see the list below. Well installation reports can be found in Appendix V.

Soil Boring ID	Monitor Well ID
	AD-37
	AD-38
	AD-39
	AD-40
SB-01A	AD-41
SB-04	AD-42
SB-04	AD-43
SB-05	AD-44
SB-05	AD-45
SB-06	AD-46
SB-06	AD-47
SB-07	AD-48
SB-07	AD-49
SB-08	AD-50
SB-08	AD-52
SB-08	AD-53
SB-09	AD-54
SB-09	AD-55
SB-11	AD-56
SB-11	AD-57

Three additional soil borings were installed to better understand the spatial variability of constituents at the site up gradient of the plant. Two monitor wells were installed at these boring locations B-2 and B-3. Well reports for soil boring B-2 and B-3 can also be found in Appendix V.

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

Appendix I contains tables showing the groundwater quality. Static water elevation data from each monitoring event also are shown in Appendix I, along with the groundwater velocity, groundwater flow direction and potentiometric maps developed after each sampling event.

As required by the assessment monitoring rules, 40 CFR 257.95 et seq., a one round of sampling in February in accordance with 40 CFR 257.95(d)(1). A May sampling event was conducted in accordance with 40 CFR 257.95(b) including all Appendix III parameters and those Appendix IV

constituents parameters followed by an August round of sampling in accordance with 40 CFR 257.95(d)(1). Assessment monitoring will continue in 2020.

V. Statistical Evaluation of 2019 Events

The two statistical analysis reports are included in Appendix II.

Statistically significant level (SSLs) above the groundwater protection standard (GWPS) were determined for cobalt at wells AD-28 on July 10, 2019. An alternate source was identified in a report (*Alternative Source Demonstration Report Federal CCR Rule*) on September 23, 2019.

Statistically significant level (SSLs) above the groundwater protection standard (GWPS) were determined for cobalt at wells AD-28 on January 3, 2020. An investigation will be conducted to see if an alternate source can be identified in a report.

VI. Alternate Source Demonstration

An alternate source investigation was conducted for the west bottom ash pond SSLs above GWPSs. SSLs above the GWPS were determined for cobalt on December 26, 2018. An alternate source for cobalt was identified in a report (*Alternative Source Demonstration Report Federal CCR Rule*) on March 26, 2019.

SSLs above the GWPS were determined for cobalt at wells AD-28 on July 10, 2019. An alternate source was identified in a report (*Alternative Source Demonstration Report Federal CCR Rule*) on September 23, 2019.

Statistically significant level (SSLs) above the groundwater protection standard (GWPS) were determined for cobalt at wells AD-28 on January 3, 2020. An alternate source investigation will be conducted for these SSLs.

The supporting information are found in Appendix III.

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

The unit transitioned from detection monitoring to assessment monitoring transition on April 3, 2018.

Assessment monitoring will continue in 2020.

Regarding defining an alternate monitoring frequency, no modification of the twice-per-year detection monitoring effort is needed.

VIII. Other Information Required

No other information applies at this time.

IX. Description of Any Problems Encountered in 2019 and Actions Taken

No significant problems were encountered.

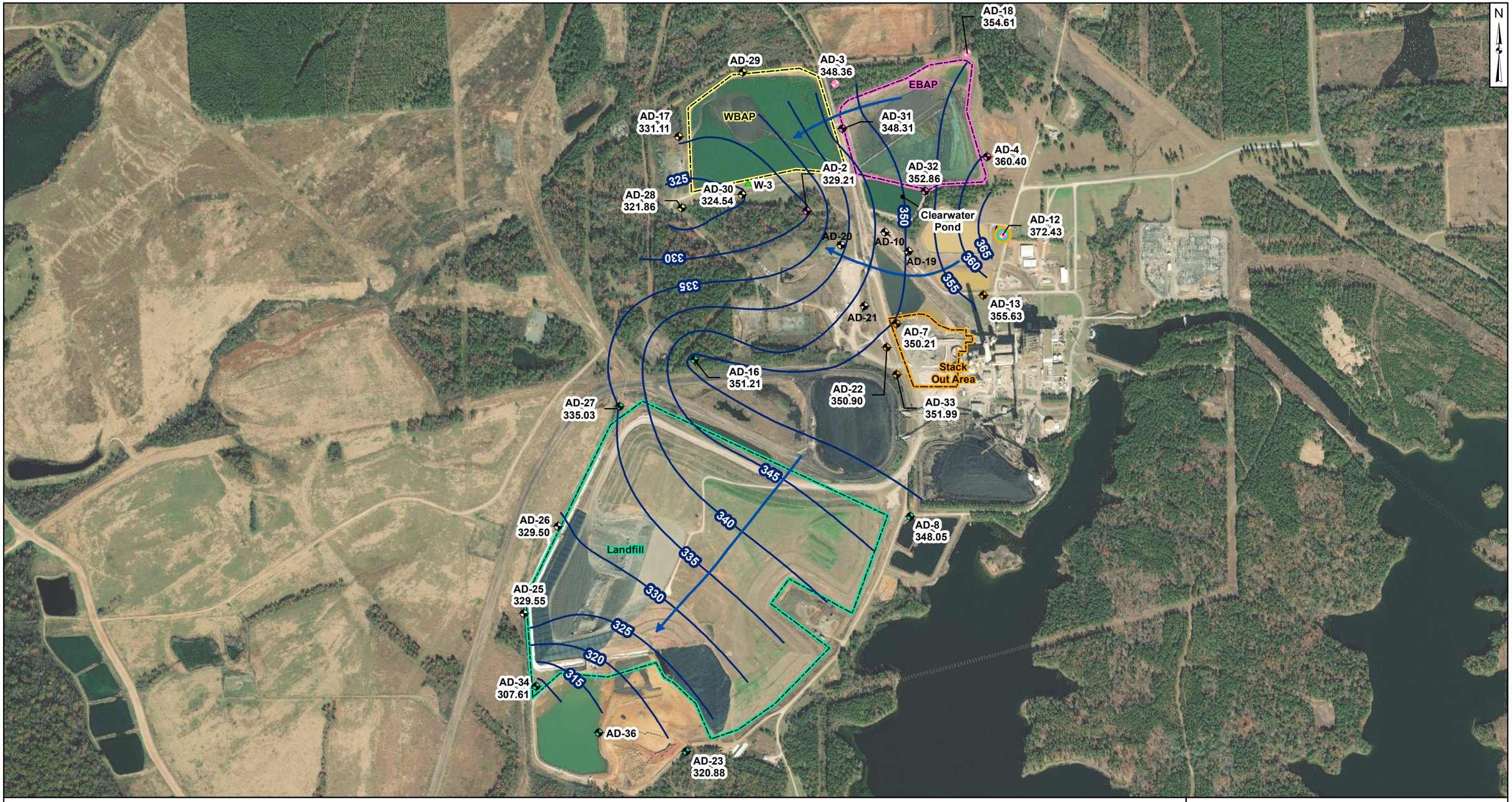
X. A Projection of Key Activities for the Upcoming Year

Key activities for 2020 include:

- Assessment monitoring sampling will be conducted;
- Evaluation of the assessment monitoring results from a statistical analysis viewpoint, looking for any SSLs above GWPS;
- Responding to any new data received in light of CCR rule requirements;
- Preparation of the fourth annual groundwater report.

APPENDIX I

Tables follow, showing the groundwater monitoring data collected, the rate and direction of groundwater flow, and a summary showing the number of samples collected per monitoring well. The dates that the samples were collected also is shown.



Legend

Groundwater Monitoring Wells

- Out of Network
- EBAP
- WBAP
- Landfill
- Stackout Area
- EBAP and WBAP

- All CCR Unit Networks
- Piezometer
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on February 23-28, 2019) provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- East and West Bottom Ash Ponds have compacted cohesive soil from elevation 344 to 347 ft. msl (Sargent and Lundy, 1984; AMEC, 2011).
- Clearwater pond base elevation is 344 ft. msl (Sargent and Lundy, 1983).
- W-3 was not gauged in February 2019.
- AD-35 was abandoned November 13, 2018. AD-36 was installed April 24, 2019.

1,000 500 0 1,000 Feet

Potentiometric Contours - Uppermost Aquifer
February 2019

AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2020/01/16

Figure **1**

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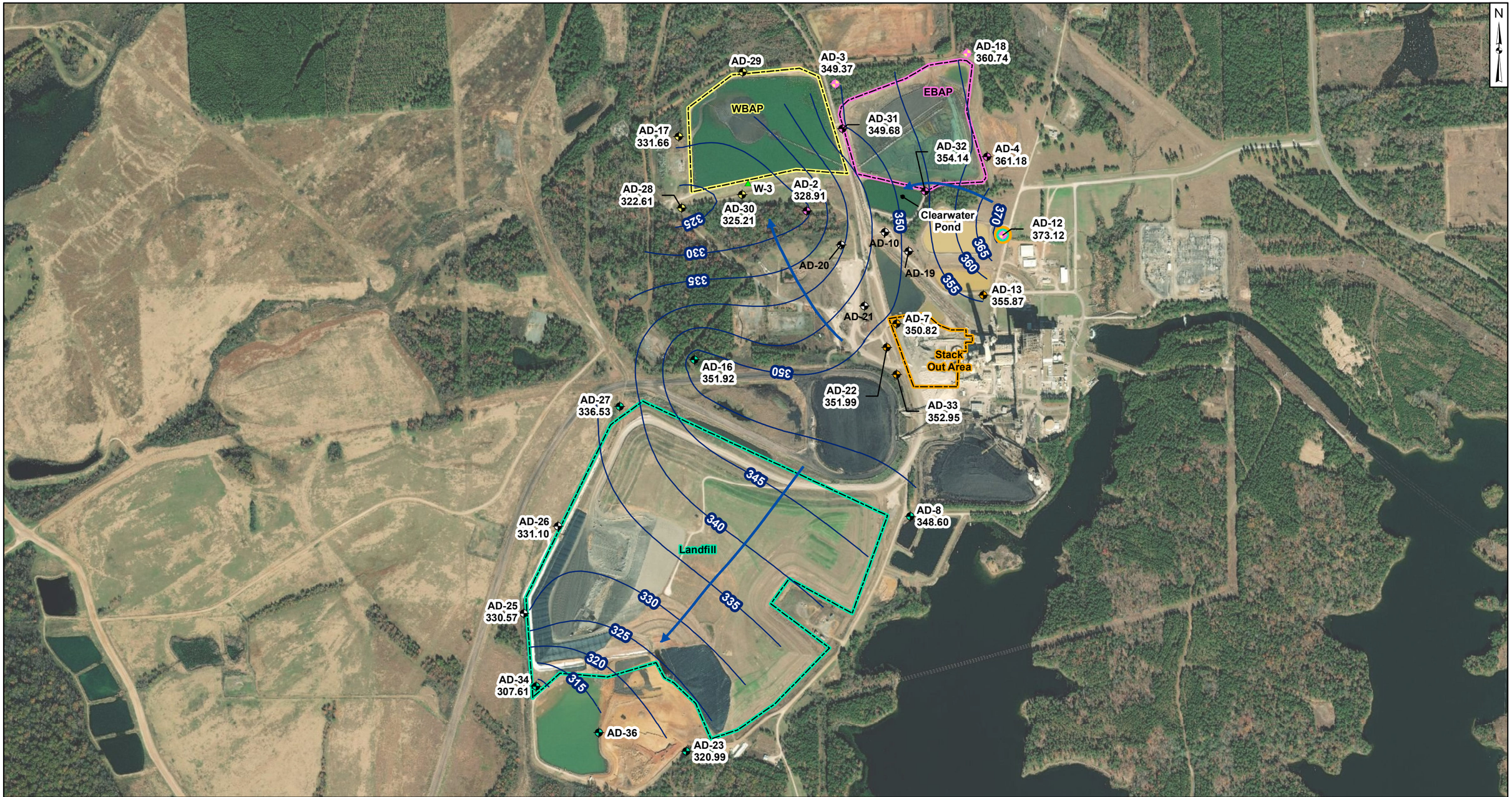

Legend

Groundwater Monitoring Wells

- Out of Network
- EBAP
- WBAP
- Landfill
- Stackout Area
- EBAP and WBAP

- All CCR Unit Networks
- Piezometer
- Groundwater Elevation Contour
- Approximate Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on May 21-23, 2019) provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- East and West Bottom Ash Ponds have compacted cohesive soil from elevation 344 to 347 ft. msl (Sargent and Lundy, 1984; AMEC, 2011).
- Clearwater pond base elevation is 344 ft. msl (Sargent and Lundy, 1983).
- W-3 was not gauged in May 2019.
- AD-35 was abandoned November 13, 2018. AD-36 was installed April 24, 2019.

1,000 500 0 1,000 Feet

Potentiometric Contours - Uppermost Aquifer May 2019

AEP Pirkey Power Plant
Hallsville, Texas

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Figure **2**

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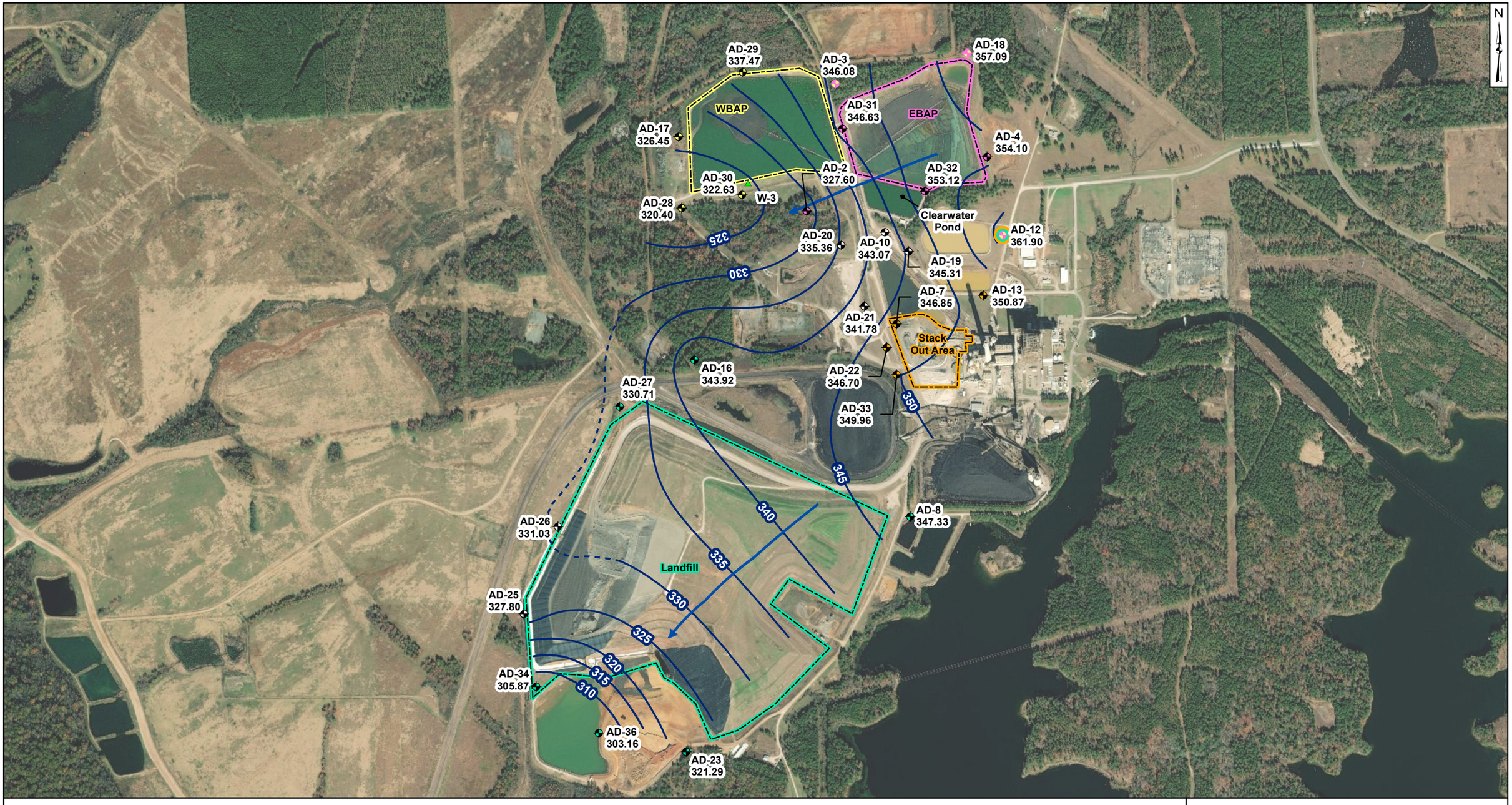

Legend

Groundwater Monitoring Wells

- Out of Network
- EBAP
- WBAP
- Landfill
- Stackout Area
- EBAP and WBAP

- All CCR Unit Networks
- Piezometer
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on August 12-16, 2019) provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- East and West Bottom Ash Ponds have compacted cohesive soil from elevation 344 to 347 ft. msl (Sargent and Lundy, 1984; AMEC, 2011).
- Clearwater pond base elevation is 344 ft. msl (Sargent and Lundy, 1983).
- W-3 was not gauged in August 2019.
- AD-35 was abandoned November 13, 2018. AD-36 was installed April 24, 2019.

1,000 500 0 1,000 Feet

Potentiometric Contours - Uppermost Aquifer August 2019

AEP Pirkey Power Plant
Hallsville, Texas

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Figure **3**

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Table 1: Residence Time Calculation Summary
Pirkey West Bottom Ash Pond

Geosyntec Consultants, Inc.

CCR Management Unit	Monitoring Well	Well Diameter (inches)	2019-02		2019-05		2019-08	
			Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
West Bottom Ash Pond	AD-3 [1]	4.0	17.6	6.9	17.6	6.9	11.3	10.7
	AD-12 [1]	4.0	34.2	3.6	35.0	3.5	21.4	5.7
	AD-17 [2]	2.0	15.3	4.0	16.0	3.8	11.4	5.3
	AD-18 [1]	2.0	9.3	6.6	8.9	6.8	7.1	8.5
	AD-28 [2]	2.0	15.8	3.8	14.2	4.3	13.0	4.7
	AD-30 [2]	2.0	14.9	4.1	14.1	4.3	15.4	3.9

Notes:
[1] - Background Well
[2] - Downgradient Well

Table 1 - Groundwater Data Summary: AD-3
Pirkey - WBAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/11/2016	Background	0.04	2.9	6	<0.083 U	4.9	136	18
7/14/2016	Background	0.06	4.67	6	<0.083 U	4.7	161	30
9/8/2016	Background	0.06	4.28	7	<0.083 U	4.5	145	28
10/13/2016	Background	0.05	4.93	8	<0.083 U	5.5	168	31
11/14/2016	Background	0.07	4.61	7	<0.083 U	5.4	170	29
1/12/2017	Background	0.05	3.81	7	<0.083 U	5.3	152	27
3/1/2017	Background	0.05	2.55	5	<0.083 U	5.1	124	16
4/10/2017	Background	0.06	2.6	10	<0.083 U	4.9	140	19
8/24/2017	Detection	0.08625	2.37	6	<0.083 U	5.6	68	17
3/22/2018	Assessment	0.05508	3.41	5	<0.083 U	5.3	140	26
8/21/2018	Assessment	0.055	4.79	9	<0.083 U	5.6	166	34
2/27/2019	Assessment	0.034	3.46	6.16	0.04 J	5.3	50	21.8
5/23/2019	Assessment	0.045	6.19	5.99	0.09	4.9	154	29.5
8/13/2019	Assessment	0.05 J	5.08	6.83	0.19	5.1	168	32.5

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AD-3
Pirkey - WBAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/11/2016	Background	<0.93 U	<1.05 U	59	0.412956 J	0.0947139 J	0.724945 J	3.12937 J	1.059	<0.083 U	<0.68 U	0.025	0.00992 J	0.774997 J	3.29747 J	<0.86 U
7/14/2016	Background	<0.93 U	2.10876 J	70	0.583927 J	<0.07 U	1	7	1.69	<0.083 U	<0.68 U	0.095	0.025	1.16077 J	2.50173 J	<0.86 U
9/8/2016	Background	<0.93 U	<1.05 U	70	0.502486 J	<0.07 U	0.974129 J	7	1.491	<0.083 U	<0.68 U	0.087	0.00618 J	<0.29 U	<0.99 U	<0.86 U
10/13/2016	Background	<0.93 U	4.22879 J	82	0.591063 J	0.159178 J	2	9	3.42	<0.083 U	<0.68 U	0.991	0.0073 J	<0.29 U	1.92667 J	<0.86 U
11/14/2016	Background	<0.93 U	1.98138 J	64	0.310985 J	<0.07 U	0.42234 J	8	1.532	<0.083 U	<0.68 U	0.092	<0.005 U	<0.29 U	<0.99 U	<0.86 U
1/12/2017	Background	<0.93 U	<1.05 U	62	0.281878 J	<0.07 U	0.551806 J	4.96138 J	2.01	<0.083 U	<0.68 U	0.079	0.0057 J	<0.29 U	<0.99 U	<0.86 U
3/1/2017	Background	<0.93 U	<1.05 U	62	0.279961 J	<0.07 U	<0.23 U	2.54266 J	0.862	<0.083 U	<0.68 U	0.046	<0.005 U	<0.29 U	1.78128 J	1.13014 J
4/10/2017	Background	<0.93 U	<1.05 U	61	0.284613 J	<0.07 U	0.250858 J	2.40319 J	0.991	<0.083 U	<0.68 U	0.046	<0.005 U	<0.29 U	<0.99 U	<0.86 U
3/22/2018	Assessment	<0.93 U	<1.05 U	57.94	0.22 J	<0.07 U	0.86 J	3.74 J	0.739	<0.083 U	<0.68 U	0.06189	<0.005 U	<0.29 U	1.13 J	<0.86 U
8/21/2018	Assessment	<0.01 U	1.01	63.3	0.240	0.02 J	0.496	7.18	1.837	<0.083 U	0.355	0.0876	<0.005 U	0.1 J	0.1	0.057
2/27/2019	Assessment	0.04 J	0.13	54.2	<0.4 U	0.03 J	0.04 J	2.31	0.3144	0.04 J	0.05 J	0.0525	<0.005 U	<0.4 U	0.05 J	<0.1 U
5/23/2019	Assessment	<0.4 U	<0.6 U	61.8	<0.4 U	<0.2 U	<0.8 U	4.94	0.988	0.09	<0.4 U	0.0734	<0.005 U	<8 U	<0.6 U	<0.1 U
8/13/2019	Assessment	<0.02 U	2.41	58.3	0.196	0.02 J	0.206	6.55	1.378	0.19	0.417	0.108	<0.005 U	<0.4 U	0.1 J	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-12
Pirkey - WBAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/11/2016	Background	0.03	0.362	5	<0.083 U	4.4	94	4
7/13/2016	Background	0.03	0.26	6	<0.083 U	3.1	75	4
9/7/2016	Background	0.04	0.343	6	<0.083 U	3.9	63	7
10/12/2016	Background	0.03	0.271	7	< 1 U	3.4	92	8
11/14/2016	Background	0.04	0.331	8	<0.083 U	2.6	80	6
1/11/2017	Background	0.03	0.315	7	<0.083 U	4.8	76	6
2/28/2017	Background	0.04	0.434	5	<0.083 U	3.6	50	4
4/11/2017	Background	0.05	0.299	6	0.2565 J	4.7	72	7
8/23/2017	Detection	0.0495	0.245	6	0.213 J	4.8	52	6
3/21/2018	Assessment	0.01397	0.269	5	<0.083 U	4.2	<2 U	3
8/20/2018	Assessment	0.017	0.338	10	<0.083 U	4.4	94	4
2/27/2019	Assessment	0.03 J	0.4 J	6.08	0.09	5.2	36	3.6
5/21/2019	Assessment	0.020	0.3 J	6.30	0.09	4.1	80	4.0
8/12/2019	Assessment	<0.02 U	0.278	7.24	0.06 J	4.9	90	2.6

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AD-12
Pirkey - WBAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/11/2016	Background	<0.93 U	<1.05 U	26	0.219521 J	<0.07 U	0.710981 J	1.58207 J	0.2073	<0.083 U	<0.68 U	<0.00013 U	<0.005 U	<0.29 U	1.73953 J	<0.86 U
7/13/2016	Background	<0.93 U	<1.05 U	23	0.190337 J	<0.07 U	0.68835 J	1.29444 J	2.909	<0.083 U	<0.68 U	0.008	<0.005 U	<0.29 U	<0.99 U	<0.86 U
9/7/2016	Background	<0.93 U	<1.05 U	30	0.232192 J	<0.07 U	0.353544 J	1.66591 J	0.881	<0.083 U	<0.68 U	0.01	<0.005 U	<0.29 U	<0.99 U	<0.86 U
10/12/2016	Background	<0.93 U	<1.05 U	27	0.149553 J	<0.07 U	0.529033 J	1.56632 J	0.257	< 1 U	<0.68 U	0.012	<0.005 U	<0.29 U	<0.99 U	<0.86 U
11/14/2016	Background	<0.93 U	<1.05 U	28	0.152375 J	<0.07 U	0.32826 J	1.47282 J	0.767	<0.083 U	<0.68 U	0.013	<0.005 U	<0.29 U	<0.99 U	<0.86 U
1/11/2017	Background	<0.93 U	<1.05 U	23	0.126621 J	<0.07 U	0.650158 J	1.09495 J	1.536	<0.083 U	<0.68 U	0.01	<0.005 U	<0.29 U	<0.99 U	<0.86 U
2/28/2017	Background	<0.93 U	<1.05 U	26	0.149219 J	<0.07 U	0.325811 J	1.29984 J	0.416	<0.083 U	<0.68 U	0.009	<0.005 U	<0.29 U	<0.99 U	0.994913 J
4/11/2017	Background	<0.93 U	<1.05 U	24	0.159412 J	<0.07 U	0.416007 J	1.33344 J	0.3895	0.2565 J	<0.68 U	0.008	0.01364 J	<0.29 U	<0.99 U	<0.86 U
3/21/2018	Assessment	<0.93 U	<1.05 U	25.82	0.16 J	<0.07 U	1.05	1.49 J	0.784	<0.083 U	<0.68 U	0.00722	<0.005 U	<0.29 U	<0.99 U	<0.86 U
8/20/2018	Assessment	<0.01 U	0.11	27.8	0.159	0.01 J	0.330	1.72	1.128	<0.083 U	0.089	0.0143	<0.005 U	0.04 J	0.1	0.04 J
2/27/2019	Assessment	<0.4 U	<0.6 U	22.5	<0.4 U	<0.2 U	<0.8 U	1.37	0.225	0.09	<0.4 U	0.00688	<0.005 U	<8 U	<0.6 U	<2 U
5/21/2019	Assessment	<0.4 U	<0.6 U	21.7	<0.4 U	<0.2 U	<0.8 U	1.15	0.201	0.09	<0.4 U	0.00576	<0.005 U	<8 U	<0.6 U	<0.1 U
8/12/2019	Assessment	<0.02 U	0.07 J	23.8	0.154	<0.01 U	0.204	1.3	0.237	0.06 J	0.08 J	0.00829	<0.005 U	<0.4 U	0.2 J	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-17
Pirkey - WBAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/11/2016	Background	0.02	0.648	12	<0.083 U	4.3	68	4
7/14/2016	Background	0.03	1.28	34	<0.083 U	3.3	96	4
9/8/2016	Background	0.03	1.19	29	<0.083 U	3.9	88	6
10/13/2016	Background	0.03	1.34	32	0.393 J	3.6	96	6
11/15/2016	Background	0.03	1.3	30	0.3446 J	3.7	88	6
1/12/2017	Background	0.03	1.08	26	<0.083 U	4.4	90	6
3/1/2017	Background	0.04	0.57	19	<0.083 U	4.0	80	5
4/10/2017	Background	0.03	0.395	20	<0.083 U	4.2	88	9
8/24/2017	Detection	0.04495	1.06	25	0.245 J	4.6	98	6
12/21/2017	Detection	- -	- -	26	<0.083 U	- -	76	8
3/22/2018	Assessment	0.03113	0.0981	13	<0.083 U	4.4	44	5
8/21/2018	Assessment	0.044	0.997	35	<0.083 U	3.9	98	7
2/28/2019	Assessment	0.03 J	0.2 J	10.2	0.12	3.7	68	2.4
5/23/2019	Assessment	0.019	0.2 J	10.3	0.13	4.0	58	2.4
8/13/2019	Assessment	0.03 J	0.777	26.3	0.24	4.8	88	1.8

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AD-17
Pirkey - WBAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/11/2016	Background	<0.93 U	1.21333 J	143	0.507354 J	0.0868344 J	1	5	2.082	<0.083 U	<0.68 U	<0.00013 U	0.06	<0.29 U	2.55378 J	<0.86 U
7/14/2016	Background	<0.93 U	1.3096 J	334	0.85295 J	0.0833036 J	2	14	3.12	<0.083 U	<0.68 U	0.027	0.138	0.485824 J	<0.99 U	<0.86 U
9/8/2016	Background	<0.93 U	1.76675 J	327	0.948023 J	<0.07 U	5	14	4.473	<0.083 U	<0.68 U	0.028	0.142	<0.29 U	<0.99 U	1.0754 J
10/13/2016	Background	<0.93 U	<1.05 U	324	0.753919 J	<0.07 U	0.542006 J	14	6.64	0.393 J	<0.68 U	0.026	0.05	<0.29 U	<0.99 U	<0.86 U
11/15/2016	Background	<0.93 U	<1.05 U	290	0.708598 J	<0.07 U	0.448238 J	13	7.94	0.3446 J	<0.68 U	0.026	0.078	<0.29 U	<0.99 U	<0.86 U
1/12/2017	Background	<0.93 U	<1.05 U	234	0.541302 J	<0.07 U	0.723126 J	10	9.6	<0.083 U	<0.68 U	0.023	0.055	<0.29 U	<0.99 U	<0.86 U
3/1/2017	Background	<0.93 U	<1.05 U	176	0.499114 J	<0.07 U	0.359001 J	8	2.31	<0.083 U	<0.68 U	0.019	0.084	<0.29 U	<0.99 U	<0.86 U
4/10/2017	Background	<0.93 U	<1.05 U	140	0.511666 J	<0.07 U	0.689417 J	7	3.67	<0.083 U	<0.68 U	0.016	0.069	<0.29 U	<0.99 U	<0.86 U
3/22/2018	Assessment	<0.93 U	<1.05 U	94.77	0.38 J	<0.07 U	1.21	4.57 J	1.669	<0.083 U	<0.68 U	0.01186	0.125	<0.29 U	<0.99 U	<0.86 U
8/21/2018	Assessment	<0.01 U	0.41	223	0.588	0.04	0.367	10.9	2.505	<0.083 U	0.181	0.0234	0.216	<0.02 U	0.5	0.051
2/28/2019	Assessment	<0.4 U	<0.6 U	71.4	<0.4 U	<0.2 U	<0.8 U	2.93	0.772	0.12	<0.4 U	0.00912	0.107	<8 U	<0.6 U	<2 U
5/23/2019	Assessment	<0.4 U	<0.6 U	82.9	<0.4 U	<0.2 U	0.9 J	3.15	1.62	0.13	<0.4 U	0.00911	0.103	<8 U	<0.6 U	<0.1 U
8/13/2019	Assessment	<0.02 U	0.40	216	0.554	0.04 J	0.732	9.03	6.40	0.24	0.2 J	0.0193	0.447	<0.4 U	0.3	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-18
Pirkey - WBAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/10/2016	Background	0.01	0.548	8	<0.083 U	4.5	108	7
7/14/2016	Background	0.01	0.409	8	<0.083 U	4.7	116	7
9/8/2016	Background	0.01	0.343	8	<0.083 U	4.7	110	8
10/13/2016	Background	0.02	0.56	7	<0.083 U	4.1	124	10
11/15/2016	Background	0.02	0.59	7	<0.083 U	4.4	134	7
1/12/2017	Background	0.01	0.415	7	<0.083 U	4.7	128	10
3/1/2017	Background	0.01	0.224	6	<0.083 U	4.1	108	7
4/10/2017	Background	0.01	0.304	7	<0.083 U	4.1	102	8
8/24/2017	Detection	0.0278	0.435	8	<0.083 U	4.9	68	8
3/22/2018	Assessment	0.01642	0.292	6	<0.083 U	5.4	100	6
8/21/2018	Assessment	0.012	0.321	10	<0.083 U	5.1	118	8
2/28/2019	Assessment	<0.02 U	0.490	8.19	0.02 J	5.0	84	6.1
5/23/2019	Assessment	0.013	0.684	8.82	0.02 J	5.2	104	10.6
8/13/2019	Assessment	<0.02 U	0.647	8.49	0.01 J	5.2	90	6.6

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AD-18
Pirkey - WBAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/10/2016	Background	<0.93 U	<1.05 U	157	0.262755 J	0.109247 J	1	1.82932 J	0.847	<0.083 U	<0.68 U	0.004	0.01536 J	<0.29 U	1.71074 J	<0.86 U
7/14/2016	Background	<0.93 U	3.77261 J	139	0.243326 J	<0.07 U	3	2.16037 J	3.264	<0.083 U	<0.68 U	0.02	0.064	0.41347 J	2.45009 J	<0.86 U
9/8/2016	Background	<0.93 U	<1.05 U	115	0.226343 J	<0.07 U	0.779959 J	1.09947 J	1.105	<0.083 U	<0.68 U	0.019	0.03	<0.29 U	<0.99 U	<0.86 U
10/13/2016	Background	<0.93 U	<1.05 U	112	0.192611 J	<0.07 U	0.631027 J	2.24885 J	1.161	<0.083 U	<0.68 U	0.026	0.01416 J	<0.29 U	<0.99 U	<0.86 U
11/15/2016	Background	<0.93 U	<1.05 U	94	0.107171 J	<0.07 U	0.724569 J	1.66054 J	1.486	<0.083 U	<0.68 U	0.017	0.029	<0.29 U	<0.99 U	<0.86 U
1/12/2017	Background	<0.93 U	<1.05 U	99	0.169196 J	<0.07 U	0.411433 J	1.62881 J	0.976	<0.083 U	<0.68 U	0.026	0.01887 J	<0.29 U	<0.99 U	<0.86 U
3/1/2017	Background	<0.93 U	<1.05 U	99	0.105337 J	<0.07 U	0.572874 J	0.976724 J	0.468	<0.083 U	<0.68 U	0.017	0.01086 J	<0.29 U	<0.99 U	<0.86 U
4/10/2017	Background	<0.93 U	<1.05 U	105	0.130316 J	<0.07 U	0.967681 J	0.98157 J	0.648	<0.083 U	<0.68 U	0.019	0.0096 J	<0.29 U	<0.99 U	<0.86 U
3/22/2018	Assessment	<0.93 U	<1.05 U	97.75	0.09 J	<0.07 U	<0.23 U	0.97 J	0.942	<0.083 U	<0.68 U	0.01647	0.006 J	<0.29 U	1.53 J	<0.86 U
8/21/2018	Assessment	0.02 J	1.01	99.8	0.129	0.02 J	0.809	1.18	1.108	<0.083 U	0.280	0.0175	0.014 J	0.08 J	0.2	0.060
2/28/2019	Assessment	<0.4 U	<0.6 U	106	<0.4 U	<0.2 U	<0.8 U	1.11	0.615	0.02 J	0.7 J	0.0177	0.009 J	<8 U	<0.6 U	<2 U
5/23/2019	Assessment	<0.4 U	<0.6 U	131	<0.4 U	<0.2 U	<0.8 U	1.47	0.492	0.02 J	<0.4 U	0.0209	0.009 J	<8 U	<0.6 U	<0.1 U
8/13/2019	Assessment	<0.02 U	0.45	100	0.118	0.02 J	0.212	1.25	0.473	0.01 J	0.2 J	0.0183	0.023 J	<0.4 U	0.09 J	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-28
Pirkey - WBAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/11/2016	Background	0.277	2.16	6	0.9005 J	4.7	106	18
7/14/2016	Background	0.301	1.69	6	0.4478 J	5.1	96	17
9/7/2016	Background	0.332	1.25	6	0.3966 J	4.1	94	19
10/13/2016	Background	0.23	3.21	6	0.532 J	5.3	124	19
11/15/2016	Background	0.32	1.64	8	0.9199 J	4.2	112	16
1/12/2017	Background	0.285	1.22	7	0.7158 J	4.1	84	17
3/1/2017	Background	0.293	1.25	5	<0.083 U	3.4	96	18
4/10/2017	Background	0.293	1.2	7	0.6732 J	4.1	104	20
8/24/2017	Detection	0.281	1.22	6	0.557 J	5.1	96	18
12/21/2017	Detection	0.277	1.14	- -	- -	- -	- -	- -
3/22/2018	Assessment	0.254	1.4	5	0.6327 J	5.2	100	23
8/21/2018	Assessment	0.330	1.39	9	0.4982 J	5.0	96	22
2/27/2019	Assessment	0.458	1.65	6.29	0.81	5.0	32	19.6
5/22/2019	Assessment	0.313	1.24	4.48	0.69	4.6	100	20.1
8/12/2019	Assessment	0.366	1.72	6.04	0.65	4.7	128	22.5

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AD-28
Pirkey - WBAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/11/2016	Background	1.58838 J	2.49885 J	223	0.968775 J	<0.07 U	1	18	1.212	0.9005 J	<0.68 U	0.004	0.146	<0.29 U	1.10335 J	<0.86 U
7/14/2016	Background	<0.93 U	1.52986 J	170	0.663081 J	<0.07 U	0.982579 J	15	2.29	0.4478 J	<0.68 U	0.034	0.162	<0.29 U	<0.99 U	<0.86 U
9/7/2016	Background	<0.93 U	<1.05 U	168	0.728735 J	<0.07 U	0.605543 J	14	1.44	0.3966 J	<0.68 U	0.03	0.069	<0.29 U	<0.99 U	1.24745 J
10/13/2016	Background	<0.93 U	6	152	0.42032 J	<0.07 U	6	18	2.547	0.532 J	<0.68 U	0.066	0.085	<0.29 U	<0.99 U	<0.86 U
11/15/2016	Background	<0.93 U	1.40867 J	148	0.520895 J	<0.07 U	0.638766 J	13	3.35	0.9199 J	<0.68 U	0.032	0.029	0.294156 J	<0.99 U	<0.86 U
1/12/2017	Background	<0.93 U	<1.05 U	154	0.475597 J	<0.07 U	<0.23 U	12	2.67	0.7158 J	<0.68 U	0.031	0.025	<0.29 U	<0.99 U	<0.86 U
3/1/2017	Background	<0.93 U	<1.05 U	163	0.576508 J	<0.07 U	0.968975 J	14	2.082	<0.083 U	<0.68 U	0.031	0.025	<0.29 U	<0.99 U	<0.86 U
4/10/2017	Background	<0.93 U	<1.05 U	162	0.654819 J	<0.07 U	0.324151 J	15	2.331	0.6732 J	<0.68 U	0.03	0.026	<0.29 U	<0.99 U	<0.86 U
3/22/2018	Assessment	<0.93 U	<1.05 U	166	0.95 J	<0.07 U	<0.23 U	14.36	1.288	0.6327 J	<0.68 U	0.02561	0.046	<0.29 U	<0.99 U	<0.86 U
8/21/2018	Assessment	0.03 J	0.64	143	0.598	0.05	0.688	14.4	2.028	0.4982 J	0.266	0.0307	0.028	0.05 J	0.3	0.03 J
2/27/2019	Assessment	<0.4 U	<0.6 U	154	0.9 J	<0.2 U	<0.8 U	14.3	2.318	0.81	<0.4 U	0.0266	0.061	<8 U	<0.6 U	<2 U
5/22/2019	Assessment	<0.4 U	<0.6 U	148	0.5 J	<0.2 U	<0.8 U	13.8	1.948	0.69	<0.4 U	0.0227	0.028	<8 U	<0.6 U	<0.1 U
8/12/2019	Assessment	0.02 J	0.64	113	0.473	0.04 J	0.416	12.8	2.381	0.65	0.1 J	0.0380	0.092	<0.4 U	0.2 J	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-30
Pirkey - WBAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/11/2016	Background	0.258	0.591	18	<0.083 U	4.7	112	14
7/14/2016	Background	0.384	0.499	22	<0.083 U	4.8	118	14
9/7/2016	Background	0.515	0.27	24	<0.083 U	4.4	110	15
10/13/2016	Background	0.625	0.373	24	<0.083 U	4.2	140	18
11/15/2016	Background	0.701	0.326	25	<0.083 U	4.3	132	19
1/12/2017	Background	0.697	0.286	26	<0.083 U	5.2	136	22
3/1/2017	Background	0.824	0.273	22	<0.083 U	4.8	136	25
4/11/2017	Background	0.837	0.242	24	<0.083 U	4.2	124	27
8/24/2017	Detection	1.39	0.294	25	<0.083 U	5.2	176	46
12/21/2017	Detection	1.27	0.363	26	<0.083 U	- -	152	48
3/22/2018	Assessment	0.937	0.345	17	<0.083 U	5.2	140	44
8/21/2018	Assessment	1.57	0.716	29	<0.083 U	4.8	188	66
2/28/2019	Assessment	0.491	0.3 J	14.6	<0.04 U	4.2	- -	31.5
4/3/2019	Assessment	- -	- -	- -	- -	- -	135	- -
5/23/2019	Assessment	0.520	1.74	18.8	0.04 J	4.9	112	29.2
8/12/2019	Assessment	1.25	0.302	28.1	0.03 J	4.9	160	39.8

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AD-30
Pirkey - WBAP
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/11/2016	Background	1.71137 J	1.92931 J	54	0.155441 J	<0.07 U	3	2.21375 J	1.057	<0.083 U	<0.68 U	<0.00013 U	0.278	<0.29 U	<0.99 U	<0.86 U
7/14/2016	Background	<0.93 U	<1.05 U	54	0.126875 J	<0.07 U	0.994219 J	2.13856 J	4.701	<0.083 U	<0.68 U	0.01	0.649	1.14165 J	<0.99 U	<0.86 U
9/7/2016	Background	<0.93 U	<1.05 U	52	0.153878 J	<0.07 U	0.769517 J	1.83325 J	0.312	<0.083 U	<0.68 U	0.009	0.214	<0.29 U	<0.99 U	1.34697 J
10/13/2016	Background	<0.93 U	<1.05 U	56	0.0606961 J	<0.07 U	0.543859 J	2.26228 J	2.27	<0.083 U	<0.68 U	0.01	0.709	<0.29 U	<0.99 U	<0.86 U
11/15/2016	Background	<0.93 U	<1.05 U	52	0.0603858 J	<0.07 U	<0.23 U	1.91681 J	4.07	<0.083 U	<0.68 U	0.009	0.584	<0.29 U	1.2068 J	0.959001 J
1/12/2017	Background	<0.93 U	<1.05 U	51	0.0580655 J	<0.07 U	0.504125 J	1.76108 J	0.355	<0.083 U	<0.68 U	0.009	1.588	<0.29 U	<0.99 U	<0.86 U
3/1/2017	Background	0.997045 J	<1.05 U	55	0.0632093 J	<0.07 U	0.740184 J	1.69598 J	0.354	<0.083 U	<0.68 U	0.008	2.59	<0.29 U	<0.99 U	<0.86 U
4/11/2017	Background	<0.93 U	<1.05 U	55	0.0611 J	<0.07 U	0.535696 J	1.80383 J	1.861	<0.083 U	<0.68 U	0.008	1.207	<0.29 U	<0.99 U	<0.86 U
3/22/2018	Assessment	<0.93 U	<1.05 U	56.42	0.09 J	<0.07 U	1.47	2.6 J	1.108	<0.083 U	<0.68 U	0.00837	0.104	<0.29 U	<0.99 U	<0.86 U
8/21/2018	Assessment	<100 U	0.77	62.9	0.07 J	<0.05 U	1.22	2.93	0.987	<0.083 U	0.2 J	0.0118	1.123	<0.2 U	0.4 J	0.1 J
2/28/2019	Assessment	<0.4 U	<0.6 U	43.3	<0.4 U	<0.2 U	4 J	1.67	1.144	<0.04 U	<0.4 U	0.00707	0.461	<8 U	<0.6 U	<2 U
5/23/2019	Assessment	<0.4 U	0.6 J	59.2	<0.4 U	<0.2 U	1 J	3.26	1.089	0.04 J	<0.4 U	0.00841	0.165	<8 U	<0.6 U	<0.1 U
8/12/2019	Assessment	<0.02 U	0.21	58.0	0.07 J	<0.01 U	0.374	2.10	1.217	0.03 J	0.06 J	0.00804	0.345	<0.4 U	0.2 J	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

APPENDIX II

Where applicable, show in this appendix the results from statistical analyses, and a description of the statistical analysis method chosen. These statistical analyses are to be conducted separately for each constituent in each monitoring well.

STATISTICAL ANALYSIS SUMMARY
WEST BOTTOM ASH POND
H.W. Pirkey Power Plant
Hallsville, Texas

Submitted to

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
Suite 103
Columbus, Ohio 43221

July 10, 2019

CHA8473

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LIST OF ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
LFB	Laboratory Fortified Blanks
LRB	Laboratory Reagent Blanks
MCL	Maximum Contaminant Level
NELAP	National Environmental Laboratory Accreditation Program
QA	Quality Assurance
QC	Quality Control
RSL	Regional Screening Level
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency
UTL	Upper Tolerance Limit
WBAP	West Bottom Ash Pond

SECTION 1

EXECUTIVE SUMMARY

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257.90-257.98, "CCR rule"), groundwater monitoring has been conducted at the West Bottom Ash Pond (WBAP), an existing CCR unit at the H.W. Pirkey Power Plant located in Hallsville, Texas.

Based on detection monitoring conducted in 2017 and 2018, statistically significant increases (SSIs) over background were concluded for boron, chloride, and sulfate at the WBAP. An alternative source was not identified at the time, so two assessment monitoring events were conducted at the WBAP in 2018, in accordance with 40 CFR 257.95. An SSL for cobalt was identified at well AD-28. An ASD was successfully completed (Geosyntec, 2019); thus, the unit remained in assessment monitoring.

A semi-annual assessment monitoring event was completed in February 2019, with the results of the February 2019 event documented in this report. 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 were identified which would impact the usability of the data.

The February 2019 monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. Groundwater protection standards (GWPSs) were re-established for the Appendix IV parameters. Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at a statistically significant level (SSL) above the GWPS. An SSL was identified for cobalt. Thus, either the unit will move to an assessment of corrective measures or an alternative source demonstration (ASD) will be conducted to evaluate if the unit can remain in assessment monitoring. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

BOTTOM ASH POND EVALUATION

2.1 Data Validation & QA/QC

During the assessment monitoring program, one set of samples was collected for analysis from each upgradient and downgradient well to meet the requirements of 40 CFR 257.95(d)(1). Although antimony, arsenic, cadmium, lead, molybdenum, and thallium were not detected during the March 2018 screening event, samples from the February 2019 semi-annual sampling event were analyzed for all Appendix III and Appendix IV parameters. A summary of data collected during this assessment monitoring event may be found in Table 1.

Chemical analysis was completed by an analytical laboratory certified by the National Environmental Laboratory Accreditation Program (NELAP). Quality assurance and quality control (QA/QC) samples completed by the analytical laboratory included the use of laboratory reagent blanks (LRBs), continuing calibration verification (CCV) samples, and laboratory fortified blanks (LFBs).

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.9.6.14 statistics software. The export file was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

2.2 Statistical Analysis

Statistical analyses for the WBAP were conducted in accordance with the January 2017 *Statistical Analysis Plan* (AEP, 2017), except where noted below. Time series plots and results for all completed statistical tests are provided in Attachment B.

The data obtained to meet the requirements of 40 CFR 257.95(d)(1) were screened for potential outliers. Thallium was not detected at any wells and was replaced with the reporting limit of 0.01 mg/L. Because this was higher than previous reporting limits, these values were flagged as outliers. However, the removal of these values as outliers did not affect the statistical evaluation of this event, as thallium was not detected during the March 2018 screening event.

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* (AEP, 2017). The established GWPS was determined to be the greater value of the background concentration and the maximum contaminant level (MCL) or risk-based level specified in 40 CFR 257.95(h)(2) for each Appendix IV parameter. To determine

background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events. Generally, tolerance limits were calculated parametrically with 95% coverage and 95% confidence. Non-parametric tolerance limits were calculated for cobalt, mercury, and selenium due to apparent non-normal distributions and for antimony, arsenic, cadmium, fluoride, lead, molybdenum, and selenium due to a high non-detect frequency. 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. Confidence limits were generally calculated parametrically ($\alpha = 0.01$); however, non-parametric confidence limits were calculated in some cases (e.g., when the data did not appear to be normally distributed or when the non-detect frequency was too high). An SSL was concluded if the lower confidence limit (LCL) exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). Calculated confidence limits are shown in Attachment B.

The following SSLs were identified at the Pirkey WBAP:

- The LCL for cobalt exceeded the GWPS of 0.009 mg/L at AD-28 (0.0132 mg/L).

As a result, the Pirkey WBAP will either move to an assessment of corrective measures or an alternative source demonstration will be conducted to evaluate if the unit can remain in assessment monitoring

2.2.3 Evaluation of Potential Appendix III SSIs

While SSLs were identified, a review of the Appendix III results were also completed to assess whether concentrations of Appendix III parameters at the compliance wells exceeded background concentrations. Prediction limits were calculated for the Appendix III parameters to represent background values. As described in the January 2018 *Statistical Analysis Summary* report (Geosyntec, 2018), intrawell tests were used to evaluate potential SSIs for calcium, pH, sulfate and TDS, whereas interwell tests were used to evaluate potential SSIs for boron, chloride and fluoride.

Prediction limits for the interwell tests were recalculated using data collected during the February 2019 assessment monitoring event. Three data points (i.e., one sample from three background wells) were added to the background dataset for each interwell test. New data were tested for outliers prior to being added to the background dataset. The updated prediction limits were calculated for a one-of-two retesting procedure, as during detection monitoring. The values of the updated prediction limits were similar to the values of the prediction limits calculated during detection monitoring. The revised interwell prediction limits were used to evaluate potential SSIs for boron, chloride, and fluoride.

For the intrawell tests, limited data made it possible to add only one data point (i.e., one sample from each compliance well) to each background dataset. Because one sample result is insufficient to compare against the existing background dataset, the prediction limits were not updated for the intrawell tests at this time. The intrawell prediction limits calculated during detection monitoring were used to evaluate potential SSIs for calcium, pH, sulfate, and TDS.

Data collected during the February 2019 assessment monitoring event from each compliance well were compared to the prediction limits to evaluate results above background values. The results from this event and the prediction limits are summarized in Table 3. The following exceedances of the upper prediction limits (UPLs) were noted:

- Boron concentrations exceeded the interwell UPL of 0.0700 mg/L at AD-28 (0.330 mg/L) and AD-30 (1.57 mg/L).
- The calcium concentration exceeded the intrawell UPL of 0.664 mg/L at AD-30 (0.716 mg/L).
- Chloride exceeded the interwell background value of 9.61 mg/L at AD-17 (35.0 mg/L) and AD-30 (29.0 mg/L).
- The sulfate concentration exceeded the intrawell background value of 155 mg/L at AD-30 (188 mg/L)
- TDS concentrations exceeded the intrawell UPL of 21.2 mg/L at AD-28 (22.0 mg/L) and the intrawell UPL of 31.6 mg/L at AD-30 (66.0 mg/L).

While the prediction limits were calculated assuming a 1-of-2 testing procedure, it was conservatively assumed that an SSI was identified if the initial sample exceeded either the UPL based on previous results. Based on these results, concentrations of Appendix III parameters exceeded background levels at compliance wells at the Pirkey WBAP during assessment monitoring.

2.3 Conclusions

A semi-annual assessment monitoring event was conducted in accordance with the CCR Rule. The laboratory and field data were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. A review of outliers identified no potential outliers in the February 2019 data. GWPSs were re-established for the 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 exceeded the GWPS. An SSL was identified for cobalt. Appendix III parameters were also evaluated, with exceedances identified for boron, calcium, chloride, sulfate, and TDS.

Based on this evaluation, the Pirkey WBAP CCR unit will either move to an assessment of corrective measures or an ASD will be conducted to evaluate if the unit can remain in assessment monitoring.

SECTION 3

REFERENCES

American Electric Power (AEP). 2017. Statistical Analysis Plan – Pirkey Plant. January 2017.

Geosyntec Consultants (Geosyntec). 2018. Statistical Analysis Summary – West Bottom Ash Pond, H.W. Pirkey Power Plant, Hallsville, Texas. January 3, 2018.

Geosyntec. 2019. Alternative Source Demonstration Report – Federal CCR Rule. H.W. Pirkey Plant - West Bottom Ash Pond. March.

TABLES

Table 1 - Groundwater Data Summary
Pirkey - West Bottom Ash Pond

Geosyntec Consultants

Parameter	Unit	AD-3	AD-12	AD-17	AD-18	AD-28	AD-30	
		2/27/2019	2/27/2019	2/28/2019	2/28/2019	2/27/2019	2/28/2019	4/3/2019
Antimony	µg/L	0.0400 J	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	-
Arsenic	µg/L	0.130	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	-
Barium	µg/L	54.2	22.5	71.4	106	154	43.3	-
Beryllium	µg/L	2.00 U	2.00 U	2.00 U	2.00 U	0.900 J	2.00 U	-
Boron	mg/L	0.0340	0.0300 J	0.0300 J	0.100 U	0.458	0.491	-
Cadmium	µg/L	0.0300 J	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	-
Calcium	mg/L	3.46	0.400 J	0.200 J	0.490	1.65	0.300 J	-
Chloride	mg/L	6.16	6.08	10.2	8.19	6.29	14.6	-
Chromium	µg/L	0.0400 J	4.00 U	4.00 U	4.00 U	4.00 U	4.00 J	-
Cobalt	µg/L	2.31	1.37	2.93	1.11	14.3	1.67	-
Combined Radium	pCi/L	0.314	0.225	0.772	0.615	2.32	1.14	-
Fluoride	mg/L	0.0400 J	0.0900	0.120	0.0200 J	0.810	0.200 U	-
Lead	µg/L	0.0500 J	2.00 U	2.00 U	0.700 J	2.00 U	2.00 U	-
Lithium	mg/L	0.0525	0.00688	0.00912	0.0177	0.0266	0.00707	-
Mercury	mg/L	0.0000250 U	0.0000250 U	0.000107	0.00000900 J	0.0000610	0.000461	-
Molybdenum	µg/L	2.00 U	40.0 U	40.0 U	40.0 U	40.0 U	40.0 U	-
Selenium	µg/L	0.0500 J	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	-
Total Dissolved Solids	mg/L	50.0	36.0	68.0	84.0	32.0	-	135
Sulfate	mg/L	21.8	3.60	2.40	6.10	19.6	31.5	-
Thallium	µg/L	0.500 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	-
pH	SU	5.31	5.17	3.70	5.02	4.99	4.20	-

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

Table 2: Groundwater Protection Standards
Pirkey Plant - West Bottom Ash Pond

Geosyntec Consultants, Inc.

Constituent Name	MCL	CCR Rule-Specified	Background Limit
Antimony, Total (mg/L)	0.006		0.002
Arsenic, Total (mg/L)	0.01		0.0042
Barium, Total (mg/L)	2		0.16
Beryllium, Total (mg/L)	0.004		0.0012
Cadmium, Total (mg/L)	0.005		0.001
Chromium, Total (mg/L)	0.1		0.0029
Cobalt, Total (mg/L)	n/a	0.006	0.009
Combined Radium, Total (pCi/L)	5		3.57
Fluoride, Total (mg/L)	4		1
Lead, Total (mg/L)	n/a	0.015	0.002
Lithium, Total (mg/L)	n/a	0.04	0.14
Mercury, Total (mg/L)	0.002		0.000064
Molybdenum, Total (mg/L)	n/a	0.1	0.04
Selenium, Total (mg/L)	0.05		0.004
Thallium, Total (mg/L)	0.002		0.002

Notes:
Grey cell indicates calculated UTL is higher than MCL.
MCL = Maximum Contaminant Level
RSL = Regional Screening Level
Calculated UTL (Upper Tolerance Limit) represents site-specific background values.
The higher of the calculated UTL or MCL/Rule-Specified Level is used as the GWPS.

Table 3: Appendix III Data Summary
Pirkey - West Bottom Ash Pond

Geosyntec Consultants, Inc.

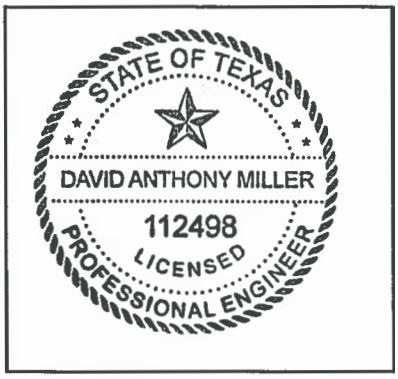
Parameter	Units	Description	AD-17	AD-28	AD-30
			8/21/2018	8/21/2018	8/21/2018
Boron	mg/L	Interwell Background Value (UPL)	0.0700		
		Detection Monitoring Data	0.0440	**0.330**	**1.57**
Calcium	mg/L	Intrawell Background Value (UPL)	1.90	3.41	0.664
		Detection Monitoring Data	0.997	1.39	**0.716**
Chloride	mg/L	Interwell Background Value (UPL)	9.61		
		Detection Monitoring Data	**35.0**	9.00	**29.0**
Fluoride	mg/L	Interwell Background Value (UPL)	1.00		
		Detection Monitoring Data	0.0830	0.498	0.0830
pH	SU	Intrawell Background Value (UPL)	4.8	5.9	5.4
		Intrawell Background Value (LPL)	3.0	2.8	3.7
		Detection Monitoring Data	3.9	5.0	4.8
TDS	mg/L	Intrawell Background Value (UPL)	109	132	155
		Detection Monitoring Data	98.0	96.0	**188**
Sulfate	mg/L	Intrawell Background Value (UPL)	9.64	21.2	31.6
		Detection Monitoring Data	7.00	**22.0**	**66.0**

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

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 Pirkey West Bottom Ash Pond 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

112498	TEXAS	07.10.19
License Number	Licensing State	Date

ATTACHMENT B

Statistical Analysis Output

GROUNDWATER STATS CONSULTING

July 10, 2019

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
941 Chatham Lane, #103
Columbus, OH 43221

Re: Pirkey WBAP
Assessment Monitoring Event – February 2019

Dear Ms. Kreinberg,

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the statistical analysis of groundwater data for the February 2019 sample event for American Electric Power Inc.'s Pirkey West Bottom Ash Pond. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals from Electric Utilities (CCR Rule, 2015) as well as with the 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:** AD-3, AD-12, and AD-18; and
- **Downgradient wells:** AD-17, AD-28, and AD-30.

Data were sent electronically, and the statistical analysis was conducted according to the Statistical Analysis Plan and 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 CCR program consists of the following constituents:

- **Appendix III** (Detection Monitoring) **-** boron, calcium, chloride, fluoride, pH, sulfate, and TDS;

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

Time series plots for Appendix III and IV parameters are provided for all wells and constituents; and are used to evaluate concentrations over the entire record (Figure A). Values previously flagged during the screening as outliers may be seen in a lighter font and disconnected symbol on the time series graphs, and a summary of those values follows this letter (Figure B).

Evaluation of Appendix III Parameters

Interwell prediction limits combined with a 1-of-2 verification strategy were constructed for boron, chloride and fluoride; and intrawell prediction limits combined with a 1-of-2 verification strategy were constructed for calcium, pH, sulfate and TDS for the February 2019 data (Figures C & D, respectively). The statistical method selected for each parameter was determined based on the results of the evaluation performed in December 2017; and all proposed background data were screened for outliers and trends at that time. The findings of those reports were submitted with that analysis.

Interwell prediction limits utilize all upgradient well data for construction of statistical limits. During each sample event, upgradient well data are screened for any newly suspected outliers or obvious trending patterns using time series plots. All values flagged as outliers may be seen on the Outlier Summary report following this letter. No obvious trending patterns were observed in the upgradient wells.

Intrawell prediction limits utilize the background data set that was originally screened in 2017. As recommended in the EPA Unified Guidance (2009), the background data set will be tested for the purpose of updating statistical limits using the Mann-Whitney two-sample test when an additional four to eight measurements are available.

Note that the reporting limit for fluoride for the February 2019 event at well AD-30 was <0.2 mg/L whereas all historical reporting limits for all wells is <1.0 mg/L. Therefore, <1.0 mg/L was substituted for all nondetects which is less than the Groundwater Protection Standard of 4 mg/L. Additionally, in the case of TDS at well AD-30, the April 2019 sample was compared against background.

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of one additional sample to determine whether the initial exceedance is confirmed. When the resample confirms the initial exceedance, a statistically significant

increase (SSI) is identified, and further research would be required to identify the cause of the exceedance (i.e. impact from the site, natural variation, or an off-site source). If the resample falls within the statistical limit, the initial exceedance is considered a false positive result and, therefore, no further action is necessary. Prediction limit exceedances were noted for boron at wells AD-28 and AD-30, and chloride at wells AD-17 and AD-30. The results of those findings may be found in the Prediction Limit Summary tables following this letter.

When a statistically significant increase is identified, the data are further evaluated using the Sen's Slope/Mann Kendall trend test to determine whether concentrations are statistically increasing, decreasing or stable (Figure E). Upgradient wells are included in the trend analyses to identify whether similar patterns exist upgradient of the site. Such patterns are an indication of natural variability in groundwater unrelated to practices at the site.

No statistically significant increasing or decreasing trends were found for any of the downgradient well/parameter pairs with prediction limit exceedances, except for a statistically significant increasing trend for boron in well AD-30.

Evaluation of Appendix IV Parameters

Interwell Tolerance limits were used to calculate background limits from all available pooled upgradient well data for Appendix IV parameters to determine the Alternate Contaminant Level (ACL) for each constituent (Figure F). Background data are screened for outliers and extreme trending patterns that would lead to artificially elevated statistical limits. Any flagged values may be seen on the Outlier Summary following this letter.

Parametric limits use a target of 95% confidence and 95% coverage. The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. These limits were compared to the Maximum Contaminant Levels (MCLs) and CCR-Rule specified levels 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 G).

Confidence intervals were then constructed on downgradient wells for each of the Appendix IV parameters using the highest limit of the MCL, CCR-Rule specified level or ACL as discussed above (Figure H). Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. Note that the reporting limit for thallium for this event was <0.01 mg/L which is higher than the historical reporting limit of <0.002 mg/L and higher than the GWPS. Since the <0.01 mg/L

values do not provide any useful information regarding whether the observations exceed the GWPS, they are flagged as outliers.

No confidence interval exceedances were found except for cobalt in well AD-28. A summary of the confidence interval results follows this letter.

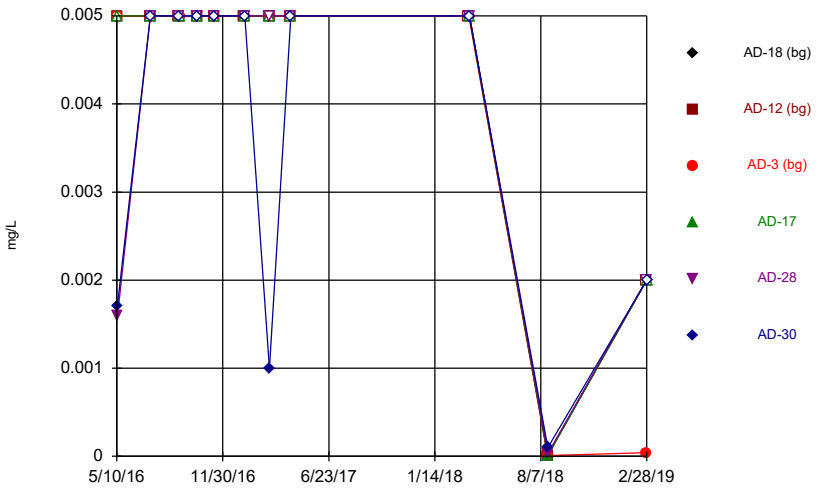
Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Pirkey West Bottom Ash Pond. If you have any questions or comments, please feel free to contact me.

For Groundwater Stats Consulting,

Kristina L. Rayner
Groundwater Statistician

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

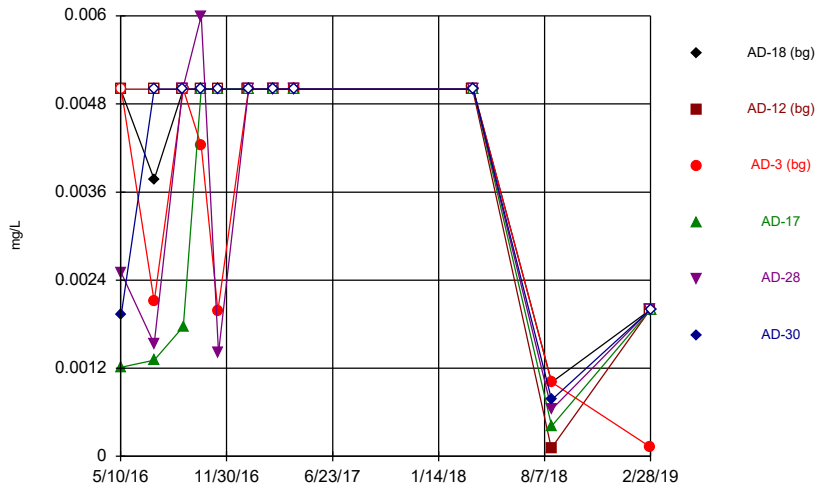
Time Series



Constituent: Antimony, total Analysis Run 7/9/2019 1:50 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



Constituent: Arsenic, total Analysis Run 7/9/2019 1:50 PM View: Time Series
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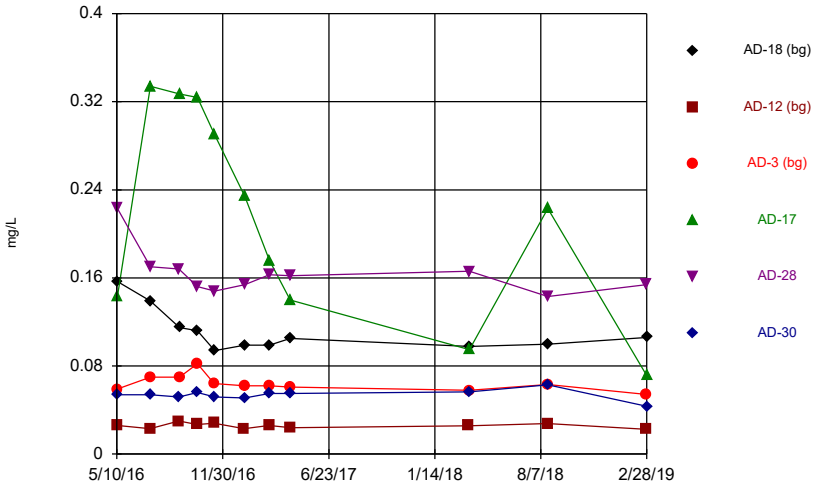
Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



Constituent: Barium, total Analysis Run 7/9/2019 1:50 PM View: Time Series
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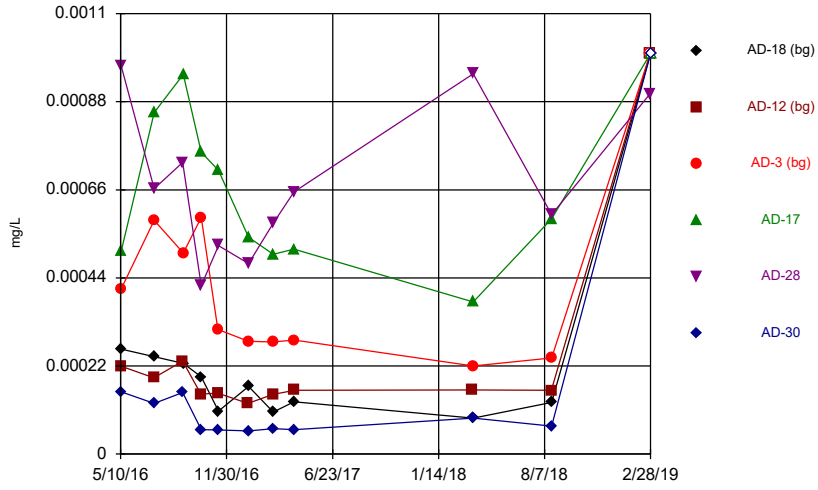
Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

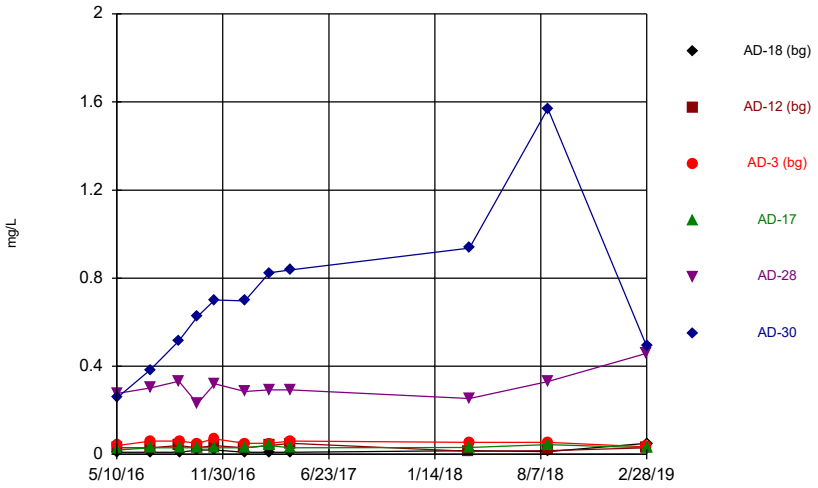
Time Series



Constituent: Beryllium, total Analysis Run 7/9/2019 1:50 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

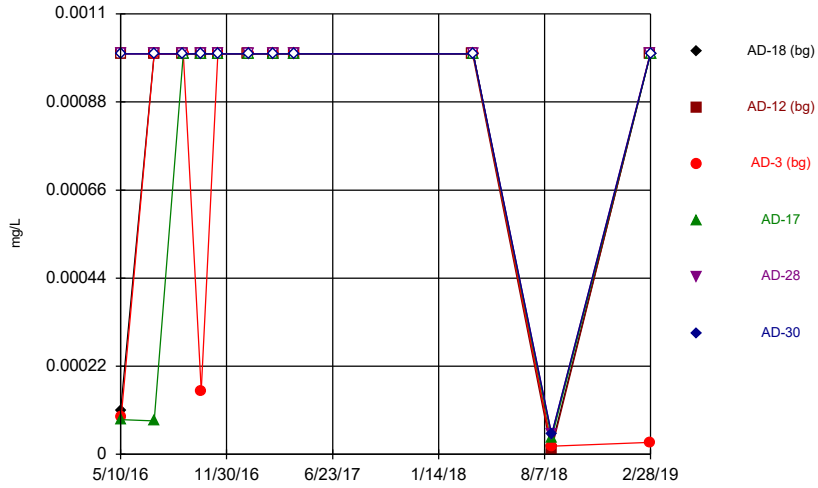
Time Series



Constituent: Boron, total Analysis Run 7/9/2019 1:50 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



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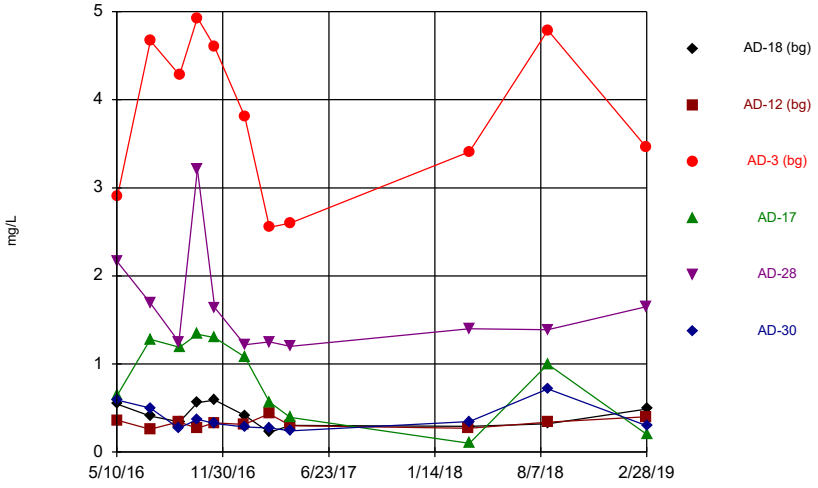
Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

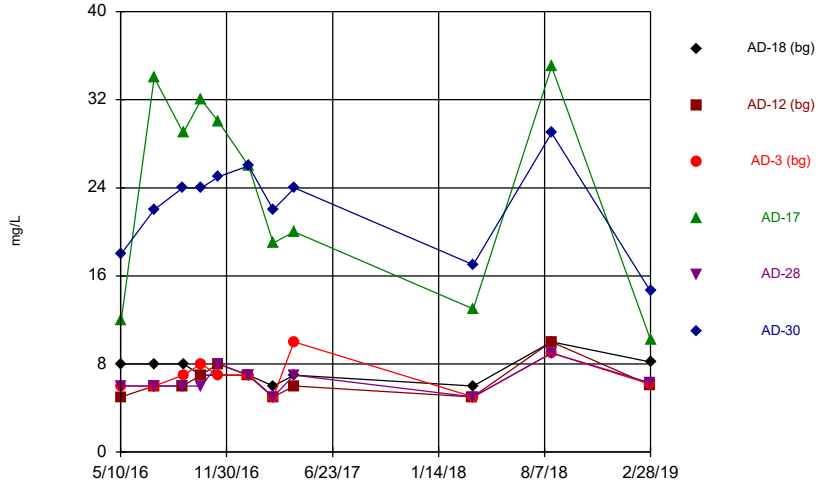
Time Series



Constituent: Calcium, total Analysis Run 7/9/2019 1:50 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

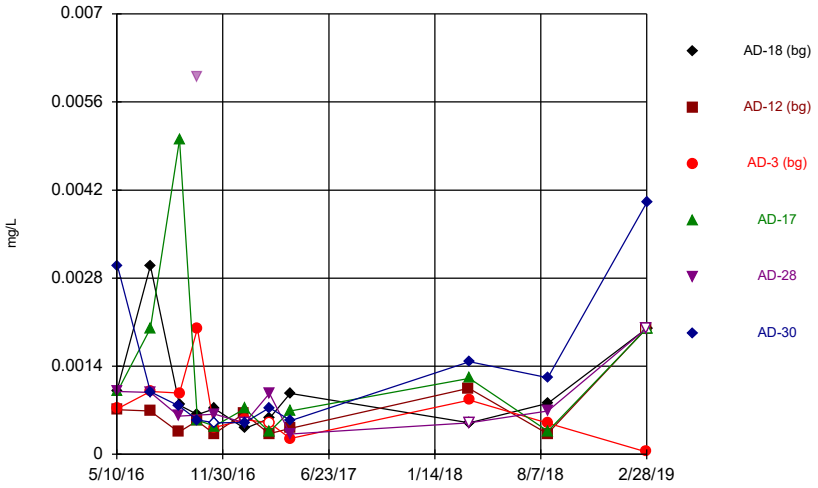
Time Series



Constituent: Chloride, total Analysis Run 7/9/2019 1:50 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

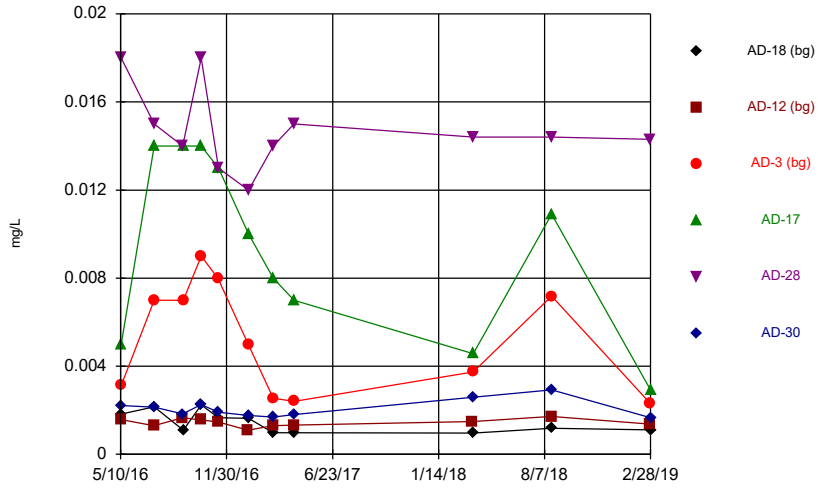
Time Series



Constituent: Chromium, total Analysis Run 7/9/2019 1:51 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

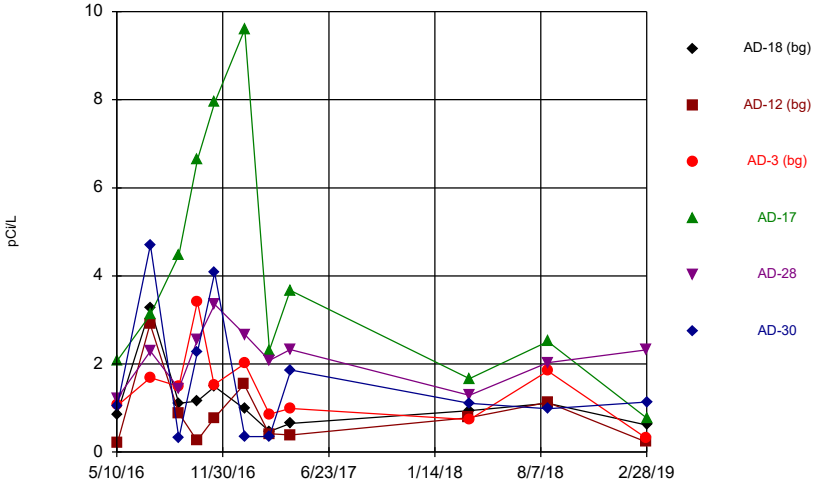
Time Series



Constituent: Cobalt, total Analysis Run 7/9/2019 1:51 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

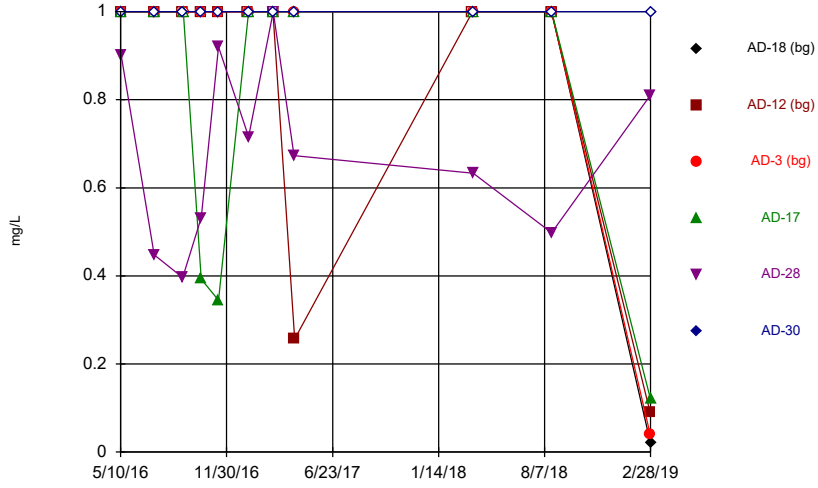
Time Series



Constituent: Combined Radium 226 + 228 Analysis Run 7/9/2019 1:51 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

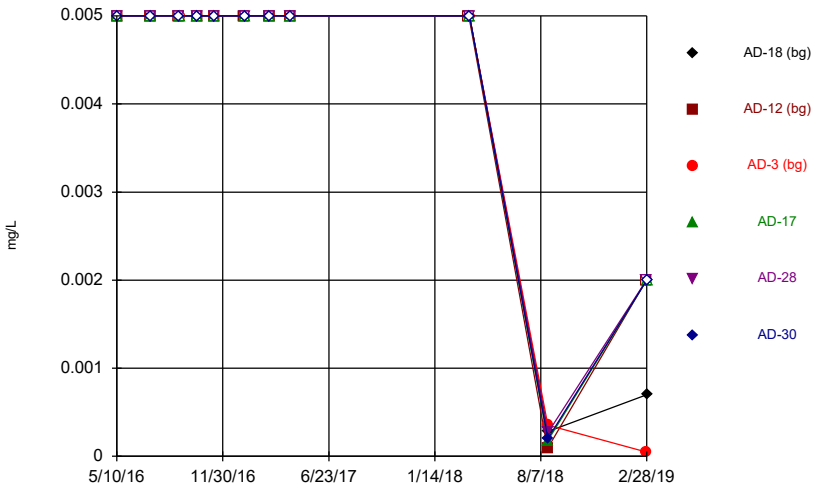
Time Series



Constituent: Fluoride, total Analysis Run 7/9/2019 1:51 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

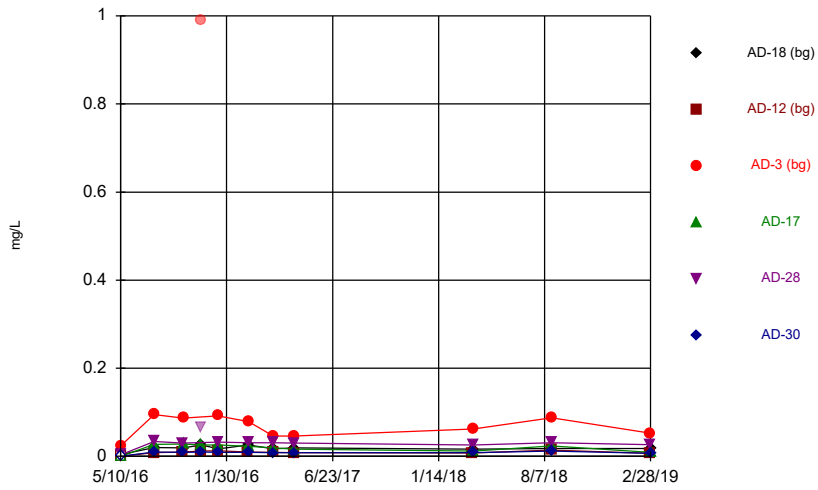
Time Series



Constituent: Lead, total Analysis Run 7/9/2019 1:51 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

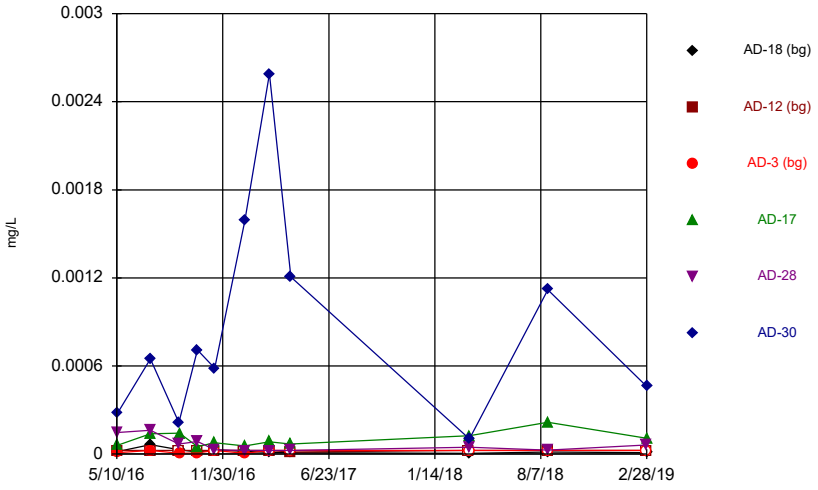
Time Series



Constituent: Lithium, total Analysis Run 7/9/2019 1:51 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

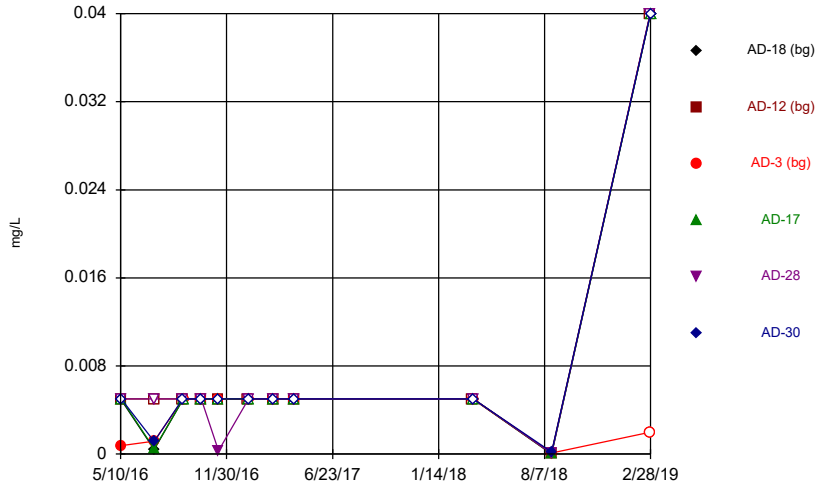
Time Series



Constituent: Mercury, total Analysis Run 7/9/2019 1:51 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

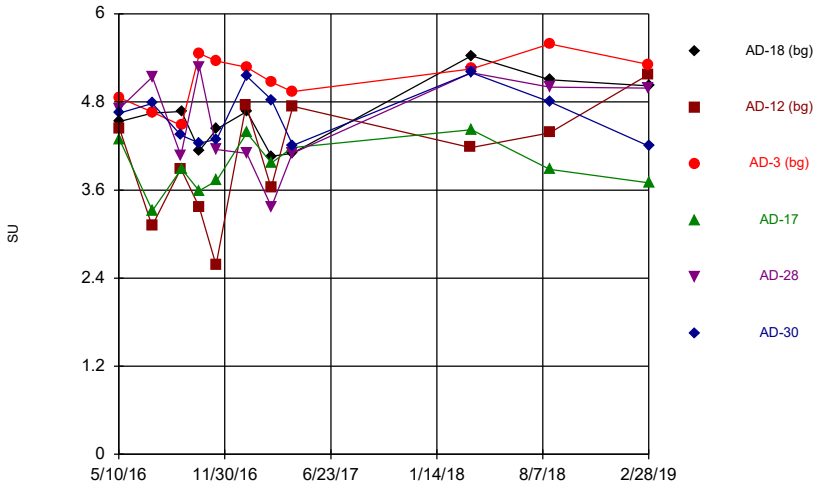
Time Series



Constituent: Molybdenum, total Analysis Run 7/9/2019 1:51 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

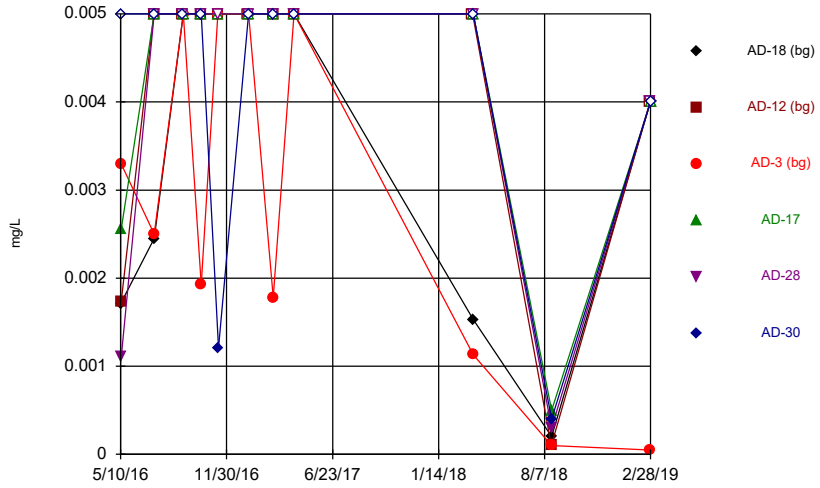
Time Series



Constituent: pH, field Analysis Run 7/9/2019 1:51 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

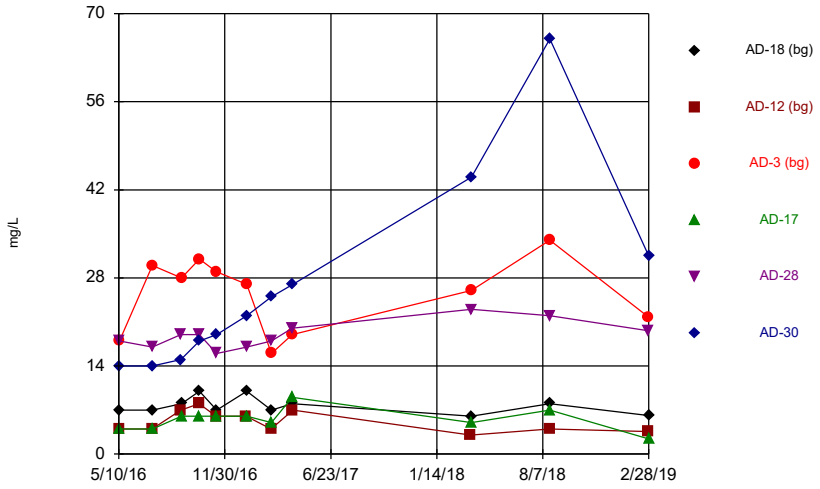
Time Series



Constituent: Selenium, total Analysis Run 7/9/2019 1:51 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

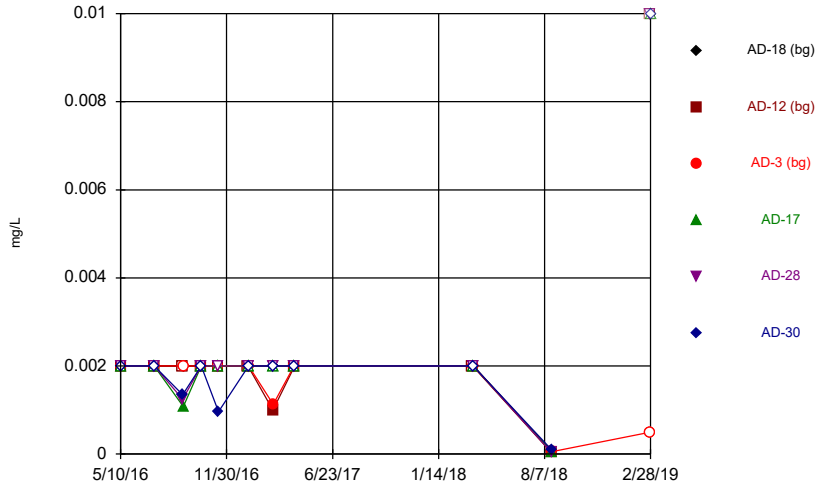
Time Series



Constituent: Sulfate, total Analysis Run 7/9/2019 1:51 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

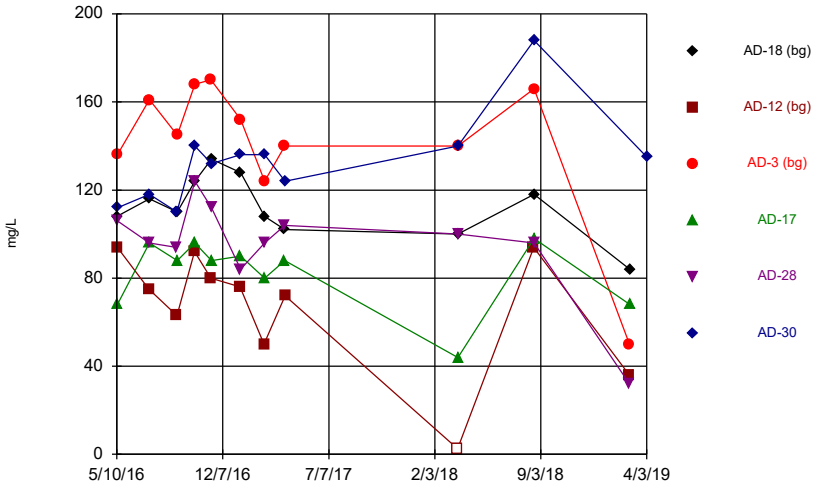
Time Series



Constituent: Thallium, total Analysis Run 7/9/2019 1:51 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



Constituent: Total Dissolved Solids [TDS] Analysis Run 7/9/2019 1:51 PM View: Time Series
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Outlier Summary

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 7/9/2019, 2:03 PM

	AD-28 Chromium, total (mg/L)	AD-3 Lithium, total (mg/L)	AD-28 Lithium, total (mg/L)	AD-18 Thallium, total (mg/L)	AD-12 Thallium, total (mg/L)	AD-17 Thallium, total (mg/L)	AD-28 Thallium, total (mg/L)	AD-30 Thallium, total (mg/L)
10/13/2016	0.006 (o)	0.991 (o)	0.066 (o)					
2/27/2019					<0.01 (o)		<0.01 (o)	
2/28/2019				<0.01 (o)		<0.01 (o)		<0.01 (o)

Interwell Prediction Limit Summary - Significant Results

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 7/7/2019, 8:01 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	**AD-28**	**0.0668**	**n/a**	**2/27/2019**	**0.458**	**Yes**	**33**	**0.03374**	**0.01858**	**3.03**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Boron, total (mg/L)	**AD-30**	**0.0668**	**n/a**	**2/28/2019**	**0.491**	**Yes**	**33**	**0.03374**	**0.01858**	**3.03**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Chloride, total (mg/L)	**AD-17**	**9.608**	**n/a**	**2/28/2019**	**10.2**	**Yes**	**33**	**2.624**	**0.2676**	**0**	**None**	**sqrt(x)**	**0.002505**	**Param Inter 1 of 2**
Chloride, total (mg/L)	**AD-30**	**9.608**	**n/a**	**2/28/2019**	**14.6**	**Yes**	**33**	**2.624**	**0.2676**	**0**	**None**	**sqrt(x)**	**0.002505**	**Param Inter 1 of 2**

Interwell Prediction Limit Summary - All Results

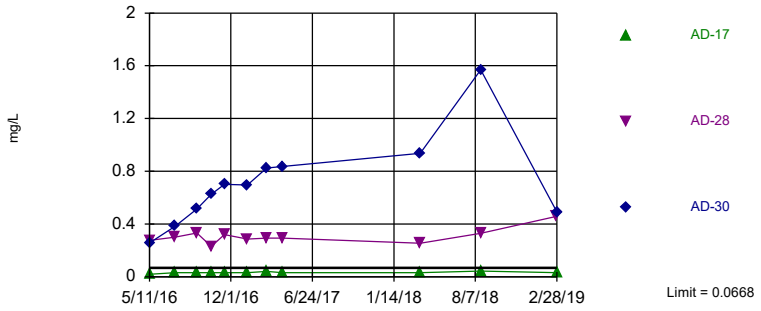
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 7/7/2019, 8:01 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	AD-17	0.0668	n/a	2/28/2019	0.03	No	33	0.03374	0.01858	3.03	None	No	0.002505	Param Inter 1 of 2
Boron, total (mg/L)	**AD-28**	**0.0668**	**n/a**	**2/27/2019**	**0.458**	**Yes**	**33**	**0.03374**	**0.01858**	**3.03**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Boron, total (mg/L)	**AD-30**	**0.0668**	**n/a**	**2/28/2019**	**0.491**	**Yes**	**33**	**0.03374**	**0.01858**	**3.03**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Chloride, total (mg/L)	**AD-17**	**9.608**	**n/a**	**2/28/2019**	**10.2**	**Yes**	**33**	**2.624**	**0.2676**	**0**	**None**	**sqrt(x)**	**0.002505**	**Param Inter 1 of 2**
Chloride, total (mg/L)	AD-28	9.608	n/a	2/27/2019	6.29	No	33	2.624	0.2676	0	None	sqrt(x)	0.002505	Param Inter 1 of 2
Chloride, total (mg/L)	**AD-30**	**9.608**	**n/a**	**2/28/2019**	**14.6**	**Yes**	**33**	**2.624**	**0.2676**	**0**	**None**	**sqrt(x)**	**0.002505**	**Param Inter 1 of 2**
Fluoride, total (mg/L)	AD-17	1	n/a	2/28/2019	0.12	No	33	n/a	n/a	87.88	n/a	n/a	0.001673	NP Inter (NDs) 1 of 2
Fluoride, total (mg/L)	AD-28	1	n/a	2/27/2019	0.81	No	33	n/a	n/a	87.88	n/a	n/a	0.001673	NP Inter (NDs) 1 of 2
Fluoride, total (mg/L)	AD-30	1	n/a	2/28/2019	1ND	No	33	n/a	n/a	87.88	n/a	n/a	0.001673	NP Inter (NDs) 1 of 2

Exceeds Limit: AD-28, AD-30

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=0.03374, Std. Dev.=0.01858, n=33, 3.03% NDs. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9114, critical = 0.906. Kappa = 1.78 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.002505. Comparing 3 points to limit.

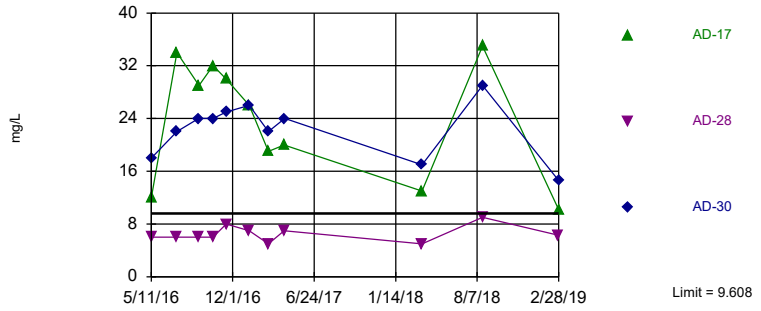
Constituent: Boron, total Analysis Run 7/7/2019 8:00 PM View: PLs - Interwell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: AD-17, AD-30

Prediction Limit

Interwell Parametric



Background Data Summary (based on square root transformation): Mean=2.624, Std. Dev.=0.2676, n=33. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9176, critical = 0.906. Kappa = 1.78 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.002505. Comparing 3 points to limit.

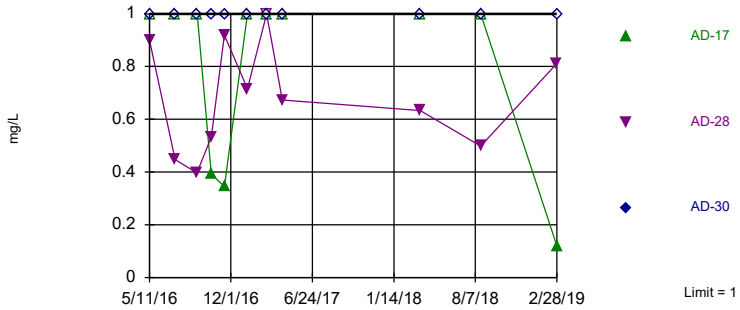
Constituent: Chloride, total Analysis Run 7/7/2019 8:00 PM View: PLs - Interwell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 33 background values. 87.88% NDs. Annual per-constituent alpha = 0.009997. Individual comparison alpha = 0.001673 (1 of 2). Comparing 3 points to limit.

Constituent: Fluoride, total Analysis Run 7/7/2019 8:00 PM View: PLs - Interwell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Intrawell Prediction Limit Summary - All Results (No Significant)

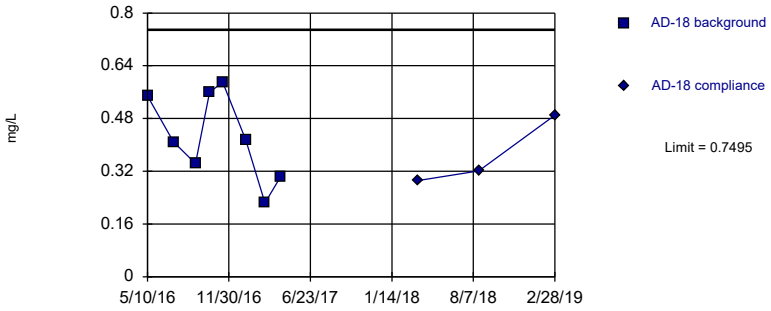
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 7/7/2019, 8:07 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Calcium, total (mg/L)	AD-18	0.7495	n/a	2/28/2019	0.49	No	8	0.4241	0.1324	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-12	0.4631	n/a	2/27/2019	0.4	No	8	0.3269	0.05542	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-3	6.204	n/a	2/27/2019	3.46	No	8	3.794	0.9807	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-17	1.903	n/a	2/28/2019	0.2	No	8	0.9754	0.3773	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-28	3.411	n/a	2/27/2019	1.65	No	8	1.703	0.695	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-30	0.6643	n/a	2/28/2019	0.3	No	8	0.3575	0.1248	0	None	No	0.002505	Param Intra 1 of 2
pH, field (SU)	AD-18	5.063	3.75	2/28/2019	5.02	No	8	4.406	0.267	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-12	5.764	1.866	2/27/2019	5.17	No	8	3.815	0.7928	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-3	5.857	4.168	2/27/2019	5.31	No	8	5.013	0.3437	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-17	4.812	3.025	2/28/2019	3.7	No	8	3.919	0.3634	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-28	5.925	2.805	2/27/2019	4.99	No	8	4.365	0.6348	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-30	5.403	3.722	2/28/2019	4.2	No	8	4.563	0.3421	0	None	No	0.001253	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-18	11.39	n/a	2/28/2019	6.1	No	8	2.821	0.2255	0	None	sqrt(x)	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-12	9.636	n/a	2/27/2019	3.6	No	8	5.75	1.581	0	None	No	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-3	39.6	n/a	2/27/2019	21.8	No	8	24.75	6.042	0	None	No	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-17	9.636	n/a	2/28/2019	2.4	No	8	5.75	1.581	0	None	No	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-28	21.22	n/a	2/27/2019	19.6	No	8	18	1.309	0	None	No	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-30	31.56	n/a	2/28/2019	31.5	No	8	19.25	5.007	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-18	144	n/a	2/28/2019	84	No	8	116.3	11.29	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-12	110.7	n/a	2/27/2019	36	No	8	75.25	14.41	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-3	189.4	n/a	2/27/2019	50	No	8	149.5	16.23	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-17	109.2	n/a	2/28/2019	68	No	8	86.75	9.13	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-28	132.3	n/a	2/27/2019	32	No	8	102	12.33	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-30	154.7	n/a	4/3/2019	135	No	8	126	11.66	0	None	No	0.002505	Param Intra 1 of 2

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=0.4241, Std. Dev.=0.1324, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9343, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

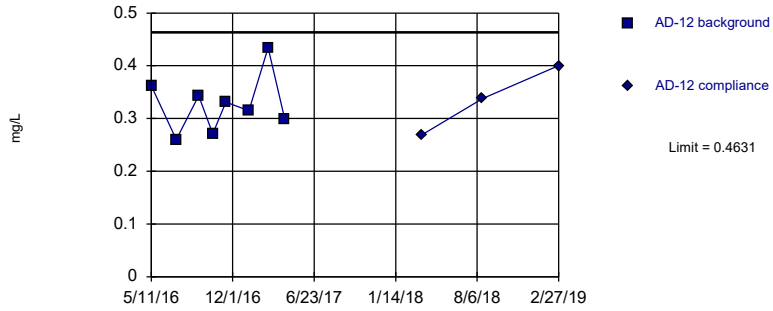
Constituent: Calcium, total Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=0.3269, Std. Dev.=0.05542, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9467, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

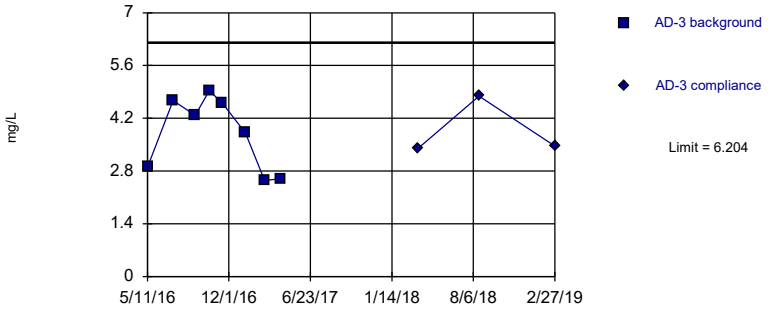
Constituent: Calcium, total Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=3.794, Std. Dev.=0.9807, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8697, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

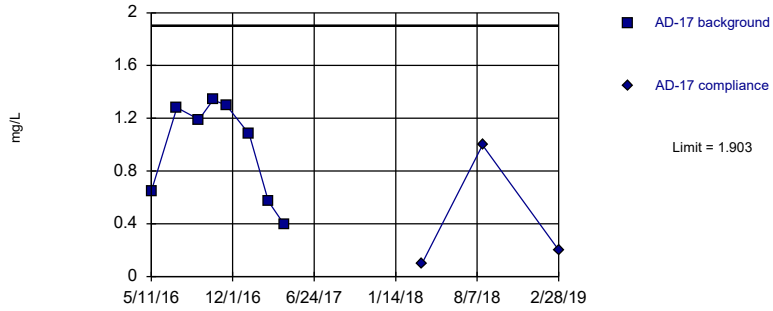
Constituent: Calcium, total Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



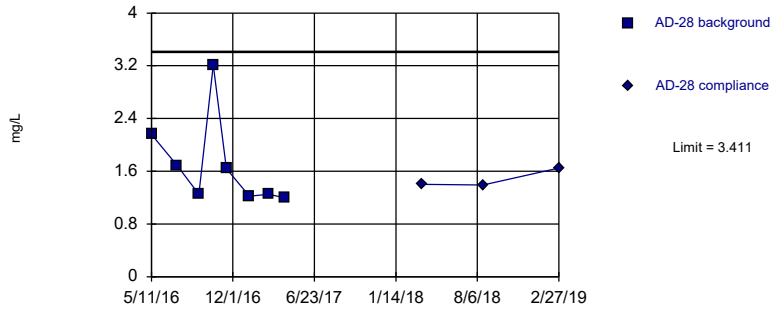
Background Data Summary: Mean=0.9754, Std. Dev.=0.3773, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8479, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Calcium, total Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=1.703, Std. Dev.=0.695, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.769, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Calcium, total Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

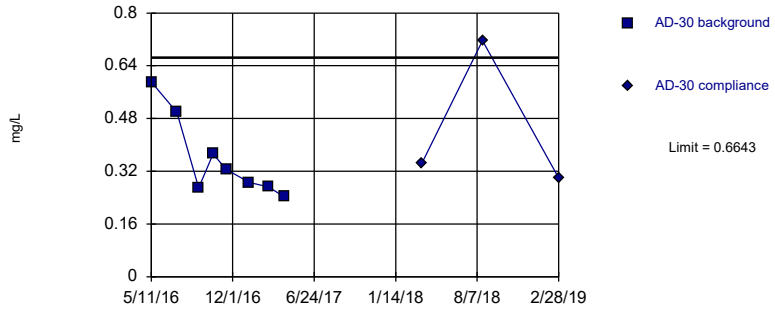
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=0.3575, Std. Dev.=0.1248, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.844, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Calcium, total Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

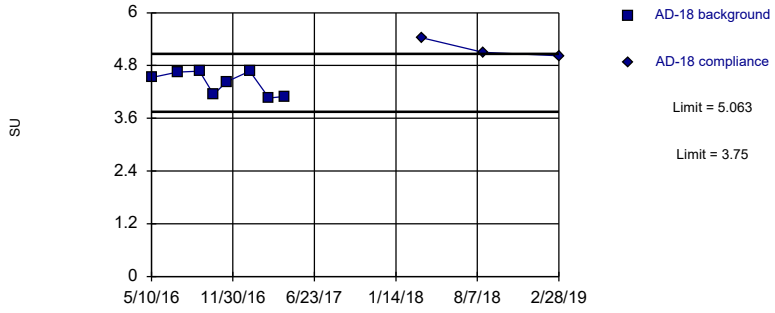
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=4.406, Std. Dev.=0.267, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8312, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: pH, field Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

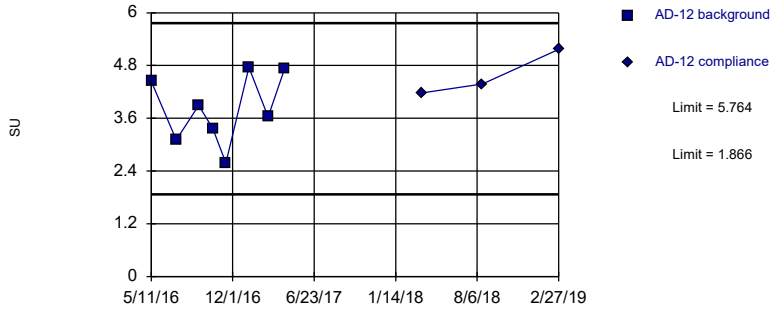
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=3.815, Std. Dev.=0.7928, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9424, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

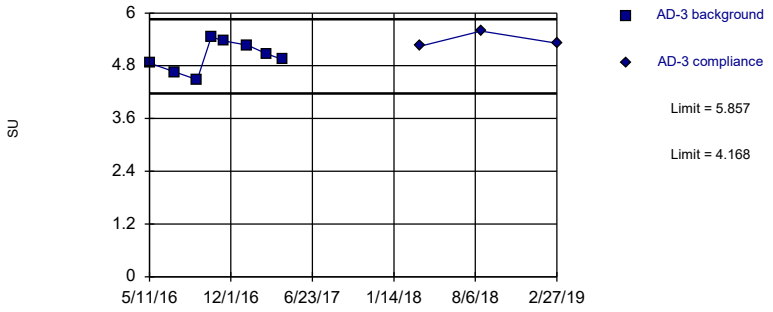
Constituent: pH, field Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=5.013, Std. Dev.=0.3437, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.965, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: pH, field Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

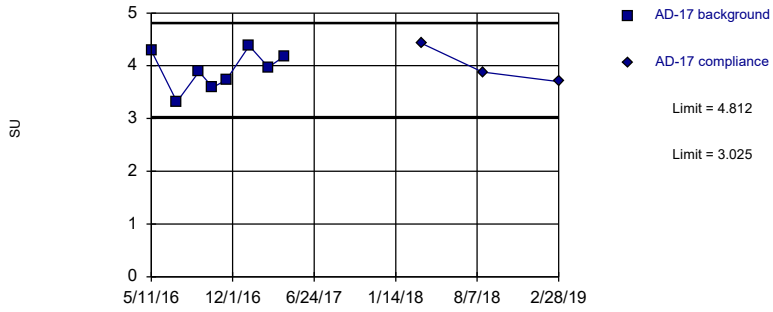
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=3.919, Std. Dev.=0.3634, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9678, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: pH, field Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

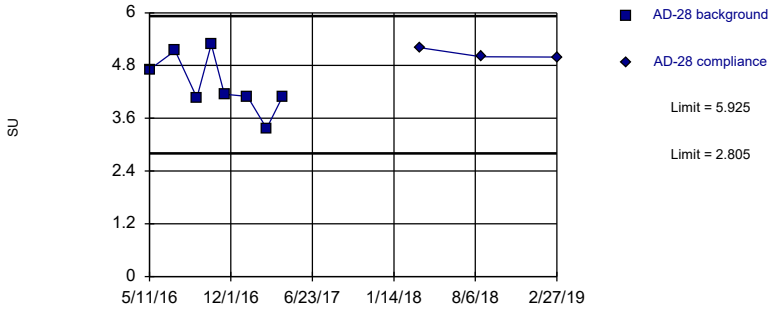
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=4.365, Std. Dev.=0.6348, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9117, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: pH, field Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

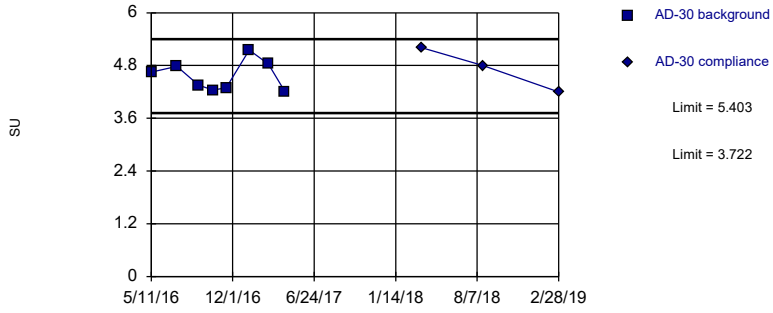
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=4.563, Std. Dev.=0.3421, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8981, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

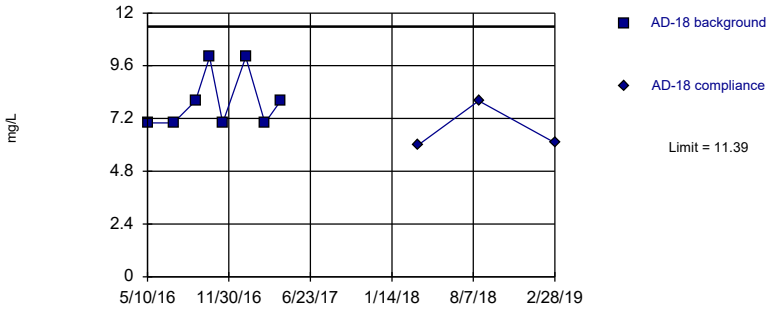
Constituent: pH, field Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary (based on square root transformation): Mean=2.821, Std. Dev.=0.2255, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7543, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Sulfate, total Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

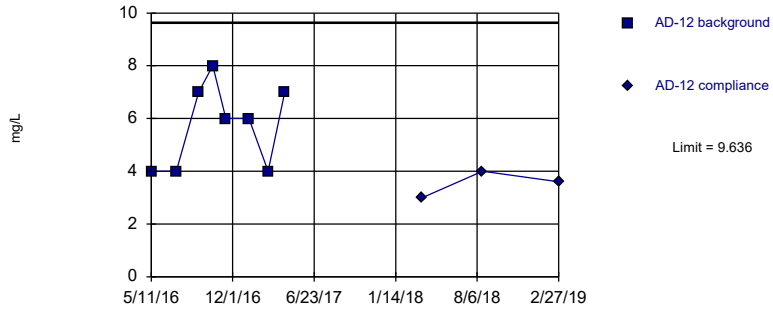
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=5.75, Std. Dev.=1.581, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.866, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Sulfate, total Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

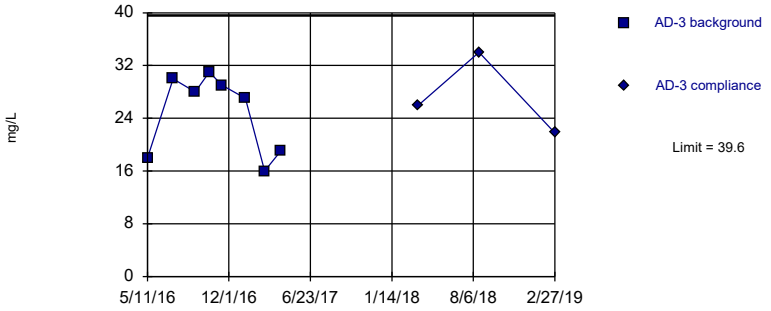
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=24.75, Std. Dev.=6.042, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8428, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Sulfate, total Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

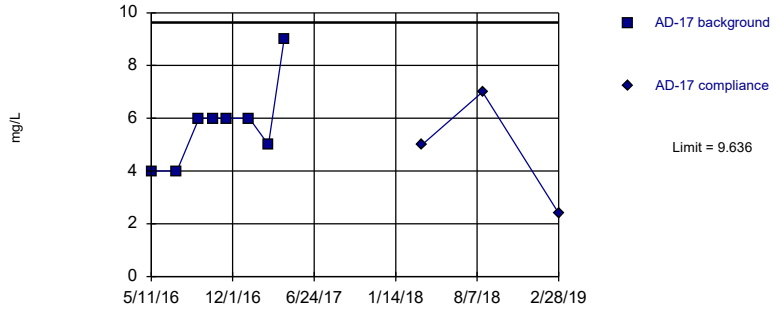
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=5.75, Std. Dev.=1.581, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8396, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

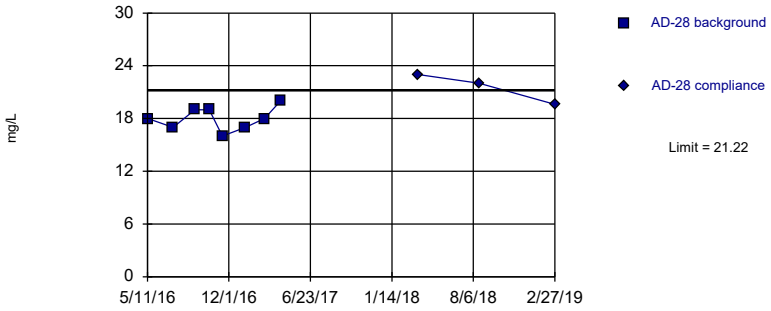
Constituent: Sulfate, total Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Within Limit

Prediction Limit

Intrawell Parametric



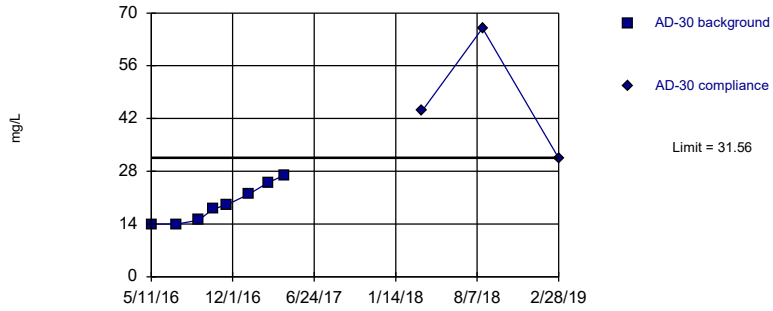
Background Data Summary: Mean=18, Std. Dev.=1.309, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9646, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Sulfate, total Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Within Limit

Prediction Limit

Intrawell Parametric



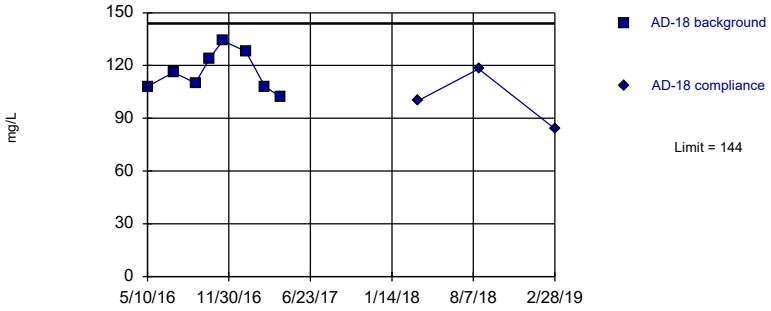
Background Data Summary: Mean=19.25, Std. Dev.=5.007, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9081, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Sulfate, total Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=116.3, Std. Dev.=11.29, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9317, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

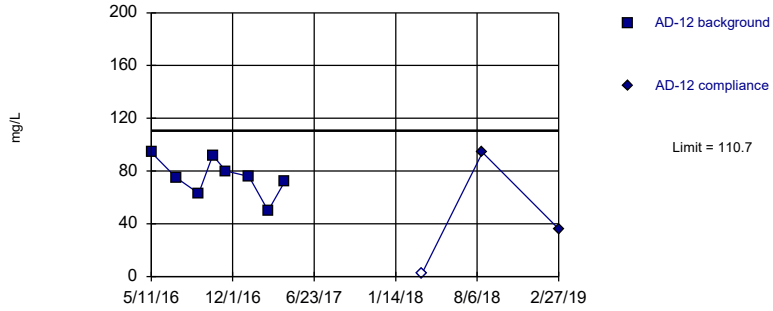
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Parametric



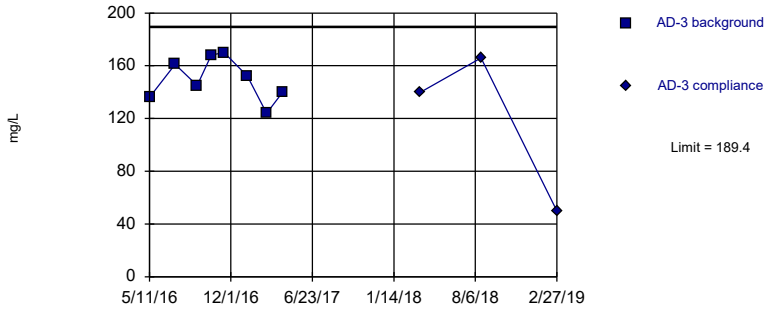
Background Data Summary: Mean=75.25, Std. Dev.=14.41, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9549, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=149.5, Std. Dev.=16.23, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9574, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

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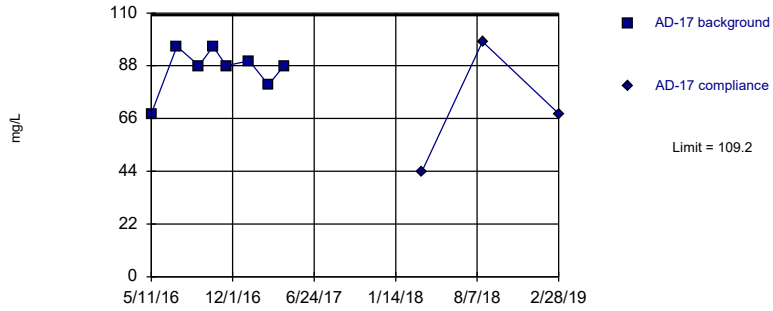
Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=86.75, Std. Dev.=9.13, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8566, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

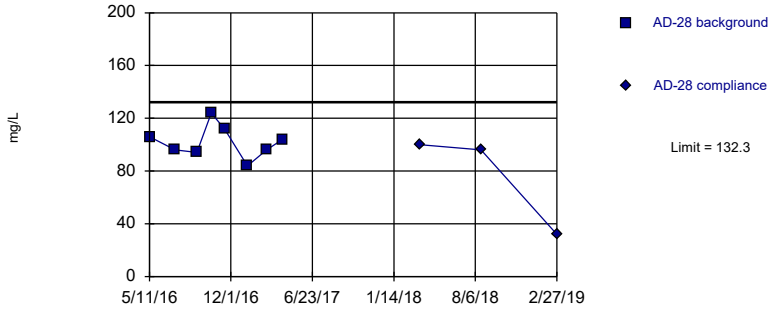
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=102, Std. Dev.=12.33, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9681, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

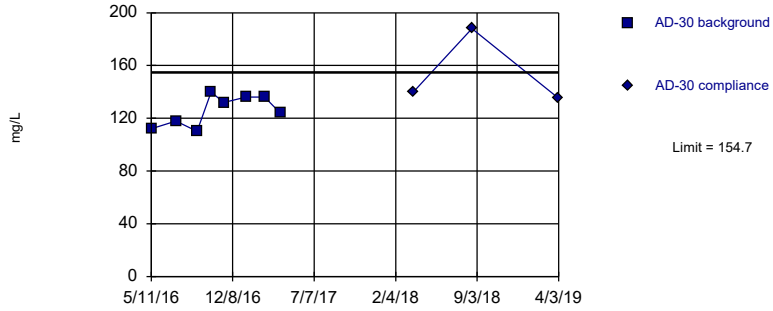
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=126, Std. Dev.=11.66, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.904, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/7/2019 8:02 PM View: PLs - Intrawell

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Trend Test Summary Table - Significant Results

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 7/7/2019, 8:20 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	**AD-30**	**0.5226**	**37**	**34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**

Trend Test Summary Table - All Results

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 7/7/2019, 8:20 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	AD-18 (bg)	0.0008764	17	34	No	11	9.091	n/a	n/a	0.01	NP
Boron, total (mg/L)	AD-12 (bg)	0	-4	-34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	AD-3 (bg)	-0.0002401	-7	-34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	AD-28	0.01986	12	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	**AD-30**	**0.5226**	**37**	**34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	AD-18 (bg)	0	-7	-34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	AD-12 (bg)	0.03234	10	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	AD-3 (bg)	0.05714	6	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	AD-17	-7.599	-15	-34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	AD-30	0	3	34	No	11	0	n/a	n/a	0.01	NP

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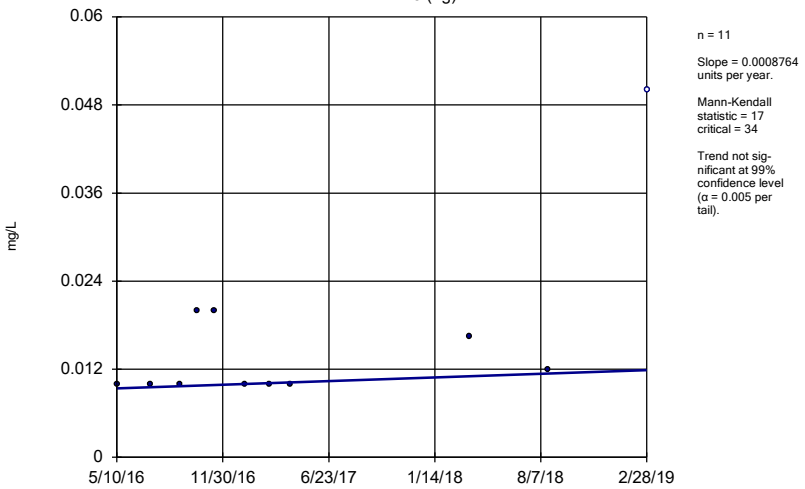
Hollow symbols indicate censored values.

Sen's Slope Estimator

AD-18 (bg)



n = 11

Slope = 0.0008764 units per year.

Mann-Kendall statistic = 17
critical = 34

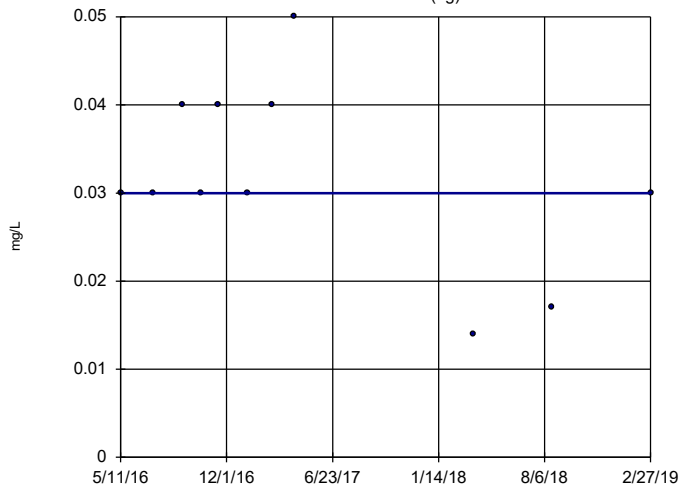
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/7/2019 8:19 PM View: Trends
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-12 (bg)



n = 11

Slope = 0 units per year.

Mann-Kendall statistic = -4
critical = -34

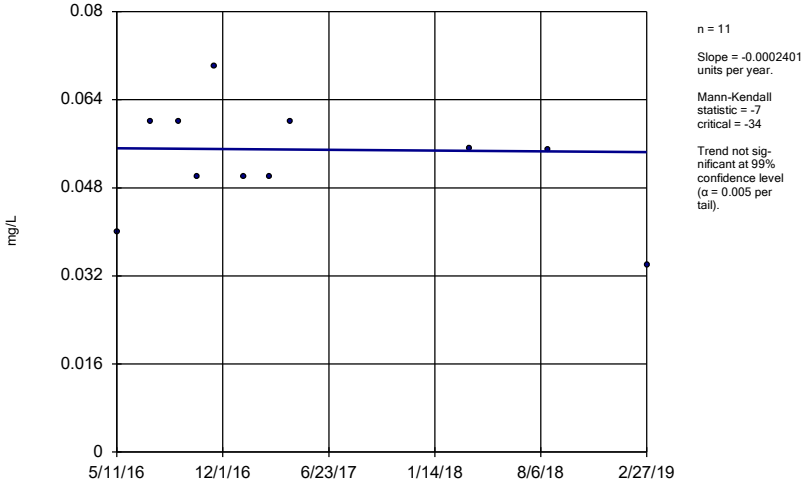
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/7/2019 8:19 PM View: Trends
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-3 (bg)



n = 11

Slope = -0.0002401 units per year.

Mann-Kendall statistic = -7
critical = -34

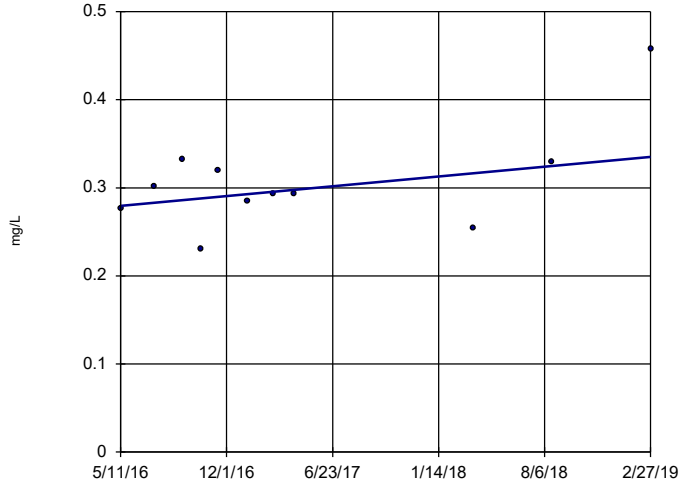
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/7/2019 8:19 PM View: Trends
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-28



n = 11

Slope = 0.01986 units per year.

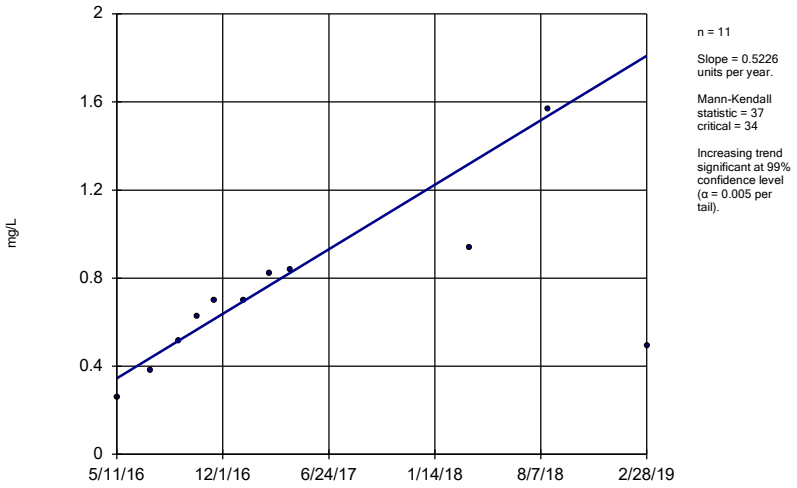
Mann-Kendall statistic = 12
critical = 34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/7/2019 8:19 PM View: Trends
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sen's Slope Estimator

AD-30



n = 11

Slope = 0.5226 units per year.

Mann-Kendall statistic = 37 critical = 34

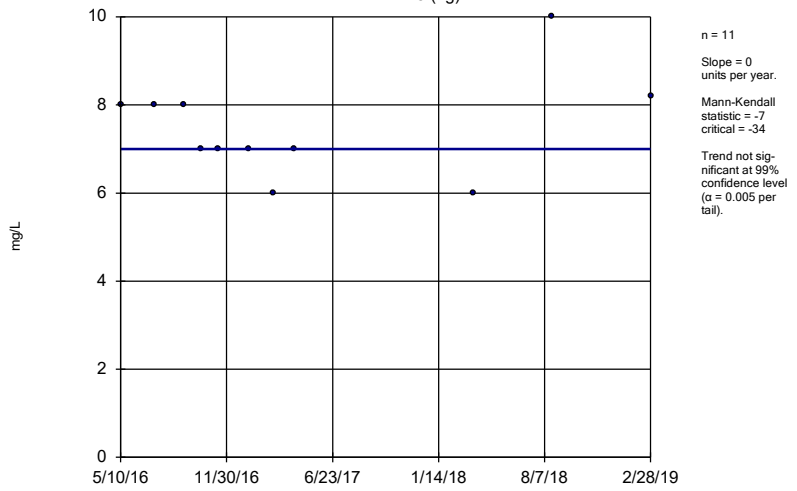
Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/7/2019 8:19 PM View: Trends
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-18 (bg)



n = 11

Slope = 0 units per year.

Mann-Kendall statistic = -7 critical = -34

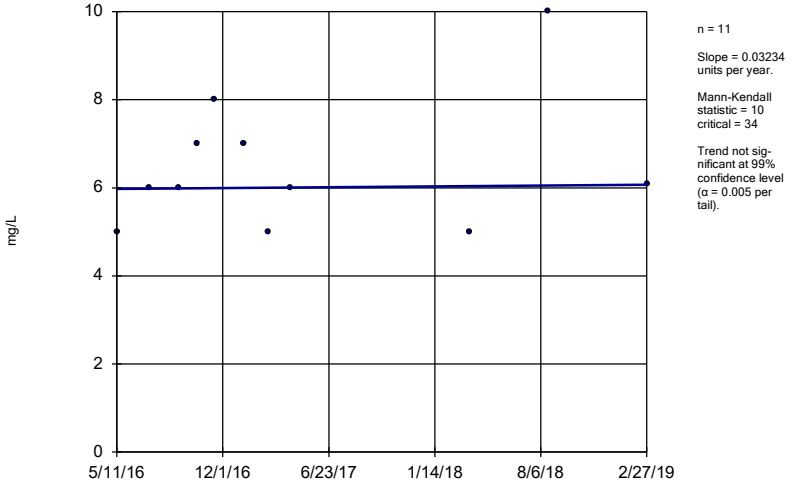
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 7/7/2019 8:19 PM View: Trends
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-12 (bg)



n = 11

Slope = 0.03234 units per year.

Mann-Kendall statistic = 10 critical = 34

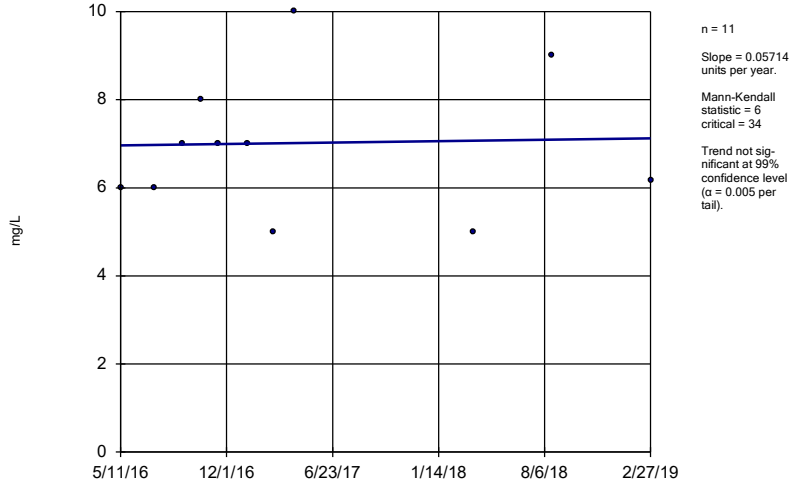
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 7/7/2019 8:19 PM View: Trends
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-3 (bg)



n = 11

Slope = 0.05714 units per year.

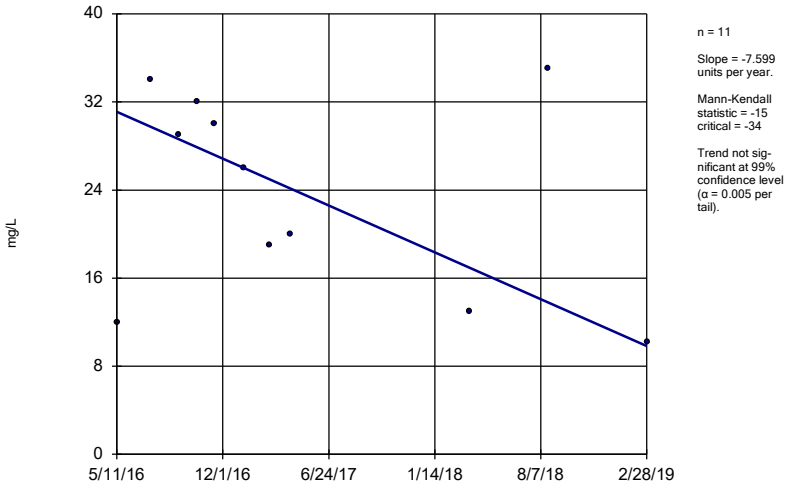
Mann-Kendall statistic = 6 critical = 34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 7/7/2019 8:19 PM View: Trends
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sen's Slope Estimator

AD-17



n = 11

Slope = -7.599 units per year.

Mann-Kendall statistic = -15 critical = -34

Trend not significant at 99% confidence level (α = 0.005 per tail).

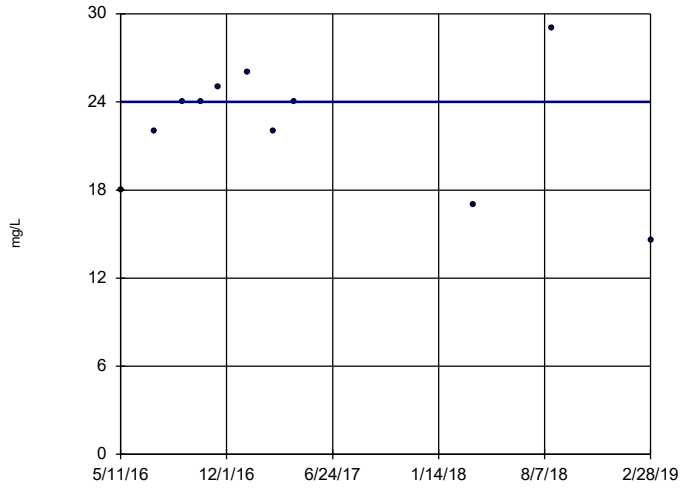
Constituent: Chloride, total Analysis Run 7/7/2019 8:19 PM View: Trends

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-30



n = 11

Slope = 0 units per year.

Mann-Kendall statistic = 3 critical = 34

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 7/7/2019 8:19 PM View: Trends

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Tolerance Limit Summary Table

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 7/8/2019, 5:28 AM

Constituent	Well	Upper Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	n/a	0.002	33	n/a	n/a	87.88	n/a	n/a	0.184	NP Inter(NDs)
Arsenic, total (mg/L)	n/a	0.004229	33	n/a	n/a	75.76	n/a	n/a	0.184	NP Inter(NDs)
Barium, total (mg/L)	n/a	0.1593	33	0.06703	0.03743	0	None	No	0.01	Inter
Beryllium, total (mg/L)	n/a	0.001196	33	-8.334	0.6511	9.091	None	ln(x)	0.01	Inter
Cadmium, total (mg/L)	n/a	0.001	33	n/a	n/a	78.79	n/a	n/a	0.184	NP Inter(NDs)
Chromium, total (mg/L)	n/a	0.002894	33	0.02814	0.01041	12.12	None	sqrt(x)	0.01	Inter
Cobalt, total (mg/L)	n/a	0.009	33	n/a	n/a	0	n/a	n/a	0.184	NP Inter(normality)
Combined Radium 226 + 228 (pCi/L)	n/a	3.565	33	1.016	0.3538	0	None	sqrt(x)	0.01	Inter
Fluoride, total (mg/L)	n/a	1	33	n/a	n/a	87.88	n/a	n/a	0.184	NP Inter(NDs)
Lead, total (mg/L)	n/a	0.002	33	n/a	n/a	84.85	n/a	n/a	0.184	NP Inter(NDs)
Lithium, total (mg/L)	n/a	0.1387	32	0.283	0.09452	3.125	None	x^(1/3)	0.01	Inter
Mercury, total (mg/L)	n/a	0.000064	33	n/a	n/a	48.48	n/a	n/a	0.184	NP Inter(normality)
Molybdenum, total (mg/L)	n/a	0.04	33	n/a	n/a	81.82	n/a	n/a	0.184	NP Inter(NDs)
Selenium, total (mg/L)	n/a	0.004	33	n/a	n/a	60.61	n/a	n/a	0.184	NP Inter(normality)
Thallium, total (mg/L)	n/a	0.002	33	n/a	n/a	84.85	n/a	n/a	0.184	NP Inter(NDs)

Confidence Interval Summary Table - Significant Results

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 7/9/2019, 12:58 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Lower Compl.	Sig.	N	%NDs	Transform	Alpha	Method
Cobalt, total (mg/L)	**AD-28**	**0.01626**	**0.01321**	**0.009**	**n/a**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**

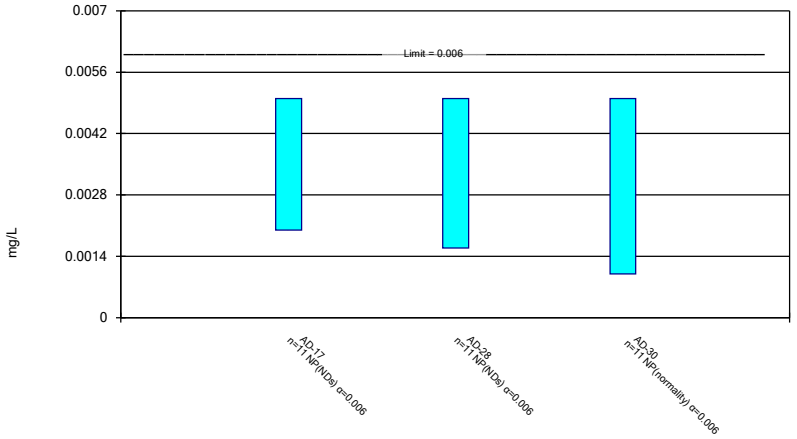
Confidence Interval Summary Table - All Results

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 7/9/2019, 12:58 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Lower Compl.	Sig.	N	%NDs	Transform	Alpha	Method
Antimony, total (mg/L)	AD-17	0.005	0.002	0.006	n/a	No	11	90.91	No	0.006	NP (NDs)
Antimony, total (mg/L)	AD-28	0.005	0.001588	0.006	n/a	No	11	81.82	No	0.006	NP (NDs)
Antimony, total (mg/L)	AD-30	0.005	0.000997	0.006	n/a	No	11	72.73	No	0.006	NP (normality)
Arsenic, total (mg/L)	AD-17	0.005	0.001213	0.01	n/a	No	11	63.64	No	0.006	NP (normality)
Arsenic, total (mg/L)	AD-28	0.005	0.001409	0.01	n/a	No	11	54.55	No	0.006	NP (normality)
Arsenic, total (mg/L)	AD-30	0.005	0.001929	0.01	n/a	No	11	81.82	No	0.006	NP (NDs)
Barium, total (mg/L)	AD-17	0.2942	0.1343	2	n/a	No	11	0	No	0.01	Param.
Barium, total (mg/L)	AD-28	0.17	0.148	2	n/a	No	11	0	No	0.006	NP (normality)
Barium, total (mg/L)	AD-30	0.05771	0.04986	2	n/a	No	11	0	No	0.01	Param.
Beryllium, total (mg/L)	AD-17	0.0008327	0.0004929	0.004	n/a	No	11	9.091	No	0.01	Param.
Beryllium, total (mg/L)	AD-28	0.000836	0.0005198	0.004	n/a	No	11	0	No	0.01	Param.
Beryllium, total (mg/L)	AD-30	0.0001554	0.0000604	0.004	n/a	No	11	9.091	No	0.006	NP (normality)
Cadmium, total (mg/L)	AD-17	0.001	0.0000833	0.005	n/a	No	11	72.73	No	0.006	NP (normality)
Cadmium, total (mg/L)	AD-28	0.001	0.001	0.005	n/a	No	11	90.91	No	0.006	NP (NDs)
Cadmium, total (mg/L)	AD-30	0.001	0.001	0.005	n/a	No	11	90.91	No	0.006	NP (NDs)
Chromium, total (mg/L)	AD-17	0.002321	0.0004231	0.1	n/a	No	11	9.091	x^(1/3)	0.01	Param.
Chromium, total (mg/L)	AD-28	0.001	0.0006055	0.1	n/a	No	10	30	No	0.011	NP (normality)
Chromium, total (mg/L)	AD-30	0.001864	0.0005964	0.1	n/a	No	11	9.091	ln(x)	0.01	Param.
Cobalt, total (mg/L)	AD-17	0.01285	0.005951	0.009	n/a	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	**AD-28**	**0.01626**	**0.01321**	**0.009**	**n/a**	**Yes**	**11**	**0**	**No**	**0.01**	**Param.**
Cobalt, total (mg/L)	AD-30	0.002411	0.001739	0.009	n/a	No	11	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	AD-17	6.421	1.722	5	n/a	No	11	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	AD-28	2.675	1.609	5	n/a	No	11	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	AD-30	2.662	0.5223	5	n/a	No	11	0	sqrt(x)	0.01	Param.
Fluoride, total (mg/L)	AD-17	1	0.3446	4	n/a	No	11	72.73	No	0.006	NP (normality)
Fluoride, total (mg/L)	AD-28	0.8546	0.5139	4	n/a	No	11	9.091	No	0.01	Param.
Fluoride, total (mg/L)	AD-30	1	1	4	n/a	No	11	100	No	0.006	NP (NDs)
Lead, total (mg/L)	AD-17	0.005	0.002	0.015	n/a	No	11	90.91	No	0.006	NP (NDs)
Lead, total (mg/L)	AD-28	0.005	0.002	0.015	n/a	No	11	90.91	No	0.006	NP (NDs)
Lead, total (mg/L)	AD-30	0.005	0.002	0.015	n/a	No	11	90.91	No	0.006	NP (NDs)
Lithium, total (mg/L)	AD-17	0.02643	0.01174	0.14	n/a	No	11	9.091	No	0.01	Param.
Lithium, total (mg/L)	AD-28	0.03262	0.02484	0.14	n/a	No	10	0	x^3	0.01	Param.
Lithium, total (mg/L)	AD-30	0.01021	0.006832	0.14	n/a	No	11	9.091	x^2	0.01	Param.
Mercury, total (mg/L)	AD-17	0.0001439	0.00006042	0.002	n/a	No	11	0	No	0.01	Param.
Mercury, total (mg/L)	AD-28	0.00009517	0.00002722	0.002	n/a	No	11	0	x^(1/3)	0.01	Param.
Mercury, total (mg/L)	AD-30	0.001473	0.000255	0.002	n/a	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	AD-17	0.005	0.0004858	0.1	n/a	No	11	81.82	No	0.006	NP (NDs)
Molybdenum, total (mg/L)	AD-28	0.005	0.0002942	0.1	n/a	No	11	81.82	No	0.006	NP (NDs)
Molybdenum, total (mg/L)	AD-30	0.005	0.001142	0.1	n/a	No	11	81.82	No	0.006	NP (NDs)
Selenium, total (mg/L)	AD-17	0.005	0.002554	0.05	n/a	No	11	81.82	No	0.006	NP (NDs)
Selenium, total (mg/L)	AD-28	0.005	0.001103	0.05	n/a	No	11	81.82	No	0.006	NP (NDs)
Selenium, total (mg/L)	AD-30	0.005	0.001207	0.05	n/a	No	11	81.82	No	0.006	NP (NDs)
Thallium, total (mg/L)	AD-17	0.002	0.001075	0.002	n/a	No	10	80	No	0.011	NP (NDs)
Thallium, total (mg/L)	AD-28	0.002	0.001247	0.002	n/a	No	10	80	No	0.011	NP (NDs)
Thallium, total (mg/L)	AD-30	0.002	0.000959	0.002	n/a	No	10	70	No	0.011	NP (normality)

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

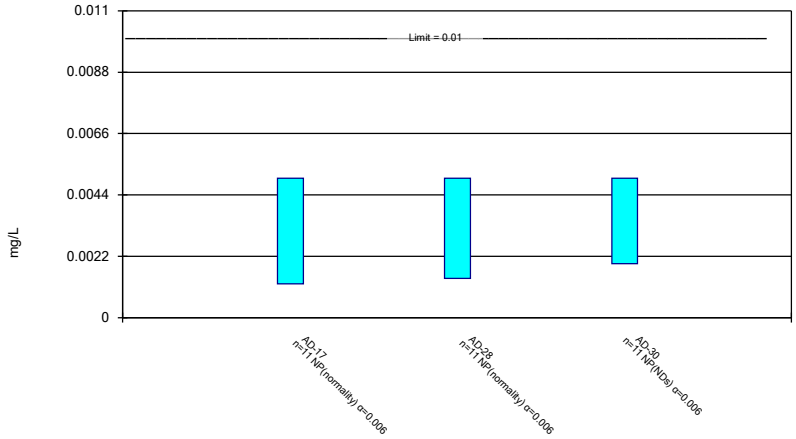


Constituent: Antimony, total Analysis Run 7/9/2019 12:53 PM View: Confidence Intervals - App IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

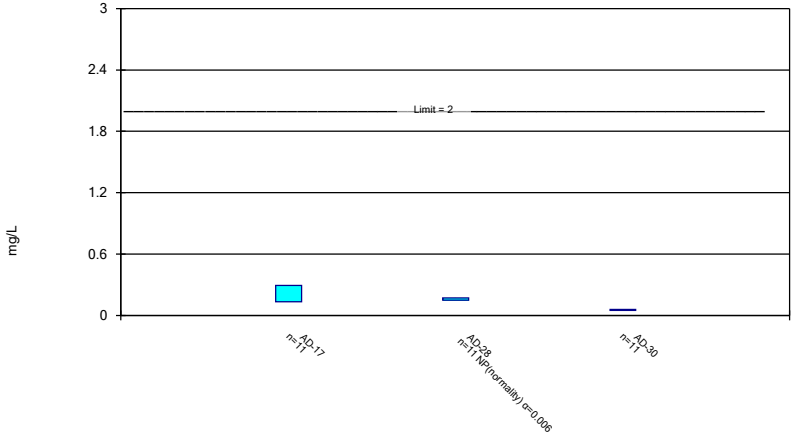


Constituent: Arsenic, total Analysis Run 7/9/2019 12:53 PM View: Confidence Intervals - App IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by 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.

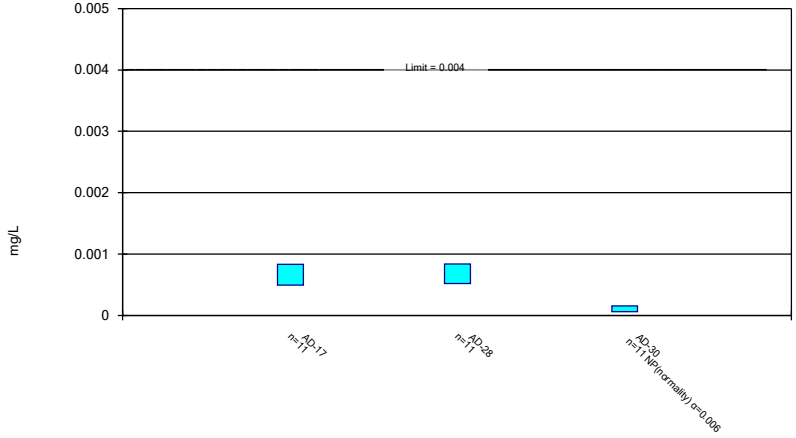


Constituent: Barium, total Analysis Run 7/9/2019 12:53 PM View: Confidence Intervals - App IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

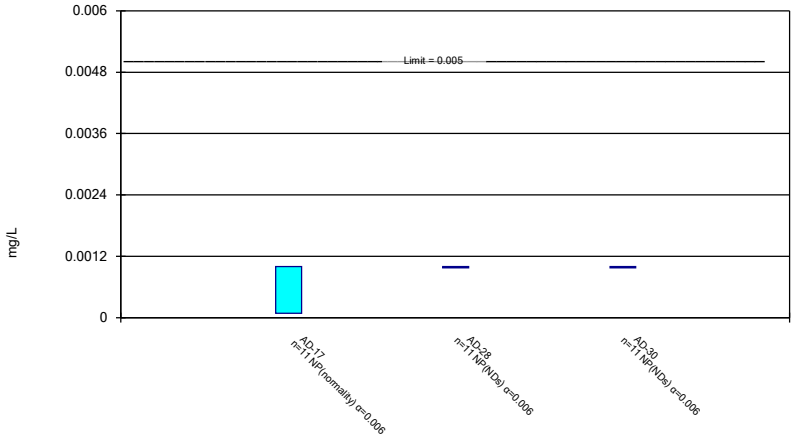
Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Beryllium, total Analysis Run 7/9/2019 12:53 PM View: Confidence Intervals - App IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Non-Parametric Confidence Interval

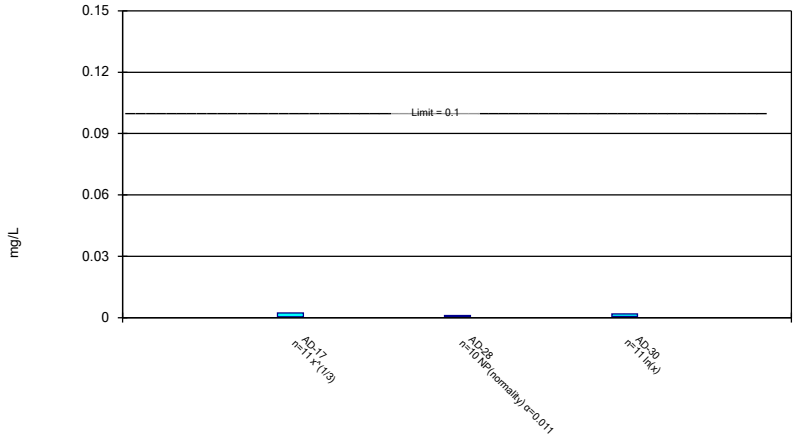
Compliance Limit is not exceeded.



Constituent: Cadmium, total Analysis Run 7/9/2019 12:53 PM View: Confidence Intervals - App IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Parametric and Non-Parametric (NP) Confidence Interval

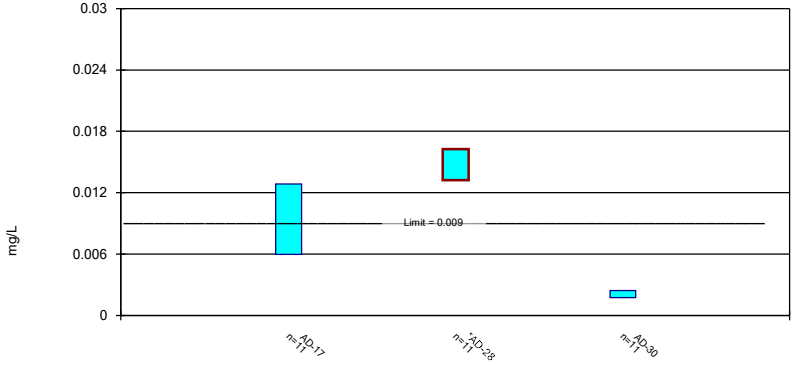
Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Chromium, total Analysis Run 7/9/2019 12:53 PM View: Confidence Intervals - App IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Parametric Confidence Interval

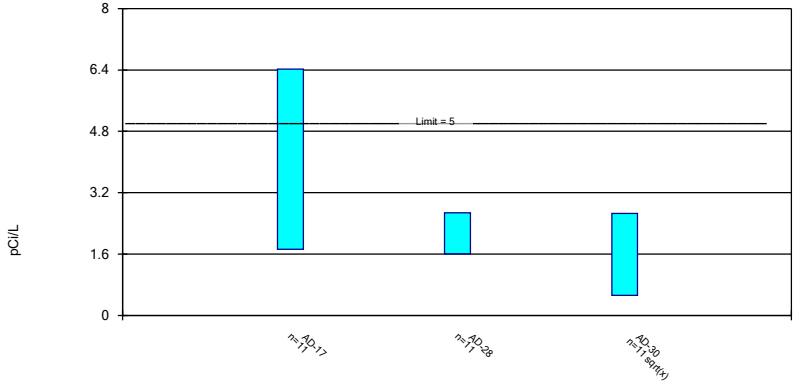
Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Cobalt, total Analysis Run 7/9/2019 12:53 PM View: Confidence Intervals - App IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Parametric Confidence Interval

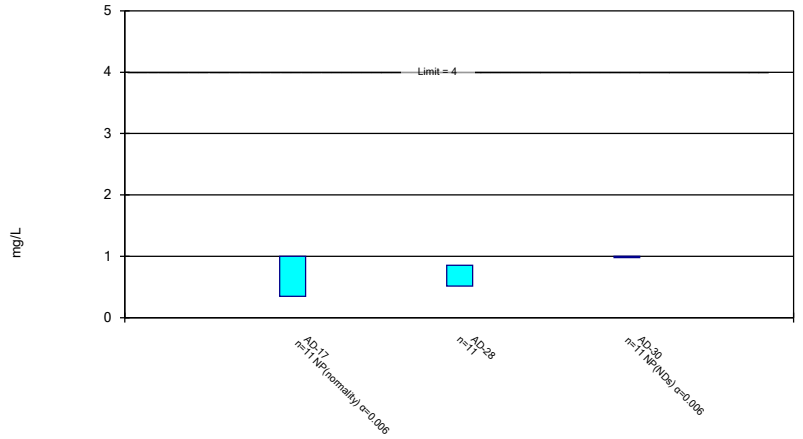
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Combined Radium 226 + 228 Analysis Run 7/9/2019 12:53 PM View: Confidence Intervals -
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Parametric and Non-Parametric (NP) Confidence Interval

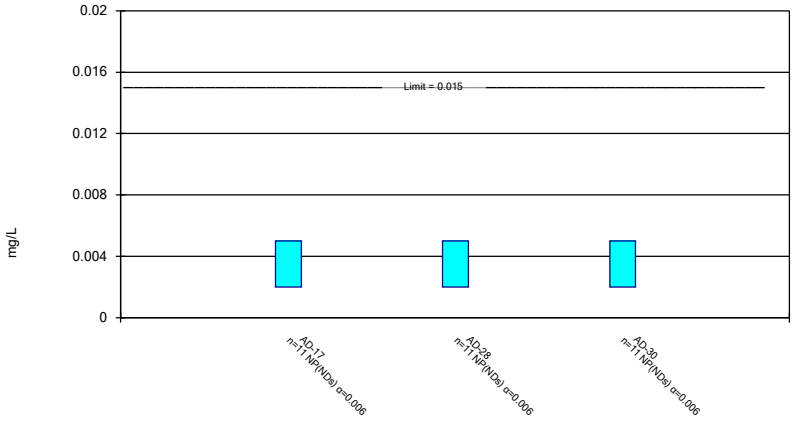
Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Fluoride, total Analysis Run 7/9/2019 12:53 PM View: Confidence Intervals - App IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Non-Parametric Confidence Interval

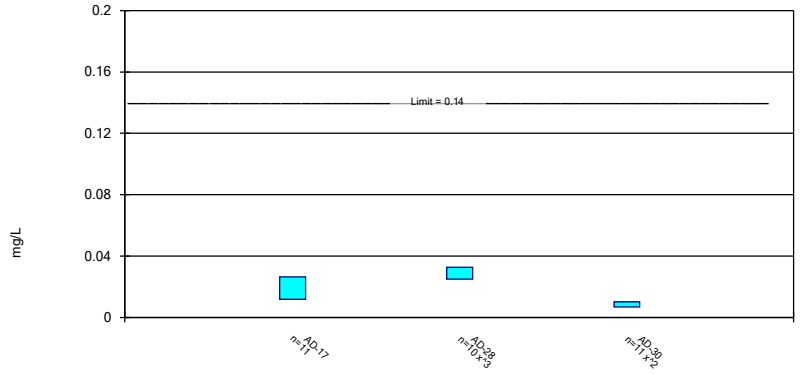
Compliance Limit is not exceeded.



Constituent: Lead, total Analysis Run 7/9/2019 12:53 PM View: Confidence Intervals - App IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Parametric Confidence Interval

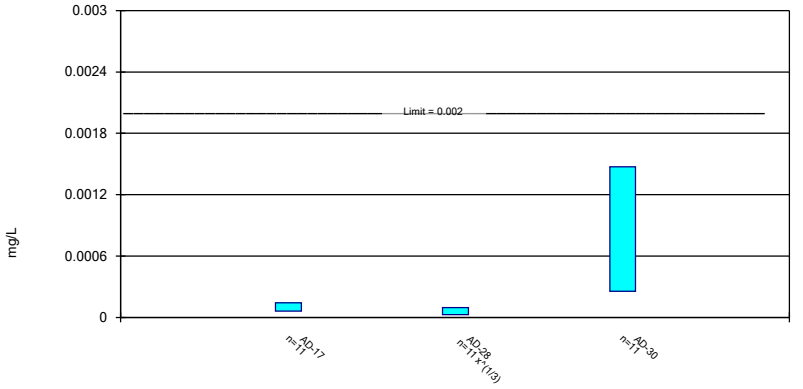
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Lithium, total Analysis Run 7/9/2019 12:53 PM View: Confidence Intervals - App IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Parametric Confidence Interval

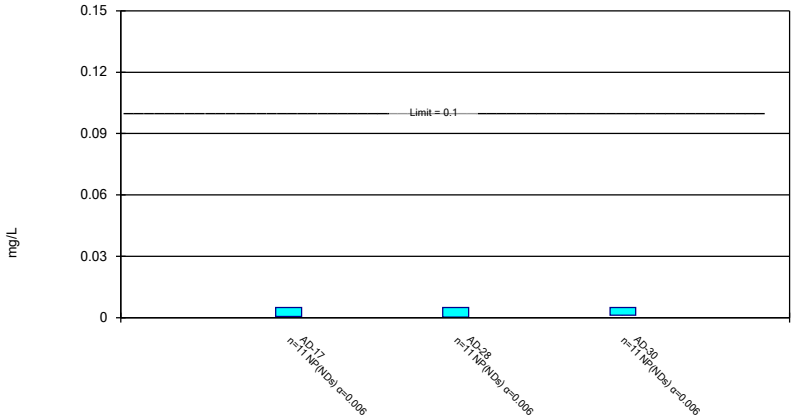
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Mercury, total Analysis Run 7/9/2019 12:53 PM View: Confidence Intervals - App IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



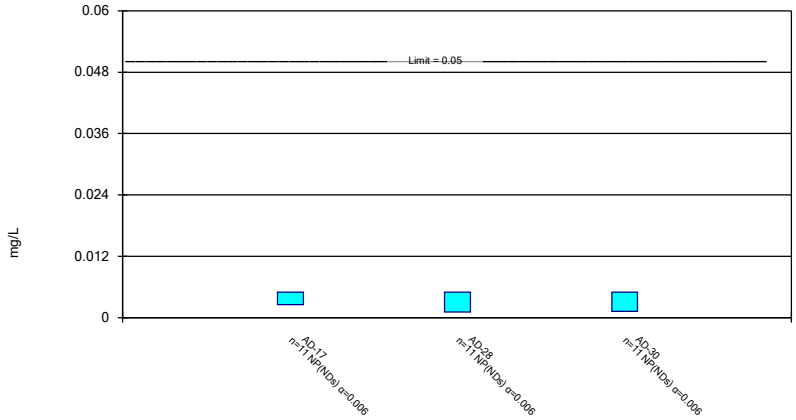
Constituent: Molybdenum, total Analysis Run 7/9/2019 12:53 PM View: Confidence Intervals - App IV

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



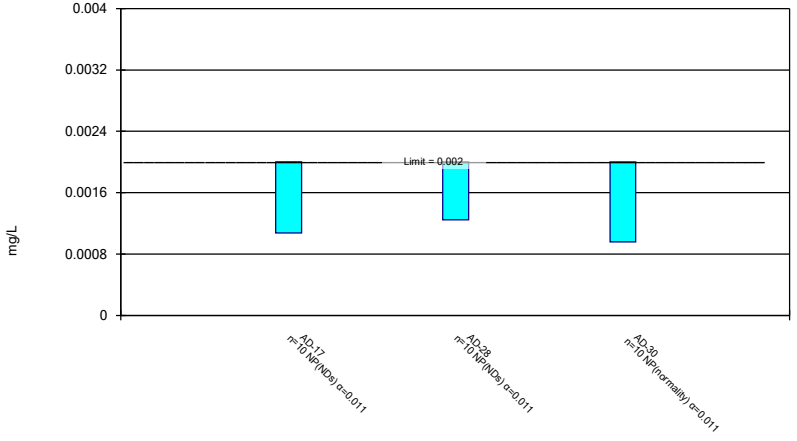
Constituent: Selenium, total Analysis Run 7/9/2019 12:53 PM View: Confidence Intervals - App IV

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Thallium, total Analysis Run 7/9/2019 12:53 PM View: Confidence Intervals - App IV

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

STATISTICAL ANALYSIS SUMMARY
WEST BOTTOM ASH POND
H.W. Pirkey Power Plant
Hallsville, Texas

Submitted to

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
Suite 103
Columbus, Ohio 43221

December 26, 2019

CHA8473

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LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
LFB	Laboratory Fortified Blanks
LRB	Laboratory Reagent Blanks
MCL	Maximum Contaminant Level
NELAP	National Environmental Laboratory Accreditation Program
QA	Quality Assurance
QC	Quality Control
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
SU	Standard Units
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency
UTL	Upper Tolerance Limit
WBAP	West Bottom Ash Pond

SECTION 1

EXECUTIVE SUMMARY

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257.90-257.98, "CCR rule"), groundwater monitoring has been conducted at the West Bottom Ash Pond (WBAP), an existing CCR unit at the Pirkey Power Plant located in Hallsville, Texas.

Based on detection monitoring conducted in 2017 and 2018, statistically significant increases (SSIs) over background were concluded for boron, chloride, and sulfate at the WBAP. An alternative source was not identified at the time, so the WBAP has been in assessment monitoring since. During the most recent assessment monitoring event, completed in February 2019, an SSL for cobalt was identified at well AD-28. An ASD was successfully completed (Geosyntec, 2019); thus, the unit remained in assessment monitoring. Two assessment monitoring events were conducted at the WBAP in May and August 2019, in accordance with 40 CFR 257.95. The results of these events are documented in this report.

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 were identified which would impact the usability of the data.

The monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. Groundwater protection standards (GWPSs) were re-established for the Appendix IV parameters. Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at a statistically significant level (SSL) above the GWPS. An SSL was identified for cobalt. Thus, either the unit will move to an assessment of corrective measures or an alternative source demonstration (ASD) will be conducted to evaluate if the unit can remain in assessment monitoring. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

WEST BOTTOM ASH POND EVALUATION

2.1 Data Validation & QA/QC

During the assessment monitoring program, two sets of samples were collected for analysis from each upgradient and downgradient well to meet the requirements of 40 CFR 257.95(b) (May 2019) and 257.95(d)(1) (August 2019). Samples from both sampling events were analyzed for the Appendix III and Appendix IV parameters. A summary of data collected during these assessment monitoring events may be found in Table 1.

Chemical analysis was completed by an analytical laboratory certified by the National Environmental Laboratory Accreditation Program (NELAP). Quality assurance and quality control (QA/QC) samples completed by the analytical laboratory included the use of laboratory reagent blanks (LRBs), continuing calibration verification (CCV) samples, and laboratory fortified blanks (LFBs).

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.9.6.23 statistics software. The export file was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

2.2 Statistical Analysis

Statistical analyses for the WBAP were conducted in accordance with the January 2017 *Statistical Analysis Plan* (AEP, 2017), except where noted below. Time series plots and results for all completed statistical tests are provided in Attachment B.

The data obtained in May and August 2019 were screened for potential outliers. No outliers were identified.

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* (AEP, 2017). The established GWPS was determined to be the greater value of the background concentration and the maximum contaminant level (MCL) or risk-based level specified in 40 CFR 257.95(h)(2) for each Appendix IV parameter. To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events. Generally, tolerance limits were calculated parametrically with 95% coverage and 95% confidence. Non-parametric tolerance limits were calculated for arsenic, barium, beryllium,

cobalt, fluoride, mercury, and selenium due to apparent non-normal distributions and for antimony, cadmium, lead, molybdenum, and thallium due to a high non-detect frequency. 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. Confidence limits were generally calculated parametrically ($\alpha = 0.01$); however, non-parametric confidence limits were calculated in some cases (e.g., when the data did not appear to be normally distributed or when the non-detect frequency was too high). An SSL was concluded if the lower confidence limit (LCL) exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). Calculated confidence limits are shown in Attachment B.

The following SSL was identified at the Pirkey WBAP:

- The LCL for cobalt exceeded the GWPS of 0.009 mg/L at AD-28 (0.0132 mg/L).

As a result, the Pirkey WBAP will either move to an assessment of corrective measures or an alternative source demonstration will be conducted to evaluate if the unit can remain in assessment monitoring.

2.2.3 Establishment of Appendix III Prediction Limits

Upper prediction limits (UPL) were previously established for all Appendix III parameters following the background monitoring period (Geosyntec, 2018). Intrawell tests were used to evaluate potential SSIs for calcium, pH, sulfate and TDS, whereas interwell tests were used to evaluate potential SSIs for boron, chloride and fluoride. While interwell prediction limits have been updated periodically during the assessment monitoring period as sufficient data became available, this represents the first update to the background dataset for parameters evaluated using intrawell tests.

Mann-Whitney (Wilcoxon rank-sum) tests were performed to determine whether the newer data are affected by a release from the WBAP. Because the interwell Appendix III limits and the Appendix IV GWPSs are based on data from upgradient wells which we would not expect to have been impacted by a release, these tests were used for intrawell Appendix III tests only. Mann-Whitney tests were used to compare the medians of historical data (May 2016 - April 2017) to the new compliance samples (August 2017 – February 2019) for calcium, pH, sulfate and TDS. Results were evaluated to determine if the medians of the two groups were similar at the 99% confidence level. Where no significant difference was found, the new compliance data were added to the background dataset. Where a statistically significant difference was found between the medians of the two groups, the data were reviewed to evaluate the cause of the difference and to determine if adding newer data to the background dataset, replacing the background dataset with the newer data, or continuing to use the existing background dataset was most appropriate. If the differences appeared to have been caused by a release, then the previous background dataset would have continued to be used.

The complete Mann-Whitney test results and a summary of the significant findings can be found in Attachment B. Significant differences were found between the two groups for pH in upgradient well AD-18 and for sulfate in downgradient well AD-30. Typically, when the test concludes that the medians of the two groups are significantly different, particularly in the downgradient wells, the background are not updated to include the newer data but will be reconsidered in the future. In the case of pH in upgradient well AD-18, the more recent reported measurements are slightly higher than those reported historically; therefore, this record was updated so that only the most recent eight samples are used to construct the prediction limits and, thus, better represent the groundwater quality upgradient of the facility. At downgradient well AD-30, the dataset was not updated, and the previously calculated prediction limit was used to more conservatively evaluate possible exceedances for sulfate.

After the revised background set was established, a parametric or non-parametric analysis was selected based on the distribution of the data and the frequency of non-detect data. Estimated results less than the practical quantitation limit (PQL) – i.e., "J-flagged" data – were considered detections and the estimated results were used in the statistical analyses. Non-parametric analyses were selected for datasets with at least 50% non-detect data or datasets that could not be normalized. Parametric analyses were selected for datasets (either transformed or untransformed) that passed the Shapiro-Wilk / Shapiro-Francía test for normality. The Kaplan-Meier non-detect adjustment was applied to datasets with between 15% and 50% non-detect data. For datasets with fewer than 15% non-detect data, non-detect data were replaced with one half of the PQL. The selected analysis (i.e., parametric or non-parametric) and transformation (where applicable) for each background dataset are shown in Attachment B.

UPLs were updated using all the historical data through February 2019 to represent background values. LPLs were also updated for pH. The updated prediction limits are summarized in Table 3. Intrawell tests continued to be used to evaluate potential SSIs for calcium, pH, sulfate and TDS, whereas interwell tests continued to be used to evaluate potential SSIs for boron, chloride and fluoride. The intrawell UPLs were calculated for a one-of-two retesting procedure; i.e., if at least one sample in a series of two does not exceed the UPL, then it can be concluded that an SSI has not occurred. In practice, where the initial result did not exceed the UPL, a second sample was not collected. The retesting procedures allowed achieving an acceptably high statistical power to detect changes at downgradient wells for constituents evaluated using intrawell prediction limits.

2.2.4 Evaluation of Potential Appendix III SSIs

While SSLs were identified, a review of the Appendix III results were also completed to assess whether concentrations of Appendix III parameters at the compliance wells exceeded background concentrations.

Data collected during the May and August 2019 assessment monitoring events from each compliance well were compared to the prediction limits to evaluate results above background values. The results from this event and the prediction limits are summarized in Table 4. The following exceedances of the upper prediction limits (UPLs) were noted:

- Boron concentrations exceeded the interwell UPL of 0.0768 at AD-28 (0.313 mg/L and 0.366 mg/L) and AD-30 (0.520 mg/L and 1.25 mg/L).

- Chloride concentrations exceeded the interwell UPL of 9.50 mg/L at AD-17 (10.3 mg/L and 26.3 mg/L) and AD-30 (18.8 mg/L and 28.1 mg/L).

- Sulfate concentrations exceeded the intrawell UPL of 31.6 mg/L at AD-30 (39.8 mg/L).

Based on these results, concentrations of Appendix III parameters exceeded background levels at compliance wells at the Pirkey WBAP during assessment monitoring.

2.3 Conclusions

A semi-annual assessment monitoring event was conducted in accordance with the CCR Rule. The laboratory and field data were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. A review of outliers identified no potential outliers in the May and August 2019 data. GWPSs were re-established for the 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 exceeded the GWPS. An SSL was identified for cobalt. Appendix III parameters were compared to recalculated prediction limits, with exceedances identified for boron, chloride, and sulfate.

Based on this evaluation, the Pirkey WBAP CCR unit will either move to an assessment of corrective measures or an ASD will be conducted to evaluate if the unit can remain in assessment monitoring.

SECTION 3

REFERENCES

American Electric Power (AEP). 2017. Statistical Analysis Plan – H.W. Pirkey Power Plant. January 2017.

Geosyntec Consultants (Geosyntec). 2018. Statistical Analysis Summary – West Bottom Ash Pond, H.W. Pirkey Power Plant, Hallsville, Texas. January 15, 2018.

Geosyntec. 2019. Alternative Source Demonstration Report – Federal CCR Rule. H.W. Pirkey Plant - West Bottom Ash Pond. September.

TABLES

Table 1 - Groundwater Data Summary
Pirkey - West Bottom Ash Pond

Component	Unit	AD-3		AD-12		AD-17		AD-18		AD-28		AD-30	
		8/13/2019	5/23/2019	5/21/2019	8/12/2019	5/23/2019	8/13/2019	5/22/2019	8/12/2019	5/22/2019	8/12/2019	5/23/2019	8/12/2019
Antimony	µg/L	2.00 U	0.100 U	2.00 U	0.100 U	2.00 U	0.100 U	2.00 U	0.100 U	2.00 U	0.0200 J	2.00 U	0.100 U
Arsenic	µg/L	2.00 U	2.41	2.00 U	0.0700 J	2.00 U	0.400	2.00 U	0.450	2.00 U	0.640	0.600 J	0.210
Barium	µg/L	61.8	58.3	21.7	23.8	82.9	216	131	100	148	113	59.2	58.0
Beryllium	µg/L	2.00 U	0.196	2.00 U	0.154	2.00 U	0.554	2.00 U	0.118	0.500 J	0.473	2.00 U	0.0700 J
Boron	mg/L	0.0450	0.0500 J	0.0200	0.0500 U	0.0190	0.0300 J	0.0130	0.0500 U	0.313	0.366	0.520	1.25
Cadmium	µg/L	1.00 U	0.0200 J	1.00 U	0.0500 U	1.00 U	0.0400 J	1.00 U	0.0200 J	1.00 U	0.0400 J	1.00 U	0.0500 U
Calcium	mg/L	6.19	5.08	0.300 J	0.278	0.200 J	0.777	0.684	0.647	1.24	1.72	1.74	0.302
Chloride	mg/L	5.99	6.83	6.30	7.24	10.3	26.3	8.82	8.49	4.48	6.04	18.8	28.1
Chromium	µg/L	4.00 U	0.206	4.00 U	0.204	0.900 J	0.732	4.00 U	0.212	4.00 U	0.416	1.00 J	0.374
Cobalt	µg/L	4.94	6.55	1.15	1.30	3.15	9.03	1.47	1.25	13.8	12.8	3.26	2.10
Combined Radium	pCi/L	0.988	1.38	0.201	0.237	1.62	6.40	0.492	0.473	1.95	2.38	1.09	1.22
Fluoride	mg/L	0.0900	0.190	0.0900	0.0600 J	0.130	0.240	0.0200 J	0.0100 J	0.690	0.650	0.0400 J	0.0300 J
Lead	µg/L	2.00 U	0.417	2.00 U	0.0800 J	2.00 U	0.200 J	2.00 U	0.200 J	2.00 U	0.100 J	2.00 U	0.0600 J
Lithium	mg/L	0.0734	0.108	0.00576	0.00829	0.00911	0.0193	0.0209	0.0183	0.0227	0.0380	0.00841	0.00804
Mercury	mg/L	0.0000250 U	0.0000250 U	0.0000250 U	0.0000250 U	0.000103	0.000447	0.00000900 J	0.0000230 J	0.0000280	0.0000920	0.000165	0.000345
Molybdenum	µg/L	40.0 U	2.00 U	40.0 U	2.00 U	40.0 U	2.00 U	40.0 U	2.00 U	40.0 U	2.00 U	40.0 U	2.00 U
Selenium	µg/L	4.00 U	0.100 J	4.00 U	0.200 J	4.00 U	0.300	4.00 U	0.0900 J	4.00 U	0.200 J	4.00 U	0.200 J
Total Dissolved Solids	mg/L	154	168	80.0	90.0	58.0	88.0	104	90.0	100	128	112	160
Sulfate	mg/L	29.5	32.5	4.00	2.60	2.40	1.80	10.6	6.60	20.1	22.5	29.2	39.8
Thallium	µg/L	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U
pH	SU	4.90	5.12	4.09	4.94	3.96	4.75	5.20	5.22	4.62	4.66	4.86	4.87

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Parameter was not present in concentrations above the method detection limit and is reported as the reporting limit
J: Estimated value. Parameter was detected in concentrations below the reporting limit

Table 2: Groundwater Protection Standards
Pirkey Plant - West Bottom Ash Pond

Constituent Name	MCL	CCR Rule-Specified	Calculated UTL
Antimony, Total (mg/L)	0.006		0.005
Arsenic, Total (mg/L)	0.01		0.005
Barium, Total (mg/L)	2		0.16
Beryllium, Total (mg/L)	0.004		0.002
Cadmium, Total (mg/L)	0.005		0.001
Chromium, Total (mg/L)	0.1		0.0032
Cobalt, Total (mg/L)	n/a	0.006	0.009
Combined Radium, Total (pCi/L)	5		3.31
Fluoride, Total (mg/L)	4		1
Lead, Total (mg/L)	0.015		0.005
Lithium, Total (mg/L)	n/a	0.04	0.14
Mercury, Total (mg/L)	0.002		0.000064
Molybdenum, Total (mg/L)	n/a	0.1	0.01
Selenium, Total (mg/L)	0.05		0.005
Thallium, Total (mg/L)	0.002		0.002

Notes:
Grey cell indicates calculated UTL is higher than MCL or CCR Rule-specified value.
MCL = Maximum Contaminant Level
Calculated UTL (Upper Tolerance Limit) represents site-specific background values.
The higher of the calculated UTL or MCL/Rule-Specified Level is used as the GWPS.

Table 3: Revised Prediction Limits
Pirkey - West Bottom Ash Pond

Parameter	Unit	Description	AD-17	AD-28	AD-30
Boron	mg/L	Interwell Background Value (UPL)	0.0768		
Calcium	mg/L	Intrawell Background Value (UPL)	1.79	2.76	0.680
Chloride	mg/L	Interwell Background Value (UPL)	9.50		
Fluoride	mg/L	Interwell Background Value (UPL)	1.00		
pH	SU	Intrawell Background Value (UPL)	4.8	5.9	5.5
		Intrawell Background Value (LPL)	3.2	3.3	3.8
Sulfate	mg/L	Intrawell Background Value (UPL)	9.32	23.2	31.6
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	115	129	189

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit

Table 4: Appendix III Data Summary
Pirkey - West Bottom Ash Pond

Geosyntec Consultants, Inc.

Parameter	Unit	Description	AD-17		AD-28		AD-30	
			5/23/2019	8/13/2019	5/22/2019	8/12/2019	5/23/2019	8/12/2019
Boron	mg/L	Interwell Background Value (UPL)	0.0768					
		Detection Monitoring Result	0.0190	0.0300	**0.313**	**0.366**	**0.520**	**1.25**
Calcium	mg/L	Intrawell Background Value (UPL)	1.79		2.76		0.680	
		Detection Monitoring Result	0.200	0.777	1.24	1.72	1.74	0.302
Chloride	mg/L	Interwell Background Value (UPL)	9.50					
		Detection Monitoring Result	**10.3**	**26.3**	4.48	6.04	**18.8**	**28.1**
Fluoride	mg/L	Interwell Background Value (UPL)	1.00					
		Detection Monitoring Result	0.130	0.240	0.690	0.650	0.0400	0.0300
pH	SU	Intrawell Background Value (UPL)	4.8		5.9		5.5	
		Intrawell Background Value (LPL)	3.2		3.3		3.8	
		Detection Monitoring Result	4.0	4.8	4.6	4.7	4.9	4.9
Sulfate	mg/L	Intrawell Background Value (UPL)	9.32		23.2		31.6	
		Detection Monitoring Result	2.40	1.80	20.1	22.5	29.2	**39.8**
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	115		129		189	
		Detection Monitoring Result	58.0	88.0	100	128	112	160

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

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 Pirkey West Bottom Ash Pond 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

112498	TEXAS	01.03.20
License Number	Licensing State	Date

ATTACHMENT B

Statistical Analysis Output

December 10, 2019

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
941 Chatham Lane, #103
Columbus, OH 43221

Re: Pirkey WBAP
Background Update – 2019

Dear Ms. Kreinberg,

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the background update of groundwater data for American Electric Power Inc.'s Pirkey West Bottom Ash Pond. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals from Electric Utilities (CCR Rule, 2015) as well as with the 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:** AD-3, AD-12, and AD-18
- **Downgradient wells:** AD-17, AD-28, and AD-30

Data were sent electronically to Groundwater Stats Consulting, and the statistical analysis report was reviewed by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to Groundwater Stats Consulting. The analysis was prepared according to the background screening conducted in December 2017 that was approved by Dr. Kirk Cameron.

The CCR program consists of the following constituents:

- **Appendix III** (Detection Monitoring) **-** boron, calcium, chloride, fluoride, pH, sulfate, and TDS;

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

Time series and box plots for both Appendix III and 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 flagged as outliers from this screening may be seen in a lighter font and disconnected symbol on the time series graphs, and a summary of those values follows this letter (Figure C).

Summary of Statistical Method:

1) Intrawell prediction limits, combined with a 1-of-2 resample plan for calcium and pH, sulfate, and TDS;
2) Interwell prediction limits combined with a 1-of-2 resample plan for boron, chloride, and fluoride.

Parametric prediction 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 nondetects, 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 (US EPA, 2009), data are analyzed using either parametric or non-parametric prediction limits.

- No statistical analyses are required on wells and analytes containing 100% nondetects (USEPA Unified Guidance, 2009, Chapter 6).
- When data contain <15% nondetects in background, the reporting limit utilized for nondetects is the practical quantification limit (PQL) as reported by the laboratory and there is no replacement of historical reporting limits with the most recent reporting limit. It was noted that the more recent reporting limits are significantly lower than those reported historically.
- When data contain between 15-50% nondetects, the Kaplan-Meier nondetect adjustment is applied to the background data. This technique adjusts the mean and standard deviation of the historical concentrations to account for concentrations below the reporting limit.
- Nonparametric prediction limits are used on data containing greater than 50% nondetects.

Historical Summary - Evaluation of Appendix III Parameters – December 2017

Outlier Evaluation

Time series plots were used to identify suspected outliers, or extreme values that would result in limits that are not conservative from a regulatory perspective, in proposed background data. Suspected outliers at all wells for Appendix III parameters were formally tested using Tukey's box plot method and, when identified, flagged in the computer database with "o" and deselected prior to construction of statistical limits.

During the previous background screening, no values were flagged as outliers for Appendix III parameters. The current assumption is that changes in concentrations are reflective of natural variation upgradient of the facility; however, a separate study and hydrogeological investigation would be required to fully understand the geochemical conditions and expected groundwater quality for the region. That study and assessment is beyond the scope of services provided by Groundwater Stats Consulting.

Statistical Limits

Interwell prediction limits combined with a 1-of-2 verification strategy were constructed for boron, chloride and fluoride; and intrawell prediction limits combined with a 1-of-2 verification strategy were constructed for calcium, pH, sulfate, and TDS for the February 2019 data. The statistical method selected for each parameter was determined based on the results of the evaluation performed in December 2017; and all proposed background data were screened for outliers and trends at that time. The findings of those reports were submitted with that analysis.

Interwell prediction limits utilize all upgradient well data for construction of statistical limits. During each sample event, upgradient well data were screened for any newly suspected outliers or obvious trending patterns using time series plots. Intrawell prediction limits utilized the background data set that was originally screened in 2017. As recommended in the EPA Unified Guidance (2009), the set background data will be tested for the purpose of updating statistical limits using the Mann-Whitney two-sample test when an additional four to eight measurements are available.

Note that the reporting limit for fluoride for the February 2019 event at well AD-30 was <0.2 mg/L whereas all historical reporting limits for all wells at that time was <1.0 mg/L. Therefore, <1.0 mg/L was substituted for all nondetects which is less than the Groundwater Protection Standard of 4 mg/L. Additionally, in the case of TDS at well AD-30, the April 2019 sample was compared against background.

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of one additional sample to determine whether the initial exceedance is confirmed. When the resample confirms the initial exceedance, a statistically significant increase (SSI) is identified, and further research would be required to identify the cause of the exceedance (i.e. impact from the site, natural variation, or an off-site source). If the resample falls within the statistical limit, the initial exceedance is considered a false positive result and, therefore, no further action is necessary. Prediction limit exceedances were noted for boron at wells AD-28 and AD-30, and chloride at wells AD-17 and AD-30.

When a statistically significant increase is identified, the data are further evaluated using the Sen's Slope/Mann Kendall trend test to determine whether concentrations are statistically increasing, decreasing or stable. Upgradient wells were included in the trend analyses to identify whether similar patterns exist upgradient of the site. Such patterns are an indication of natural variability in groundwater unrelated to practices at the site.

No statistically significant increasing or decreasing trends were found for any of the downgradient well/parameter pairs with prediction limit exceedances, except for a statistically significant increasing trend for boron in well AD-30.

Appendix III Background Update – November 2019

Prior to updating background data, samples are re-evaluated for all wells for intrawell parameters and all upgradient wells for interwell parameters using Tukey's outlier test and visual screening with the February 2019 samples. Samples during August and December 2017 that were previously absent were also incorporated into this analysis. No values were noted or flagged as outliers for Appendix III parameters. As mentioned above, any flagged data are displayed in a lighter font and as a disconnected symbol on the time series reports, as well as in a lighter font on the accompanying data pages. An updated summary of Tukey's test results and flagged outliers follows this letter.

For constituents requiring intrawell prediction limits, the Mann-Whitney (Wilcoxon Rank Sum) test was used to compare the medians of historical data through April 2017 to the new compliance samples at each well through February 2019 to evaluate whether the groups are statistically different at the 99% confidence level, in which case background data may be updated with compliance data (Figure D). Statistically significant differences were found between the two groups for pH in upgradient well AD-18, and sulfate in downgradient well AD-30.

Typically, when the test concludes that the medians of the two groups are significantly different, particularly in the downgradient wells, the background are not updated to include the newer data but will be reconsidered in the future. Although the differences for pH in well AD-18 occurred in an upgradient well, more recent data are fairly similar to background, thus better representing the groundwater quality upgradient of the facility. As a result, the background for well AD-18 was updated to be the most recent 8 samples rather than the data set as a whole.

Regarding downgradient well AD-30 for sulfate, more recent concentrations exhibited substantial increases and exceeded median compliance values of all other wells and, therefore, the background will not be updated at this time. A summary of these results follows this letter and the test results are included with the Mann Whitney test section at the end of this report. Additionally, summaries of well/constituent pairs using a truncated portion of their data follow this letter (Figure E).

Intrawell prediction limits using all historical data through February 2019, except in the cases mentioned above, combined with a 1-of-2 resample plan, were constructed and a summary of the updated limits follows this letter (Figure F).

For parameters tested using interwell analyses, the Sen's Slope/Mann-Kendall trend test was used on upgradient wells to determine whether concentrations are statistically increasing, decreasing or stable (Figure G). No statistically significant increasing or decreasing trends were noted. A summary of those results is included with the trend tests.

Interwell prediction limits, combined with a 1-of-2 resample plan, were updated using all available data from upgradient wells through February 2019 for boron, chloride, and fluoride (Figure H). Interwell prediction limits pool upgradient well data to establish a background limit for an individual constituent. A summary table of the updated limits may be found following this letter in the Prediction Limit Summary Tables.

Evaluation of Appendix IV Parameters – November 2019

Interwell Tolerance limits were used to calculate background limits from all available pooled upgradient well data for Appendix IV parameters to determine the Alternate Contaminant Level (ACL) for each constituent (Figure I).
Background data are screened for outliers and extreme trending patterns that would lead to artificially elevated statistical limits. Tukey's outlier test identified both high and low values for lithium in well AD-28, and molybdenum for wells AD-17, AD-28, and AD-30. The low value for lithium was not flagged due to the value being consistent with

values reported for other wells for the same event. Additionally, low values for molybdenum in the aforementioned wells were not flagged due to the values being consistent across all downgradient wells for each given event and occurring more than once. These values appear to provide an accurate representation of the populations within their respective wells.

Note that the reporting limit for thallium for the February 2019 event was <0.01 mg/L, which is higher than the historical reporting limit of <0.002 mg/L and the GWPS. Since the <0.01 mg/L values cannot help distinguish whether other observations exceed the GWPS, they are flagged as outliers.

Tukey's outlier test on pooled upgradient well data did not identify any outliers; however, a high value was flagged for lithium in well AD-3 because the stability of background samples indicates that this value does not accurately represent the population of its respective well. Any flagged values may be seen on the Outlier Summary following this letter.

Parametric limits use a target of 95% confidence and 95% coverage. The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. These limits were compared to the Maximum Contaminant Levels (MCLs) and CCR-Rule specified levels 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 J).

Confidence intervals were then constructed on downgradient wells for each of the Appendix IV parameters using the highest limit of the MCL, CCR-Rule specified level, or ACL as discussed above (Figure K). Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. No confidence interval exceedances were found except for cobalt in well AD-28. A summary of the confidence interval results follows this letter.

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

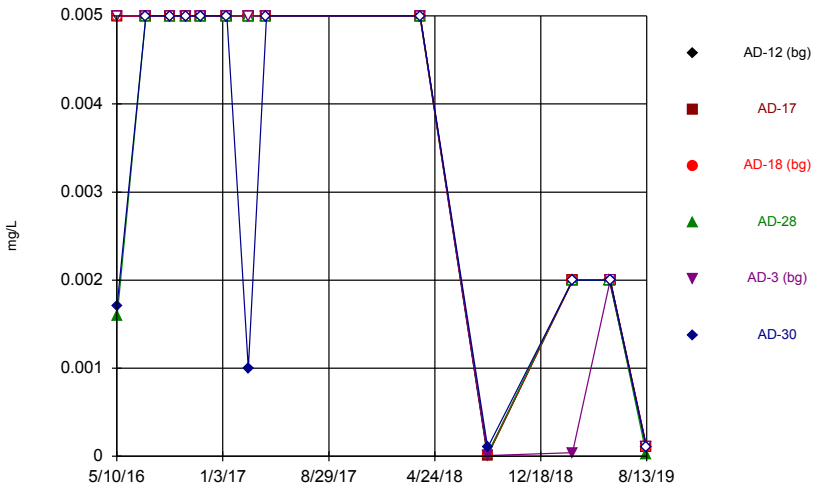
For Groundwater Stats Consulting,

Andrew T. Collins
Groundwater Analyst

Kristina L. Rayner
Groundwater Statistician

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

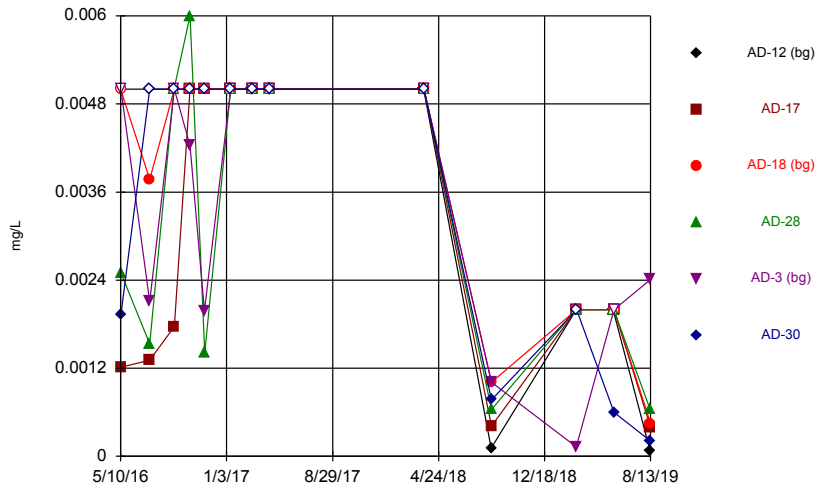
Time Series



Constituent: Antimony, total Analysis Run 12/6/2019 8:34 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

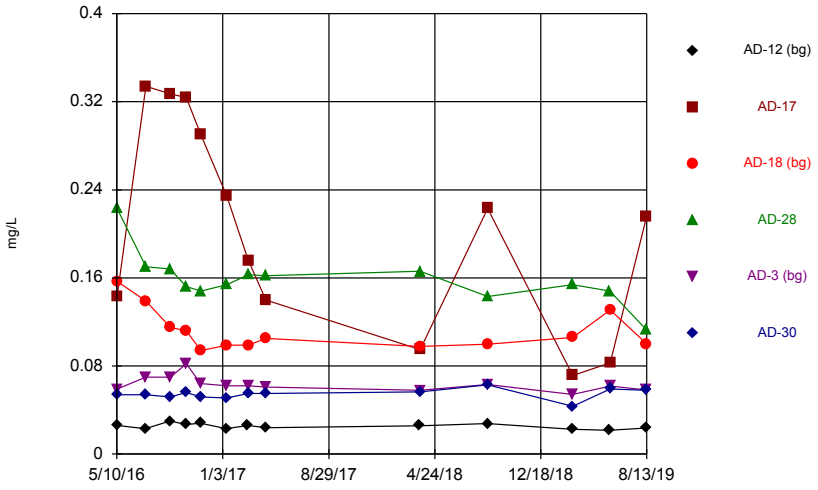
Time Series



Constituent: Arsenic, total Analysis Run 12/6/2019 8:34 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

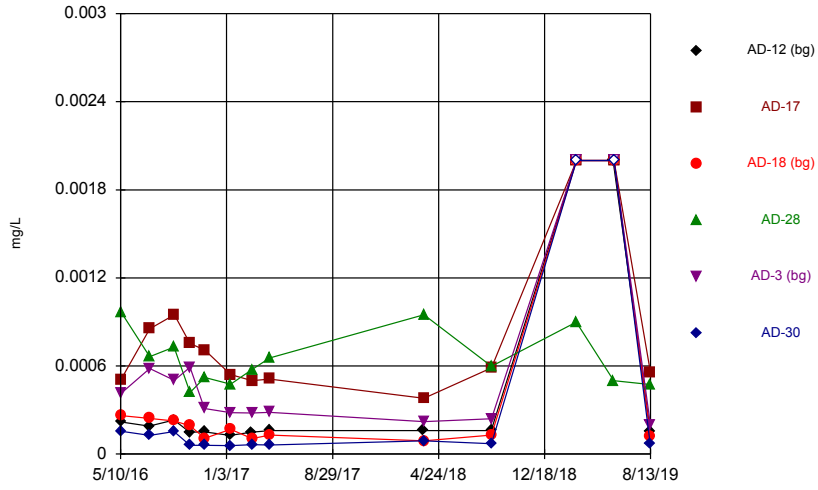
Time Series



Constituent: Barium, total Analysis Run 12/6/2019 8:34 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

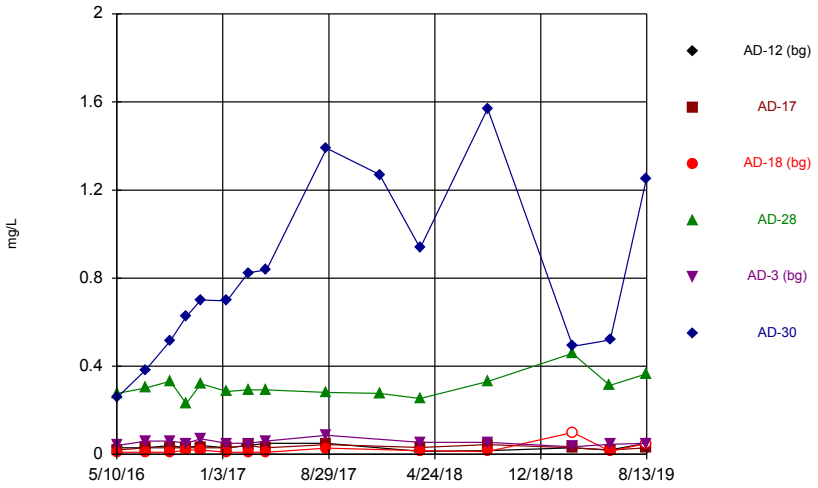
Time Series



Constituent: Beryllium, total Analysis Run 12/6/2019 8:34 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



Constituent: Boron, total Analysis Run 12/6/2019 8:34 AM
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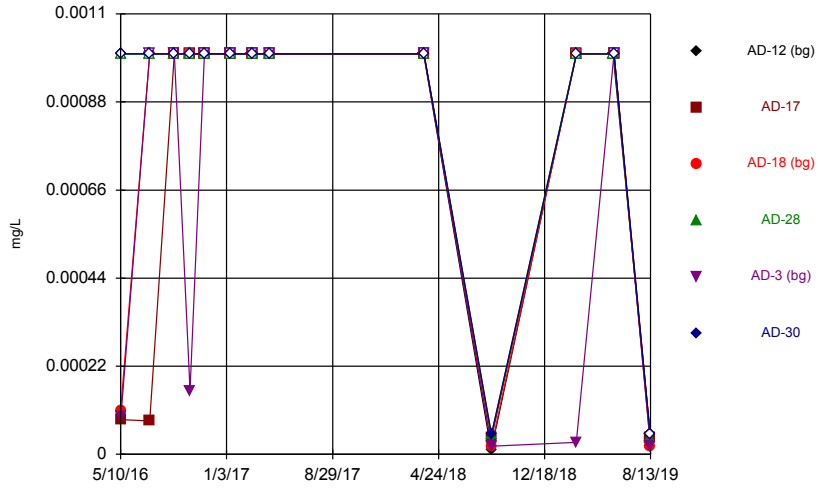
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

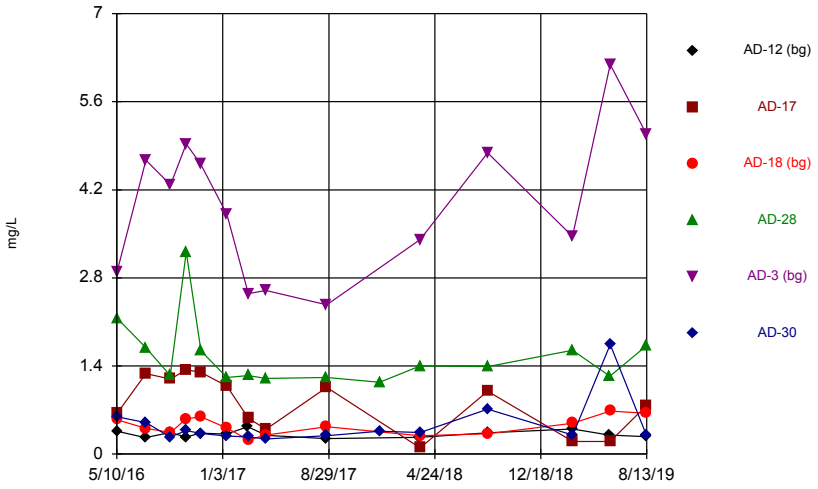
Time Series



Constituent: Cadmium, total Analysis Run 12/6/2019 8:34 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

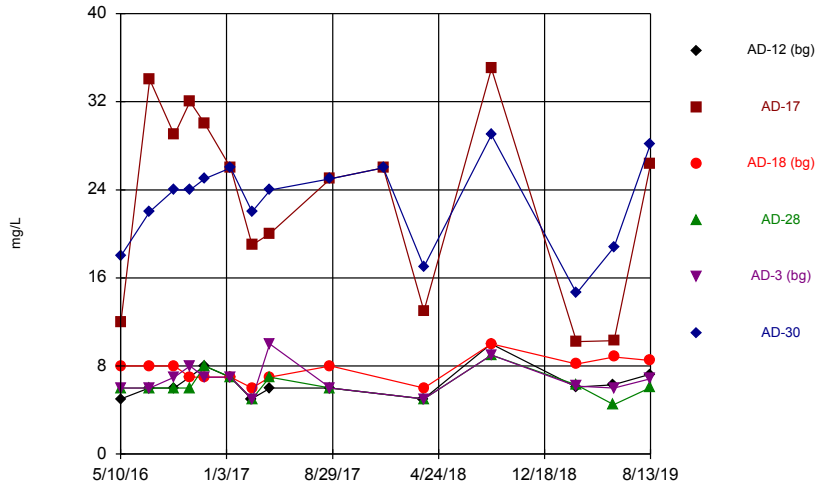
Time Series



Constituent: Calcium, total Analysis Run 12/6/2019 8:34 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

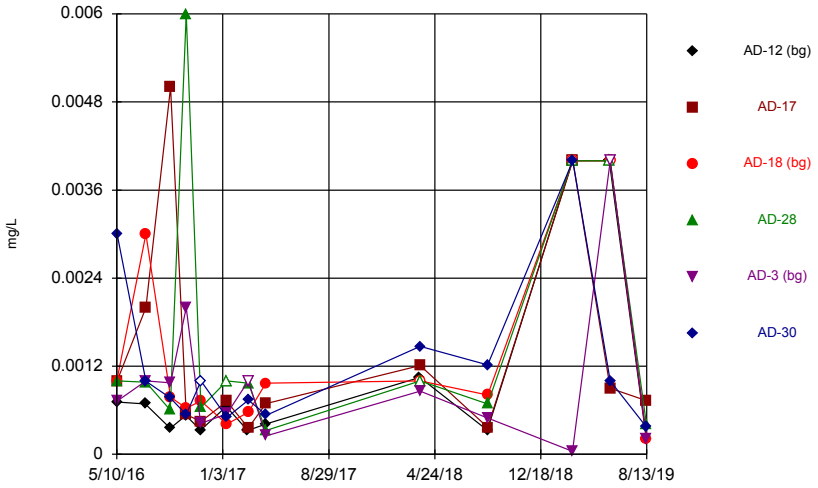
Time Series



Constituent: Chloride, total Analysis Run 12/6/2019 8:34 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

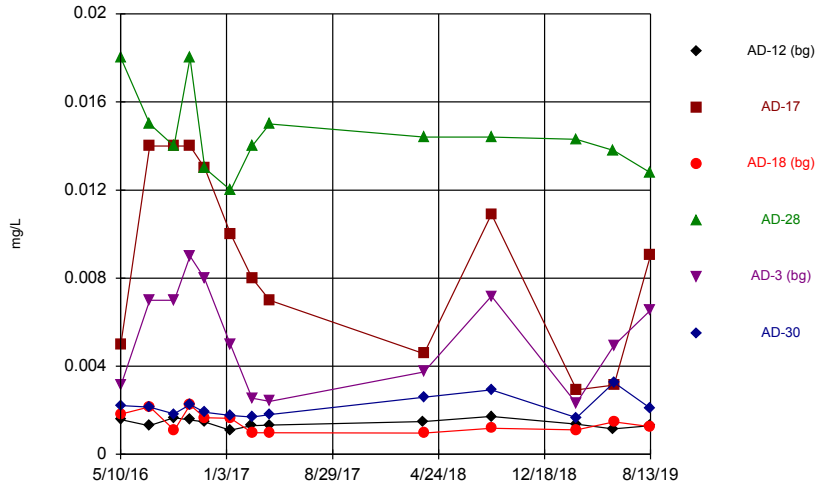
Time Series



Constituent: Chromium, total Analysis Run 12/6/2019 8:34 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

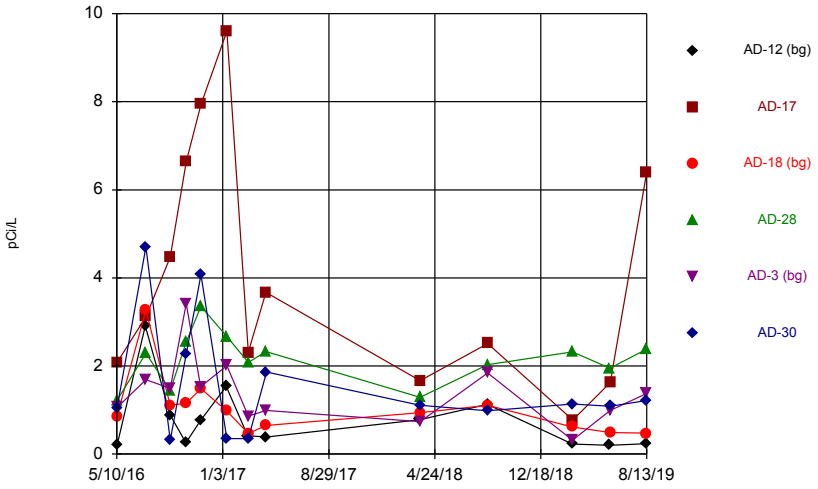
Time Series



Constituent: Cobalt, total Analysis Run 12/6/2019 8:34 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Time Series



Constituent: Combined Radium 226 + 228 Analysis Run 12/6/2019 8:34 AM
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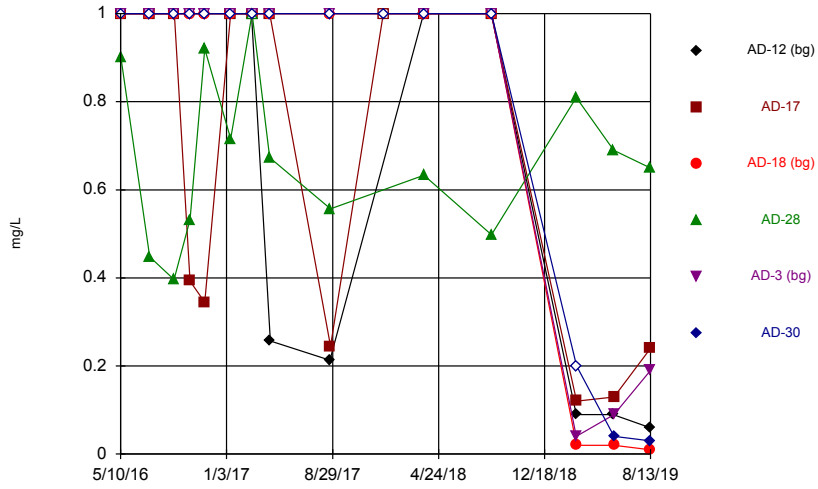
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

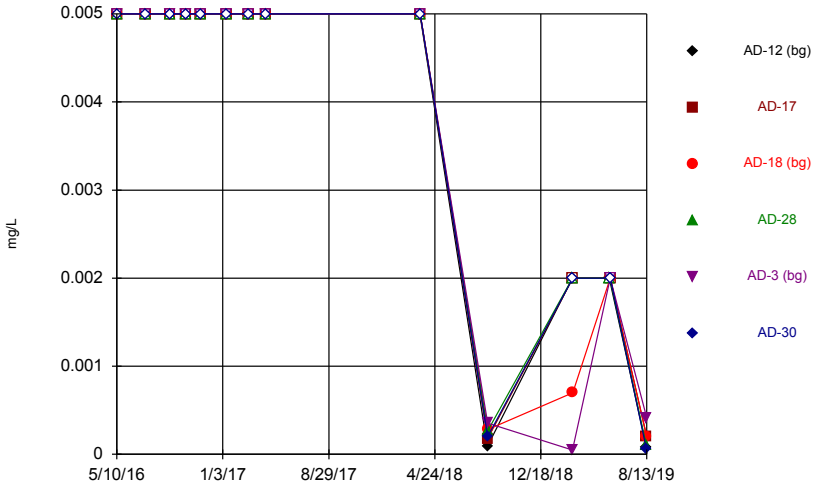
Time Series



Constituent: Fluoride, total Analysis Run 12/6/2019 8:34 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

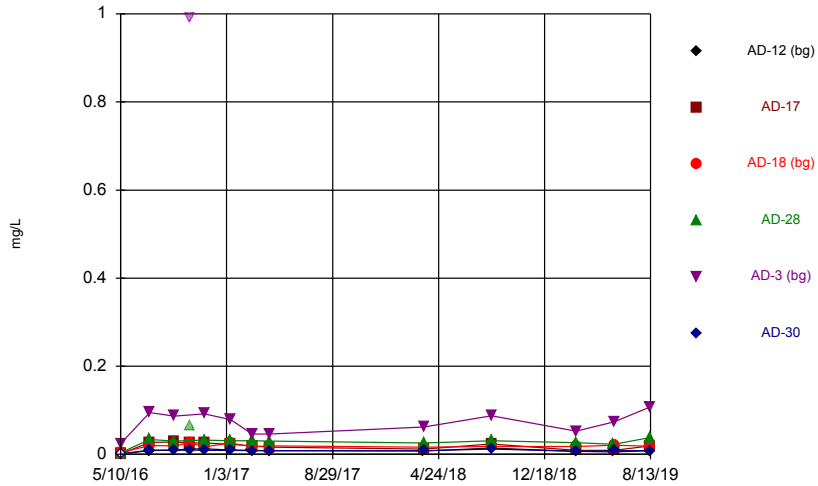
Time Series



Constituent: Lead, total Analysis Run 12/6/2019 8:34 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



Constituent: Lithium, total Analysis Run 12/6/2019 8:34 AM
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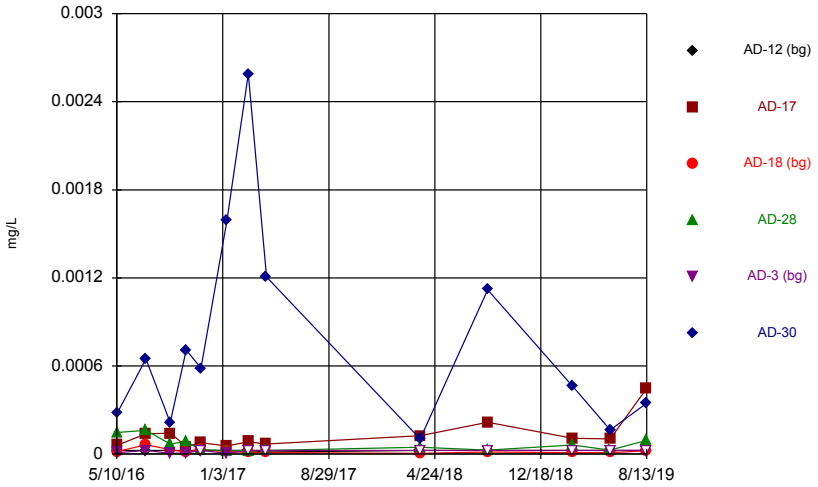
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



Constituent: Mercury, total Analysis Run 12/6/2019 8:34 AM
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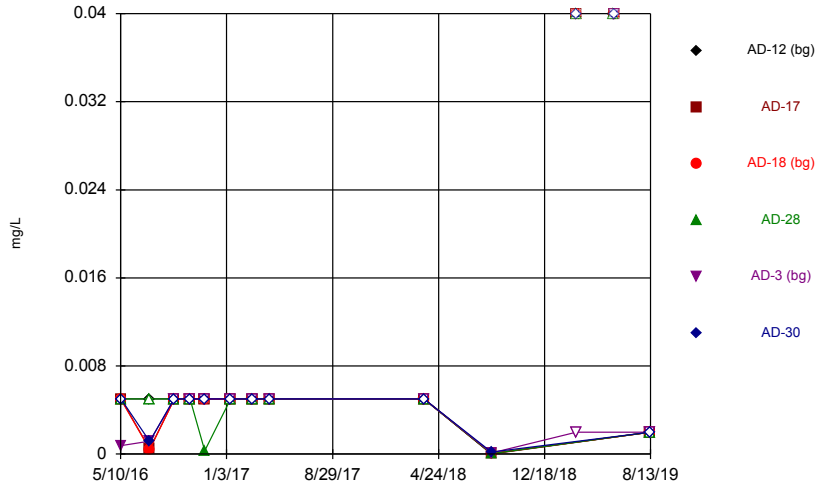
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

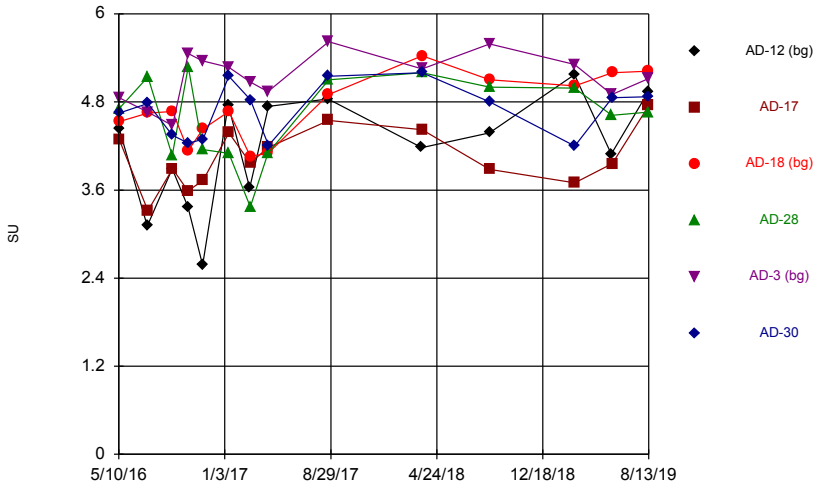
Time Series



Constituent: Molybdenum, total Analysis Run 12/6/2019 8:34 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Time Series



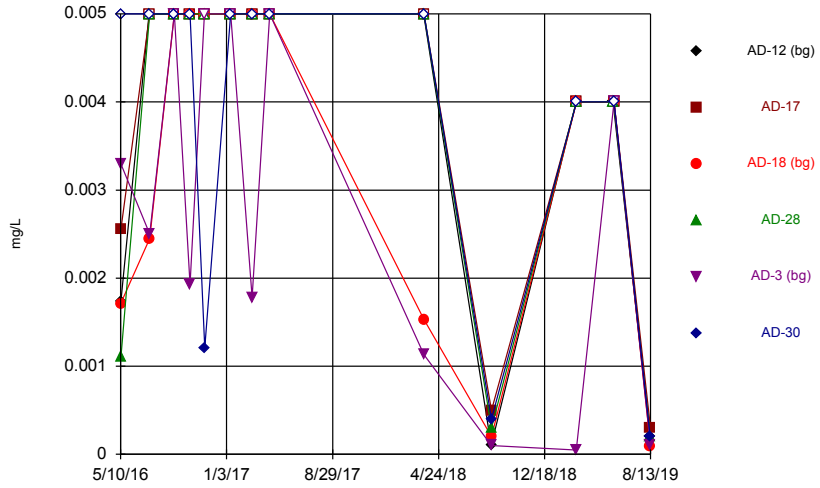
Constituent: pH, field Analysis Run 12/6/2019 8:34 AM

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Time Series

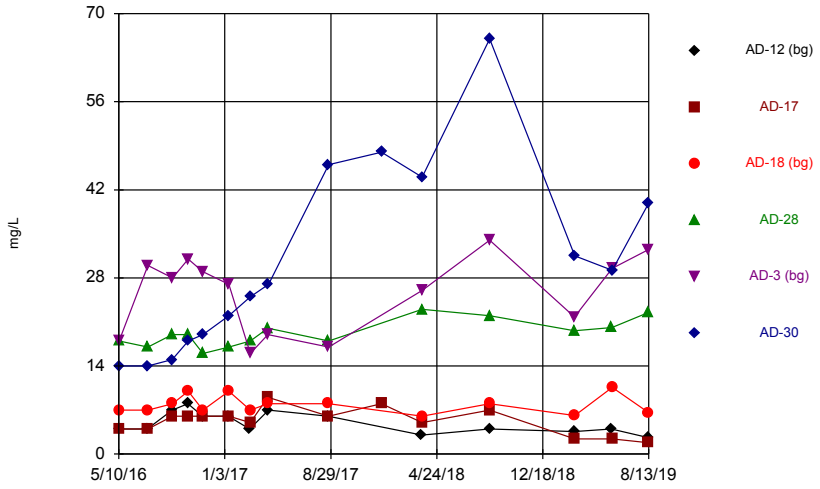


Constituent: Selenium, total Analysis Run 12/6/2019 8:34 AM

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Time Series



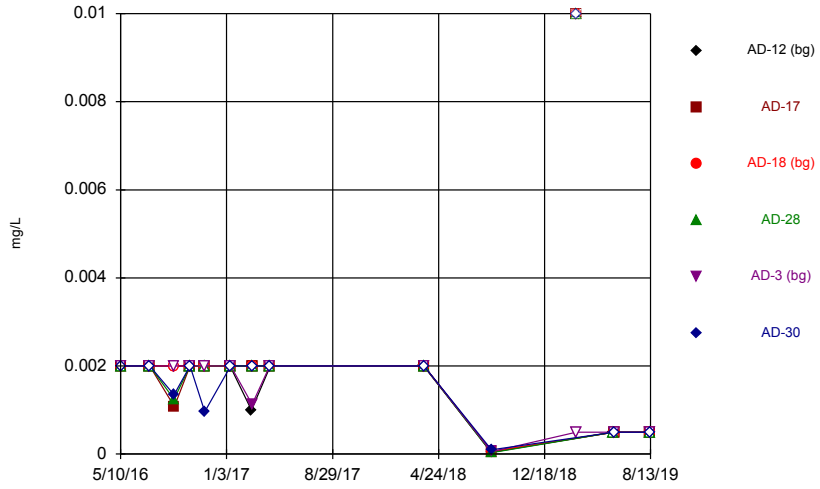
Constituent: Sulfate, total Analysis Run 12/6/2019 8:35 AM

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

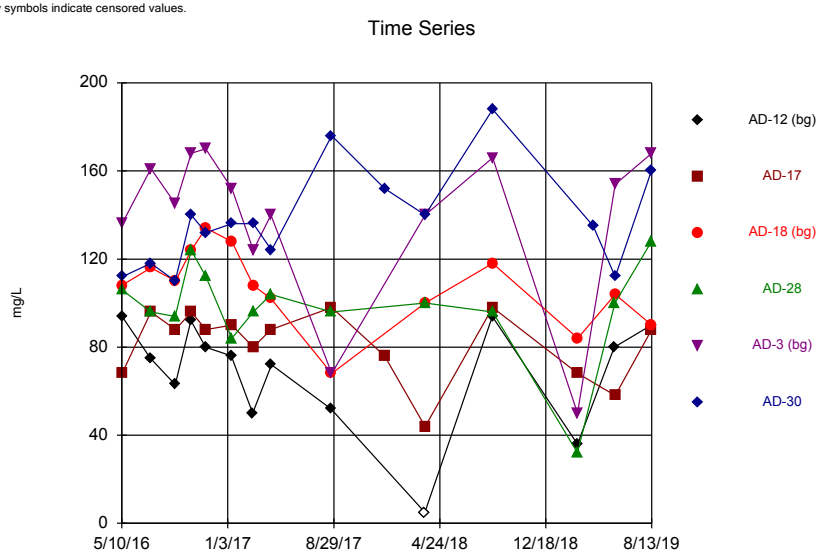
Time Series



Constituent: Thallium, total Analysis Run 12/6/2019 8:35 AM

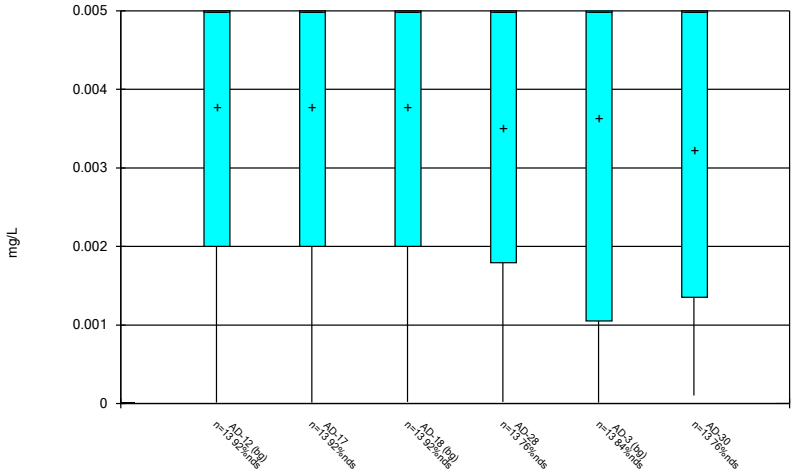
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



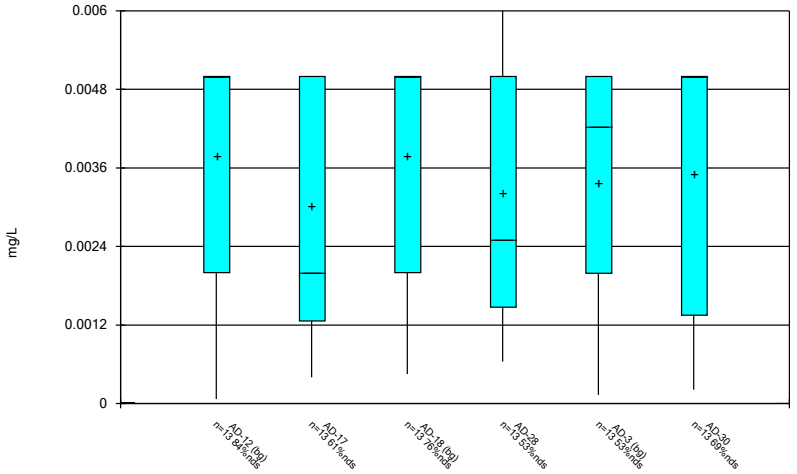
Constituent: Total Dissolved Solids [TDS] Analysis Run 12/6/2019 8:35 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Box & Whiskers Plot



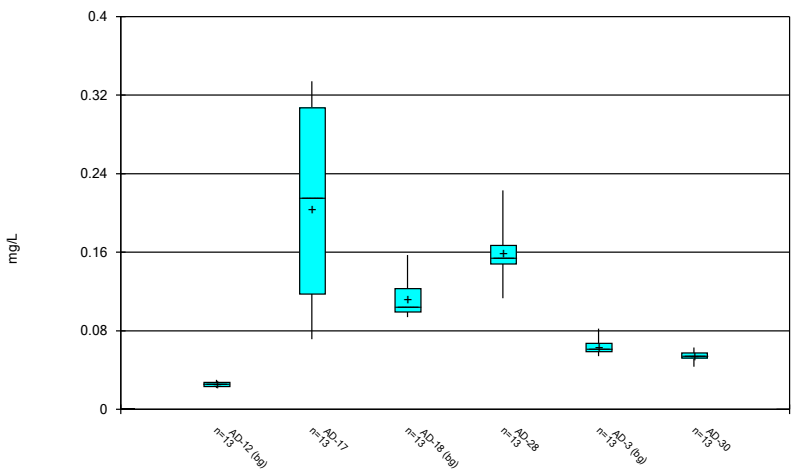
Constituent: Antimony, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Box & Whiskers Plot



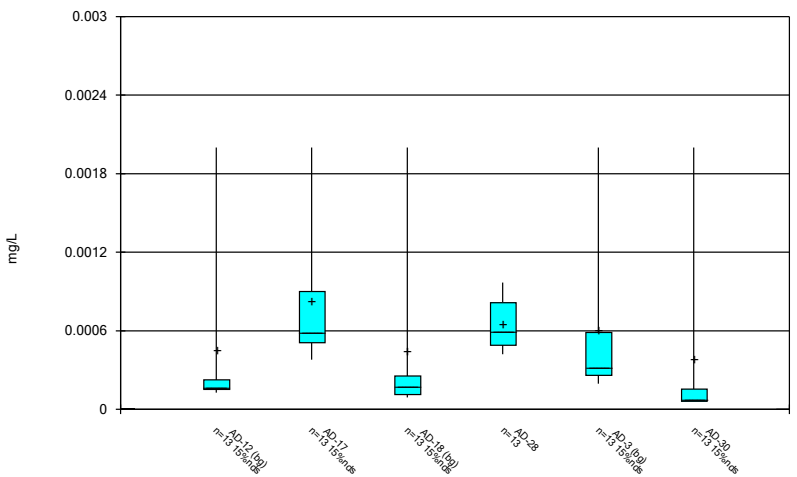
Constituent: Arsenic, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Box & Whiskers Plot



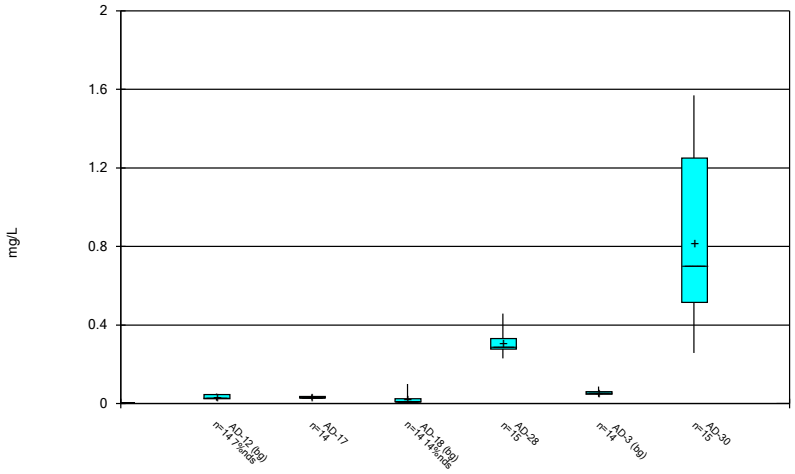
Constituent: Barium, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Box & Whiskers Plot



Constituent: Beryllium, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Box & Whiskers Plot



Constituent: Boron, total Analysis Run 12/6/2019 8:36 AM
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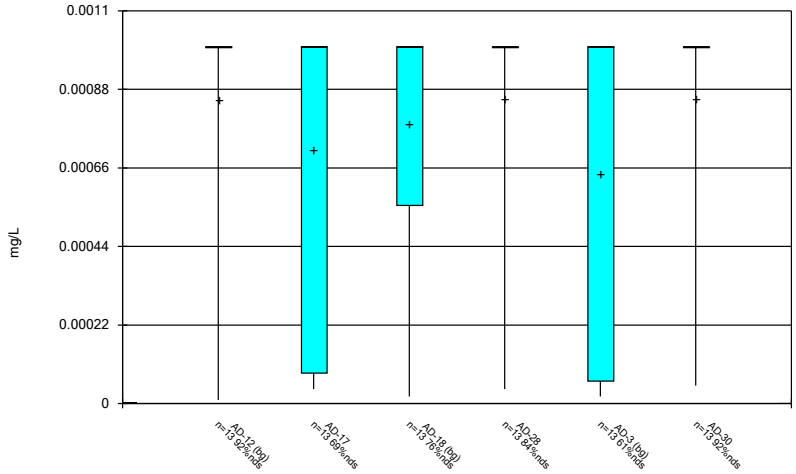
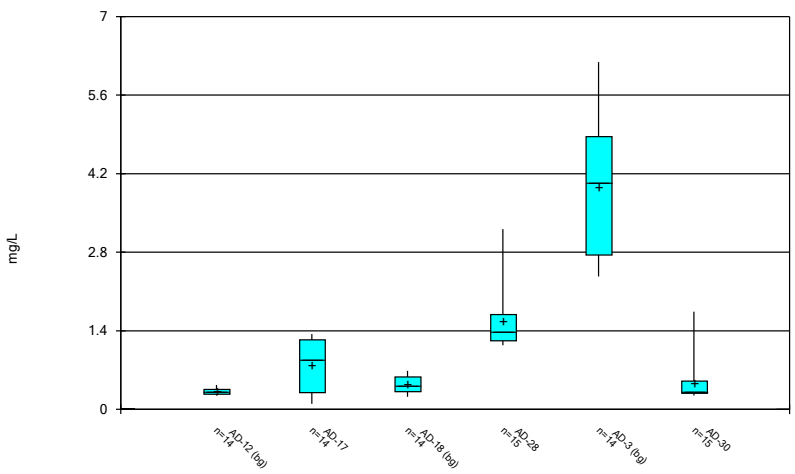
Box & Whiskers Plot



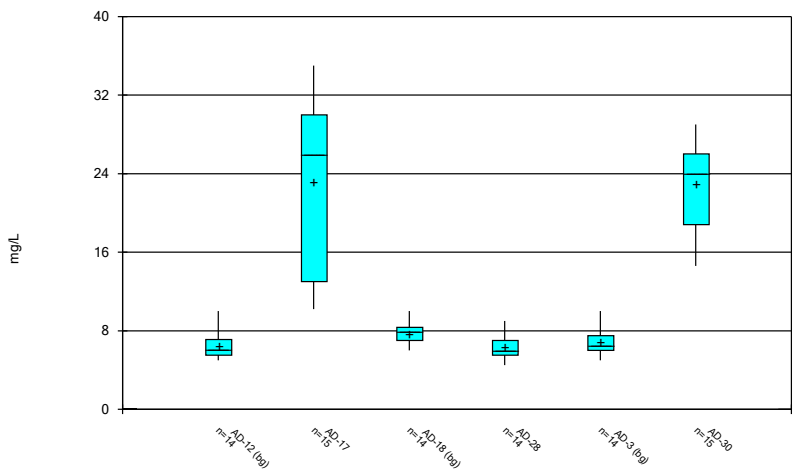
Constituent: Cadmium, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Box & Whiskers Plot



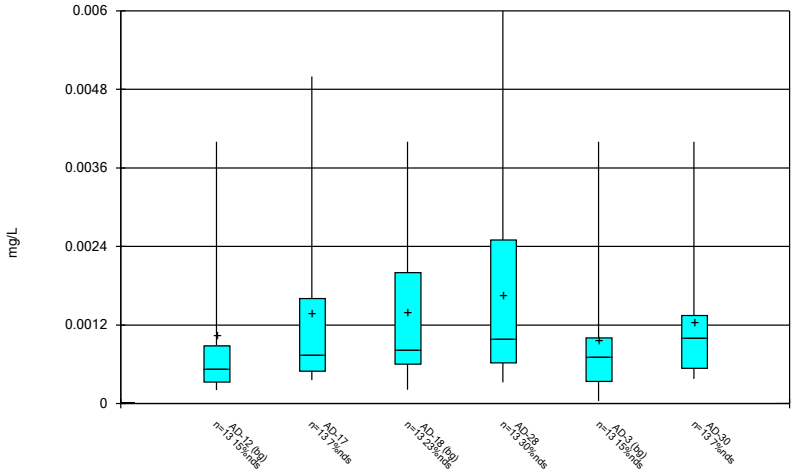
Constituent: Calcium, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Box & Whiskers Plot



Constituent: Chloride, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

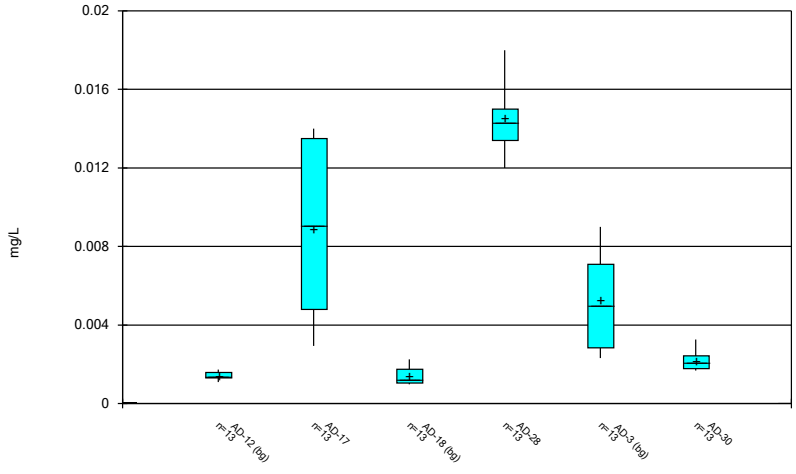
Box & Whiskers Plot



Constituent: Chromium, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

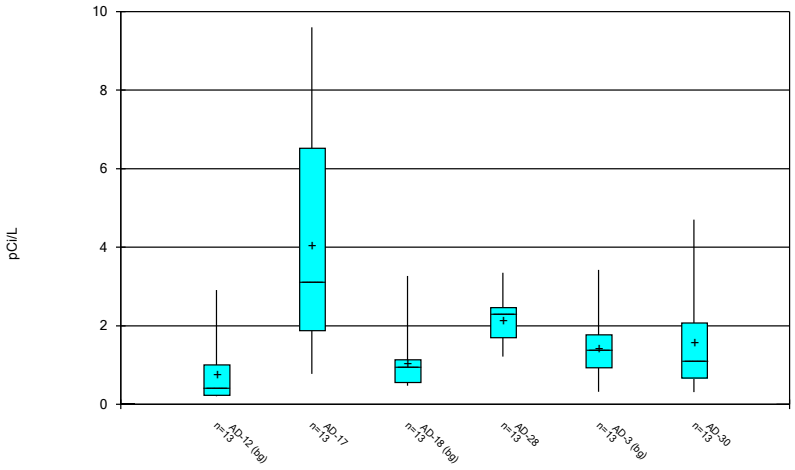
Box & Whiskers Plot



Constituent: Cobalt, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

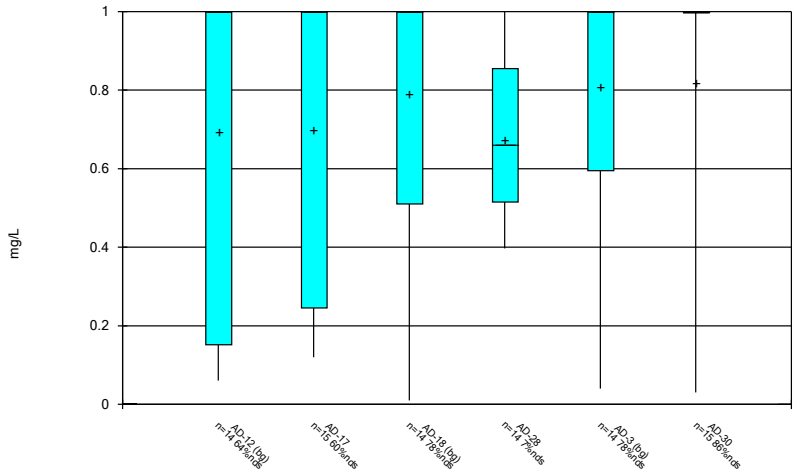
Box & Whiskers Plot



Constituent: Combined Radium 226 + 228 Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot



Constituent: Fluoride, total Analysis Run 12/6/2019 8:36 AM
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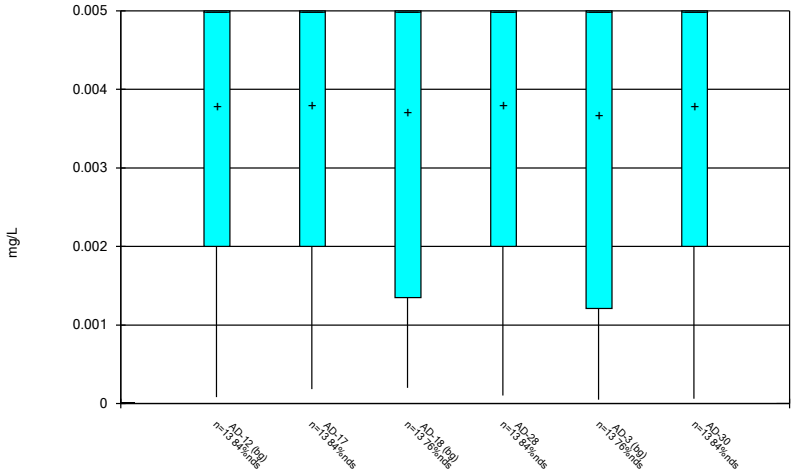
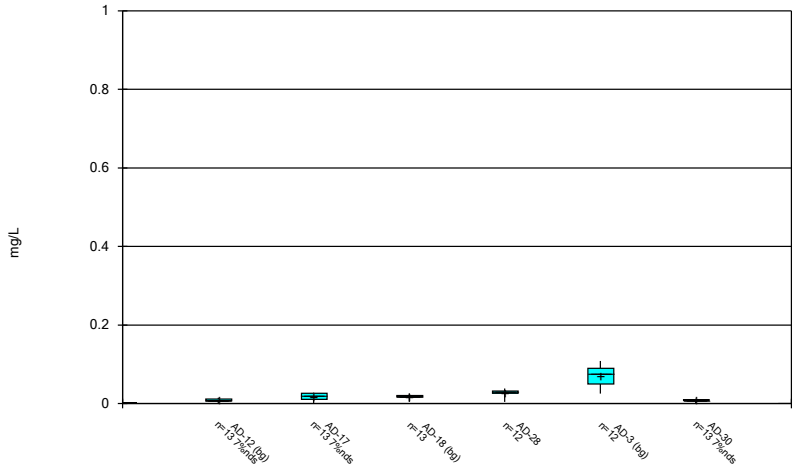
Box & Whiskers Plot



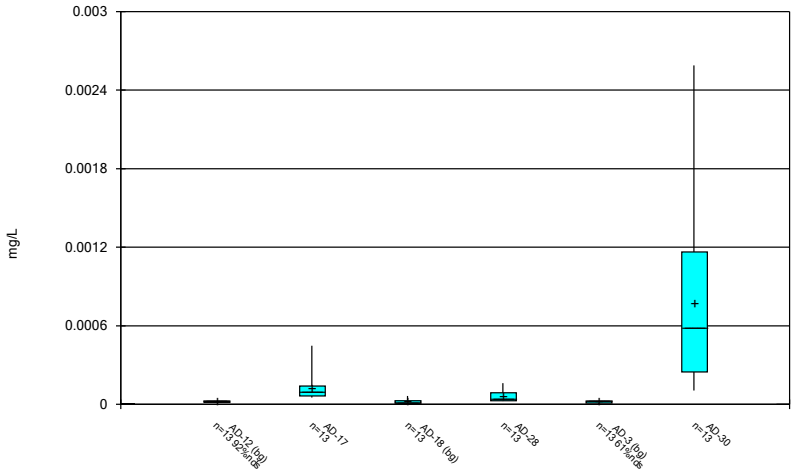
Constituent: Lead, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Box & Whiskers Plot



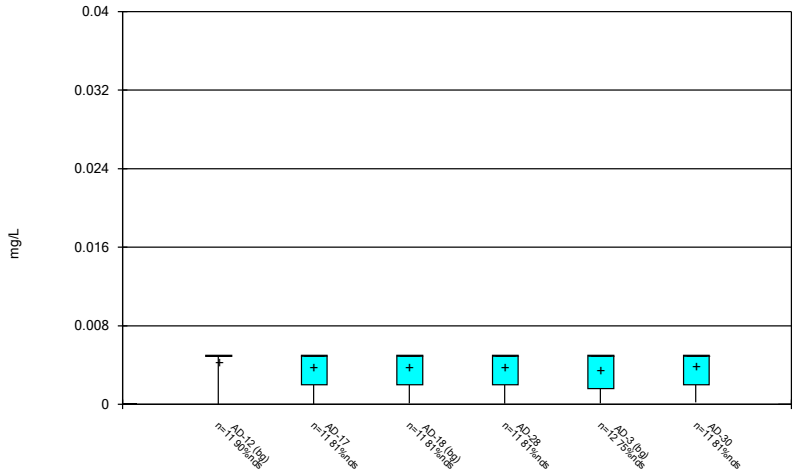
Constituent: Lithium, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Box & Whiskers Plot



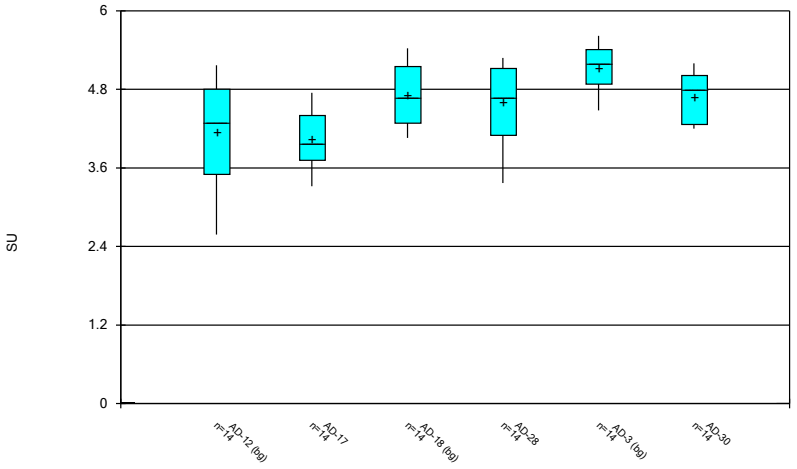
Constituent: Mercury, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Box & Whiskers Plot



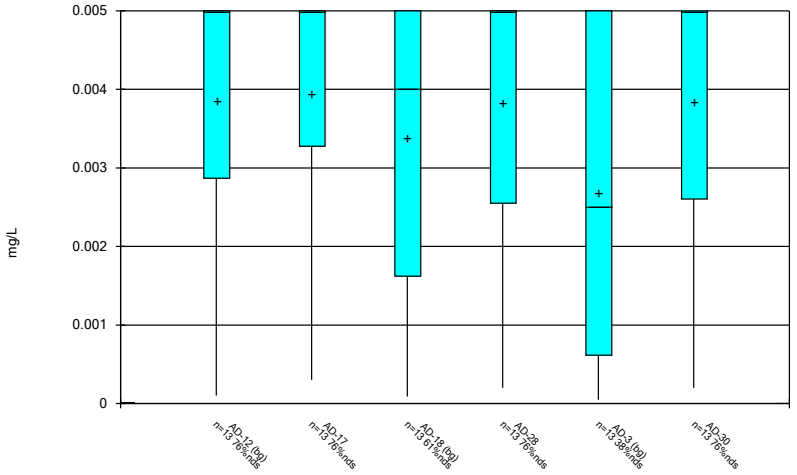
Constituent: Molybdenum, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Box & Whiskers Plot



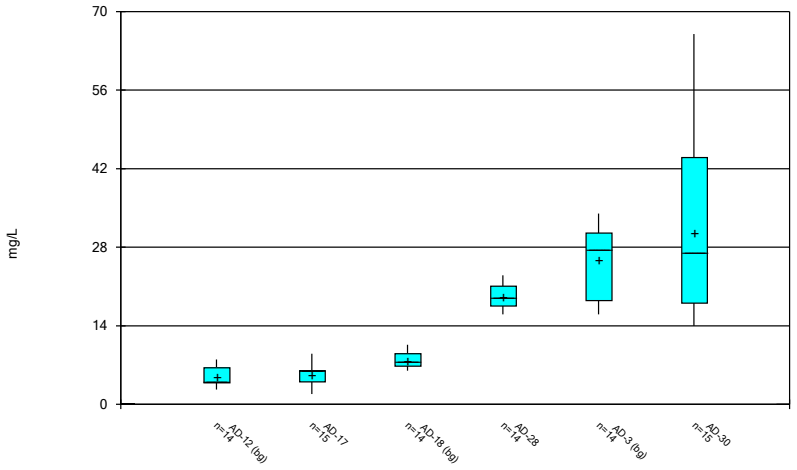
Constituent: pH, field Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Box & Whiskers Plot



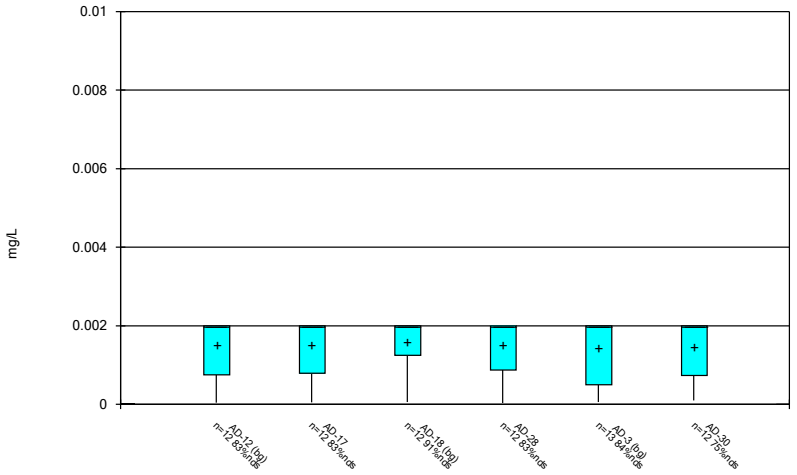
Constituent: Selenium, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Box & Whiskers Plot



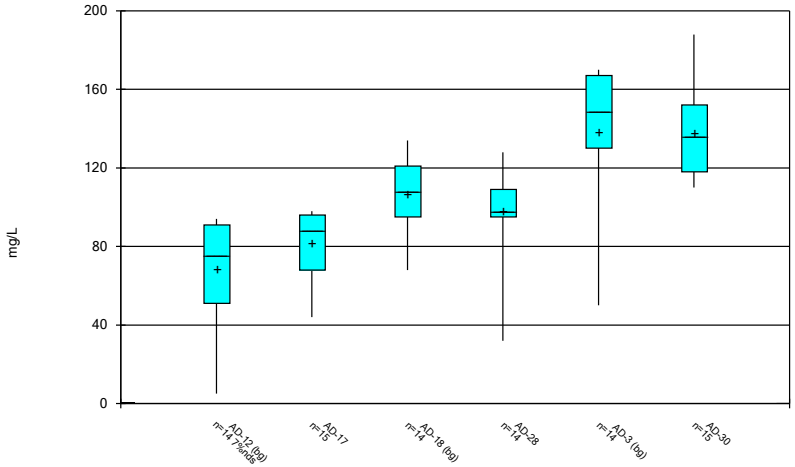
Constituent: Sulfate, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Box & Whiskers Plot



Constituent: Thallium, total Analysis Run 12/6/2019 8:36 AM
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Box & Whiskers Plot



Constituent: Total Dissolved Solids [TDS] Analysis Run 12/6/2019 8:36 AM

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Outlier Summary

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 12/6/2019, 8:40 AM

	AD-28 Lithium, total (mg/L)	AD-3 Lithium, total (mg/L)	AD-12 Molybdenum, total (mg/L)	AD-17 Molybdenum, total (mg/L)	AD-18 Molybdenum, total (mg/L)	AD-28 Molybdenum, total (mg/L)	AD-3 Molybdenum, total (mg/L)	AD-30 Molybdenum, total (mg/L)	AD-12 Thallium, total (mg/L)	AD-17 Thallium, total (mg/L)
10/13/2016	0.066 (o)	0.991 (o)								
2/27/2019			<0.04 (o)			<0.04 (o)			<0.01 (o)	
2/28/2019				<0.04 (o)	<0.04 (o)			<0.04 (o)		<0.01 (o)
5/21/2019			<0.04 (o)							
5/22/2019						<0.04 (o)				
5/23/2019				<0.04 (o)	<0.04 (o)		<0.04 (o)	<0.04 (o)		

	AD-18 Thallium, total (mg/L)	AD-28 Thallium, total (mg/L)	AD-30 Thallium, total (mg/L)
10/13/2016			
2/27/2019		<0.01 (o)	
2/28/2019	<0.01 (o)		<0.01 (o)
5/21/2019			
5/22/2019			
5/23/2019			

Welch's t-test/Mann-Whitney - Significant Results

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 12/9/2019, 7:40 AM

Constituent	Well	Calc.	0.01	Method
pH, field (SU)	**AD-18 (bg)**	**2.637**	**Yes**	**Mann-W**
Sulfate, total (mg/L)	**AD-30**	**2.858**	**Yes**	**Mann-W**

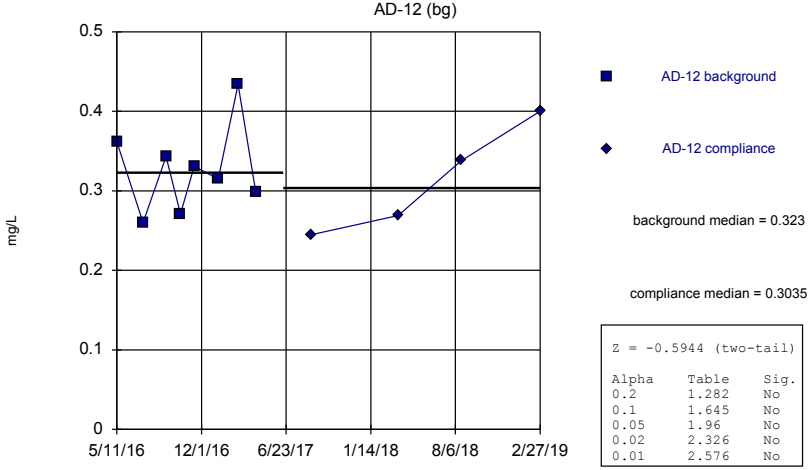
Welch's t-test/Mann-Whitney - All Results

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 12/9/2019, 7:40 AM

Constituent	Well	Calc.	0.01	Method
Calcium, total (mg/L)	AD-12 (bg)	-0.5944	No	Mann-W
Calcium, total (mg/L)	AD-17	-1.783	No	Mann-W
Calcium, total (mg/L)	AD-18 (bg)	-0.5944	No	Mann-W
Calcium, total (mg/L)	AD-28	-0.8807	No	Mann-W
Calcium, total (mg/L)	AD-3 (bg)	-0.5944	No	Mann-W
Calcium, total (mg/L)	AD-30	0.8051	No	Mann-W
pH, field (SU)	AD-12 (bg)	1.613	No	Mann-W
pH, field (SU)	AD-17	0.7643	No	Mann-W
pH, field (SU)	**AD-18 (bg)**	**2.637**	**Yes**	**Mann-W**
pH, field (SU)	AD-28	1.446	No	Mann-W
pH, field (SU)	AD-3 (bg)	1.783	No	Mann-W
pH, field (SU)	AD-30	0.8507	No	Mann-W
Sulfate, total (mg/L)	AD-12 (bg)	-1.919	No	Mann-W
Sulfate, total (mg/L)	AD-17	0.151	No	Mann-W
Sulfate, total (mg/L)	AD-18 (bg)	-1.147	No	Mann-W
Sulfate, total (mg/L)	AD-28	1.802	No	Mann-W
Sulfate, total (mg/L)	AD-3 (bg)	-0.2548	No	Mann-W
Sulfate, total (mg/L)	**AD-30**	**2.858**	**Yes**	**Mann-W**
Total Dissolved Solids [TDS] (mg/L)	AD-12 (bg)	-1.361	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	AD-17	-0.4434	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	AD-18 (bg)	-1.957	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	AD-28	-1.124	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	AD-3 (bg)	-1.361	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	AD-30	2.557	No	Mann-W

Mann-Whitney (Wilcoxon Rank Sum)

AD-12 (bg)



Z = -0.5944 (two-tail)

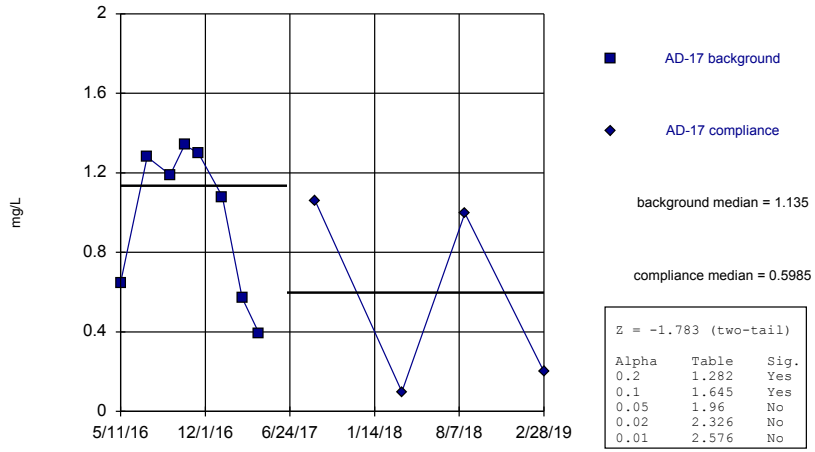
Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: Calcium, total Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-17



Z = -1.783 (two-tail)

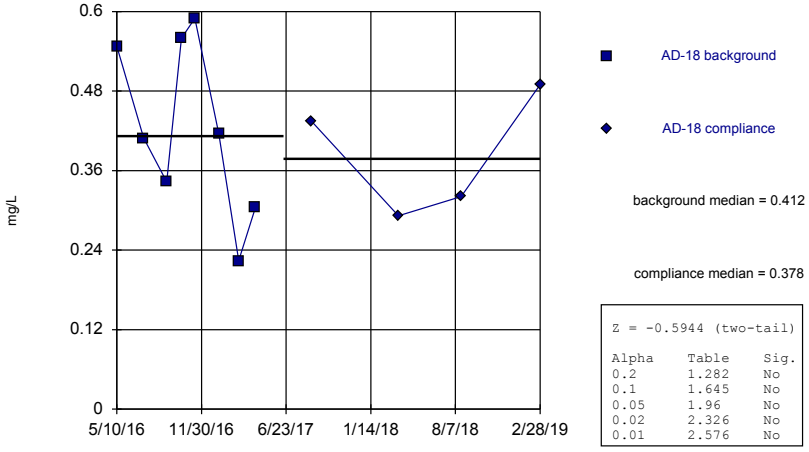
Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	Yes
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: Calcium, total Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-18 (bg)



Z = -0.5944 (two-tail)

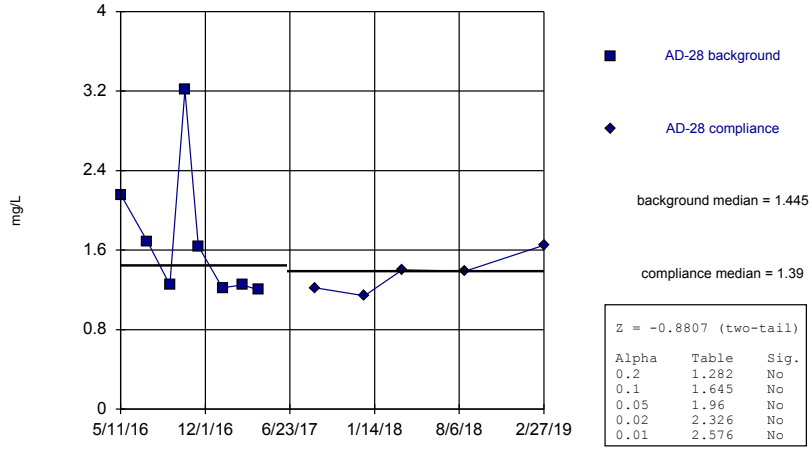
Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: Calcium, total Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-28



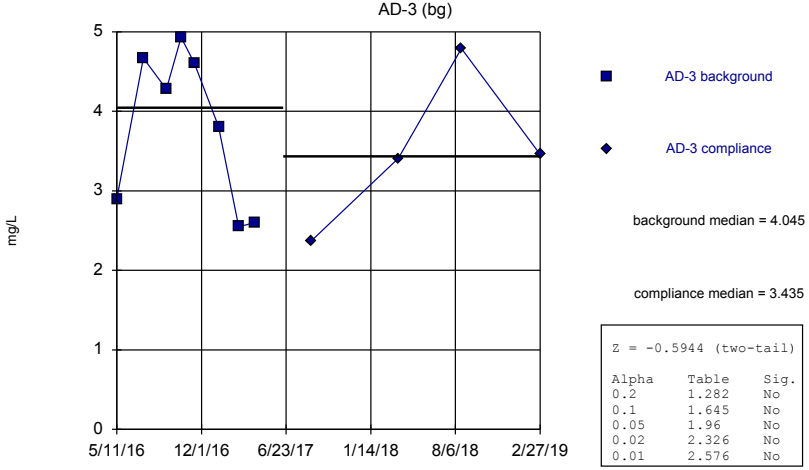
Z = -0.8807 (two-tail)

Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: Calcium, total Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Mann-Whitney (Wilcoxon Rank Sum)

AD-3 (bg)



background median = 4.045

compliance median = 3.435

Z = -0.5944 (two-tail)

Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

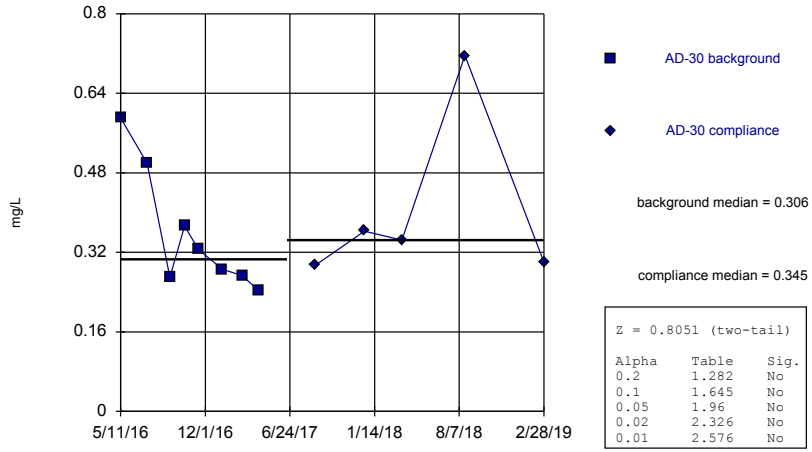
Constituent: Calcium, total Analysis Run 12/9/2019 7:39 AM View: Intrawell

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-30



background median = 0.306

compliance median = 0.345

Z = 0.8051 (two-tail)

Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

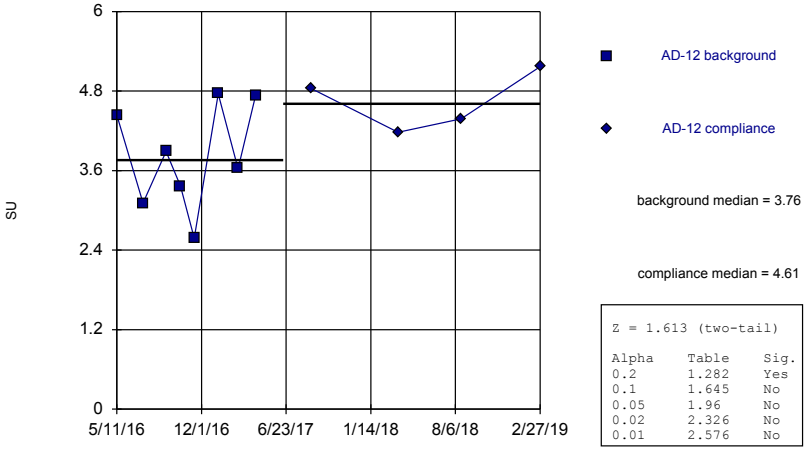
Constituent: Calcium, total Analysis Run 12/9/2019 7:39 AM View: Intrawell

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-12 (bg)



background median = 3.76

compliance median = 4.61

Z = 1.613 (two-tail)

Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

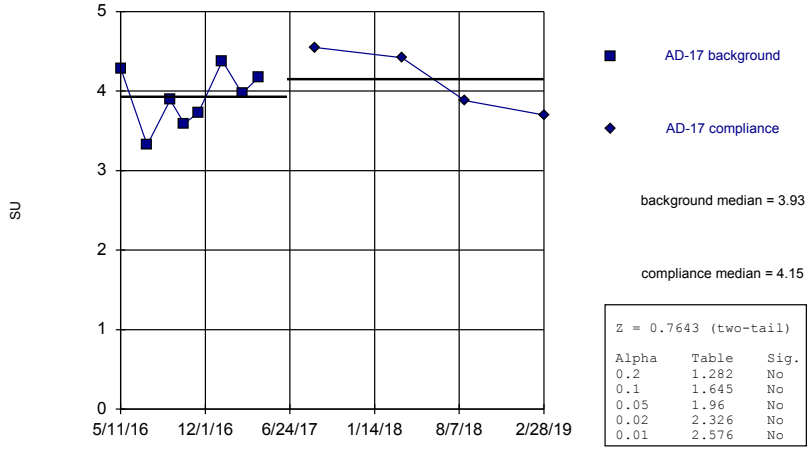
Constituent: pH, field Analysis Run 12/9/2019 7:39 AM View: Intrawell

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-17



background median = 3.93

compliance median = 4.15

Z = 0.7643 (two-tail)

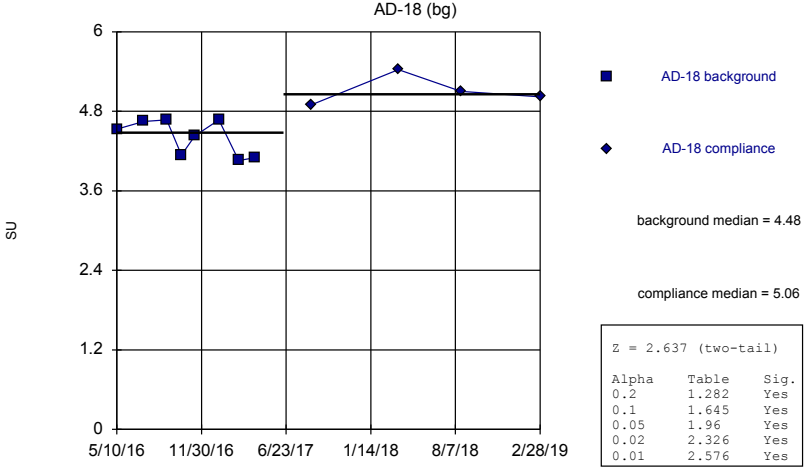
Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: pH, field Analysis Run 12/9/2019 7:39 AM View: Intrawell

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Mann-Whitney (Wilcoxon Rank Sum)

AD-18 (bg)



background median = 4.48

compliance median = 5.06

Z = 2.637 (two-tail)

Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	Yes
0.05	1.96	Yes
0.02	2.326	Yes
0.01	2.576	Yes

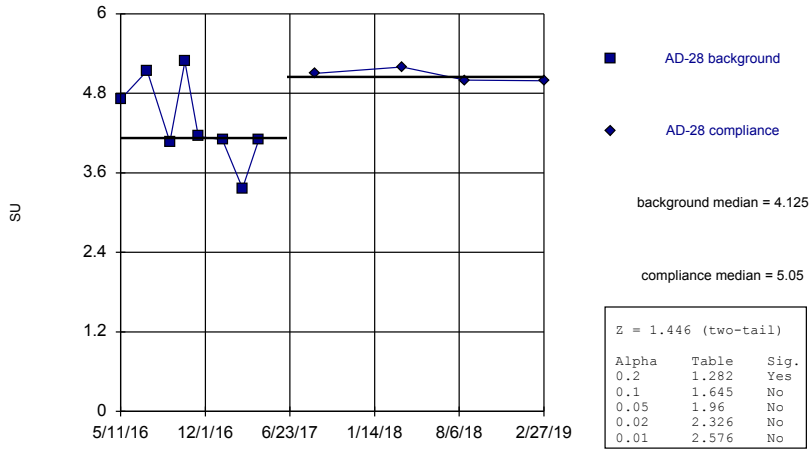
Constituent: pH, field Analysis Run 12/9/2019 7:39 AM View: Intrawell

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-28



background median = 4.125

compliance median = 5.05

Z = 1.446 (two-tail)

Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

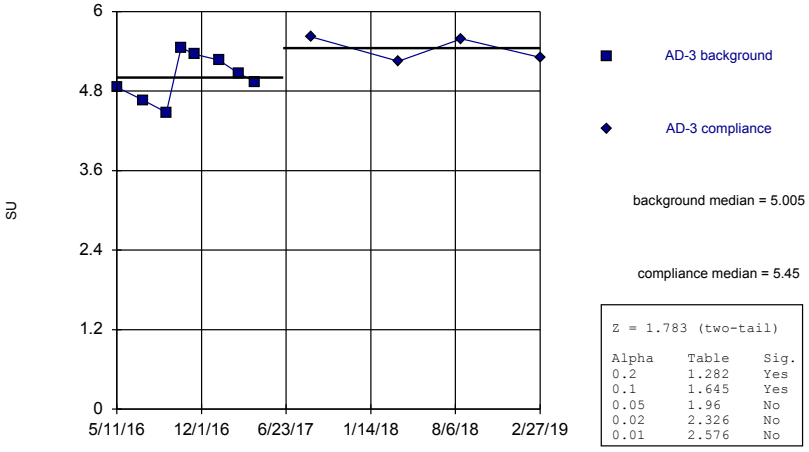
Constituent: pH, field Analysis Run 12/9/2019 7:39 AM View: Intrawell

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-3 (bg)



background median = 5.005

compliance median = 5.45

Z = 1.783 (two-tail)

Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	Yes
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

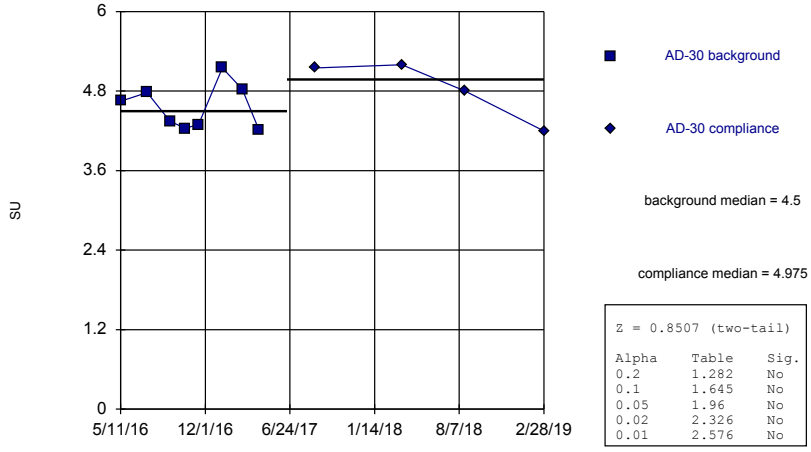
Constituent: pH, field Analysis Run 12/9/2019 7:39 AM View: Intrawell

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-30



background median = 4.5

compliance median = 4.975

Z = 0.8507 (two-tail)

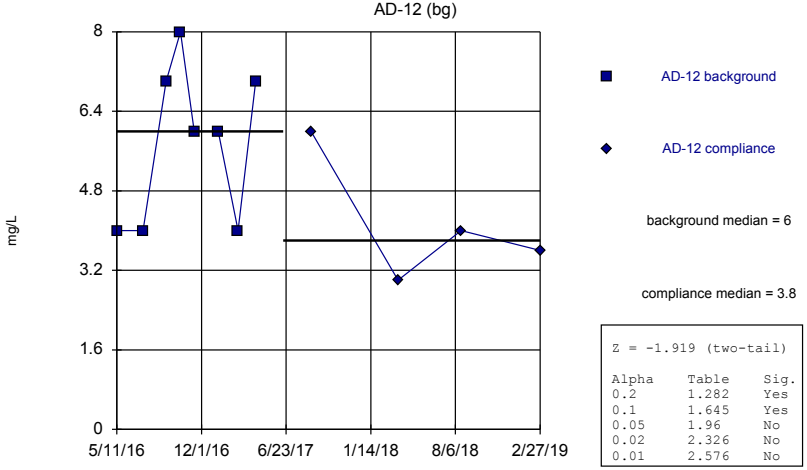
Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: pH, field Analysis Run 12/9/2019 7:39 AM View: Intrawell

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Mann-Whitney (Wilcoxon Rank Sum)

AD-12 (bg)

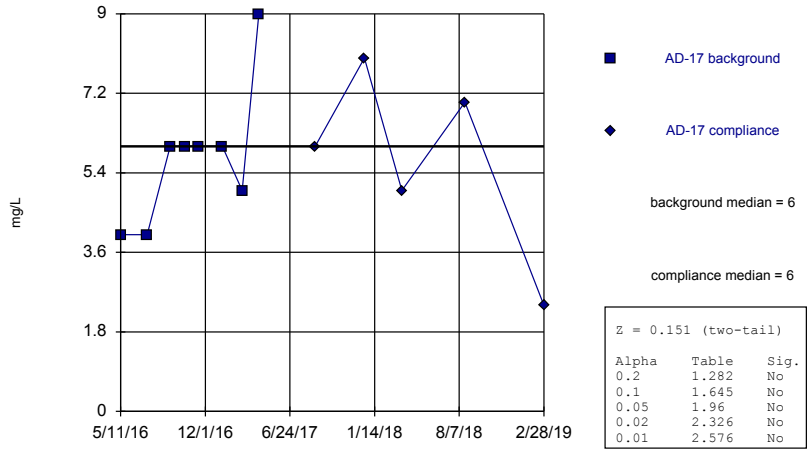


Constituent: Sulfate, total Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-17

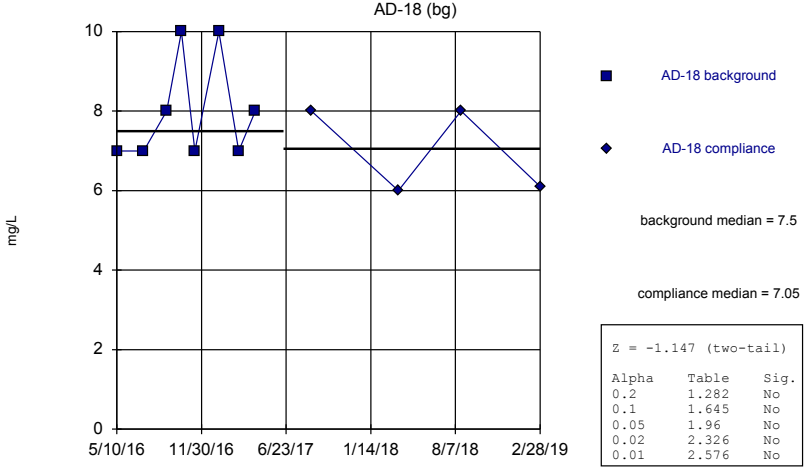


Constituent: Sulfate, total Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-18 (bg)

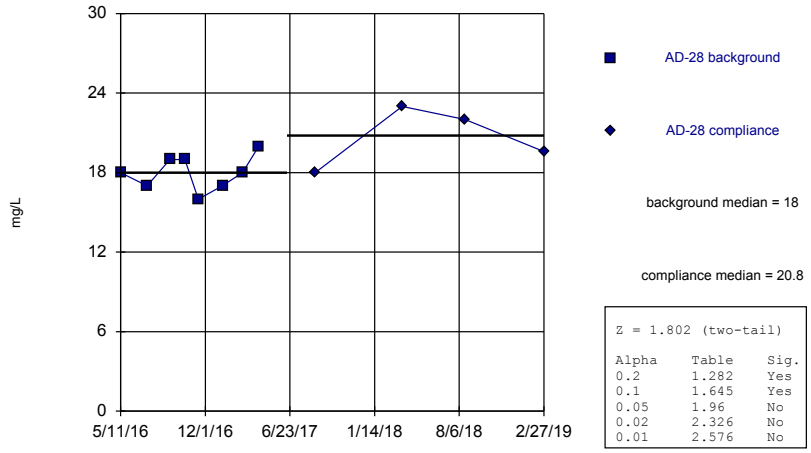


Constituent: Sulfate, total Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

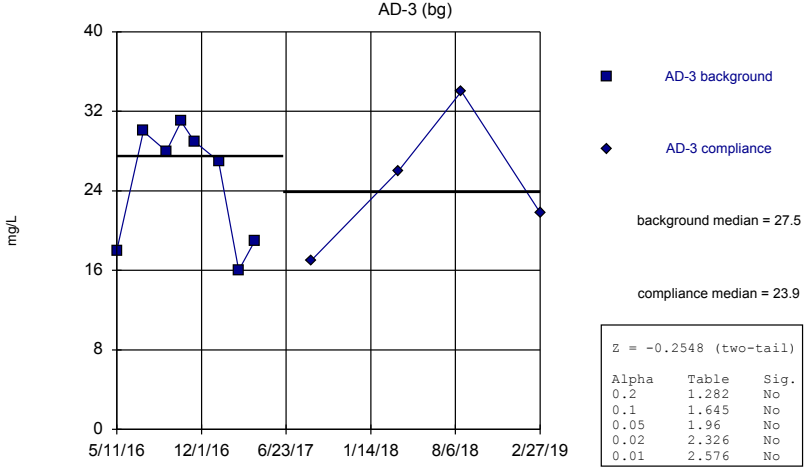
AD-28



Constituent: Sulfate, total Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Mann-Whitney (Wilcoxon Rank Sum)

AD-3 (bg)



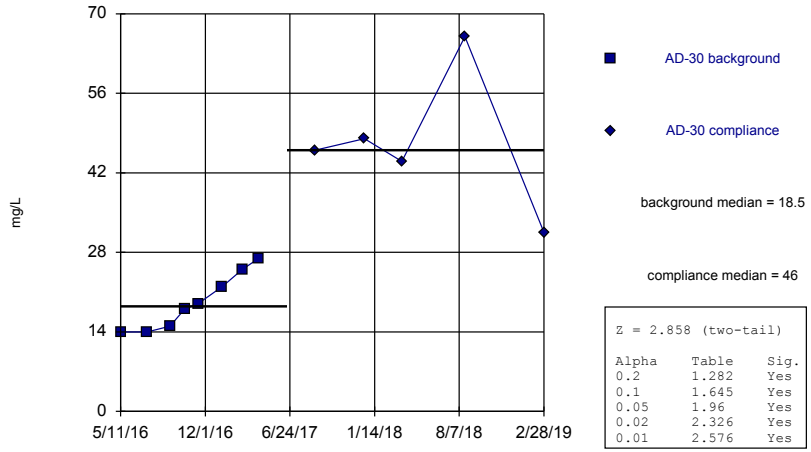
Z = -0.2548 (two-tail)

Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: Sulfate, total Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Mann-Whitney (Wilcoxon Rank Sum)

AD-30



Z = 2.858 (two-tail)

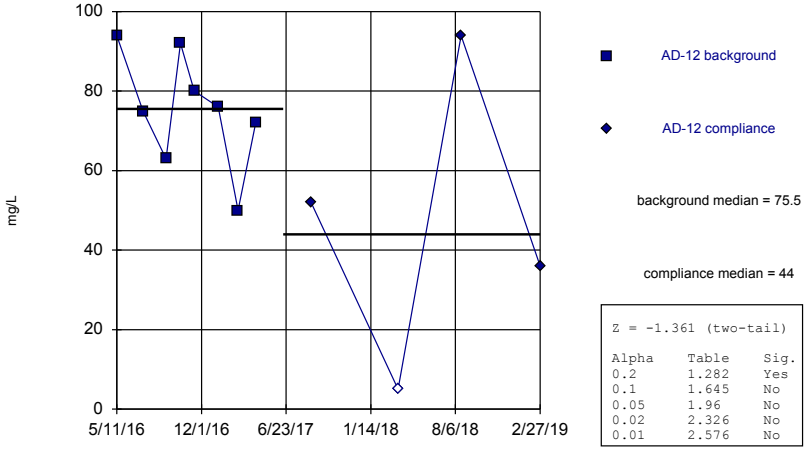
Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	Yes
0.05	1.96	Yes
0.02	2.326	Yes
0.01	2.576	Yes

Constituent: Sulfate, total Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Hollow symbols indicate censored values.

Mann-Whitney (Wilcoxon Rank Sum)

AD-12 (bg)



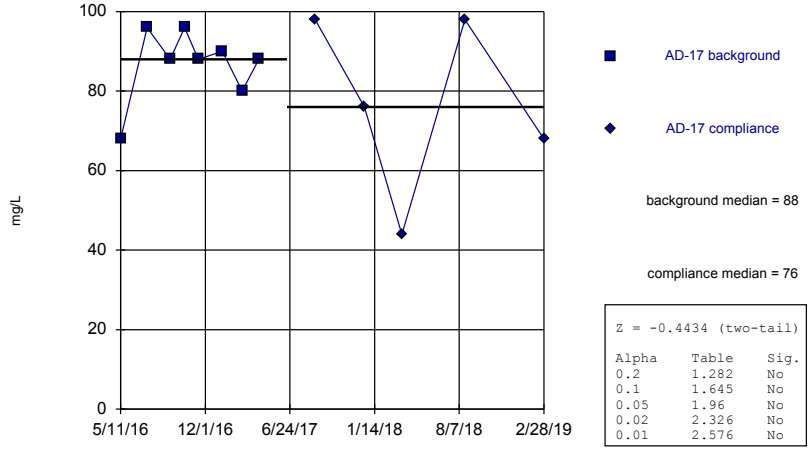
Z = -1.361 (two-tail)

Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Mann-Whitney (Wilcoxon Rank Sum)

AD-17



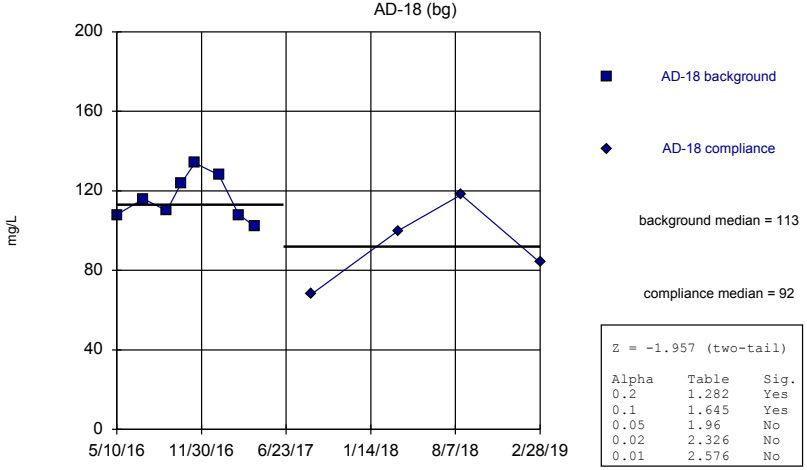
Z = -0.4434 (two-tail)

Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Mann-Whitney (Wilcoxon Rank Sum)

AD-18 (bg)



Z = -1.957 (two-tail)

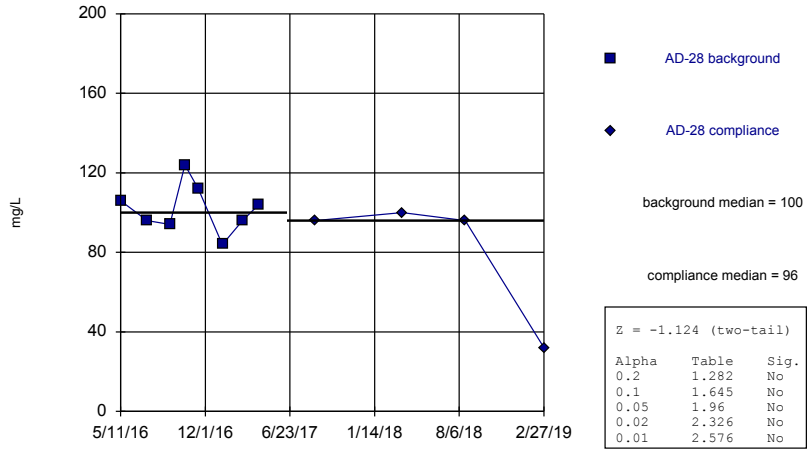
Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	Yes
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-28



Z = -1.124 (two-tail)

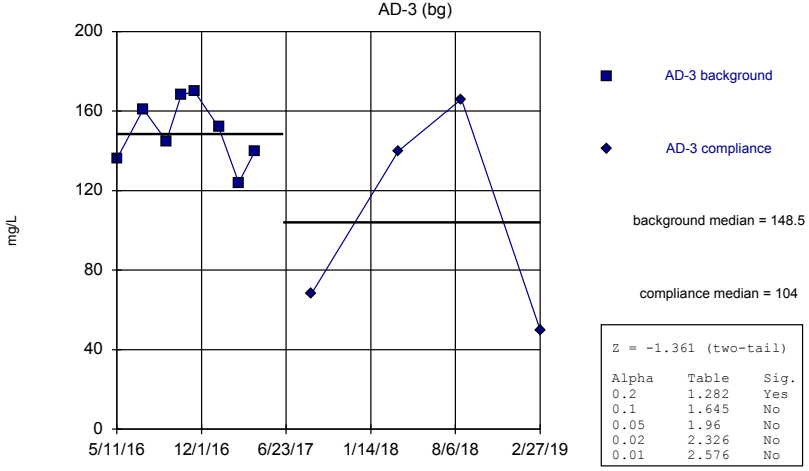
Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-3 (bg)



Z = -1.361 (two-tail)

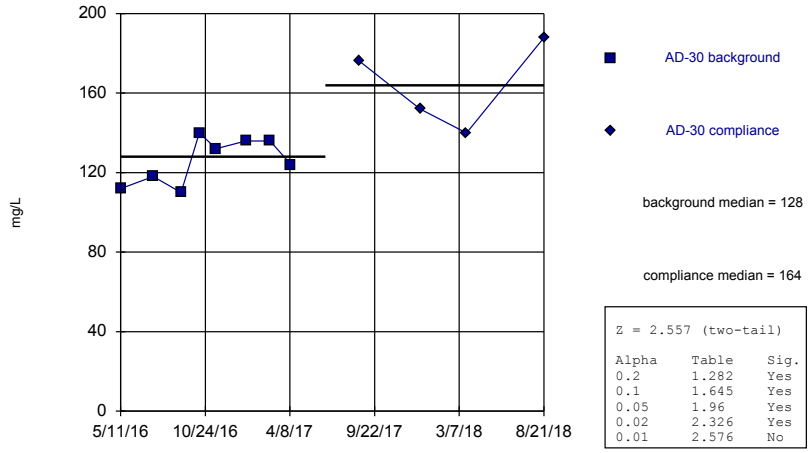
Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-30



Z = 2.557 (two-tail)

Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	Yes
0.05	1.96	Yes
0.02	2.326	Yes
0.01	2.576	No

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/9/2019 7:39 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Date Ranges

Date: 12/9/2019 7:43 AM

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

pH, field (SU)

AD-18 background:11/15/2016-2/28/2019

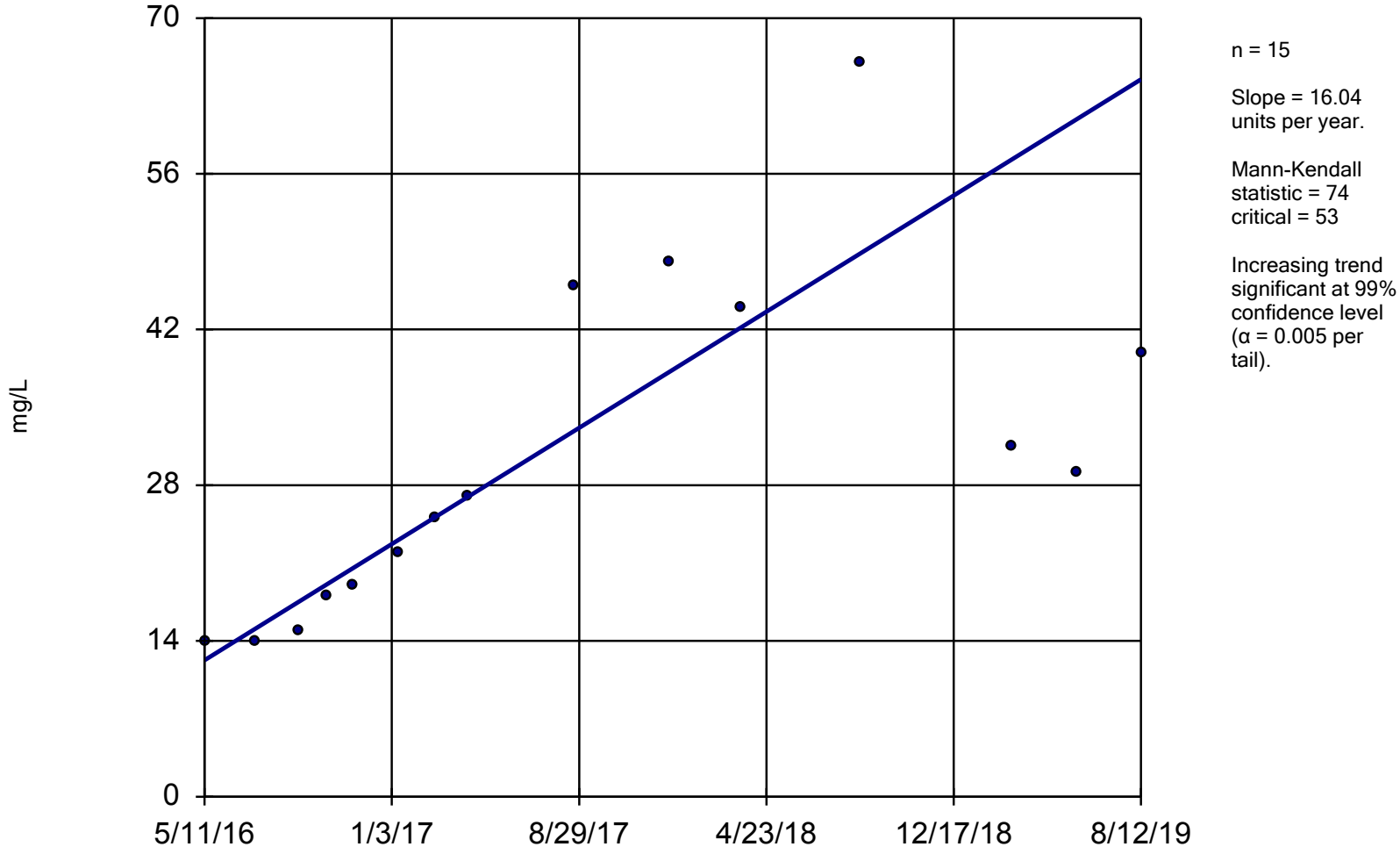
Trend Tests Summary Table - All Resuts

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 11/25/2019, 6:30 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Sulfate, total (mg/L)	**AD-30**	**16.04**	**74**	**53**	**Yes**	**15**	**0**	**n/a**	**n/a**	**0.01**	**NP**

Sen's Slope Estimator

AD-30



n = 15

Slope = 16.04 units per year.

Mann-Kendall statistic = 74
critical = 53

Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 11/25/2019 6:29 PM View: Intrawell Trend Tests

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

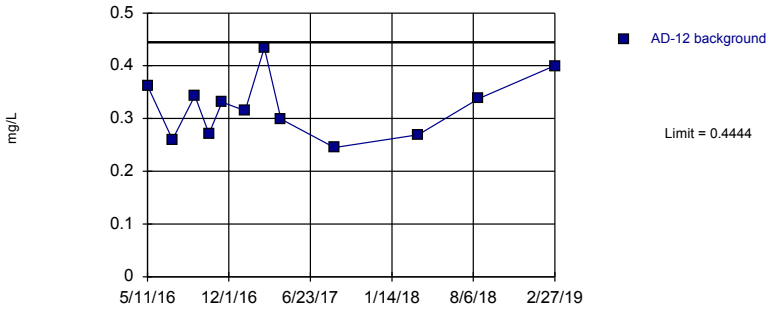
Intrawell Prediction Limit Summary Table - All Results

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 12/9/2019, 7:45 AM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Calcium, total (mg/L)	AD-12	0.4444	n/a	n/a	1 future	n/a	12	0.3223	0.05781	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-17	1.786	n/a	n/a	1 future	n/a	12	0.8465	0.4447	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-18	0.6601	n/a	n/a	1 future	n/a	12	0.4109	0.118	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-28	2.758	n/a	n/a	1 future	n/a	13	0.4061	0.2931	0	None	ln(x)	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-3	5.702	n/a	n/a	1 future	n/a	12	3.698	0.9488	0	None	No	0.002505	Param Intra 1 of 2
Calcium, total (mg/L)	AD-30	0.6804	n/a	n/a	1 future	n/a	13	0.604	0.1064	0	None	sqrt(x)	0.002505	Param Intra 1 of 2
pH, field (SU)	AD-12	5.754	2.427	n/a	1 future	n/a	12	4.091	0.7877	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-17	4.787	3.196	n/a	1 future	n/a	12	3.992	0.3766	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-18	5.917	3.511	n/a	1 future	n/a	8	4.714	0.4895	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-28	5.903	3.298	n/a	1 future	n/a	12	4.601	0.6168	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-3	5.917	4.395	n/a	1 future	n/a	12	5.156	0.3603	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-30	5.474	3.834	n/a	1 future	n/a	12	4.654	0.3882	0	None	No	0.001253	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-12	8.669	n/a	n/a	1 future	n/a	12	5.217	1.635	0	None	No	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-17	9.318	n/a	n/a	1 future	n/a	13	5.723	1.731	0	None	No	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-18	10.4	n/a	n/a	1 future	n/a	12	7.675	1.291	0	None	No	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-28	23.21	n/a	n/a	1 future	n/a	12	18.88	2.049	0	None	No	0.002505	Param Intra 1 of 2
Sulfate, total (mg/L)	AD-3	37.65	n/a	n/a	1 future	n/a	12	24.73	6.115	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-12	121.8	n/a	n/a	1 future	n/a	12	65.75	26.52	8.333	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-17	115.4	n/a	n/a	1 future	n/a	13	82.92	15.65	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-18	147.5	n/a	n/a	1 future	n/a	12	108.3	18.52	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-28	129.1	n/a	n/a	1 future	n/a	12	9479	3403	0	None	x^2	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-3	194.3	n/a	n/a	1 future	n/a	12	19577	8603	0	None	x^2	0.002505	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	AD-30	189	n/a	n/a	1 future	n/a	12	138.7	23.82	0	None	No	0.002505	Param Intra 1 of 2

Prediction Limit

Intrawell Parametric, AD-12 (bg)

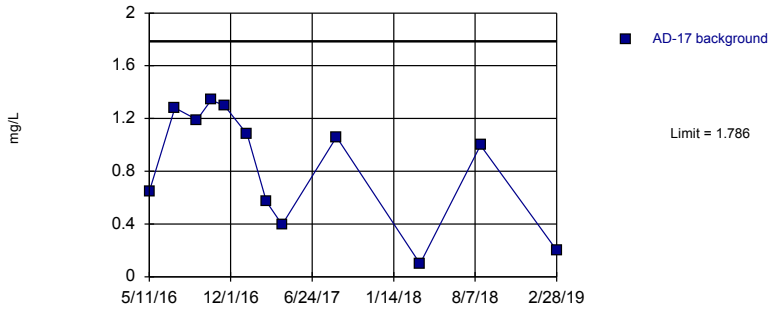


Background Data Summary: Mean=0.3223, Std. Dev.=0.05781, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9547, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-17

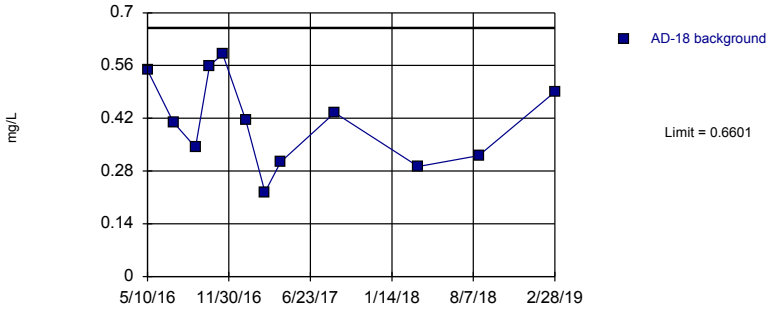


Background Data Summary: Mean=0.8465, Std. Dev.=0.4447, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8925, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-18 (bg)

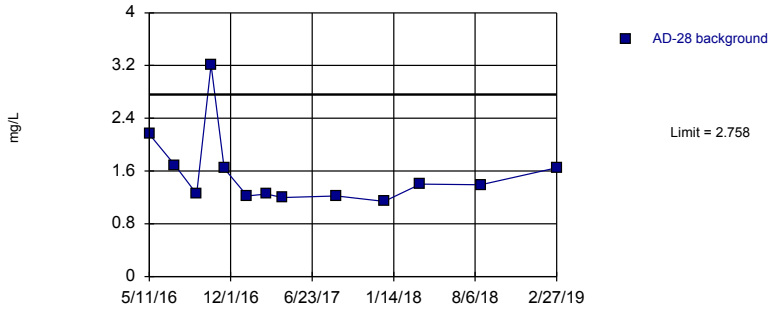


Background Data Summary: Mean=0.4109, Std. Dev.=0.118, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.954, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-28

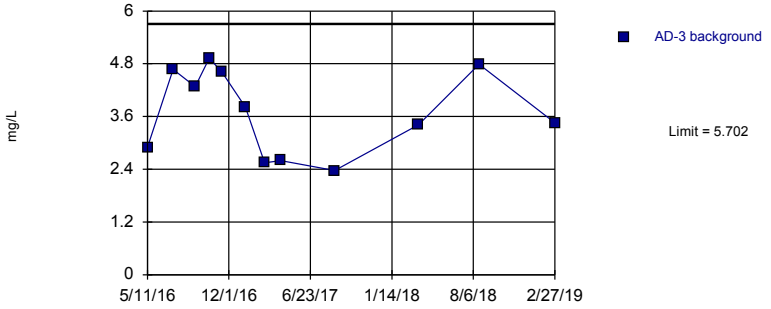


Background Data Summary (based on natural log transformation): Mean=0.4061, Std. Dev.=0.2931, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8147, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-3 (bg)

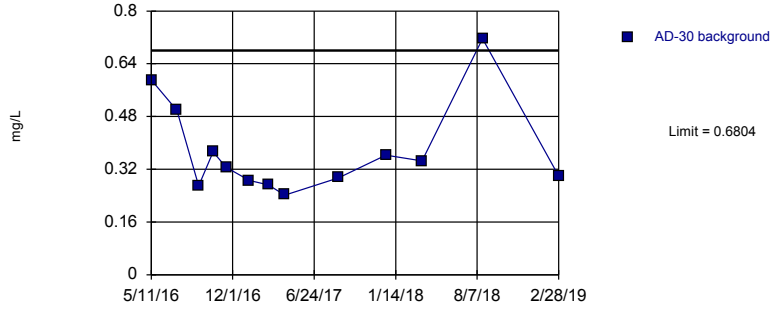


Background Data Summary: Mean=3.698, Std. Dev.=0.9488, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9055, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-30

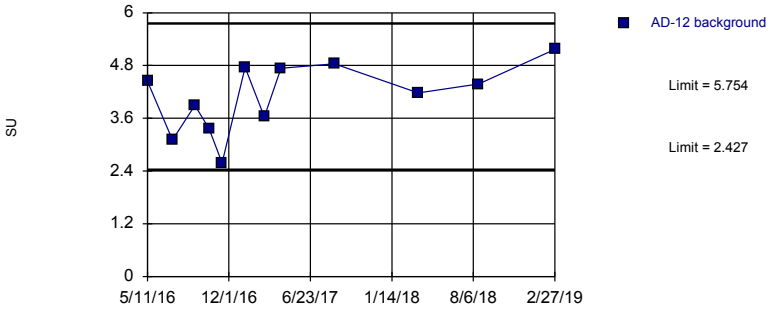


Background Data Summary (based on square root transformation): Mean=0.604, Std. Dev.=0.1064, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8451, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-12 (bg)

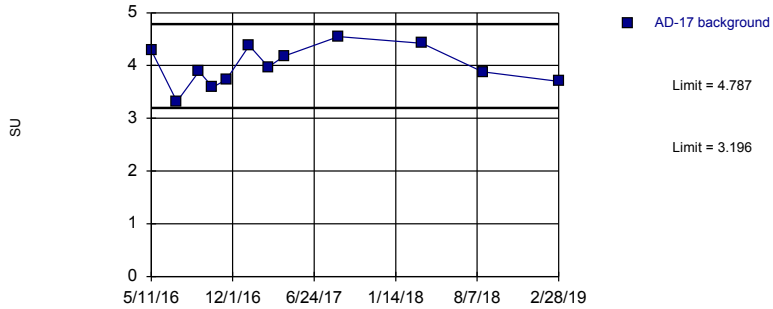


Background Data Summary: Mean=4.091, Std. Dev.=0.7877, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9544, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-17

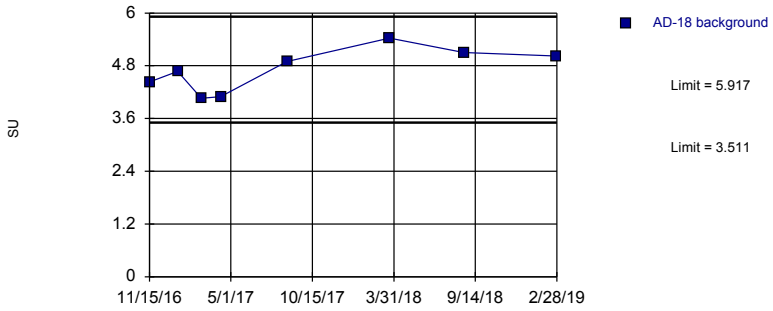


Background Data Summary: Mean=3.992, Std. Dev.=0.3766, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9666, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-18 (bg)

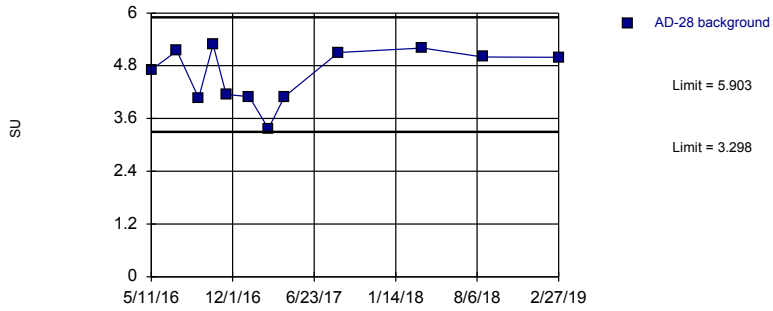


Background Data Summary: Mean=4.714, Std. Dev.=0.4895, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9485, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-28

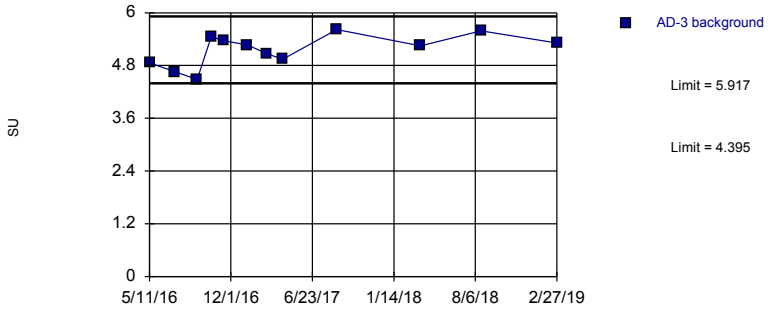


Background Data Summary: Mean=4.601, Std. Dev.=0.6168, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8727, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-3 (bg)

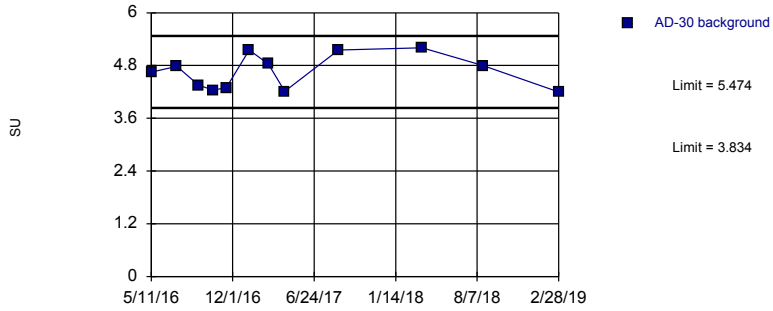


Background Data Summary: Mean=5.156, Std. Dev.=0.3603, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9481, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-30

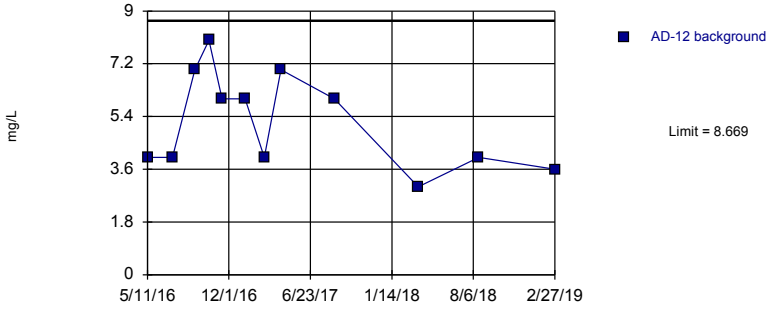


Background Data Summary: Mean=4.654, Std. Dev.=0.3882, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8754, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-12 (bg)

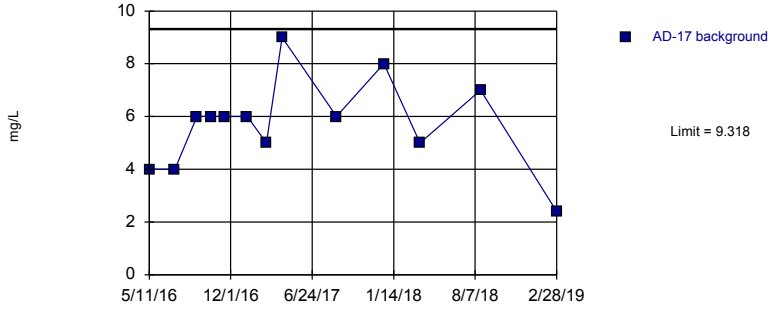


Background Data Summary: Mean=5.217, Std. Dev.=1.635, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8967, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-17

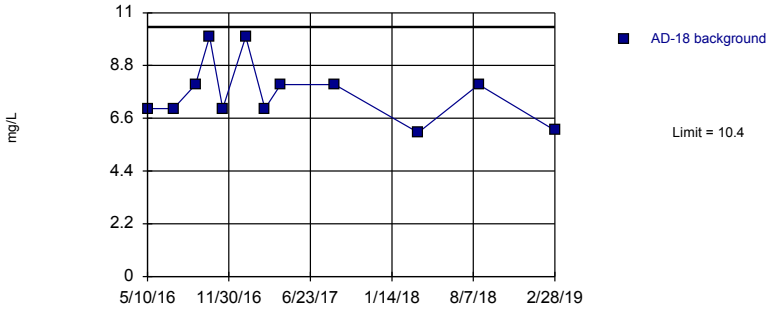


Background Data Summary: Mean=5.723, Std. Dev.=1.731, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9585, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-18 (bg)

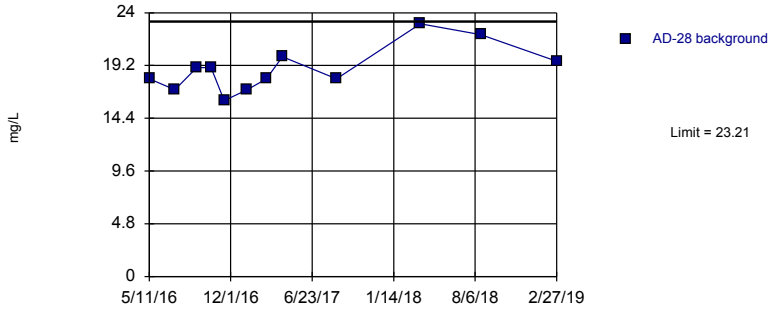


Background Data Summary: Mean=7.675, Std. Dev.=1.291, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8734, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-28

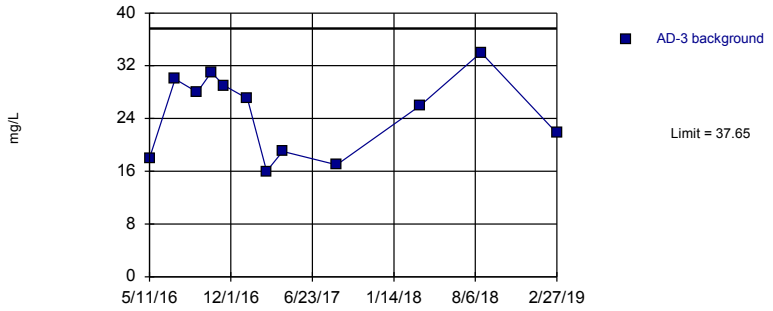


Background Data Summary: Mean=18.88, Std. Dev.=2.049, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9359, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-3 (bg)

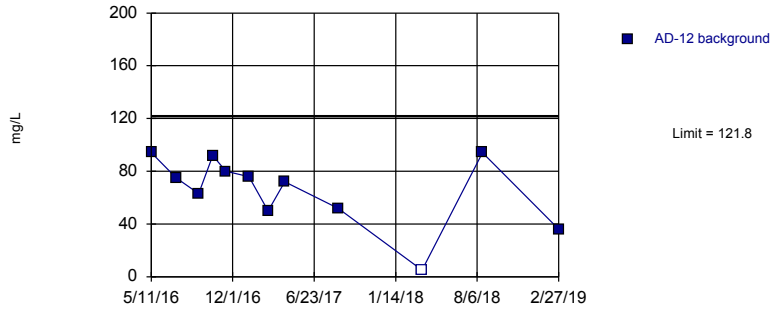


Background Data Summary: Mean=24.73, Std. Dev.=6.115, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9257, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-12 (bg)

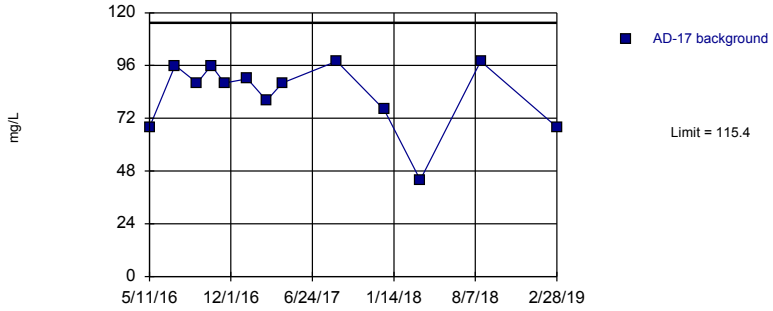


Background Data Summary: Mean=65.75, Std. Dev.=26.52, n=12, 8.333% NDs. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9032, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-17

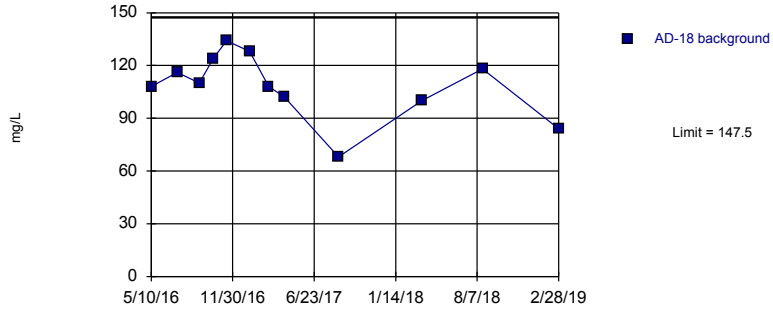


Background Data Summary: Mean=82.92, Std. Dev.=15.65, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8562, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-18 (bg)

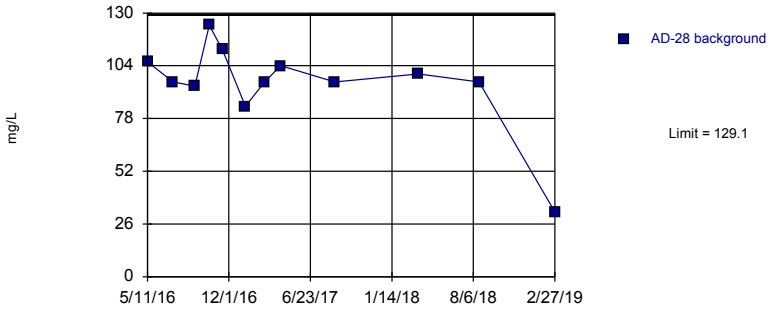


Background Data Summary: Mean=108.3, Std. Dev.=18.52, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9453, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Prediction Limit

Intrawell Parametric, AD-28



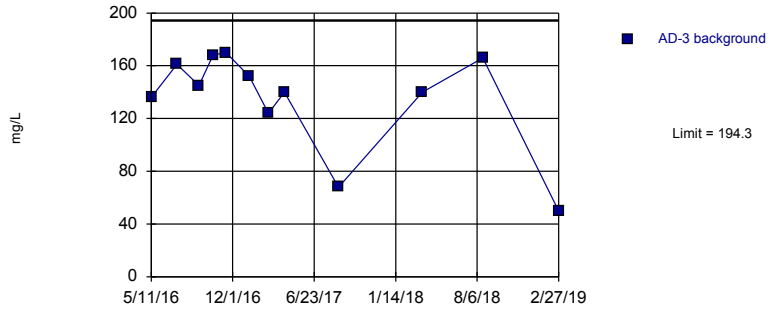
Background Data Summary (based on square transformation): Mean=9479, Std. Dev.=3403, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8775, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-3 (bg)



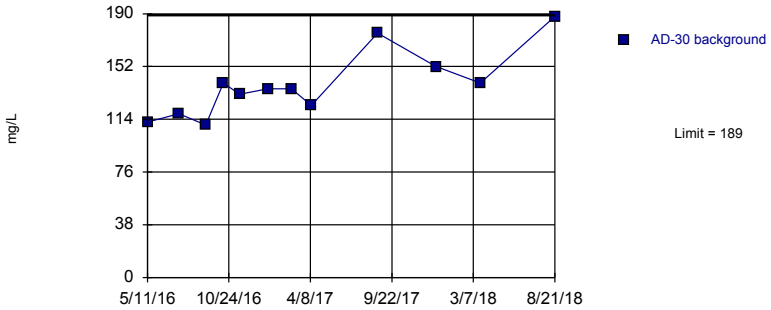
Background Data Summary (based on square transformation): Mean=19577, Std. Dev.=8603, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8758, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.24 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-30



Background Data Summary: Mean=138.7, Std. Dev.=23.82, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9068, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/9/2019 7:43 AM View: Intrawell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Interwell Prediction Limit Summary Table - All Results

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 12/9/2019, 7:47 AM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	n/a	0.07675	n/a	n/a	3 future	n/a	36	0.03686	0.02259	2.778	None	No	0.002505	Param Inter 1 of 2
Chloride, total (mg/L)	n/a	9.495	n/a	n/a	3 future	n/a	36	2.62	0.2615	0	None	sqrt(x)	0.002505	Param Inter 1 of 2
Fluoride, total (mg/L)	n/a	1	n/a	n/a	3 future	n/a	36	n/a	n/a	86.11	n/a	n/a	0.001409	NP Inter (NDs) 1 of 2

Trend Tests Summary Table - Upgradient Wells

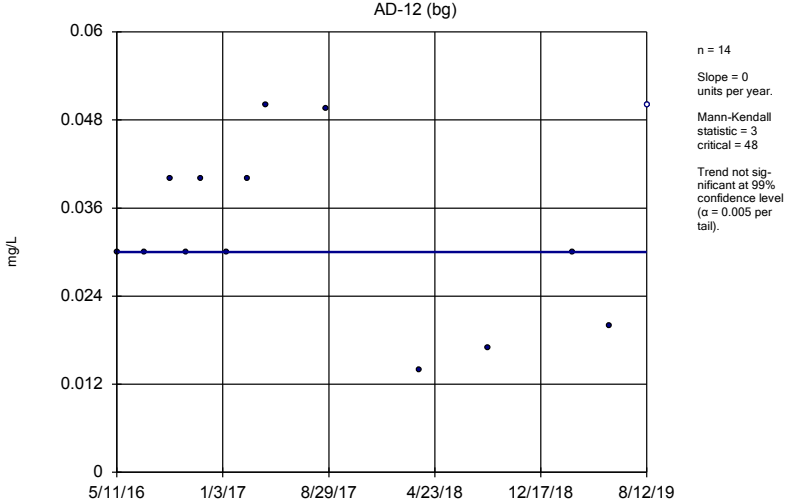
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 12/6/2019, 9:02 AM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	AD-12 (bg)	0	3	48	No	14	7.143	n/a	n/a	0.01	NP
Boron, total (mg/L)	AD-18 (bg)	0.001357	37	48	No	14	14.29	n/a	n/a	0.01	NP
Boron, total (mg/L)	AD-3 (bg)	-0.00212	-14	-48	No	14	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	AD-12 (bg)	0.1051	23	48	No	14	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	AD-18 (bg)	0.0768	18	48	No	14	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	AD-3 (bg)	0	-4	-48	No	14	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	AD-12 (bg)	-0.08118	-46	-48	No	14	64.29	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	AD-18 (bg)	0	-35	-48	No	14	78.57	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	AD-3 (bg)	0	-30	-48	No	14	78.57	n/a	n/a	0.01	NP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

AD-12 (bg)



n = 14

Slope = 0 units per year.

Mann-Kendall statistic = 3
critical = 48

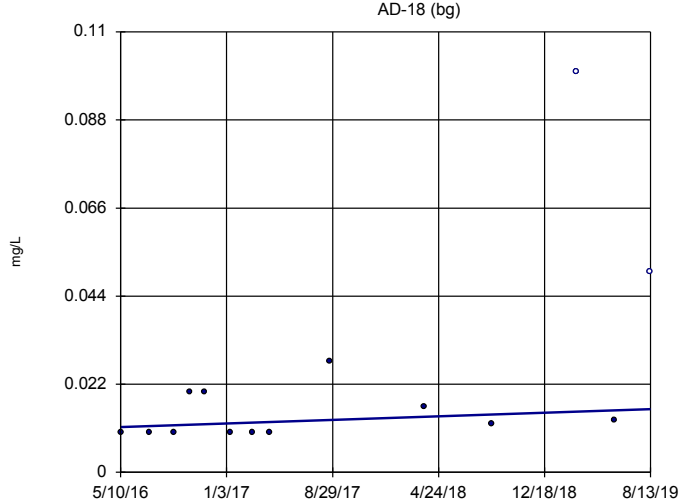
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 12/6/2019 9:01 AM View: Interwell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

AD-18 (bg)



n = 14

Slope = 0.001357 units per year.

Mann-Kendall statistic = 37
critical = 48

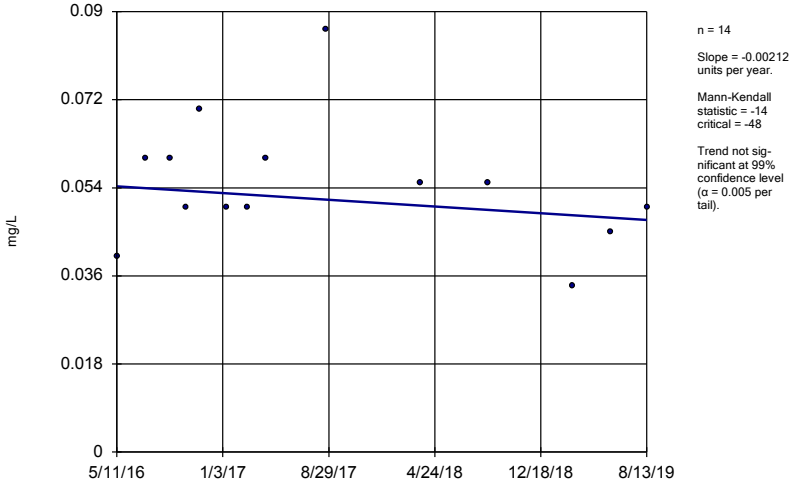
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 12/6/2019 9:01 AM View: Interwell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-3 (bg)



n = 14

Slope = -0.00212 units per year.

Mann-Kendall statistic = -14
critical = -48

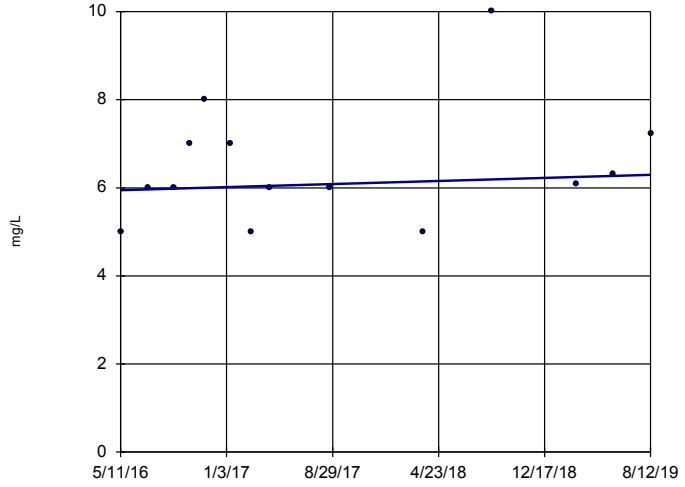
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 12/6/2019 9:01 AM View: Interwell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-12 (bg)



n = 14

Slope = 0.1051 units per year.

Mann-Kendall statistic = 23
critical = 48

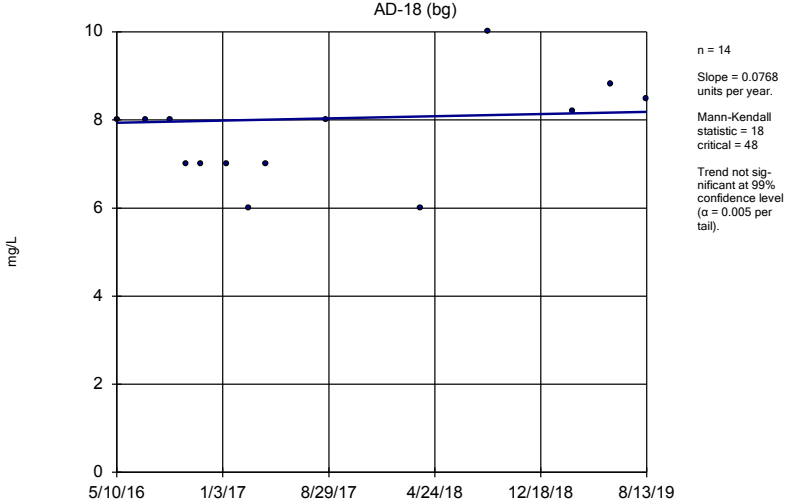
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 12/6/2019 9:01 AM View: Interwell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-18 (bg)



n = 14

Slope = 0.0768 units per year.

Mann-Kendall statistic = 18 critical = 48

Trend not significant at 99% confidence level (α = 0.005 per tail).

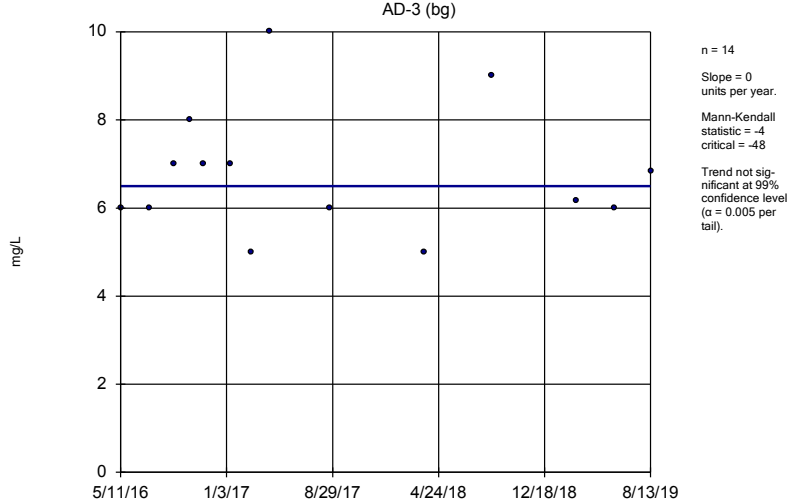
Constituent: Chloride, total Analysis Run 12/6/2019 9:02 AM View: Interwell

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Sen's Slope Estimator

AD-3 (bg)



n = 14

Slope = 0 units per year.

Mann-Kendall statistic = -4 critical = -48

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 12/6/2019 9:02 AM View: Interwell

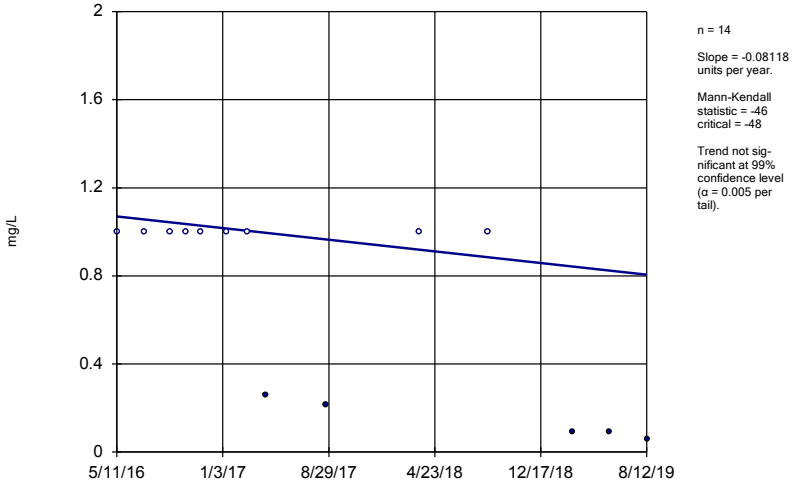
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Sen's Slope Estimator

AD-12 (bg)



n = 14

Slope = -0.08118 units per year.

Mann-Kendall statistic = -46 critical = -48

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 12/6/2019 9:02 AM View: Interwell

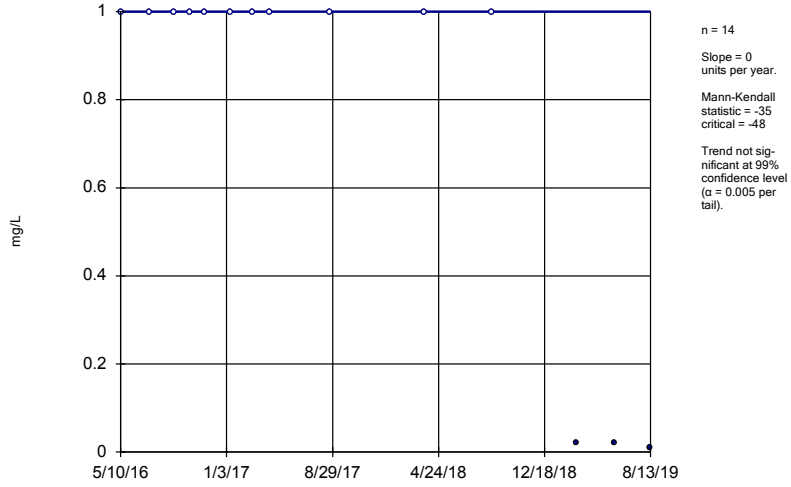
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Sen's Slope Estimator

AD-18 (bg)



n = 14

Slope = 0 units per year.

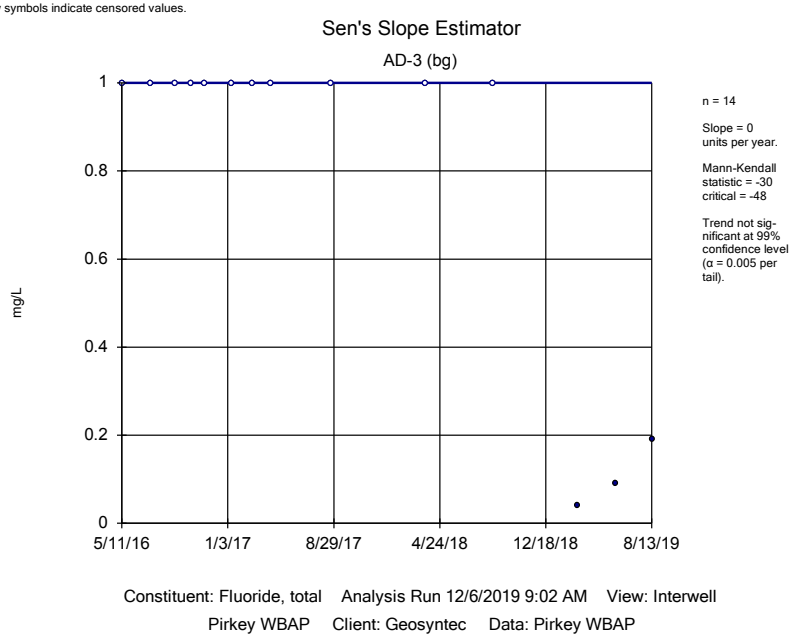
Mann-Kendall statistic = -35 critical = -48

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Fluoride, total Analysis Run 12/6/2019 9:02 AM View: Interwell

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Fluoride, total Analysis Run 12/6/2019 9:02 AM View: Interwell
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Upper Tolerance Limits - App IV

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 12/6/2019, 9:09 AM

Constituent	Upper Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	0.005	39	n/a	n/a	89.74	n/a	n/a	0.1353	NP Inter(NDs)
Arsenic, total (mg/L)	0.005	39	n/a	n/a	71.79	n/a	n/a	0.1353	NP Inter(normality)
Barium, total (mg/L)	0.157	39	n/a	n/a	0	n/a	n/a	0.1353	NP Inter(normality)
Beryllium, total (mg/L)	0.002	39	n/a	n/a	15.38	n/a	n/a	0.1353	NP Inter(normality)
Cadmium, total (mg/L)	0.001	39	n/a	n/a	76.92	n/a	n/a	0.1353	NP Inter(NDs)
Chromium, total (mg/L)	0.003171	39	-7.563	0.7605	17.95	Kaplan-Meier	ln(x)	0.01	Inter
Cobalt, total (mg/L)	0.009	39	n/a	n/a	0	n/a	n/a	0.1353	NP Inter(normality)
Combined Radium 226 + 228 (pCi/L)	3.305	39	0.9749	0.3544	0	None	sqrt(x)	0.01	Inter
Fluoride, total (mg/L)	1	42	n/a	n/a	73.81	n/a	n/a	0.116	NP Inter(normality)
Lead, total (mg/L)	0.005	39	n/a	n/a	79.49	n/a	n/a	0.1353	NP Inter(NDs)
Lithium, total (mg/L)	0.1378	38	0.2867	0.09613	2.632	None	x^(1/3)	0.01	Inter
Mercury, total (mg/L)	0.000064	39	n/a	n/a	51.28	n/a	n/a	0.1353	NP Inter(normality)
Molybdenum, total (mg/L)	0.005	34	n/a	n/a	82.35	n/a	n/a	0.1748	NP Inter(NDs)
Selenium, total (mg/L)	0.005	39	n/a	n/a	58.97	n/a	n/a	0.1353	NP Inter(normality)
Thallium, total (mg/L)	0.002	37	n/a	n/a	86.49	n/a	n/a	0.1499	NP Inter(NDs)

PIRKEY WBAP GWPS				
Constituent Name	**MCL**	**CCR-Rule Specified**	**Background Limit**	**GWPS**
Antimony, Total (mg/L)	0.006		0.005	0.006
Arsenic, Total (mg/L)	0.01		0.005	0.01
Barium, Total (mg/L)	2		0.16	2
Beryllium, Total (mg/L)	0.004		0.002	0.004
Cadmium, Total (mg/L)	0.005		0.001	0.005
Chromium, Total (mg/L)	0.1		0.0032	0.1
Cobalt, Total (mg/L)	n/a	0.006	0.009	0.009
Combined Radium, Total (pCi/L)	5		3.31	5
Fluoride, Total (mg/L)	4		1	4
Lead, Total (mg/L)	0.015		0.005	0.015
Lithium, Total (mg/L)	n/a	0.04	0.14	0.14
Mercury, Total (mg/L)	0.002		0.000064	0.002
Molybdenum, Total (mg/L)	n/a	0.1	0.005	0.1
Selenium, Total (mg/L)	0.05		0.005	0.05
Thallium, Total (mg/L)	0.002		0.002	0.002

**Grey cell indicates Background Limit is higher than MCL.*

**MCL = Maximum Contaminant Level*

**GWPS = Groundwater Protection Standard*

Confidence Intervals - Significant Results

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 12/6/2019, 9:13 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Cobalt, total (mg/L)	**AD-28**	**0.01583**	**0.0132**	**0.009**	**Yes**	**13**	**0.01452**	**0.001766**	**0**	**None**	**No**	**0.01**	**Param.**

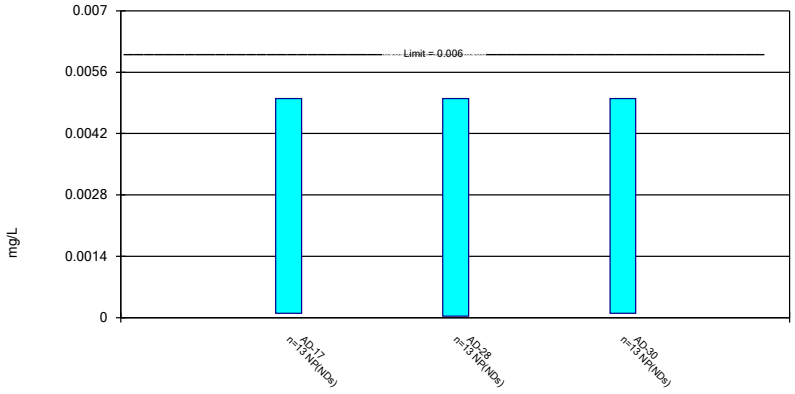
Confidence Intervals - All Results

Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP Printed 12/6/2019, 9:13 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	AD-17	0.005	0.0001	0.006	No	13	0.003778	0.001989	92.31	None	No	0.01	NP (NDs)
Antimony, total (mg/L)	AD-28	0.005	0.00003	0.006	No	13	0.003511	0.002047	76.92	None	No	0.01	NP (NDs)
Antimony, total (mg/L)	AD-30	0.005	0.0001	0.006	No	13	0.003224	0.002078	76.92	None	No	0.01	NP (NDs)
Arsenic, total (mg/L)	AD-17	0.005	0.00041	0.01	No	13	0.003008	0.00198	61.54	None	No	0.01	NP (normality)
Arsenic, total (mg/L)	AD-28	0.006	0.001409	0.01	No	13	0.003209	0.001969	53.85	None	No	0.01	NP (normality)
Arsenic, total (mg/L)	AD-30	0.005	0.0006	0.01	No	13	0.003501	0.002029	69.23	None	No	0.01	NP (normality)
Barium, total (mg/L)	AD-17	0.2749	0.1338	2	No	13	0.2043	0.09487	0	None	No	0.01	Param.
Barium, total (mg/L)	AD-28	0.1761	0.1408	2	No	13	0.1588	0.0243	0	None	sqrt(x)	0.01	Param.
Barium, total (mg/L)	AD-30	0.058	0.05105	2	No	13	0.05452	0.004672	0	None	No	0.01	Param.
Beryllium, total (mg/L)	AD-17	0.000948	0.0004991	0.004	No	13	0.0008342	0.0005407	15.38	None	No	0.01	NP (normality)
Beryllium, total (mg/L)	AD-28	0.0007879	0.000509	0.004	No	13	0.0006484	0.0001876	0	None	No	0.01	Param.
Beryllium, total (mg/L)	AD-30	0.0001554	0.0000604	0.004	No	13	0.0003823	0.0007188	15.38	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	AD-17	0.001	0.0000833	0.005	No	13	0.0007115	0.0004505	69.23	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	AD-28	0.001	0.00005	0.005	No	13	0.0008531	0.0003586	84.62	None	No	0.01	NP (NDs)
Cadmium, total (mg/L)	AD-30	0.001	0.00005	0.005	No	13	0.0008538	0.0003568	92.31	None	No	0.01	NP (NDs)
Chromium, total (mg/L)	AD-17	0.00177	0.0005093	0.1	No	13	0.001382	0.001464	7.692	None	ln(x)	0.01	Param.
Chromium, total (mg/L)	AD-28	0.004	0.000416	0.1	No	13	0.001663	0.00179	30.77	None	No	0.01	NP (Cohens/xfrm)
Chromium, total (mg/L)	AD-30	0.001742	0.0005665	0.1	No	13	0.001242	0.001068	7.692	None	x^(1/3)	0.01	Param.
Cobalt, total (mg/L)	AD-17	0.01198	0.005801	0.009	No	13	0.008891	0.004155	0	None	No	0.01	Param.
Cobalt, total (mg/L)	**AD-28**	**0.01583**	**0.0132**	**0.009**	**Yes**	**13**	**0.01452**	**0.001766**	**0**	**None**	**No**	**0.01**	**Param.**
Cobalt, total (mg/L)	AD-30	0.002535	0.001801	0.009	No	13	0.002168	0.0004933	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	AD-17	6.109	2.015	5	No	13	4.062	2.753	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	AD-28	2.585	1.706	5	No	13	2.145	0.5906	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	AD-30	2.349	0.6237	5	No	13	1.579	1.37	0	None	sqrt(x)	0.01	Param.
Fluoride, total (mg/L)	AD-17	1	0.24	4	No	15	0.6982	0.3883	60	None	No	0.01	NP (normality)
Fluoride, total (mg/L)	AD-28	0.8025	0.5437	4	No	14	0.6731	0.1827	7.143	None	No	0.01	Param.
Fluoride, total (mg/L)	AD-30	1	0.2	4	No	15	0.818	0.3785	86.67	None	No	0.01	NP (NDs)
Lead, total (mg/L)	AD-17	0.005	0.0002	0.015	No	13	0.003799	0.001947	84.62	None	No	0.01	NP (NDs)
Lead, total (mg/L)	AD-28	0.005	0.000266	0.015	No	13	0.003797	0.00195	84.62	None	No	0.01	NP (NDs)
Lead, total (mg/L)	AD-30	0.005	0.0002	0.015	No	13	0.003789	0.001966	84.62	None	No	0.01	NP (NDs)
Lithium, total (mg/L)	AD-17	0.02464	0.01211	0.14	No	13	0.01837	0.008427	7.692	None	No	0.01	Param.
Lithium, total (mg/L)	AD-28	0.03356	0.02389	0.14	No	12	0.02797	0.008512	0	None	x^2	0.01	Param.
Lithium, total (mg/L)	AD-30	0.009892	0.007132	0.14	No	13	0.008284	0.002493	7.692	None	x^2	0.01	Param.
Mercury, total (mg/L)	AD-17	0.0001652	0.00006705	0.002	No	13	0.0001288	0.000106	0	None	ln(x)	0.01	Param.
Mercury, total (mg/L)	AD-28	0.00008396	0.00003015	0.002	No	13	0.00006323	0.00004673	0	None	ln(x)	0.01	Param.
Mercury, total (mg/L)	AD-30	0.001162	0.0002761	0.002	No	13	0.0007703	0.0007062	0	None	sqrt(x)	0.01	Param.
Molybdenum, total (mg/L)	AD-17	0.005	0.0004858	0.1	No	11	0.003864	0.002	81.82	None	No	0.006	NP (NDs)
Molybdenum, total (mg/L)	AD-28	0.005	0.0002942	0.1	No	11	0.003849	0.002027	81.82	None	No	0.006	NP (NDs)
Molybdenum, total (mg/L)	AD-30	0.005	0.001142	0.1	No	11	0.00394	0.001859	81.82	None	No	0.006	NP (NDs)
Selenium, total (mg/L)	AD-17	0.005	0.0005	0.05	No	13	0.00395	0.001732	76.92	None	No	0.01	NP (NDs)
Selenium, total (mg/L)	AD-28	0.005	0.0003	0.05	No	13	0.003816	0.001917	76.92	None	No	0.01	NP (NDs)
Selenium, total (mg/L)	AD-30	0.005	0.0004	0.05	No	13	0.003831	0.001889	76.92	None	No	0.01	NP (NDs)
Thallium, total (mg/L)	AD-17	0.002	0.0005	0.002	No	12	0.001511	0.0007555	83.33	None	No	0.01	NP (NDs)
Thallium, total (mg/L)	AD-28	0.002	0.0005	0.002	No	12	0.001523	0.0007519	83.33	None	No	0.01	NP (NDs)
Thallium, total (mg/L)	AD-30	0.002	0.0005	0.002	No	12	0.00145	0.0007383	75	None	No	0.01	NP (normality)

Non-Parametric Confidence Interval

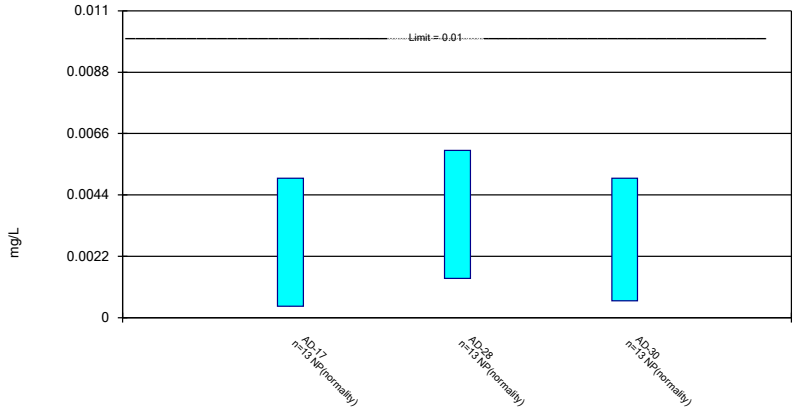
Compliance Limit is not exceeded. Per-well alpha = 0.01.



Constituent: Antimony, total Analysis Run 12/6/2019 9:10 AM View: Appendix IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Non-Parametric Confidence Interval

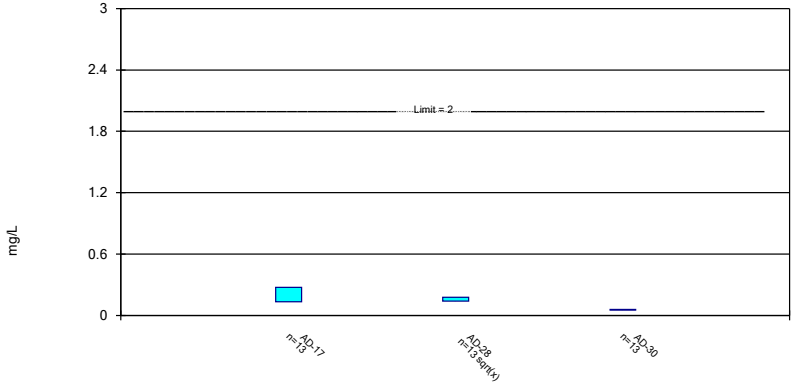
Compliance Limit is not exceeded. Per-well alpha = 0.01.



Constituent: Arsenic, total Analysis Run 12/6/2019 9:10 AM View: Appendix IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Parametric Confidence Interval

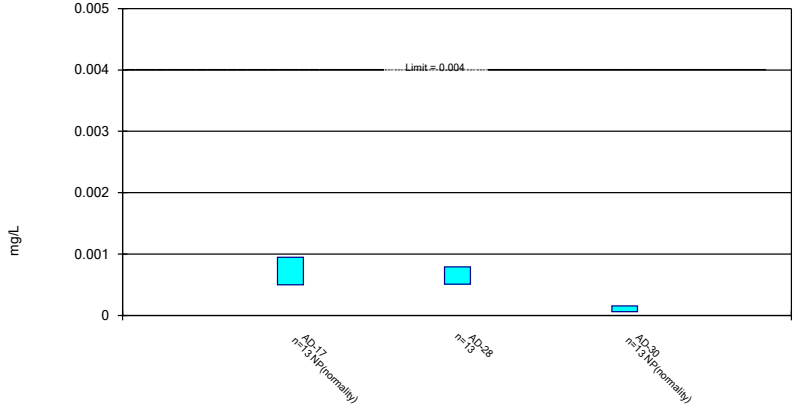
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Barium, total Analysis Run 12/6/2019 9:10 AM View: Appendix IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Parametric and Non-Parametric (NP) Confidence Interval

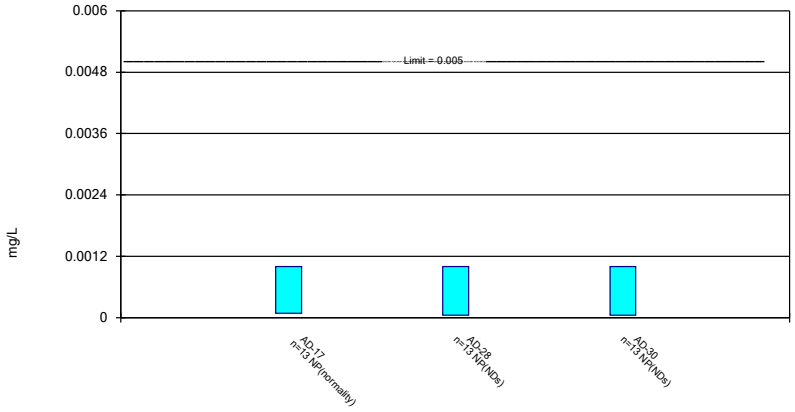
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Beryllium, total Analysis Run 12/6/2019 9:10 AM View: Appendix IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Non-Parametric Confidence Interval

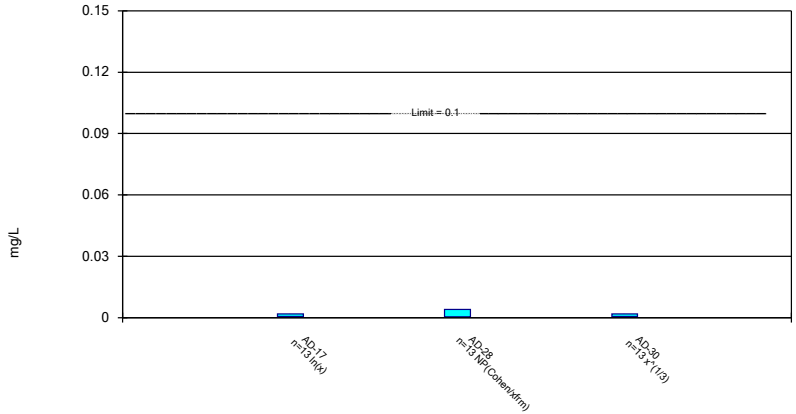
Compliance Limit is not exceeded. Per-well alpha = 0.01.



Constituent: Cadmium, total Analysis Run 12/6/2019 9:10 AM View: Appendix IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Parametric and Non-Parametric (NP) Confidence Interval

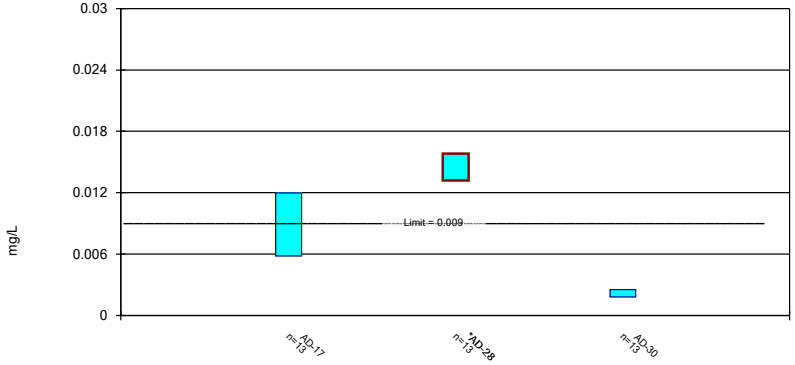
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Chromium, total Analysis Run 12/6/2019 9:10 AM View: Appendix IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Parametric Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Cobalt, total Analysis Run 12/6/2019 9:10 AM View: Appendix IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Parametric Confidence Interval

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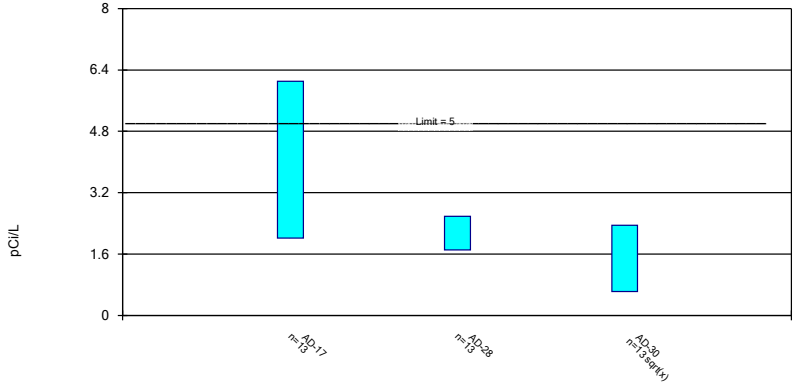
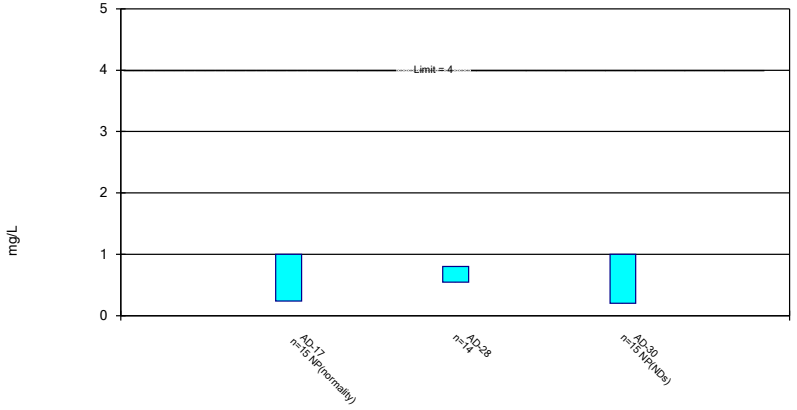


Constituent: Combined Radium 226 + 228 Analysis Run 12/6/2019 9:10 AM View: Appendix IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Parametric and Non-Parametric (NP) Confidence Interval

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



Constituent: Fluoride, total Analysis Run 12/6/2019 9:10 AM View: Appendix IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Non-Parametric Confidence Interval

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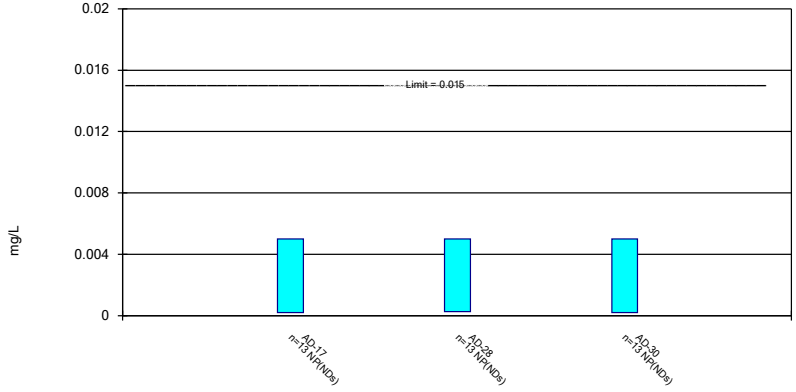
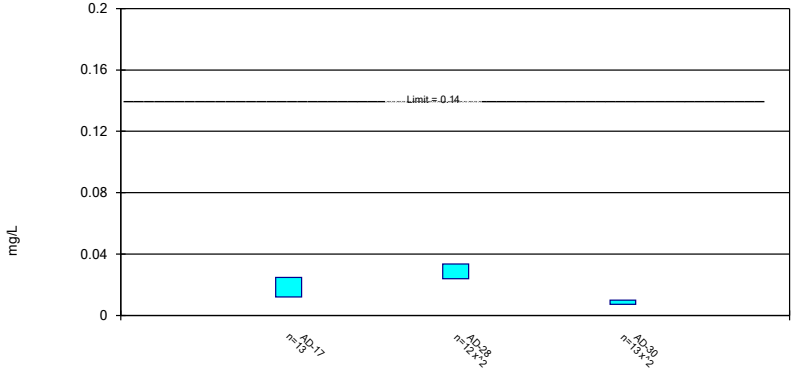


Constituent: Lead, total Analysis Run 12/6/2019 9:10 AM View: Appendix IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Parametric Confidence Interval

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



Constituent: Lithium, total Analysis Run 12/6/2019 9:10 AM View: Appendix IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Parametric Confidence Interval

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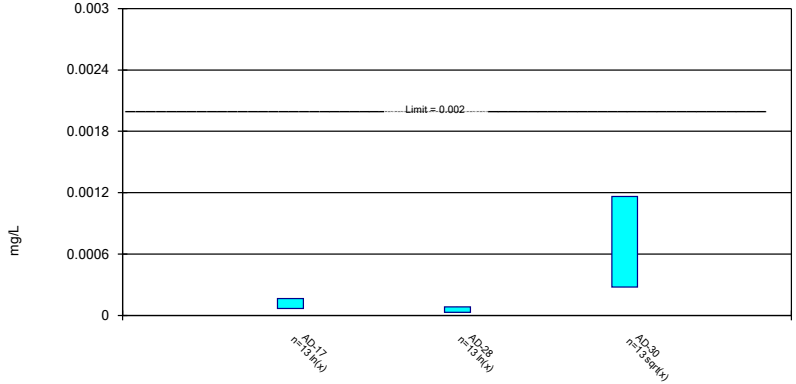
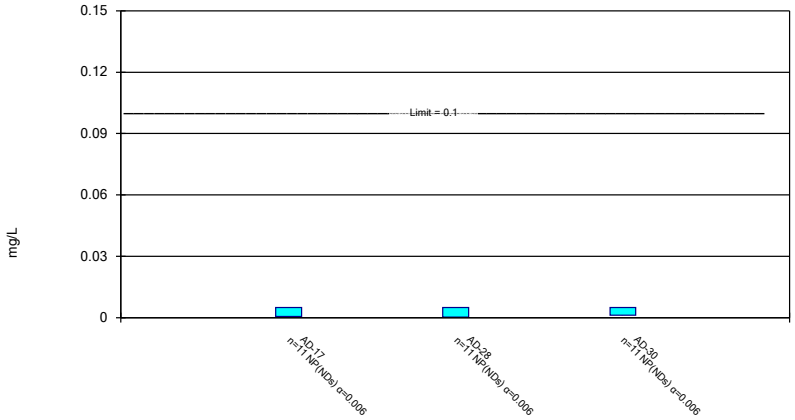


Constituent: Mercury, total Analysis Run 12/6/2019 9:10 AM View: Appendix IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Non-Parametric Confidence Interval

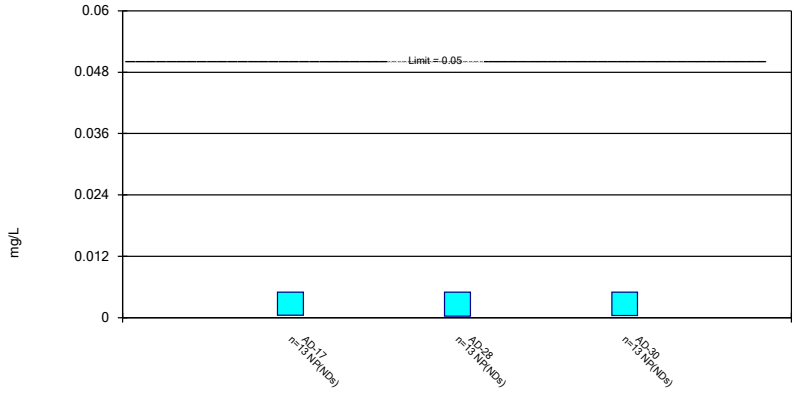
Compliance Limit is not exceeded.



Constituent: Molybdenum, total Analysis Run 12/6/2019 9:10 AM View: Appendix IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Non-Parametric Confidence Interval

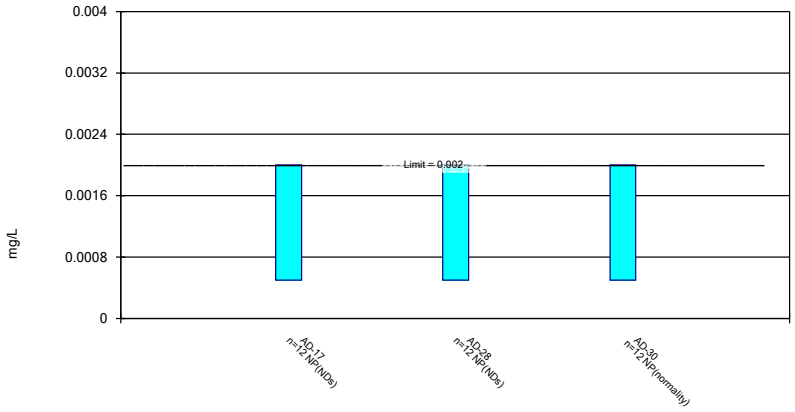
Compliance Limit is not exceeded. Per-well alpha = 0.01.



Constituent: Selenium, total Analysis Run 12/6/2019 9:10 AM View: Appendix IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.



Constituent: Thallium, total Analysis Run 12/6/2019 9:10 AM View: Appendix IV
Pirkey WBAP Client: Geosyntec Data: Pirkey WBAP

APPENDIX III

Alternate source demonstrations are included in this appendix. Alternate sources are sources or reasons that explain that statistically significant increases over background or statistically significant levels above the groundwater protection standard are not attributable to the CCR unit.

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

H.W. Pirkey Power Plant
West Bottom Ash Pond
Hallsville, Texas

Submitted to

AMERICAN ELECTRIC POWER

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
Suite 103
Columbus, OH 43221

March 26, 2019

CHA8462

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FIGURES

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ATTACHMENTS

LIST OF ACRONYMS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EPRI	Electric Power Research Institute
GSC	Groundwater Stats Consulting, LLC
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
MCL	Maximum Contaminant Level
QA	Quality Assurance
QC	Quality Control
RSL	Regional Screening Level
SPLP	Synthetic Precipitation Leaching Procedure
SSL	Statistically Significant Level
UTL	Upper Tolerance Limit
USEPA	United States Environmental Protection Agency
WBAP	West Bottom Ash Pond

SECTION 1

INTRODUCTION AND SUMMARY

The H.W. Pirkey Plant, located in Hallsville, Texas, has four regulated coal combustion residuals (CCR) storage units, including the West Bottom Ash Pond (WBAP, Figure 1). In 2018, two assessment monitoring events were conducted at the WBAP in accordance with 40 CFR 257.95. The monitoring data were submitted to Groundwater Stats Consulting, LLC (GSC) for statistical analysis. Groundwater protection standards (GWPSs) were established for each Appendix IV parameter in accordance with the statistical analysis plan developed for the facility (AEP, 2017) and United States Environmental Protection Agency's (USEPA) *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance* (Unified Guidance; USEPA, 2009). The GWPS for each parameter was established as the greater of the background concentration and the maximum contaminant level (MCL) or regional screening level (RSL). To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events.

Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at a statistically significant level (SSL) above the GWPSs. An SSL was concluded if the lower confidence limit (LCL) of a parameter exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). An SSL was identified for cobalt at AD-28 at the WBAP where the LCL of 0.0131 mg/L was above the calculated GWPS of 0.009 mg/L (Geosyntec, 2018). No other SSLs were identified.

1.1 CCR Rule Requirements

United States Environmental Protection Agency (USEPA) regulations regarding assessment monitoring programs for coal combustion residuals (CCR) landfills and surface impoundments provide owners and operators with the option to make an alternative source demonstration when an SSL is identified (40 CFR 257.95(g)(3)(ii)). An owner or operator may:

> *Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Any such demonstration must be supported by a report that includes the factual or evidentiary basis for any conclusions and must be certified to be accurate by a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority. If a successful demonstration is made, the owner or operator must continue monitoring in accordance with the assessment monitoring program pursuant to this section….*

Pursuant to 40 CFR 257.95(g)(3)(ii), Geosyntec Consultants, Inc. (Geosyntec) has prepared this Alternative Source Demonstration (ASD) report to document that the SSL identified for cobalt at AD-28 should not be attributed to the WBAP.

1.2 Demonstration of Alternative Sources

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

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

A demonstration was conducted to show that the SSL identified for cobalt at AD-28 was based on a Type IV cause and not by a release from the Pirkey WBAP.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

The Federal CCR Rule allows the owner or operator 90 days from the determination of an SSL to demonstrate that a source other than the CCR unit caused the SSL. The methodology used to evaluate the SSL identified for cobalt and the proposed alternative source are described below.

2.1 Proposed Alternative Source

Initial review of site geochemistry, site historical data, and laboratory QA/QC data did not identify ASDs due to Type I (sampling), Type II (laboratory), or Type III (statistical evaluation) issues. As described below, the SSL has been attributed to natural variation associated with the underlying geology, which is a Type IV issue.

The onsite hydrostratigraphic unit for the WBAP was identified as the clayey and silty sand stratum located between an elevation of approximately 325 and 340 feet above mean sea level (Arcadis, 2016). This unit is within the Reklaw Formation, which consists predominantly of clay and fine-grained sand and is underlain by the Eocene-age Carrizo Sand. The presence of lignite in the area is well-documented (Broom and Myers, 1966; ETTL, 2010). The Sabine Mining Company operates a lignite surface mining operation immediately to the southwest of the site which supplies lignite to the Pirkey Plant.

Soil samples collected across the site identified cobalt in the aquifer material at varying concentrations (Table 1), including locations near the WBAP. The highest reported cobalt concentration of 15 milligrams per kilogram (mg/kg) was collected at AD-30, which is located south of the WBAP and approximately 600 feet northeast of AD-28 (Figure 2). Additionally, mineralogic samples collected from these locations identified the presence of pyrite (cubic FeS_2) and marcasite (orthorhombic FeS_2) at concentrations up to 3% of the total composition of the material (Table 1). Cobalt is known to substitute for iron in crystalline iron minerals such as pyrite and marcasite due to their similar ionic radii (Krupka and Serne, 2002; Hitzman et al., 2019). While not detected in the mineralogical analyses, the presence of limonite (FeO(OH)) in the Reklaw formation has been noted (Brooms and Myers, 1966). In addition to iron sulfides, cobalt can also substitute in iron oxides such as limonite (Hitzman et al., 2019). While soil analytical and mineralogical data are not available for AD-28, the wide distribution of cobalt and iron sulfides across the site suggests that naturally occurring cobalt may be present in the aquifer media near AD-28.

Naturally occurring cobalt in the aquifer media is proposed as the alternate source for cobalt concentrations in the groundwater which exceed the GWPS at AD-28. Further investigation shows that a release from the WBAP itself does not appear to be a source for cobalt. Analysis of the bottom ash sluiced to the WBAP had a reported cobalt concentration of 5.8 mg/kg (Attachment A). When Synthetic Precipitation Leaching Procedure (SPLP) analysis (SW-864 Test Method 1312, [USEPA, 1994]) was conducted on the ash sample to evaluate cobalt mobility under

simulated conditions, cobalt was not detected above the reporting limit of 0.01 milligrams per liter (mg/L) in the leachate sample (Attachment A). Cobalt was also not detected above the reporting limit of 0.005 mg/L in a grab sample of the pond water (Attachment B). The reporting limit for both the SPLP and pond water analyses are both over an order of magnitude lower than the average concentration of cobalt observed at AD-28 during the background and assessment monitoring period. The analytical sample results are summarized in Table 2.

Because cobalt mobility is affected by pH, the SPLP test results are likely even more conservative than actual pond conditions, as SPLP is run at a pH of 5 SU, whereas the operational pH of the pond varies between approximately 5.8 and 7.0 SU. According to a recent study, cobalt mobility increases under more acidic conditions, although even at a pH of approximately 5, only 2% of cobalt in fly ash is mobile (Izquierdo and Querol, 2012).

The pond was not identified as the source of cobalt at AD-28 based on the documented low mobility of cobalt under the pond conditions. This is further supported by the lack of detected cobalt in the SPLP and pond water analyses. Instead, the widespread distribution of cobalt within the aquifer material is proposed as the alternate source. This cobalt could be present as substitutions within iron-containing minerals such as pyrite, marcasite, or limonite, all of which are observed across the site.

2.2 Sampling Requirements

As the ASD described above supports the position that the identified SSL is not due to a release from the Pirkey WBAP, the unit will remain in the assessment monitoring program. Groundwater at the unit will continue to be sampled for Appendix IV parameters on a semi-annual basis.

SECTION 3

CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.95(g)(3)(ii) and supports the position that the SSL of cobalt for AD-28 identified during assessment monitoring in 2018 was not due to a release from the WBAP. The identified SSL was, instead, attributed to natural variation in the underlying geology. Therefore, no further action is warranted, and the Pirkey WBAP will remain in the assessment monitoring program. Certification of this ASD by a qualified professional engineer is provided in Attachment C.

SECTION 4

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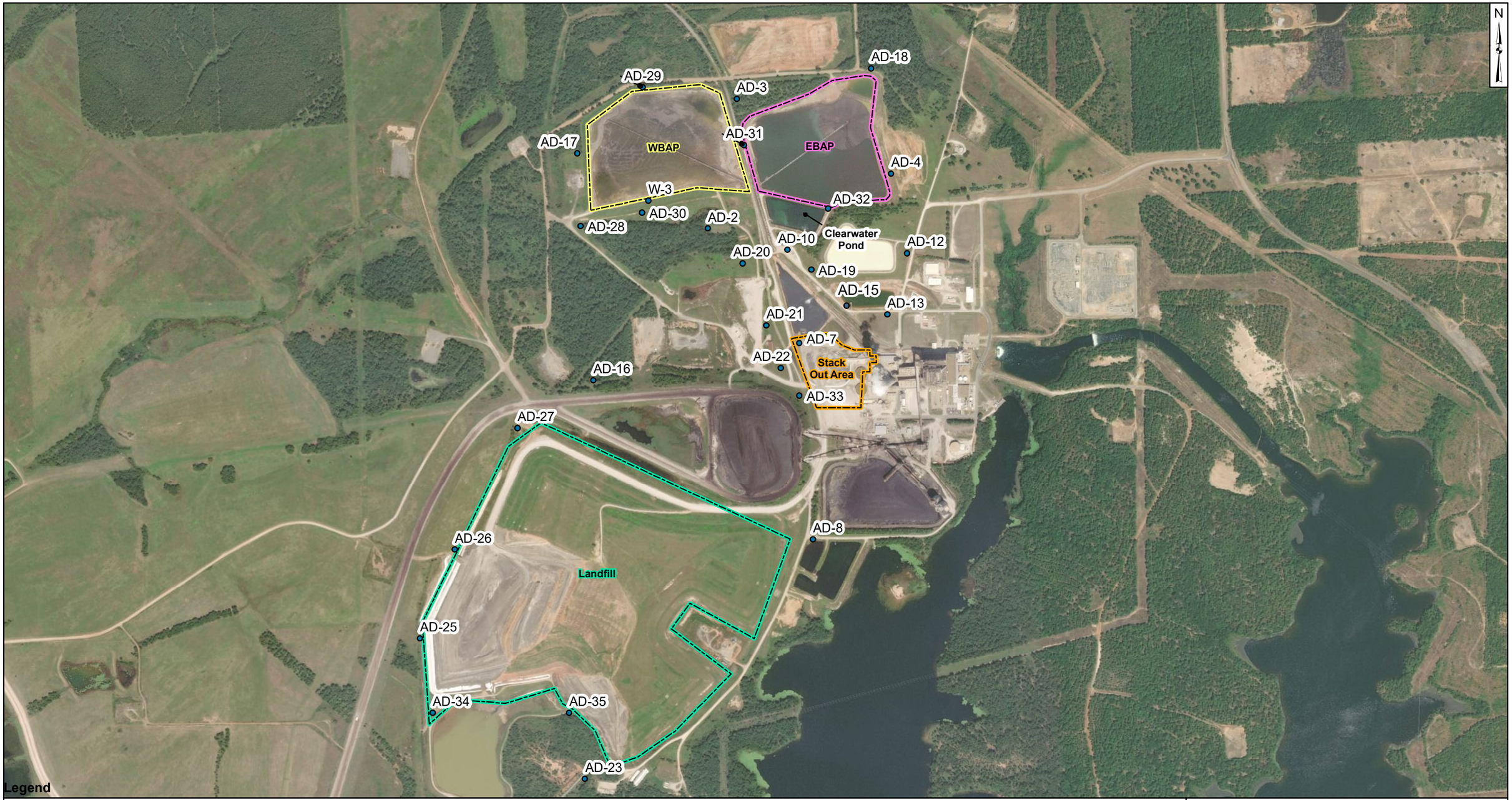
USEPA, 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. EPA 530/R-09/007. March.

FIGURES



Legend

- AD-15
- Monitoring Wells

Location Boundaries

CCR Units

- EBAP
- Landfill
- Stack Out Area
- WBAP

Notes

- Monitoring well coordinates provided by AEP.
- Data provided by AEP, 2019
- AD-15 location is approximate.

0 380 760 1,520 2,280 3,040 Feet

Site Layout

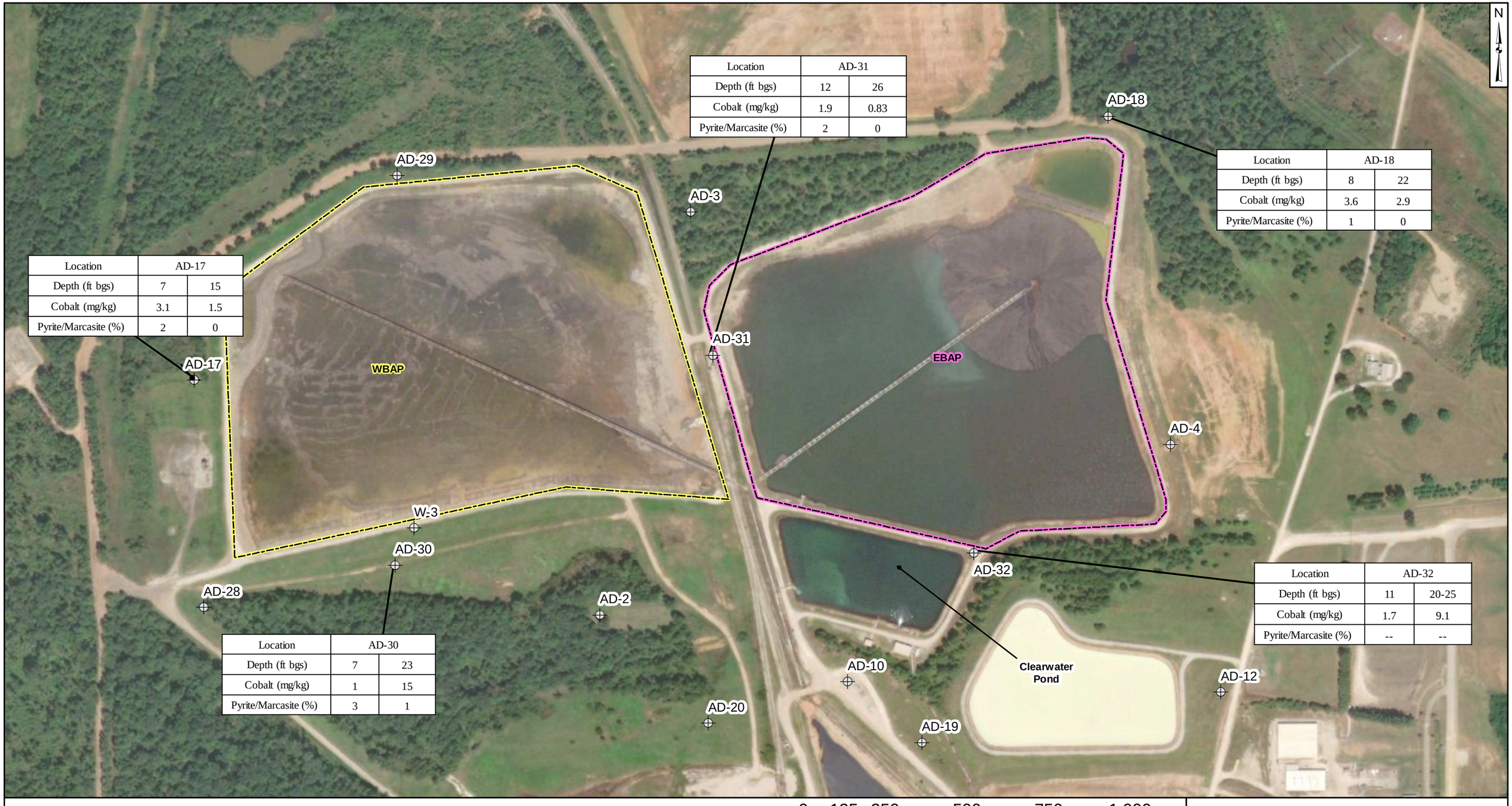
AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2019/03/25

Figure **1**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Pirkey\Site_Layout_20190322.mxd. HDuff. 3/25/2019. Project/Phase/Task.



Location	AD-31	
Depth (ft bgs)	12	26
Cobalt (mg/kg)	1.9	0.83
Pyrite/Marcasite (%)	2	0

Location	AD-18	
Depth (ft bgs)	8	22
Cobalt (mg/kg)	3.6	2.9
Pyrite/Marcasite (%)	1	0

Location	AD-17	
Depth (ft bgs)	7	15
Cobalt (mg/kg)	3.1	1.5
Pyrite/Marcasite (%)	2	0

Location	AD-32	
Depth (ft bgs)	11	20-25
Cobalt (mg/kg)	1.7	9.1
Pyrite/Marcasite (%)	--	--

Location	AD-30	
Depth (ft bgs)	7	23
Cobalt (mg/kg)	1	15
Pyrite/Marcasite (%)	3	1

Legend

Monitoring Wells

Notes
- Monitoring well coordinates provided by AEP.
- Data provided by AEP, 2019
- ft bgs: feet below ground surface
- mg/kg: milligrams per kilogram

0 125 250 500 750 1,000 Feet

Soil Chemical and Mineralogical Analysis Results

AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2019/03/25

Figure 2

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Pirkey\Pirkey_SoilChem_minerals_March2019.mxd. SKaroly. 3/25/2019. Project/Phase/Task.

TABLES

Table 1: Soil Cobalt and Mineralogy Data
West Bottom Ash Pond - H.W. Pirkey Plant

Location ID	Sample Depth (ft bgs)	Cobalt (mg/kg)	Pyrite/Marcasite (%)
AD-15	13	0.85	--
	40-43	0.79	--
AD-16	10	0.17	0
	19	0.44	1
AD-17	7	3.10	2
	15	1.50	0
AD-18	8	3.60	1
	22	2.90	0
AD-30	7	1.00	3
	23	15.0	1
AD-31	12	1.90	2
	26	0.83	0
AD-32	11	1.70	--
	20-25	9.10	--
AD-33	11	0.61	1
	21	0.64	--
AD-34	6	1.10	1
	24	6.50	2
AD-35	2	2.10	2
	17	0.18	0

Notes:
'--' - analysis not completed
mg/kg- milligram per kilogram
ft bgs - feet below ground surface

Samples were collected from additional boreholes advanced in the immediate area of the location identified by the well ID. Samples were not collected from the cuttings of the borings advanced for well installation.

Table 2: Summary of Key Analytical Data
West Bottom Ash Pond - H.W. Pirkey Plant

Sample	Unit	Cobalt Concentration
Bottom Ash	mg/kg	5.8
SPLP Leachate	mg/L	<0.01
WBAP Pond Water	mg/L	<0.005
AD-28 - Average	mg/L	0.0148

Notes:
mg/kg - milligram per kilogram
mg/L - milligram per liter
AD-28 - Average value was calculated using all cobalt data collected under 40 CFR 257 Subpart D.

ATTACHMENT A
Bottom Ash and Bottom Ash SPLP
Laboratory Analytical Data

Client Sample ID: CCR SAMPLE-WBAP-1

Date Collected: 02/11/19 16:40
Date Received: 02/13/19 09:40

Lab Sample ID: 490-168389-1

Matrix: Solid
Percent Solids: 75.9

Method: 9056 - Anions, Ion Chromatography - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	1.3	U	1.3	1.0	mg/Kg	☼		02/14/19 00:30	1

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	11	U	11	1.1	mg/Kg	☼	02/13/19 16:11	02/16/19 23:06	1
Arsenic	**2.2**		2.2	1.3	mg/Kg	☼	02/13/19 16:11	02/16/19 23:06	1
Barium	**250**		2.2	1.1	mg/Kg	☼	02/13/19 16:11	02/16/19 23:06	1
Beryllium	**0.25**	**J**	1.1	0.22	mg/Kg	☼	02/13/19 16:11	02/16/19 23:06	1
Boron	**93**		11	4.8	mg/Kg	☼	02/13/19 16:11	02/18/19 22:40	1
Cadmium	1.1	U	1.1	0.11	mg/Kg	☼	02/13/19 16:11	02/16/19 23:06	1
Chromium	**12**		1.1	1.0	mg/Kg	☼	02/13/19 16:11	02/16/19 23:06	1
Cobalt	**5.8**		2.2	1.1	mg/Kg	☼	02/13/19 16:11	02/16/19 23:06	1
Lead	**1.2**	**F1**	1.1	0.56	mg/Kg	☼	02/13/19 16:11	02/19/19 18:53	1
Lithium	**4.2**	**J**	11	1.1	mg/Kg	☼	02/13/19 16:11	02/16/19 23:06	1
Molybdenum	11	U	11	5.6	mg/Kg	☼	02/13/19 16:11	02/16/19 23:06	1
Selenium	2.2	U	2.2	1.2	mg/Kg	☼	02/13/19 16:11	02/19/19 18:53	1
Thallium	2.2	U	2.2	0.67	mg/Kg	☼	02/13/19 16:11	02/16/19 23:06	1

Method: 7471B - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.13	U	0.13	0.039	mg/Kg	☼	02/14/19 10:07	02/14/19 13:12	1

Client Sample Results

Client: Burns & McDonnell
Project/Site: CCR App III & IV GW Monitoring - Texas

TestAmerica Job ID: 490-168389-1
SDG: AEP-Pirkey Plant

Client Sample ID: CCR SAMPLE-WBAP-1

Date Collected: 02/11/19 16:40
Date Received: 02/13/19 09:40

Lab Sample ID: 490-168389-1

Matrix: Solid

Method: 9056 - Anions, Ion Chromatography - SPLP West

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	**0.035**	**J B**	0.10	0.010	mg/L			02/19/19 23:08	1

Method: 6010C - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	0.010	U	0.010	0.0050	mg/L		02/19/19 16:41	02/20/19 13:32	1
Arsenic	0.010	U	0.010	0.0086	mg/L		02/19/19 16:41	02/20/19 13:32	1
Barium	**0.11**		0.010	0.0050	mg/L		02/19/19 16:41	02/20/19 13:32	1
Beryllium	0.0040	U	0.0040	0.0020	mg/L		02/19/19 16:41	02/20/19 13:32	1
Boron	**0.15**		0.050	0.020	mg/L		02/19/19 16:41	02/20/19 13:32	1
Cadmium	0.0010	U	0.0010	0.00050	mg/L		02/19/19 16:41	02/20/19 13:32	1
Chromium	0.0050	U	0.0050	0.0030	mg/L		02/19/19 16:41	02/20/19 13:32	1
Cobalt	0.010	U	0.010	0.0050	mg/L		02/19/19 16:41	02/20/19 13:32	1
Lead	0.0050	U	0.0050	0.0020	mg/L		02/19/19 16:41	02/20/19 13:32	1
Lithium	**0.016**	**J B ***	0.050	0.010	mg/L		02/19/19 16:41	02/20/19 13:32	1
Molybdenum	0.050	U	0.050	0.030	mg/L		02/19/19 16:41	02/20/19 13:32	1
Selenium	**0.0052**	**J**	0.010	0.0050	mg/L		02/19/19 16:41	02/20/19 13:32	1
Thallium	0.010	U	0.010	0.0050	mg/L		02/19/19 16:41	02/20/19 13:32	1

Method: 7470A - Mercury (CVAA) - SPLP West

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.00020	U	0.00020	0.00010	mg/L		02/19/19 16:03	02/21/19 15:39	1

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**75.9**		0.1	0.1	%			02/17/19 12:25	1

ATTACHMENT B

Bottom Ash Pond Water Laboratory Analytical Data

Client Sample ID: SW-WBAP-1

Date Collected: 12/15/18 14:15
Date Received: 12/18/18 10:30

Lab Sample ID: 490-165222-5

Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	**0.88**	**J**	1.0	0.010	mg/L			12/20/18 19:29	1
Sulfate	**1400**		1000	6.0	mg/L			12/30/18 09:25	200
Chloride	**61**	**B**	15	1.0	mg/L			12/30/18 09:08	5

Method: 6020A - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	0.0030	U	0.0030	0.00080	mg/L		12/19/18 14:26	12/27/18 15:30	1
Arsenic	**0.0030**	**J**	0.0050	0.00040	mg/L		12/28/18 12:47	01/03/19 11:39	1
Barium	0.20	U	0.20	0.00010	mg/L		12/19/18 14:26	12/27/18 15:30	1
Beryllium	**0.00029**	**J**	0.0040	0.00010	mg/L		12/19/18 14:26	12/26/18 22:24	1
Boron	**7.3**	**J ***	10	0.35	mg/L		12/28/18 12:47	01/03/19 11:48	10
Cadmium	0.0050	U	0.0050	0.00010	mg/L		12/19/18 14:26	12/27/18 15:30	1
Calcium	**220**		1.0	0.053	mg/L		12/19/18 14:26	12/26/18 22:24	1
Chromium	0.0050	U	0.0050	0.00050	mg/L		12/19/18 14:26	12/27/18 15:30	1
Cobalt	0.0050	U	0.0050	0.00010	mg/L		12/19/18 14:26	12/27/18 15:30	1
Lead	**0.00077**	**J**	0.0050	0.00010	mg/L		12/19/18 14:26	12/21/18 21:37	1
Lithium	**0.053**		0.040	0.0030	mg/L		12/19/18 14:26	12/21/18 21:37	1
Molybdenum	**0.0047**	**J**	0.010	0.0010	mg/L		12/19/18 14:26	12/26/18 22:24	1
Selenium	**0.015**		0.010	0.00030	mg/L		12/19/18 14:26	12/26/18 22:24	1
Thallium	0.0020	U	0.0020	0.00080	mg/L		12/19/18 14:26	12/21/18 21:37	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.00020	U	0.00020	0.00010	mg/L		12/20/18 12:26	12/21/18 12:20	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	**2000**		50	14	mg/L			12/19/18 23:00	1

ATTACHMENT C
Certification by Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected and above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Pirkey West Bottom Ash Pond CCR management area and that the requirements of 40 CFR 257.95(g)(3)(ii) have been met.

Beth Ann Gross
Printed Name of Licensed Professional Engineer

Beth Ann Gross
Signature

Geosyntec Consultants
8217 Shoal Creek Blvd., Suite 200
Austin, TX 78757

Texas Registered Engineering Firm
No. F-1182

79864	Texas	3/26/2019
License Number	Licensing State	Date

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

H.W. Pirkey Power Plant
West Bottom Ash Pond
Hallsville, Texas

Submitted to

AMERICAN ELECTRIC POWER

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
Suite 103
Columbus, OH 43221

September 23, 2019

CHA8462

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LIST OF ACRONYMS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EDS	Energy Dispersive Spectroscopic Analyzer
EPRI	Electric Power Research Institute
GSC	Groundwater Stats Consulting, LLC
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
MCL	Maximum Contaminant Level
QA	Quality Assurance
QC	Quality Control
SEM	Scanning Electron Microscopy
SPLP	Synthetic Precipitation Leaching Procedure
SSL	Statistically Significant Level
UTL	Upper Tolerance Limit
USEPA	United States Environmental Protection Agency
VAP	Vertical Aquifer Profiling
WBAP	West Bottom Ash Pond
XRD	X-Ray Diffraction

SECTION 1

INTRODUCTION AND SUMMARY

The H.W. Pirkey Plant, located in Hallsville, Texas, has four regulated coal combustion residuals (CCR) storage units, including the West Bottom Ash Pond (WBAP, Figure 1). In February 2019, a semi-annual assessment monitoring event was conducted at the WBAP in accordance with 40 CFR 257.95(d)(1). The monitoring data were submitted to Groundwater Stats Consulting, LLC (GSC) for statistical analysis. Groundwater protection standards (GWPSs) were previously established for each Appendix IV parameter in accordance with the statistical analysis plan developed for the facility (AEP, 2017) and United States Environmental Protection Agency's (USEPA) *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance* (Unified Guidance; USEPA, 2009). The GWPS for each parameter was established as the greater of the background concentration and the maximum contaminant level (MCL) or risk-based level specified in 40 CFR 257.95(h)(2). To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events.

Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at a statistically significant level (SSL) above the GWPSs. An SSL was concluded if the lower confidence limit (LCL) of a parameter exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). At the WBAP, an SSL was identified for cobalt at AD-28, where the LCL of 0.0132 milligrams per liter (mg/L) was above the calculated GWPS of 0.009 mg/L (Geosyntec, 2019a). No other SSLs were identified.

1.1 CCR Rule Requirements

United States Environmental Protection Agency (USEPA) regulations regarding assessment monitoring programs for coal combustion residuals (CCR) landfills and surface impoundments provide owners and operators with the option to make an alternative source demonstration when an SSL is identified (40 CFR 257.95(g)(3)(ii)). An owner or operator may:

> *Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Any such demonstration must be supported by a report that includes the factual or evidentiary basis for any conclusions and must be certified to be accurate by a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority. If a successful demonstration is made, the owner or operator must continue monitoring in accordance with the assessment monitoring program pursuant to this section….*

Pursuant to 40 CFR 257.95(g)(3)(ii), Geosyntec Consultants, Inc. (Geosyntec) has prepared this Alternative Source Demonstration (ASD) report to document that the SSL identified for cobalt at AD-28 should not be attributed to the WBAP.

1.2 Demonstration of Alternative Sources

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

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

A demonstration was conducted to show that the SSL identified for cobalt at AD-28 was based on a Type IV cause and not by a release from the Pirkey WBAP.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

The Federal CCR Rule allows the owner or operator 90 days from the determination of an SSL to demonstrate that a source other than the CCR unit caused the SSL. The methodology used to evaluate the SSL identified for cobalt and the proposed alternative source are described below.

2.1 Proposed Alternative Source

An initial review of site geochemistry, site historical data, and laboratory quality assurance/quality control (QA/QC) data did not identify ASDs due to Type I (sampling), Type II (laboratory), or Type III (statistical evaluation) issues. As described below, the SSL has been attributed to natural variation associated with the underlying geology, which is a Type IV issue.

AD-28 is located at the southwest corner of the pond, as shown in Figure 1. In a previous ASD for cobalt at the WBAP, evidence was provided to show that cobalt is present in the aquifer media at the site and that the observed cobalt concentrations were due to natural variation (Geosyntec, 2019b). The previous ASD discussed how the WBAP itself did not appear to be a source for cobalt in downgradient groundwater, based on observed concentrations of cobalt both in the ash material and in leachate from Synthetic Precipitation Leaching Procedure (SPLP) analysis (SW-864 Test Method 1312, [USEPA, 1994]) of the ash material. Cobalt was not detected in the SPLP leachate above the reporting limit of 0.01 mg/L. Because cobalt mobility is affected by pH, the SPLP test results are likely even more conservative than actual pond conditions. SPLP is run at a pH of 5 SU, whereas the operational pH of the pond varies between approximately 5.8 and 7.0 SU. Cobalt mobility increases under more acidic conditions, although even at a pH of approximately 5, only 2% of cobalt in fly ash is mobile (Izquierdo and Querol, 2012).

Cobalt was also not detected above the reporting limit of 0.005 mg/L in a grab sample of the pond water. As shown in Table 1, the reporting limits for the SPLP ash leachate test and pond water analysis are both below the average concentration of cobalt observed at AD-28 during the background and assessment monitoring periods (0.0147 mg/L). Since the previous ASD was prepared, there have been no notable changes in coal handling or sourcing at the plant that would have affected the composition of the ash or pond water.

Since completion of the prior ASD, four additional permanent wells (B-2, B-3, AD-40, and AD-41) have been installed upgradient of the WBAP. The most recent data available for select wells in the vicinity of the WBAP, including the new upgradient locations, are shown in Figure 2. Groundwater cobalt concentrations at upgradient locations vary from 0.0008 mg/L to 0.0345 mg/L at AD-40 and B-3, respectively. This wide range in cobalt concentrations provides further evidence for the natural variation of cobalt at the Site, particularly as the concentrations at B-3 exceed both the GWPS for the WBAP and the LCL calculated for cobalt at AD-28 (the well of interest).

As noted in the prior ASD, soil samples collected across the site, including from locations near the WBAP, identified cobalt in the aquifer solids at varying concentrations. Since completion of the prior ASD, additional soil samples have been collected from locations upgradient of the WBAP. Select soil sample data from the previous ASD and recently collected data are summarized in Table 2. Cobalt was identified in the aquifer solids at varying concentrations, with the highest value of 24 milligrams per kilogram (mg/kg) reported at AD-41, which is upgradient of the EBAP (Figure 3). Other testing included collection of aquifer solids to evaluate for the presence of cobalt-containing minerals. X-ray diffraction evidence identified pyrite and marcasite (both iron sulfides) at select locations at concentrations up to 3% by weight (Table 2). Cobalt is known to substitute for iron in crystalline iron minerals such as pyrite and marcasite due to their similar ionic radii (Krupka and Serne, 2002; Hitzman et al., 2019).

Groundwater samples were collected from upgradient location B-3 via vertical aquifer profiling (VAP), as described in an ASD previously generated for the EBAP (Geosyntec, 2019c). The VAP groundwater samples were centrifuged to separate solid and liquid phases, and the solid material was submitted for analysis of total metals and mineralogy by X-ray diffraction (XRD). The samples were also submitted for analysis of chemical composition and mineralogy by scanning electron microscopy (SEM) using an energy dispersive spectroscopic analyzer (EDS). Following installation of permanent monitoring wells at B-2 and B-3, groundwater samples were collected by purging groundwater through the filter pack using a submersible pump. An additional groundwater sample was collected at AD-30. These permanent well groundwater samples were filtered through a 1.5-micron filter, and the solid material retained on the filter was submitted for analysis of total metals and by SEM/EDS.

Based on total metals analysis, cobalt was identified both in the centrifuged solid material collected from upgradient location B-3 [VAP-B3-(40-45)] and in the material retained on the filter after processing groundwater from B-2 and B-3 (Table 2). Cobalt was detected in the AD-30 solid material at estimated value of 9.3 mg/kg, which is comparable to the concentration observed in bulk soil collected at the same location at the screened interval (15 mg/kg). These results provide further evidence that cobalt concentrations reported during groundwater sampling are naturally occurring and associated with the solid phase in the aquifer.

According to XRD results of the centrifuged solid sample [VAP-B3-(40-45)], pyrite was present as approximately 3% of the solid phase, with hematite (an iron(III) oxide) present at 2% (Table 3). Logging completed while the VAP boring was advanced identified coal at several intervals, including 45 and 48 ft bgs (Figure 4). Furthermore, SEM/EDS of both centrifuged solid samples [VAP-B3-(40-45) and VAP-B3-(50-55)] identified pyrite in backscattered electron micrographs by the distinctive framboid pattern (Harris, 1981; Sawlowicz, 2000). Major peaks involving iron and sulfur were identified in the EDS spectrum, which further support the identification of pyrite (Attachment A). While cobalt was not identified in the EDS spectrum, it is likely present at concentrations below the detection limit. Pyrite was also identified during SEM/EDS analysis of lignite which is mined immediately adjacent to the site.

While soil analytical and mineralogical data are not available for AD-28, the wide distribution of pyrite across the site suggests that naturally occurring cobalt, which may substitute for iron in pyrite, may also be present in the aquifer solids near AD-28. The presence of lignite in the area is well-documented, including at upgradient and downgradient locations relative to the WBAP (Broom and Myers, 1966; ETTL, 2010). Additionally, the pond was not identified as the source of cobalt at AD-28 in the previous ASD based on the documented low mobility of cobalt under the pond conditions and lack of detectable cobalt in the pond itself.

2.2 Sampling Requirements

As the ASD presented above supports the position that the identified SSL is not due to a release from the Pirkey WBAP, the unit will remain in the assessment monitoring program. Groundwater at the unit will continue to be sampled for Appendix IV parameters on a semi-annual basis.

SECTION 3

CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.95(g)(3)(ii) and supports the position that the SSL of cobalt for AD-28 identified during assessment monitoring in . February 2019 was not due to a release from the WBAP. The identified SSL was, instead, attributed to natural variation in the underlying geology, including the presence of pyrite in the solid aquifer material. Therefore, no further action is warranted, and the Pirkey WBAP will remain in the assessment monitoring program. Certification of this ASD by a qualified professional engineer is provided in Attachment B.

SECTION 4

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TABLES

Table 1: Summary of Key Analytical Data
West Bottom Ash Pond - H.W. Pirkey Plant

Sample	Unit	Cobalt Concentration
Bottom Ash	mg/kg	5.8
SPLP Leachate	mg/L	<0.01
WBAP Pond Water	mg/L	<0.005
AD-28 - Average	mg/L	0.0147

Notes:
mg/kg - milligram per kilogram
mg/L - milligram per liter
AD-28 - Average value was calculated using all cobalt data collected under 40 CFR 257 Subpart D.

Table 2: Soil Cobalt and Mineralogy Data
West Bottom Ash Pond - H.W. Pirkey Plant

Geosyntec Consultants, Inc.

Location ID	Sample Depth (ft bgs)	Cobalt (mg/kg)	Pyrite/Marcasite (%)
Bulk Soil Samples			
AD-17	7	3.10	2
	15	1.50	0
AD-18	8	3.60	1
	22	2.90	0
AD-30	7	1.00	3
	23	15.0	1
AD-31	12	1.90	2
	26	0.83	0
AD-32	11	1.70	--
	20-25	9.10	--
AD-41	15	< 1.0	--
	35	23.5	---
	95	1.90	---
B-2	10	2.36	---
	16	3.62	---
	71	10.30	---
	82	7.21	---
	87	3.11	---
B-3	10	1.30	---
	20	0.59	---
	97	1.11	---
Solid Material Retained After Filtration			
AD-30	15-25	9.3 J	--
B-2	38-48	4.3 J	--
B-3	29-34	12.0	--
	VAP 40-45	18.0	3

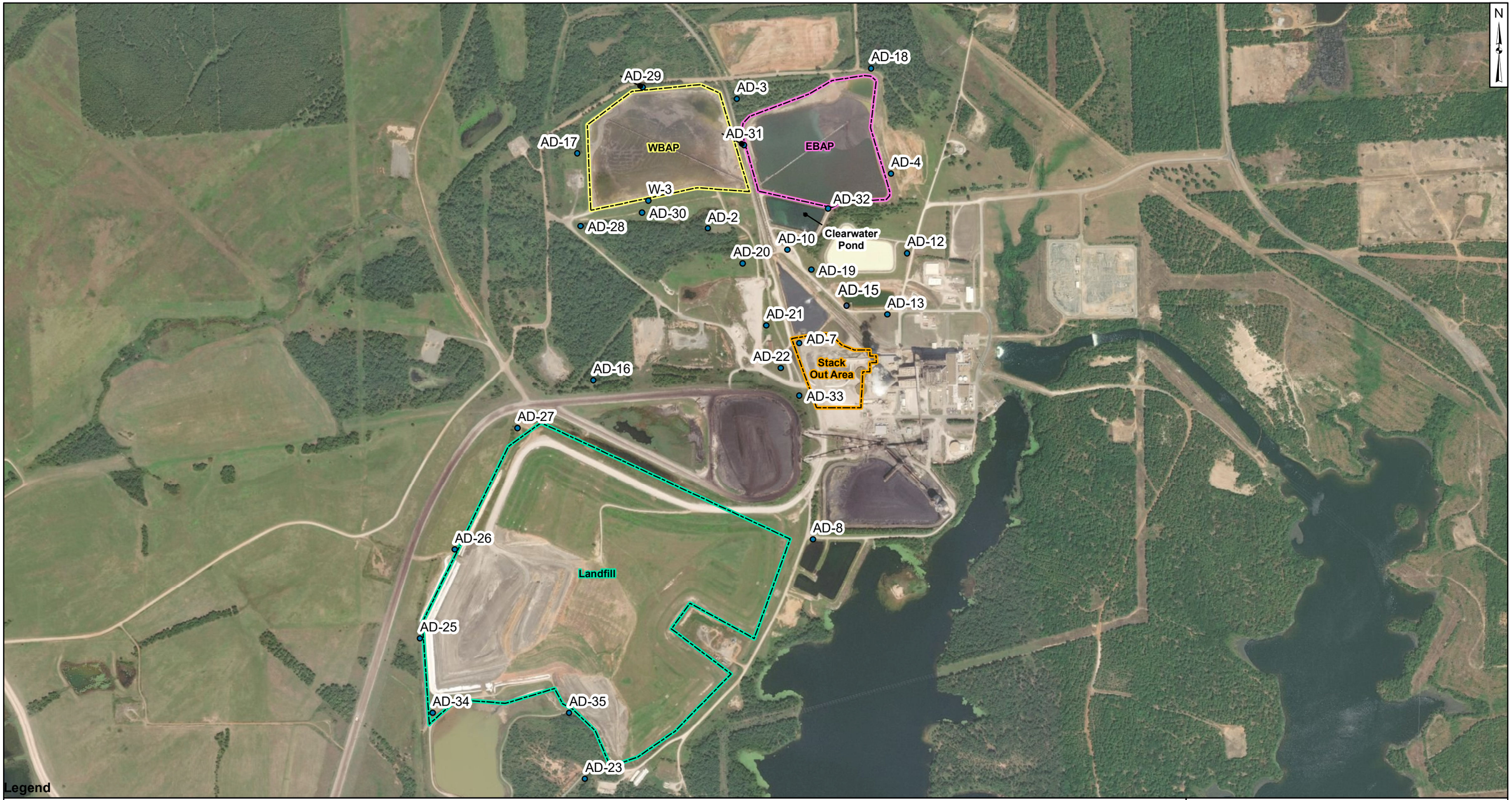
Notes:
'--' - analysis not completed
mg/kg- milligram per kilogram
ft bgs - feet below ground surface
J = estimated value
For AD-XX locations, samples were collected from additional boreholes advanced in the immediate area of the location identified by the well ID. Samples were not collected from the cuttings of the borings advanced for well installation. Samples for B-X locations were collected from cores removed from the borehole during well lithology logging.
Depths for samples collected after filtration represent the screened interval for the permanent well where the sample was collected.

Table 3: X-Ray Diffraction Results
West Bottom Ash Pond - H. W. Pirkey Plant

Constituent	VAP-B3-(40-45)
Quartz	15
Plagioclase Feldspar	0.5
Orthoclase	ND
Calcite	ND
Dolomite	ND
Siderite	0.5
Goethite	ND
Hematite	2
Pyrite	3
Kaolinte	42
Chlorite	4
Illite/Mica	6
Smectite	12
Amorphous	15

Notes:
ND: Not detected
VAP-B3-(40-45) is the centrifuged solid material from the groundwater sample collected at that interval.

FIGURES



Legend

- AD-15
- Monitoring Wells

Location Boundaries

CCR Units

- EBAP
- Landfill
- Stack Out Area
- WBAP

Notes

- Monitoring well coordinates provided by AEP.
- Data provided by AEP, 2019
- AD-15 location is approximate.

0 380 760 1,520 2,280 3,040 Feet

Site Layout

AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2019/03/25

Figure **1**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Pirkey\Site_Layout_20190322.mxd. HDuff. 3/25/2019. Project/Phase/Task.

Location	LCL (mg/L)
AD-31	0.0094

Location	Result (mg/L)
B-2	0.00814

Location	Result (mg/L)
AD-40	0.000799

Location	Result (mg/L)
AD-41	0.00801

Location	Result (mg/L)
B-3	0.0345

Location	LCL (mg/L)
AD-28	0.0132

Location	LCL (mg/L)
AD-2	0.010

Location	LCL (mg/L)
AD-32	0.033

AD-18
B-2
AD-29
WBAP
EBAP
AD-31
AD-40
AD-17
HPT-05
AD-4
AD-41
B-3
W-3
AD-30
AD-32
AD-37
AD-28
AD-2
AD-43
AD-42
AD-10
Clearwater Pond
AD-20
AD-12
AD-19
AD-15
AD-44
AD-45
HPT-09
AD-13
AD-38
AD-21
AD-7
Stack Out Area

N

Legend

- Out of Network
- EBAP
- WBAP
- Stackout Area
- EBAP and WBAP
- All CCR Unit Networks
- Piezometer

EBAP
Stack Out Area
WBAP

Notes
- Monitoring well coordinates, site features, and data provided by AEP.
- AD-15 location is approximated
- LCL: lower confidence limit
- Cobalt concentrations and LCL values displayed in milligrams per liter (mg/L).

400 200 0 400
Feet

Cobalt Distribution in Groundwater

AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2019/09/17

Figure **2**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Pirkey\2019\AEP_Pirkey_Cobalt_20190912.mxd. ARevezzo. 9/17/2019. Project/Phase/Task.

Location	AD-31	
Depth (ft bgs)	12	26
Cobalt (mg/kg)	1.9	0.83
Pyrite/Marcasite (%)	2	0

Location	AD-18	
Depth (ft bgs)	8	22
Cobalt (mg/kg)	3.6	2.9
Pyrite/Marcasite (%)	1	0

Location	B-2				
Depth (ft bgs)	10	16	71	82	87
Cobalt (mg/kg)	2.36	3.62	10.30	7.21	3.11
Pyrite/Marcasite (%)	-	-	-	-	-

Location	AD-17	
Depth (ft bgs)	7	15
Cobalt (mg/kg)	3.1	1.5
Pyrite/Marcasite (%)	2	0

Location	AD-41		
Depth (ft bgs)	15	35	95
Cobalt (mg/kg)	< 1.0	23.5	1.9
Pyrite/Marcasite (%)	-	-	-

Location	B-3		
Depth (ft bgs)	10	20	97
Cobalt (mg/kg)	1.30	0.59	1.11
Pyrite/Marcasite (%)	-	-	-

Location	AD-30	
Depth (ft bgs)	7	23
Cobalt (mg/kg)	1	15
Pyrite/Marcasite (%)	3	1

Location	AD-32	
Depth (ft bgs)	11	20-25
Cobalt (mg/kg)	1.7	9.1
Pyrite/Marcasite (%)	--	--

AD-29
AD-31
AD-18
B-2
AD-40
AD-17
HPT-05
AD-4
AD-41
WBAP
EBAP
B-3
W-3
AD-30
AD-37
AD-28
AD-2
AD-32
Clearwater Pond
AD-10
AD-12
AD-20
AD-19

N

Legend

- Monitoring Wells
- EBAP
- WBAP

Notes
- Monitoring well coordinates provided by AEP.
- Data provided by AEP, 2019.
- ft bgs: feet below ground surface.
- mg/kg: milligrams per kilogram.
- -- not analyzed.

300 150 0 300 Feet

Soil Chemical and Mineralogical Analysis Results

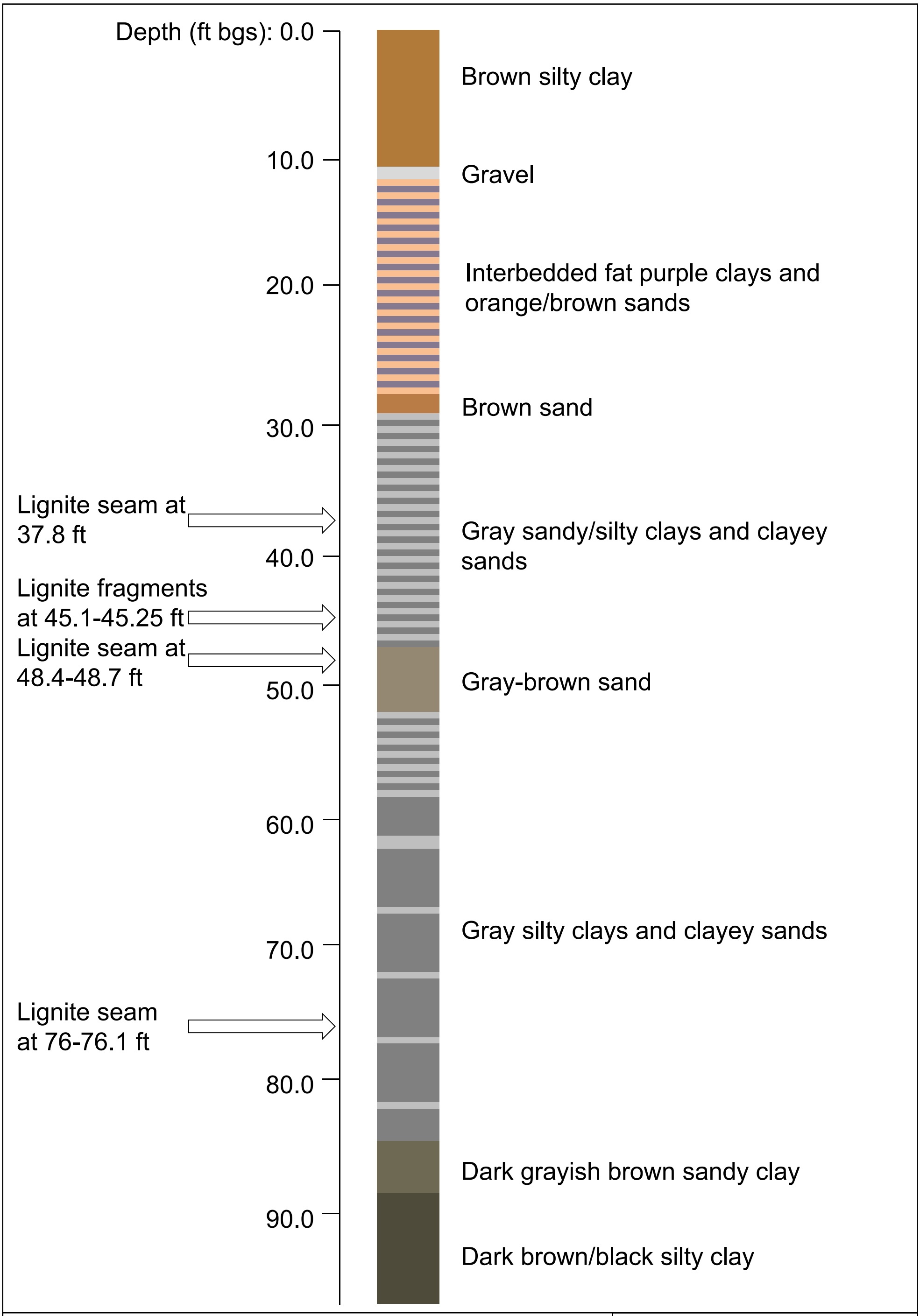
AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2019/09/18

Figure 3

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Pirkey\2019\Pirkey_SoilChem_minerals_March2019.mxd. hduff. 9/18/2019. Project/Phase/Task.



Notes:
- Ft = feet
- Bgs = below ground surface
- Boring completed May 2019
- Total depth of 97.5 ft bgs
- Well installed in offset boring screened at 29-34 ft bgs

Boring B-3 Visual Lithology Log

AEP Pirkey Powerplant
Hallsville, TX

Geosyntec consultants

CHA8462 | September 2019

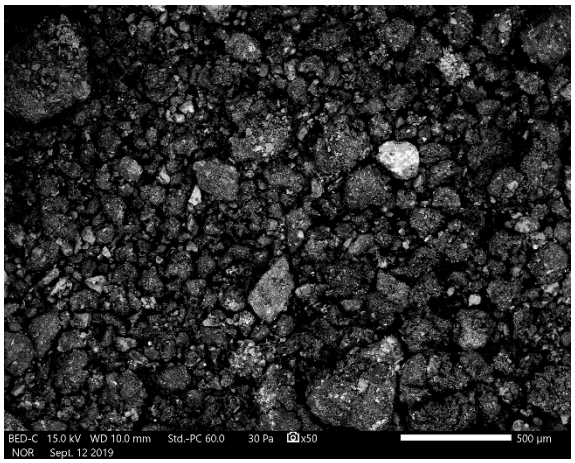
Figure 4

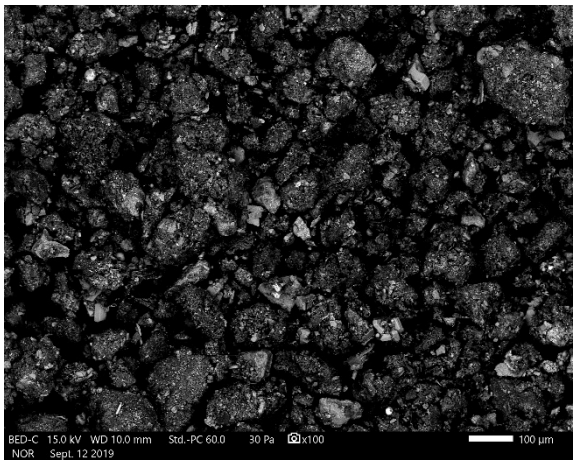
\\annarbor-01\data\Projects\AEP\Legal Department - ASD Review\Pirkey\2019-05 Field Investigation\Field Forms\Compiled Boring Logs\Visual boring logs

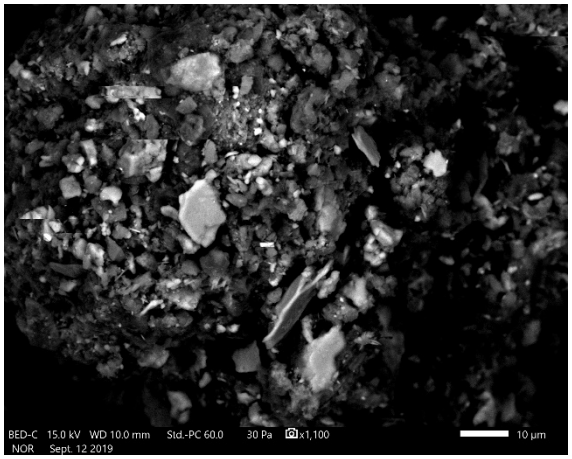
ATTACHMENT A
SEM/EDS Analysis

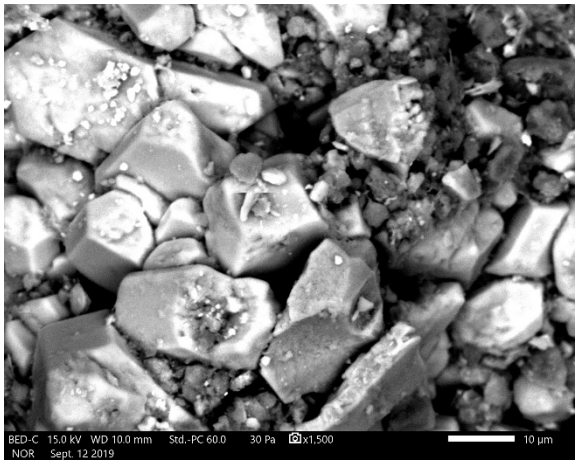
September 16, 2019

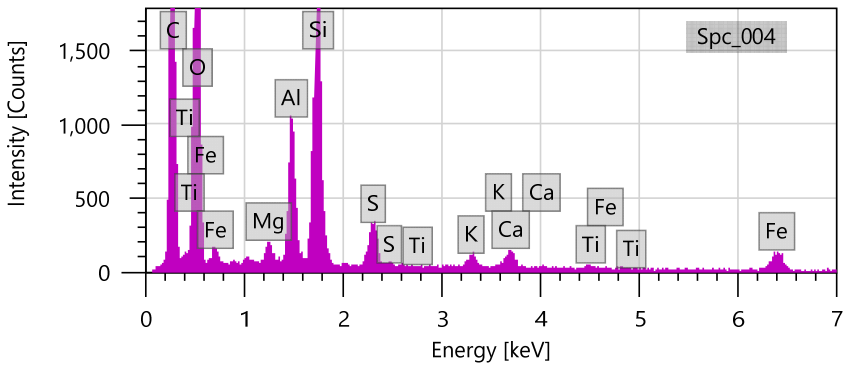
Dr. Bruce Sass
941 Chatham Lane, Suite 103, Columbus, OH 43221
via Email: BSass@geosyntec.com



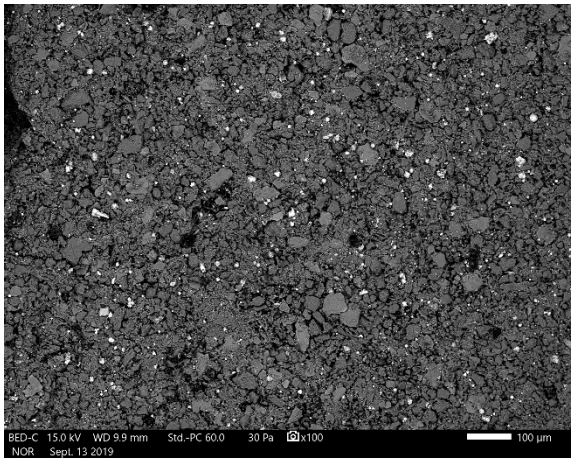


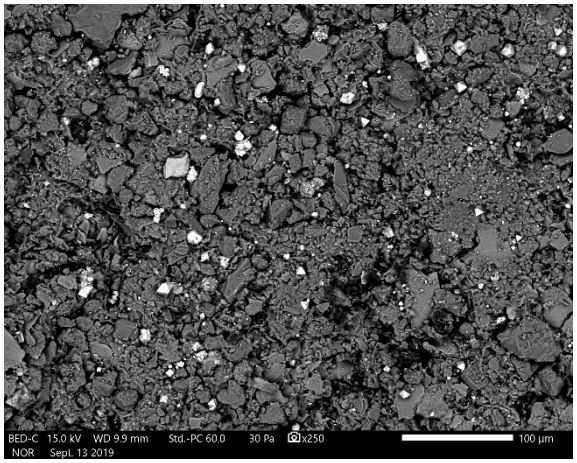


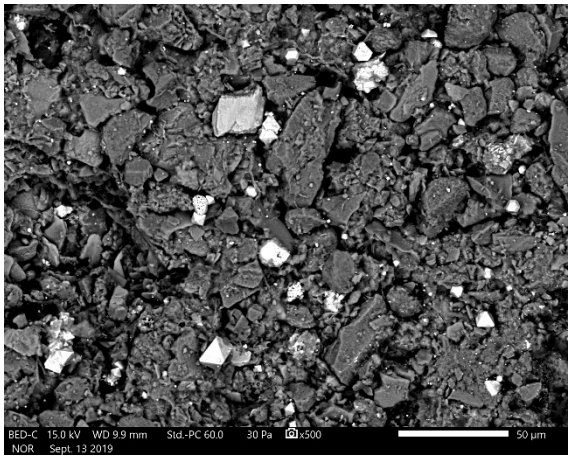


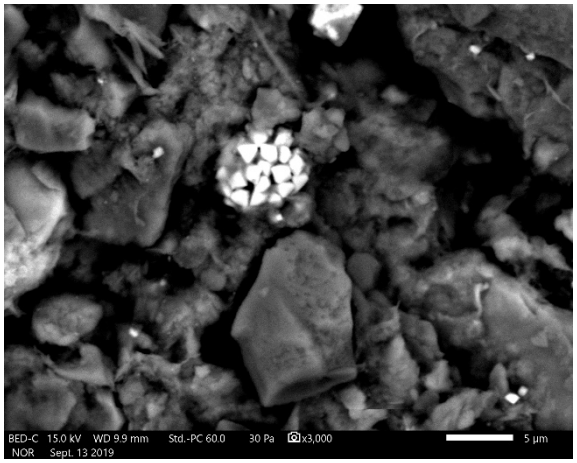


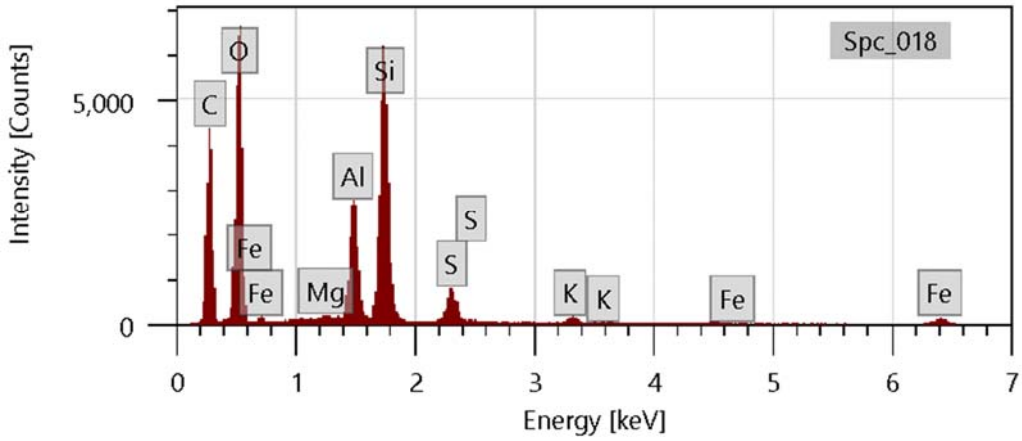
Lignite. Backscattered electron micrographs show the sample at 100X, 1,100X, and 1,500X. EDS spectrum at bottom is an area scan of the region shown in top right micrograph. Bright particles are mostly quartz and feldspar. Major peaks for carbon, oxygen, silicon, and aluminum suggest coal and clay.



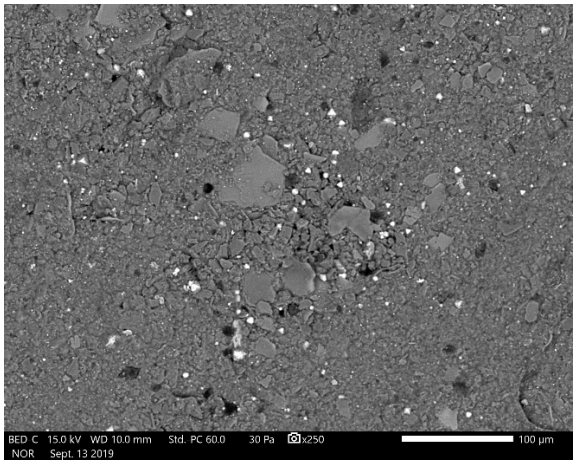


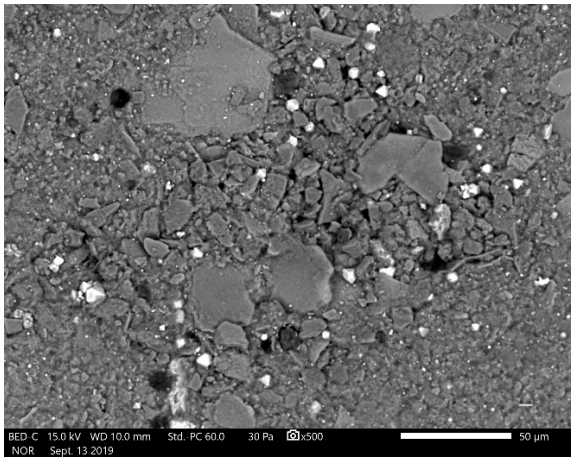


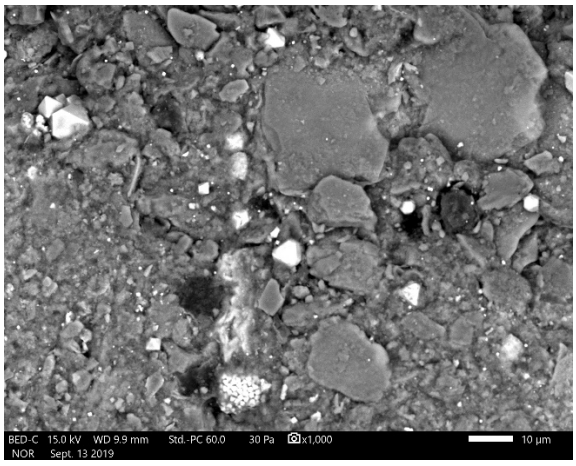


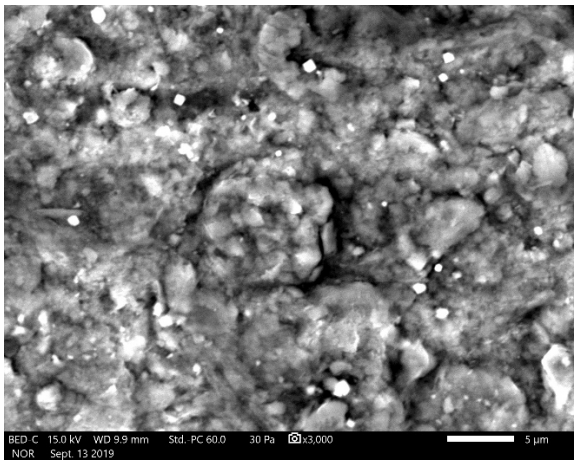


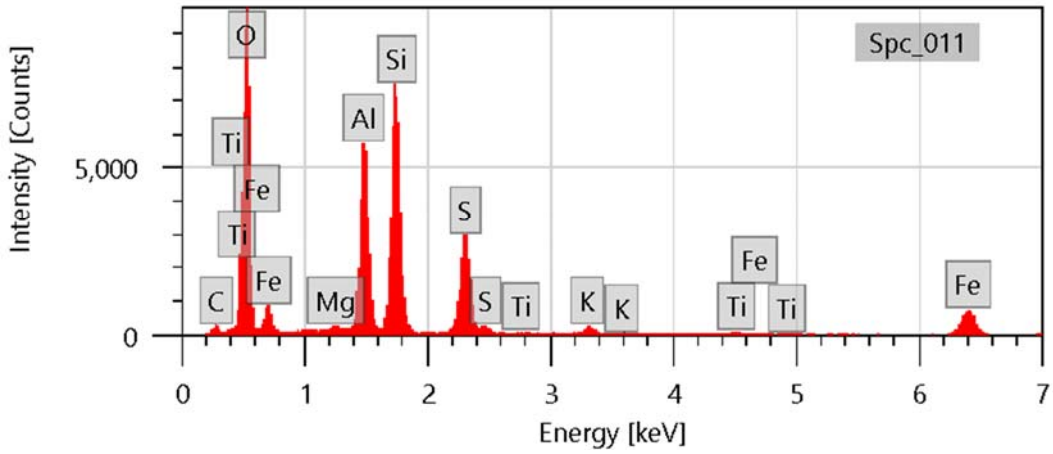
Sample VAP B3 40-45. Backscattered electron micrographs show the sample at 100X, 250X, 500X, and 3000X. EDS spectrum at bottom is an area scan of the region shown at 500X. Bright particles are pyrite (framboid in bottom right micrograph). Major peaks for carbon, oxygen, silicon, and aluminum suggest coal and clay.











Sample VAP B3 50-55. Backscattered electron micrographs show the sample at 250X, 500X, 1000X, and 3000X. EDS spectrum at bottom is an area scan of the region shown at 3000X. Bright particles are mostly pyrite (framboid in bottom left micrograph); occasional particles of Fe-Ti oxide are detected. Major peaks for oxygen, silicon, and aluminum suggest clay. Large blocky particles are mostly quartz, feldspar, and clay.

ATTACHMENT B
Certification by Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected and above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Pirkey West Bottom Ash Pond CCR management area and that the requirements of 40 CFR 257.95(g)(3)(ii) have been met.

Beth Ann Gross
Printed Name of Licensed Professional Engineer

Beth Ann Gross
Signature

Geosyntec Consultants
8217 Shoal Creek Blvd., Suite 200
Austin, TX 78757

Texas Registered Engineering Firm
No. F-1182

79864	Texas	10/3/2019
License Number	Licensing State	Date

APPENDIX IV

Notices of groundwater monitoring program transitions are included in this appendix.

APPENDIX V

Reports documenting monitoring well plugging and abandonment or well installation are included in the appendix.

STATE OF TEXAS WELL REPORT for Tracking #506035

Owner:	**H W PIRKEY POWER PLANT**	Owner Well #:	**SB10**
Address:	**2400 FM 3251 HALLSVILLE, TX 75650**	Grid #:	**35-37-4**
Well Location:	**2400 FM 3251 HALLSVILLE, TX 75650**	Latitude:	**32° 26' 52.08" N**
	LOCATED ON OWNERS PROPERTY	Longitude:	**094° 29' 58.82" W**
Well County:	**Harrison**	Elevation:	**No Data**
			****Plugged Within 48 Hours****

****This well has been plugged**** **Plugging Report Tracking #185184**

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **2/19/2019** Drilling End Date: **2/20/2019**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**60**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Screened**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**31**	**38**	**Bentonite 3 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **No Data** **Surface Completion NOT by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

	Description (number of sacks & material)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Plug Information:	**SAND**	**50**	**60**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Plains Environmental Services**

1900 Tonys Rd
salina, KS 67401

Driller Name: **Jesse Kalvig** License Number: **5025**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**clay brown**
1	**5**	**silty sand**
5	**9.5**	**clay**
9.5	**11**	**sand**
11	**32**	**clay**
32	**39**	**sand and clay**
39	**55**	**sand**
55	**60**	**fine sand**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**40**
2	**Screen**	**New Plastic (PVC)**	**40 0.1**	**40**	**50**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS PLUGGING REPORT for Tracking #185184

Owner:	**H W PIRKEY POWER PLANT**	Owner Well #:	**SB10**
Address:	**2400 FM 3251 HALLSVILLE, TX 75650**	Grid #:	**35-37-4**
Well Location:	**2400 FM 3251 HALLSVILLE, TX 75650**	Latitude:	**32° 26' 52.08" N**
		Longitude:	**094° 29' 58.82" W**
	LOCATED ON OWNERS PROPERTY	Elevation:	**No Data**
Well County:	**Harrison**		

Well Type: **Monitor**

Drilling Information

Company: **Plains Environmental Services** Date Drilled: **2/20/2019**

Driller: **Jesse Kalvig** License Number: **5025**

Well Report Tracking #506035

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**60**

Plugging Information

Date Plugged: **2/21/2019** Plugger: **Jesse Kalvig**

Plug Method: **Pour in 3/8 bentonite chips when standing water in well is less than 100 feet depth, cement top 2 feet**

Casing Left in Well:

DIa (in.)	*Top (ft.)*	*Bottom (ft.)*
2	**15**	**50**

Plug(s) Placed in Well:

Top (ft.)	*Bottom (ft.)*	*Description (number of sacks & material)*
1	**40**	**Bentonite 10 Bags/Sacks**

Certification Data: The driller certified that the driller plugged this well (or the well was plugged under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the reports(s) being returned for completion and resubmittal.

Company Information: **Plains Environmental Services**

1900 Tonys Rd
salina, KS 67401

Driller Name: **Jesse Kalvig** License Number: **5025**

Comments: **No Data**

STATE OF TEXAS WELL REPORT for Tracking #506039

Owner:	**H W PIRKEY POWER PLANT**	Owner Well #:	**AD37**
Address:	**2400 FM 3251 HALLSVILLE, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 HALLSVILLE, TX 75650**	Latitude:	**32° 27' 56.32" N**
	LOCATED ON OWNERS PROPERTY	Longitude:	**094° 29' 41.78" W**
Well County:	**Harrison**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **2/22/2019** Drilling End Date: **2/22/2019**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**17**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Screened**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**1**	**10**	**Bentonite 5 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **No Data** **Surface Completion NOT by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Plains Environmental Services**

1900 Tonys Rd
salina, KS 67401

Driller Name: **Jesse Kalvig** License Number: **5025**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**8.5**	**CLAYS WITH SOME SAND**
8.5	**10.5**	**SAND**
10.5	**13**	**CLAY SOME SAND**
13	**15**	**SAND WITH SOME CLAYS**
15	**17**	**CLAYS**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**12**
2	**Screen**	**New Plastic (PVC)**	**40 0.1**	**12**	**17**

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Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #506038

Owner:	**H W PIRKEY POWER PLANT**	Owner Well #:	**AD38**
Address:	**2400 FM 3251 HALLSVILLE, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 HALLSVILLE, TX 75650**	Latitude:	**32° 27' 46.12" N**
		Longitude:	**094° 29' 43.34" W**
	LOCATED ON OWNERS PROPERTY	Elevation:	**No Data**
Well County:	**Harrison**		

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **2/21/2019** Drilling End Date: **2/21/2019**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**18**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Screened**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**1**	**11**	**Bentonite 5 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **No Data** **Surface Completion NOT by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Plains Environmental Services**

1900 Tonys Rd
salina, KS 67401

Driller Name: **Jesse Kalvig** License Number: **5025**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**5**	**CLAY RED**
5	**7**	**CLAY GRAY/RED**
7	**11.5**	**SAND/CLAY**
11.5	**17.5**	**SAND SOME CLAYS**
17.5	**18**	**CLAY SLITS**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**13**
2	**Screen**	**New Plastic (PVC)**	**40 0.1**	**13**	**18**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #506037

Owner:	**H W PIRKEY POWER PLANT**	Owner Well #:	**AD39**
Address:	**2400 FM 3251 HALLSVILLE, TX 75650**	Grid #:	**35-37-4**
Well Location:	**2400 FM 3251 HALLSVILLE, TX 75650**	Latitude:	**32° 26' 52.05" N**
	LOCATED ON OWNERS PROPERTY	Longitude:	**094° 29' 58.84" W**
Well County:	**Harrison**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **2/20/2019** Drilling End Date: **2/20/2019**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**12**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Screened**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**1**	**5**	**Bentonite 3 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **No Data** **Surface Completion NOT by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Plains Environmental Services**

1900 Tonys Rd
salina, KS 67401

Driller Name: **Jesse Kalvig** License Number: **5025**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1**	**CLAY**
1	**5**	**CLAY/SAND**
5	**9.5**	**CLAY**
9.5	**12**	**SAND/CLAY**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**7**
2	**Screen**	**New Plastic (PVC)**	**40 0.1**	**7**	**12**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508688

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**AD-40 (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 28' 03" N**
		Longitude:	**094° 29' 00.5" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/10/2019** Drilling End Date: **3/10/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**40**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
27	**40**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**13**	**Cement**
13	**27**	**Bentonite 4 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**6**	**tan and brown sandy, silty clay**
6	**15**	**red and tan sand**
15	**28**	**red and grey clay**
28	**40**	**red and grey sand with occasional clay intervals**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**30**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**30**	**40**

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(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508686

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB(MW)-01A**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 28' 03" N**
		Longitude:	**094° 29' 00.5" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/9/2019** Drilling End Date: **3/10/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**100**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
86	**100**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**10**	**Cement**
10	**86**	**Bentonite 17 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**6**	**tan and brown sandy, silty clay**
6	**15**	**red and tan sand**
15	**28**	**red and grey clay**
28	**85**	**red and grey sand with occasional clay intervals**
85	**88**	**grey clay**
88	**100**	**grey sand**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**90**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**90**	**100**

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Texas Department of Licensing and Regulation
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Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508703

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-4 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 55" N**
		Longitude:	**094° 29' 50" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/22/2019** Drilling End Date: **2/22/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**22**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
8	**22**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**3**	**Cement**
3	**8**	**Bentonite 1 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**7**	**tan and brown sandy, silty clay**
7	**22**	**red and grey sand w/occ. lignite layers**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**12**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**12**	**22**

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(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508695

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-4 deep (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 55" N**
		Longitude:	**094° 29' 50" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/20/2019** Drilling End Date: **2/22/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**80**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
56	**80**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**8**	**Cement**
8	**56**	**Bentonite 9 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**7**	**tan and brown sandy, silty clay**
7	**36**	**red and grey sand w/occ. lignite layers**
36	**41**	**red and tan clay**
41	**69**	**red and grey sand with occasional clay iand lignite layers**
69	**80**	**grey sandy clay with lignite layers**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**59**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**59**	**69**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508712

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-5 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 48" N**
		Longitude:	**094° 29' 53" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/24/2019** Drilling End Date: **2/24/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**25**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
12	**25**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**8**	**Cement**
8	**12**	**Bentonite 1 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**5**	**tan and brown sandy, silty clay**
5	**18**	**red and grey sand w/occ. clay layers**
18	**20**	**gray clay**
20	**25**	**brown sand**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**15**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**15**	**25**

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Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508708

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-5 deep (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 48" N**
		Longitude:	**094° 29' 53" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/23/2019** Drilling End Date: **2/23/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**70**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
45	**70**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**10**	**Cement**
10	**45**	**Bentonite 9 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**5**	**tan and brown sandy, silty clay**
5	**18**	**red and grey sand w/occ. clay layers**
18	**20**	**gray clay**
20	**28**	**brown sand**
28	**41**	**brown and grey silty clay**
41	**70**	**grey sand with occasional lignite layers**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**50**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**50**	**60**

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P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #506040

Owner:	**H W PIRKEY POWER PLANT**	Owner Well #:	**SB6S**
Address:	**2400 FM 3251 HALLSVILLE, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 HALLSVILLE, TX 75650**	Latitude:	**32° 27' 30.34" N**
		Longitude:	**094° 29' 27.76" W**
	LOCAATED ON OWNERS PROPERTY	Elevation:	**No Data**
Well County:	**Harrison**		

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **2/23/2019** Drilling End Date: **2/23/2019**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**18**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Screened**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**1**	**11**	**Bentonite 5 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **No Data** **Surface Completion NOT by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Plains Environmental Services**

1900 Tonys Rd
salina, KS 67401

Driller Name: **Jesse Kalvig** License Number: **5025**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**10**	**CLAYS**
10	**18**	**SANDS AND CLAYS**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**13**
2	**Screen**	**New Plastic (PVC)**	**40 0.1**	**13**	**18**

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Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #506041

Owner:	**H W PIRKEY POWER PLANT**	Owner Well #:	**SB6D**
Address:	**2400 FM 3251 HALLSVILLE, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 HALLSVILLE, TX 75650**	Latitude:	**32° 27' 30.28" N**
	LOCATED ON OWNERS PROPERTY	Longitude:	**094° 29' 27.75" W**
Well County:	**Harrison**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **2/22/2019** Drilling End Date: **2/23/2019**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**65**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Screened**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**1**	**53**	**Bentonite 19 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **No Data** **Surface Completion NOT by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Plains Environmental Services**

1900 Tonys Rd
salina, KS 67401

Driller Name: **Jesse Kalvig** License Number: **5025**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**10**	**CLAYS**
10	**24**	**SANDS AND CLAYS**
24	**29**	**CLAYS**
29	**42.5**	**SANDS AND CLAYS**
42.5	**48.5**	**SANDS WITH SOME CLAY**
48.5	**56**	**CLAYS WITH SOME SAND**
56	**65**	**SILY SANDS**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**55**
2	**Screen**	**New Plastic (PVC)**	**40 0.1**	**55**	**65**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508722

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-7 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 27" N**
		Longitude:	**094° 30' 08" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/3/2019** Drilling End Date: **3/3/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**45**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
32	**45**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**32**	**Bentonite 6 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**45**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**35**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**35**	**45**

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508720

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-7 deep (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 27" N**
		Longitude:	**094° 30' 08" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/28/2019** Drilling End Date: **2/28/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**70**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
57	**70**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**57**	**Bentonite 10 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**70**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**60**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**60**	**70**

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508724

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-8 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 10" N**
		Longitude:	**094° 30' 12" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/27/2019** Drilling End Date: **2/27/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**35**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
23	**35**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**23**	**Bentonite 4 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**35**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**25**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**25**	**35**

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508729

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-8 medium (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 10" N**
		Longitude:	**094° 30' 12" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/27/2019** Drilling End Date: **2/27/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**65**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
52	**65**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**53**	**Bentonite 4 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**65**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**55**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**55**	**65**

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Texas Department of Licensing and Regulation
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Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508777

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-8 deep (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 10" N**
		Longitude:	**094° 30' 12" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **2/24/2019** Drilling End Date: **2/26/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**93**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
77	**93**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**77**	**Bentonite 15 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**90**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**
90	**93**	**gray clay (old pit base?)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**80**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**80**	**90**

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P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508781

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-9 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 01" N**
		Longitude:	**094° 30' 11" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/5/2019** Drilling End Date: **3/5/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**30**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
17	**30**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**17**	**Bentonite 1 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**30**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**20**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**20**	**30**

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508779

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-9 deep (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 01" N**
		Longitude:	**094° 30' 11" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/4/2019** Drilling End Date: **3/4/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**60**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
48	**60**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**12**	**Cement**
12	**48**	**Bentonite 10 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**60**	**tan and brown sandy, silty clay and occasional lignite inclusions (reclaim)**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**50**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**50**	**60**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508718

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-11 shallow (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 26' 41" N**
		Longitude:	**094° 30' 11" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/8/2019** Drilling End Date: **3/8/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**15**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
3	**15**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**1**	**Cement**
1	**3**	**Bentonite 5 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**18**	**tan and brown sandy, silty clay and occasional gravel**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**5**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**5**	**15**

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #508717

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**SB-11 deep (MW)**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-36-6**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 26' 41" N**
		Longitude:	**094° 30' 11" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/7/2019** Drilling End Date: **3/8/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
6.75	**0**	**43**

Drilling Method: **Mud (Hydraulic) Rotary**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
30	**43**	**Sand**	**16/30**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**10**	**Cement**
10	**30**	**Bentonite 5 Bags/Sacks**

Seal Method: **Gravity**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Mhc x-ploration corp**

P.O. Box 7405
Tyler, TX 75711

Driller Name: **James K. Collum** License Number: **3184**

Apprentice Name: **Jason Smith** Apprentice Number: **60448**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**18**	**tan and brown sandy, silty clay and occasional gravel**
18	**43**	**red and grey sand w/occ. clay layers**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**33**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**33**	**43**

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(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #525309

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**B-2**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 54.7" N**
		Longitude:	**094° 28' 25.01" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **5/13/2019** Drilling End Date: **5/17/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
8.25	**0**	**49**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
36	**49**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**32**	**Concrete 1 Bags/Sacks**
32	**36**	**Bentonite 1 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **BEST DRILLING SERVICES, INC.**

P.O. BOX 845
FRIENDSWOOD, TX 77549

Driller Name: **Ali Firouzbakht** License Number: **4997**

Apprentice Name: **Ramon Gutierrez** Apprentice Number: **56591**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**0.5**	**SILTY SAND, black**
0.5	**2**	**SAND, red/brown**
2	**5**	**SANDY CLAY, alternating layers red + brown**
5	**5.5**	**NO RECOVERY**
5.5	**6.7**	**SANDY CLAY, gray + brown/red**
6.7	**8**	**CLAY, gray**
8	**11**	**CLAY, gray with brown striations**
11	**11.5**	**CLAY, gray**
11.5	**12**	**CLAYEY, gray SAND, red-brown**
12	**14**	**NO RECOVERY**
14	**14.75**	**SANDY CLAY, reddish brown + gray**
14.75	**16**	**CLAY, gray + red & trace brown fine grained SAND**
16	**18.5**	**NO RECOVERY**
18.5	**18.75**	**CLAY, red & gray, trace SILT**
18.75	**18.95**	**SAND, tan**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**38**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**38**	**48**
2	**SUMP**	**New Plastic (PVC)**	**40**	**48**	**48.5**

18.95	20	CLAY, red/drk. gray
20	21.1	NO RECOVERY
21.1	21.8	SANDY CLAY, lt. brown + red
21.8	24	CLAY, red + drk. gray
24	24.5	SANDY CLAY, lt. brown
24.5	24.8	SANDY CLAY, red-brown
24.8	28	CLAY, purple + gray
28	29.9	CLAY, drk. purple
29.9	30.7	CLAY, black/drk. gray
30.7	32	SILTY CLAY, black/drk. gray
32	33.5	SILTY CLAY, drk. gray
33.5	36	SILTY CLAY, black
36	36.5	NO RECOVERY
36.5	38.1	SAND, drk. green
38.1	38.3	SILTY SAND, drk. brown
38.3	38.4	CLAYEY SAND, very drk. brown
38.4	38.5	SILTY SAND, drk. green
38.5	39	SILTY SAND, drk. brown
39	39.2	Laminated SANDY CLAY/CLAYEY SANDS, gray to drk. gray
39.2	43.1	NO RECOVERY
43.1	44.5	Fine graded SAND w/trace SILT, greenish gray
44.5	47	CLAYEY SAND/SANDY CLAY, drk. brown
47	48.1	NO RECOVERY
48.1	49	CLAYEY SAND/SANDY CLAY, drk. brown

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Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #525308

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**B-3**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 54.7" N**
		Longitude:	**094° 28' 25.01" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **5/15/2019** Drilling End Date: **5/15/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
8	**0**	**35**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
26.9	**35**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**22**	**Concrete 1 Bags/Sacks**
22	**26.9**	**Bentonite 1 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **BEST DRILLING SERVICES, INC.**

P.O. BOX 845
FRIENDSWOOD, TX 77549

Driller Name: **Ali Firouzbakht** License Number: **4997**

Apprentice Name: **Ramon Gutierrez** Apprentice Number: **56591**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**2**	**CLAY, medium red-brown**
2	**3**	**CLAY, lt. brown**
3	**4**	**Organic CLAY, gray to lt. brown**
4	**4.5**	**Organic CLAY, lt. brown**
4.5	**5**	**Organic CLAY, lt. brown to reddish brown**
5	**9.5**	**Organic CLAY, lt. brown to reddish brown**
9.5	**10.5**	**SILTY CLAY, reddish-orange**
10.5	**11**	**Poorly graded gravel**
11	**13**	**CLAYEY SAND,**
13	**13.9**	**SANDY CLAY, brown to orange**
13.9	**15**	**SAND, orange**
15	**16**	**SANDY CLAY**
16	**18**	**SAND, orange**
18	**18.5**	**Fat CLAY, grayish purple**
18.5	**19.5**	**SAND, orange to grayish orange**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**29.2**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**29.2**	**34**
2	**SUMP**	**New Plastic (PVC)**	**40 0.010**	**34**	**34.5**

19.5	20	Fat CLAY, grayish purple
20	22.1	SAND, lt. brown to orange
22.1	22.3	Lenes of fat CLAY, drk. gray to purple
22.3	22.6	SAND, lt. brown to orange
22.6	23	Gravelly SAND
23	24	SANDY CLAY, grayish purple
24	25.6	SAND, tan to lt. brown
25.6	26.4	CLAY, purple and gray
26.4	26.8	CLAYEY SAND, tan to lt. brown
26.8	27.3	CLAY, purple
27.3	28	CLAY, drk. gray
28	28.6	NO RECOVERY
28.6	29.2	SAND, lt. brown
29.2	29.5	SILTY CLAY, drk. gray
29.5	32	CLAY, drk. gray to black
32	32.7	CLAY, drk. gray
32.7	33.1	CLAYEY SILT, drk. gray
33.1	35	SAND, drk. gray

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P.O. Box 12157
Austin, TX 78711
(512) 334-5540

STATE OF TEXAS WELL REPORT for Tracking #525304

Owner:	**AEP Pirkey Power Plant**	Owner Well #:	**B-6**
Address:	**2400 FM 3251 Hallsville, TX 75650**	Grid #:	**35-37-1**
Well Location:	**2400 FM 3251 Hallsville, TX 75650**	Latitude:	**32° 27' 54.7" N**
		Longitude:	**094° 28' 25.01" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **5/20/2019** Drilling End Date: **5/20/2019**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
4	**0**	**40**

Drilling Method: **Direct Push**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
27	**40**	**Sand**	**20/40**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**25**	**Concrete 1 Bags/Sacks**
25	**27**	**Bentonite 1 Bags/Sacks**

Seal Method: **Tremie**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **BEST DRILLING SERVICES, INC.**

P.O. BOX 845
FRIENDSWOOD, TX 77549

Driller Name: **Ali Firouzbakht** License Number: **4997**

Apprentice Name: **Ramon Gutierrez** Apprentice Number: **56591**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**0.4**	**Topsoil with vegetation, black SILT**
0.4	**1.8**	**SILT, brown**
1.8	**7**	**SILTY CLAY, red & lt. gray**
2.3	**23.5**	**SILT, drk. red**
7	**7.2**	**SILT, brown**
7.2	**7.6**	**SILTY CLAY, red & lt. gray**
7.6	**8**	**CLAY, lt. gray**
8	**9**	**CLAY, lt. gray & lt. red**
9	**9.3**	**SILTY CLAY, lt. gray & brown**
9.3	**9.8**	**CLAY, lt. gray**
9.8	**12**	**CLAY, reddish-brown**
12	**12.8**	**SILTY CLAY, red & brown**
12.8	**16**	**SILTY CLAY, drk. brown**
16	**18.1**	**CLAY, red & brown**
18.1	**18.8**	**SILTY CLAY, brown**
18.8	**18.9**	**CLAY, brown**
18.9	**19.1**	**SILT, lt. gray & brown**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**29**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**29**	**39**
2	**SUMP**	**New Plastic (PVC)**	**40**	**39**	**39.5**

19.1	19.4	SILTY CLAY, brown
19.4	20	CLAYEY SILT, lt. gray & brown
20	20.9	CLAY, red/brown
20.9	22.1	CLAYEY SILT, lt. brown
22.1	23.2	SILTY CLAY, lt. brown & gray
23.5	24	SILTY CLAY, lt. brown & gray
24	25.9	NO RECOVERY
25.9	26.1	CLAYEY SILT, lt. brown
26.1	26.3	SILTY CLAY, brown
26.3	28	SILTY CLAY, black & drk. green
28	28.7	Trace CLAY, brown SILT
28.7	29.6	SILTY CLAY, drk. brown & green
29.6	29.9	CLAY, drk. brown
29.9	30.3	CLAYEY SAND, drk. green & drk. brown
30.3	32	Fine grained SAND, drk. green
32	34.4	Fine grained SAND, gray & brown
34.4	34.5	SILT w/gravel, tan/brown
34.5	34.7	CLAY, drk. brown
34.7	35.1	Fine grained SAND, drk. green
35.1	36	Fine grained SANDY SILT, drk. green & black
36	37.4	Fine grained SAND, drk. brown
37.4	38.5	Fine grained SILTY SAND, drk. gray & drk. green
38.5	40	SANDY SILT, drk. green & black

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