Annual Groundwater Monitoring Report

Kentucky Power Company

Big Sandy Plant

Bottom Ash Pond CCR Management Unit

Louisa, Kentucky

January 2020

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KENTUCKY POWER
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I. Overview

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

In general, the following activities were completed:

- All monitoring wells that were installed and developed to establish a certified groundwater monitoring system around the CCR unit, in accordance with the requirements of 40 CFR 257.91 and documented in AEP's *Groundwater Monitoring Network Evaluation (Geosyntec, December 2016)*, were sampled pursuant to 40 CFR 257.95(d)(1) on March 11 and March 14, 2019. All samples were analyzed for all parameters in Appendix III of the CCR rules and for those Appendix IV constituents detected during the April 24, 2018 sampling pursuant to 40 CFR 257.95(b), following the establishment of an assessment monitoring program on April 13, 2018 and a subsequent sampling pursuant to 40 CFR 257.95(d)(1) on September 24, 2018. All sampling and analyses were in accordance with 40 CFR 257.95 *et seq.*, AEP's *Groundwater Sampling and Analysis Plan (AEP and EHS Support, October 2016), and AEP's Statistical Analysis Plan (Geosyntec, January 2017)*. The statistical process was guided by USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* ("Unified Guidance", USEPA, 2009);

- Groundwater assessment monitoring data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;

- Statistical analysis of the background and assessment monitoring data was conducted in accordance with *AEP's Statistical Analysis Plan (Geosyntec, January 2017)* to establish groundwater protection standards and to determine whether or not one or more Appendix IV constituents were detected at statistically significant levels (SSLs) above the corresponding groundwater protection standards in assessment monitoring samples collected during the September 2018 and March 2019 sampling events. The statistical analyses were completed in January 2019 and July 2019;

- Because no SSLs above (or outside for pH) the corresponding groundwater protection standard statistical limits were identified at the CCR unit following either the September 2018 or March 2019 assessment monitoring sampling events, no releases from the CCR unit have occurred, and all CCR materials have been removed from the unit including removal of at least two feet of the natural lean clay or sandy lean clay and silt soils beneath the unit, the CCR unit is hereby closed by removal with further details provided

in Sections VII and VIII of this report. Consequently, all groundwater monitoring network wells will be decommissioned.

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

- A figure showing the CCR unit, 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 regarding the rationale for the installation/decommission;
- 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 required by detection monitoring or assessment monitoring programs (attached as Appendixes 1 and 2);
- Results of the required statistical analysis of groundwater monitoring results;
- A narrative discussion of the closure of the unit by removal and certification by a qualified professional engineer verifying that closure has been completed in accordance with the closure plan and the requirements of 40 CFR 257.102;
- Other information required in the annual report such as alternative source demonstrations, transition to a corrective measures program, or assessment of corrective measures is not applicable to the CCR unit in 2019 and thus not included in this report.

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

II. Groundwater Monitoring Well Locations and Identification Numbers

A figure depicting the PE-certified groundwater monitoring network, with the monitoring well locations and their corresponding identification numbers, is in Appendix 2.

III. Monitoring Wells Installed or Decommissioned

There were no monitoring wells installed or decommissioned in 2019. The network design, as summarized in the *Groundwater Monitoring Network Evaluation* (*Geosyntec, December 2016*) and as posted at the CCR web site for Big Sandy Plant, did not change. That report, viewable on the publicly accessible AEP CCR Rule Compliance Data and Information Internet site at the following link: http://www.aep.com/about/codeofconduct/ccrrule/, discusses the facility location,

the hydrogeological setting, the hydrostratigraphic units, the uppermost aquifer, downgradient monitoring well locations, and upgradient monitoring well locations.

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

Appendix 1 contains Table 1 showing the data analyzed from the samples collected during the March 2019 assessment monitoring event, including the number of samples collected per well, the sample collection dates, and the groundwater velocities for each sampling event. Table 1 also includes background data collected during the nine background sampling events and previous detection and assessment monitoring data. Static water elevation data and groundwater flow directions, in the form of a potentiometric surface map from the March 2019 monitoring event, are shown in Appendix 2.

V. Statistical Analysis of Groundwater Monitoring Data

Statistical analyses of data collected during the September 2018 and March 2019 assessment monitoring events, for determination of SSLs detected above (or outside for pH) the corresponding groundwater protection standard statistical limits, were completed and documented in the January 8, 2019 *Statistical Analysis Summary (Geosyntec, January 2019)* for the September 2018 sampling event and in the July 12, 2019 Statistical Analysis Summary (Geosyntec, July 2019) for the March 2019 sampling event. Both summaries contain the full statistical evaluations in Attachment B of each summary. The summaries, including the attachments, are provided in Appendix 3 of this report. No SSLs above (or outside for pH) the corresponding groundwater protection standard statistical limits were identified in either of the statistical analysis summaries.

VI. Alternative Source Demonstration

No alternative source demonstrations were completed in association with the September 2018 or March 2019 assessment monitoring sampling events and statistical analyses.

VII. Discussion About Transition Between Monitoring Requirements

Because no SSLs above (or outside for pH) the corresponding groundwater protection standard statistical limits were identified during two consecutive rounds of assessment monitoring and the corresponding statistical analyses, no releases from the CCR unit have occurred, and all CCR materials were removed from the unit including removal of at least two feet of the natural lean clay or sandy lean clay and silt soils beneath the unit to remove any CCR potentially mixed with soil during excavation of the CCR, the CCR unit was transitioned to closure status in accordance

with 40 CFR 257.102. A certification from a qualified professional engineer verifying that closure has been completed in accordance with the closure plan and the requirements of 40 CFR 257.102 was placed in the facility's operating record on January 31, 2020.

VIII. Other Information Required

The CCR unit has progressed from assessment monitoring to its current closed status in accordance with the closure plan and the requirements of 40 CFR 257.102. Because the unit has been closed by removal as provided by 40 CFR 257.102(c), it is not subject to post-closure care criteria as provided by 40 CFR 257.104(a)(2). All required information has been included in this annual groundwater monitoring report.

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

No significant problems were encountered. Through previous, proper construction of monitoring wells and use of low-flow purging and sampling methodology, samples representative of uppermost aquifer groundwater, with low turbidity, were obtained and the schedule to support preparation of this annual groundwater monitoring report was met.

X. A Projection of Key Activities for the Upcoming Year

Key activities for 2020 include:

- All monitoring wells in the CCR unit's groundwater monitoring network will be properly abandoned in accordance with state regulations.

APPENDIX 1—Tables

Tables follow showing the groundwater monitoring data collected, the rate of groundwater flow each time groundwater was sampled, the number of samples collected per monitoring well, dates that the samples were collected, and whether each sample was collected as part of a detection monitoring or an assessment monitoring program.

Table 1 - Groundwater Data Summary: MW-1614
Big Sandy - BAP
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
9/8/2016	Background	0.115	61.6	68.0	0.06 J	6.3	686	359
11/7/2016	Background	0.126	54.1	58.6	0.03 J	5.4	664	338
1/10/2017	Background	0.144	57.8	74.9	<0.05 U	6.2	744	368
2/20/2017	Background	0.167	54.4	49.2	0.1 J	6.5	572	323
4/24/2017	Background	0.122	59.1	54.5	0.06 J	6.2	640	346
5/22/2017	Background	0.163	53.3	87.0	0.07	6.0	941	510
6/26/2017	Background	0.147	64.7	51.8	<0.05 U	6.2	692	364
7/11/2017	Background	0.144	61.1	52.0	<0.05 U	5.9	638	346
9/13/2017	Background	0.174	61.9	44.7	0.07 J	5.7	652	344
11/28/2017	Detection	0.199	53.4	40.8	0.08 J	6.4	592	321
1/30/2018	Detection	0.159	- -	- -	- -	6.5	- -	314
4/24/2018	Assessment	0.146	49.1	50.5	0.09 J	5.9	592	351
9/24/2018	Assessment	0.183	49.6	42.1	0.08 J	6.4	578	295
3/14/2019	Assessment	0.119	40.9	52.6	0.06 J	5.9	661	343

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: MW-1614
Big Sandy - BAP
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
9/8/2016	Background	0.02 J	15.4	69.5	0.061	0.007 J	0.4	2.67	1.624	0.06 J	0.241	0.003	<0.002 U	0.56	0.03 J	0.02 J
11/7/2016	Background	0.02 J	12.7	61.7	0.066	0.008 J	0.7	2.40	1.841	0.03 J	0.342	<0.0002 U	<0.002 U	0.60	0.07 J	0.02 J
1/10/2017	Background	0.03 J	9.89	128	0.086	<0.004 U	0.338	0.921	2.573	<0.05 U	0.109	0.004	<0.002 U	0.52	0.1 J	<0.01 U
2/20/2017	Background	0.03 J	17.8	50.3	0.085	0.01 J	0.442	3.64	0.839	0.1 J	0.131	0.005	<0.002 U	3.65	0.1	0.02 J
4/24/2017	Background	0.03 J	20.1	55.1	0.046	0.006 J	0.465	3.82	0.5919	0.06 J	0.101	<0.0002 U	<0.002 U	0.69	0.07 J	0.02 J
5/22/2017	Background	0.02 J	7.29	79.6	0.091	<0.005 U	0.443	2.57	1.032	0.07	0.174	0.004	<0.002 U	0.24	0.08 J	0.02 J
6/26/2017	Background	0.04 J	13.8	44.6	0.082	<0.005 U	0.280	3.26	83.973	<0.05 U	0.155	0.0003 J	<0.002 U	0.41	0.09 J	0.04 J
7/11/2017	Background	0.02 J	9.68	45.5	0.048	0.006 J	0.170	2.98	7.956	<0.05 U	0.087	0.0004 J	<0.002 U	0.37	0.09 J	0.02 J
4/24/2018	Assessment	0.05 J	11.5	58.7	0.097	<0.005 U	0.341	2.16	0.268	0.09 J	0.087	0.002	<0.002 U	0.45	0.09 J	0.02 J
9/24/2018	Assessment	0.05	13.9	42.6	0.113	<0.005 U	0.405	1.65	65.861	0.08 J	0.141	<0.0002 U	- -	0.66	0.10	0.02 J
3/14/2019	Assessment	0.03 J	8.97	59.6	0.305	<0.01 U	0.457	1.04	1.685	0.06 J	0.215	<0.009 U	<0.004 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: MW-1615
Big Sandy - BAP
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
9/8/2016	Background	0.070	47.3	35.3	0.20	6.5	484	242
11/7/2016	Background	0.114	59.5	41.8	0.21	5.5	568	336
1/10/2017	Background	0.088	79.5	43.0	0.16	6.3	716	372
2/20/2017	Background	0.121	71.8	43.5	0.21	6.5	694	377
4/24/2017	Background	0.092	74.0	48.4	0.20	6.2	718	405
5/22/2017	Background	0.143	74.5	43.8	0.18	6.2	723	392
6/26/2017	Background	0.128	76.4	43.1	0.1 J	6.3	720	387
7/11/2017	Background	0.135	65.1	37.6	0.15	6.2	666	332
9/13/2017	Background	0.121	44.3	19.9	0.23	5.9	428	215
11/28/2017	Detection	0.124	45.9	21.1	0.22	6.5	418	227
1/30/2018	Detection	- -	- -	- -	- -	6.1	- -	419
4/24/2018	Assessment	0.099	45.2	30.4	0.20	6.1	404	256
9/24/2018	Assessment	0.156	58.3	82.1	0.11	5.8	854	474
3/14/2019	Assessment	0.09 J	47.5	37.5	0.17	5.7	555	300

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: MW-1615
Big Sandy - BAP
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
9/8/2016	Background	0.02 J	0.20	14.3	0.007 J	0.05	0.3	1.51	0.95	0.20	0.169	0.001	<0.002 U	0.21	0.1	0.066
11/7/2016	Background	0.02 J	0.22	19.4	0.007 J	0.05	0.7	1.86	2.43	0.21	0.303	<0.0002 U	<0.002 U	0.18	0.08 J	0.074
1/10/2017	Background	0.01 J	0.22	20.5	0.005 J	0.05	0.229	2.04	1.323	0.16	0.043	<0.0002 U	<0.002 U	0.14	0.07 J	0.072
2/20/2017	Background	<0.01 U	0.22	21.4	0.01 J	0.05	0.377	2.19	0.9562	0.21	0.045	0.004	<0.002 U	2.42	0.2	0.417
4/24/2017	Background	0.02 J	0.24	23.8	0.005 J	0.06	0.33	2.43	0.459	0.20	0.029	<0.0002 U	<0.002 U	0.11	<0.03 U	0.075
5/22/2017	Background	0.02 J	0.21	21.2	0.008 J	0.04	0.284	2.15	0.8095	0.18	0.034	0.0006 J	<0.002 U	0.07 J	0.07 J	0.075
6/26/2017	Background	0.03 J	0.49	42.3	0.02 J	0.10	0.531	4.31	18.65	0.1 J	0.071	0.005	<0.002 U	0.21	0.2	0.272
7/11/2017	Background	0.01 J	0.20	18.4	<0.004 U	0.03	0.176	1.79	1.519	0.15	0.037	0.0004 J	<0.002 U	0.07 J	0.03 J	0.063
4/24/2018	Assessment	0.08	0.23	18.5	0.008 J	0.07	0.215	3.10	0.921	0.20	0.171	0.0008 J	<0.002 U	0.08 J	0.08 J	0.097
9/24/2018	Assessment	0.03 J	1.20	27.3	0.024	0.17	0.323	27.1	1.065	0.11	0.070	0.003	- -	0.14	0.09 J	0.103
3/14/2019	Assessment	<0.02 U	0.55	17.2	<0.02 U	0.05 J	0.385	5.43	0.622	0.17	0.04 J	<0.009 U	<0.004 U	<0.4 U	0.08 J	0.1 J

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: MW-1618
Big Sandy - BAP
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
9/8/2016	Background	0.083	70.5	63.8	0.1 J	6.2	652	339
11/7/2016	Background	0.129	61.7	52.7	0.14	5.3	620	319
1/10/2017	Background	0.081	68.4	56.2	0.09 J	6.1	678	335
2/20/2017	Background	0.111	59.1	37.8	0.1 J	6.4	530	277
4/24/2017	Background	0.108	61.6	40.5	0.1 J	6.0	570	312
5/22/2017	Background	0.118	66.1	37.2	0.11	6.0	657	356
6/26/2017	Background	0.156	68.9	37.5	0.09 J	6.2	594	340
7/11/2017	Background	0.177	58.2	31.4	0.1 J	6.0	534	301
9/13/2017	Background	0.161	51.3	27.7	0.16	5.7	514	276
11/28/2017	Detection	0.126	52.8	35.2	0.1 J	6.3	526	307
1/30/2018	Detection	- -	- -	- -	- -	6.0	- -	393
4/24/2018	Assessment	0.145	50.8	31.2	0.18	5.9	484	267
9/24/2018	Assessment	0.133	70.0	71.4	0.09	5.9	764	422
3/14/2019	Assessment	0.09 J	53.4	49.8	0.12	5.7	574	287

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: MW-1618
Big Sandy - BAP
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
9/8/2016	Background	0.02 J	0.28	18.0	0.01 J	0.06	0.3	2.02	1.506	0.1 J	0.251	0.0008 J	<0.002 U	0.36	0.09 J	0.083
11/7/2016	Background	0.02 J	0.22	16.3	0.01 J	0.05	0.8	1.93	1.810	0.14	0.317	<0.0002 U	<0.002 U	0.17	0.09 J	0.071
1/10/2017	Background	0.01 J	2.24	19.4	0.01 J	0.03	0.239	5.17	1.277	0.09 J	0.100	<0.0002 U	<0.002 U	0.20	0.05 J	0.066
2/20/2017	Background	0.01 J	0.77	16.1	0.01 J	0.04	0.287	1.98	0.463	0.1 J	0.109	0.002	<0.002 U	1.09	0.08 J	0.191
4/24/2017	Background	0.02 J	0.59	18.2	0.009 J	0.04	0.367	1.46	1.106	0.1 J	0.150	<0.0002 U	<0.002 U	0.15	0.04 J	0.079
5/22/2017	Background	0.02 J	0.54	18.3	0.01 J	0.05	0.262	2.72	0.597	0.11	0.107	0.007	<0.002 U	0.06 J	0.07 J	0.109
6/26/2017	Background	0.02 J	0.37	17.5	0.008 J	0.04	0.239	1.34	0.871	0.09 J	0.077	0.008	<0.002 U	0.06 J	0.09 J	0.086
7/11/2017	Background	0.04 J	0.32	16.0	0.006 J	0.03	0.149	1.16	4.472	0.1 J	0.121	0.005	<0.002 U	0.07 J	0.08 J	0.073
4/24/2018	Assessment	0.03 J	0.43	16.8	0.01 J	0.03	0.05 J	2.26	1.663	0.18	0.052	<0.0002 U	<0.002 U	0.09 J	0.09 J	0.113
9/24/2018	Assessment	0.02 J	3.74	31.5	0.02 J	0.05	0.326	12.1	1.266	0.09	0.083	0.014	- -	0.10	0.08 J	0.141
3/14/2019	Assessment	<0.02 U	1.78	18.8	<0.02 U	0.04 J	0.39	2.98	0.143	0.12	0.141	<0.009 U	<0.004 U	<0.4 U	0.06 J	0.1 J

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: MW-1619
Big Sandy - BAP
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
9/8/2016	Background	0.038	163	1050	0.07	6.1	2140	48.0
11/7/2016	Background	0.163	141	1060	0.07 J	5.4	1900	50.2
1/10/2017	Background	0.032	152	1070	0.05 J	6.0	1950	48.2
2/20/2017	Background	0.102	143	1040	0.05 J	6.1	1850	46.5
4/24/2017	Background	0.108	146	1080	0.06	5.9	1900	47.8
5/22/2017	Background	0.061	151	1080	0.06 J	6.0	2050	46.5
6/26/2017	Background	0.073	157	1030	<0.05 U	6.0	2210	48.1
7/11/2017	Background	0.024	150	1060	<0.2 U	6.4	2180	46.7
9/13/2017	Background	0.047	137	1050	<0.1 U	5.9	2190	55.0
11/28/2017	Detection	0.103	150	1070	<0.1 U	6.4	1990	65.1
4/24/2018	Assessment	0.06	146	1100	0.07 J	6.3	1910	48.7
9/24/2018	Assessment	0.054	146	1070	<0.05 U	6.0	2070	44.9
3/11/2019	Assessment	0.06 J	135	1090	0.06 J	6.6	2210	46.4

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: MW-1619
Big Sandy - BAP
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
9/8/2016	Background	0.03 J	2.82	1440	0.053	0.03 J	0.7	14.0	7.68	0.07	0.486	0.020	<0.002 U	0.56	0.2 J	0.05 J
11/7/2016	Background	<0.02 U	3.06	1710	0.044	0.04 J	1.2	7.64	11.52	0.07 J	0.507	0.013	<0.002 U	0.57	0.1 J	0.116
1/10/2017	Background	<0.02 U	2.15	1230	0.02 J	0.03 J	0.361	6.98	9.57	0.05 J	0.127	0.018	<0.002 U	0.23	<0.06 U	0.03 J
2/20/2017	Background	<0.02 U	3.26	1540	0.045	0.03 J	0.712	7.11	10.49	0.05 J	0.222	0.021	<0.002 U	1.58	0.1 J	0.153
4/24/2017	Background	0.03 J	3.22	1820	0.04 J	0.05	0.714	6.81	8.01	0.06	0.318	0.019	<0.002 U	1.54	<0.06 U	0.04 J
5/22/2017	Background	<0.02 U	3.04	1710	0.052	0.05	0.611	5.62	6.35	0.06 J	0.425	0.021	<0.002 U	0.23	0.1 J	0.06 J
6/26/2017	Background	<0.02 U	2.52	1240	0.04 J	0.03 J	2.18	5.97	9.57	<0.05 U	0.179	0.021	<0.002 U	0.25	0.08 J	0.05 J
7/11/2017	Background	<0.02 U	2.84	1290	0.04 J	0.04 J	0.483	7.00	10.11	<0.2 U	0.29	0.020	<0.002 U	0.2 J	0.2 J	0.05 J
4/24/2018	Assessment	0.04 J	3.15	1570	0.04 J	0.03 J	0.226	5.70	7.32	0.07 J	0.14	0.018	<0.002 U	0.38	<0.06 U	0.06 J
9/24/2018	Assessment	0.03 J	1.84	970	0.072	0.12	0.445	9.64	7.25	<0.05 U	0.178	0.027	- -	0.09 J	0.2	0.058
3/11/2019	Assessment	<0.04 U	3.26	1460	<0.04 U	0.03 J	0.414	6.42	8.25	0.06 J	0.1 J	0.01 J	<0.002 U	<0.8 U	0.09 J	<0.2 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: MW-1620
Big Sandy - BAP
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
9/8/2016	Background	0.048	8.57	17.3	0.05 J	5.7	174	50.5
11/7/2016	Background	0.111	8.23	18.2	0.06 J	4.9	164	52.6
1/10/2017	Background	0.055	9.13	17.8	0.05 J	5.8	180	50.0
2/20/2017	Background	0.070	8.28	15.3	0.06	6.0	176	48.6
4/24/2017	Background	0.057	8.28	14.0	0.06	5.7	174	50.6
5/22/2017	Background	0.042	8.58	12.9	0.06	5.7	174	50.1
6/26/2017	Background	0.096	9.02	14.1	0.04 J	5.8	190	51.4
7/11/2017	Background	0.040	8.46	15.0	0.05 J	5.9	166	51.3
9/13/2017	Background	0.053	8.62	16.6	0.06	5.2	164	53.6
11/28/2017	Detection	0.086	8.91	18.1	0.06	5.8	172	57.1
4/24/2018	Assessment	0.117	8.40	18.1	0.07	5.5	138	51.2
9/24/2018	Assessment	0.055	9.46	16.5	0.07	6.1	178	50.4
3/11/2019	Assessment	0.03 J	9.41	6.25	0.09	6.5	169	48.5

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: MW-1620
Big Sandy - BAP
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
9/8/2016	Background	<0.01 U	8.11	131	0.01 J	0.04	0.3	20.5	2.086	0.05 J	0.173	0.008	<0.002 U	0.21	<0.03 U	0.073
11/7/2016	Background	<0.01 U	8.39	126	0.02 J	0.06	0.7	22.5	4.600	0.06 J	0.268	0.005	<0.002 U	0.26	0.04 J	0.055
1/10/2017	Background	<0.01 U	8.68	118	0.02 J	0.05	0.243	21.7	1.479	0.05 J	0.025	0.005	<0.002 U	0.74	<0.03 U	0.04 J
2/20/2017	Background	<0.01 U	12.2	137	0.022	0.05	0.382	23.0	1.865	0.06	0.035	0.006	<0.002 U	0.68	0.03 J	0.087
4/24/2017	Background	0.01 J	15.4	153	0.020	0.04	0.437	20.6	0.806	0.06	0.038	0.004	<0.002 U	0.41	<0.03 U	0.056
5/22/2017	Background	<0.01 U	15.6	148	0.02 J	0.03	0.278	16.6	1.659	0.06	0.021	0.010	<0.002 U	0.23	0.04 J	0.052
6/26/2017	Background	<0.01 U	14.4	145	0.022	0.03	0.262	19.1	1.657	0.04 J	0.02 J	0.010	<0.002 U	0.21	0.03 J	0.058
7/11/2017	Background	<0.01 U	12.7	135	0.02 J	0.04	0.189	18.6	4.483	0.05 J	0.022	0.007	<0.002 U	0.24	0.05 J	0.061
4/24/2018	Assessment	0.03 J	14.8	159	0.026	0.04	0.212	22.6	0.714	0.07	0.030	0.005	<0.002 U	0.27	<0.03 U	0.068
9/24/2018	Assessment	0.05 J	12.4	141	0.032	0.04	0.294	20.4	1.327	0.07	0.361	0.011	- -	0.17	<0.03 U	0.065
3/11/2019	Assessment	<0.02 U	21.4	173	<0.02 U	<0.01 U	0.394	12.1	0.901	0.09	0.02 J	<0.009 U	<0.002 U	<0.4 U	<0.03 U	<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: Residence Time Calculation Summary
Big Sandy Bottom Ash Ponds

Geosyntec Consultants, Inc.

			2019-03	
CCR Management Unit	Monitoring Well	Well Diameter (inches)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Bottom Ash Pond	MW-1614 [2]	4.0	94	1.3
	MW-1615 [2]	4.0	96	1.3
	MW-1618 [2]	4.0	115	1.1
	MW-1619 [1]	4.0	83	1.5
	MW-1620 [1]	4.0	1175	0.1

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

APPENDIX 2—Figures

Figures follow showing the PE-certified groundwater monitoring network with the corresponding well identifications along with static water elevation data and groundwater flow directions each time the groundwater was sampled in the form of annotated potentiometric surface maps.

Legend

- Monitoring Well (Sampling)
- Monitoring Well (Water Level Measurement Only)
- CCR Unit - Bottom Ash Ponds (Approximate Limits)

N

MW-1619

NORTH BOTTOM ASH POND

SOUTH BOTTOM ASH POND

MW-1618

MW-1616

MW-1615

MW-1614

MW-1617

MW-1620

Big Sandy River

Big Sandy River

0 150 300 600 900 1,200 Feet

N:\AEP\GIS\MXDs\Bottom Ash Pond\July 2016\August 2016 MW Network.mxd\DY\14 November 2016

GROUNDWATER MONITORING WELL NETWORK

BOTTOM ASH PONDS
AEP BIG SANDY PLANT
LOUISA, KENTUCKY

Geosyntec consultants

AUSTIN, TX

DECEMBER 2016

FIGURE 1

Legend

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

Notes

- Monitoring well coordinates and water level data (collected on March 11, 2019) provided by AEP.
- Big Sandy River elevation at Louisa Station recorded as 530.29 feet above mean sea level on March 11, 2019 (source: USGS).
- Groundwater elevation units are feet above mean sea level.

400 200 0 400 Feet

Potentiometric Surface Map - Uppermost Aquifer March 2019

AEP Big Sandy Plant - Bottom Ash Ponds
Louisa, Kentucky

Geosyntec consultants

Columbus, Ohio | 2020/01/22

Figure **2**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Big Sandy\2019\AEP-BigSandy_BAP_GW_2019-03-March.mxd. ARevezzo. 1/22/2020. CHA8423.

APPENDIX 3—Statistical Analysis Summaries

The January and July 2019 statistical analysis summaries concluding that no SSLs were identified at the CCR unit follow.

STATISTICAL ANALYSIS SUMMARY
BOTTOM ASH POND
Big Sandy Plant
Louisa, Kentucky

Submitted to

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
Suite 103
Columbus, Ohio 43221

January 8, 2019

CHA8473

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LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
BAP	Bottom Ash Pond
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

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 Bottom Ash Pond (BAP), an existing CCR unit at the Big Sandy Power Plant located in Louisa, Kentucky.

Based on detection monitoring conducted in 2017 and 2018, statistically significant increases (SSIs) over background were concluded for boron and sulfate at the BAP. An alternate source was not identified at the time, so two assessment monitoring events were conducted at the BAP in 2018, in accordance with 40 CFR 257.95.

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 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. No SSLs were identified, but Appendix III concentrations for boron and sulfate remained above background. Thus, either the unit will remain in assessment monitoring or an alternative source demonstration will be conducted to evaluate if the unit can return to detection 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, two sets of samples were collected for analysis from each upgradient and downgradient well to meet the requirements of 40 CFR 257.95(b) and 257.95(d)(1). Samples from both sampling events were analyzed for the Appendix III and Appendix IV parameters. A summary of data collected during assessment monitoring 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.9.5 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 BAP 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(b) and 257.95(d)(1) were screened for potential outliers. Outliers identified from the background and detection monitoring events conducted through January 2018 were summarized in a previous report (Geosyntec, 2018). While the reported combined radium value of 83.973 pCi/L for the June 2017 sampling event at downgradient well MW-1614 was not previously identified as an outlier, it was removed from the dataset as an outlier during these analyses based on recent sampling values. Additionally, the reported combined radium value of 65.9 pCi/L for the September 24, 2018 sampling event at downgradient well MW-1614 was identified as an outlier and removed from the database without replacement. The removal of these values did not affect the determination that an SSL was not present for radium at MW-1614.

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 regional screening level (RSL) 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 antimony, arsenic, barium, cadmium, cobalt, fluoride, and selenium due to apparent non-normal distributions and for mercury 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.

No SSLs were identified at the Big Sandy BAP.

2.2.3 Evaluation of Potential Appendix III SSIs

The CCR rule allows CCR units to move from assessment monitoring to detection monitoring if all Appendix III and Appendix IV parameters were at or below background levels for two consecutive sampling events [40 CFR 257.95(e)]. Since no Appendix IV SSLs were identified, Appendix III results were analyzed 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, chloride, and TDS, whereas interwell tests were used to evaluate potential SSIs for boron, fluoride, pH, and sulfate.

Prediction limits for the interwell tests were recalculated using data collected during the 2018 assessment monitoring events. Six data points (i.e., two samples 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 prediction limits were used to evaluate potential SSIs for boron, fluoride, pH, and sulfate.

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

Data collected during the second assessment monitoring event from each compliance well were compared to the prediction limits to evaluate SSIs. 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 0.132 mg/L at MW-1614 (0.146 mg/L and 0.183 mg/L) and MW-1618 (0.145 mg/L and 0.133 mg/L).

- Sulfate concentrations exceeded the interwell UPL of 54 mg/L at MW-1614 (351 mg/L and 295 mg/L), MW-1615 (256 mg/L and 474 mg/L), and MW-1618 (267 mg/L and 422 mg/L).

Based on these results, concentrations of Appendix III parameters exceeded background levels at compliance wells at the Big Sandy BAP during assessment monitoring. As a result, the Big Sandy BAP CCR unit will remain in assessment monitoring.

2.3 Conclusions

Two assessment monitoring events were conducted in 2018 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 five potential outliers, including two new outliers which were not previously identified. These outliers were removed without replacement. GWPSs were 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. No SSLs were identified.

The Appendix III results were evaluated to assess whether concentrations of Appendix III parameters exceeded background levels. Interwell tests were used to evaluate potential SSIs for boron, fluoride, pH, and sulfate, and intrawell tests were used to evaluate potential SSIs for calcium, chloride, and TDS. The prediction limits for the interwell tests were updated with additional data collected from the background wells. Prediction limits were recalculated using a one-of-two retesting procedure. The prediction limits calculated during detection monitoring were used for the intrawell tests. Boron and sulfate results exceeded background levels.

Based on this evaluation, the Big Sandy BAP CCR unit will either remain in assessment monitoring or an alternative source demonstration will be conducted to evaluate if the unit can return to detection monitoring.

SECTION 3

REFERENCES

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

Geosyntec Consultants (Geosyntec). 2018. Statistical Analysis Summary – Bottom Ash Pond, Big Sandy Plant, Louisa, Kentucky. January 15, 2018.

United States Environmental Protection Agency (USEPA). 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. EPA 530/R-09-007. March 2009.

TABLES

Table 1 – Groundwater Data Summary
Big Sandy – Bottom Ash Pond

Geosyntec Consultants, Inc.

Parameter	Unit	MW-1614		MW-1615		MW-1618		MW-1619		MW-1620	
		4/24/2018	9/24/2018	4/24/2018	9/24/2018	4/24/2018	9/24/2018	4/24/2018	9/24/2018	4/24/2018	9/24/2018
Antimony	µg/L	0.05 J	0.05	0.08	0.03 J	0.03 J	0.02 J	0.04 J	0.03 J	0.03 J	0.05 J
Arsenic	µg/L	11.5	13.9	0.23	1.2	0.43	3.74	3.15	1.84	14.8	12.4
Barium	µg/L	58.7	42.6	18.5	27.3	16.8	31.5	1570	970	159	141
Beryllium	µg/L	0.097	0.113	0.008 J	0.024	0.01 J	0.02 J	0.04J	0.072	0.026	0.032
Boron	mg/L	0.146	0.183	0.099	0.156	0.145	0.133	0.06	0.054	0.117	0.055
Cadmium	µg/L	0.02 U	0.02 U	0.07	0.17	0.03	0.05	0.03 J	0.12	0.04	0.04
Calcium	mg/L	49.1	49.6	45.2	58.3	50.8	70	146	146	8.4	9.46
Chloride	mg/L	50.5	42.1	30.4	82.1	31.2	71.4	1100	1070	18.1	16.5
Chromium	µg/L	0.341	0.405	0.215	0.323	0.05 J	0.326	0.226	0.445	0.212	0.294
Cobalt	µg/L	2.16	1.65	3.1	27.1	2.26	12.1	5.7	9.64	22.6	20.4
Combined Radium	pCi/L	0.268	65.9	0.921	1.07	1.66	1.27	7.32	7.25	0.714	1.33
Fluoride	mg/L	0.09 J	0.08 J	0.2	0.11	0.18	0.09	0.07 J	0.02 U	0.07	0.07
Lead	µg/L	0.087	0.141	0.171	0.07	0.052	0.083	0.14	0.178	0.03	0.361
Lithium	mg/L	0.002	0.001 U	0.0008 J	0.003	0.001 U	0.014	0.018	0.027	0.005	0.011
Mercury	µg/L	0.007 U	-	0.007 U	-	0.007 U	-	0.007 U	-	0.007 U	-
Molybdenum	µg/L	0.45	0.660	0.08 J	0.14	0.09 J	0.1	0.38	0.09 J	0.27	0.17
Selenium	µg/L	0.09 J	0.1	0.08 J	0.09 J	0.09 J	0.08 J	0.2 U	0.2	0.10 U	0.10 U
Total Dissolved Solids	mg/L	592	578	404	854	484	764	1910	2070	138	178
Sulfate	mg/L	351	295	256	474	267	422	48.7	44.9	51.2	50.4
Thallium	µg/L	0.02 J	0.02 J	0.097	0.103	0.113	0.141	0.06 J	0.058	0.068	0.065
pH	SU	5.94	6.38	6.11	5.80	5.89	5.89	6.34	5.97	5.53	6.08

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 method detection limit and is reported as the reporting limit
J: Estimated value. Parameter was detected in concentrations below the reporting limit
-: Not sampled

Table 2: Groundwater Protection Standards
Big Sandy Plant - Bottom Ash Pond

Constituent Name	MCL	RSL	Background Limit
Antimony, Total (mg/L)	0.006		0.00005
Arsenic, Total (mg/L)	0.01		0.016
Barium, Total (mg/L)	2		1.82
Beryllium, Total (mg/L)	0.004		0.00007
Cadmium, Total (mg/L)	0.005		0.00012
Chromium, Total (mg/L)	0.1		0.0017
Cobalt, Total (mg/L)	n/a	0.006	0.023
Combined Radium, Total (pCi/L)	5		14.43
Fluoride, Total (mg/L)	4		0.2
Lead, Total (mg/L)	n/a	0.015	0.00058
Lithium, Total (mg/L)	n/a	0.04	0.031
Mercury, Total (mg/L)	0.002		0.000007
Molybdenum, Total (mg/L)	n/a	0.1	0.002
Selenium, Total (mg/L)	0.05		0.2
Thallium, Total (mg/L)	0.002		0.00014

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/RSL is used as the GWPS.

Table 3: Appendix III Data Evaluation
Big Sandy Plant - Bottom Ash Pond

Geosyntec Consultants, Inc.

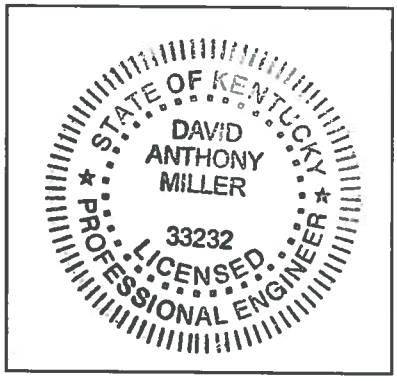
Parameter	Units	Description	MW-1614		MW-1615		MW-1618	
			4/24/2018	9/24/2018	4/24/2018	9/24/2018	4/24/2018	9/24/2018
Boron	mg/L	Interwell Backgorund Value (UPL)	0.132					
		Assessment Monitoring Result	**0.146**	**0.183**	0.099	**0.156**	**0.145**	**0.133**
Calcium	mg/L	Intrawell Backgorund Value (UPL)	68.1		96.0		77.5	
		Assessment Monitoring Result	49.1	49.6	45.2	58.3	50.8	70.0
Chloride	mg/L	Intrawell Backgorund Value (UPL)	92.5		59.1		71.1	
		Assessment Monitoring Result	50.5	42.1	30.4	**82.1**	31.2	**71.4**
Fluoride	mg/L	Interwell Backgorund Value (UPL)	0.3					
		Assessment Monitoring Result	0.09	0.08	0.2	0.11	0.18	0.09
pH	SU	Interwell Backgorund Value (UPL)	6.50					
		Interwell Background Value (LPL)	5.13					
		Assessment Monitoring Result	5.94	6.38	6.11	5.80	5.89	5.89
Sulfate	mg/L	Interwell Backgorund Value (UPL)	54					
		Assessment Monitoring Result	**351**	**295**	**256**	**474**	**267**	**422**
Total Dissolved Solids	mg/L	Intrawell Backgorund Value (UPL)	937		902		738	
		Assessment Monitoring Result	592	578	404	854	484	**764**

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.
Based on a 1-of-2 resampling, a statistically significant increase (SSI) is only identified when both samples in the detection monitoring period are above the calculated background value.

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 Big Sandy 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

33232	KENTUCKY	01.08.19
License Number	Licensing State	Date

ATTACHMENT B

Statistical Analysis Output

GROUNDWATER STATS CONSULTING

November 11, 2018

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
150 E. Wilson Bridge Rd., #232
Worthington, OH 43085

Re: Big Sandy Bottom Ash Pond
Assessment Monitoring Event – September 2018

Dear Ms. Kreinberg,

Groundwater Stats Consulting (GSC), formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the evaluation of groundwater data for the September 2018 Assessment Monitoring event for American Electric Power Company's Big Sandy 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 site for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, consists of the following:

- **Upgradient wells:** MW-1619 and MW-1620; and
- **Downgradient wells:** MW-1614, MW-1615, and MW-1618.

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; and

- **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. Values in background which have previously been flagged as outliers may be seen in a lighter font and disconnected symbol on the graphs. Additionally, a summary of flagged values follows this letter.

Evaluation of Appendix III Parameters

Interwell prediction limits combined with a 1-of-2 verification strategy were constructed for boron, fluoride, pH and sulfate; and intrawell prediction limits combined with a 1-of-2 verification strategy were constructed for calcium, chloride and TDS. 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. SSIs were noted for some of the Appendix III parameters and 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 data are statistically increasing, decreasing or stable. No statistically significant trends were found. The Trend Test Summary Table follows this letter.

Evaluation of Appendix IV Parameters

Parametric tolerance limits were used to calculate background limits from pooled upgradient well data for Appendix IV parameters with a target of 95% confidence and 95% coverage to determine the Alternate Contaminant Level (ACL). 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 Regional Screening Levels (RSLs) in the Groundwater Protection Standards (GWPS) table following this letter to determine the highest limit for use as the GWPS in the Confidence Interval comparisons.

Confidence intervals were then constructed on downgradient wells for each of the Appendix IV parameters using the highest limit of either the MCL, RSL, or ACL as discussed above. Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. No exceedances were noted for any of the well/constituent pairs. Well MW-1614 had reported observations of 83.97 pCi/L and 65.90 pCi/L on 6/26/17 and 9/24/18, respectively. Because those values are anomalous per discussion with Geosyntec, they were flagged in the database as outliers and deselected prior to construction of the confidence interval. A summary of the confidence interval results follows this letter.

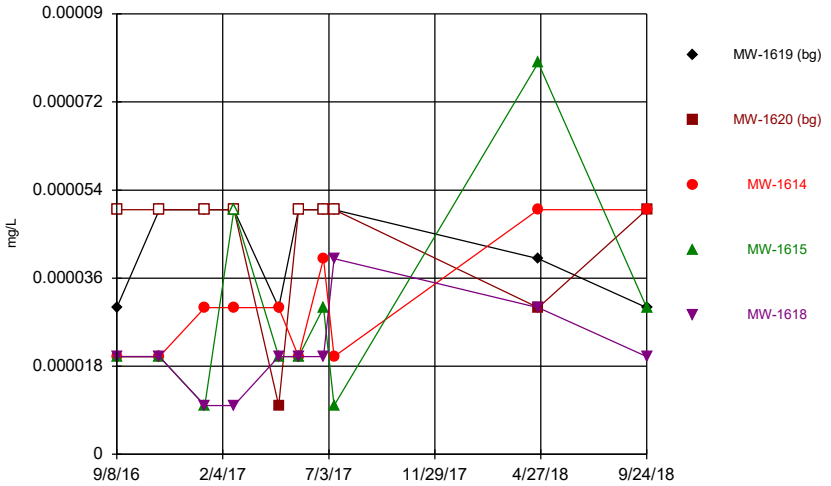
Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for Big Sandy Bottom Ash Pond. If you have any questions or comments, please feel free to contact me.

For Groundwater Stats Consulting,

Kristina L. Rayner
Groundwater Statistician

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

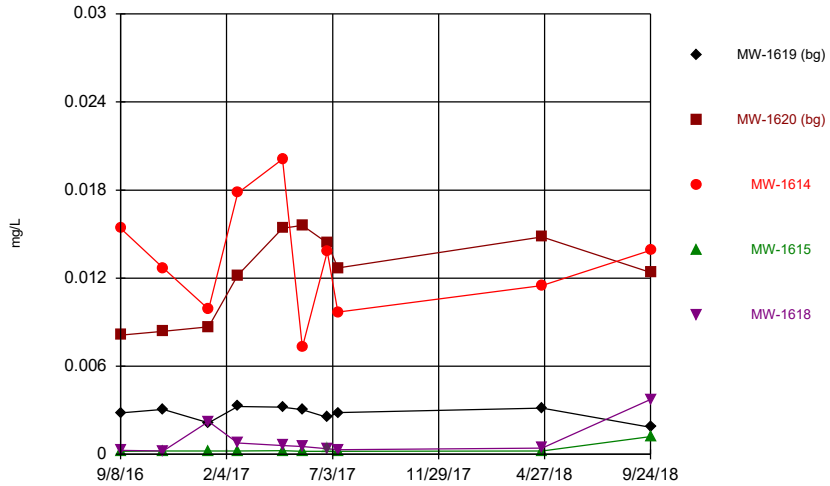
Time Series



Constituent: Antimony, total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

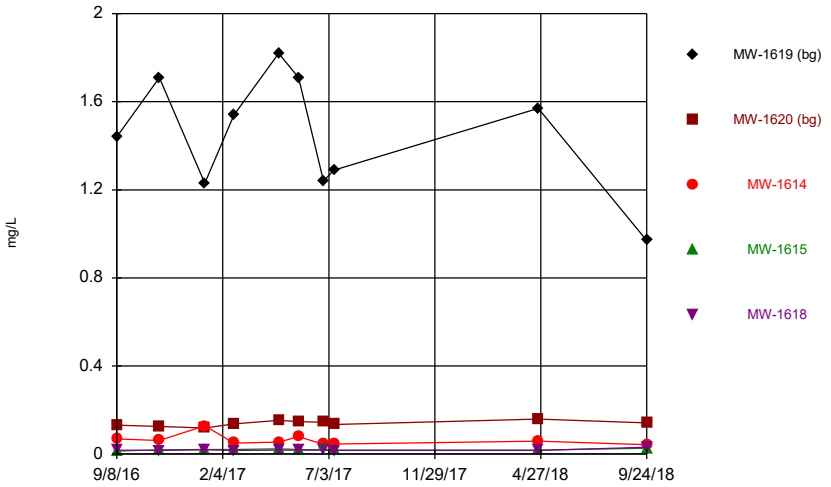
Time Series



Constituent: Arsenic, Total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

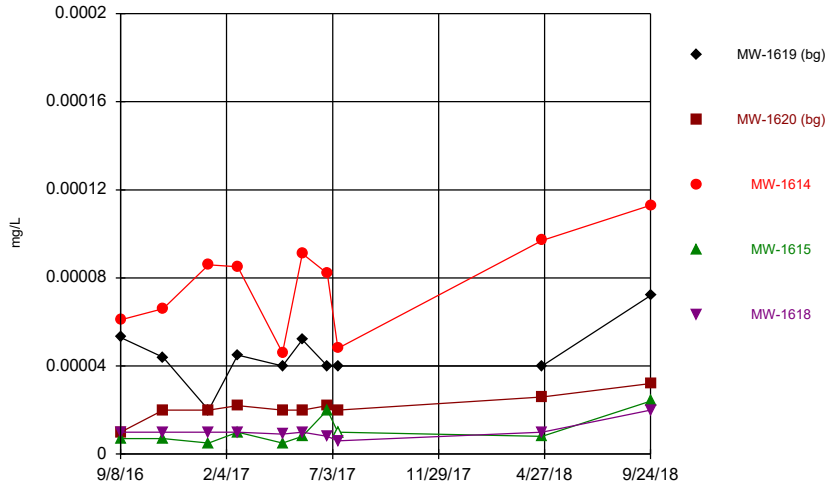
Time Series



Constituent: Barium, Total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

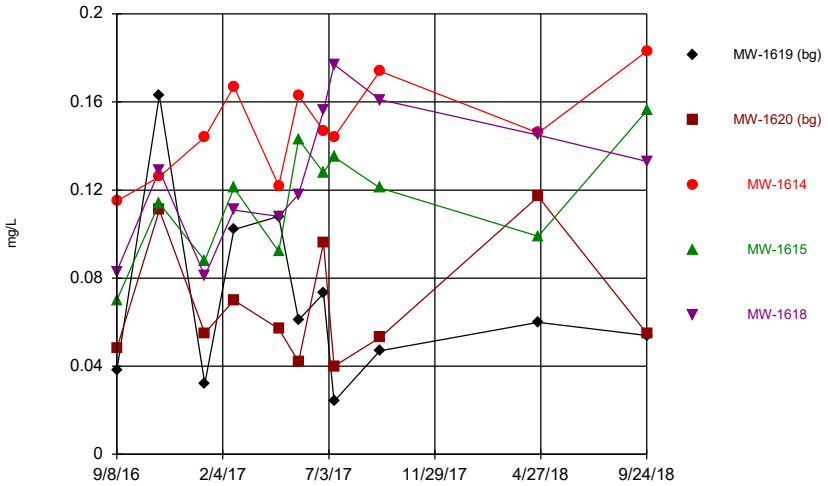
Time Series



Constituent: Beryllium, total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

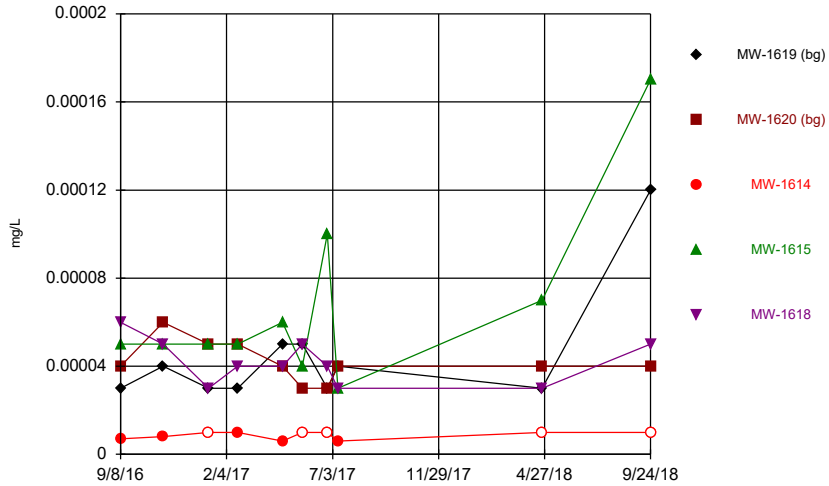
Time Series



Constituent: Boron, total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

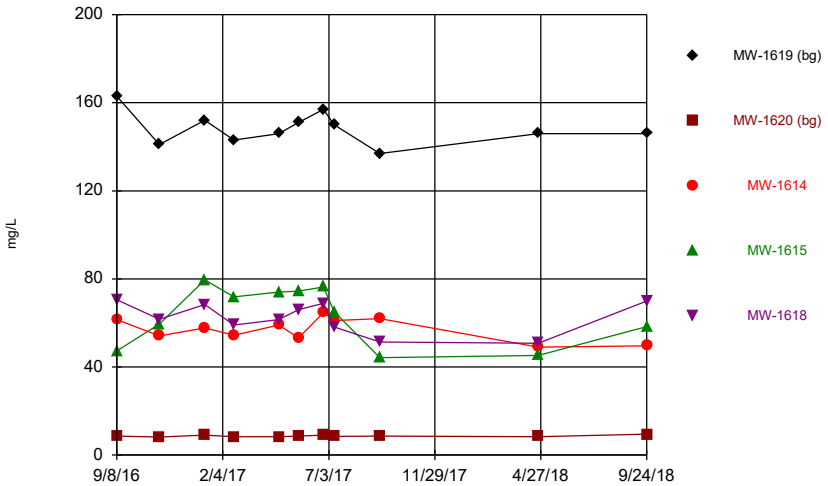
Time Series



Constituent: Cadmium, total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

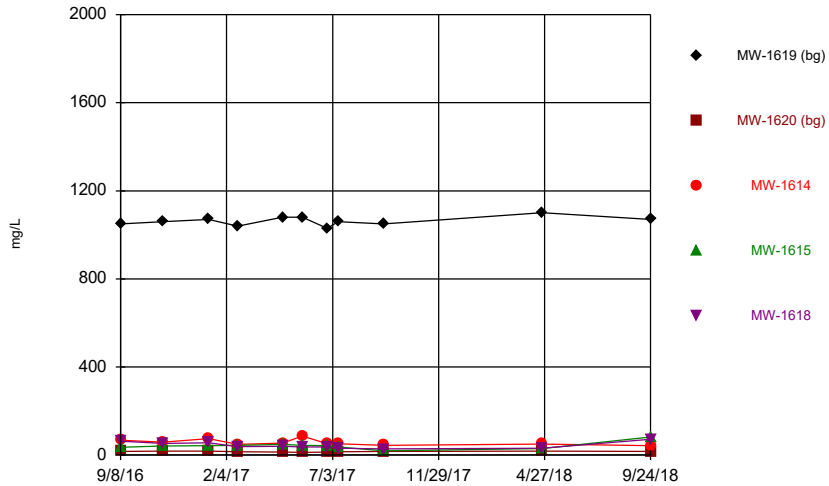
Time Series



Constituent: Calcium, total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

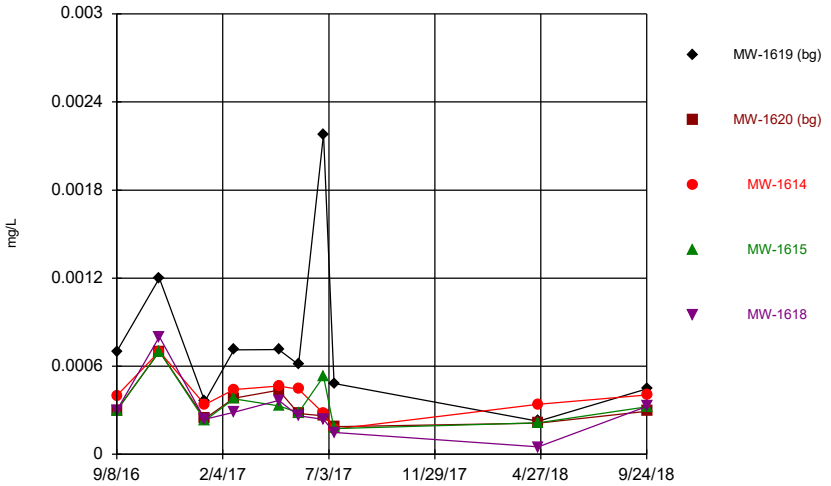
Time Series



Constituent: Chloride, total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

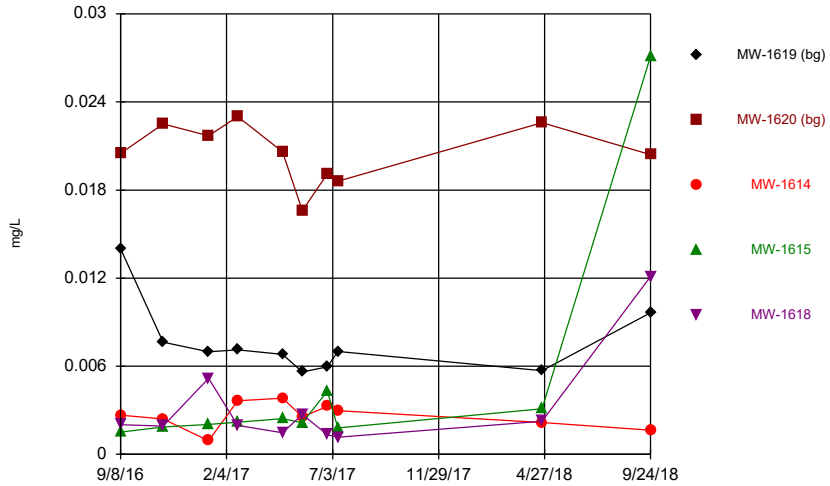
Time Series



Constituent: Chromium, total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

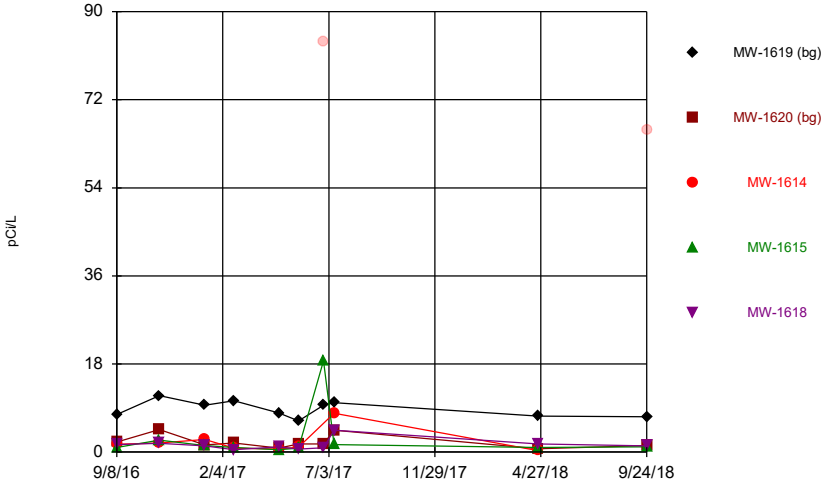
Time Series



Constituent: Cobalt, total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

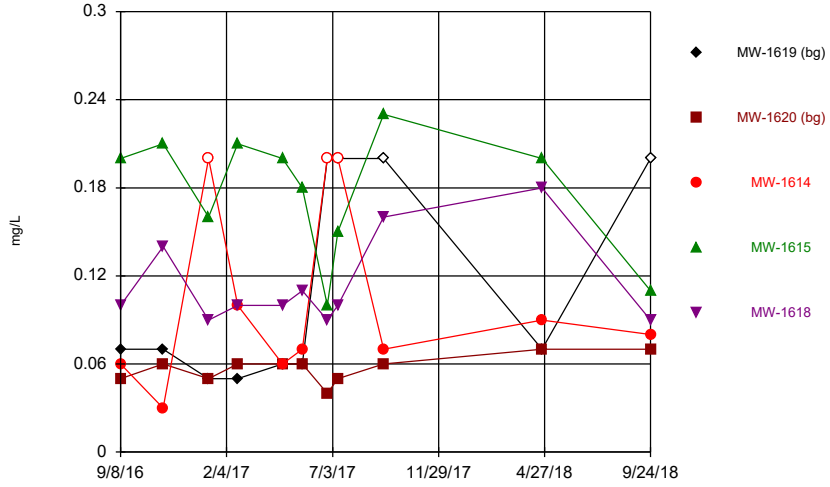
Time Series



Constituent: Combined Radium 226 + 228 Analysis Run 11/11/2018 8:56 AM View: Time Series - All Well
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

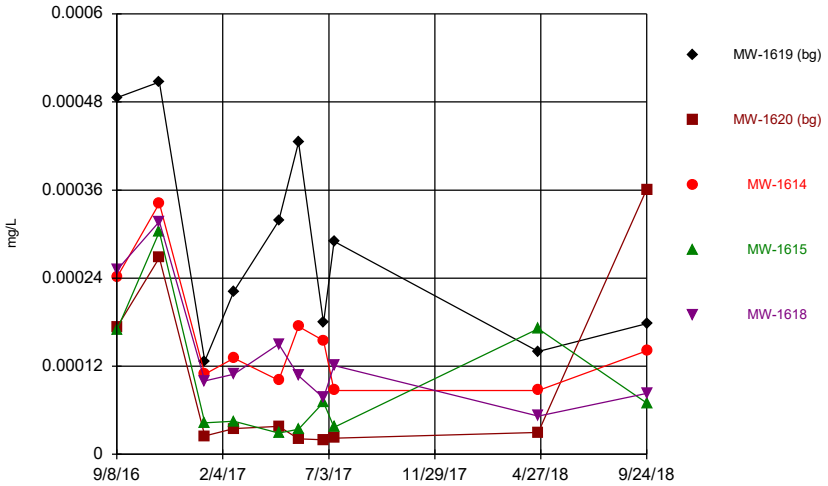
Time Series



Constituent: Fluoride, total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

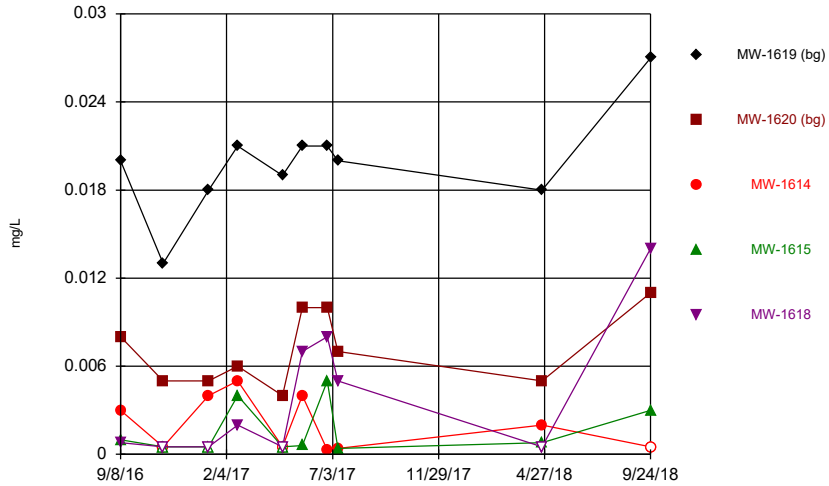
Time Series



Constituent: Lead, total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

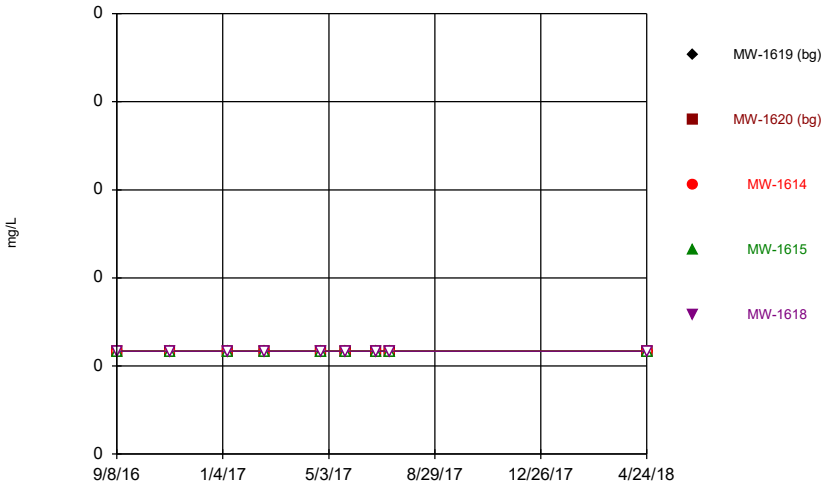
Time Series



Constituent: Lithium, total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

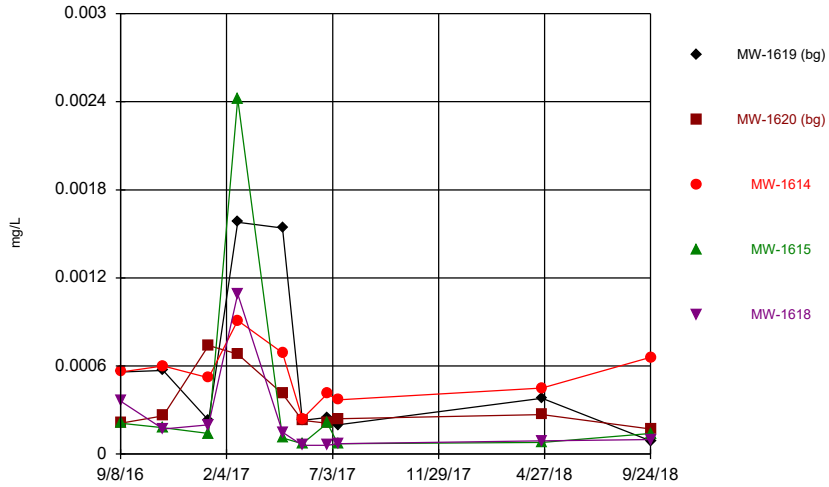
Time Series



Constituent: Mercury, total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

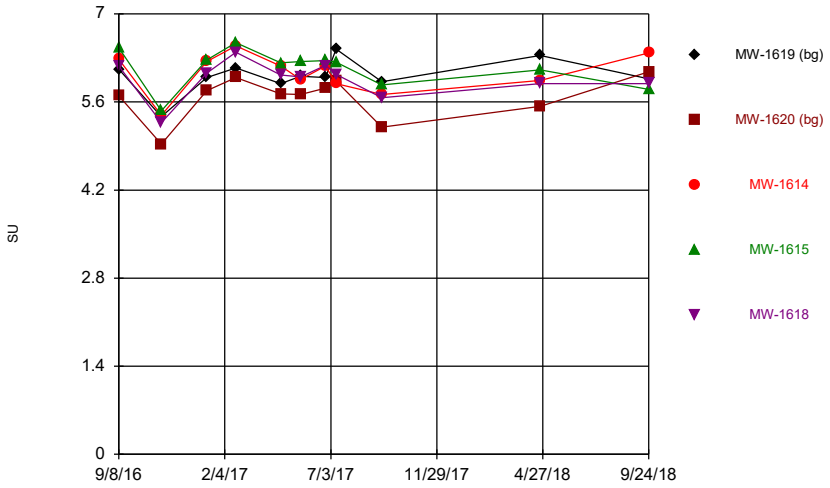
Time Series



Constituent: Molybdenum, total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

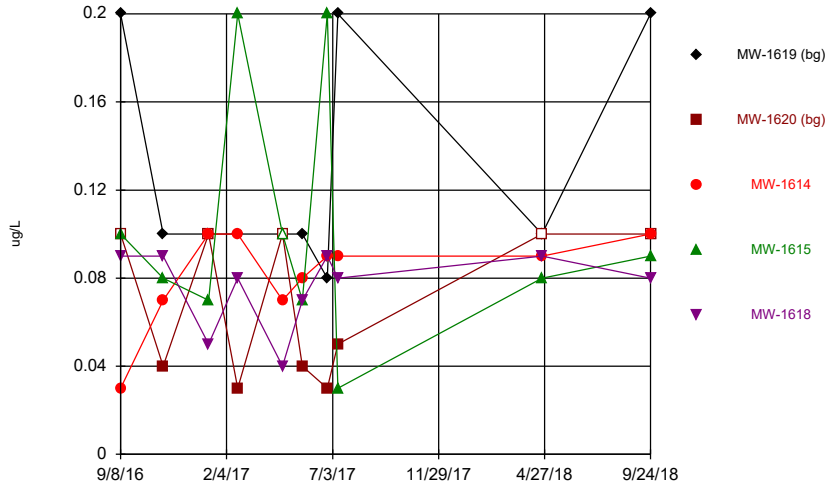
Time Series



Constituent: pH, field Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

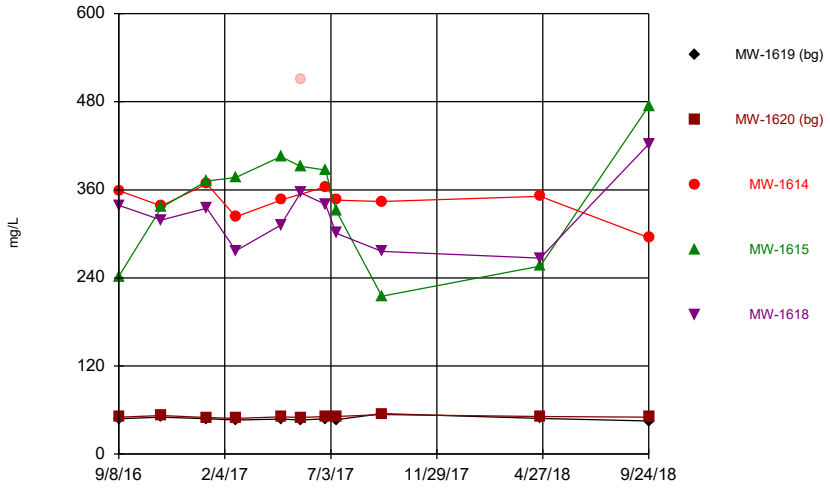
Time Series



Constituent: Selenium, Total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

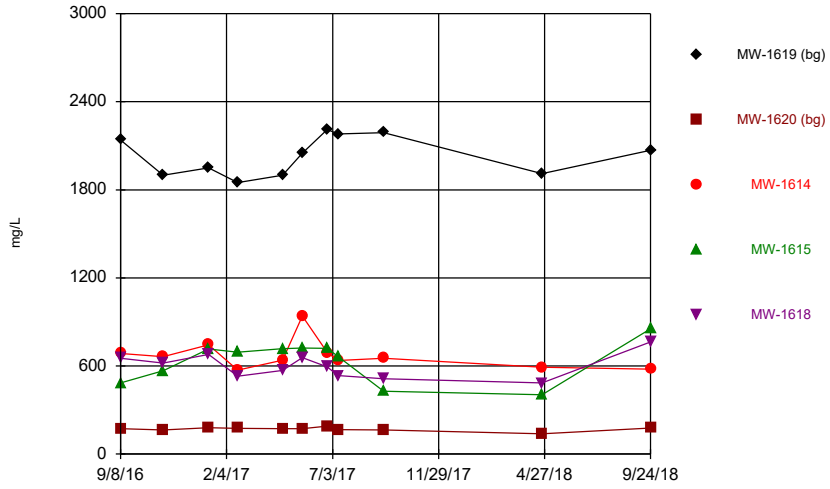
Time Series



Constituent: Sulfate, total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

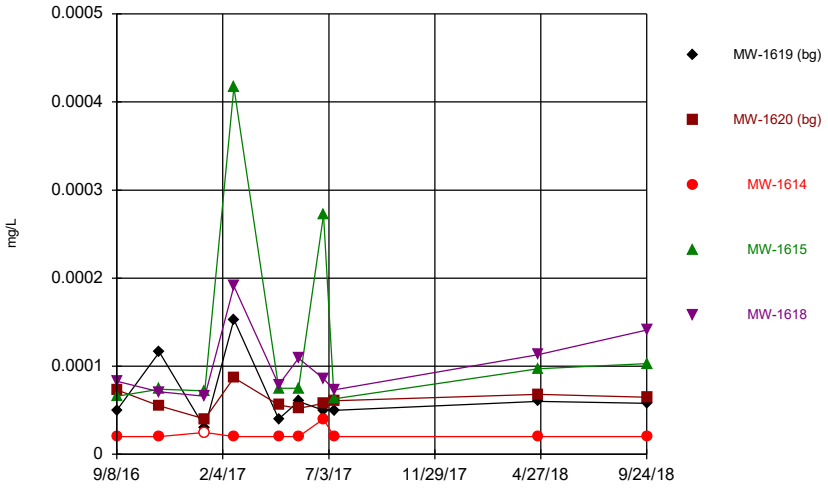
Time Series



Constituent: TDS Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Hollow symbols indicate censored values.

Time Series



Constituent: Thallium, Total Analysis Run 11/11/2018 8:56 AM View: Time Series - All Wells

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Interwell Prediction Limit Summary Table - Significant Results

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 10/30/2018, 9:06 AM

Constituent	Well	Upper Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	**MW-1614**	**0.1319**	**9/24/2018**	**0.183**	**Yes**	**22**	**0.06845**	**0.03399**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Boron, total (mg/L)	**MW-1615**	**0.1319**	**9/24/2018**	**0.156**	**Yes**	**22**	**0.06845**	**0.03399**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Boron, total (mg/L)	**MW-1618**	**0.1319**	**9/24/2018**	**0.133**	**Yes**	**22**	**0.06845**	**0.03399**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Sulfate, total (mg/L)	**MW-1614**	**54.19**	**9/24/2018**	**295**	**Yes**	**22**	**49.59**	**2.465**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Sulfate, total (mg/L)	**MW-1615**	**54.19**	**9/24/2018**	**474**	**Yes**	**22**	**49.59**	**2.465**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Sulfate, total (mg/L)	**MW-1618**	**54.19**	**9/24/2018**	**422**	**Yes**	**22**	**49.59**	**2.465**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**

Interwell Prediction Limit Summary Table - All Results

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 10/30/2018, 9:06 AM

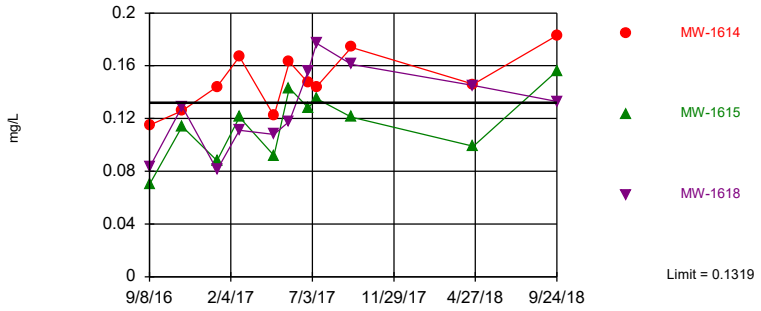
Constituent	Well	Upper Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	**MW-1614**	**0.1319**	**9/24/2018**	**0.183**	**Yes**	**22**	**0.06845**	**0.03399**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Boron, total (mg/L)	**MW-1615**	**0.1319**	**9/24/2018**	**0.156**	**Yes**	**22**	**0.06845**	**0.03399**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Boron, total (mg/L)	**MW-1618**	**0.1319**	**9/24/2018**	**0.133**	**Yes**	**22**	**0.06845**	**0.03399**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Fluoride, total (mg/L)	MW-1614	0.2	9/24/2018	0.08	No	22	n/a	n/a	18.18	n/a	n/a	0.003586	NP Inter (normality) ...
Fluoride, total (mg/L)	MW-1615	0.2	9/24/2018	0.11	No	22	n/a	n/a	18.18	n/a	n/a	0.003586	NP Inter (normality) ...
Fluoride, total (mg/L)	MW-1618	0.2	9/24/2018	0.09	No	22	n/a	n/a	18.18	n/a	n/a	0.003586	NP Inter (normality) ...
pH, field (SU)	MW-1614	6.498	9/24/2018	6.38	No	22	5.845	0.3499	0	None	No	0.001253	Param Inter 1 of 2
pH, field (SU)	MW-1615	6.498	9/24/2018	5.8	No	22	5.845	0.3499	0	None	No	0.001253	Param Inter 1 of 2
pH, field (SU)	MW-1618	6.498	9/24/2018	5.89	No	22	5.845	0.3499	0	None	No	0.001253	Param Inter 1 of 2
Sulfate, total (mg/L)	**MW-1614**	**54.19**	**9/24/2018**	**295**	**Yes**	**22**	**49.59**	**2.465**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Sulfate, total (mg/L)	**MW-1615**	**54.19**	**9/24/2018**	**474**	**Yes**	**22**	**49.59**	**2.465**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Sulfate, total (mg/L)	**MW-1618**	**54.19**	**9/24/2018**	**422**	**Yes**	**22**	**49.59**	**2.465**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: MW-1614, MW-1615, MW-1618

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=0.06845, Std. Dev.=0.03399, n=22. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8851, critical = 0.878. Kappa = 1.866 (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 10/30/2018 9:04 AM View: PLs - Interwell

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

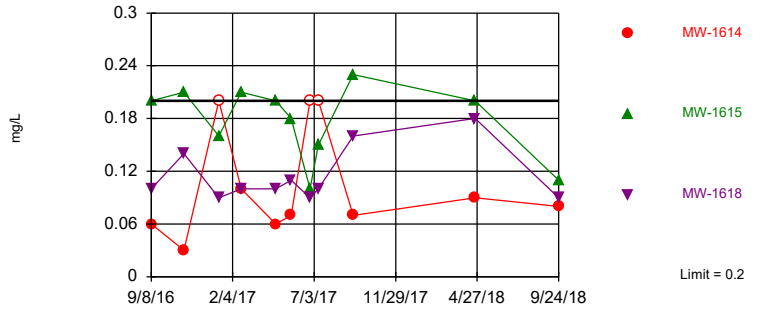
Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 22 background values. 18.18% NDs. Annual per-constituent alpha = 0.02133. Individual comparison alpha = 0.003586 (1 of 2). Comparing 3 points to limit.

Constituent: Fluoride, total Analysis Run 10/30/2018 9:05 AM View: PLs - Interwell

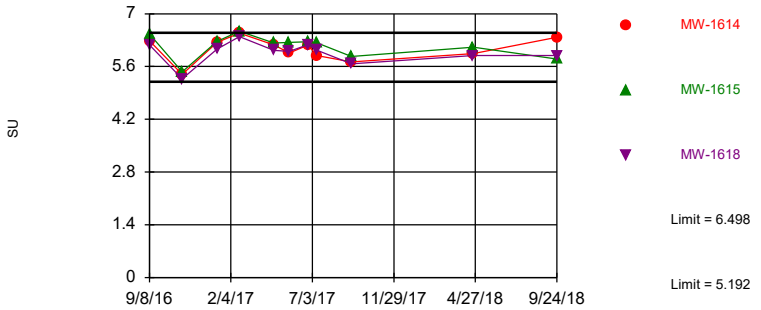
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=5.845, Std. Dev.=0.3499, n=22. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9314, critical = 0.878. Kappa = 1.866 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.001253. Comparing 3 points to limit.

Constituent: pH, field Analysis Run 10/30/2018 9:05 AM View: PLs - Interwell

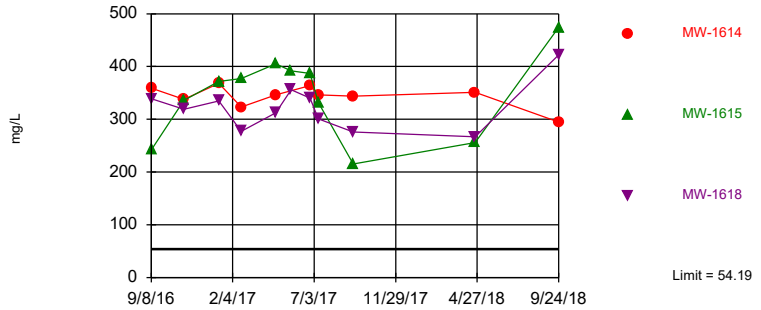
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: MW-1614, MW-1615, MW-1618

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=49.59, Std. Dev.=2.465, n=22. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.98, critical = 0.878. Kappa = 1.866 (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: Sulfate, total Analysis Run 10/30/2018 9:05 AM View: PLs - Interwell

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Intrawell Prediction Limit Summary Table - Significant Results

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 10/30/2018, 9:16 AM

Constituent	Well	Upper Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Calcium, total (mg/L)	**MW-1620**	**9.324**	**9/24/2018**	**9.46**	**Yes**	**9**	**8.574**	**0.3191**	**0**	**None**	**No**	**0.002505**	Param 1 of 2
Chloride, total (mg/L)	**MW-1618**	**71.11**	**9/24/2018**	**71.4**	**Yes**	**9**	**42.76**	**12.07**	**0**	**None**	**No**	**0.002505**	Param 1 of 2
TDS (mg/L)	**MW-1618**	**737.5**	**9/24/2018**	**764**	**Yes**	**9**	**594.3**	**60.97**	**0**	**None**	**No**	**0.002505**	Param 1 of 2
Chloride, total (mg/L)	**MW-1615**	**59.06**	**9/24/2018**	**82.1**	**Yes**	**9**	**39.6**	**8.288**	**0**	**None**	**No**	**0.002505**	Param 1 of 2

Intrawell Prediction Limit Summary Table - All Results

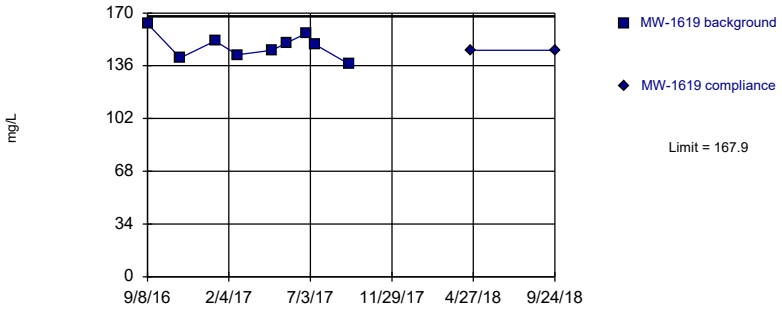
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 10/30/2018, 9:16 AM

Constituent	Well	Upper Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Calcium, total (mg/L)	MW-1614	68.14	9/24/2018	49.6	No	9	58.67	4.034	0	None	No	0.002505	Param 1 of 2
Calcium, total (mg/L)	MW-1615	96.02	9/24/2018	58.3	No	9	65.82	12.86	0	None	No	0.002505	Param 1 of 2
Calcium, total (mg/L)	MW-1618	77.45	9/24/2018	70	No	9	62.87	6.209	0	None	No	0.002505	Param 1 of 2
Calcium, total (mg/L)	MW-1619	167.9	9/24/2018	146	No	9	148.9	8.115	0	None	No	0.002505	Param 1 of 2
Calcium, total (mg/L)	**MW-1620**	**9.324**	**9/24/2018**	**9.46**	**Yes**	**9**	**8.574**	**0.3191**	**0**	**None**	**No**	**0.002505**	Param 1 of 2
Chloride, total (mg/L)	MW-1614	92.54	9/24/2018	42.1	No	9	60.08	13.83	0	None	No	0.002505	Param 1 of 2
Chloride, total (mg/L)	**MW-1615**	**59.06**	**9/24/2018**	**82.1**	**Yes**	**9**	**39.6**	**8.288**	**0**	**None**	**No**	**0.002505**	Param 1 of 2
Chloride, total (mg/L)	**MW-1618**	**71.11**	**9/24/2018**	**71.4**	**Yes**	**9**	**42.76**	**12.07**	**0**	**None**	**No**	**0.002505**	Param 1 of 2
Chloride, total (mg/L)	MW-1619	1098	9/24/2018	1070	No	9	1058	17.16	0	None	No	0.002505	Param 1 of 2
Chloride, total (mg/L)	MW-1620	20.08	9/24/2018	16.5	No	9	15.69	1.87	0	None	No	0.002505	Param 1 of 2
TDS (mg/L)	MW-1614	937.2	9/24/2018	578	No	9	692.1	104.4	0	None	No	0.002505	Param 1 of 2
TDS (mg/L)	MW-1615	901.6	9/24/2018	854	No	9	635.2	113.5	0	None	No	0.002505	Param 1 of 2
TDS (mg/L)	**MW-1618**	**737.5**	**9/24/2018**	**764**	**Yes**	**9**	**594.3**	**60.97**	**0**	**None**	**No**	**0.002505**	Param 1 of 2
TDS (mg/L)	MW-1619	2378	9/24/2018	2070	No	9	2041	143.4	0	None	No	0.002505	Param 1 of 2
TDS (mg/L)	MW-1620	193.2	9/24/2018	178	No	9	173.6	8.353	0	None	No	0.002505	Param 1 of 2

Within Limit

Prediction Limit

Intrawell Parametric



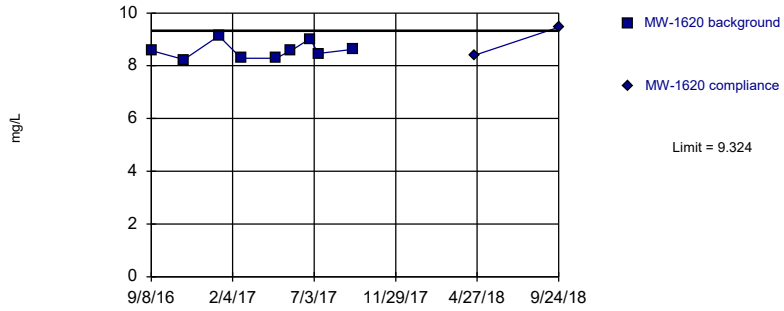
Background Data Summary: Mean=148.9, Std. Dev.=8.115, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9824, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Calcium, total Analysis Run 10/30/2018 9:08 AM View: PLs - Intrawell
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Exceeds Limit

Prediction Limit

Intrawell Parametric



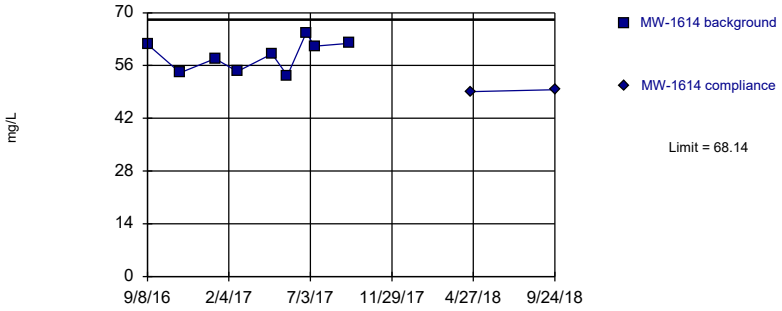
Background Data Summary: Mean=8.574, Std. Dev.=0.3191, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8841, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Calcium, total Analysis Run 10/30/2018 9:08 AM View: PLs - Intrawell
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Within Limit

Prediction Limit

Intrawell Parametric



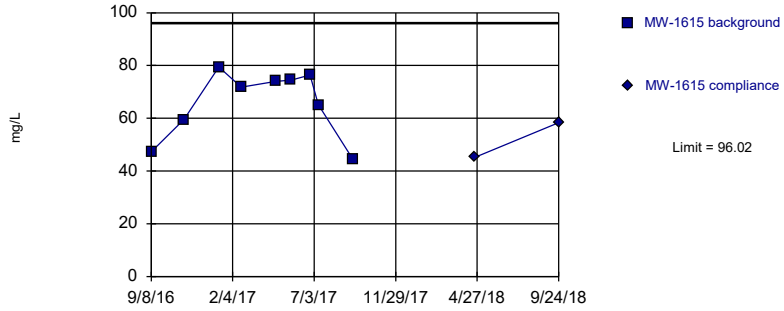
Background Data Summary: Mean=58.67, Std. Dev.=4.034, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9257, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Calcium, total Analysis Run 10/30/2018 9:08 AM View: PLs - Intrawell
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Within Limit

Prediction Limit

Intrawell Parametric



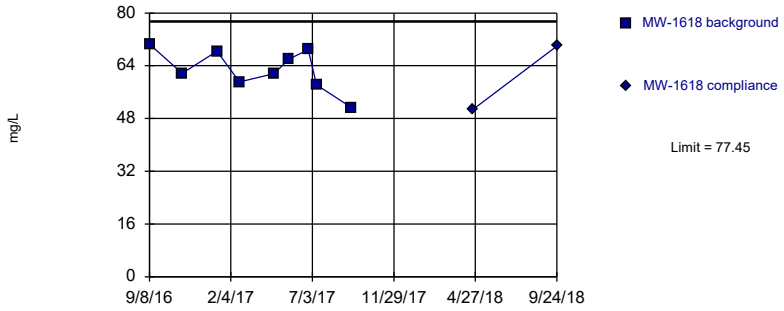
Background Data Summary: Mean=65.82, Std. Dev.=12.86, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8719, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Calcium, total Analysis Run 10/30/2018 9:08 AM View: PLs - Intrawell
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=62.87, Std. Dev.=6.209, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9413, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Calcium, total Analysis Run 10/30/2018 9:08 AM View: PLs - Intrawell

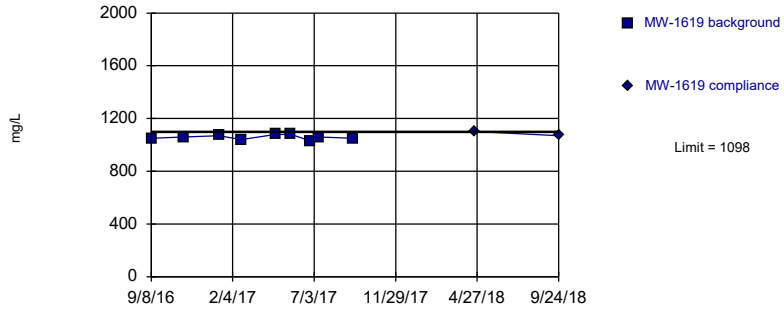
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=1058, Std. Dev.=17.16, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9504, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Chloride, total Analysis Run 10/30/2018 9:08 AM View: PLs - Intrawell

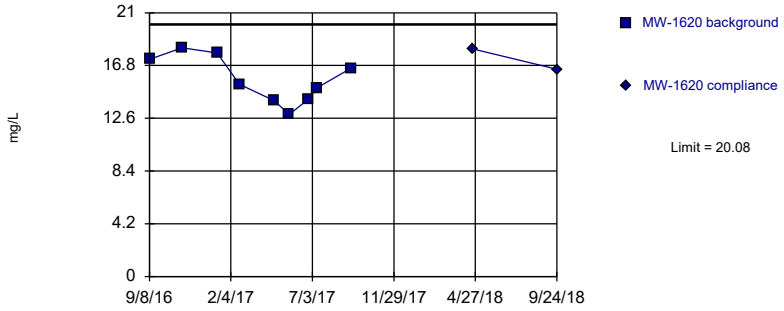
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=15.69, Std. Dev.=1.87, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9436, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Chloride, total Analysis Run 10/30/2018 9:08 AM View: PLs - Intrawell

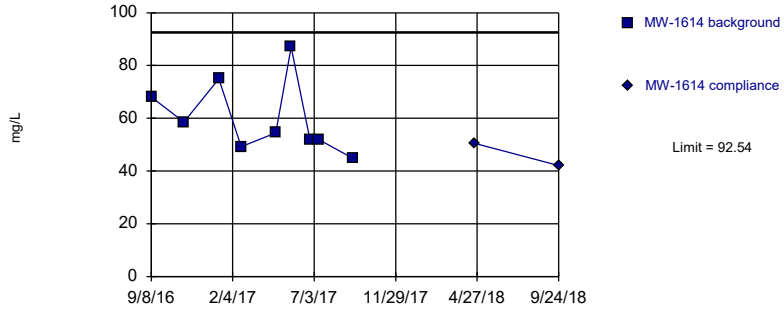
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=60.08, Std. Dev.=13.83, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8986, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

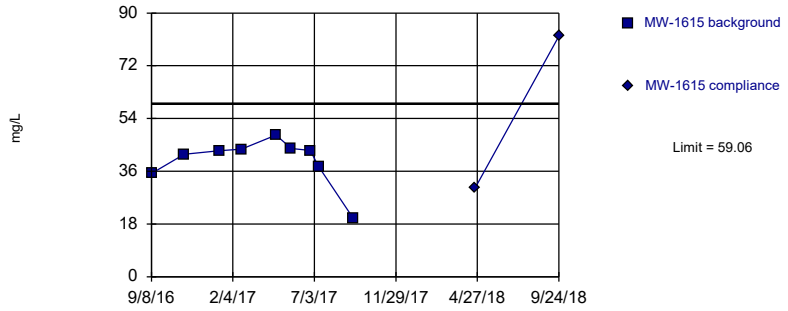
Constituent: Chloride, total Analysis Run 10/30/2018 9:08 AM View: PLs - Intrawell

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Exceeds Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=39.6, Std. Dev.=8.288, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7894, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

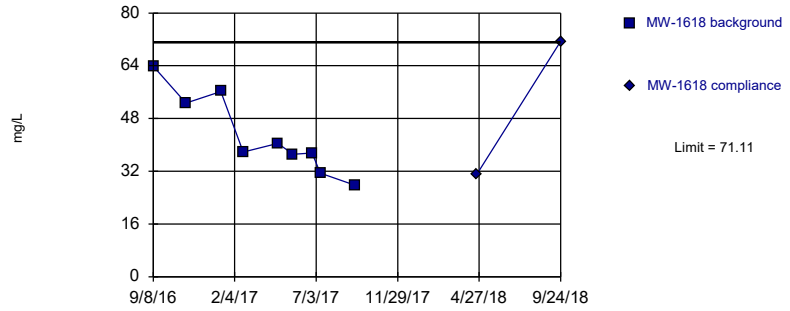
Constituent: Chloride, total Analysis Run 10/30/2018 9:08 AM View: PLs - Intrawell
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=42.76, Std. Dev.=12.07, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9139, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

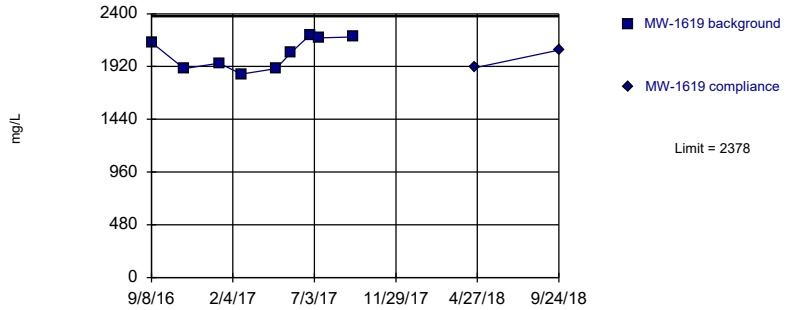
Constituent: Chloride, total Analysis Run 10/30/2018 9:08 AM View: PLs - Intrawell
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=2041, Std. Dev.=143.4, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8749, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

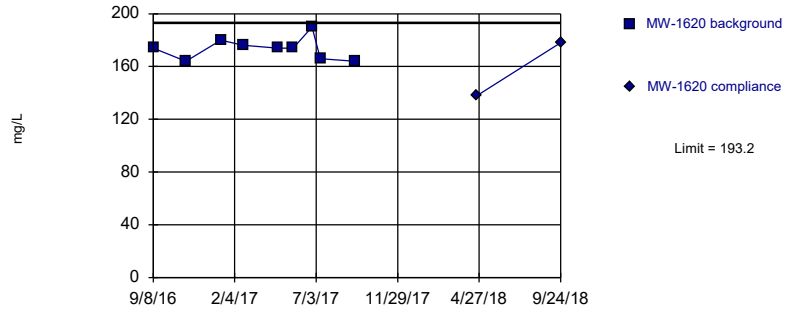
Constituent: TDS Analysis Run 10/30/2018 9:08 AM View: PLs - Intrawell
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



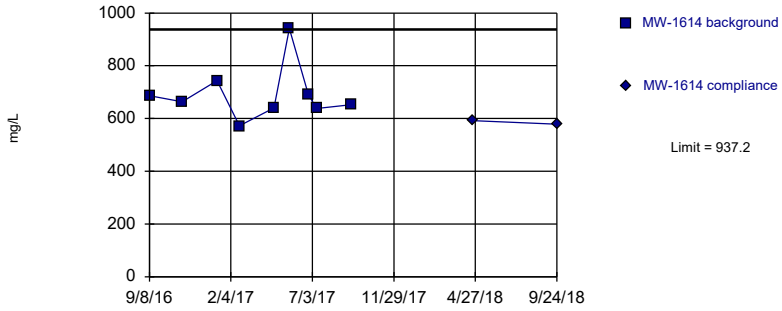
Background Data Summary: Mean=173.6, Std. Dev.=8.353, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9049, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: TDS Analysis Run 10/30/2018 9:08 AM View: PLs - Intrawell
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=692.1, Std. Dev.=104.4, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8067, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: TDS Analysis Run 10/30/2018 9:08 AM View: PLs - Intrawell

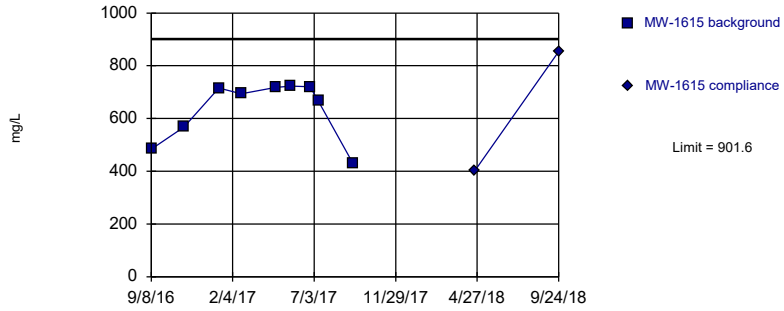
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=635.2, Std. Dev.=113.5, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7865, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: TDS Analysis Run 10/30/2018 9:08 AM View: PLs - Intrawell

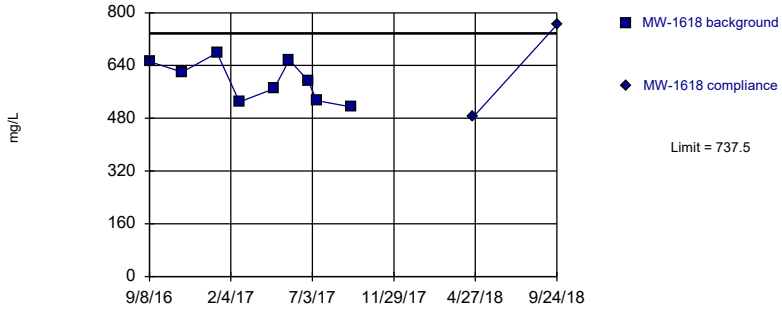
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=594.3, Std. Dev.=60.97, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9246, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: TDS Analysis Run 10/30/2018 9:08 AM View: PLs - Intrawell

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Trend Test Summary Table - All Results (No Significant Results)

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 10/30/2018, 9:20 AM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	MW-1619 (bg)	-0.01604	-11	-34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1620 (bg)	0	0	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1614	0.02888	28	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1615	0.02433	26	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1618	0.03816	27	34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1619 (bg)	-3.724	-10	-34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1620 (bg)	0.1738	16	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1619 (bg)	11.93	11	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1620 (bg)	-0.3914	-5	-34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1615	1.203	3	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1618	-21.1	-27	-34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1619 (bg)	-1.005	-6	-34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1620 (bg)	0.4309	9	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1614	-13.23	-10	-30	No	10	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1615	44.51	7	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1618	-15.21	-9	-34	No	11	0	n/a	n/a	0.01	NP
TDS (mg/L)	MW-1619 (bg)	57.03	14	34	No	11	0	n/a	n/a	0.01	NP
TDS (mg/L)	MW-1620 (bg)	-9.542	-9	-34	No	11	0	n/a	n/a	0.01	NP
TDS (mg/L)	MW-1618	-86	-15	-34	No	11	0	n/a	n/a	0.01	NP

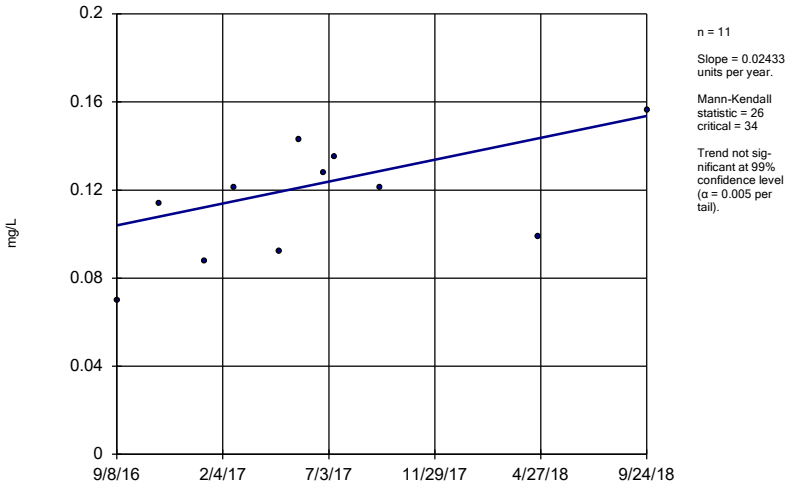
Trend Test Summary Table - All Results (No Significant Results)

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 10/30/2018, 9:20 AM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	MW-1619 (bg)	-0.01604	-11	-34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1620 (bg)	0	0	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1614	0.02888	28	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1615	0.02433	26	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1618	0.03816	27	34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1619 (bg)	-3.724	-10	-34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1620 (bg)	0.1738	16	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1619 (bg)	11.93	11	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1620 (bg)	-0.3914	-5	-34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1615	1.203	3	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1618	-21.1	-27	-34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1619 (bg)	-1.005	-6	-34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1620 (bg)	0.4309	9	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1614	-13.23	-10	-30	No	10	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1615	44.51	7	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1618	-15.21	-9	-34	No	11	0	n/a	n/a	0.01	NP
TDS (mg/L)	MW-1619 (bg)	57.03	14	34	No	11	0	n/a	n/a	0.01	NP
TDS (mg/L)	MW-1620 (bg)	-9.542	-9	-34	No	11	0	n/a	n/a	0.01	NP
TDS (mg/L)	MW-1618	-86	-15	-34	No	11	0	n/a	n/a	0.01	NP

Sen's Slope Estimator

MW-1615



n = 11

Slope = 0.02433 units per year.

Mann-Kendall statistic = 26
critical = 34

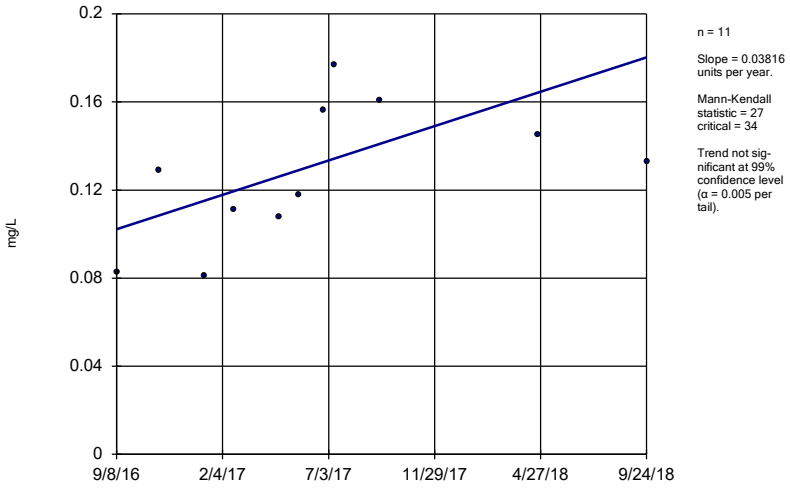
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 10/30/2018 9:17 AM View: Trend Testing
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1618



n = 11

Slope = 0.03816 units per year.

Mann-Kendall statistic = 27
critical = 34

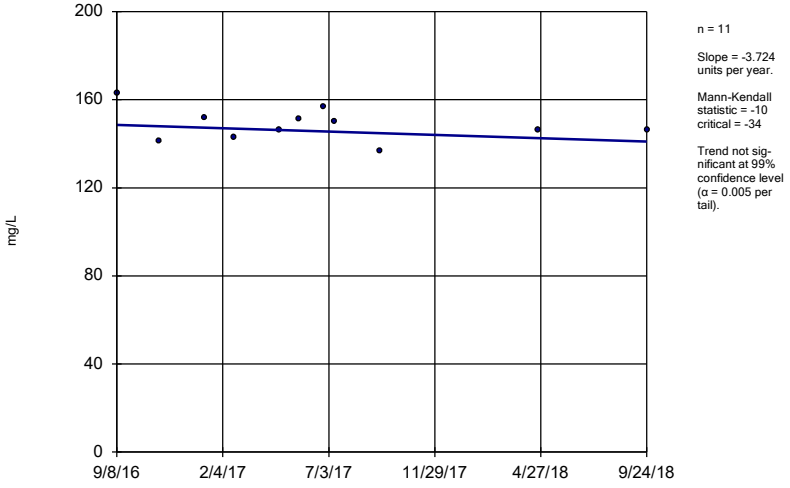
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 10/30/2018 9:17 AM View: Trend Testing
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1619 (bg)



n = 11

Slope = -3.724 units per year.

Mann-Kendall statistic = -10
critical = -34

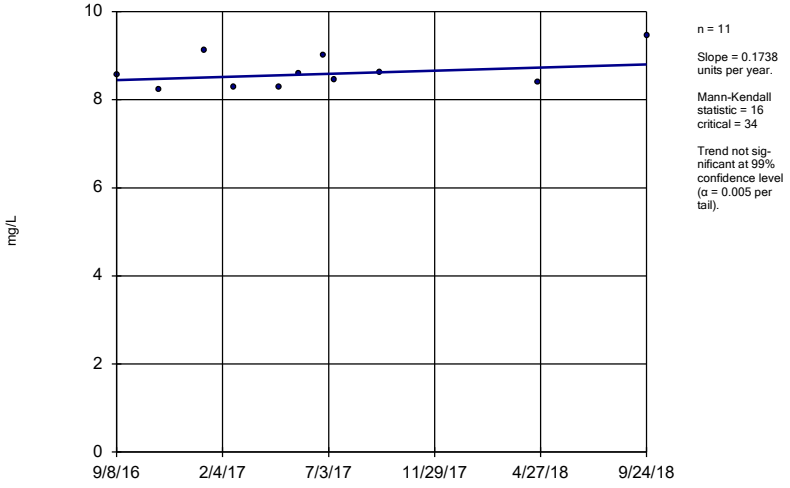
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 10/30/2018 9:17 AM View: Trend Testing
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1620 (bg)



n = 11

Slope = 0.1738 units per year.

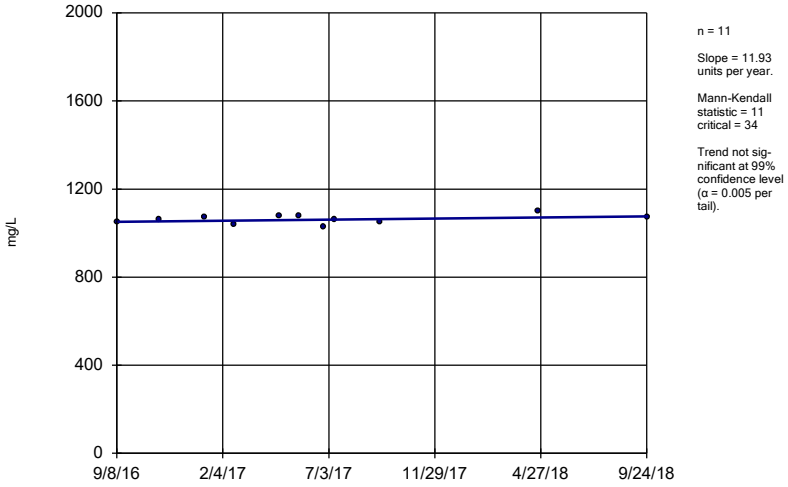
Mann-Kendall statistic = 16
critical = 34

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

Constituent: Calcium, total Analysis Run 10/30/2018 9:17 AM View: Trend Testing
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sen's Slope Estimator

MW-1619 (bg)



n = 11

Slope = 11.93 units per year.

Mann-Kendall statistic = 11 critical = 34

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

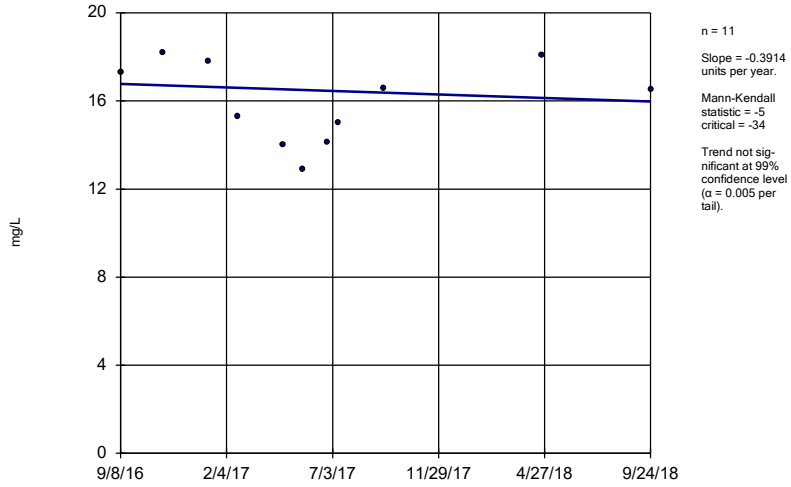
Constituent: Chloride, total Analysis Run 10/30/2018 9:17 AM View: Trend Testing

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1620 (bg)



n = 11

Slope = -0.3914 units per year.

Mann-Kendall statistic = -5 critical = -34

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

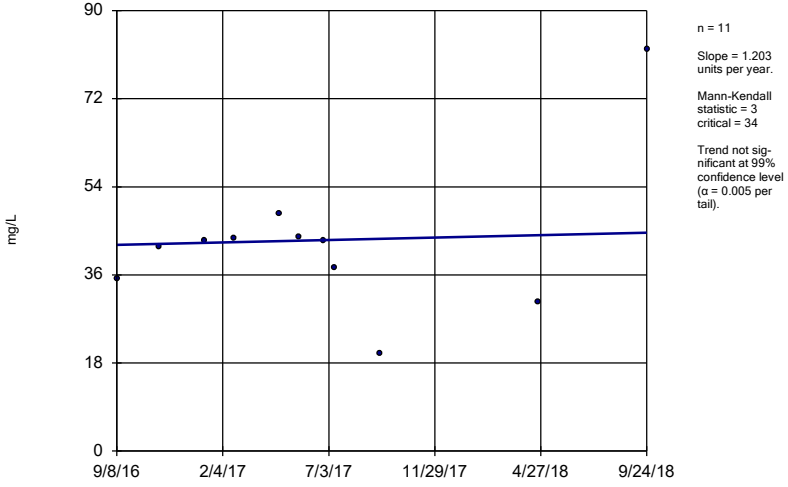
Constituent: Chloride, total Analysis Run 10/30/2018 9:17 AM View: Trend Testing

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1615



n = 11

Slope = 1.203 units per year.

Mann-Kendall statistic = 3 critical = 34

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

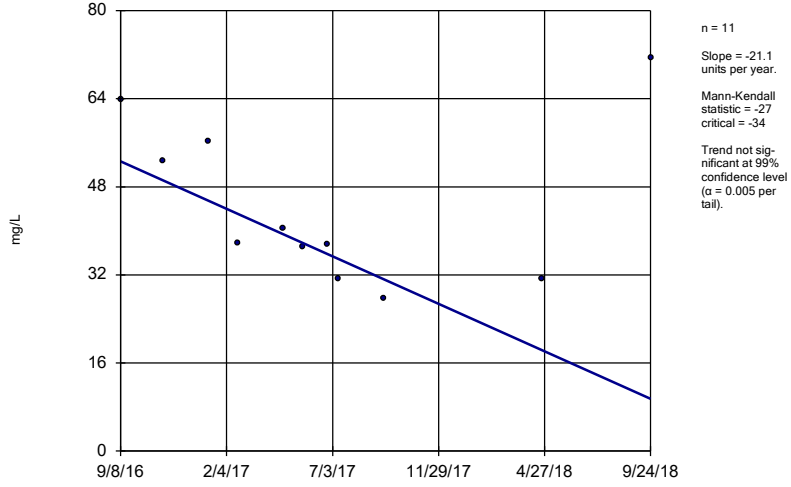
Constituent: Chloride, total Analysis Run 10/30/2018 9:17 AM View: Trend Testing

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1618



n = 11

Slope = -21.1 units per year.

Mann-Kendall statistic = -27 critical = -34

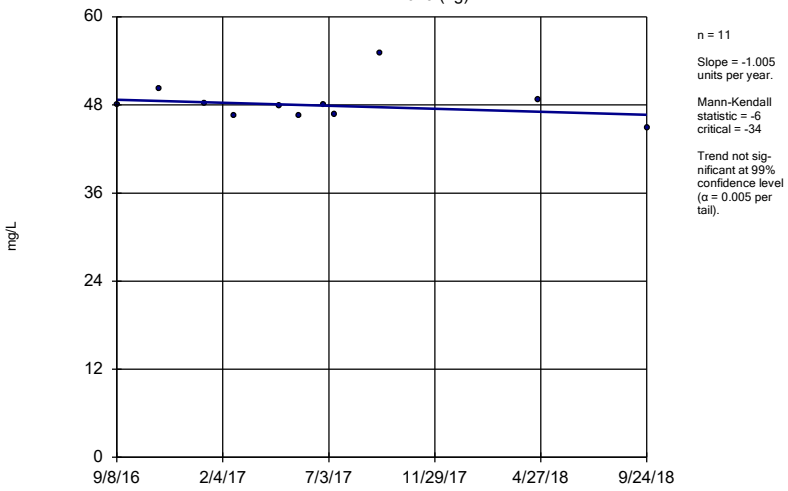
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 10/30/2018 9:17 AM View: Trend Testing

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sen's Slope Estimator

MW-1619 (bg)



n = 11

Slope = -1.005 units per year.

Mann-Kendall statistic = -6
critical = -34

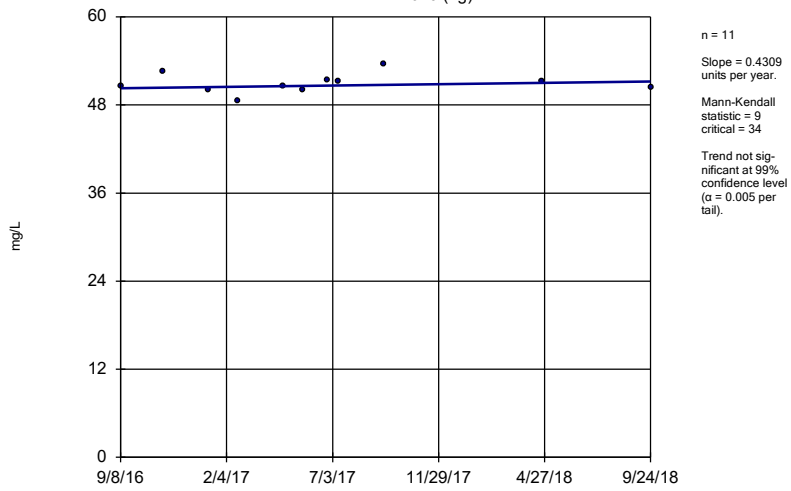
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 10/30/2018 9:17 AM View: Trend Testing
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1620 (bg)



n = 11

Slope = 0.4309 units per year.

Mann-Kendall statistic = 9
critical = 34

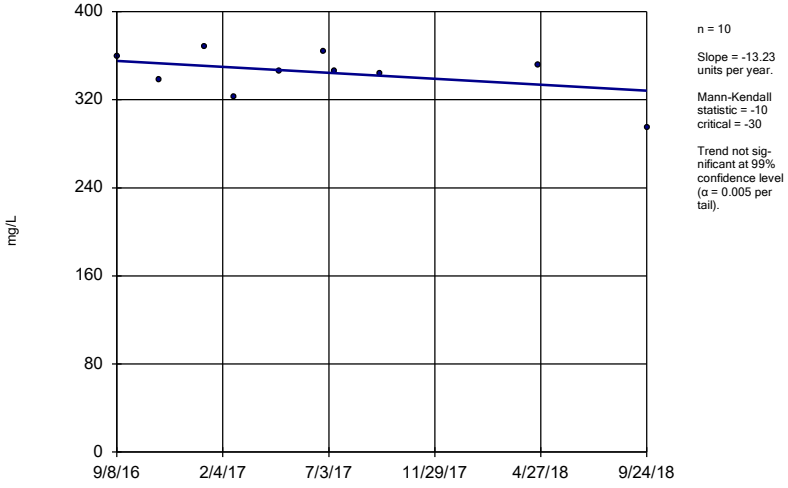
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 10/30/2018 9:17 AM View: Trend Testing
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1614



n = 10

Slope = -13.23 units per year.

Mann-Kendall statistic = -10
critical = -30

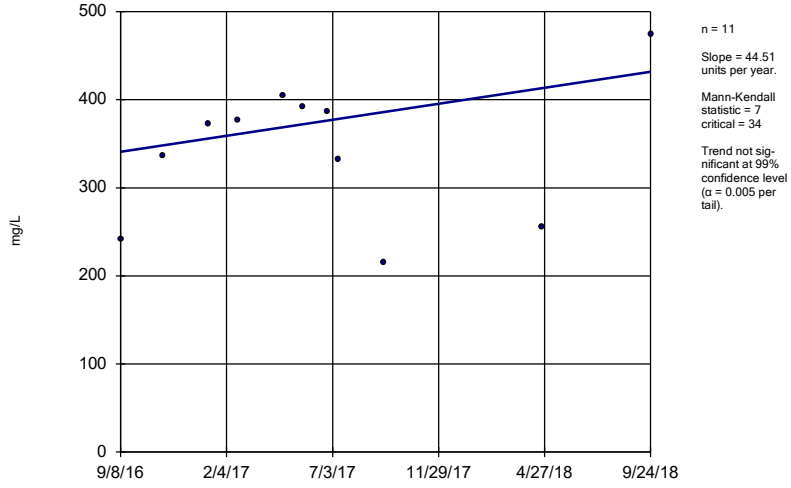
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 10/30/2018 9:17 AM View: Trend Testing
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1615



n = 11

Slope = 44.51 units per year.

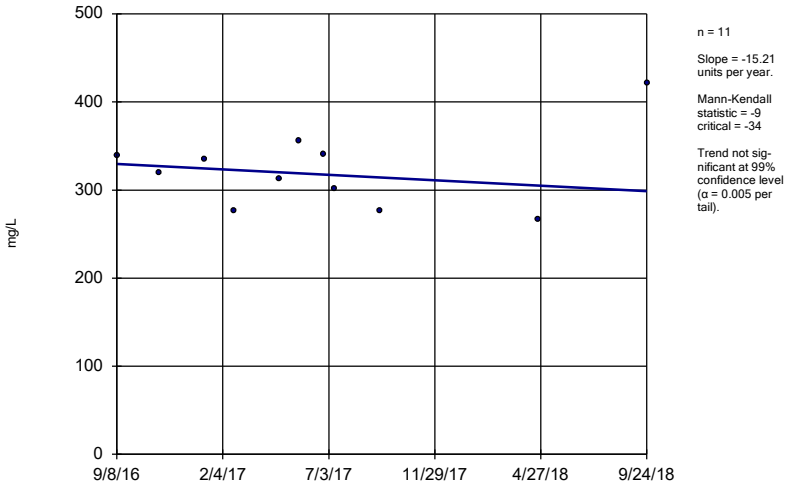
Mann-Kendall statistic = 7
critical = 34

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

Constituent: Sulfate, total Analysis Run 10/30/2018 9:17 AM View: Trend Testing
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sen's Slope Estimator

MW-1618



n = 11

Slope = -15.21 units per year.

Mann-Kendall statistic = -9 critical = -34

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

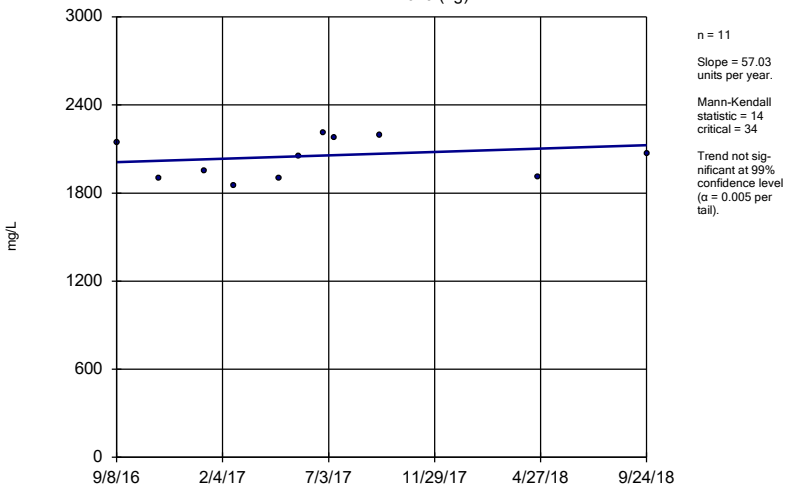
Constituent: Sulfate, total Analysis Run 10/30/2018 9:17 AM View: Trend Testing

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1619 (bg)



n = 11

Slope = 57.03 units per year.

Mann-Kendall statistic = 14 critical = 34

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

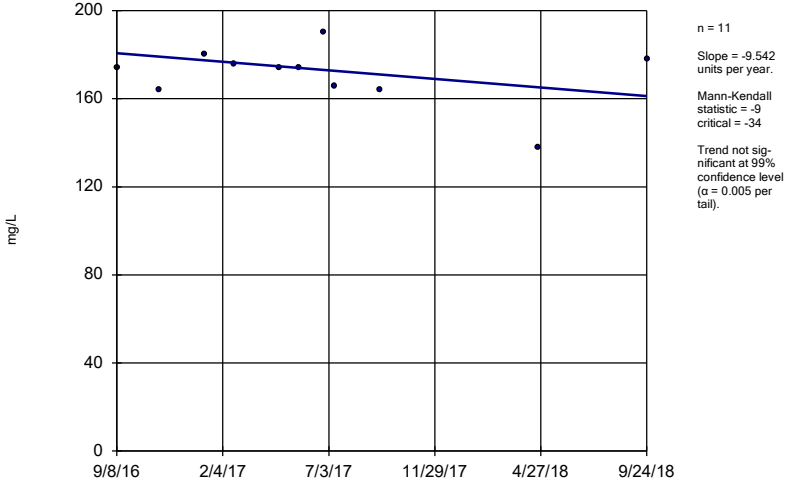
Constituent: TDS Analysis Run 10/30/2018 9:17 AM View: Trend Testing

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1620 (bg)



n = 11

Slope = -9.542 units per year.

Mann-Kendall statistic = -9 critical = -34

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

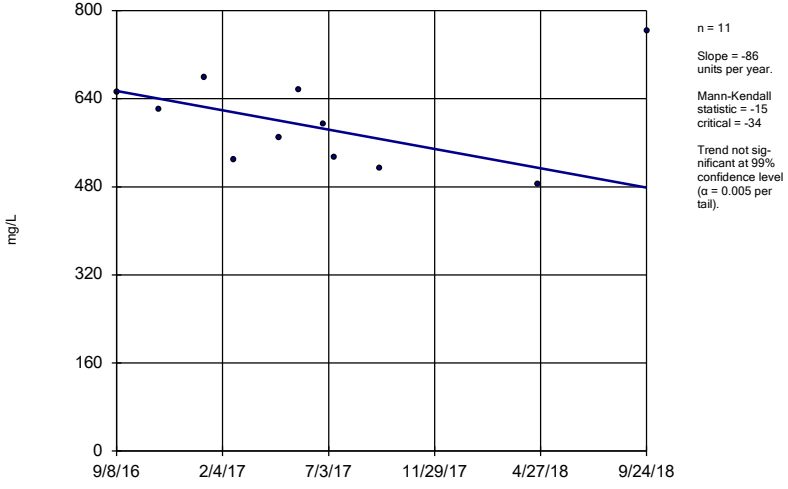
Constituent: TDS Analysis Run 10/30/2018 9:17 AM View: Trend Testing

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW-1618



n = 11

Slope = -86 units per year.

Mann-Kendall statistic = -15 critical = -34

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

Constituent: TDS Analysis Run 10/30/2018 9:17 AM View: Trend Testing

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Trend Test Summary Table - All Results (No Significant Results)

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 10/30/2018, 9:20 AM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	MW-1619 (bg)	-0.01604	-11	-34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1620 (bg)	0	0	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1614	0.02888	28	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1615	0.02433	26	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW-1618	0.03816	27	34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1619 (bg)	-3.724	-10	-34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW-1620 (bg)	0.1738	16	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1619 (bg)	11.93	11	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1620 (bg)	-0.3914	-5	-34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1615	1.203	3	34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW-1618	-21.1	-27	-34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1619 (bg)	-1.005	-6	-34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1620 (bg)	0.4309	9	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1614	-13.23	-10	-30	No	10	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1615	44.51	7	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW-1618	-15.21	-9	-34	No	11	0	n/a	n/a	0.01	NP
TDS (mg/L)	MW-1619 (bg)	57.03	14	34	No	11	0	n/a	n/a	0.01	NP
TDS (mg/L)	MW-1620 (bg)	-9.542	-9	-34	No	11	0	n/a	n/a	0.01	NP
TDS (mg/L)	MW-1618	-86	-15	-34	No	11	0	n/a	n/a	0.01	NP

BIG SANDY BAP GWPS			
Constituent Name	**MCL**	**RSL**	**Background Limit**
Antimony, Total (mg/L)	0.006		0.00005
Arsenic, Total (mg/L)	0.01		0.016
Barium, Total (mg/L)	2		1.82
Beryllium, Total (mg/L)	0.004		0.00007
Cadmium, Total (mg/L)	0.005		0.00012
Chromium, Total (mg/L)	0.1		0.0017
Cobalt, Total (mg/L)	n/a	0.006	0.023
Combined Radium, Total (pCi/L)	5		14.43
Fluoride, Total (mg/L)	4		0.2
Lead, Total (mg/L)	0.015		0.00058
Lithium, Total (mg/L)	n/a	0.04	0.031
Mercury, Total (mg/L)	0.002		0.000007
Molybdenum, Total (mg/L)	n/a	0.1	0.002
Selenium, Total (mg/L)	0.05		0.2
Thallium, Total (mg/L)	0.002		0.00014

**Grey cell indicates ACL is higher than MCL.*

**MCL = Maximum Contaminant Level*

**RSL = Regional Screening Level*

Upper Tolerance Limits

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 10/30/2018, 9:26 AM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	n/a	0.00005	n/a	n/a	n/a	n/a	20	n/a	n/a	65	n/a	n/a	0.3585	NP Inter(normal...
Arsenic, Total (mg/L)	n/a	0.0156	n/a	n/a	n/a	n/a	20	n/a	n/a	0	n/a	n/a	0.3585	NP Inter(normal...
Barium, Total (mg/L)	n/a	1.82	n/a	n/a	n/a	n/a	20	n/a	n/a	0	n/a	n/a	0.3585	NP Inter(normal...
Beryllium, total (mg/L)	n/a	0.00007009	n/a	n/a	n/a	n/a	20	0.0000329	0.00001552	0	None	No	0.05	Inter
Cadmium, total (mg/L)	n/a	0.00012	n/a	n/a	n/a	n/a	20	n/a	n/a	0	n/a	n/a	0.3585	NP Inter(normal...
Chromium, total (mg/L)	n/a	0.001741	n/a	n/a	n/a	n/a	20	0.07773	0.01777	0	None	x^(1/3)	0.05	Inter
Cobalt, total (mg/L)	n/a	0.023	n/a	n/a	n/a	n/a	20	n/a	n/a	0	n/a	n/a	0.3585	NP Inter(normal...
Combined Radium 226 + 228 (pCi/L)	n/a	14.43	n/a	n/a	n/a	n/a	20	5.427	3.758	0	None	No	0.05	Inter
Fluoride, total (mg/L)	n/a	0.2	n/a	n/a	n/a	n/a	22	n/a	n/a	18.18	n/a	n/a	0.3235	NP Inter(normal...
Lead, total (mg/L)	n/a	0.0005814	n/a	n/a	n/a	n/a	20	0.0001933	0.000162	0	None	No	0.05	Inter
Lithium, total (mg/L)	n/a	0.0306	n/a	n/a	n/a	n/a	20	0.01345	0.007156	0	None	No	0.05	Inter
Mercury, total (mg/L)	n/a	0.000007	n/a	n/a	n/a	n/a	18	n/a	n/a	100	n/a	n/a	0.3972	NP Inter(NDs)
Molybdenum, total (mg/L)	n/a	0.001946	n/a	n/a	n/a	n/a	20	-7.987	0.7285	0	None	ln(x)	0.05	Inter
Selenium, Total (ug/L)	n/a	0.2	n/a	n/a	n/a	n/a	18	n/a	n/a	38.89	n/a	n/a	0.3972	NP Inter(normal...
Thallium, Total (mg/L)	n/a	0.0001352	n/a	n/a	n/a	n/a	20	0.0394	0.004975	0	None	x^(1/3)	0.05	Inter

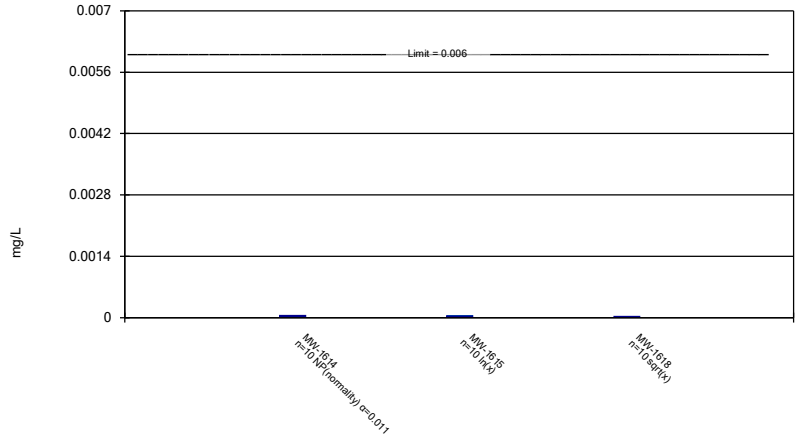
Confidence Interval - All Results (No Significant Results)

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 11/11/2018, 11:05 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
Antimony, total (mg/L)	MW-1614	0.00005	0.00002	0.006	No	10	0	No	0.011	NP (normality)
Antimony, total (mg/L)	MW-1615	0.00003761	0.00001308	0.006	No	10	10	ln(x)	0.01	Param.
Antimony, total (mg/L)	MW-1618	0.00002841	0.00001341	0.006	No	10	0	sqrt(x)	0.01	Param.
Arsenic, Total (mg/L)	MW-1614	0.01667	0.009739	0.016	No	10	0	No	0.01	Param.
Arsenic, Total (mg/L)	MW-1615	0.0012	0.0002	0.016	No	9	0	No	0.002	NP (normality)
Arsenic, Total (mg/L)	MW-1618	0.001362	0.0002677	0.016	No	10	0	ln(x)	0.01	Param.
Barium, Total (mg/L)	MW-1614	0.08256	0.0438	2	No	10	0	x^(1/3)	0.01	Param.
Barium, Total (mg/L)	MW-1615	0.02406	0.01701	2	No	9	0	No	0.01	Param.
Barium, Total (mg/L)	MW-1618	0.0194	0.016	2	No	10	0	No	0.011	NP (normality)
Beryllium, total (mg/L)	MW-1614	0.00009686	0.00005814	0.004	No	10	0	No	0.01	Param.
Beryllium, total (mg/L)	MW-1615	0.000015	0.000005495	0.004	No	10	10	x^(1/3)	0.01	Param.
Beryllium, total (mg/L)	MW-1618	0.00001	0.000006	0.004	No	10	0	No	0.011	NP (normality)
Cadmium, total (mg/L)	MW-1614	0.00001	0.000006	0.005	No	10	50	No	0.011	NP (normality)
Cadmium, total (mg/L)	MW-1615	0.00009516	0.00003695	0.005	No	10	0	x^(1/3)	0.01	Param.
Cadmium, total (mg/L)	MW-1618	0.00005121	0.00003279	0.005	No	10	0	No	0.01	Param.
Chromium, total (mg/L)	MW-1614	0.0005219	0.0002749	0.1	No	10	0	No	0.01	Param.
Chromium, total (mg/L)	MW-1615	0.0004882	0.0002048	0.1	No	10	0	No	0.01	Param.
Chromium, total (mg/L)	MW-1618	0.0004579	0.00014	0.1	No	10	0	sqrt(x)	0.01	Param.
Cobalt, total (mg/L)	MW-1614	0.0034	0.001814	0.023	No	10	0	No	0.01	Param.
Cobalt, total (mg/L)	MW-1615	0.00431	0.00151	0.023	No	10	0	No	0.011	NP (normality)
Cobalt, total (mg/L)	MW-1618	0.004523	0.001289	0.023	No	10	0	ln(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1614	4.149	0.2828	14.43	No	8	0	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW-1615	2.43	0.459	14.43	No	10	0	No	0.011	NP (normality)
Combined Radium 226 + 228 (pCi/L)	MW-1618	2.312	0.6622	14.43	No	10	0	sqrt(x)	0.01	Param.
Fluoride, total (mg/L)	MW-1614	0.1848	0.04953	4	No	11	27.27	No	0.01	Param.
Fluoride, total (mg/L)	MW-1615	0.2126	0.1419	4	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW-1618	0.16	0.09	4	No	11	0	No	0.006	NP (normality)
Lead, total (mg/L)	MW-1614	0.0002195	0.00009234	0.015	No	10	0	sqrt(x)	0.01	Param.
Lead, total (mg/L)	MW-1615	0.0001555	0.00003199	0.015	No	10	0	x^(1/3)	0.01	Param.
Lead, total (mg/L)	MW-1618	0.000201	0.00007016	0.015	No	10	0	sqrt(x)	0.01	Param.
Lithium, total (mg/L)	MW-1614	0.004	0.0003	0.04	No	10	30	No	0.011	NP (normality)
Lithium, total (mg/L)	MW-1615	0.004	0.0004	0.04	No	10	30	No	0.011	NP (normality)
Lithium, total (mg/L)	MW-1618	0.008	0.0005	0.04	No	10	40	No	0.011	NP (normality)
Mercury, total (mg/L)	MW-1614	0.0000035	0.0000035	0.002	No	9	100	No	0.002	NP (NDs)
Mercury, total (mg/L)	MW-1615	0.0000035	0.0000035	0.002	No	9	100	No	0.002	NP (NDs)
Mercury, total (mg/L)	MW-1618	0.0000035	0.0000035	0.002	No	9	100	No	0.002	NP (NDs)
Molybdenum, total (mg/L)	MW-1614	0.0007098	0.0003722	0.1	No	10	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW-1615	0.00021	0.00007	0.1	No	10	0	No	0.011	NP (normality)
Molybdenum, total (mg/L)	MW-1618	0.0003303	0.00006494	0.1	No	10	0	ln(x)	0.01	Param.
Selenium, Total (ug/L)	MW-1614	0.09873	0.06733	0.2	No	10	0	x^2	0.01	Param.
Selenium, Total (ug/L)	MW-1615	0.143	0.04943	0.2	No	10	10	sqrt(x)	0.01	Param.
Selenium, Total (ug/L)	MW-1618	0.08932	0.06686	0.2	No	10	0	x^4	0.01	Param.
Thallium, Total (mg/L)	MW-1614	0.000025	0.00002	0.002	No	10	10	No	0.011	NP (normality)
Thallium, Total (mg/L)	MW-1615	0.000272	0.000063	0.002	No	10	0	No	0.011	NP (normality)
Thallium, Total (mg/L)	MW-1618	0.0001328	0.00006895	0.002	No	10	0	sqrt(x)	0.01	Param.

Parametric and Non-Parametric (NP) Confidence Interval

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

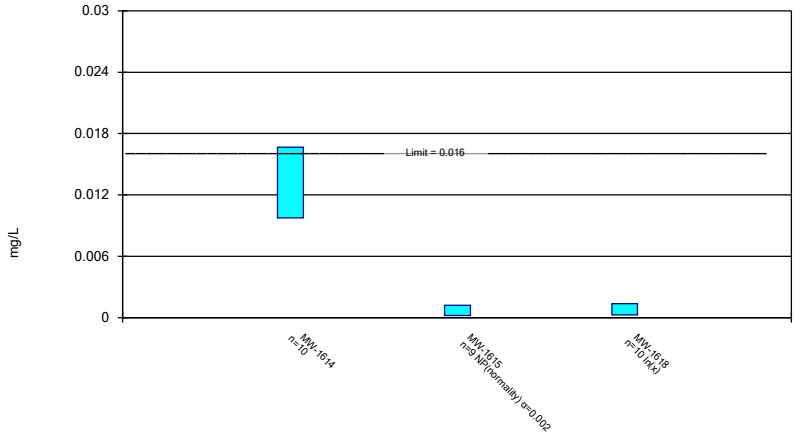


Constituent: Antimony, total Analysis Run 11/11/2018 11:03 AM View: Confidence Intervals - App IV
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e 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.

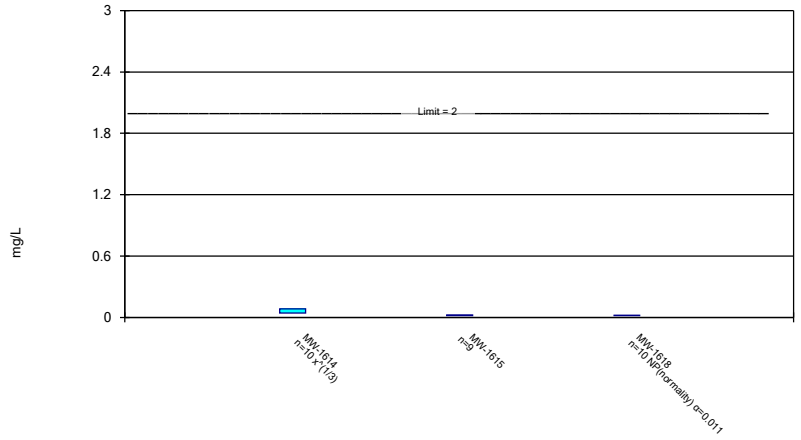


Constituent: Arsenic, Total Analysis Run 11/11/2018 11:03 AM View: Confidence Intervals - App IV
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e 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.

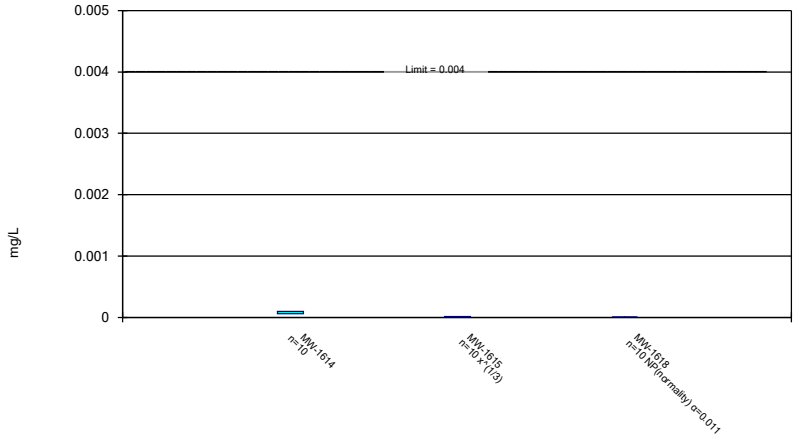


Constituent: Barium, Total Analysis Run 11/11/2018 11:03 AM View: Confidence Intervals - App IV
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

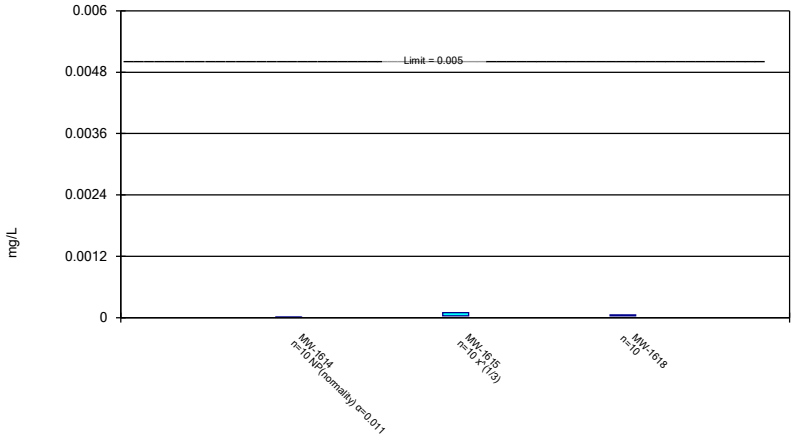
Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Beryllium, total Analysis Run 11/11/2018 11:03 AM View: Confidence Intervals - App IV
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Parametric and Non-Parametric (NP) Confidence Interval

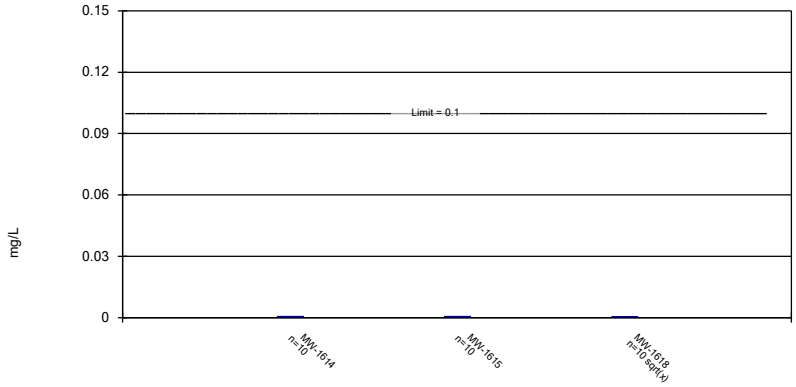
Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Cadmium, total Analysis Run 11/11/2018 11:03 AM View: Confidence Intervals - App IV
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Parametric Confidence Interval

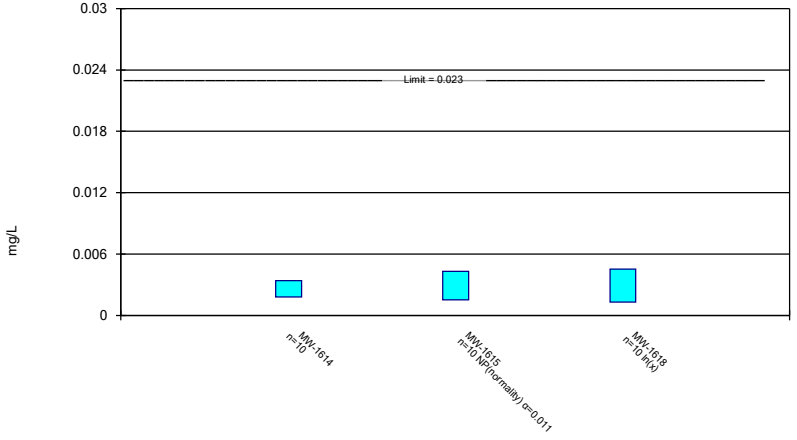
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Chromium, total Analysis Run 11/11/2018 11:03 AM View: Confidence Intervals - App IV
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Parametric and Non-Parametric (NP) Confidence Interval

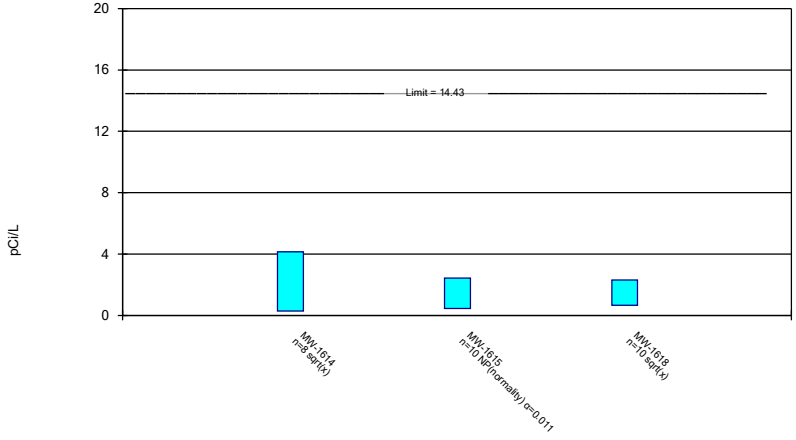
Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Cobalt, total Analysis Run 11/11/2018 11:03 AM View: Confidence Intervals - App IV
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Parametric and Non-Parametric (NP) Confidence Interval

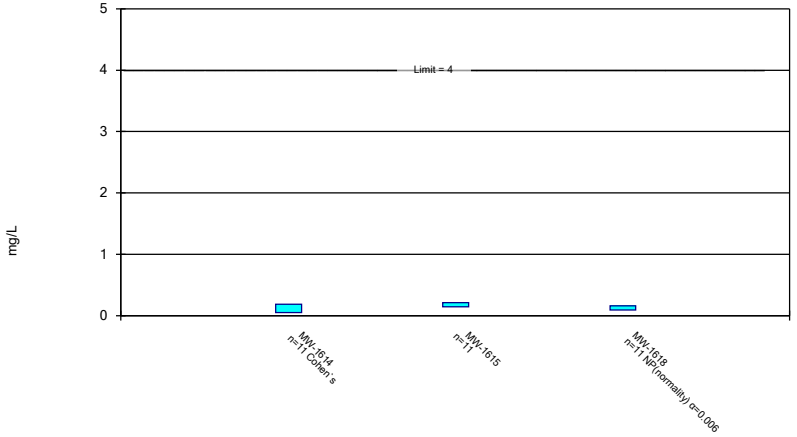
Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Combined Radium 226 + 228 Analysis Run 11/11/2018 11:03 AM View: Confidence Intervals
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Parametric and Non-Parametric (NP) Confidence Interval

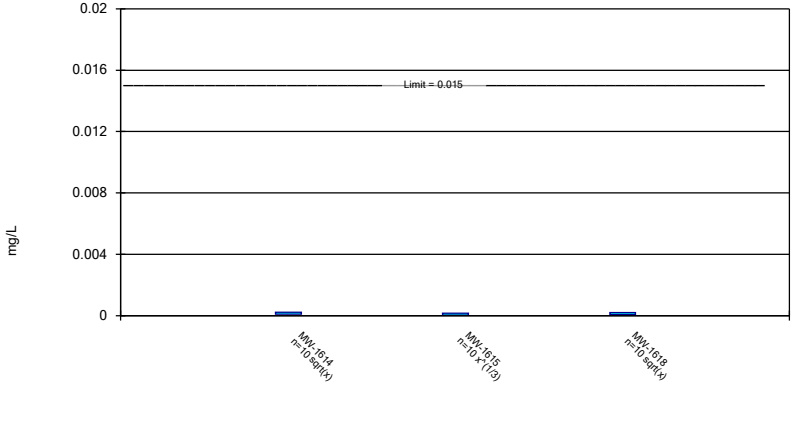
Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Fluoride, total Analysis Run 11/11/2018 11:03 AM View: Confidence Intervals - App IV
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Parametric Confidence Interval

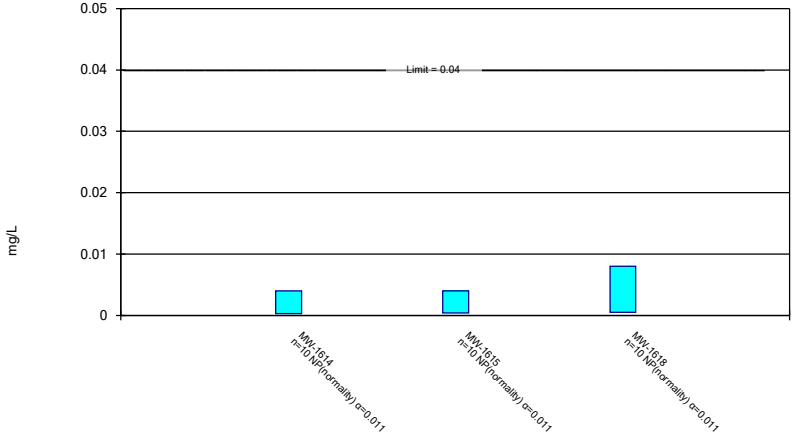
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Lead, total Analysis Run 11/11/2018 11:03 AM View: Confidence Intervals - App IV
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Non-Parametric Confidence Interval

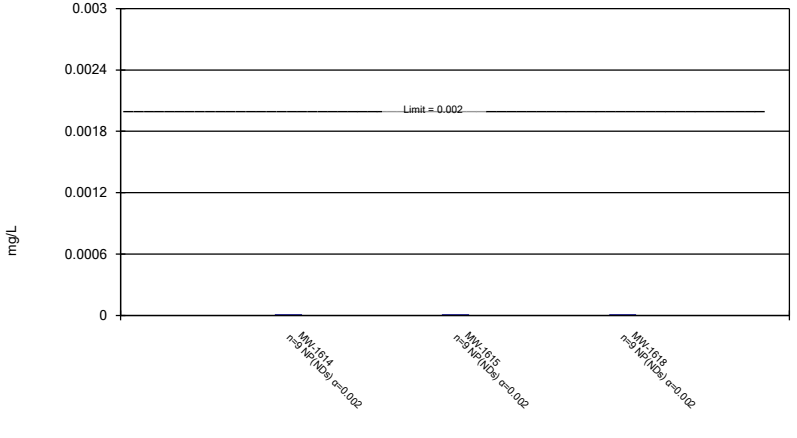
Compliance Limit is not exceeded.



Constituent: Lithium, total Analysis Run 11/11/2018 11:03 AM View: Confidence Intervals - App IV
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Non-Parametric Confidence Interval

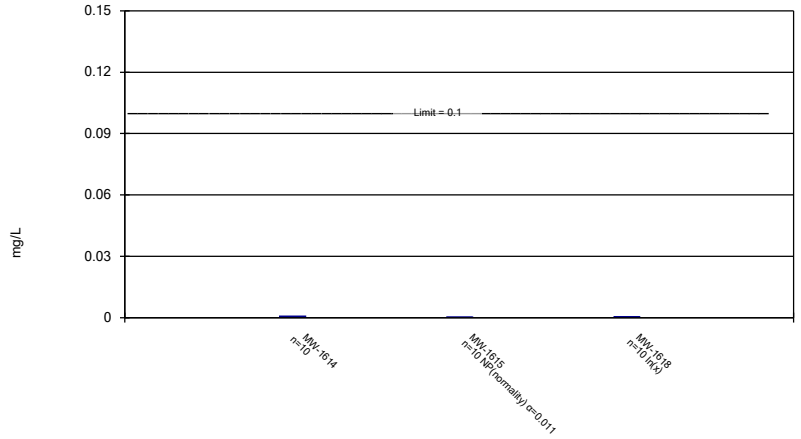
Compliance Limit is not exceeded.



Constituent: Mercury, total Analysis Run 11/11/2018 11:03 AM View: Confidence Intervals - App IV
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Parametric and Non-Parametric (NP) Confidence Interval

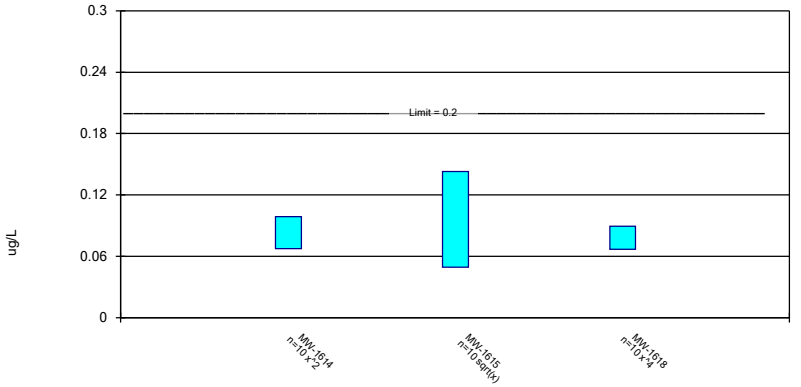
Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Molybdenum, total Analysis Run 11/11/2018 11:03 AM View: Confidence Intervals - App IV
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Parametric Confidence Interval

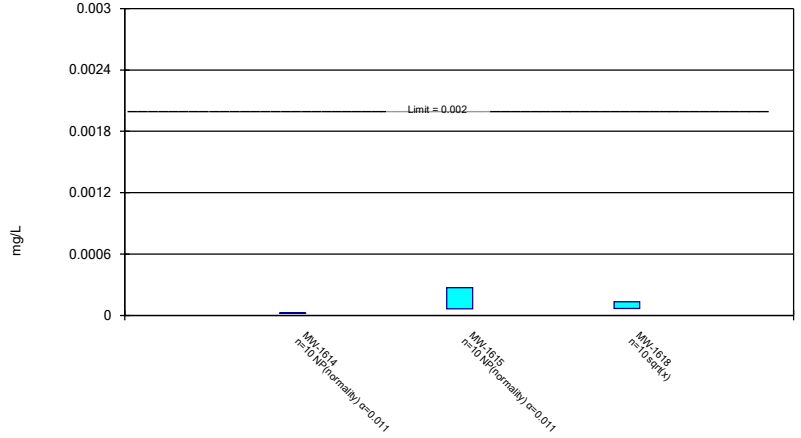
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Selenium, Total Analysis Run 11/11/2018 11:03 AM View: Confidence Intervals - App IV
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Parametric and Non-Parametric (NP) Confidence Interval

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



Constituent: Thallium, Total Analysis Run 11/11/2018 11:03 AM View: Confidence Intervals - App IV
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

STATISTICAL ANALYSIS SUMMARY
BOTTOM ASH POND
Big Sandy Plant
Louisa, Kentucky

Submitted to

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
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July 12, 2019

CHA8473

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LIST OF ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
BAP	Bottom Ash Pond
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

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 Bottom Ash Pond (BAP), an existing CCR unit at the Big Sandy Power Plant located in Louisa, Kentucky.

Based on detection monitoring conducted in 2017 and 2018, statistically significant increases (SSIs) over background were concluded for boron and sulfate at the BAP. An alternative source was not identified at the time, so two assessment monitoring events were conducted at the BAP in 2018, in accordance with 40 CFR 257.95. No SSLs were identified during these events, and the unit remained in assessment monitoring. A semi-annual assessment monitoring event was also completed in March 2019, with the results of the March 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 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. No SSLs were identified, but Appendix III concentrations for boron, chloride, sulfate, and TDS remained above background. Thus, either the unit will remain in assessment monitoring or an alternative source demonstration (ASD) will be conducted to evaluate if the unit can return to detection 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). Samples from the March 2019 semi-annual sampling event were analyzed for the 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 BAP 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. 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 antimony, arsenic, barium,

cadmium, cobalt, fluoride, selenium, and thallium due to apparent non-normal distributions and for mercury 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.

No SSLs were identified at the Big Sandy BAP.

2.2.3 Evaluation of Potential Appendix III SSIs

The CCR rule allows CCR units to move from assessment monitoring to detection monitoring if all Appendix III and Appendix IV parameters were at or below background levels for two consecutive sampling events [40 CFR 257.95(e)]. Since no Appendix IV SSLs were identified, Appendix III results were analyzed 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, chloride, and TDS, whereas interwell tests were used to evaluate potential SSIs for boron, fluoride, pH, and sulfate.

Prediction limits for the interwell tests were recalculated using data collected during the March 2019 assessment monitoring event. Two data points (i.e., one sample from two 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, fluoride, pH, and sulfate.

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, chloride, and TDS.

Data collected during the September 2018 and March 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 3. The following exceedances of the upper prediction limits (UPLs) were noted:

- Boron concentrations exceeded the interwell UPL of 0.132 mg/L at MW-1614 (0.183 mg/L), MW-1615 (0.156 mg/L), and MW-1615 (0.133 mg/L).
- Chloride concentrations exceeded the intrawell UPL of 59.1 mg/L at MW-1615 (82.1 mg/L) and the intrawell UPL of 71.1 mg/L at MW-1618 (71.4 mg/L).
- Sulfate concentrations exceeded the interwell UPL of 53.9 mg/L at MW-1614 (295 mg/L and 343 mg/L), MW-1615 (474 mg/L and 300 mg/L), and MW-1618 (422 mg/L and 287 mg/L).
- TDS concentrations exceeded the intrawell UPL of 738 mg/L at MW-1618 (764 mg/L).

Based on these results, concentrations of Appendix III parameters exceeded background levels at compliance wells at the Big Sandy BAP during assessment monitoring. As a result, the Big Sandy BAP CCR unit will remain in 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 March 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. No SSLs were identified.

The Appendix III results were evaluated to assess whether concentrations of Appendix III parameters exceeded background levels. Interwell tests were used to evaluate potential SSIs for boron, pH, and sulfate, and intrawell tests were used to evaluate potential SSIs for calcium, chloride, fluoride, and TDS. The prediction limits for the interwell tests were updated with additional data collected from the background wells. Prediction limits were recalculated using a one-of-two retesting procedure. The prediction limits calculated during detection monitoring were used for the intrawell tests. Boron, chloride, sulfate, and TDS results exceeded background levels.

Based on this evaluation, either the Big Sandy BAP CCR unit will remain in assessment monitoring or an ASD will be conducted to evaluate if the unit can return to detection monitoring.

SECTION 3

REFERENCES

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

Geosyntec Consultants (Geosyntec). 2018. Statistical Analysis Summary – Bottom Ash Pond, Big Sandy Plant, Louisa, Kentucky. January 15, 2018.

United States Environmental Protection Agency (USEPA). 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. EPA 530/R-09-007. March 2009.

TABLES

Table 1 - Groundwater Data Summary
Big Sandy - Bottom Ash Pond

Geosyntec Consultants

Parameter	Unit	MW-1614	MW-1615	MW-1618	MW-1619	MW-1620
		3/14/2019	3/14/2019	3/14/2019	3/11/2019	3/11/2019
Antimony	µg/L	0.0300 J	0.100 U	0.100 U	0.200 U	0.100 U
Arsenic	µg/L	8.97	0.550	1.78	3.26	21.4
Barium	µg/L	59.6	17.2	18.8	1460	173
Beryllium	µg/L	0.305	0.100 U	0.100 U	0.200 U	0.100 U
Boron	mg/L	0.119	0.0900 J	0.0900 J	0.0600 J	0.0300 J
Cadmium	µg/L	0.0500 U	0.0500 J	0.0400 J	0.0300 J	0.0500 U
Calcium	mg/L	40.9	47.5	53.4	135	9.41
Chloride	mg/L	52.6	37.5	49.8	1090	6.25
Chromium	µg/L	0.457	0.385	0.390	0.414	0.394
Cobalt	µg/L	1.0400	5.43	2.98	6.42	12.1
Combined Radium	pCi/	1.69	0.622	0.143	8.25	0.901
Fluoride	mg/L	0.0600 J	0.170	0.120	0.0600 J	0.0900
Lead	µg/L	0.215	0.0400 J	0.141	0.100 J	0.0200 J
Lithium	mg/L	0.0300 U	0.0300 U	0.0300 U	0.0100 J	0.0300 U
Mercury	µg/L	0.0100 U	0.0100 U	0.0100 U	0.00500 U	0.00500 U
Molybdenum	µg/L	2.00 U	2.00 U	2.00 U	4.00 U	2.00 U
Selenium	µg/L	0.200 J	0.0800 J	0.0600 J	0.0900 J	0.200 U
Total Dissolved Solids	mg/L	661	555	574	2210	169
Sulfate	mg/L	343	300	287	46.4	48.5
Thallium	µg/L	0.500 U	0.100 J	0.100 J	1.00 U	0.500 U
pH	SU	5.89	5.73	5.68	6.63	6.46

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.

Table 2: Groundwater Protection Standards
Big Sandy Plant - Bottom Ash Pond

Geosyntec Consultants, Inc.

Constituent Name	MCL	CCR Rule-Specified	Background Limit
Antimony, Total (mg/L)	0.006		0.0001
Arsenic, Total (mg/L)	0.01		0.021
Barium, Total (mg/L)	2		1.82
Beryllium, Total (mg/L)	0.004		0.00007
Cadmium, Total (mg/L)	0.005		0.00012
Chromium, Total (mg/L)	0.1		0.0018
Cobalt, Total (mg/L)	n/a	0.006	0.023
Combined Radium, Total (pCi/L)	5		14.18
Fluoride, Total (mg/L)	4		0.2
Lead, Total (mg/L)	n/a	0.015	0.00056
Lithium, Total (mg/L)	n/a	0.04	0.029
Mercury, Total (mg/L)	0.002		0.000005
Molybdenum, Total (mg/L)	n/a	0.1	0.002
Selenium, Total (mg/L)	0.05		0.2
Thallium, Total (mg/L)	0.002		0.00025

Notes:
Grey cell indicates calculated UTL is higher than MCL.
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: Appendix III Data Summary
Big Sandy Plant - Bottom Ash Pond

Geosyntec Consultants, Inc.

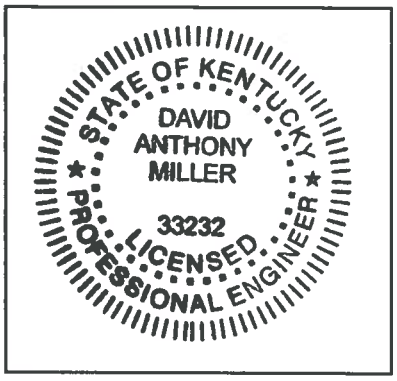
Parameter	Units	Description	MW-1614	MW-1614	MW-1615	MW-1615	MW-1618	MW-1618
			9/24/2018	3/14/2019	9/24/2018	3/14/2019	9/24/2018	3/14/2019
Boron	mg/L	Interwell Background Value (UPL)	0.132					
		Detection Monitoring Result	**0.183**	0.119	**0.156**	0.09	**0.133**	0.09
Calcium	mg/L	Intrawell Background Value (UPL)	68.1		96.0		77.5	
		Detection Monitoring Result	49.6	40.9	58.3	47.5	70.0	53.4
Chloride	mg/L	Intrawell Background Value (UPL)	92.5		59.1		71.1	
		Detection Monitoring Result	42.1	52.6	**82.1**	37.5	**71.4**	49.8
Fluoride	mg/L	Intrawell Background Value (UPL)	0.200					
		Detection Monitoring Result	0.08	0.06	0.11	0.17	0.09	0.12
pH	SU	Interwell Background Value (UPL)	6.5					
		Interwell Background Value (LPL)	5.2					
		Detection Monitoring Result	6.4	5.9	5.8	5.7	5.9	5.7
Sulfate	mg/L	Interwell Background Value (UPL)	53.9					
		Detection Monitoring Result	**295**	**343**	**474**	**300**	**422**	**287**
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	937		902		738	
		Detection Monitoring Result	578	661	854	555	**764**	574

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
*: Designates results for a duplicate sample
-: Not Sampled
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 Big Sandy 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

33232	KENTUCKY	07.12.19
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, Suite 103
Columbus, OH 43221

Re: Big Sandy Bottom Ash Pond
Assessment Monitoring Event – March 2019

Dear Ms. Kreinberg,

Groundwater Stats Consulting (GSC), formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the evaluation of groundwater data for the March 2019 Assessment Monitoring event for American Electric Power Company's Big Sandy 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 site for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, consists of the following:

- **Upgradient wells:** MW-1619 and MW-1620; and
- **Downgradient wells:** MW-1614, MW-1615, and MW-1618.

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; and

- **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 in background which have previously been flagged as outliers may be seen in a lighter font and disconnected symbol on the graphs. Additionally, a summary of flagged values follows this letter (Figure B).

Evaluation of Appendix III Parameters

Interwell prediction limits combined with a 1-of-2 verification strategy were constructed for boron, fluoride, pH and sulfate; and intrawell prediction limits combined with a 1-of-2 verification strategy were constructed for calcium, chloride and TDS (Figures C and 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.

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. SSIs were noted for sulfate and calcium, and 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 data are statistically increasing, decreasing or stable. No statistically significant trends were found. The Trend Test Summary Table follows this letter (Figure E).

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 either the MCL, CCR-rule specified or ACL as discussed above. Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. No exceedances were noted for any of the well/constituent pairs. A summary of the confidence interval results follows this letter (Figure H).

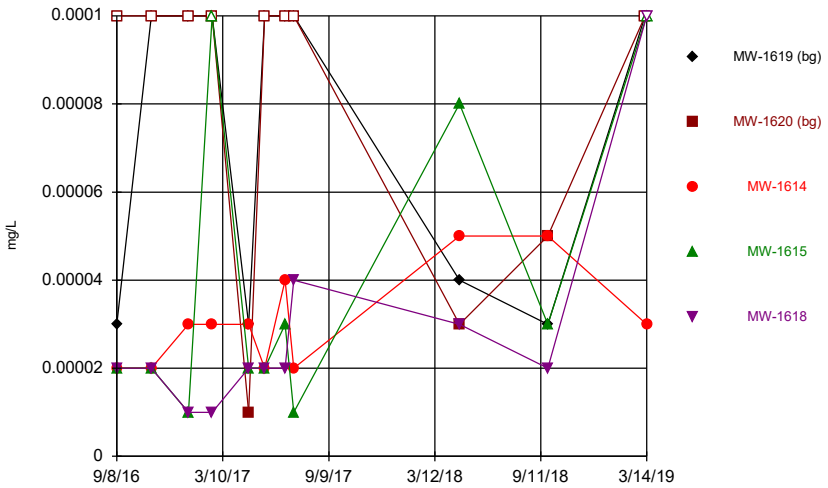
Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for Big Sandy Bottom Ash Pond. If you have any questions or comments, please feel free to contact me.

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.

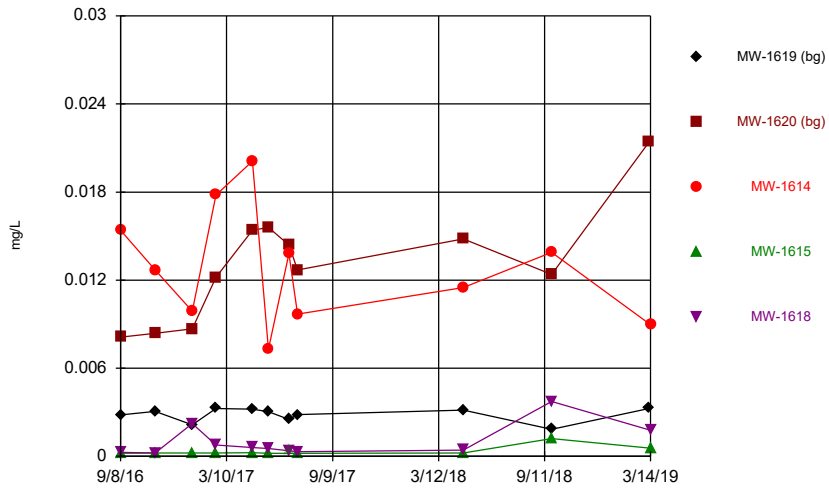
Time Series



Constituent: Antimony, total Analysis Run 6/29/2019 8:33 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

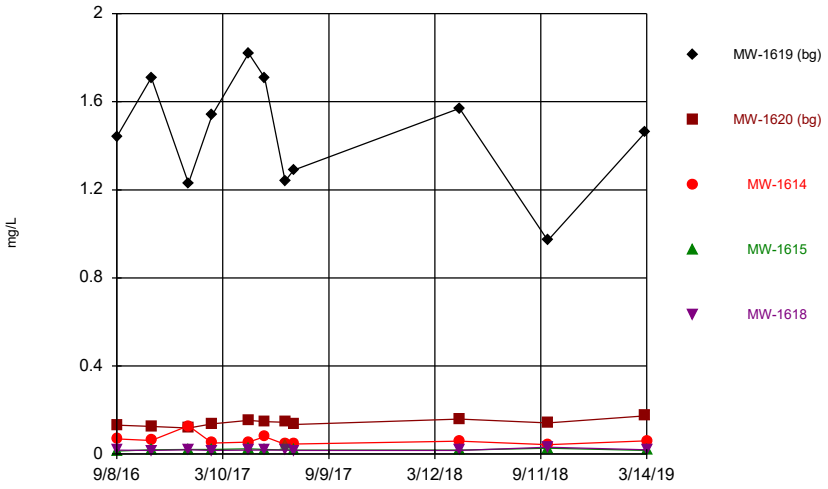
Time Series



Constituent: Arsenic, Total Analysis Run 6/29/2019 8:33 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

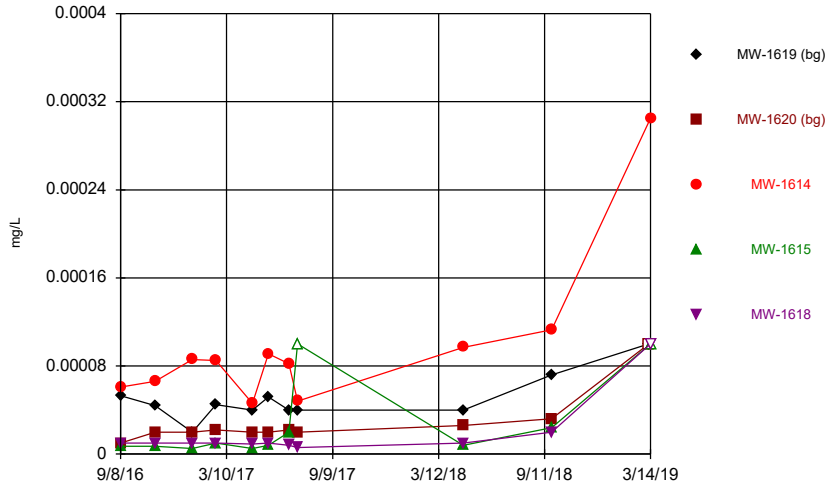
Time Series



Constituent: Barium, Total Analysis Run 6/29/2019 8:33 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

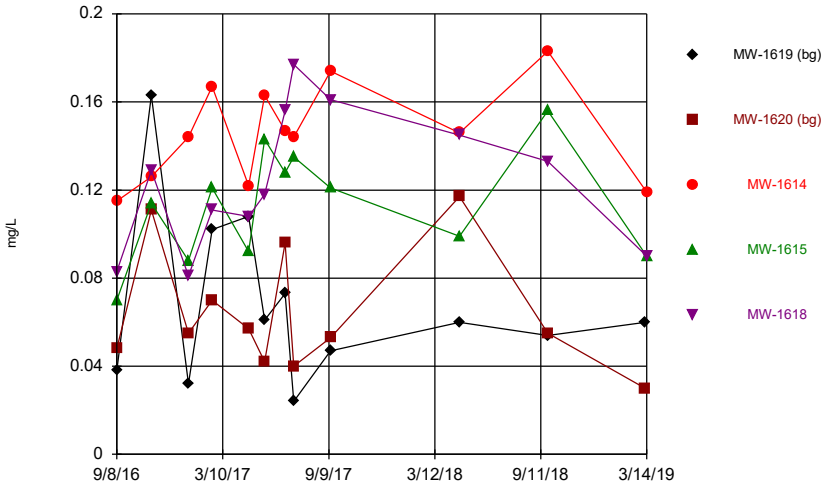
Time Series



Constituent: Beryllium, total Analysis Run 6/29/2019 8:33 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

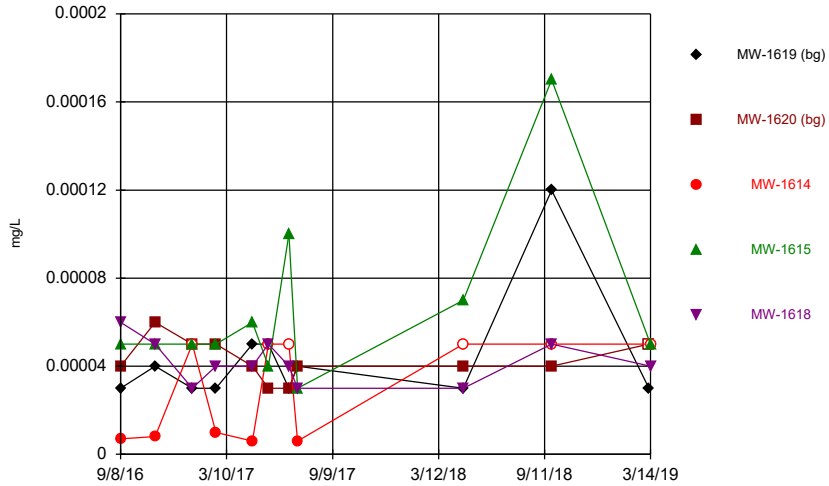
Time Series



Constituent: Boron, total Analysis Run 6/29/2019 8:33 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

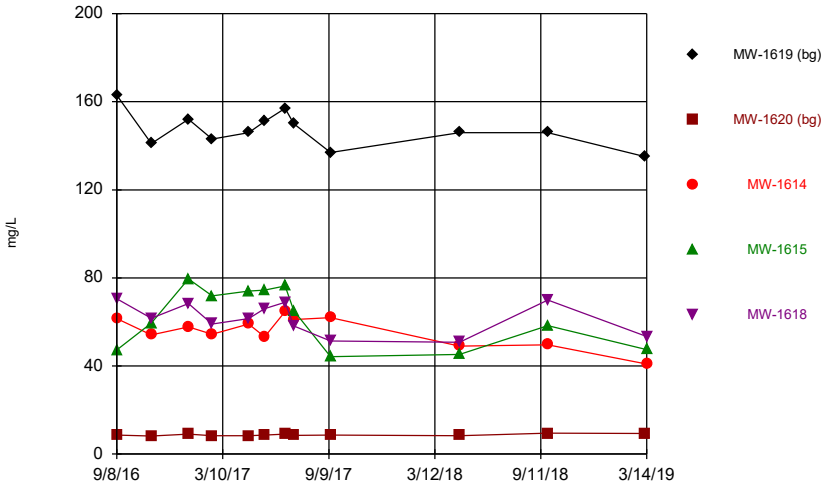
Time Series



Constituent: Cadmium, total Analysis Run 6/29/2019 8:33 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

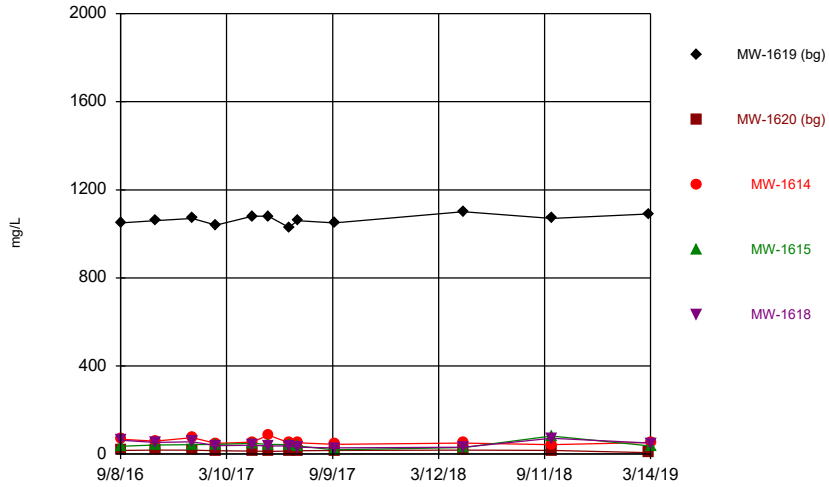
Time Series



Constituent: Calcium, total Analysis Run 6/29/2019 8:33 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

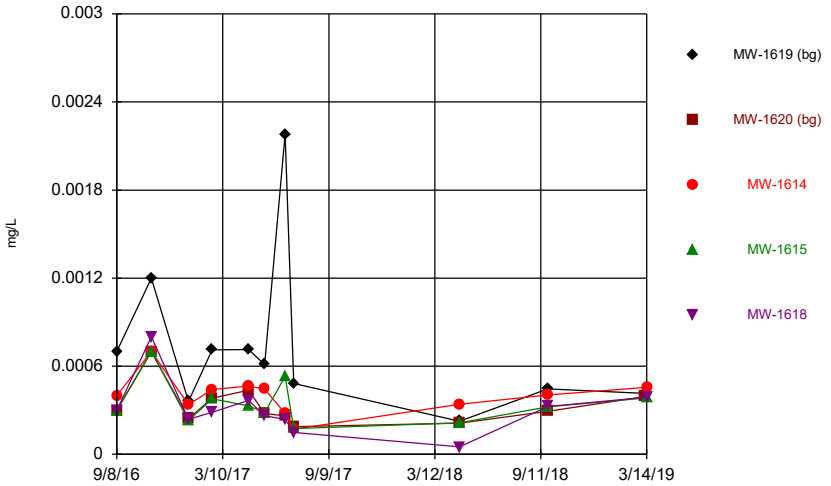
Time Series



Constituent: Chloride, total Analysis Run 6/29/2019 8:33 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

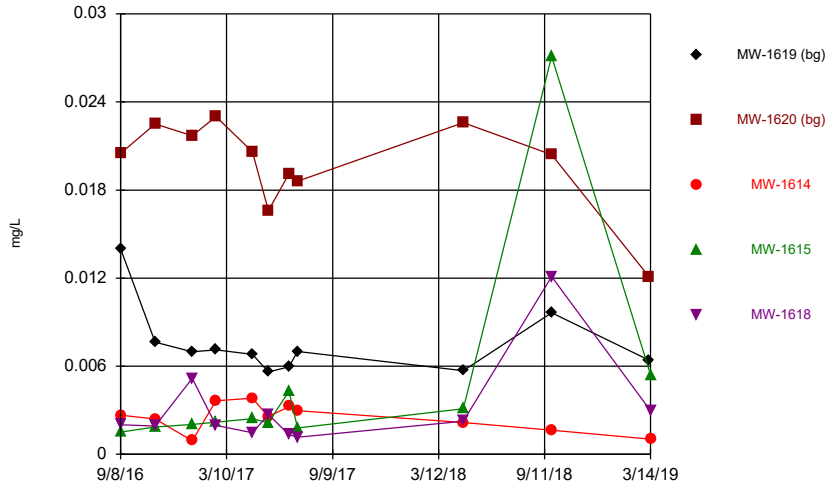
Time Series



Constituent: Chromium, total Analysis Run 6/29/2019 8:33 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

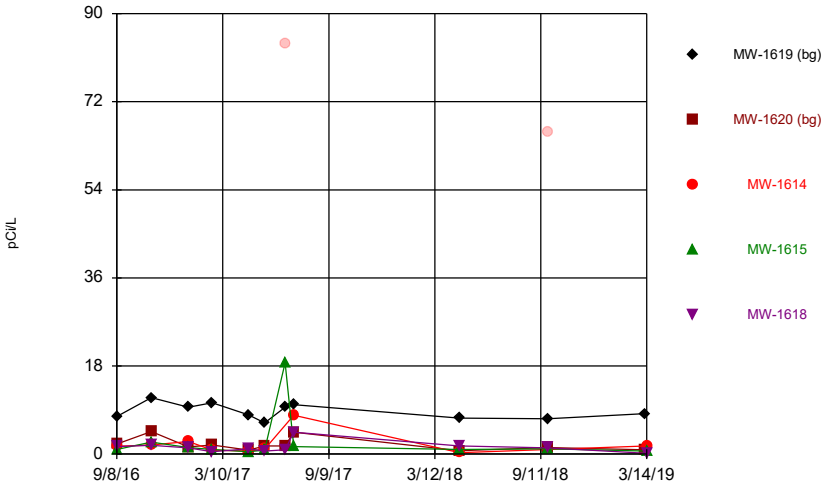
Time Series



Constituent: Cobalt, total Analysis Run 6/29/2019 8:33 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

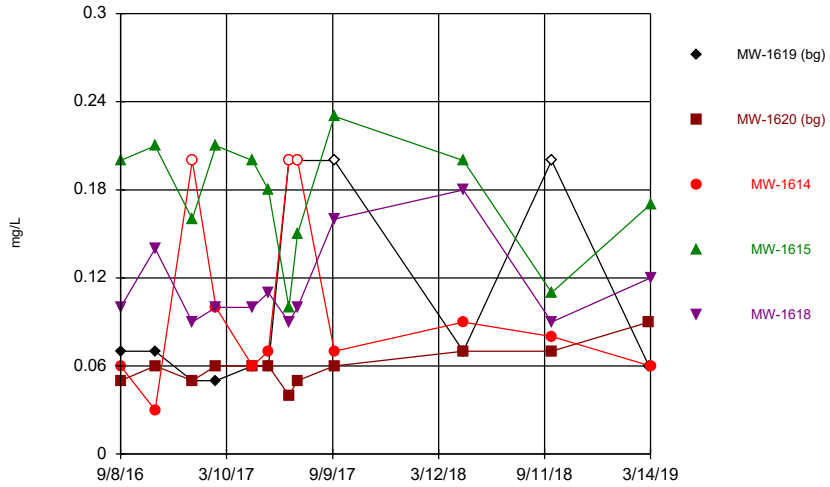
Time Series



Constituent: Combined Radium 226 + 228 Analysis Run 6/29/2019 8:33 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

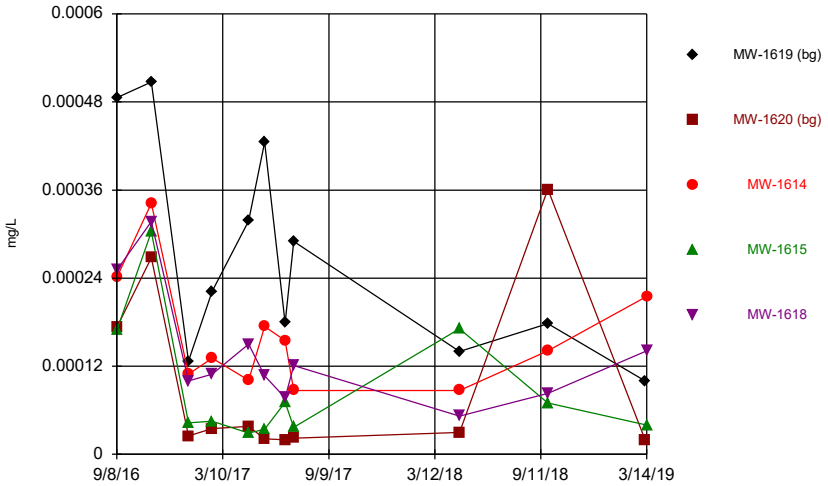
Time Series



Constituent: Fluoride, total Analysis Run 6/29/2019 8:33 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

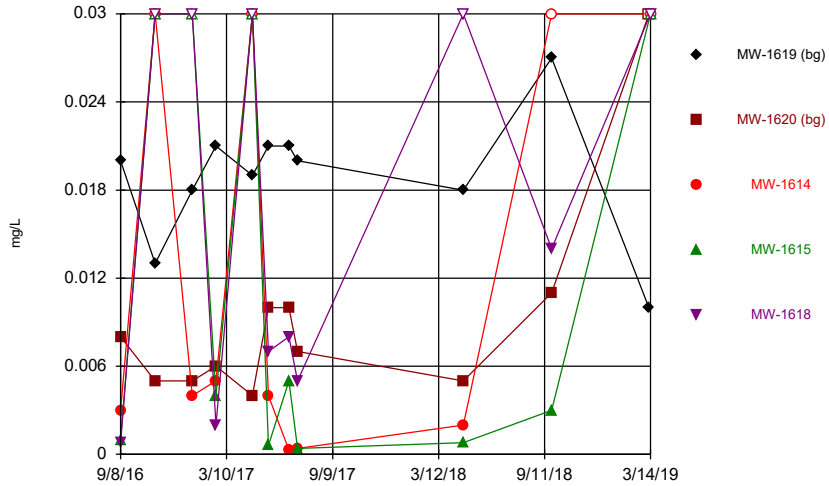
Time Series



Constituent: Lead, total Analysis Run 6/29/2019 8:33 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

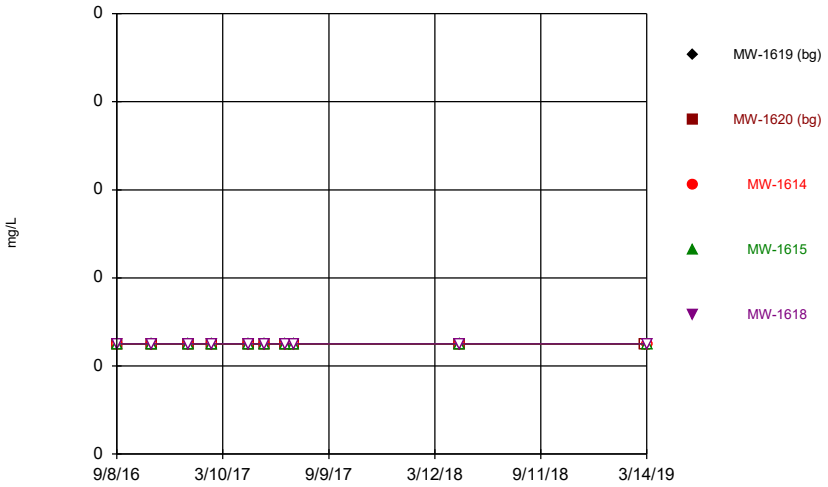
Time Series



Constituent: Lithium, total Analysis Run 6/29/2019 8:33 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

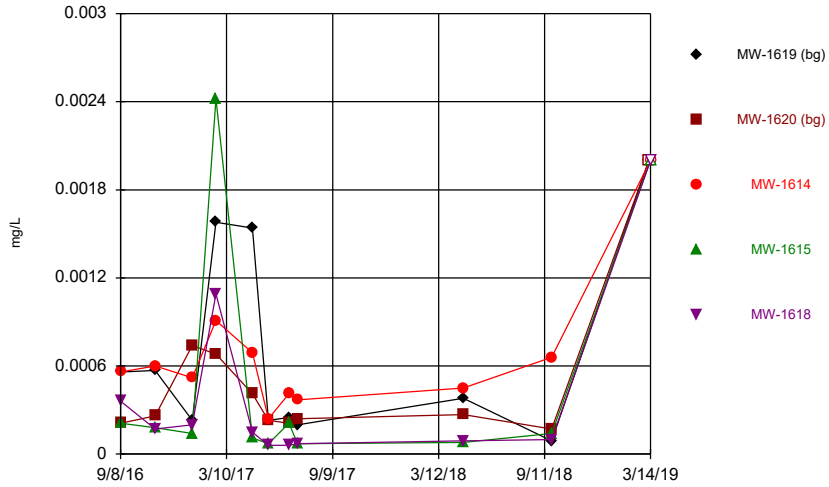
Time Series



Constituent: Mercury, total Analysis Run 6/29/2019 8:33 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

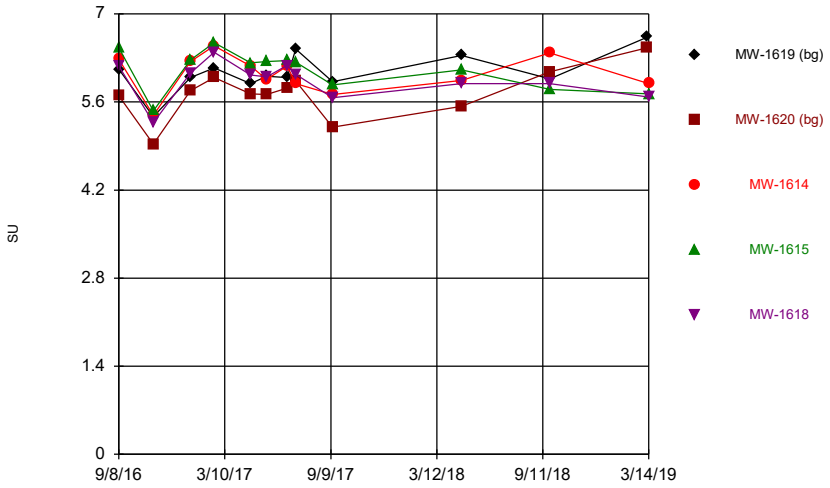
Time Series



Constituent: Molybdenum, total Analysis Run 6/29/2019 8:34 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

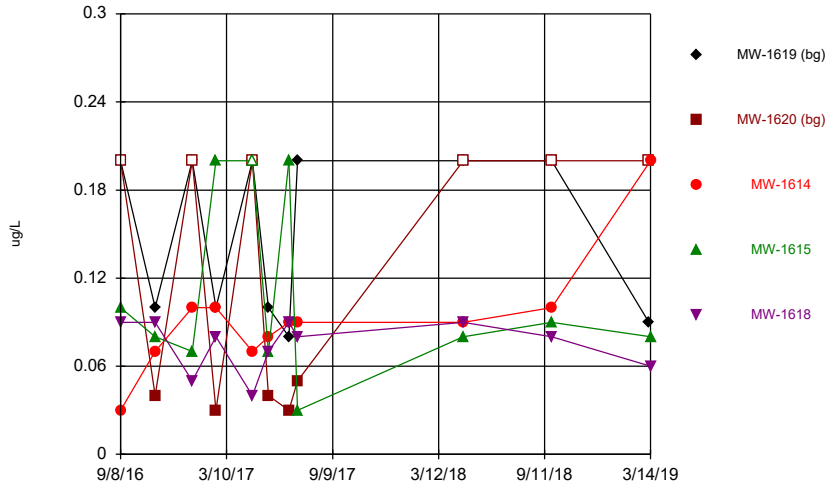
Time Series



Constituent: pH, field Analysis Run 6/29/2019 8:34 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

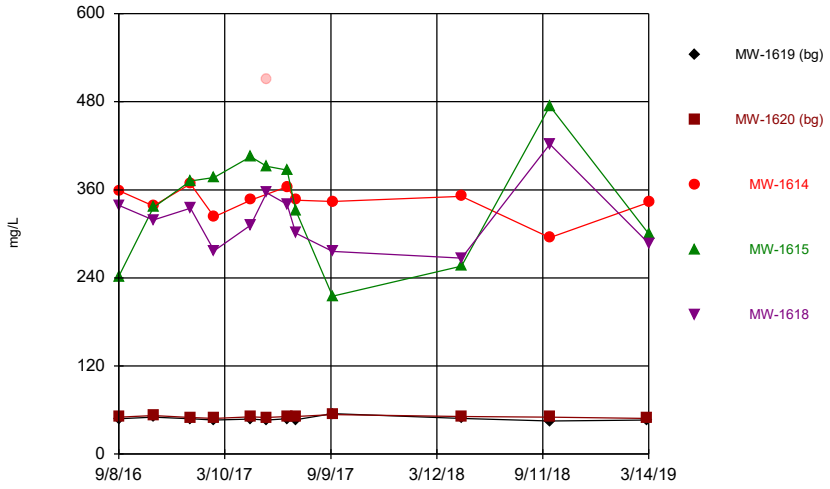
Time Series



Constituent: Selenium, Total Analysis Run 6/29/2019 8:34 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

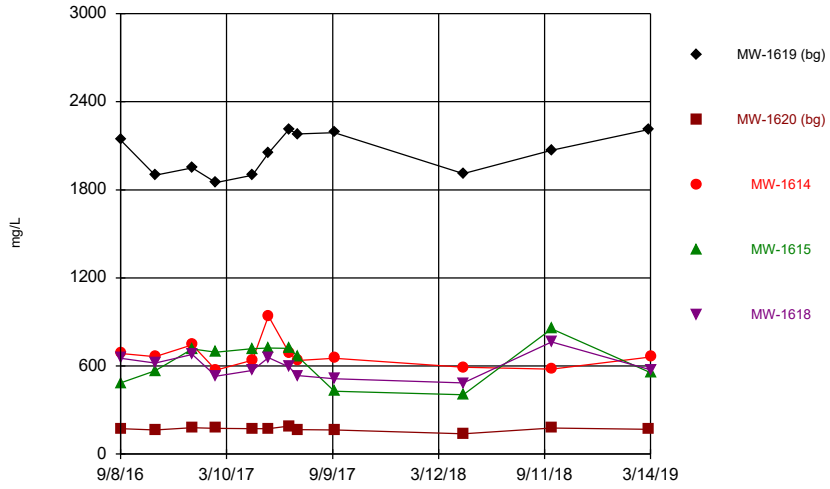
Time Series



Constituent: Sulfate, total Analysis Run 6/29/2019 8:34 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

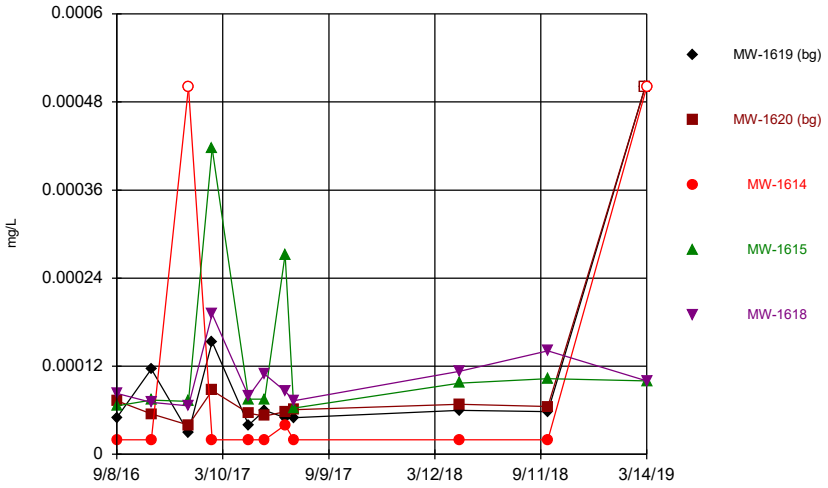
Time Series



Constituent: TDS Analysis Run 6/29/2019 8:34 AM View: Time Series - All Wells
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Hollow symbols indicate censored values.

Time Series



Constituent: Thallium, Total Analysis Run 6/29/2019 8:34 AM View: Time Series - All Wells

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Outlier Summary

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 6/29/2019, 8:31 AM

	MW-1615 Arsenic, Total (mg/L)	MW-1615 Barium, Total (mg/L)	MW-1614 Combined Radium 226 + 228 (pCi/L)	MW-1614 Sulfate, total (mg/L)
5/22/2017				510 (o)
6/26/2017	0.00049 (o)	0.0423 (o)	83.973 (o)	
9/24/2018			65.9 (o)	

Interwell Prediction Limit Summary - Significant Results

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 6/29/2019, 8:19 AM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Sulfate, total (mg/L)	**MW-1614**	**53.93**	**n/a**	**3/14/2019**	**343**	**Yes**	**24**	**49.41**	**2.451**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Sulfate, total (mg/L)	**MW-1615**	**53.93**	**n/a**	**3/14/2019**	**300**	**Yes**	**24**	**49.41**	**2.451**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Sulfate, total (mg/L)	**MW-1618**	**53.93**	**n/a**	**3/14/2019**	**287**	**Yes**	**24**	**49.41**	**2.451**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**

Interwell Prediction Limit Summary - All Results

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 6/29/2019, 8:19 AM

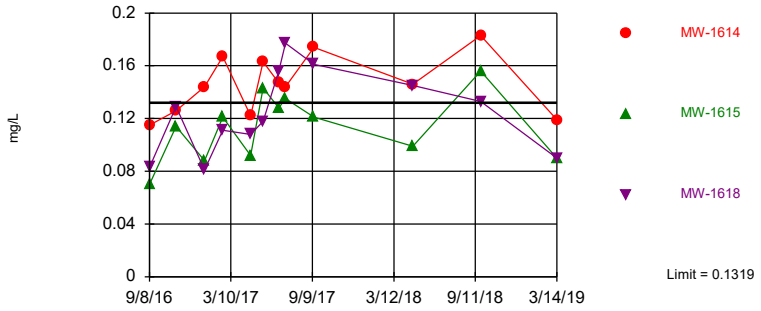
Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	MW-1614	0.1319	n/a	3/14/2019	0.119	No	24	0.2509	0.06086	0	None	sqrt(x)	0.002505	Param Inter 1 of 2
Boron, total (mg/L)	MW-1615	0.1319	n/a	3/14/2019	0.09	No	24	0.2509	0.06086	0	None	sqrt(x)	0.002505	Param Inter 1 of 2
Boron, total (mg/L)	MW-1618	0.1319	n/a	3/14/2019	0.09	No	24	0.2509	0.06086	0	None	sqrt(x)	0.002505	Param Inter 1 of 2
Fluoride, total (mg/L)	MW-1614	0.2	n/a	3/14/2019	0.06	No	24	n/a	n/a	16.67	n/a	n/a	0.003036	NP Inter (normality) 1 of 2
Fluoride, total (mg/L)	MW-1615	0.2	n/a	3/14/2019	0.17	No	24	n/a	n/a	16.67	n/a	n/a	0.003036	NP Inter (normality) 1 of 2
Fluoride, total (mg/L)	MW-1618	0.2	n/a	3/14/2019	0.12	No	24	n/a	n/a	16.67	n/a	n/a	0.003036	NP Inter (normality) 1 of 2
pH, field (SU)	MW-1614	6.621	5.185	3/14/2019	5.89	No	24	5.903	0.3892	0	None	No	0.001253	Param Inter 1 of 2
pH, field (SU)	MW-1615	6.621	5.185	3/14/2019	5.73	No	24	5.903	0.3892	0	None	No	0.001253	Param Inter 1 of 2
pH, field (SU)	MW-1618	6.621	5.185	3/14/2019	5.68	No	24	5.903	0.3892	0	None	No	0.001253	Param Inter 1 of 2
Sulfate, total (mg/L)	**MW-1614**	**53.93**	**n/a**	**3/14/2019**	**343**	**Yes**	**24**	**49.41**	**2.451**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Sulfate, total (mg/L)	**MW-1615**	**53.93**	**n/a**	**3/14/2019**	**300**	**Yes**	**24**	**49.41**	**2.451**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**
Sulfate, total (mg/L)	**MW-1618**	**53.93**	**n/a**	**3/14/2019**	**287**	**Yes**	**24**	**49.41**	**2.451**	**0**	**None**	**No**	**0.002505**	**Param Inter 1 of 2**

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

Within Limit

Prediction Limit

Interwell Parametric



Background Data Summary (based on square root transformation): Mean=0.2509, Std. Dev.=0.06086, n=24. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9411, critical = 0.884. Kappa = 1.845 (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 6/29/2019 8:17 AM View: PLs - Interwell

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

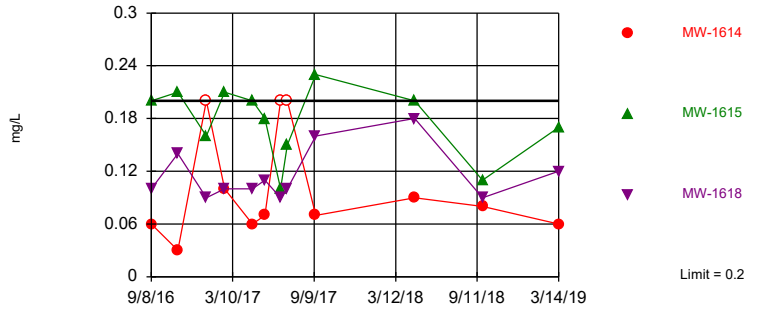
Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 24 background values. 16.67% NDs. Annual per-constituent alpha = 0.01808. Individual comparison alpha = 0.003036 (1 of 2). Comparing 3 points to limit.

Constituent: Fluoride, total Analysis Run 6/29/2019 8:17 AM View: PLs - Interwell

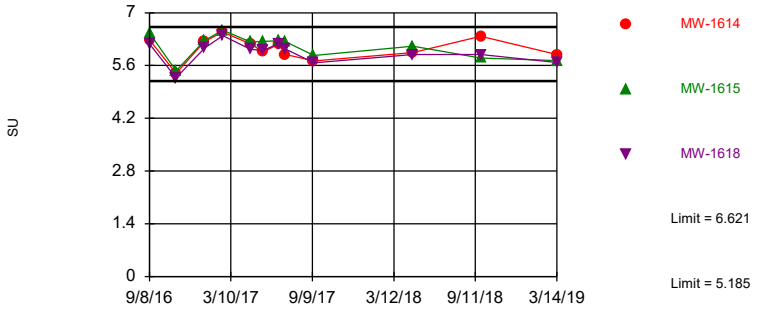
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

Within Limits

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=5.903, Std. Dev.=0.3892, n=24. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9601, critical = 0.884. Kappa = 1.845 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.001253. Comparing 3 points to limit.

Constituent: pH, field Analysis Run 6/29/2019 8:17 AM View: PLs - Interwell

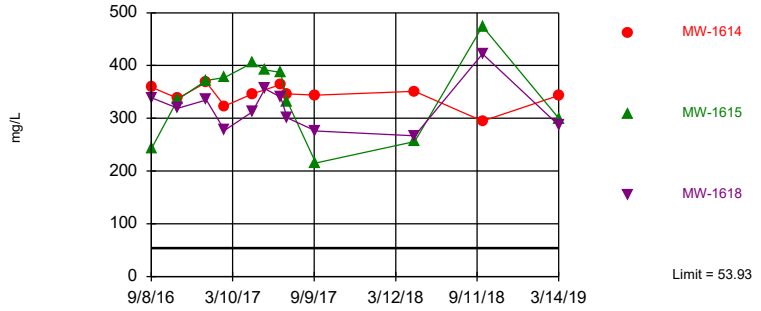
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

Exceeds Limit: MW-1614, MW-1615, MW-1618

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=49.41, Std. Dev.=2.451, n=24. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9751, critical = 0.884. Kappa = 1.845 (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: Sulfate, total Analysis Run 6/29/2019 8:17 AM View: PLs - Interwell

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Intrawell Prediction Limit Summary - Significant Results

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 6/29/2019, 8:24 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)	**MW-1620**	**9.324**	**n/a**	**3/11/2019**	**9.41**	**Yes**	**9**	**8.574**	**0.3191**	**0**	**None**	**No**	**0.002505**	Param 1 of 2

Intrawell Prediction Limit Summary - All Results

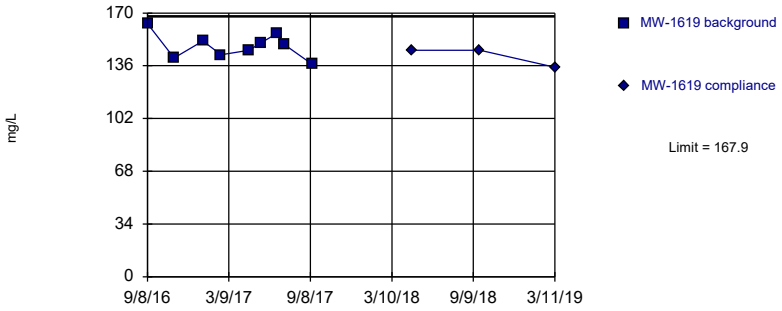
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 6/29/2019, 8:24 AM

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)	MW-1619	167.9	n/a	3/11/2019	135	No	9	148.9	8.115	0	None	No	0.002505	Param 1 of 2
Calcium, total (mg/L)	**MW-1620**	**9.324**	**n/a**	**3/11/2019**	**9.41**	**Yes**	**9**	**8.574**	**0.3191**	**0**	**None**	**No**	**0.002505**	Param 1 of 2
Calcium, total (mg/L)	MW-1614	68.14	n/a	3/14/2019	40.9	No	9	58.67	4.034	0	None	No	0.002505	Param 1 of 2
Calcium, total (mg/L)	MW-1615	96.02	n/a	3/14/2019	47.5	No	9	65.82	12.86	0	None	No	0.002505	Param 1 of 2
Calcium, total (mg/L)	MW-1618	77.45	n/a	3/14/2019	53.4	No	9	62.87	6.209	0	None	No	0.002505	Param 1 of 2
Chloride, total (mg/L)	MW-1619	1098	n/a	3/11/2019	1090	No	9	1058	17.16	0	None	No	0.002505	Param 1 of 2
Chloride, total (mg/L)	MW-1620	20.08	n/a	3/11/2019	6.25	No	9	15.69	1.87	0	None	No	0.002505	Param 1 of 2
Chloride, total (mg/L)	MW-1614	92.54	n/a	3/14/2019	52.6	No	9	60.08	13.83	0	None	No	0.002505	Param 1 of 2
Chloride, total (mg/L)	MW-1615	59.06	n/a	3/14/2019	37.5	No	9	39.6	8.288	0	None	No	0.002505	Param 1 of 2
Chloride, total (mg/L)	MW-1618	71.11	n/a	3/14/2019	49.8	No	9	42.76	12.07	0	None	No	0.002505	Param 1 of 2
TDS (mg/L)	MW-1619	2378	n/a	3/11/2019	2210	No	9	2041	143.4	0	None	No	0.002505	Param 1 of 2
TDS (mg/L)	MW-1620	193.2	n/a	3/11/2019	169	No	9	173.6	8.353	0	None	No	0.002505	Param 1 of 2
TDS (mg/L)	MW-1614	937.2	n/a	3/14/2019	661	No	9	692.1	104.4	0	None	No	0.002505	Param 1 of 2
TDS (mg/L)	MW-1615	901.6	n/a	3/14/2019	555	No	9	635.2	113.5	0	None	No	0.002505	Param 1 of 2
TDS (mg/L)	MW-1618	737.5	n/a	3/14/2019	574	No	9	594.3	60.97	0	None	No	0.002505	Param 1 of 2

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=148.9, Std. Dev.=8.115, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9824, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Calcium, total Analysis Run 6/29/2019 8:21 AM View: PLs - Intrawell

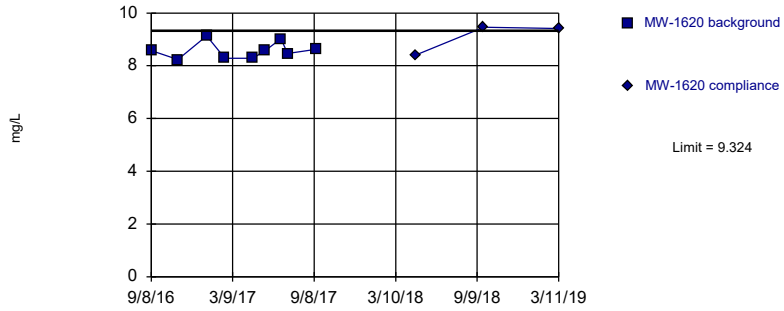
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

Exceeds Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=8.574, Std. Dev.=0.3191, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8841, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Calcium, total Analysis Run 6/29/2019 8:21 AM View: PLs - Intrawell

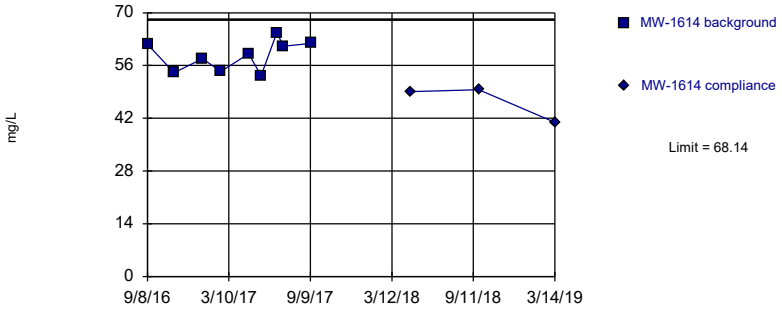
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=58.67, Std. Dev.=4.034, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9257, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Calcium, total Analysis Run 6/29/2019 8:21 AM View: PLs - Intrawell

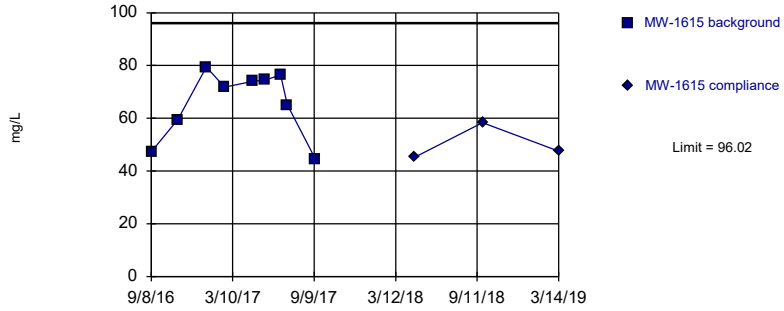
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=65.82, Std. Dev.=12.86, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8719, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

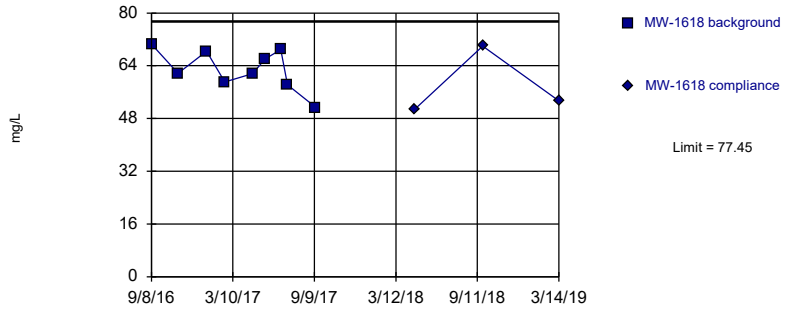
Constituent: Calcium, total Analysis Run 6/29/2019 8:21 AM View: PLs - Intrawell

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=62.87, Std. Dev.=6.209, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9413, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Calcium, total Analysis Run 6/29/2019 8:21 AM View: PLs - Intrawell

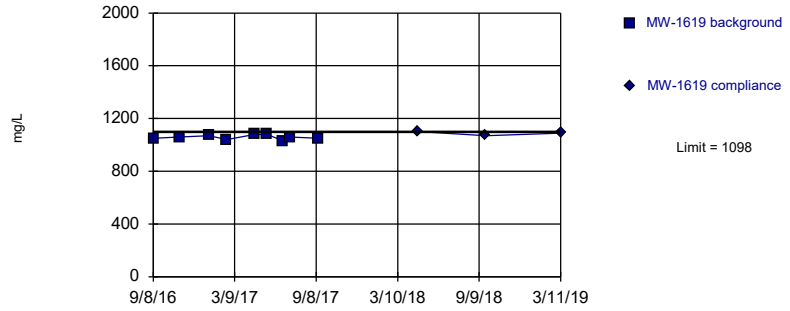
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=1058, Std. Dev.=17.16, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9504, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Chloride, total Analysis Run 6/29/2019 8:21 AM View: PLs - Intrawell

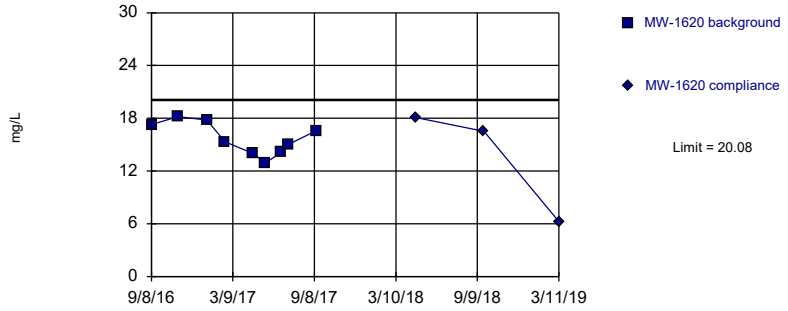
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=15.69, Std. Dev.=1.87, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9436, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Chloride, total Analysis Run 6/29/2019 8:21 AM View: PLs - Intrawell

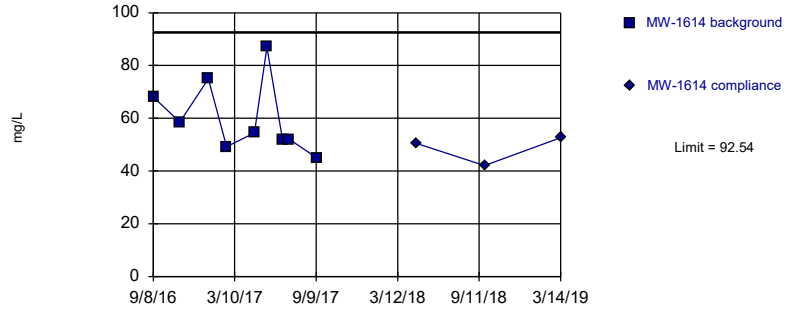
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=60.08, Std. Dev.=13.83, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8986, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

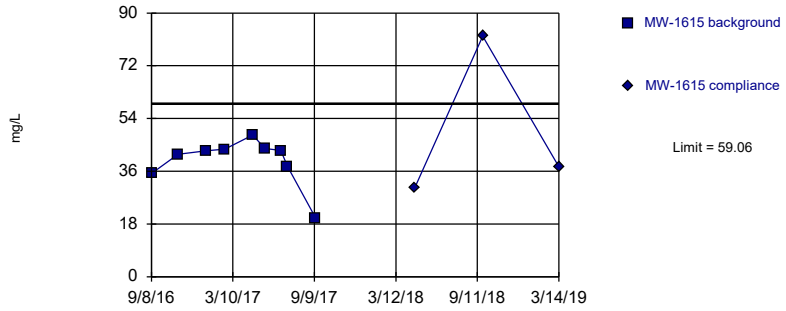
Constituent: Chloride, total Analysis Run 6/29/2019 8:21 AM View: PLs - Intrawell

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=39.6, Std. Dev.=8.288, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7894, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Chloride, total Analysis Run 6/29/2019 8:21 AM View: PLs - Intrawell

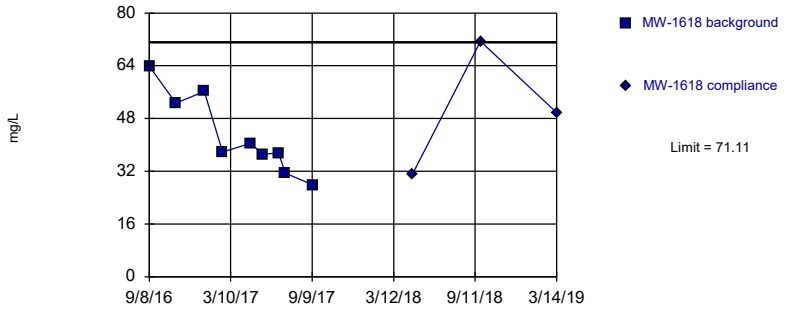
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=42.76, Std. Dev.=12.07, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9139, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: Chloride, total Analysis Run 6/29/2019 8:21 AM View: PLs - Intrawell

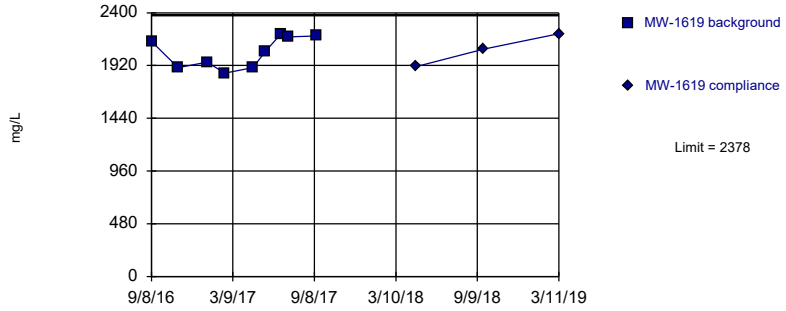
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=2041, Std. Dev.=143.4, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8749, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: TDS Analysis Run 6/29/2019 8:21 AM View: PLs - Intrawell

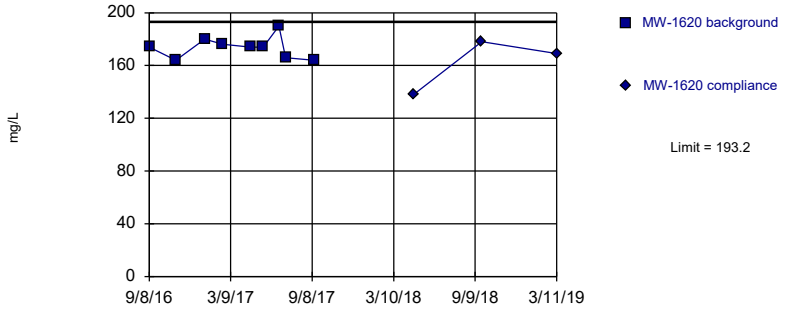
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=173.6, Std. Dev.=8.353, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9049, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

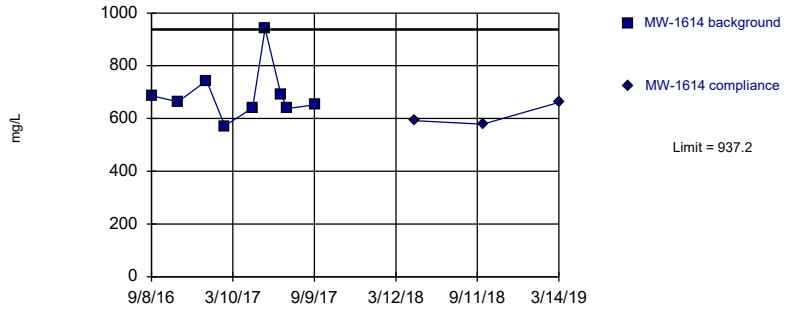
Constituent: TDS Analysis Run 6/29/2019 8:21 AM View: PLs - Intrawell

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=692.1, Std. Dev.=104.4, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8067, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: TDS Analysis Run 6/29/2019 8:21 AM View: PLs - Intrawell

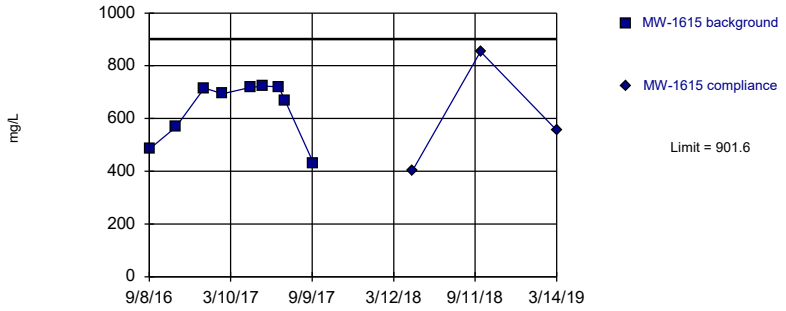
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=635.2, Std. Dev.=113.5, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7865, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: TDS Analysis Run 6/29/2019 8:21 AM View: PLs - Intrawell

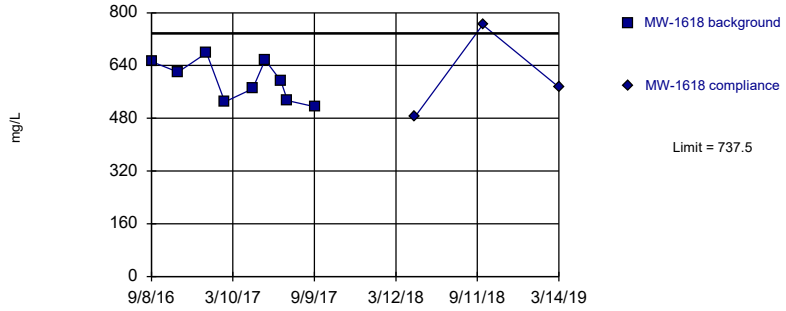
Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

Within Limit

Prediction Limit

Intrawell Parametric



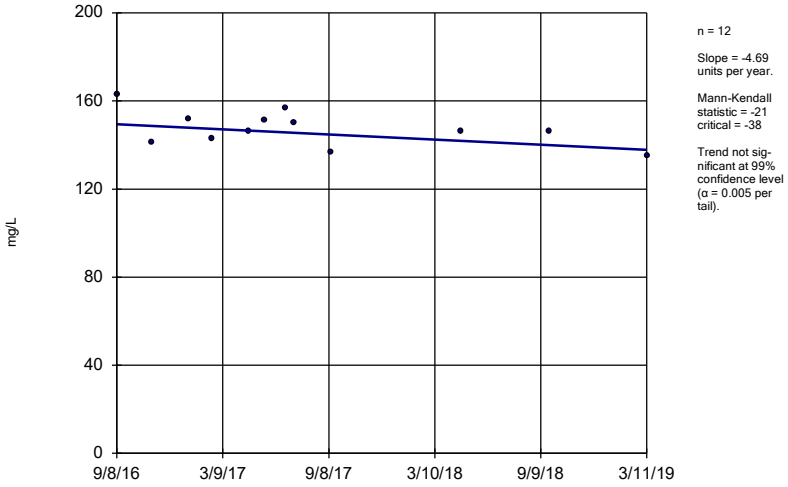
Background Data Summary: Mean=594.3, Std. Dev.=60.97, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9246, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Constituent: TDS Analysis Run 6/29/2019 8:21 AM View: PLs - Intrawell

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sen's Slope Estimator

MW-1619 (bg)



n = 12

Slope = -4.69 units per year.

Mann-Kendall statistic = -21 critical = -38

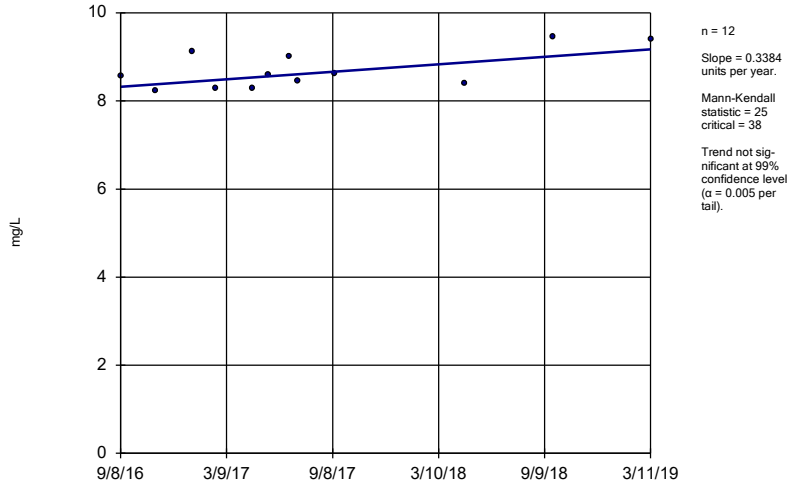
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 6/29/2019 8:30 AM View: Trend Testing

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sen's Slope Estimator

MW-1620 (bg)



n = 12

Slope = 0.3384 units per year.

Mann-Kendall statistic = 25 critical = 38

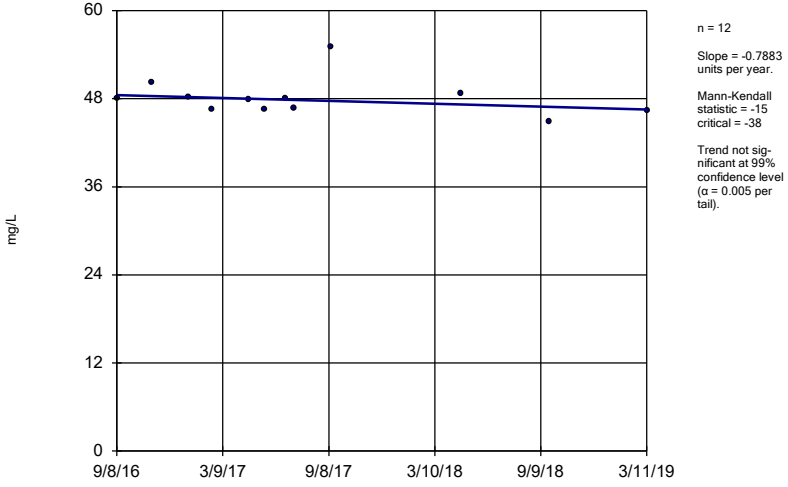
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Calcium, total Analysis Run 6/29/2019 8:31 AM View: Trend Testing

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sen's Slope Estimator

MW-1619 (bg)



n = 12

Slope = -0.7883 units per year.

Mann-Kendall statistic = -15 critical = -38

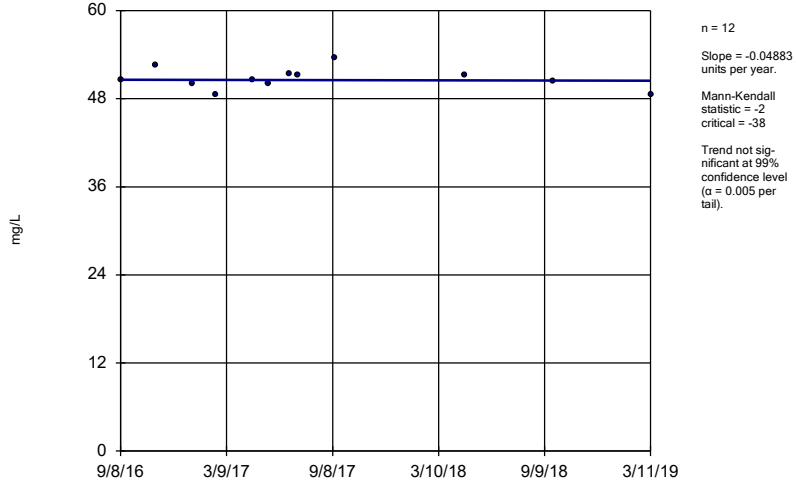
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 6/29/2019 8:31 AM View: Trend Testing

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sen's Slope Estimator

MW-1620 (bg)



n = 12

Slope = -0.04883 units per year.

Mann-Kendall statistic = -2 critical = -38

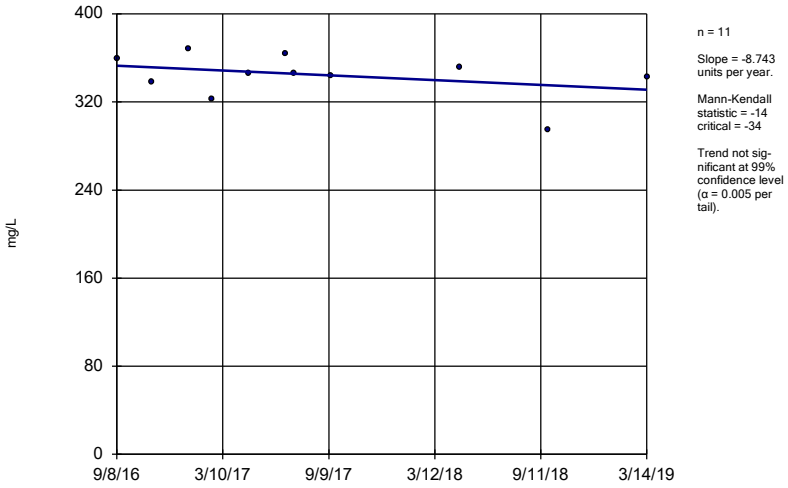
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 6/29/2019 8:31 AM View: Trend Testing

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sen's Slope Estimator

MW-1614



n = 11

Slope = -8.743 units per year.

Mann-Kendall statistic = -14 critical = -34

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

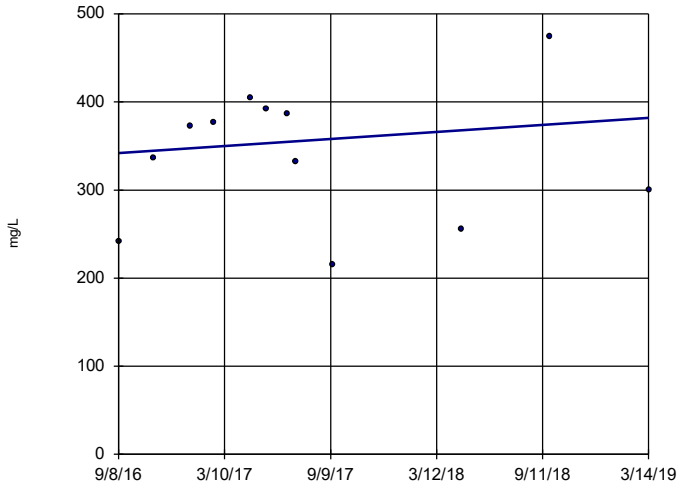
Constituent: Sulfate, total Analysis Run 6/29/2019 8:31 AM View: Trend Testing

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

Sen's Slope Estimator

MW-1615



n = 12

Slope = 15.85 units per year.

Mann-Kendall statistic = 2 critical = 38

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

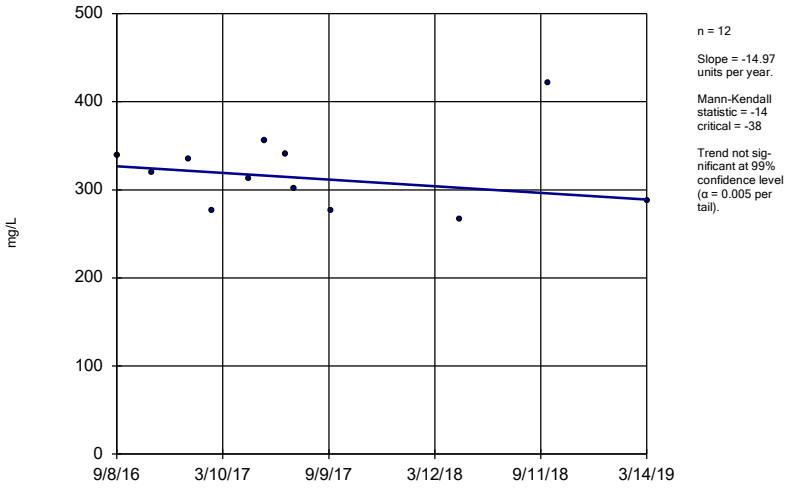
Constituent: Sulfate, total Analysis Run 6/29/2019 8:31 AM View: Trend Testing

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

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

Sen's Slope Estimator

MW-1618



n = 12

Slope = -14.97 units per year.

Mann-Kendall statistic = -14 critical = -38

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

Constituent: Sulfate, total Analysis Run 6/29/2019 8:31 AM View: Trend Testing

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Upper Tolerance Limits

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 6/12/2019, 2:57 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Wells	%NDs	Transform	Alpha	Method
Antimony, total (mg/L)	n/a	0.0001	n/a	n/a	n/a	n/a	22	MW-1619,MW...	68.18	n/a	0.3235	NP Inter(normality)
Arsenic, Total (mg/L)	n/a	0.0214	n/a	n/a	n/a	n/a	22	MW-1619,MW...	0	n/a	0.3235	NP Inter(normality)
Barium, Total (mg/L)	n/a	1.82	n/a	n/a	n/a	n/a	22	MW-1619,MW...	0	n/a	0.3235	NP Inter(normality)
Beryllium, total (mg/L)	n/a	0.00007111	n/a	n/a	n/a	n/a	22	MW-1619,MW...	9.091	No	0.05	Inter
Cadmium, total (mg/L)	n/a	0.00012	n/a	n/a	n/a	n/a	22	MW-1619,MW...	4.545	n/a	0.3235	NP Inter(normality)
Chromium, total (mg/L)	n/a	0.001775	n/a	n/a	n/a	n/a	22	MW-1619,MW...	0	ln(x)	0.05	Inter
Cobalt, total (mg/L)	n/a	0.023	n/a	n/a	n/a	n/a	22	MW-1619,MW...	0	n/a	0.3235	NP Inter(normality)
Combined Radium 226 + 228 (pCi/L)	n/a	14.18	n/a	n/a	n/a	n/a	22	MW-1619,MW...	0	No	0.05	Inter
Fluoride, total (mg/L)	n/a	0.2	n/a	n/a	n/a	n/a	24	MW-1619,MW...	16.67	n/a	0.292	NP Inter(normality)
Lead, total (mg/L)	n/a	0.0005559	n/a	n/a	n/a	n/a	22	MW-1619,MW...	0	No	0.05	Inter
Lithium, total (mg/L)	n/a	0.02948	n/a	n/a	n/a	n/a	22	MW-1619,MW...	4.545	No	0.05	Inter
Mercury, total (mg/L)	n/a	0.000005	n/a	n/a	n/a	n/a	20	MW-1619,MW...	100	n/a	0.3585	NP Inter(NDs)
Molybdenum, total (mg/L)	n/a	0.001777	n/a	n/a	n/a	n/a	22	MW-1619,MW...	9.091	x^(1/3)	0.05	Inter
Selenium, Total (ug/L)	n/a	0.2	n/a	n/a	n/a	n/a	22	MW-1619,MW...	40.91	n/a	0.3235	NP Inter(normality)
Thallium, Total (mg/L)	n/a	0.00025	n/a	n/a	n/a	n/a	22	MW-1619,MW...	9.091	n/a	0.3235	NP Inter(normality)

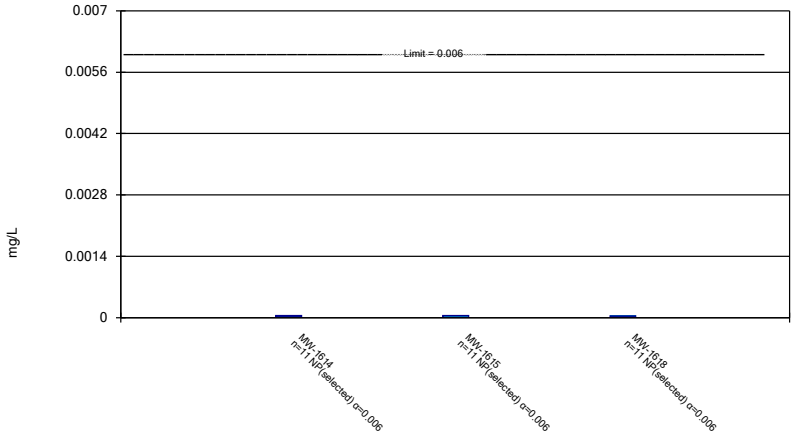
Confidence Interval - All Results (No Significant Results)

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP Printed 6/12/2019, 3:06 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Lower Compl.	Sig.	N	%NDs	Transform	Alpha	Method
Antimony, total (mg/L)	MW-1614	0.00005	0.00002	0.006	n/a	No	11	0	No	0.006	NP (selected)
Antimony, total (mg/L)	MW-1615	0.00005	0.00001	0.006	n/a	No	11	18.18	No	0.006	NP (selected)
Antimony, total (mg/L)	MW-1618	0.00004	0.00001	0.006	n/a	No	11	9.091	No	0.006	NP (selected)
Arsenic, Total (mg/L)	MW-1614	0.0178	0.00729	0.0214	n/a	No	11	0	No	0.006	NP (selected)
Arsenic, Total (mg/L)	MW-1615	0.00055	0.0002	0.0214	n/a	No	10	0	No	0.011	NP (selected)
Arsenic, Total (mg/L)	MW-1618	0.00224	0.00022	0.0214	n/a	No	11	0	No	0.006	NP (selected)
Barium, Total (mg/L)	MW-1614	0.0796	0.0426	2	n/a	No	11	0	No	0.006	NP (selected)
Barium, Total (mg/L)	MW-1615	0.0238	0.0143	2	n/a	No	10	0	No	0.011	NP (selected)
Barium, Total (mg/L)	MW-1618	0.0194	0.016	2	n/a	No	11	0	No	0.006	NP (selected)
Beryllium, total (mg/L)	MW-1614	0.000113	0.000046	0.004	n/a	No	11	0	No	0.006	NP (selected)
Beryllium, total (mg/L)	MW-1615	0.00005	0.000005	0.004	n/a	No	11	18.18	No	0.006	NP (selected)
Beryllium, total (mg/L)	MW-1618	0.00002	0.000006	0.004	n/a	No	11	9.091	No	0.006	NP (selected)
Cadmium, total (mg/L)	MW-1614	0.00005	0.000006	0.005	n/a	No	11	54.55	No	0.006	NP (selected)
Cadmium, total (mg/L)	MW-1615	0.0001	0.00003	0.005	n/a	No	11	0	No	0.006	NP (selected)
Cadmium, total (mg/L)	MW-1618	0.00005	0.00003	0.005	n/a	No	11	0	No	0.006	NP (selected)
Chromium, total (mg/L)	MW-1614	0.000465	0.00017	0.1	n/a	No	11	0	No	0.006	NP (selected)
Chromium, total (mg/L)	MW-1615	0.000531	0.000176	0.1	n/a	No	11	0	No	0.006	NP (selected)
Chromium, total (mg/L)	MW-1618	0.00039	0.00005	0.1	n/a	No	11	0	No	0.006	NP (selected)
Cobalt, total (mg/L)	MW-1614	0.00364	0.000921	0.023	n/a	No	11	0	No	0.006	NP (selected)
Cobalt, total (mg/L)	MW-1615	0.00543	0.00151	0.023	n/a	No	11	0	No	0.006	NP (selected)
Cobalt, total (mg/L)	MW-1618	0.00517	0.00116	0.023	n/a	No	11	0	No	0.006	NP (selected)
Combined Radium 226 + 228 (pCi/L)	MW-1614	7.956	0.268	14.18	n/a	No	9	0	No	0.002	NP (selected)
Combined Radium 226 + 228 (pCi/L)	MW-1615	2.43	0.459	14.18	n/a	No	11	0	No	0.006	NP (selected)
Combined Radium 226 + 228 (pCi/L)	MW-1618	1.81	0.143	14.18	n/a	No	11	0	No	0.006	NP (selected)
Fluoride, total (mg/L)	MW-1614	0.1	0.03	4	n/a	No	12	25	No	0.01	NP (selected)
Fluoride, total (mg/L)	MW-1615	0.21	0.11	4	n/a	No	12	0	No	0.01	NP (selected)
Fluoride, total (mg/L)	MW-1618	0.16	0.09	4	n/a	No	12	0	No	0.01	NP (selected)
Lead, total (mg/L)	MW-1614	0.000241	0.000087	0.015	n/a	No	11	0	No	0.006	NP (selected)
Lead, total (mg/L)	MW-1615	0.000171	0.000029	0.015	n/a	No	11	0	No	0.006	NP (selected)
Lead, total (mg/L)	MW-1618	0.000251	0.000052	0.015	n/a	No	11	0	No	0.006	NP (selected)
Lithium, total (mg/L)	MW-1614	0.03	0.0003	0.04	n/a	No	11	36.36	No	0.006	NP (selected)
Lithium, total (mg/L)	MW-1615	0.03	0.0004	0.04	n/a	No	11	36.36	No	0.006	NP (selected)
Lithium, total (mg/L)	MW-1618	0.03	0.0008	0.04	n/a	No	11	45.45	No	0.006	NP (selected)
Mercury, total (mg/L)	MW-1614	0.00001	0.00001	0.002	n/a	No	10	100	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1615	0.00001	0.00001	0.002	n/a	No	10	100	No	0.011	NP (NDs)
Mercury, total (mg/L)	MW-1618	0.00001	0.00001	0.002	n/a	No	10	100	No	0.011	NP (NDs)
Molybdenum, total (mg/L)	MW-1614	0.00091	0.00024	0.1	n/a	No	11	9.091	No	0.006	NP (selected)
Molybdenum, total (mg/L)	MW-1615	0.001	0.00007	0.1	n/a	No	11	9.091	No	0.006	NP (selected)
Molybdenum, total (mg/L)	MW-1618	0.001	0.00006	0.1	n/a	No	11	9.091	No	0.006	NP (selected)
Selenium, Total (ug/L)	MW-1614	0.1	0.03	0.2	n/a	No	11	0	No	0.006	NP (selected)
Selenium, Total (ug/L)	MW-1615	0.2	0.03	0.2	n/a	No	11	9.091	No	0.006	NP (selected)
Selenium, Total (ug/L)	MW-1618	0.09	0.04	0.2	n/a	No	11	0	No	0.006	NP (selected)
Thallium, Total (mg/L)	MW-1614	0.00025	0.00002	0.002	n/a	No	11	18.18	No	0.006	NP (selected)
Thallium, Total (mg/L)	MW-1615	0.000272	0.000063	0.002	n/a	No	11	0	No	0.006	NP (selected)
Thallium, Total (mg/L)	MW-1618	0.000141	0.000066	0.002	n/a	No	11	0	No	0.006	NP (selected)

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Normality testing disabled.

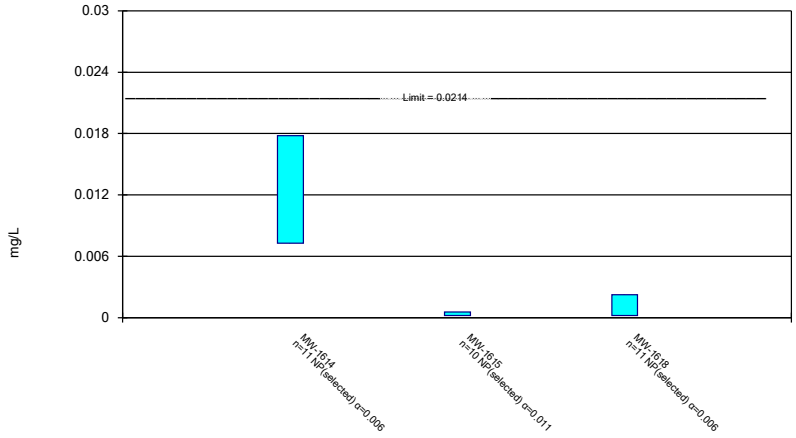
Constituent: Antimony, total Analysis Run 6/12/2019 3:05 PM View: Confidence Intervals

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.14 Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Normality testing disabled.

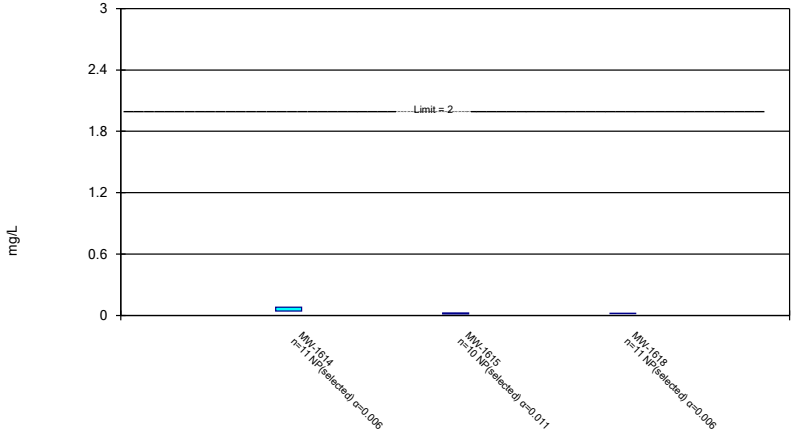
Constituent: Arsenic, Total Analysis Run 6/12/2019 3:05 PM View: Confidence Intervals

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.14 Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Normality testing disabled.

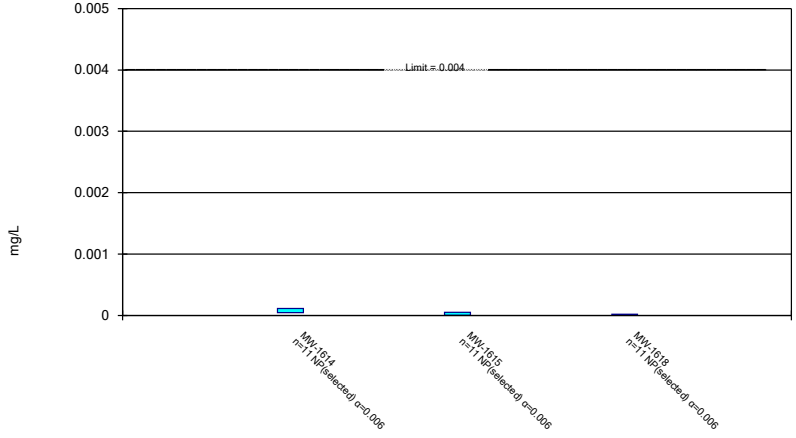
Constituent: Barium, Total Analysis Run 6/12/2019 3:05 PM View: Confidence Intervals

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.14 Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



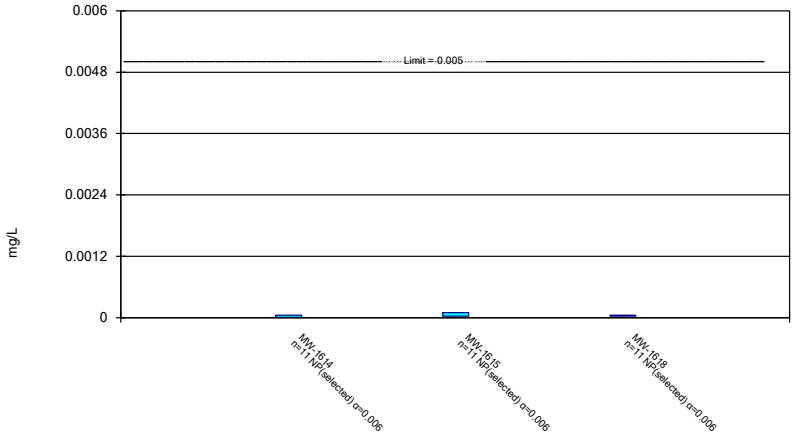
Normality testing disabled.

Constituent: Beryllium, total Analysis Run 6/12/2019 3:05 PM View: Confidence Intervals

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Normality testing disabled.

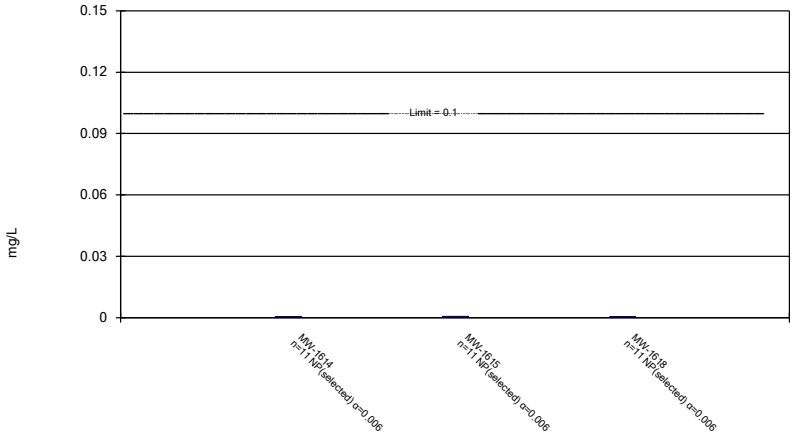
Constituent: Cadmium, total Analysis Run 6/12/2019 3:05 PM View: Confidence Intervals

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.14 Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Normality testing disabled.

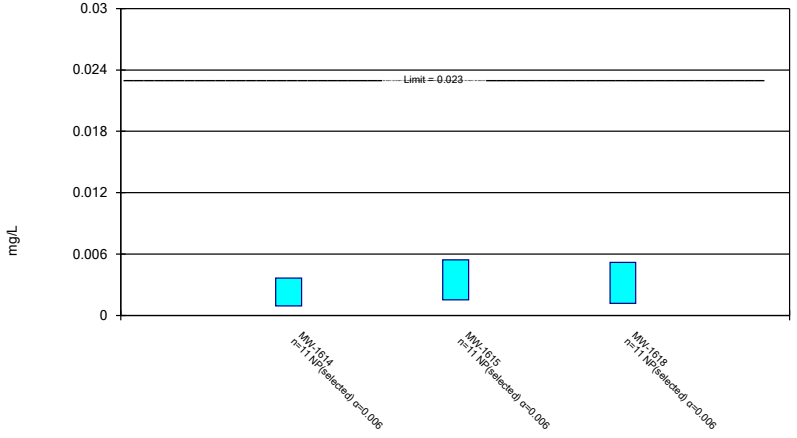
Constituent: Chromium, total Analysis Run 6/12/2019 3:05 PM View: Confidence Intervals

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.14 Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Normality testing disabled.

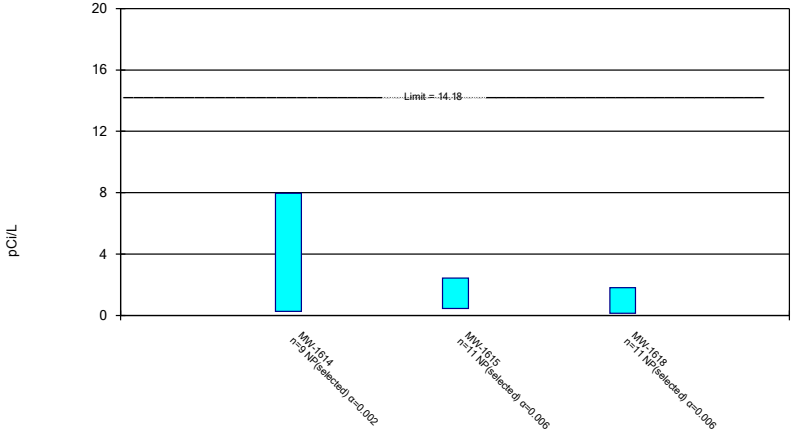
Constituent: Cobalt, total Analysis Run 6/12/2019 3:05 PM View: Confidence Intervals

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.14 Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



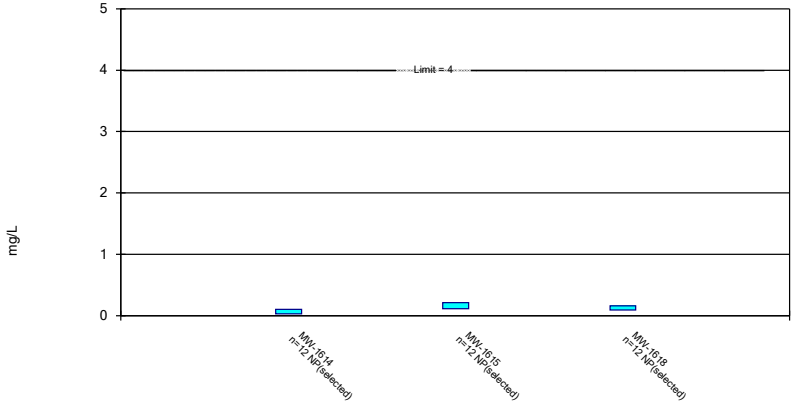
Normality testing disabled.

Constituent: Combined Radium 226 + 228 Analysis Run 6/12/2019 3:05 PM View: Confidence Intervals

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Non-Parametric Confidence Interval

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



Normality testing disabled.

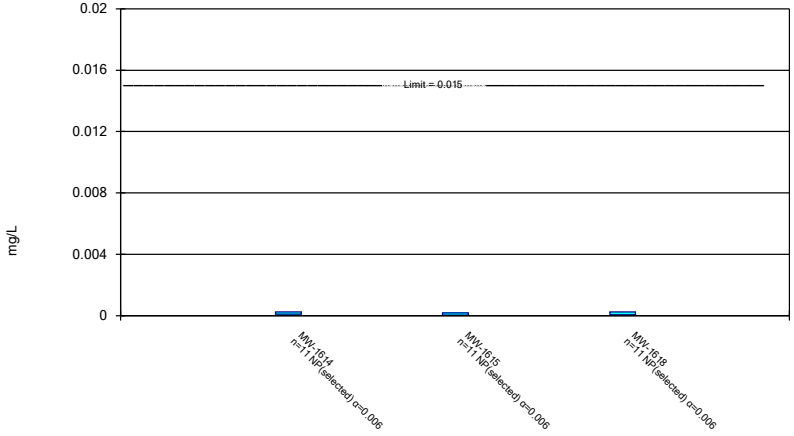
Constituent: Fluoride, total Analysis Run 6/12/2019 3:05 PM View: Confidence Intervals

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.14 Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Normality testing disabled.

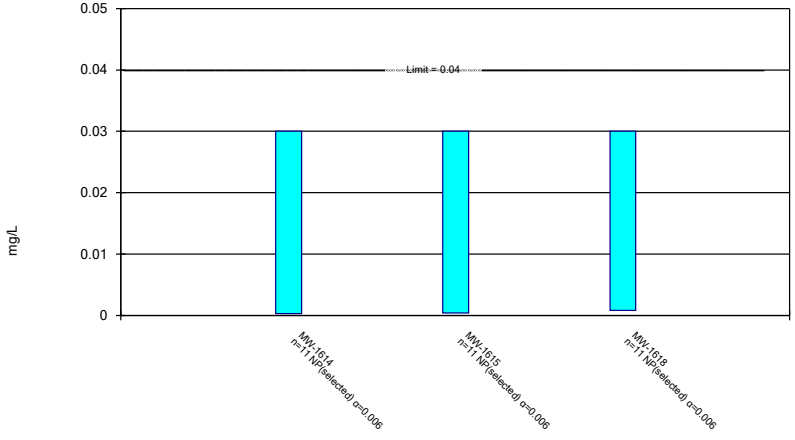
Constituent: Lead, total Analysis Run 6/12/2019 3:05 PM View: Confidence Intervals

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.14 Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Normality testing disabled.

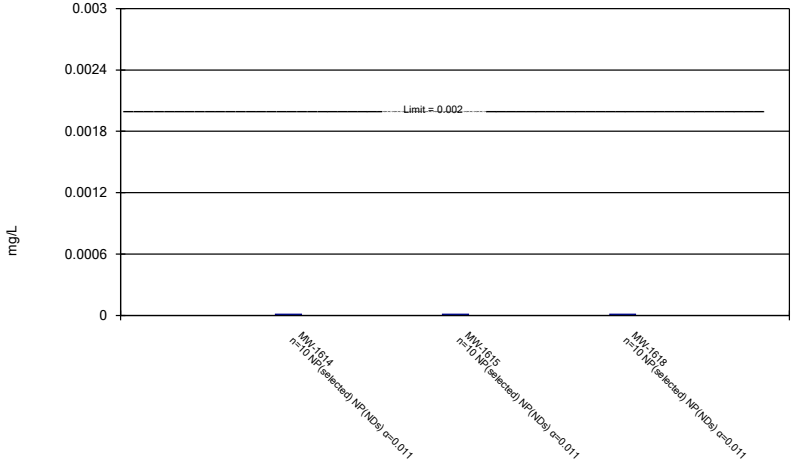
Constituent: Lithium, total Analysis Run 6/12/2019 3:05 PM View: Confidence Intervals

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.14 Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



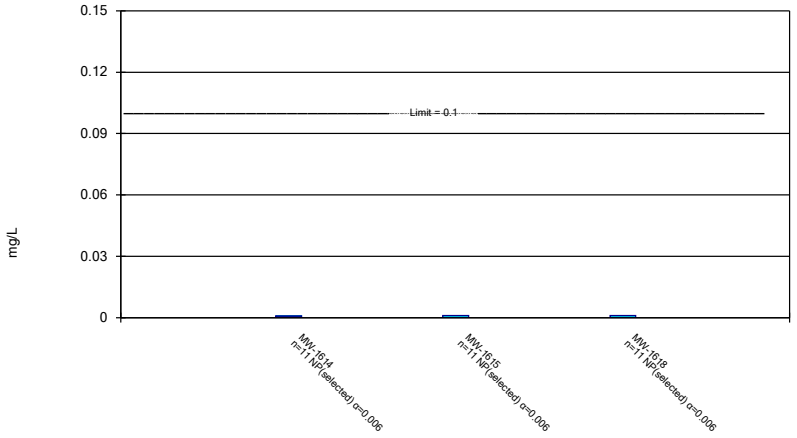
Normality testing disabled.

Constituent: Mercury, total Analysis Run 6/12/2019 3:05 PM View: Confidence Intervals

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Normality testing disabled.

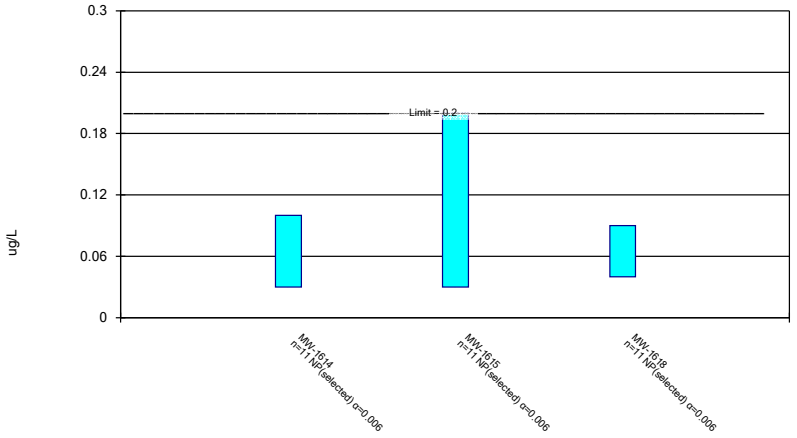
Constituent: Molybdenum, total Analysis Run 6/12/2019 3:05 PM View: Confidence Intervals

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.14 Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Normality testing disabled.

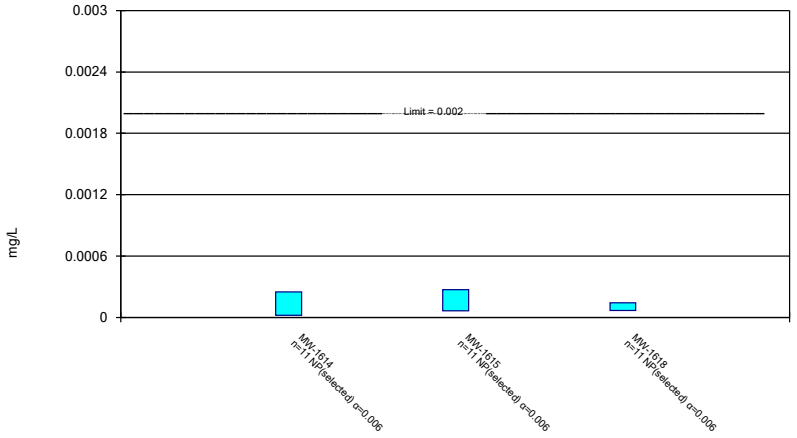
Constituent: Selenium, Total Analysis Run 6/12/2019 3:05 PM View: Confidence Intervals

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP

Sanitas™ v.9.6.14 Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Normality testing disabled.

Constituent: Thallium, Total Analysis Run 6/12/2019 3:05 PM View: Confidence Intervals

Big Sandy BAP Client: Geosyntec Data: Big Sandy BAP