

Annual Groundwater Monitoring Report

Appalachian Power Company
Mountaineer Plant
Landfill CCR Management Unit
Letart, WV

January 2021

Prepared by:
American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43215



An **AEP** Company

BOUNDLESS ENERGY™

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I. Overview

This *Annual Groundwater Monitoring and Corrective Action Report* (Report) has been prepared to report the status of activities for the preceding year for the landfill CCR unit at Appalachian Power Company's, a wholly-owned subsidiary of American Electric Power Company (AEP), Mountaineer Power Plant. The USEPA's CCR rules require that the Annual Groundwater Monitoring and Corrective Action Report be posted to the operating record for the preceding year no later than January 31st.

In general, the following activities were completed in 2020:

- Groundwater samples were collected and analyzed for Appendix III constituents, as specified in 40 CFR 257.94 *et seq.* and AEP's *Groundwater Sampling and Analysis Plan (2016)*;
- Groundwater data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Groundwater data, flow, and velocities are included in **Appendix 1**.
- Appendix III constituents were compared to prediction intervals established from background data established previously;
- Background updates were completed for appendix III indicator parameters and are summarized in the *Statistical Analysis Summary – Background Update Calculation* (January 2020) report for Mountaineer Landfill, include in **Appendix 2**.
- No Statistically significant increases were observed in the May 2020 detection monitoring event. The complete statistical analysis for this event is included in **Appendix 2**.
- October 2020 detection monitoring data is undergoing statistical analysis and will be completed in early 2021.

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

- A map, aerial photograph or a drawing showing the CCR management unit(s), all groundwater monitoring wells and monitoring well identification numbers;
- All of the monitoring data collected, including the rate and direction of groundwater flow, plus a summary showing the number of samples collected per monitoring well, the dates the samples were collected and whether the sample was collected as part of detection monitoring or assessment monitoring programs (Attached as **Appendix 1**);
- Statistical comparison of monitoring data to determine if there have been significant increase over background concentrations (Attached as **Appendix 2**, where applicable);

- A discussion of whether any alternate source demonstration were performed, and the conclusions (Attached as **Appendix 3**, where applicable);
- A summary of any transition between monitoring program, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring (Notices attached as **Appendix 4**, where applicable);
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement as to why that happened (Attached as **Appendix 5**, where applicable); and
- Other information required to be included in the annual report such as an alternate monitoring frequency, or assessment of corrective measures, if applicable.

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

II. Groundwater Monitoring Well Locations and Identification Numbers

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

III. Monitoring Wells Installed or Decommissioned

There were no monitoring wells installed or decommissioned in 2020. The network design, as summarized in the *Groundwater Monitoring Network Design Report* (2016) and as posted at the CCR web site for Mountaineer Plant, did not change. That design report, viewable on the AEP CCR web site, discusses the facility location, the hydrogeological setting, the hydrostratigraphic units, the uppermost aquifer, downgradient monitoring well locations and the upgradient monitoring well locations.

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

Appendix 1 contains tables showing the groundwater quality data collected since background through data received in 2020. Static water elevation data from each monitoring event also are shown in **Appendix 1**, along with the groundwater velocity calculations, groundwater flow direction and potentiometric maps developed after each sampling event.

V. Groundwater Quality Data Statistical Analysis

Statistical analysis completed in 2020 of the detection monitoring samples collected and analyzed in May 2020 are included in **Appendix 2** of this report.

Samples collected in October 2020 were analyzed and results received in late 2020. The statistical analysis of these results is underway and will be completed within the 90-day timeframe allowed.

Background updates for the appendix III indicator parameters was completed and that report is also included in **Appendix 2**.

VI. Alternative Source Demonstrations

No alternative source demonstrations were completed in 2020.

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

There has been no transition between detection monitoring and assessment monitoring at Mountaineer Plant's Landfill. Detection monitoring will continue in 2021. The sampling frequency of twice per year will be maintained for the Appendix III parameters (boron, calcium, chloride, fluoride, pH, sulfate and total dissolved solids).

Statistical analysis of the October 2020 event will be completed in early 2021. If necessary, an ASD will be completed or an assessment monitoring program will be initiated.

Regarding defining an alternate monitoring frequency, the groundwater velocity and monitoring well production is high enough at this facility that no modification of the twice-per-year detection monitoring effort is needed.

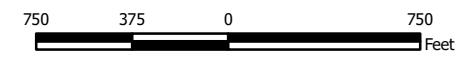


Monitoring Well Network

- ◆ Downgradient Sampling Location
- ◆ Background Sampling Location
- Landfill

Notes

- Monitoring well coordinates provided by AEP.
- Site features based on information available in Little Broad Run Landfill-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.



**Site Layout
CCR Landfill**

AEP Mountaineer Generating Plant
Letart, West Virginia

Geosyntec
consultants

Columbus, Ohio

2018/01/26

Figure

1

VIII. Description of Any Problems Encountered in 2020 and Actions Taken

No significant problems were encountered. The low flow sampling effort went smoothly and the schedule was met to support this first annual groundwater report preparation.

IX. A Projection of Key Activities for the Upcoming Year

Key activities for 2021 include:

- Detection monitoring on a twice per year schedule.
- Evaluation of the detection monitoring results from a statistical analysis viewpoint, looking for any statistically significant increases, or decreases when pH is considered.
- Responding to any new data received in light of what the CCR rule requires.
- Preparation of the 2021 annual groundwater report.

APPENDIX 1 - Groundwater Data Tables and Figures

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

**Table 1 - Groundwater Data Summary: MW-26
Mountaineer - LF
Appendix III Constituents**

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	0.097	61.5	5.57	0.12	7.5	9.6	322
11/1/2016	Background	0.117	50.5	5.17	0.13	7.4	10.6	270
12/21/2016	Background	0.074	48.6	5.21	0.13	7.6	10.2	316
2/22/2017	Background	0.145	56.2	5.35	0.13	7.4	6.5	325
3/28/2017	Background	0.222	52.9	6.25	0.13	7.4	7.3	334
4/17/2017	Background	0.169	57.1	5.73	0.13	7.3	6.7	320
5/17/2017	Background	0.161	58.6	5.87	0.13	8.1	6.5	343
6/13/2017	Background	0.121	53.7	5.00	0.12	7.4	5.3	324
10/31/2017	Detection	0.165	54.7	5.48	0.13	7.5	5.8	346
1/22/2018	Detection	--	55.7	--	--	7.3	--	--
9/20/2018	Detection	0.214	49.4	6.04	0.16	8.0	6.3	344
11/26/2018	Detection	0.182	53.6	5.97	0.14	7.4	7.2	364
4/9/2019	Detection	0.128	62.8	6.71	0.13	7.3	7.6	370
6/18/2019	Detection	--	--	7.22	--	7.2	--	387
9/9/2019	Detection	0.099	60.2	5.80	0.14	7.4	5.7	353
5/15/2020	Detection	0.100	55.6	1.72	2.56	7.1	3.9	547
7/8/2020	Detection	--	--	--	--	7.4	--	366
10/8/2020	Detection	0.103	51.2	5.74	0.16	6.9	6.4	344

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-26
Mountaineer - LF
Appendix IV Constituents**

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.13	3.57	917	< 0.005 U	0.01 J	0.4	0.214	3.25	0.12	0.165	0.010	< 0.002 U	1.88	0.1	0.03 J
11/1/2016	Background	0.11	4.06	871	< 0.005 U	0.005 J	0.3	0.220	3.57	0.13	0.043	0.006	< 0.002 U	3.07	0.1	0.02 J
12/21/2016	Background	0.12	4.51	872	0.01 J	0.006 J	1.27	0.329	3.15	0.13	0.167	0.004	< 0.002 U	3.52	0.2	0.062
2/22/2017	Background	0.09	4.11	717	0.01 J	0.01 J	0.731	0.345	3.6	0.13	0.244	0.012	< 0.002 U	2.53	0.1	0.04 J
3/28/2017	Background	0.50	3.95	886	0.028	0.01 J	1.43	0.532	2.88	0.13	0.517	0.014	< 0.002 U	1.18	0.2	0.03 J
4/17/2017	Background	0.09	3.60	802	0.007 J	0.007 J	0.328	0.299	1.967	0.13	0.164	0.009	< 0.002 U	1.08	0.1 J	0.01 J
5/17/2017	Background	0.06	4.01	869	< 0.004 U	0.007 J	0.238	0.251	3.22	0.13	0.090	0.007	< 0.002 U	3.99	0.1	0.01 J
6/13/2017	Background	0.10	3.45	905	0.008 J	0.008 J	0.405	0.325	3.28	0.12	0.252	0.018	< 0.002 U	1.23	0.1	0.01 J

Notes:

µg/L: micrograms per liter

mg/L: milligrams per liter

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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-27**Mountaineer - LF
Appendix III Constituents**

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	0.276	18.9	1.82	2.23	9.2	4.9	618
11/1/2016	Background	0.288	1.57	1.86	2.38	9.1	7.2	558
12/21/2016	Background	0.219	1.39	1.69	2.44	9.2	7.3	528
2/22/2017	Background	0.282	1.42	1.48	2.27	9.1	4.3	531
3/28/2017	Background	0.387	1.26	1.59	2.32	9.3	4.7	508
4/17/2017	Background	0.312	1.65	1.56	2.30	9.0	5.0	536
5/17/2017	Background	0.290	1.48	1.59	2.38	11.1	4.8	539
6/13/2017	Background	0.293	1.77	1.64	2.33	9.4	4.5	526
10/31/2017	Detection	0.275	1.33	1.63	2.38	9.2	4.2	544
9/20/2018	Detection	0.357	1.14	1.69	2.41	9.1	4.4	550
11/26/2018	Detection	0.292	1.20	1.52	2.37	9.0	3.6	522
4/9/2019	Detection	0.303	1.19	1.54	2.32	9.0	2.9	542
9/10/2019	Detection	0.285	1.13	1.67	2.71	9.1	3.0	530
5/15/2020	Detection	0.100	54.5	6.06	0.14	8.8	7.0	359
7/8/2020	Detection	--	1.20	1.63	--	9.1	--	--
10/8/2020	Detection	0.273	1.20	1.67	2.38	8.7	3.4	541

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-27

Mountaineer - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.39	8.05	326	0.654	0.11	11.6	4.95	2.565	2.23	17.3	0.016	0.004 J	24.2	2.2	0.1 J
11/1/2016	Background	0.26	5.42	151	0.158	0.02	5.0	0.817	2.003	2.38	4.00	0.007	< 0.002 U	35.6	0.4	0.03 J
12/21/2016	Background	0.23	4.26	113	0.093	0.01 J	2.94	0.502	1.489	2.44	8.87	0.001	< 0.002 U	34.6	0.3	0.04 J
2/22/2017	Background	0.06	3.76	94.8	0.054	0.009 J	1.95	0.320	1.419	2.27	1.28	0.012	0.002 J	32.1	0.1	0.03 J
3/28/2017	Background	0.08	4.45	105	0.062	0.008 J	1.69	0.319	0.888	2.32	1.06	0.016	< 0.002 U	31.5	0.2	0.02 J
4/17/2017	Background	0.15	4.54	108	0.085	0.01 J	2.36	0.511	0.486	2.30	1.45	0.005	0.002 J	32.0	0.2	0.02 J
5/17/2017	Background	0.11	4.54	94.6	0.052	0.005 J	1.33	0.335	0.20279	2.38	0.971	0.015	< 0.002 U	31.6	0.2	0.01 J
6/13/2017	Background	0.18	4.55	102	0.082	0.01 J	2.25	0.600	0.797	2.33	1.39	0.015	< 0.002 U	30.6	0.2	0.02 J

Notes:

µg/L: micrograms per liter

mg/L: milligrams per liter

<: 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-30**Mountaineer - LF
Appendix III Constituents**

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
10/26/2016	Background	0.239	16.6	250	3.42	8.7	31.5	--
11/2/2016	Background	0.240	10.9	257	3.41	8.6	19.6	1,350
12/28/2016	Background	0.250	9.91	250	3.43	8.0	19.1	1,280
2/22/2017	Background	0.257	2.76	246	3.18	8.6	11.5	1,220
3/29/2017	Background	0.344	2.54	242	3.31	8.7	0.1 J	1,270
4/19/2017	Background	0.296	2.91	247	3.28	8.5	11.2	1,210
5/17/2017	Background	0.269	2.97	247	1.34	10.1	4.4	1,290
6/13/2017	Background	0.283	4.06	255	3.28	8.9	10.8	1,170
10/31/2017	Detection	0.315	3.27	257	3.30	8.5	11.4	1,210
9/20/2018	Detection	0.315	4.69	253	3.36	8.6	13.0	1,230
11/27/2018	Detection	0.344	3.16	247	3.40	8.4	11.7	1,240
4/9/2019	Detection	0.290	2.88	245	3.32	8.4	10.6	1,260
9/10/2019	Detection	0.259	3.39	249	3.76	8.3	9.6	1,260
5/18/2020	Detection	0.271	2.95	264	3.54	8.1	10.8	1,240
10/8/2020	Detection	0.249	2.93	247	2.73	8.0	10.9	1,260

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-30

Mountaineer - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
10/26/2016	Background	0.36	7.38	567	0.692	0.10	13.1	33.8	2.588	3.42	33.2	0.034	0.054	68.7	3.8	0.724
11/3/2016	Background	0.26	7.54	576	0.630	0.09	11.7	33.3	1.404	3.41	30.9	0.026	0.016	73.7	2.7	0.654
12/28/2016	Background	0.91	6.87	360	0.502	0.08	18.1	15.9	2.725	3.43	13.8	0.024	0.026	107	2.6	0.350
2/22/2017	Background	0.52	4.65	223	0.082	0.008 J	3.24	2.40	2.418	3.18	1.68	0.022	0.004 J	125	0.5	0.258
3/29/2017	Background	0.66	5.45	243	0.149	0.007 J	6.13	4.24	1.204	3.31	3.62	0.027	0.003 J	120	0.7	0.381
4/19/2017	Background	1.55	5.80	246	0.140	0.01 J	5.76	3.91	3.83	3.28	3.49	0.019	0.061	123	0.7	0.365
5/17/2017	Background	0.75	6.90	241	0.120	< 0.005 U	3.99	3.63	2.395	1.34	3.41	0.027	0.004 J	128	0.9	0.287
6/13/2017	Background	2.74	6.86	251	0.197	0.02 J	6.83	5.35	3.45	3.28	4.80	0.027	0.005 J	118	0.8	0.366

Notes:

µg/L: micrograms per liter

mg/L: milligrams per liter

<: 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-38**Mountaineer - LF
Appendix III Constituents**

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/27/2016	Background	0.024	55.7	7.12	0.32	7.1	28.1	410
11/2/2016	Background	0.040	46.3	7.27	0.32	7.0	36.6	358
12/21/2016	Background	0.019	48.2	7.43	0.35	7.4	35.8	404
2/22/2017	Background	0.028	47.2	7.21	0.29	7.0	31.7	409
3/28/2017	Background	0.070	50.0	7.08	0.32	7.0	30.1	390
4/18/2017	Background	0.038	52.5	7.22	0.33	7.0	30.6	422
5/16/2017	Background	0.027	54.5	7.41	0.33	7.6	32.5	421
6/13/2017	Background	0.093	51.4	7.01	0.28	7.0	31.0	406
10/31/2017	Detection	0.045	56.1	7.59	0.38	7.0	28.7	460
1/22/2018	Detection	--	53.8	--	--	6.7	--	419
9/20/2018	Detection	0.068	51.2	7.31	0.36	7.4	31.5	441
11/26/2018	Detection	0.08 J	48.2	7.06	0.34	7.0	35.2	415
4/9/2019	Detection	0.04 J	52.0	7.46	0.32	6.9	27.8	427
6/18/2019	Detection	--	--	--	--	7.6	--	--
9/10/2019	Detection	0.03 J	49.9	7.45	0.35	7.7	28.2	417
10/22/2019	Detection	--	--	--	--	6.9	--	--
5/15/2020	Detection	0.02 J	48.3	7.59	0.38	6.7	31.4	421
10/8/2020	Detection	0.03 J	53.4	7.68	0.47	6.8	25.5	452

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-38

Mountaineer - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
9/27/2016	Background	0.09	9.82	221	0.023	0.03	1.0	2.72	2.229	0.32	0.442	0.002	< 0.002 U	2.76	0.2	0.103
11/2/2016	Background	0.07	8.15	179	< 0.005 U	0.02 J	0.4	0.855	1.744	0.32	0.113	0.0009 J	< 0.002 U	2.10	0.04 J	0.04 J
12/21/2016	Background	0.05	6.62	162	< 0.005 U	0.02	1.67	0.655	2.06	0.35	0.082	< 0.0002 U	< 0.002 U	2.50	0.06 J	0.082
2/22/2017	Background	0.03 J	5.74	141	< 0.005 U	0.02	0.526	0.949	1	0.29	0.039	0.004	< 0.002 U	3.37	0.03 J	0.04 J
3/28/2017	Background	0.05 J	11.5	184	< 0.005 U	0.03	0.197	0.916	0.548	0.32	0.073	0.006	< 0.002 U	2.47	0.06 J	0.05 J
4/18/2017	Background	0.04 J	6.34	179	< 0.004 U	0.03	0.111	2.87	0.494	0.33	0.02 J	0.003	< 0.002 U	2.30	< 0.03 U	0.068
5/16/2017	Background	0.06	5.09	186	< 0.004 U	0.03	0.093	3.66	0.536	0.33	0.01 J	0.004	< 0.002 U	3.76	< 0.03 U	0.062
6/13/2017	Background	0.06	8.09	187	< 0.004 U	0.03	0.130	2.53	1.268	0.28	0.056	0.013	< 0.002 U	2.67	0.04 J	0.056

Notes:

µg/L: micrograms per liter

mg/L: milligrams per liter

<: 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-39**Mountaineer - LF
Appendix III Constituents**

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/26/2016	Background	0.143	12.4	3.00	0.77	8.4	< 0.04 U	350
11/2/2016	Background	0.134	7.88	3.05	0.83	8.4	< 0.04 U	344
12/21/2016	Background	0.122	10.5	3.07	0.86	8.8	< 0.04 U	450
2/22/2017	Background	0.134	7.65	2.98	0.80	8.4	< 0.04 U	374
3/28/2017	Background	0.202	5.95	2.95	0.78	8.4	0.1 J	310
4/18/2017	Background	0.156	6.48	2.91	0.78	8.3	< 0.04 U	344
5/16/2017	Background	0.139	6.74	2.98	0.79	9.5	1.5	367
6/14/2017	Background	0.179	6.15	2.92	0.78	8.5	0.1	340
10/31/2017	Detection	0.171	7.25	3.05	0.78	8.3	0.2	385
9/20/2018	Detection	0.182	6.43	2.99	0.80	8.5	0.1 J	369
11/26/2018	Detection	0.167	6.33	2.93	0.80	8.3	0.07 J	380
4/9/2019	Detection	0.158	6.65	2.94	0.77	8.3	< 0.06 U	376
9/9/2019	Detection	0.144	6.78	3.07	0.84	8.1	< 0.06 U	369
5/15/2020	Detection	0.148	6.15	3.11	0.84	7.9	0.2 J	374
7/8/2020	Detection	--	--	--	--	8.4	--	--
10/8/2020	Detection	0.133	6.11	2.98	0.89	7.9	< 0.06 U	404

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-39

Mountaineer - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
9/26/2016	Background	0.06	4.80	264	0.095	0.01 J	2.2	1.43	1.142	0.77	2.21	0.016	< 0.002 U	8.51	0.3	0.04 J
11/2/2016	Background	0.04 J	3.89	276	0.068	< 0.004 U	3.2	0.615	1.941	0.83	0.532	0.011	< 0.002 U	9.54	0.09 J	0.03 J
12/21/2016	Background	0.08	3.95	296	0.202	0.006 J	6.32	2.34	1.311	0.86	1.79	0.008	< 0.002 U	8.03	0.6	0.070
2/22/2017	Background	0.03 J	3.91	243	0.041	0.01 J	1.41	0.539	1.162	0.80	0.467	0.012	0.002 J	9.23	0.1	0.03 J
3/28/2017	Background	0.02 J	3.58	241	0.01 J	< 0.004 U	0.560	0.206	0.793	0.78	0.176	0.015	< 0.002 U	8.50	0.06 J	0.02 J
4/18/2017	Background	0.01 J	3.70	244	0.007 J	< 0.005 U	0.243	0.188	0.1602	0.78	0.113	0.009	< 0.002 U	8.65	0.04 J	< 0.01 U
5/16/2017	Background	0.01 J	3.88	244	0.004 J	0.02	0.221	0.174	0.611	0.79	0.073	0.017	< 0.002 U	9.39	0.04 J	< 0.01 U
6/14/2017	Background	0.02 J	3.76	247	0.008 J	< 0.005 U	0.203	0.209	0.47	0.78	0.092	0.028	< 0.002 U	9.06	0.06 J	< 0.01 U

Notes:

µg/L: micrograms per liter

mg/L: milligrams per liter

<: 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-1611**Mountaineer - LF
Appendix III Constituents**

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
9/26/2016	Background	0.136	25.0	8.72	0.56	7.8	17.3	382
11/2/2016	Background	0.140	22.8	9.36	0.61	7.8	22.7	388
12/20/2016	Background	0.124	22.2	9.39	0.64	7.7	21.8	380
2/22/2017	Background	0.175	22.5	9.10	0.57	7.7	18.0	381
3/28/2017	Background	0.210	22.3	8.04	0.50	7.8	15.7	326
4/18/2017	Background	0.155	22.8	8.59	0.56	7.7	17.7	388
5/16/2017	Background	0.190	23.1	9.14	0.60	8.3	18.7	392
6/12/2017	Background	0.158	22.4	9.29	0.57	7.2	19.4	384
10/31/2017	Detection	0.152	24.0	9.80	0.61	7.8	18.9	402
1/22/2018	Detection	--	22.6	--	--	7.5	--	376
9/20/2018	Detection	0.258	23.2	9.48	0.61	7.8	19.0	416
11/26/2018	Detection	0.147	21.9	9.57	0.62	7.7	18.5	387
4/9/2019	Detection	0.139	26.2	7.96	0.46	7.6	20.7	431
6/18/2019	Detection	--	22.8	9.58	--	7.9	--	--
7/10/2019	Detection	--	--	--	--	7.6	--	402
9/9/2019	Detection	0.136	26.1	10.1	0.62	7.7	17.3	402
5/15/2020	Detection	0.135	24.0	9.35	0.61	7.3	20.8	404
10/8/2020	Detection	0.124	24.8	9.44	0.64	7.3	22.2	451

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-1611
Mountaineer - LF
Appendix IV Constituents**

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
9/26/2016	Background	0.03 J	1.01	165	0.046	0.02	1.4	0.370	1.258	0.56	0.482	0.004	< 0.002 U	6.97	0.07 J	0.088
11/2/2016	Background	0.03 J	0.97	156	0.030	0.01 J	0.9	0.245	2.888	0.61	0.310	0.004	< 0.002 U	5.83	0.06 J	0.03 J
12/20/2016	Background	< 0.01 U	0.74	140	< 0.005 U	< 0.004 U	2.10	0.092	0.772	0.64	0.023	0.002	< 0.002 U	5.46	< 0.03 U	< 0.01 U
2/22/2017	Background	< 0.01 U	0.75	135	0.007 J	0.006 J	0.209	0.096	0.5828	0.57	0.055	0.007	0.002 J	5.36	0.04 J	0.208
3/28/2017	Background	0.01 J	0.60	166	0.01 J	0.005 J	0.426	0.108	0.645	0.50	0.195	0.011	< 0.002 U	7.26	0.07 J	0.02 J
4/18/2017	Background	0.01 J	0.69	155	0.01 J	0.006 J	0.337	0.104	0.487	0.56	0.133	0.003	< 0.002 U	6.01	< 0.03 U	< 0.01 U
5/16/2017	Background	0.03 J	0.75	145	0.008 J	< 0.005 U	0.661	0.101	2.534	0.60	0.119	0.006	< 0.002 U	5.49	0.04 J	0.02 J
6/12/2017	Background	0.03 J	0.76	148	0.007 J	< 0.005 U	0.138	0.092	0.508	0.57	0.058	0.018	< 0.002 U	5.39	0.03 J	< 0.01 U

Notes:

µg/L: micrograms per liter

mg/L: milligrams per liter

<: 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-1612**Mountaineer - LF
Appendix III Constituents**

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
10/26/2016	Background	0.637	9.47	38.1	3.02	8.3	272	--
11/2/2016	Background	0.629	8.48	33.4	3.23	8.3	238	850
12/21/2016	Background	0.501	8.96	36.1	3.33	8.1	271	966
2/22/2017	Background	0.473	7.90	35.6	2.95	8.4	288	1,090
3/29/2017	Background	0.673	7.10	23.7	3.50	8.7	190	1,240
4/19/2017	Background	0.589	8.61	22.4	3.26	8.4	226	1,040
5/16/2017	Background	0.565	12.5	27.8	2.88	8.8	346	1,150
6/13/2017	Background	0.532	8.09	27.4	2.98	8.2	334	1,130
10/31/2017	Detection	0.457	7.22	20.2	3.53	8.2	147	914
9/20/2018	Detection	0.543	4.50	14.6	3.78	8.4	63.9	835
11/26/2018	Detection	0.413	4.25	11.5	3.91	8.0	49.2	764
4/9/2019	Detection	0.449	3.21	10.2	4.02	8.3	54.8	725
9/10/2019	Detection	0.438	4.77	11.1	4.34	8.3	31.3	786
5/18/2020	Detection	0.388	4.18	6.75	4.39	8.2	40.5	637
10/8/2020	Detection	0.351	3.43	6.36	3.92	8.3	40.0	662

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-1612

Mountaineer - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
10/26/2016	Background	0.31	12.4	66.2	0.033	0.007 J	1.63	0.367	2.765	3.02	0.391	0.018	< 0.002 U	62.1	0.2	0.03 J
11/2/2016	Background	0.35	16.8	80.4	0.009 J	< 0.004 U	0.6	0.197	0.973	3.23	0.168	0.014	0.002 J	67.6	0.08 J	0.087
12/21/2016	Background	0.13	14.9	62.1	0.007 J	< 0.004 U	0.913	0.111	0.947	3.33	0.121	0.011	0.002 J	52.2	0.1	< 0.01 U
2/22/2017	Background	0.31	14.4	72.4	0.058	< 0.004 U	2.13	0.700	1.084	2.95	0.640	0.018	0.003 J	38.5	0.1	0.04 J
3/29/2017	Background	0.77	12.4	141	0.290	0.01 J	3.19	2.60	0.86	3.50	1.37	0.020	0.014	45.9	0.5	0.03 J
4/19/2017	Background	0.82	10.7	233	0.551	< 0.05 U	15.5	3.94	0.425	3.26	4.10	0.019	0.004 J	58.0	1.2	0.2 J
5/16/2017	Background	0.15	10.4	77.1	0.02 J	< 0.005 U	0.445	0.231	2.744	2.88	0.210	0.022	< 0.002 U	43.1	0.1	0.02 J
6/13/2017	Background	0.15	10.7	59.6	0.006 J	< 0.005 U	0.227	0.101	0.824	2.98	0.023	0.028	< 0.002 U	34.3	0.06 J	< 0.01 U

Notes:

µg/L: micrograms per liter

mg/L: milligrams per liter

<: 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 2: Residence Time Calculation Summary - Landfill
Mountaineer Landfill**

CCR Management Unit	Monitoring Well	Well Diameter (inches)	2020-05		2020-10	
			Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Landfill	MW-26 ^[2]	2.0	1.8	33.3	1.7	35.6
	MW-27 ^[2]	2.0	18.9	3.2	17.8	3.4
	MW-30 ^[1]	2.0	5.0	12.1	5.4	11.2
	MW-38 ^[2]	2.0	NC	NC	NC	NC
	MW-39 ^[2]	2.0	16.9	3.6	18.1	3.4
	MW-1611 ^[2]	2.0	10.6	5.7	11.3	5.4
	MW-1612 ^[1]	2.0	16.1	3.8	16.2	3.8

Notes:

[1] - Background Well

[2] - Downgradient Well

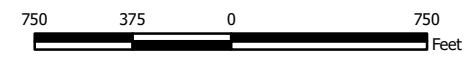
NC - Not Calculated. Groundwater residence time for MW-38 could not be calculated, as it is the only monitoring well for its lithologic unit (valley alluvium) within the monitoring network.



Legend	
Monitoring Wells	Groundwater Elevation Contours
⊕ Alluvium	→ Approximate Groundwater Flow Direction (Unit 3)
⊕ Hydrologic Unit 3	— Hydrologic Unit 3
⊕ Hydrologic Unit 4	- - - Hydrologic Unit 3, Inferred
	→ Approximate Groundwater Flow Direction (Unit 4)
	— Hydrologic Unit 4

Notes

- Monitoring well coordinates and water level data (collected on May 15, 2020) provided by AEP.
- Site features based on information available in Little Broad Run Landfill-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Water level measurements from MW-25 (screened in shale below Unit 4), MW-37 (hydraulically disconnected from the rest of Unit 3), and MW-38 (screened in alluvium) were not used in ground water contouring.
- Groundwater elevation units are feet above mean sea level.



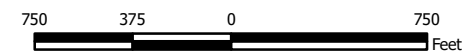
Potentiometric Surface Map - Uppermost Aquifer May 2020	
AEP Mountaineer Generating Plant - CCR Landfill New Haven, West Virginia	
Geosyntec consultants	
Columbus, Ohio	2020/06/19
Figure 2	



Legend	
Monitoring Wells	Groundwater Elevation Contours
⊕ Alluvium	→ Approximate Groundwater Flow Direction (Unit 3)
⊕ Hydrologic Unit 3	— Hydrologic Unit 3
⊕ Hydrologic Unit 4	- - - Unit 3, Inferred
	→ Approximate Groundwater Flow Direction (Unit 4)
	— Hydrologic Unit 4

Notes

- Monitoring well coordinates and water level data (collected on October 5, 2020) provided by AEP.
- Site features based on information available in Little Broad Run Landfill-CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016) provided by AEP.
- Water level measurements from MW-25 (screened in shale below Unit 4), MW-37 (hydraulically disconnected from the rest of Unit 3), and MW-38 (screened in alluvium) were not used in ground water contouring.
- Groundwater elevation units are feet above mean sea level.



**Potentiometric Surface Map - Uppermost Aquifer
October 2020**

AEP Mountaineer Generating Plant - CCR Landfill
New Haven, West Virginia

Geosyntec
consultants

Figure
3

Columbus, Ohio

2021/01/05

APPENDIX 2 - Statistical Analyses

The statistical analyses completed in 2021 follow.

STATISTICAL ANALYSIS SUMMARY-
Background Update Calculations
Landfill - Mountaineer Plant
New Haven, West Virginia

Submitted to



1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by



engineers | scientists | innovators

941 Chatham Lane
Suite 103
Columbus, Ohio 43221

January 6, 2020

CHA8473

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Table 1	Detection Monitoring Groundwater Data Summary
Table 2	Background Level Summary

LIST OF ATTACHMENTS

Attachment A	Certification by a Qualified Professional Engineer
Attachment B	Statistical Analysis Output

LIST OF ACRONYMS AND ABBREVIATIONS

ANOVA	Analysis of Variance
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CCV	Continuing Calibration Value
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
LF	Landfill
LFB	Laboratory Fortified Blanks
LPL	Lower Prediction Limit
LRB	Laboratory Reagent Blanks
NELAP	National Environmental Laboratory Accreditation Program
PQL	Practical Quantitation Limit
QA	Quality Assurance
QC	Quality Control
SSI	Statistically Significant Increase
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency

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 Landfill (LF), an existing CCR unit at the Mountaineer Power Plant located in New Haven, West Virginia.

Eight monitoring events were completed prior to October 2017 to establish background concentrations for Appendix III and Appendix IV parameters under the CCR rule. Four semiannual detection monitoring events were conducted between October 2017 and June 2019. Data from these four events, including both initial and verification results, were evaluated for inclusion in the background dataset. 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 detection monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. The compliance data were reviewed for outliers, which were removed (when appropriate) prior to updating upper prediction limits (UPLs) for each Appendix III parameter to represent background values. Oversight on the use of statistical calculations was provided by Dr. Kirk Cameron of MacStat Consulting, Ltd. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

LANDFILL EVALUATION

2.1 Previous Background Calculations

Eight background monitoring events were completed from September 2016 through June 2017 to establish background concentrations for Appendix III and Appendix IV parameters under the CCR rule. The data were reviewed for outliers and trends prior to calculating upper prediction limits (UPLs) for each Appendix III parameter. Intrawell prediction limits were selected for boron, chloride, sulfate, and total dissolved solids (TDS) with a one-of-two resampling plan. Interwell prediction limits with a one-of-two resampling plan were constructed from the upgradient wells for calcium, fluoride, and pH. Lower prediction limits (LPLs) were also established for pH. The statistical analyses to establish background levels were previously documented in the January 2018 *Statistical Analysis Summary* report (Geosyntec, 2018). Tests for calcium and pH were revised to intrawell prediction limits based on an alternative source demonstration (ASD) certified on March 1, 2019 (Geosyntec, 2019).

2.2 Data Validation & QA/QC

Since October 2017, four semiannual detection monitoring events have been conducted at the LF. If the initial results for each detection monitoring event identified possible exceedances, verification sampling was completed on an individual well/parameter basis. Thus, a minimum of four samples were collected from each compliance well. A summary of data collected during these detection monitoring events may be found in Table 1.

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

The analytical data were imported into a Microsoft Access database, where checks were completed to assess the accuracy of sample location identification and analyte identification. Where necessary, unit conversions were applied to standardize reported units across all sampling events. Exported data files were created for use with the Sanitas™ v.9.6.23 statistics software. The export was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

2.3 Statistical Analysis

The detection monitoring data used to conduct the statistical analyses described below are summarized in Table 1. Statistical analyses for the Landfill were conducted in accordance with

the January 2017 *Statistical Analysis Plan* (AEP, 2017), except where noted below. The complete statistical analysis results are included in Attachment B.

Time series plots of Appendix III parameters are included in Attachment B and were used to evaluate concentrations over time and to provide an initial screening of suspected outliers and trends. Box plots were also compiled to provide visual representation of variations between wells and within individual wells (Attachment B).

2.3.1 Outlier Evaluation

Potential outliers were evaluated using Tukey's outlier test; i.e., data points were considered potential outliers if they met one of the following criteria:

$$x_i < \tilde{x}_{0.25} - 3 \times IQR \quad (1)$$

or

$$x_i > \tilde{x}_{0.75} + 3 \times IQR \quad (2)$$

where:

- x_i = individual data point
- $\tilde{x}_{0.25}$ = first quartile
- $\tilde{x}_{0.75}$ = third quartile
- IQR = the interquartile range = $\tilde{x}_{0.75} - \tilde{x}_{0.25}$

Of the data collected during the detection monitoring period, one fluoride value at MW-30 was identified as a potential outlier. However, because this value was similar to the concentrations reported in neighboring wells it was not flagged as an outlier or removed from the dataset.

2.3.2 Establishment of Updated Background Levels

Analysis of variance (ANOVA) was conducted during the initial background screening to assist in identifying if intrawell tests are the most appropriate statistical approach for assessing Appendix III parameters. Intrawell tests compare compliance data from a single well to background data within the same well and are most appropriate when 1) upgradient wells exhibit spatial variation; 2) when statistical limits constructed from upgradient wells would not be conservative from a regulatory perspective; or 3) when downgradient water quality is not impacted compared to upgradient water quality for the same parameter. Periodic updating of background statistical limits is necessary as natural systems continuously change due to physical changes to the environment. For intrawell analyses, data for all wells and constituents are re-evaluated when a minimum of four new data points are available. These four (or more) new data points are used to determine if earlier concentrations are representative of present-day groundwater quality. For interwell comparisons, newer data are evaluated during each event for new outliers, and prediction limits are constructed using all available data from upgradient wells.

For intrawell comparisons, Mann-Whitney (Wilcoxon rank-sum) tests were used to compare the medians of historical data (September 2016 - June 2017) to the new compliance samples (October 2017 – July 2019). Results were evaluated to determine if the medians of the two groups were similar at the 99% confidence level. Where no significant difference was found, the new compliance data were added to the background dataset. Where a statistically significant difference was found between the medians of the two groups, the data were reviewed to evaluate the cause of the difference and to determine if adding newer data to the background dataset, replacing the background dataset with the newer data, or continuing to use the existing background dataset was most appropriate. If the differences appeared to have been caused by a release, then the previous background dataset would have continued to be used.

The complete Mann-Whitney test results and a summary of the significant findings can be found in Attachment B. Significant differences were found between the two groups for TDS in downgradient well MW-26. Upon review of the differences between the two groups, it was found that TDS concentrations at downgradient well MW-26 were lower than those reported in at least one upgradient well, and therefore the background data were updated to include the compliance data for TDS at MW-26.

For interwell predictions limits for fluoride a Sen's Slope/Mann Kendall trend test was used to evaluate data at upgradient wells. This analysis identifies statistically significant increasing or decreasing trends. The trend analysis results indicated that the data are consistent over time with no statistically significant increasing or decreasing trends (Attachment B)

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

2.3.3 Updated Prediction Limits

Intrawell upper prediction limits (UPLs) were updated using all the historical data through July 2019 to represent background values. Intrawell lower prediction limits (LPLs) were also generated for pH. The updated prediction limits are summarized in Table 2.

The intrawell UPLs were calculated for a one-of-two retesting procedure; i.e., if at least one sample in a series of two does not exceed the UPL, then it can be concluded that an SSI has not occurred. In practice, where the initial result did not exceed the UPL, a second sample will not be collected.

The retesting procedures are intended to achieve an acceptably high statistical power to detect changes at downgradient wells for constituents evaluated using intrawell prediction limits.

Interwell prediction limits pool upgradient data to establish a background limit for an individual constituent. Interwell UPLs, with a one-of-two resample plan, were updated using all available data from upgradient wells for the same time period for fluoride. The updated prediction limits are summarized in Table 2.

2.4 Conclusions

Four detection monitoring events were completed in accordance with the CCR Rule. The laboratory and field data from these events were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. Mann-Whitney tests were completed to evaluate whether data from the detection monitoring events could be added to the existing background dataset. Where appropriate, the background datasets were updated, and UPLs and LPLs were recalculated. Intrawell tests using a one-of-two retesting procedure were selected and updated for Appendix III parameters boron, calcium, chloride, pH, sulfate, and TDS. For fluoride, an interwell test using a one-of-two retesting procedure was selected and updated with the most current data.

SECTION 3

REFERENCES

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

Geosyntec Consultants, 2018. Statistical Analysis Summary. Landfill – Mountaineer Plant. January 2018.

Geosyntec Consultants, 2019. Alternative Source Demonstration – Federal CCR Rule. Mountaineer Plant Landfill. March.

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
Mountaineer - Landfill**

Parameter	Unit	MW-1611							MW-1612			
		10/31/2017	1/22/2018	9/20/2018	11/26/2018	4/9/2019	6/18/2019	7/10/2019	10/30/2017	9/20/2018	11/26/2018	4/9/2019
		2017-D1	2017-D1-R1	2018-D1	2018-D2	2019-D1	2019-D1-R1	2019-D1-R1	2017-D1	2018-D1	2018-D2	2019-D1
Boron	mg/L	0.152	-	0.258	0.147	0.139	-	-	0.457	0.543	0.413	0.449
Calcium	mg/L	24.0	22.6	23.2	21.9	26.2	22.8	-	7.22	4.50	4.25	3.21
Chloride	mg/L	9.80	-	9.48	9.57	7.96	9.58	-	20.2	14.6	11.5	10.2
Fluoride	mg/L	0.610	-	0.610	0.620	0.460	-	-	3.53	3.78	3.91	4.02
Total Dissolved Solids	mg/L	402	376	416	387	431	-	402	914	835	764	725
Sulfate	mg/L	18.9	-	19.0	18.5	20.7	-	-	147	63.9	49.2	54.8
pH	SU	7.8	7.5	7.8	7.7	7.6	7.9	7.6	8.2	8.4	8.0	8.3

Parameter	Unit	MW-26						MW-27				MW-30			
		10/31/2017	1/22/2018	9/20/2018	11/26/2018	4/9/2019	6/18/2019	10/31/2017	9/20/2018	11/26/2018	4/9/2019	10/30/2017	9/20/2018	11/27/2018	4/9/2019
		2017-D1	2017-D1-R1	2018-D1	2018-D2	2019-D1	2019-D1-R1	2017-D1	2018-D1	2018-D2	2019-D1	2017-D1	2018-D1	2018-D2	2019-D1
Boron	mg/L	0.165	-	0.214	0.182	0.128	-	0.275	0.357	0.292	0.303	0.315	0.315	0.344	0.290
Calcium	mg/L	54.7	55.7	49.4	53.6	62.8	-	1.33	1.14	1.20	1.19	3.27	4.69	3.16	2.88
Chloride	mg/L	5.48	-	6.04	5.97	6.71	7.22	1.63	1.69	1.52	1.54	257	253	247	245
Fluoride	mg/L	0.130	-	0.160	0.140	0.130	-	2.38	2.41	2.37	2.32	3.30	3.36	3.40	3.32
Total Dissolved Solids	mg/L	346	-	344	364	370	387	544	550	522	542	1210	1230	1240	1260
Sulfate	mg/L	5.80	-	6.30	7.20	7.60	-	4.20	4.40	3.60	2.90	11.4	13.0	11.7	10.6
pH	SU	7.5	7.3	8.0	7.4	7.3	7.2	9.2	9.1	9.0	9.0	8.5	8.6	8.4	8.4

Parameter	Unit	MW-38						MW-39			
		10/31/2017	1/22/2018	9/20/2018	11/26/2018	4/9/2019	6/18/2019	10/31/2017	9/20/2018	11/26/2018	4/9/2019
		2017-D1	2017-D1-R1	2018-D1	2018-D2	2019-D1	2019-D1-R1	2017-D1	2018-D1	2018-D2	2019-D1
Boron	mg/L	0.045	-	0.068	0.080 J	0.040 J	-	0.171	0.182	0.167	0.158
Calcium	mg/L	56.1	53.8	51.2	48.2	52.0	-	7.25	6.43	6.33	6.65
Chloride	mg/L	7.59	-	7.31	7.06	7.46	-	3.05	2.99	2.93	2.94
Fluoride	mg/L	0.380	-	0.360	0.340	0.320	-	0.780	0.800	0.800	0.770
Total Dissolved Solids	mg/L	460	419	441	415	427	-	385	369	380	376
Sulfate	mg/L	28.7	-	31.5	35.2	27.8	-	0.200	0.100 J	0.070 J	0.400 U
pH	SU	7.0	6.7	7.4	7.0	6.9	7.6	8.3	8.5	8.3	8.3

Notes:

mg/L: milligrams per liter

SU: standard unit

U: Parameter was not present in concentrations above the method detection limit and is reported as the reporting limit

J: Estimated value. Parameter was detected in concentrations below the reporting limit

-: Not Measured

D1: First semi-annual detection monitoring event of the year

D2: Second semi-annual detection monitoring event of the year

R1: First verification event associated with detection monitoring round

**Table 2: Background Level Summary
Mountaineer - Landfill**

Parameter	Units	Description	MW-1611	MW-26	MW-27	MW-38	MW-39	
Boron	mg/L	Intrawell Background UPL	0.254	0.254	0.395	0.104	0.213	
Calcium	mg/L	Intrawell Background UPL	26.2	64.9	1.89	58.6	12.4	
Chloride	mg/L	Intrawell Background UPL	10.4	7.27	1.90	7.69	3.11	
Fluoride	mg/L	Interwell Background UPL	3.91					
pH	SU	Intrawell Background UPL	8.1	8.0	9.5	7.6	8.8	
		Intrawell Background LPL	7.3	7.2	8.8	6.6	8.1	
Sulfate	mg/L	Intrawell Background UPL	23.5	11.5	7.79	38.5	0.200	
Total Dissolved Solids	mg/L	Intrawell Background UPL	441	402	606	469	445	

Notes:

UPL: Upper prediction limit

LPL: Lower prediction limit

ATTACHMENT A

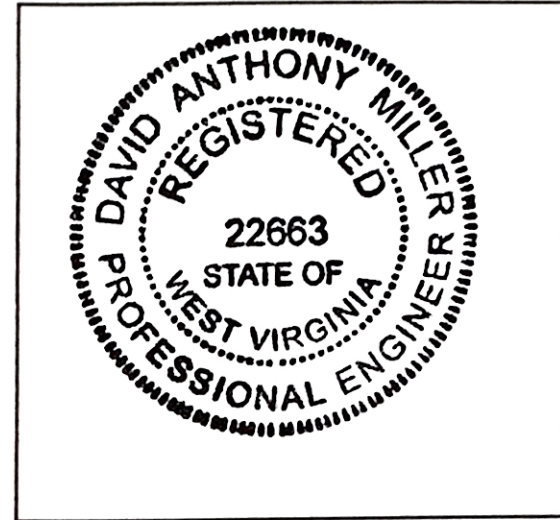
Certification by a Qualified Professional Engineer

Certification by a Qualified Professional Engineer

I certify that the selected and above described statistical method is appropriate for evaluating the groundwater monitoring data for the Mountaineer Landfill 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



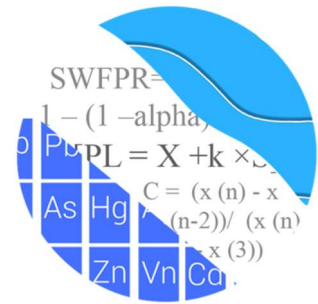
22663
License Number

WEST VIRGINIA
Licensing State

01.13.2020
Date

ATTACHMENT B
Statistical Analysis Output

GROUNDWATER STATS CONSULTING



November 22, 2019

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

RE: July 2019 Background Update – Mountaineer Landfill

Dear Ms. Kreinberg,

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the screening for the proposed background update of prediction limits with data through July 2019 for American Electric Power's Mountaineer Landfill. 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 Mountaineer Landfill for the CCR program in 2016, and 8 background samples were initially collected at each of the groundwater monitoring wells. The monitoring well network, as provided by Geosyntec Consultants, consists of the following:

- **Upgradient wells:** MW-1612 and MW-30; and
- **Downgradient wells:** MW-1611, MW-26, MW-27, MW-38, and MW-39.

Data were sent electronically to Groundwater Stats Consulting, and the background update report was reviewed by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to Groundwater Stats Consulting.

The following CCR Detection Monitoring constituents were evaluated:

- **Appendix III Parameters:** boron, calcium, chloride, fluoride, pH, sulfate, and TDS

Time series plots for Appendix III at all wells are provided for the purpose of screening data at these wells (Figure A). Additionally, box plots are included for all constituents at upgradient and downgradient wells (Figure B). The time series plots are used to initially screen for suspected outliers and trends, while the box plots provide visual representation of variation within individual wells and between all wells.

Data at all wells were evaluated during the initial background screening conducted in December 2017 for the following: 1) outliers; 2) trends; 3) most appropriate statistical method for Appendix III parameters based on site characteristics of groundwater data upgradient of the facility; and 4) eligibility of downgradient wells when intrawell statistical methods are recommended.

Summary of Statistical Method:

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

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

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

- Nonparametric prediction limits are used on data containing greater than 50% nondetects.

Summary of Background Screening Conducted in December 2017

Outlier Evaluation

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

Tukey's outlier test noted a few outliers. Any values flagged as outliers are plotted in a lighter font on the time series graph. The pH values reported during the May 2017 sample event were, reportedly, due to instrumentation error. The test identified two outliers for boron in well MW-27; an outlier for calcium in well MW-1611; a low outlier for pH in well MW-1611; and an outlier for TDS in well MW-1611. However, these values were not flagged due to all concentrations being consistent over time and similar to concentrations in neighboring wells. A substitution of the most recent reporting limit was applied when varying detection limits existed in data.

As mentioned above, flagged data are displayed in a lighter font and as a disconnected symbol on the time series reports, as well as in a lighter font on the accompanying data pages.

No true seasonal patterns were observed on the time series plots for any of the detected data; therefore, no deseasonalizing adjustments were made to the data. When seasonal patterns are observed, data may be deseasonalized so that the resulting limits will correctly account for the seasonality as a predictable pattern rather than random variation or a release. It was noted that for the majority of constituents evaluated, the highest concentrations are reported in the upgradient wells.

While trends may be visual, a quantification of the trend and its significance is needed. The Sen's Slope/Mann Kendall trend test was used to evaluate all data at each well to identify statistically significant increasing or decreasing trends. In the absence of suspected contamination, significant trending data are typically not included as part of the background data used for construction of prediction limits. This step serves to eliminate the trend and, thus, reduce variation in background. When statistically

significant decreasing trends are present, earlier data are evaluated to determine whether earlier concentration levels are significantly different than current reported concentrations and will be deselected as necessary. When the historical records of data are truncated for the reasons above, a summary report will be provided to show the date ranges used in construction of the statistical limits.

The results of the trend analyses showed all data are consistent over time with no statistically significant increasing trends. A few statistically significant decreasing trends were noted; however, the magnitudes of the trends were low relative to the average concentrations, as may be seen on the Trend Test Summary table. It was noted that boron, sulfate, and TDS concentrations are found to have the highest concentrations in the upgradient wells. No adjustments to any data sets were required at this time.

Appendix III – Determination of Spatial Variation

The Analysis of Variance (ANOVA) was used to statistically evaluate differences in average concentrations among upgradient wells, which assists in identifying the most appropriate statistical approach. Interwell tests, which compare downgradient well data to statistical limits constructed from pooled upgradient well data, are appropriate when average concentrations are similar across upgradient wells. Intrawell tests, which compare compliance data from a single well to screened historical data within the same well, are appropriate when upgradient wells exhibit spatial variation; when statistical limits constructed from upgradient wells would not be conservative from a regulatory perspective; and when downgradient water quality is unimpacted compared to upgradient water quality for the same parameter.

Appendix III - Statistical Limits

Intrawell limits constructed from carefully screened background data from within each well serve to provide statistical limits that are conservative (i.e. lower) from a regulatory perspective, and that will rapidly identify a change in more recent compliance data from within a given well. This statistical method removes the element of variation from across wells and eliminates the chance of mistaking natural spatial variation for a release from the facility. Prior to performing intrawell prediction limits, several steps are required to reasonably demonstrate downgradient water quality does not have existing impacts from the practices of the facility.

In cases where downgradient average concentrations are higher than observed concentrations upgradient for a given constituent, an independent study and hydrogeological investigation would be required to identify local geochemical

conditions and expected groundwater quality for the region to justify an intrawell approach. Such an assessment is beyond the scope of services provided by Groundwater Stats Consulting. When there is not an obvious explanation for observed concentration differences in downgradient wells relative to reported concentrations in upgradient wells, interwell prediction limits will initially be selected for the statistical method until further evidence shows that concentrations are due to natural variation rather than a result of the facility.

Confidence Intervals for boron, chloride, sulfate, and TDS were found to be within their respective background limits and are, therefore, eligible for intrawell prediction limits. Interwell prediction limits were initially recommended for calcium, fluoride, and pH. However, additional studies provided by Geosyntec Consultants support natural variation in groundwater for calcium and pH; therefore, interwell methods will be used for fluoride only.

All available data through June 2017, for parameters mentioned above, at each well were used to establish intrawell background limits based on a 1-of-2 resample plan that will be used for future comparisons. Interwell prediction limits for fluoride as described above, combined with a 1-of-2 resample plan, were constructed from upgradient wells.

Natural systems continuously evolve due to physical changes made to the environment. Examples include capping a landfill, paving areas near a well, or lining a drainage channel to prevent erosion. Periodic updating of background statistical limits will be necessary to accommodate these types of changes. In the intrawell case, data are evaluated when at least 4 new compliance values are available. In the interwell case, newer data are carefully evaluated during each event for new outliers, and prediction limits are constructed using all available data from upgradient wells.

October 2019 - Background Update

Data were re-evaluated using Tukey's outlier test and visual screening with the July 2019 samples. Fluoride is tested using interwell prediction limits and, therefore, only upgradient wells were tested for outliers for this constituent (Figure C). All other Appendix III parameters, which use intrawell prediction limits, were tested for each well (Figure C). In addition to the pH values previously flagged as outliers due to reported instrumentation error for those samples, a low value was noted for fluoride in MW-30 and high values were noted for calcium in well MW-27 and sulfate in well MW-39. These values were flagged in the database as outliers. Tukey's also identified a high value for fluoride in the pooled upgradient well data; however, this value was similar to concentrations reported in neighboring wells and was not flagged as an outlier in the

database. A similar occurrence was present for TDS in well MW-27, but this value was not flagged in the database as an outlier. It is consistent with the other reported values in this well and the concentrations overall are significantly less than those reported in at least one upgradient well. However, a high sulfate value in well MW-39 was not identified by Tukey's due to the natural log transformation, but this value was flagged as an outlier as this sample did not appear to represent the population for this well/constituent pair.

For constituents requiring intrawell prediction limits, the Mann-Whitney (Wilcoxon Rank Sum) test was used to compare the medians of historical data through June 2017 to the new compliance samples at each well through July 2019 to evaluate whether the groups are statistically different at the 99% confidence level, in which case background data may not be updated with more recent compliance data (Figure D). Statistically significant differences were found for TDS in well MW-26.

Typically, when the test concludes that the medians of the two groups are significantly different, particularly in the downgradient wells, the background are not updated to include the newer data but will be reconsidered in the future. However, in the case of TDS at well MW-26, concentrations are lower than those reported in at least one upgradient well and were, therefore, updated. A summary of these results follows this letter and the test results are included with the Mann Whitney test section at the end of this report.

Intrawell prediction limits using all historical data reported through July 2019, combined with a 1-of-2 resample plan, were constructed and a summary of the updated limits follows this letter (Figure E).

The Sen's Slope/Mann Kendall trend test was used to evaluate data at upgradient wells for fluoride to identify statistically significant increasing or decreasing trends. The results of the trend analyses showed all data are consistent over time with no statistically significant increasing or decreasing trends (Figure F).

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

Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Mountaineer Landfill. If you have any questions or comments, please feel free to contact us.

For Groundwater Stats Consulting,



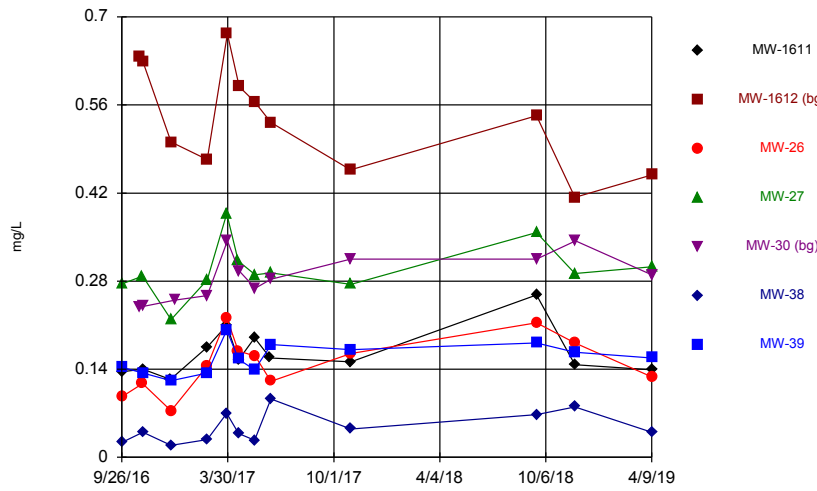
Andrew T. Collins
Groundwater Analyst



Kristina L. Rayner
Groundwater Statistician

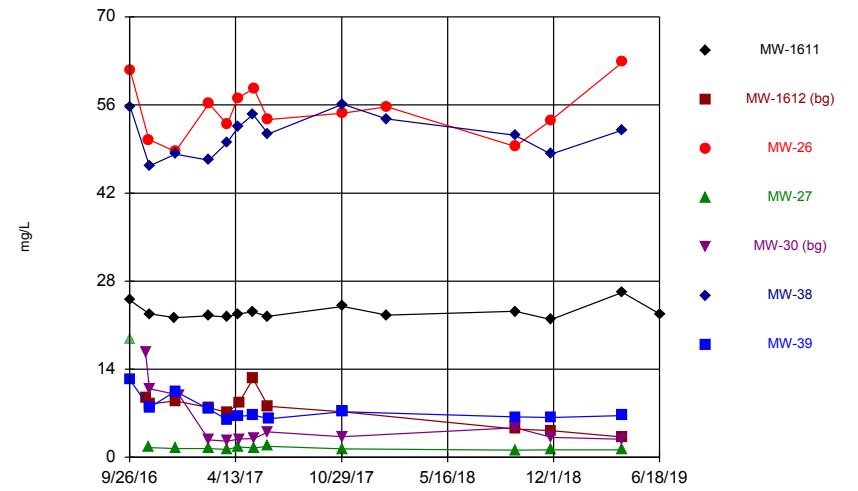
FIGURE A: TIME SERIES

Time Series



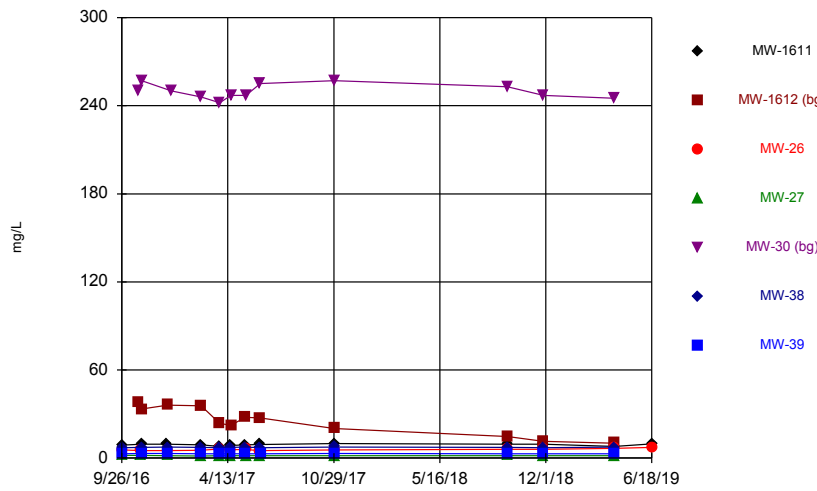
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 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Time Series



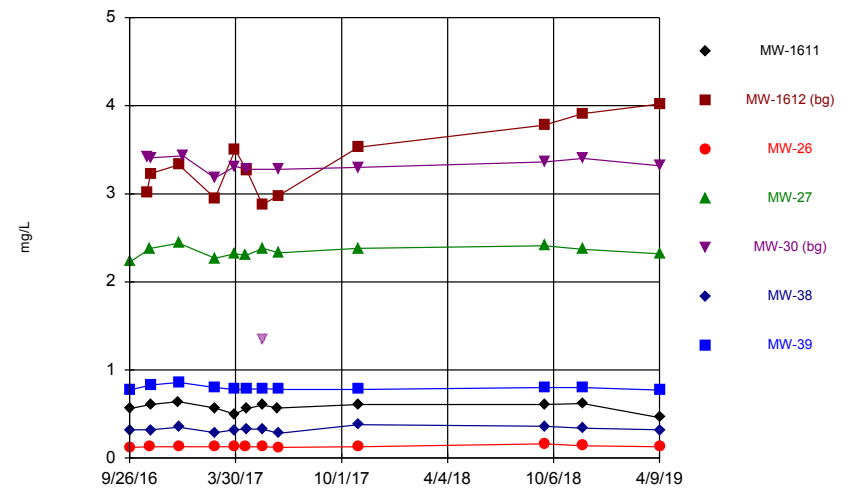
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Time Series



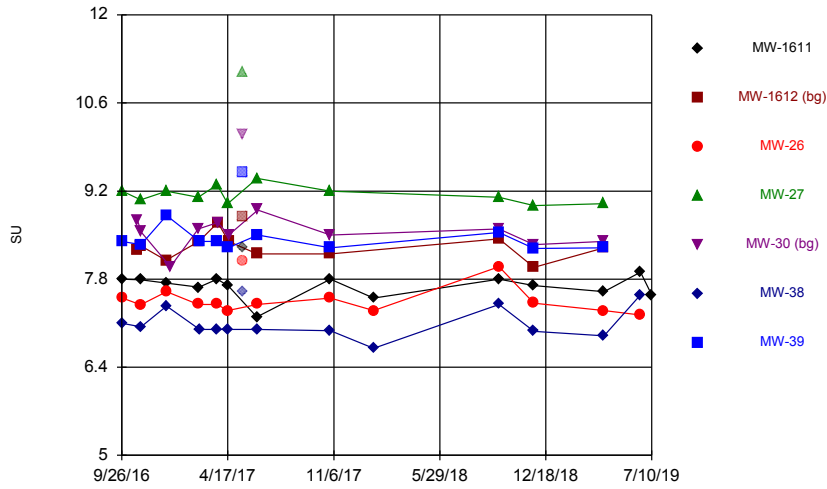
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Time Series



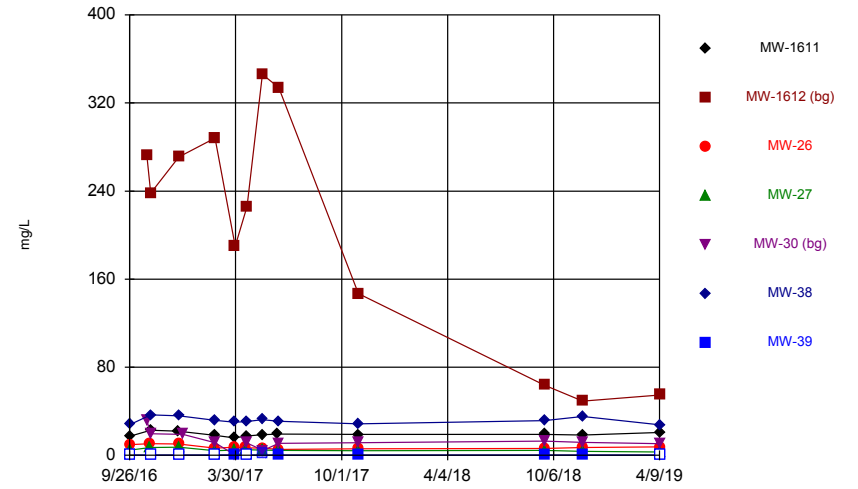
Constituent: Fluoride, total Analysis Run 11/22/2019 9:04 AM
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Time Series



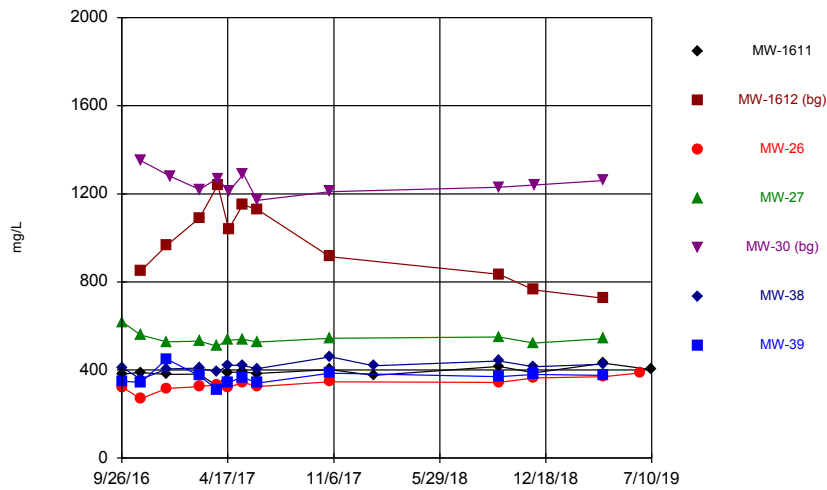
Constituent: pH, field Analysis Run 11/22/2019 9:04 AM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Time Series



Constituent: Sulfate, total Analysis Run 11/22/2019 9:04 AM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

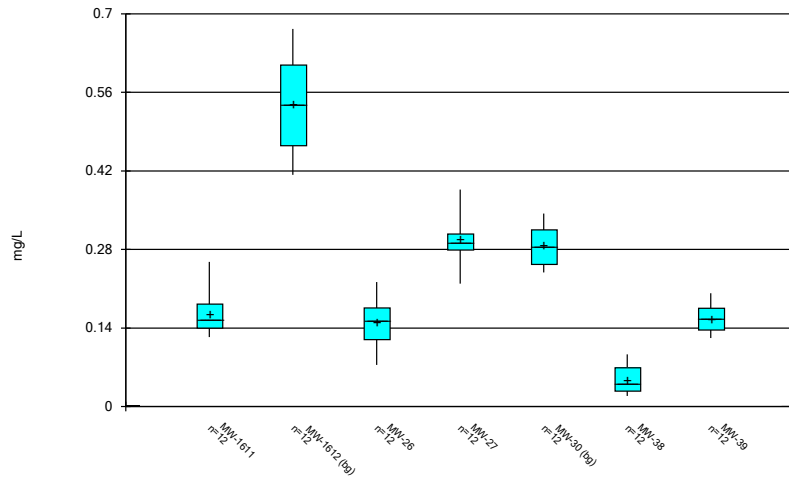
Time Series



Constituent: Total Dissolved Solids [TDS] Analysis Run 11/22/2019 9:04 AM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

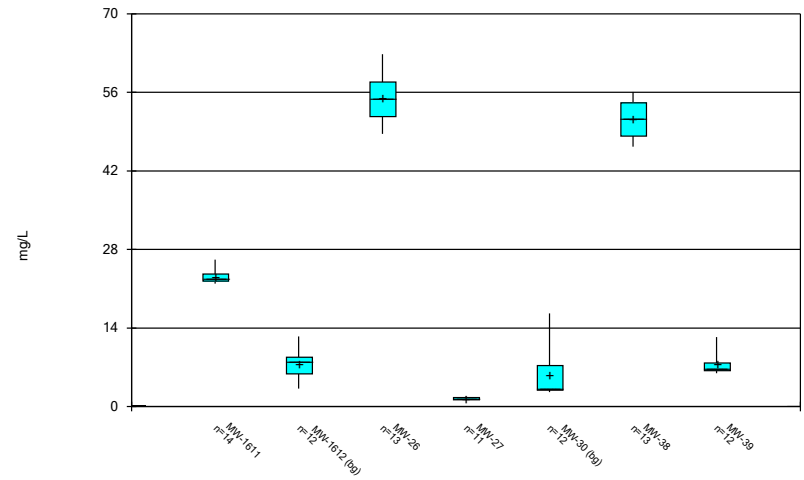
FIGURE B: BOX PLOTS

Box & Whiskers Plot



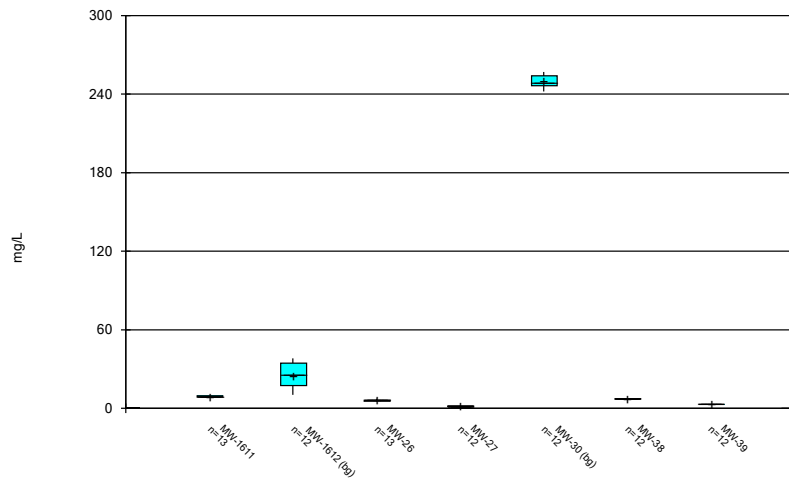
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 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Box & Whiskers Plot



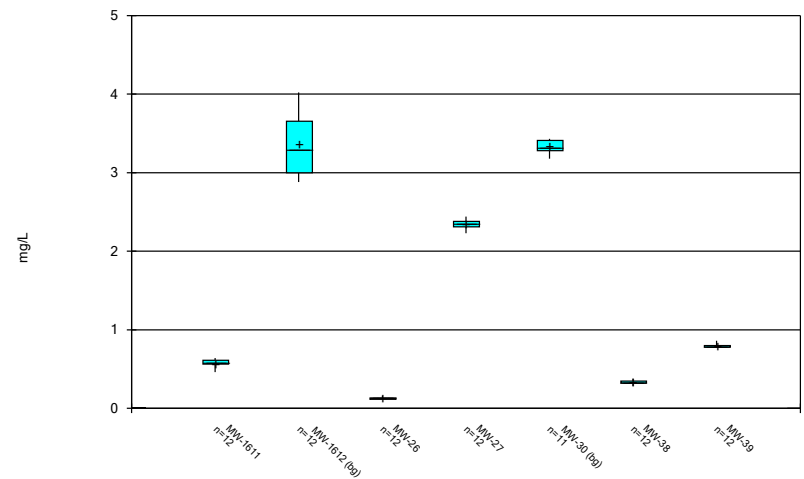
Constituent: Calcium, total Analysis Run 11/22/2019 9:07 AM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Box & Whiskers Plot



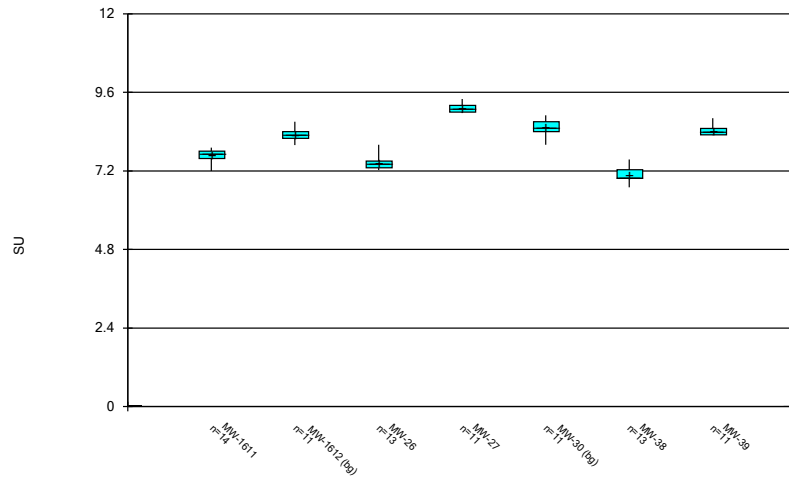
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 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Box & Whiskers Plot



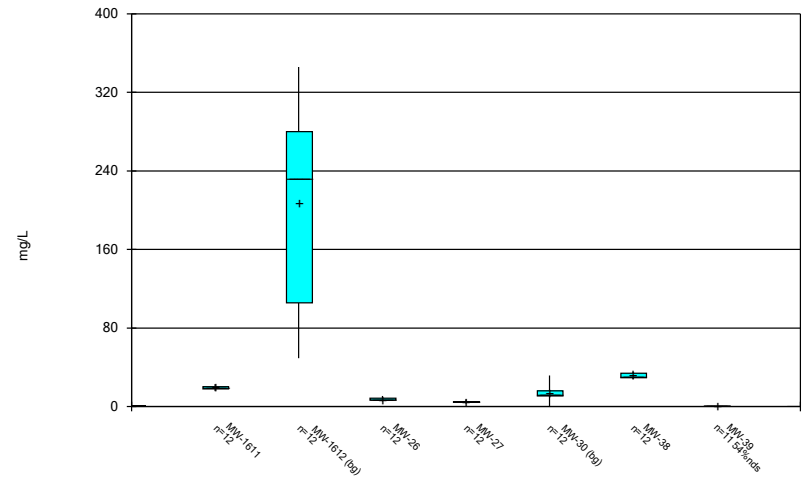
Constituent: Fluoride, total Analysis Run 11/22/2019 9:07 AM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Box & Whiskers Plot



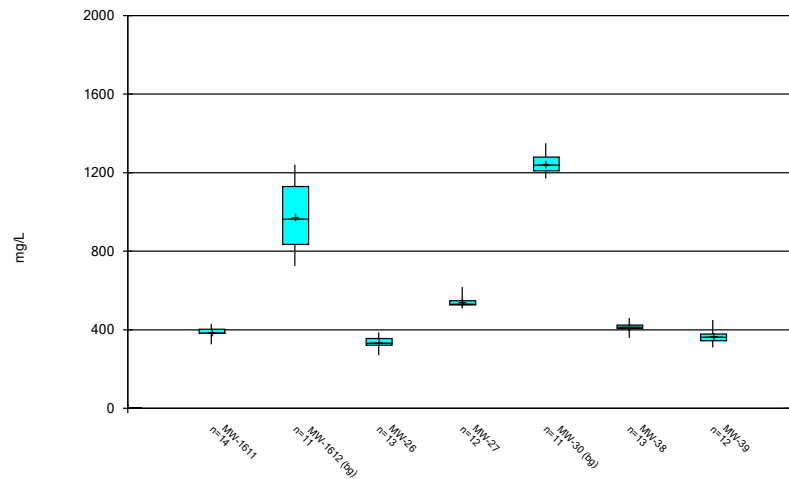
Constituent: pH, field Analysis Run 11/22/2019 9:07 AM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Box & Whiskers Plot



Constituent: Sulfate, total Analysis Run 11/22/2019 9:07 AM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Box & Whiskers Plot



Constituent: Total Dissolved Solids [TDS] Analysis Run 11/22/2019 9:07 AM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

FIGURE C: OUTLIER SUMMARY

Outlier Summary

Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill Printed 11/22/2019, 9:10 AM

	MW-27 Calcium, total (mg/L)	MW-30 Fluoride, total (mg/L)	MW-1611 pH, field (SU)	MW-1612 pH, field (SU)	MW-26 pH, field (SU)	MW-27 pH, field (SU)	MW-30 pH, field (SU)	MW-38 pH, field (SU)	MW-39 pH, field (SU)	MW-39 Sulfate, total (mg/L)
9/27/2016	18.9 (o)									
5/16/2017		8.3 (o)	8.8 (o)					7.6 (o)	9.5 (o)	1.5 (o)
5/17/2017		1.34 (o)			8.09 (o)	11.1 (o)	10.1 (o)			

Upgradient Outlier Analysis - All Results

Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill Printed 10/7/2019, 4:23 PM

<u>Constituent</u>	<u>Well</u>	<u>Outlier</u>	<u>Value(s)</u>	<u>Date(s)</u>	<u>Method</u>	<u>Alpha</u>	<u>N</u>	<u>Mean</u>	<u>Std. Dev.</u>	<u>Distribution</u>	<u>Normality Test</u>
Fluoride, total (mg/L)	MW-1612,MW-30	Yes	4.02,1.34	n/a w/combined bg	NP	NaN	24	3.268	0.493	x^4	ShapiroWilk

Outlier Analysis - Significant Results

Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill Printed 10/7/2019, 4:21 PM

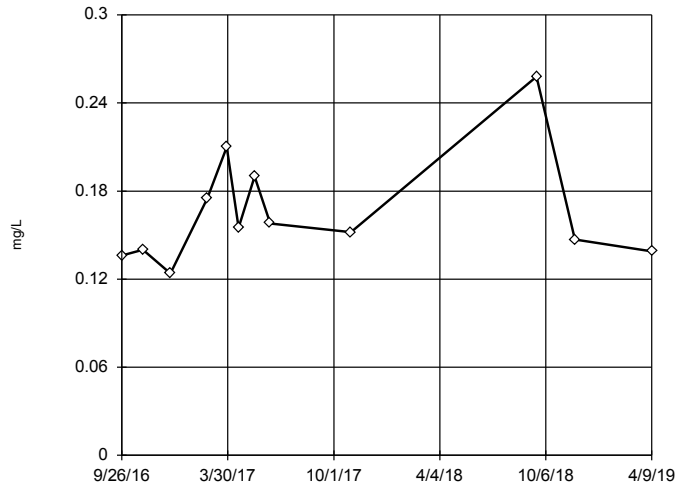
Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Calcium, total (mg/L)	MW-27	Yes	18.9	9/27/2016	NP	NaN	12	2.858	5.056	In(x)	ShapiroWilk
pH, field (SU)	MW-27	Yes	11.1	5/17/2017	NP	NaN	12	9.303	0.5805	In(x)	ShapiroWilk
pH, field (SU)	MW-30 (bg)	Yes	10.1	5/17/2017	NP	NaN	12	8.662	0.5053	In(x)	ShapiroWilk
pH, field (SU)	MW-39	Yes	9.5	5/16/2017	NP	NaN	12	8.508	0.3456	In(x)	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	MW-27	Yes	618	9/27/2016	NP	NaN	12	541.8	27.43	In(x)	ShapiroWilk

Outlier Analysis - All Results

Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill Printed 10/7/2019, 4:21 PM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Boron, total (mg/L)	MW-1611	No	n/a	n/a	NP	NaN	12	0.1653	0.03797	ln(x)	ShapiroWilk
Boron, total (mg/L)	MW-1612 (bg)	No	n/a	n/a	NP	NaN	12	0.5384	0.08279	x^(1/3)	ShapiroWilk
Boron, total (mg/L)	MW-26	No	n/a	n/a	NP	NaN	12	0.1496	0.04475	normal	ShapiroWilk
Boron, total (mg/L)	MW-27	No	n/a	n/a	NP	NaN	12	0.2978	0.04195	ln(x)	ShapiroWilk
Boron, total (mg/L)	MW-30 (bg)	No	n/a	n/a	NP	NaN	12	0.2868	0.03727	ln(x)	ShapiroWilk
Boron, total (mg/L)	MW-38	No	n/a	n/a	NP	NaN	12	0.04767	0.02417	ln(x)	ShapiroWilk
Boron, total (mg/L)	MW-39	No	n/a	n/a	NP	NaN	12	0.1573	0.02381	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-1611	No	n/a	n/a	NP	NaN	14	23.13	1.186	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-1612 (bg)	No	n/a	n/a	NP	NaN	12	7.524	2.557	normal	ShapiroWilk
Calcium, total (mg/L)	MW-26	No	n/a	n/a	NP	NaN	13	55.02	4.312	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-27	Yes	18.9	9/27/2016	NP	NaN	12	2.858	5.056	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-30 (bg)	No	n/a	n/a	NP	NaN	12	5.554	4.484	ln(x)	ShapiroWilk
Calcium, total (mg/L)	MW-38	No	n/a	n/a	NP	NaN	13	51.32	3.209	normal	ShapiroWilk
Calcium, total (mg/L)	MW-39	No	n/a	n/a	NP	NaN	12	7.534	1.961	ln(x)	ShapiroWilk
Chloride, total (mg/L)	MW-1611	No	n/a	n/a	NP	NaN	13	9.078	0.5843	x^6	ShapiroWilk
Chloride, total (mg/L)	MW-1612 (bg)	No	n/a	n/a	NP	NaN	12	25.08	9.687	normal	ShapiroWilk
Chloride, total (mg/L)	MW-26	No	n/a	n/a	NP	NaN	13	5.813	0.638	ln(x)	ShapiroWilk
Chloride, total (mg/L)	MW-27	No	n/a	n/a	NP	NaN	12	1.634	0.1156	ln(x)	ShapiroWilk
Chloride, total (mg/L)	MW-30 (bg)	No	n/a	n/a	NP	NaN	12	249.7	4.887	ln(x)	ShapiroWilk
Chloride, total (mg/L)	MW-38	No	n/a	n/a	NP	NaN	12	7.264	0.1812	ln(x)	ShapiroWilk
Chloride, total (mg/L)	MW-39	No	n/a	n/a	NP	NaN	12	2.981	0.05384	ln(x)	ShapiroWilk
pH, field (SU)	MW-1611	No	n/a	n/a	NP	NaN	15	7.724	0.2343	ln(x)	ShapiroWilk
pH, field (SU)	MW-1612 (bg)	No	n/a	n/a	NP	NaN	12	8.344	0.2304	ln(x)	ShapiroWilk
pH, field (SU)	MW-26	No	n/a	n/a	NP	NaN	14	7.488	0.2553	ln(x)	ShapiroWilk
pH, field (SU)	MW-27	Yes	11.1	5/17/2017	NP	NaN	12	9.303	0.5805	ln(x)	ShapiroWilk
pH, field (SU)	MW-30 (bg)	Yes	10.1	5/17/2017	NP	NaN	12	8.662	0.5053	ln(x)	ShapiroWilk
pH, field (SU)	MW-38	No	n/a	n/a	NP	NaN	14	7.115	0.2612	ln(x)	ShapiroWilk
pH, field (SU)	MW-39	Yes	9.5	5/16/2017	NP	NaN	12	8.508	0.3456	ln(x)	ShapiroWilk
Sulfate, total (mg/L)	MW-1611	No	n/a	n/a	NP	NaN	12	19.03	1.94	ln(x)	ShapiroWilk
Sulfate, total (mg/L)	MW-1612 (bg)	No	n/a	n/a	NP	NaN	12	206.7	106.2	x^2	ShapiroWilk
Sulfate, total (mg/L)	MW-26	No	n/a	n/a	NP	NaN	12	7.467	1.739	ln(x)	ShapiroWilk
Sulfate, total (mg/L)	MW-27	No	n/a	n/a	NP	NaN	12	4.817	1.278	ln(x)	ShapiroWilk
Sulfate, total (mg/L)	MW-30 (bg)	No	n/a	n/a	NP	NaN	12	12.91	7.883	normal	ShapiroWilk
Sulfate, total (mg/L)	MW-38	No	n/a	n/a	NP	NaN	12	31.63	2.941	ln(x)	ShapiroWilk
Sulfate, total (mg/L)	MW-39	No	n/a	n/a	NP	NaN	12	0.21	0.4099	ln(x)	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	MW-1611	No	n/a	n/a	NP	NaN	14	388.2	23.52	x^4	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	MW-1612 (bg)	No	n/a	n/a	NP	NaN	11	973.1	169.8	normal	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	MW-26	No	n/a	n/a	NP	NaN	13	335.8	29.2	x^3	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	MW-27	Yes	618	9/27/2016	NP	NaN	12	541.8	27.43	ln(x)	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	MW-30 (bg)	No	n/a	n/a	NP	NaN	11	1248	48.95	ln(x)	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	MW-38	No	n/a	n/a	NP	NaN	13	414	24.27	x^3	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	MW-39	No	n/a	n/a	NP	NaN	12	365.8	34.14	ln(x)	ShapiroWilk

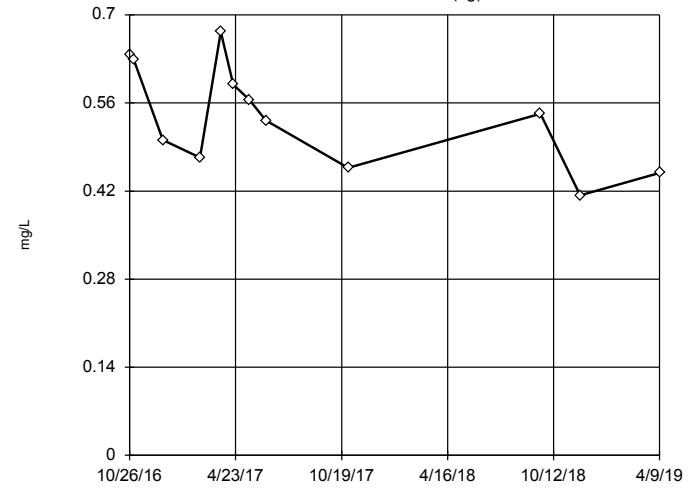
Tukey's Outlier Screening
MW-1611



n = 12
No outliers found. Tukey's method selected by user.
Data were natural log transformed to achieve best W statistic (graph shown in original units).
High cutoff = 0.4073, low cutoff = 0.06246, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

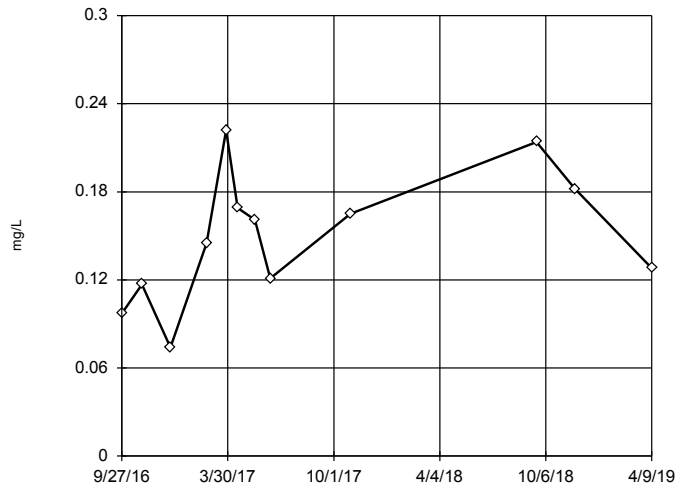
Tukey's Outlier Screening
MW-1612 (bg)



n = 12
No outliers found. Tukey's method selected by user.
Data were cube root transformed to achieve best W statistic (graph shown in original units).
High cutoff = 1.211, low cutoff = 0.1721, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

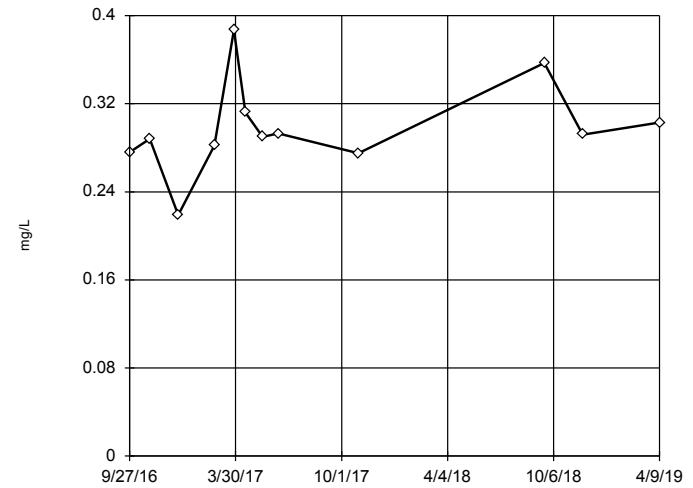
Tukey's Outlier Screening
MW-26



n = 12
No outliers found. Tukey's method selected by user.
Ladder of Powers transformations did not improve normality, analysis run on raw data.
High cutoff = 0.345, low cutoff = -0.0505, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

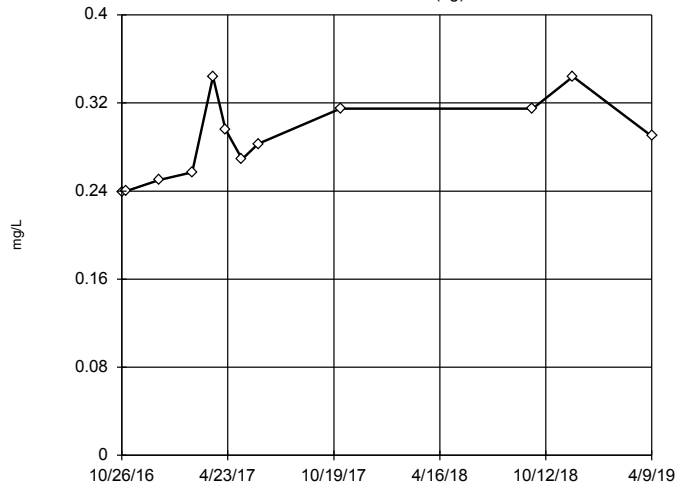
Tukey's Outlier Screening
MW-27



n = 12
No outliers found. Tukey's method selected by user.
Data were natural log transformed to achieve best W statistic (graph shown in original units).
High cutoff = 0.4116, low cutoff = 0.2084, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

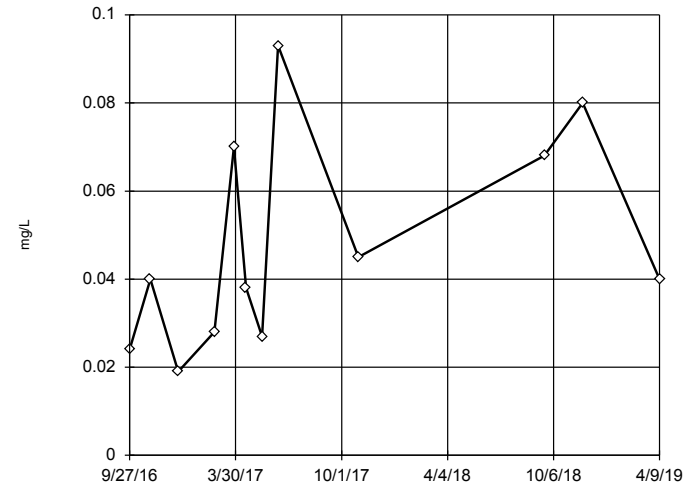
Tukey's Outlier Screening
MW-30 (bg)



n = 12
No outliers found. Tukey's method selected by user.
Data were natural log transformed to achieve best W statistic (graph shown in original units).
High cutoff = 0.6046, low cutoff = 0.1321, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

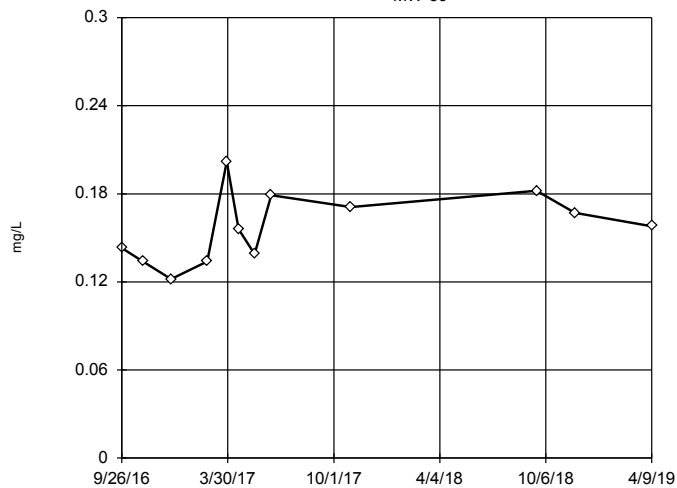
Tukey's Outlier Screening
MW-38



n = 12
No outliers found. Tukey's method selected by user.
Data were natural log transformed to achieve best W statistic (graph shown in original units).
High cutoff = 1.09, low cutoff = 0.00174, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

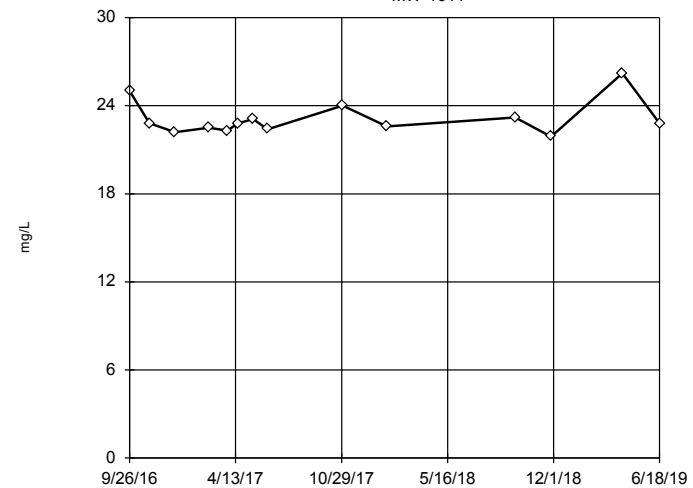
Tukey's Outlier Screening
MW-39



n = 12
No outliers found. Tukey's method selected by user.
Data were natural log transformed to achieve best W statistic (graph shown in original units).
High cutoff = 0.3686, low cutoff = 0.06478, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening
MW-1611

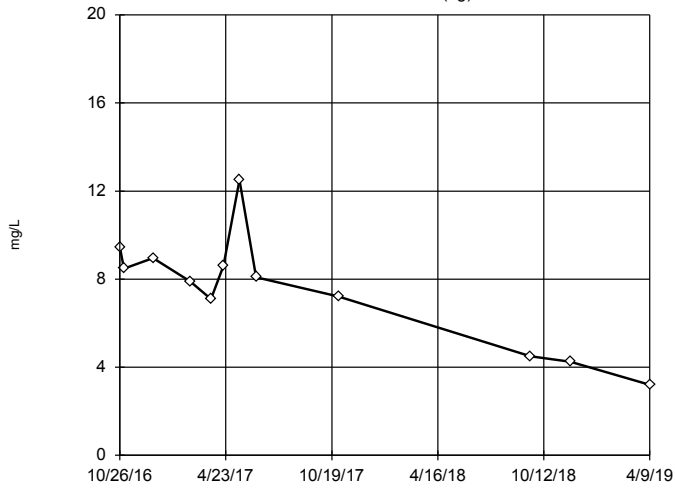


n = 14
No outliers found. Tukey's method selected by user.
Data were natural log transformed to achieve best W statistic (graph shown in original units).
High cutoff = 27.77, low cutoff = 18.99, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

MW-1612 (bg)

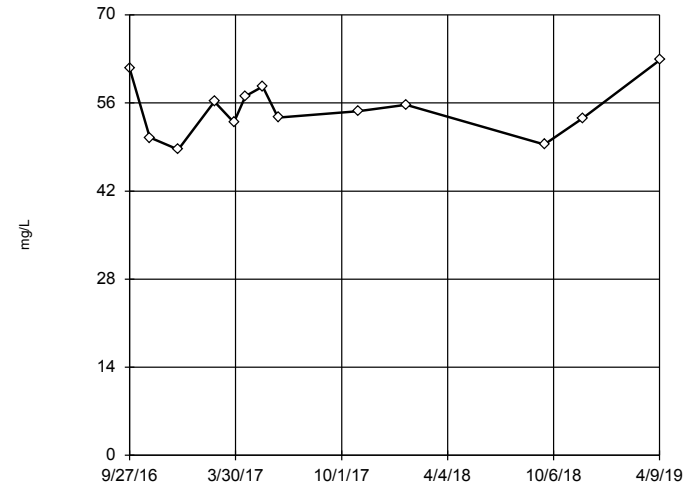


n = 12
 No outliers found.
 Tukey's method selected by user.
 Ladder of Powers transformations did not improve normality; analysis run on raw data.
 High cutoff = 17.74, low cutoff = -3.155, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 10/7/2019 4:18 PM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

MW-26

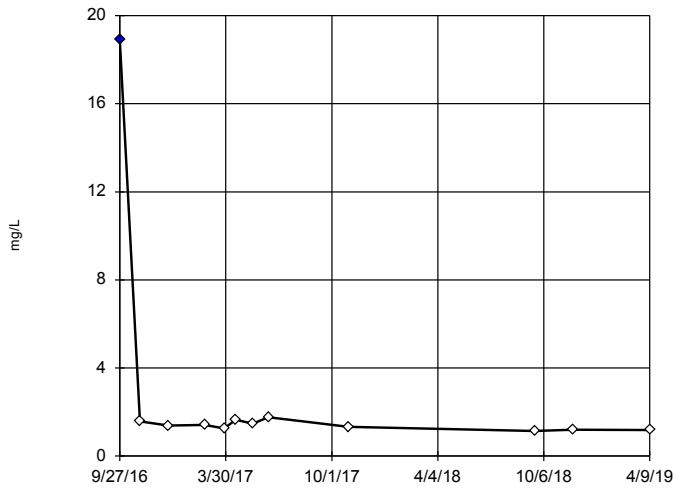


n = 13
 No outliers found.
 Tukey's method selected by user.
 Data were natural log transformed to achieve best W statistic (graph shown in original units).
 High cutoff = 81.09, low cutoff = 36.87, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 10/7/2019 4:18 PM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

MW-27

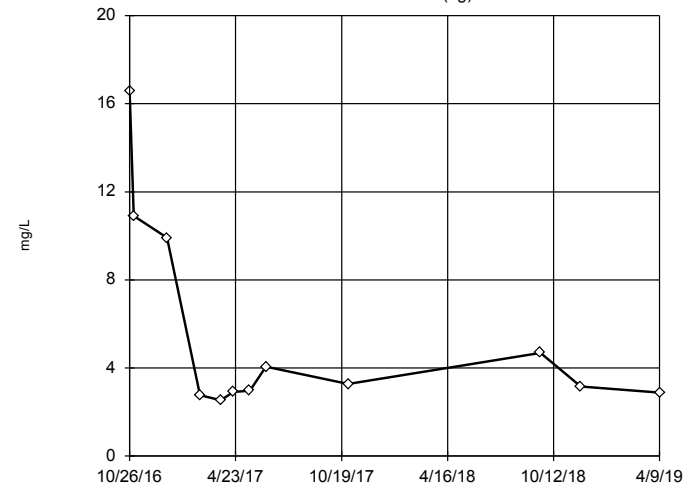


n = 12
 Outlier is drawn as solid.
 Tukey's method selected by user.
 Data were natural log transformed to achieve best W statistic (graph shown in original units).
 High cutoff = 3.609, low cutoff = 0.5483, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 10/7/2019 4:18 PM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

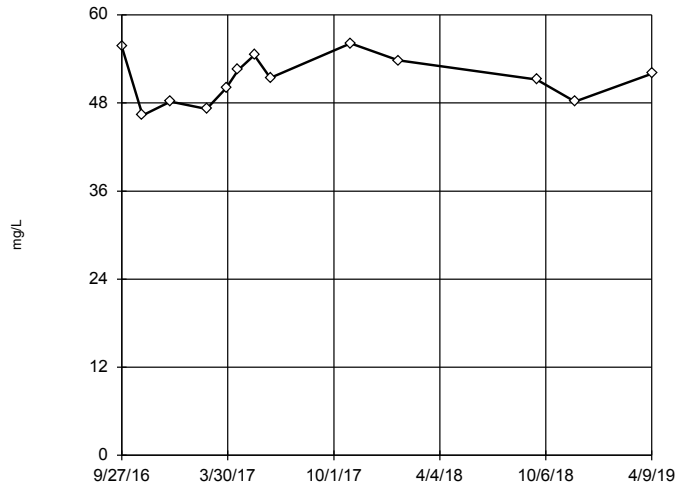
MW-30 (bg)



n = 12
 No outliers found.
 Tukey's method selected by user.
 Data were natural log transformed to achieve best W statistic (graph shown in original units).
 High cutoff = 89.04, low cutoff = 0.2217, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 10/7/2019 4:18 PM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

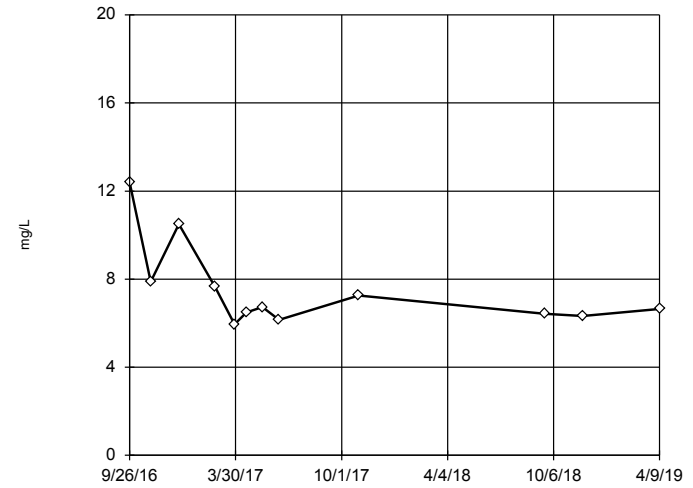
Tukey's Outlier Screening
MW-38



n = 13
No outliers found. Tukey's method selected by user.
Ladder of Powers transformations did not improve normality; analysis run on raw data.
High cutoff = 72, low cutoff = 30.35, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

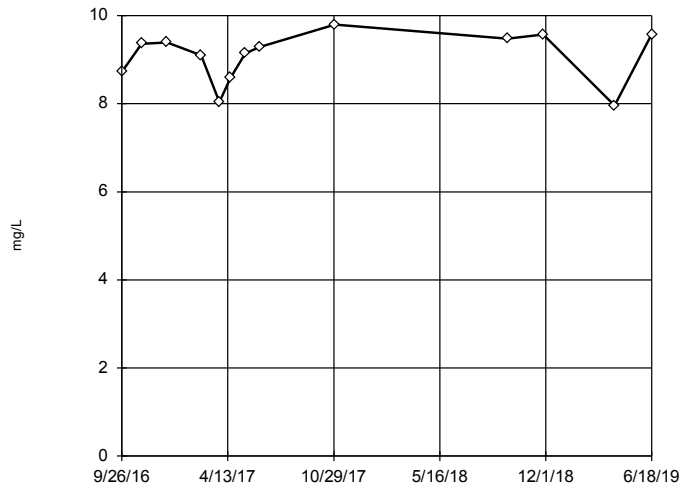
Tukey's Outlier Screening
MW-39



n = 12
No outliers found. Tukey's method selected by user.
Data were natural log transformed to achieve best W statistic (graph shown in original units).
High cutoff = 13.99, low cutoff = 3.54, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

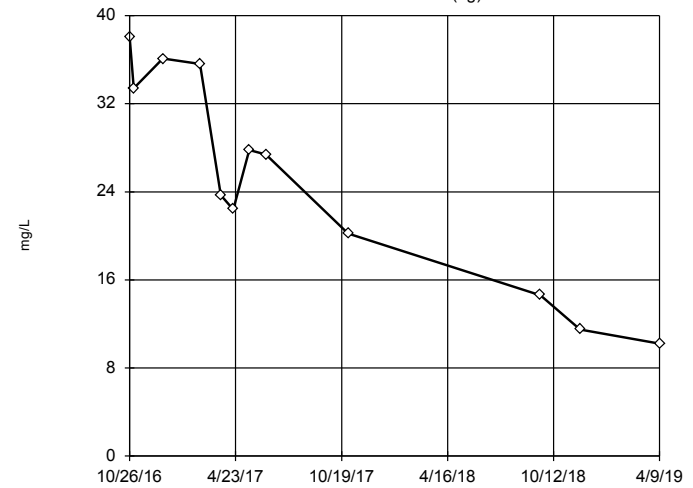
Tukey's Outlier Screening
MW-1611



n = 13
No outliers found. Tukey's method selected by user.
Data were x*6 transformed to achieve best W statistic (graph shown in original units).
High cutoff = 10.95, low cutoff = -9.074, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening
MW-1612 (bg)

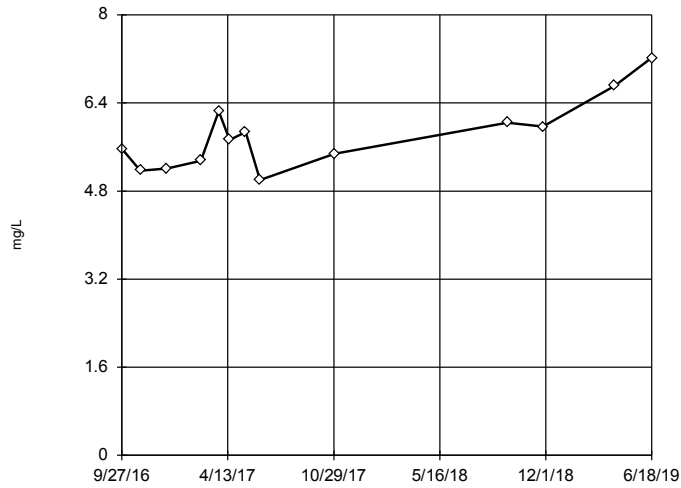


n = 12
No outliers found. Tukey's method selected by user.
Ladder of Powers transformations did not improve normality; analysis run on raw data.
High cutoff = 85.8, low cutoff = -33.9, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

MW-26

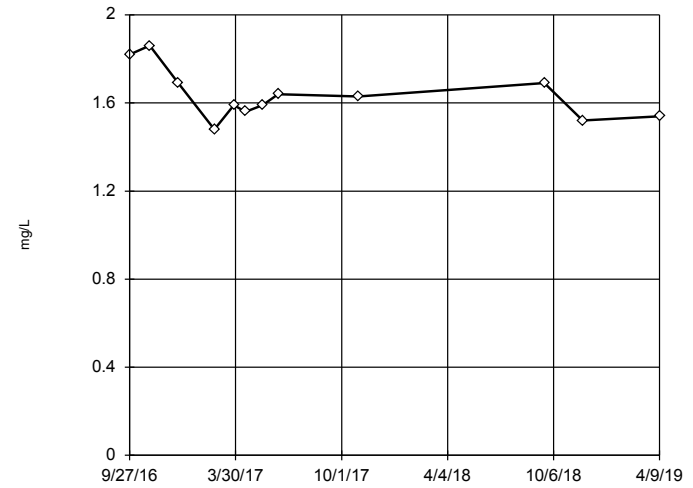


n = 13
 No outliers found.
 Tukey's method selected by user.
 Data were natural log transformed to achieve best W statistic (graph shown in original units).
 High cutoff = 9.684, low cutoff = 3.35, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 10/7/2019 4:18 PM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

MW-27

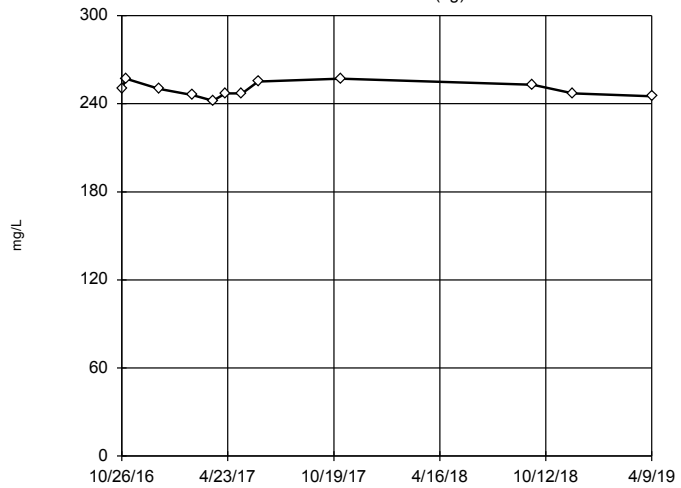


n = 12
 No outliers found.
 Tukey's method selected by user.
 Data were natural log transformed to achieve best W statistic (graph shown in original units).
 High cutoff = 2.191, low cutoff = 1.196, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 10/7/2019 4:18 PM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

MW-30 (bg)

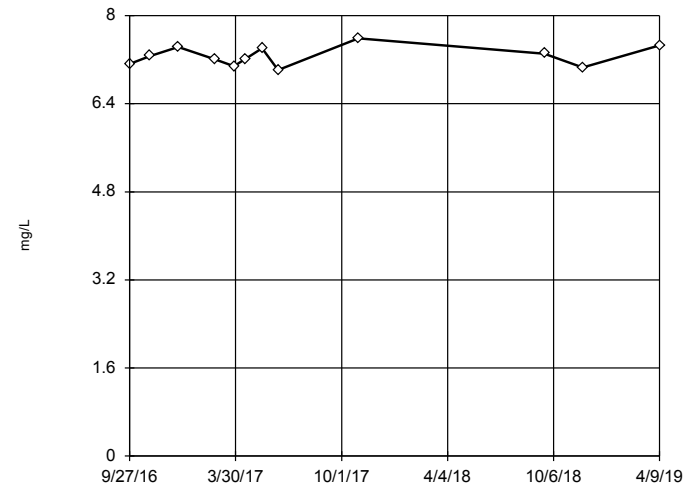


n = 12
 No outliers found.
 Tukey's method selected by user.
 Data were natural log transformed to achieve best W statistic (graph shown in original units).
 High cutoff = 277.9, low cutoff = 225.3, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 10/7/2019 4:18 PM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

MW-38

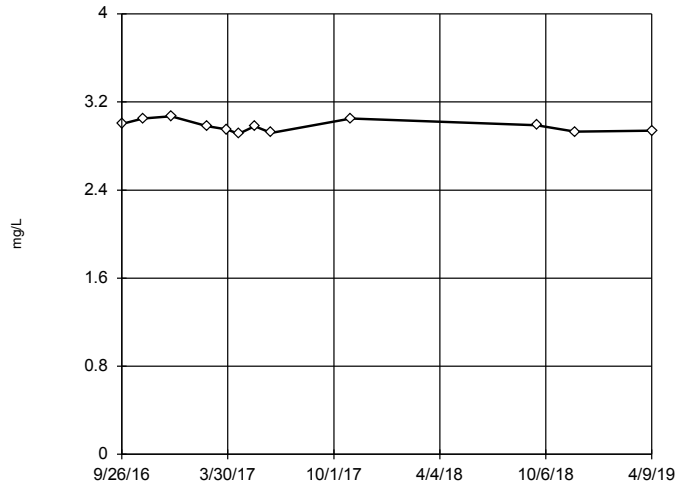


n = 12
 No outliers found.
 Tukey's method selected by user.
 Data were natural log transformed to achieve best W statistic (graph shown in original units).
 High cutoff = 8.469, low cutoff = 6.22, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 10/7/2019 4:18 PM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

MW-39

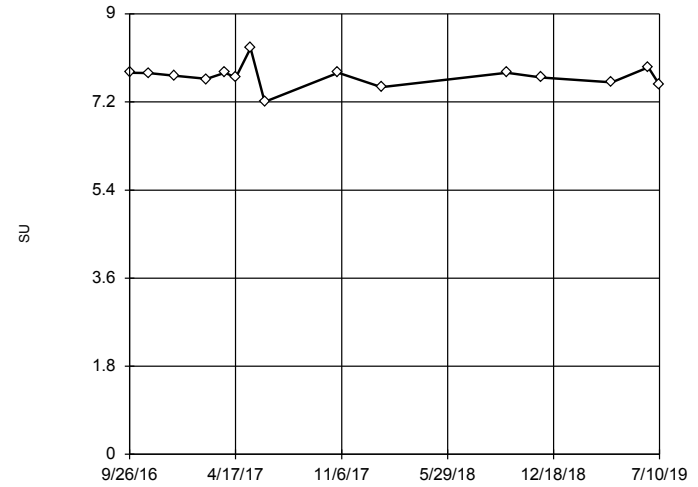


n = 12
 No outliers found.
 Tukey's method selected by user.
 Data were natural log transformed to achieve best W statistic (graph shown in original units).
 High cutoff = 3.311, low cutoff = 2.681, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 10/7/2019 4:18 PM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

MW-1611

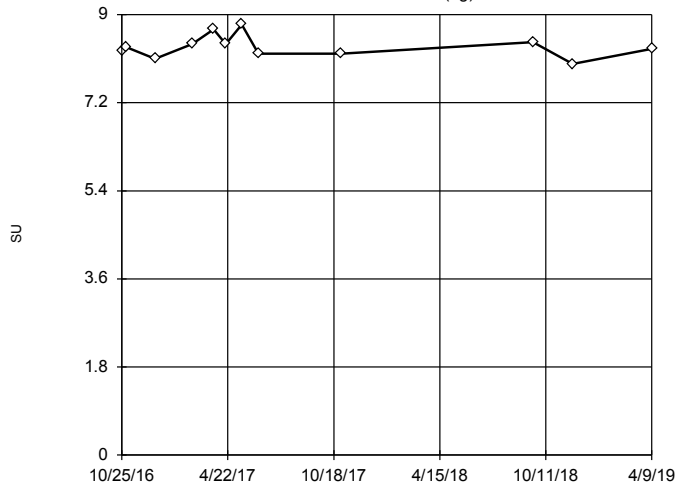


n = 15
 No outliers found.
 Tukey's method selected by user.
 Data were natural log transformed to achieve best W statistic (graph shown in original units).
 High cutoff = 8.432, low cutoff = 7.03, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 10/7/2019 4:18 PM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

MW-1612 (bg)

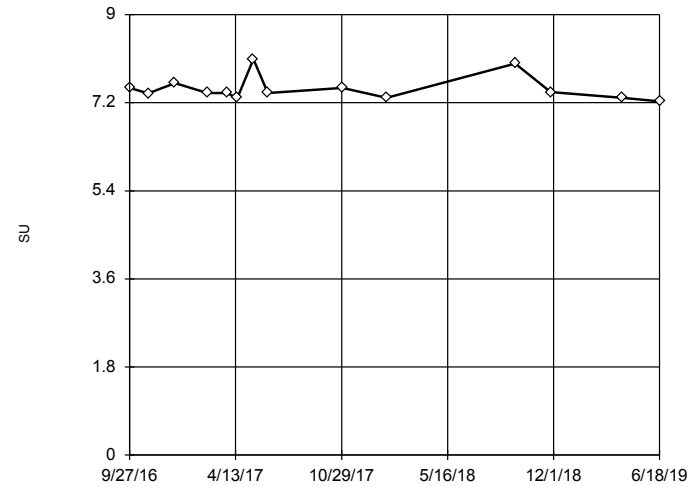


n = 12
 No outliers found.
 Tukey's method selected by user.
 Data were natural log transformed to achieve best W statistic (graph shown in original units).
 High cutoff = 9.116, low cutoff = 7.574, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 10/7/2019 4:18 PM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

MW-26

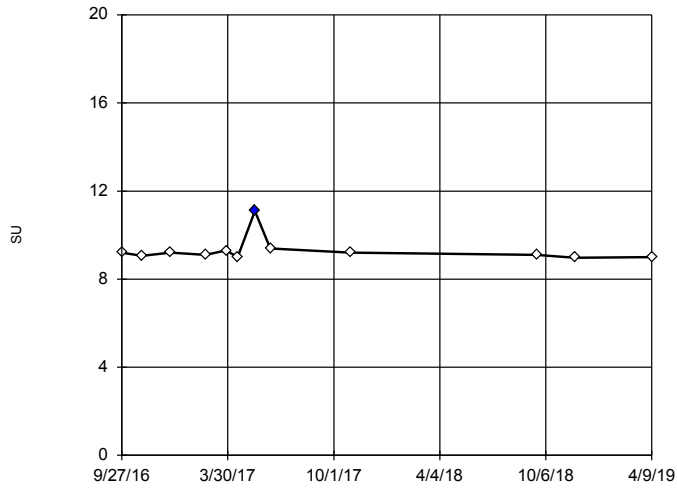


n = 14
 No outliers found.
 Tukey's method selected by user.
 Data were natural log transformed to achieve best W statistic (graph shown in original units).
 High cutoff = 8.352, low cutoff = 6.599, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 10/7/2019 4:18 PM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

MW-27



n = 12

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

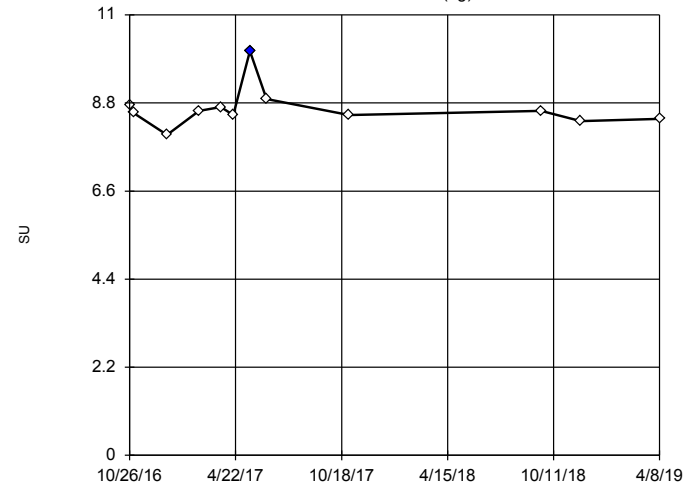
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 9.942, low cutoff = 8.401, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

MW-30 (bg)



n = 12

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

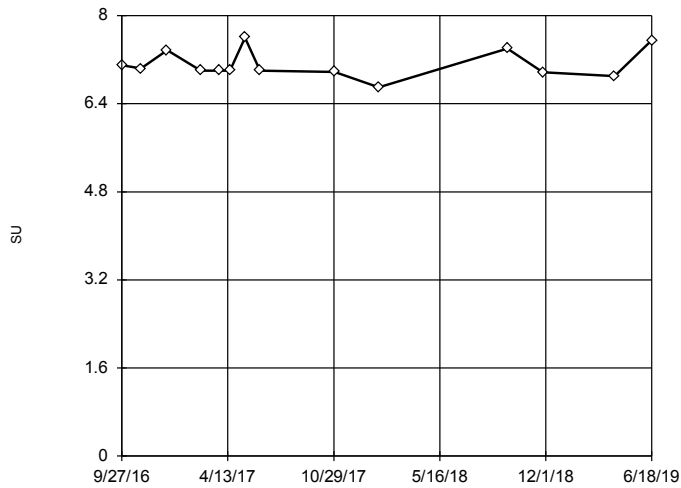
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 9.583, low cutoff = 7.689, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

MW-38



n = 14

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

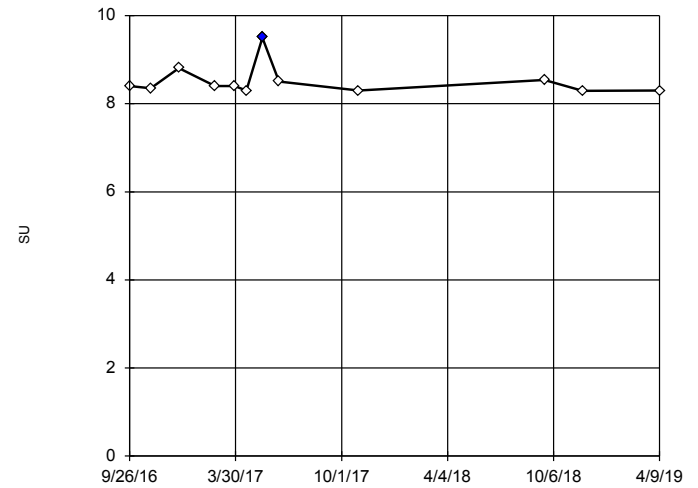
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.765, low cutoff = 5.877, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening

MW-39



n = 12

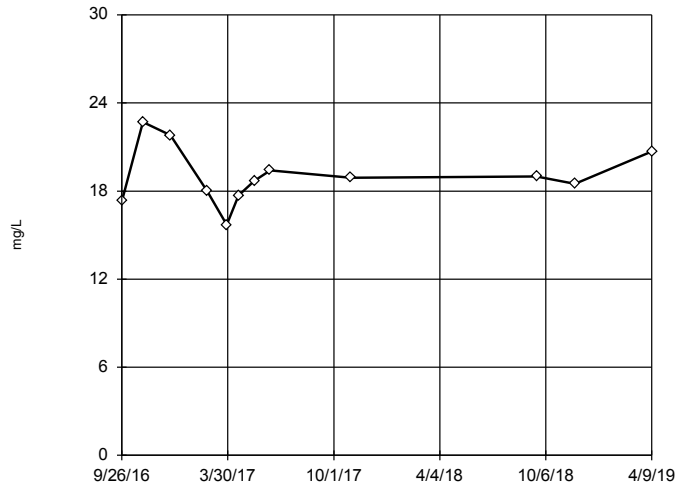
Outlier is drawn as solid. Tukey's method selected by user.

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

High cutoff = 9.216, low cutoff = 7.674, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

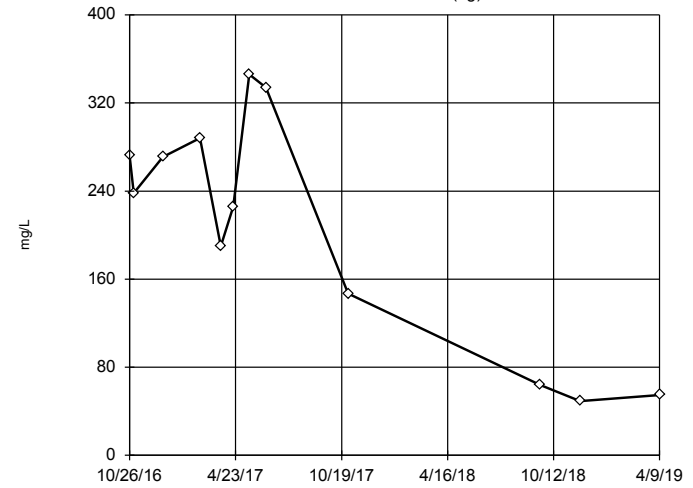
Tukey's Outlier Screening
MW-1611



n = 12
No outliers found.
Tukey's method selected by user.
Data were natural log transformed to achieve best W statistic (graph shown in original units).
High cutoff = 28.36, low cutoff = 12.61, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

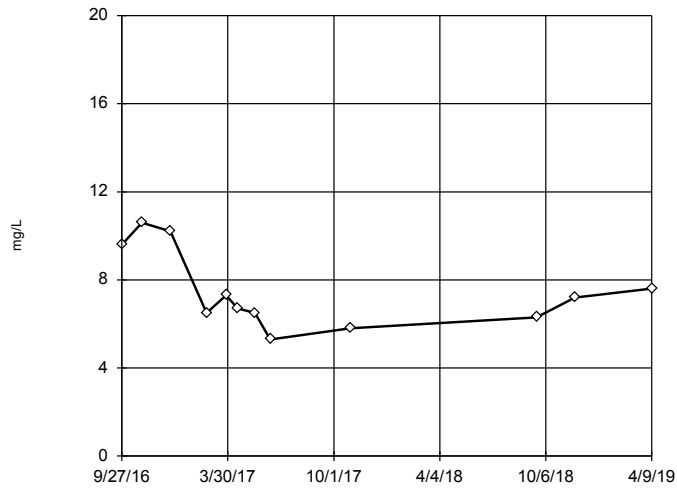
Tukey's Outlier Screening
MW-1612 (bg)



n = 12
No outliers found.
Tukey's method selected by user.
Data were square transformed to achieve best W statistic (graph shown in original units).
High cutoff = 524.7, low cutoff = -429, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

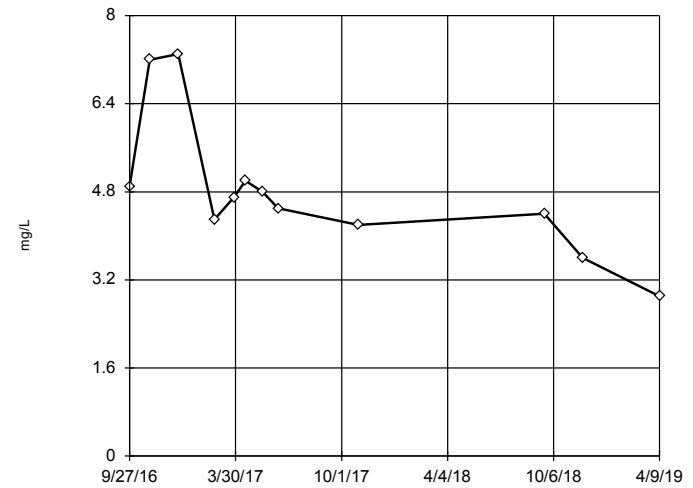
Tukey's Outlier Screening
MW-26



n = 12
No outliers found.
Tukey's method selected by user.
Data were natural log transformed to achieve best W statistic (graph shown in original units).
High cutoff = 20.31, low cutoff = 2.691, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

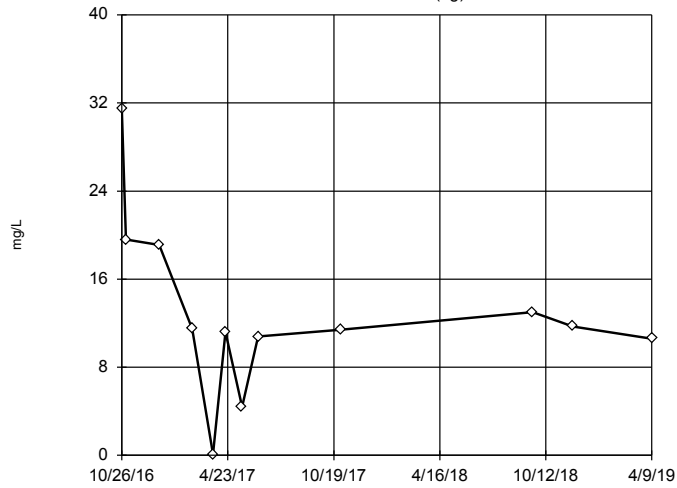
Tukey's Outlier Screening
MW-27



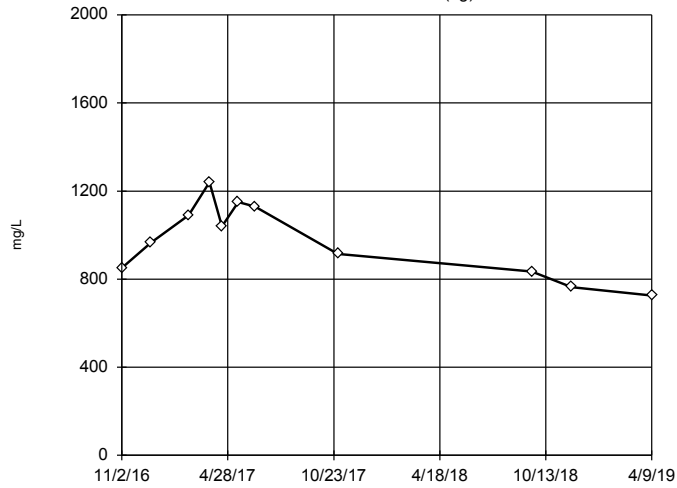
n = 12
No outliers found.
Tukey's method selected by user.
Data were natural log transformed to achieve best W statistic (graph shown in original units).
High cutoff = 7.821, low cutoff = 2.69, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 10/7/2019 4:18 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening MW-30 (bg)



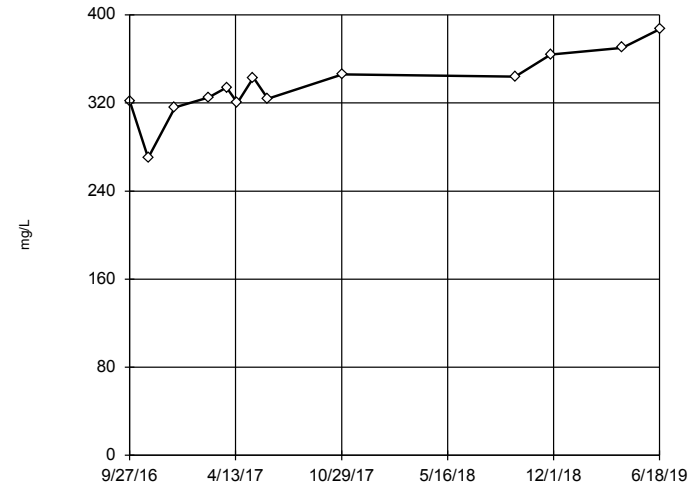
Tukey's Outlier Screening
MW-1612 (bg)



n = 11
No outliers found.
Tukey's method selected by user.
Ladder of Powers transformations did not improve normality; analysis run on raw data.
High cutoff = 2015, low cutoff = -50, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 10/7/2019 4:19 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

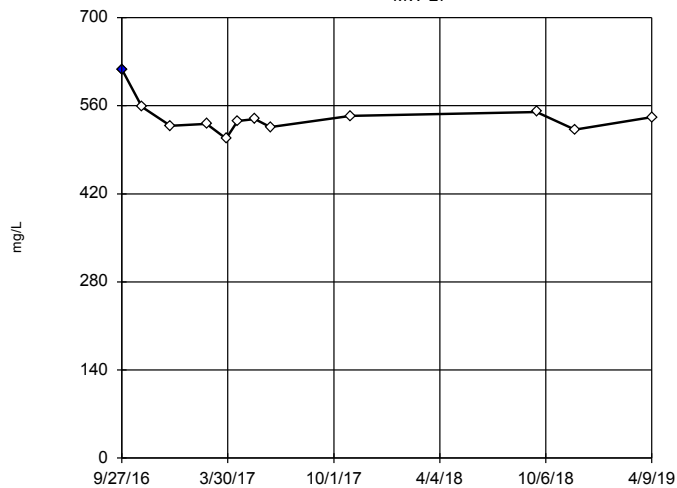
Tukey's Outlier Screening
MW-26



n = 13
No outliers found.
Tukey's method selected by user.
Data were cube transformed to achieve best W statistic (graph shown in original units).
High cutoff = 431, low cutoff = -129.4, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 10/7/2019 4:19 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

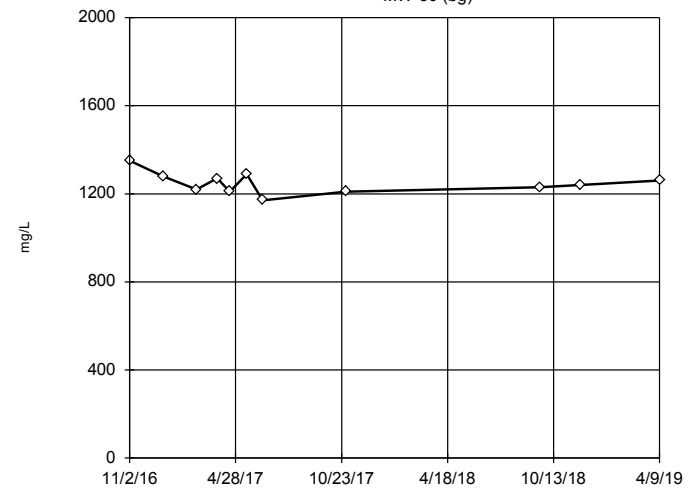
Tukey's Outlier Screening
MW-27



n = 12
Outlier is drawn as solid.
Tukey's method selected by user.
Data were natural log transformed to achieve best W statistic (graph shown in original units).
High cutoff = 611.6, low cutoff = 471.3, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 10/7/2019 4:19 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

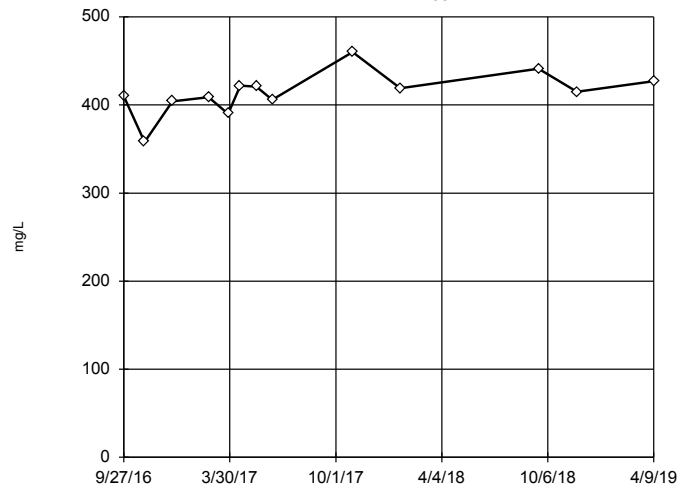
Tukey's Outlier Screening
MW-30 (bg)



n = 11
No outliers found.
Tukey's method selected by user.
Data were natural log transformed to achieve best W statistic (graph shown in original units).
High cutoff = 1515, low cutoff = 1022, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 10/7/2019 4:19 PM
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

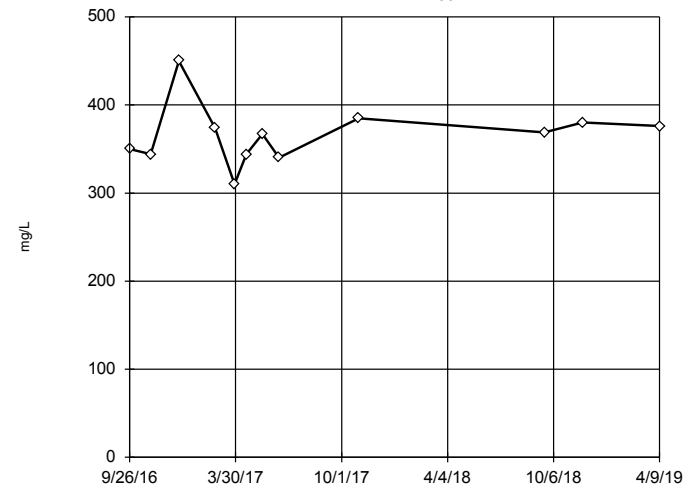
Tukey's Outlier Screening
MW-38



n = 13
 No outliers found.
 Tukey's method selected by user.
 Data were cube transformed to achieve best W statistic (graph shown in original units).
 High cutoff = 474.3, low cutoff = 330.9, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 10/7/2019 4:19 PM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Tukey's Outlier Screening
MW-39



n = 12
 No outliers found.
 Tukey's method selected by user.
 Data were natural log transformed to achieve best W statistic (graph shown in original units).
 High cutoff = 501.5, low cutoff = 259.3, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 10/7/2019 4:19 PM
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

FIGURE D: MANN-WHITNEY ANALYSIS

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

Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill Printed 10/15/2019, 2:40 PM

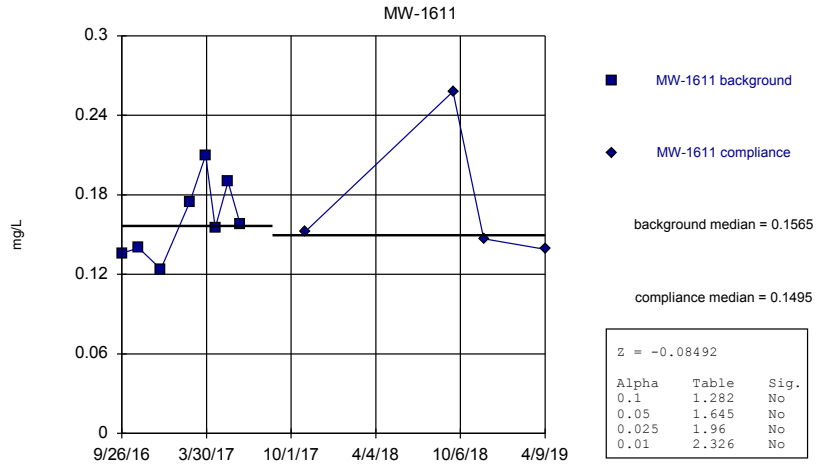
<u>Constituent</u>	<u>Well</u>	<u>Calc.</u>	<u>0.01</u>	<u>Method</u>
Total Dissolved Solids [TDS] (mg/L)	MW-26	2.855	Yes	Mann-W

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

Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill Printed 10/15/2019, 2:40 PM

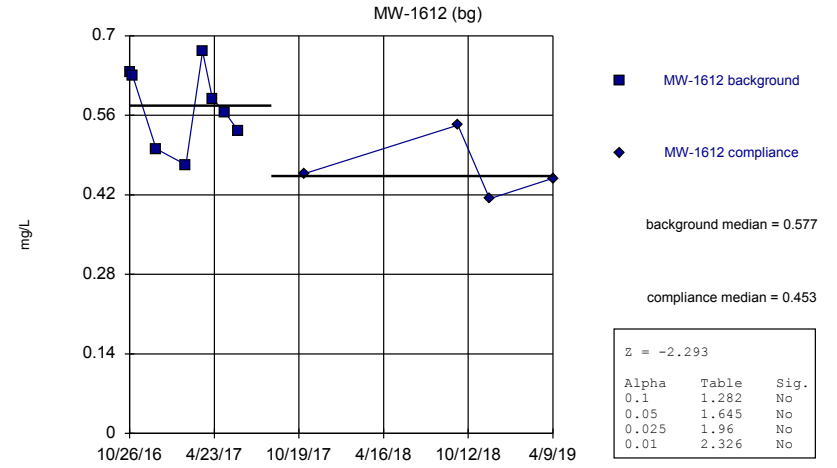
<u>Constituent</u>	<u>Well</u>	<u>Calc.</u>	<u>0.01</u>	<u>Method</u>
Boron, total (mg/L)	MW-1611	-0.08492	No	Mann-W
Boron, total (mg/L)	MW-1612 (bg)	-2.293	No	Mann-W
Boron, total (mg/L)	MW-26	1.274	No	Mann-W
Boron, total (mg/L)	MW-27	0.4246	No	Mann-W
Boron, total (mg/L)	MW-30 (bg)	1.875	No	Mann-W
Boron, total (mg/L)	MW-38	1.361	No	Mann-W
Boron, total (mg/L)	MW-39	1.446	No	Mann-W
Calcium, total (mg/L)	MW-1611	0.8429	No	Mann-W
Calcium, total (mg/L)	MW-1612 (bg)	-2.633	No	Mann-W
Calcium, total (mg/L)	MW-26	-0.07319	No	Mann-W
Calcium, total (mg/L)	MW-27	-2.551	No	Mann-W
Calcium, total (mg/L)	MW-30 (bg)	-0.2548	No	Mann-W
Calcium, total (mg/L)	MW-38	0.7329	No	Mann-W
Calcium, total (mg/L)	MW-39	-0.9341	No	Mann-W
Chloride, total (mg/L)	MW-1611	1.683	No	Mann-W
Chloride, total (mg/L)	MW-1612 (bg)	-2.802	No	Mann-W
Chloride, total (mg/L)	MW-26	1.976	No	Mann-W
Chloride, total (mg/L)	MW-27	-0.8522	No	Mann-W
Chloride, total (mg/L)	MW-30 (bg)	0.1717	No	Mann-W
Chloride, total (mg/L)	MW-38	1.104	No	Mann-W
Chloride, total (mg/L)	MW-39	-0.1704	No	Mann-W
pH, field (SU)	MW-1611	-0.4675	No	Mann-W
pH, field (SU)	MW-1612 (bg)	-1.023	No	Mann-W
pH, field (SU)	MW-26	-0.7824	No	Mann-W
pH, field (SU)	MW-27	-1.631	No	Mann-W
pH, field (SU)	MW-30 (bg)	-1.619	No	Mann-W
pH, field (SU)	MW-38	-1.371	No	Mann-W
pH, field (SU)	MW-39	-1.637	No	Mann-W
Sulfate, total (mg/L)	MW-1611	0.5944	No	Mann-W
Sulfate, total (mg/L)	MW-1612 (bg)	-2.802	No	Mann-W
Sulfate, total (mg/L)	MW-26	-0.9358	No	Mann-W
Sulfate, total (mg/L)	MW-27	-2.633	No	Mann-W
Sulfate, total (mg/L)	MW-30 (bg)	-0.08492	No	Mann-W
Sulfate, total (mg/L)	MW-38	-0.9341	No	Mann-W
Sulfate, total (mg/L)	MW-39	-1.458	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	MW-1611	1.747	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	MW-1612 (bg)	-2.551	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	MW-26	2.855	Yes	Mann-W
Total Dissolved Solids [TDS] (mg/L)	MW-27	0.4246	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	MW-30 (bg)	-0.7577	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	MW-38	2.269	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	MW-39	1.786	No	Mann-W

Mann-Whitney (Wilcoxon Rank Sum)



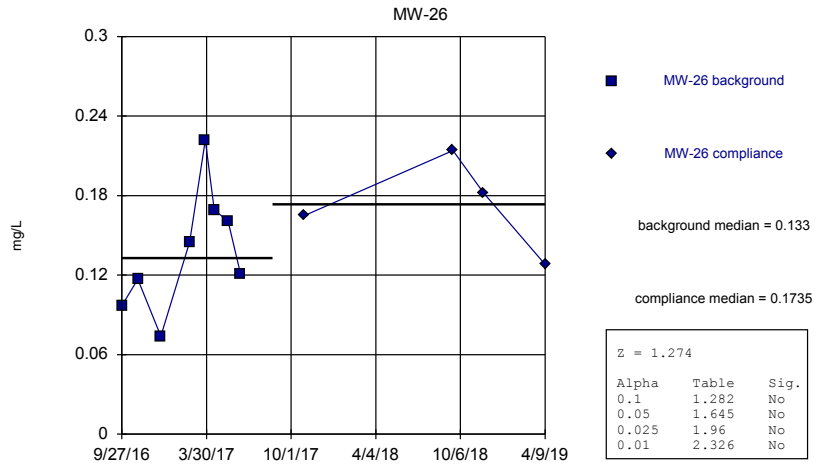
Constituent: Boron, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)



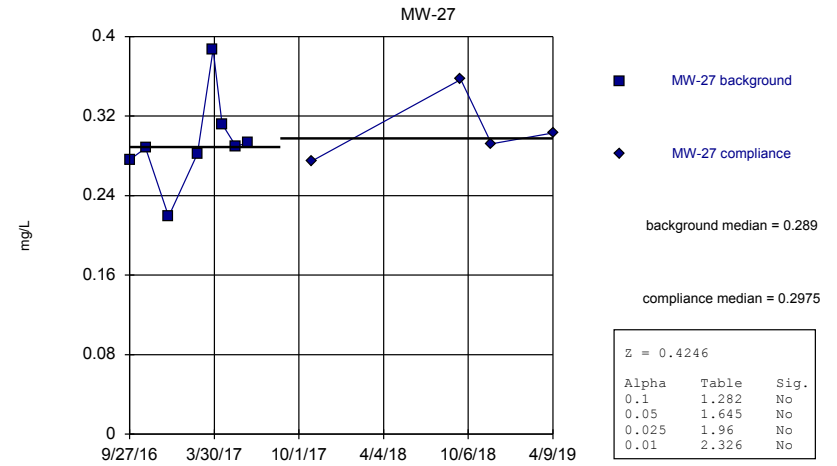
Constituent: Boron, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)



Constituent: Boron, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

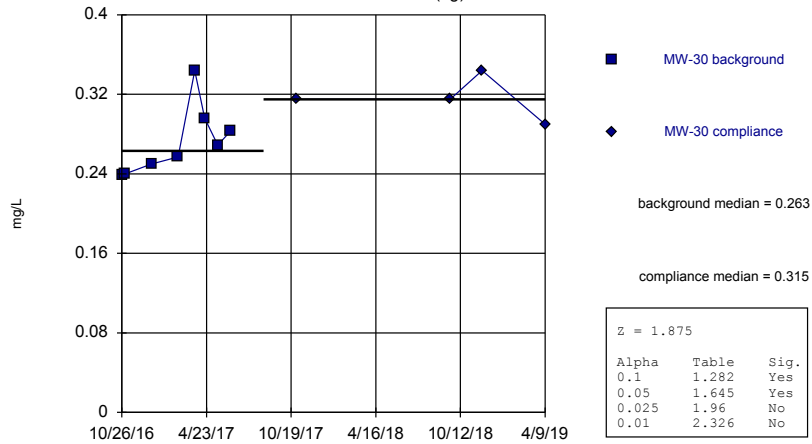
Mann-Whitney (Wilcoxon Rank Sum)



Constituent: Boron, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

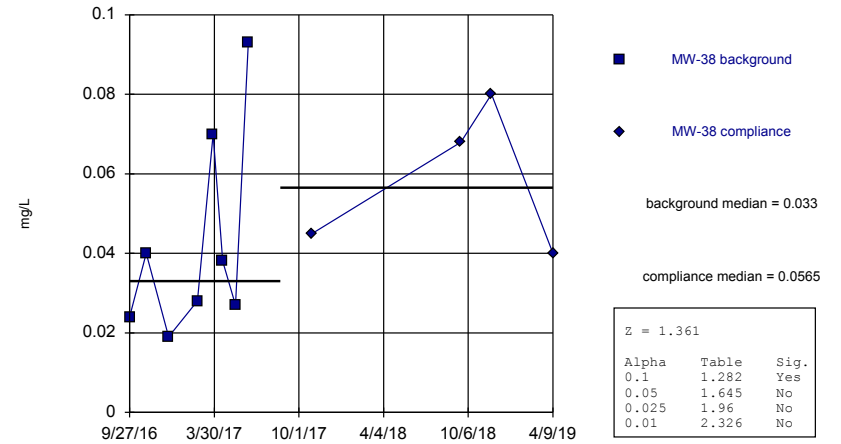
MW-30 (bg)



Constituent: Boron, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

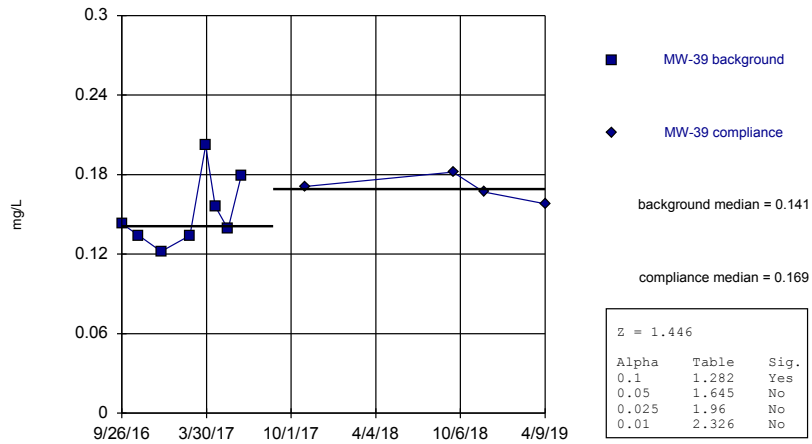
MW-38



Constituent: Boron, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

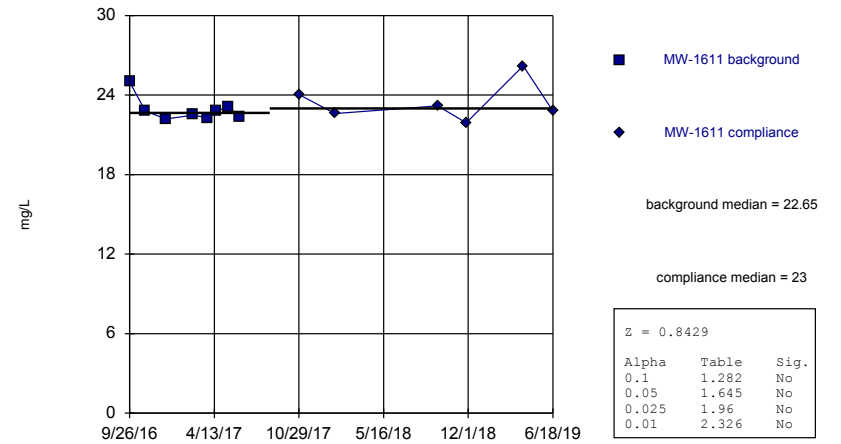
MW-39



Constituent: Boron, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

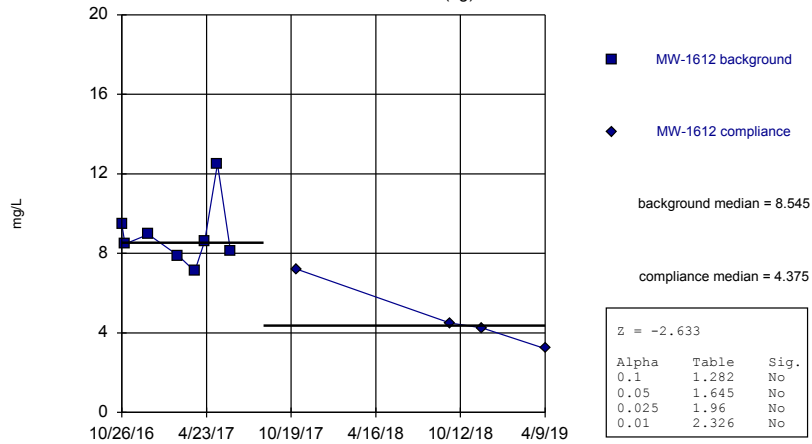
MW-1611



Constituent: Calcium, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

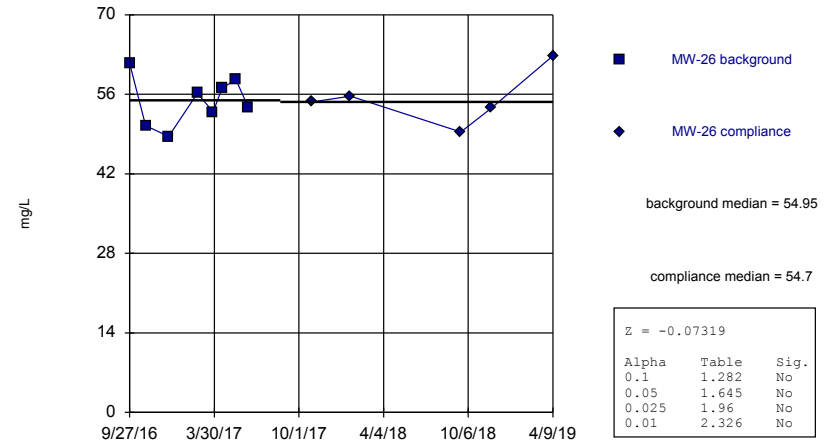
MW-1612 (bg)



Constituent: Calcium, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

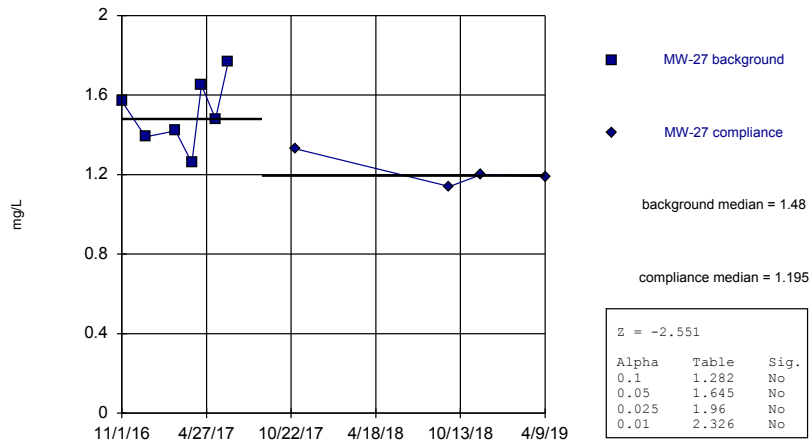
MW-26



Constituent: Calcium, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

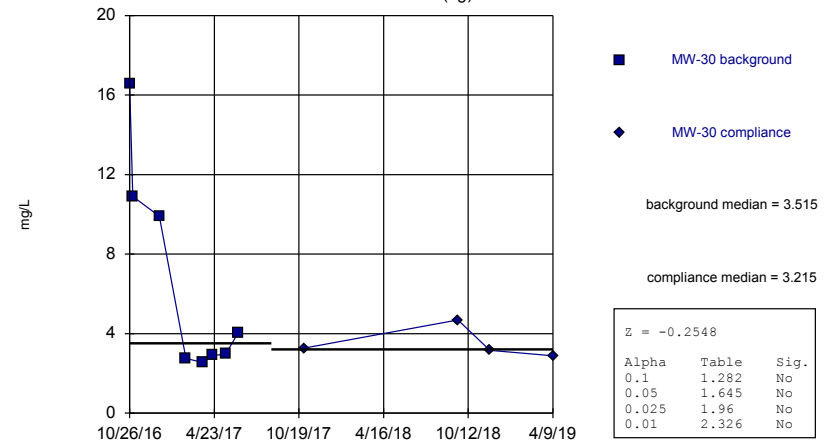
MW-27



Constituent: Calcium, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

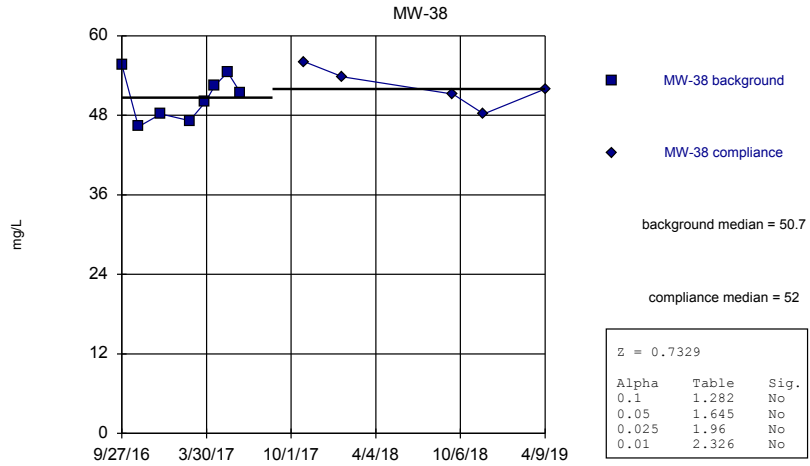
Mann-Whitney (Wilcoxon Rank Sum)

MW-30 (bg)



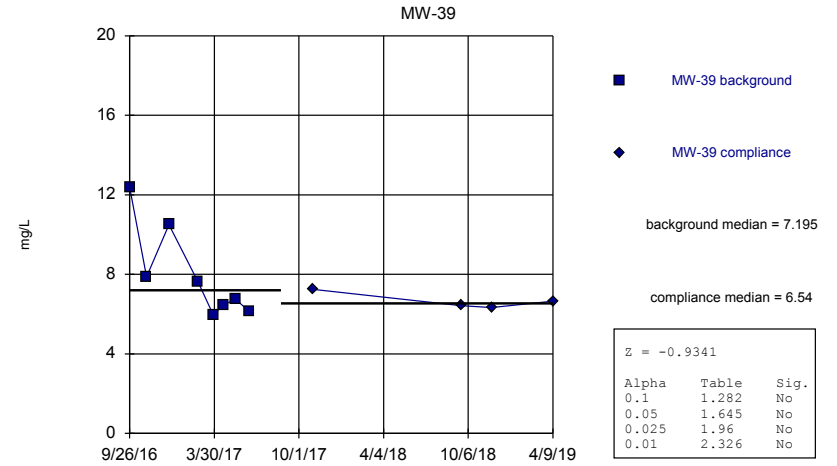
Constituent: Calcium, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)



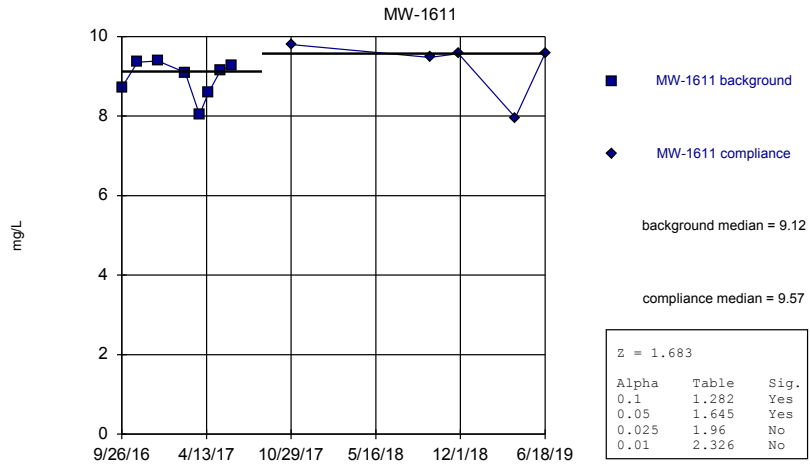
Constituent: Calcium, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)



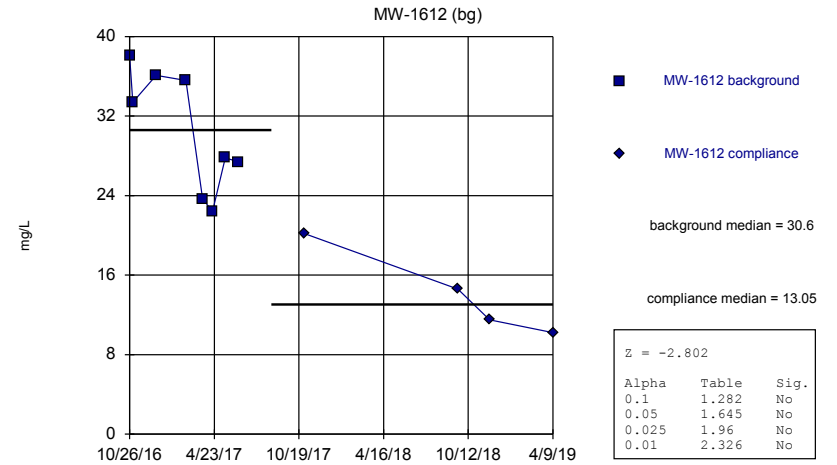
Constituent: Calcium, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)



Constituent: Chloride, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

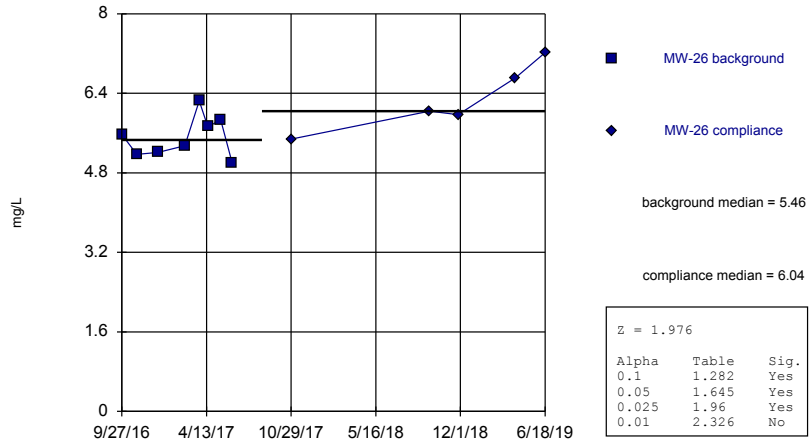
Mann-Whitney (Wilcoxon Rank Sum)



Constituent: Chloride, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

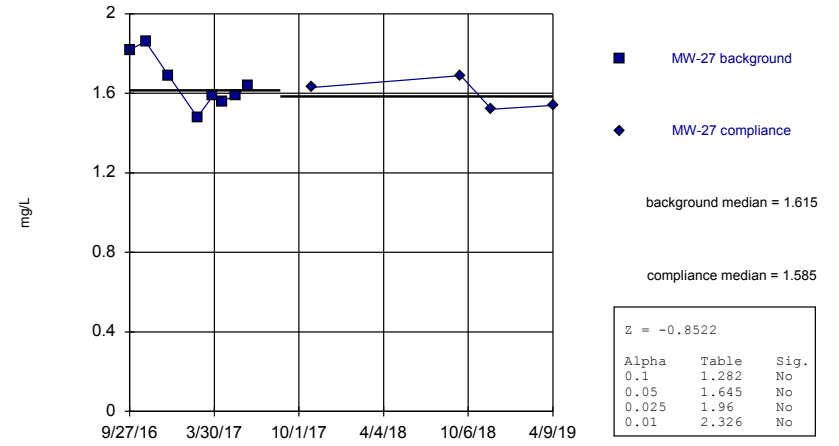
MW-26



Constituent: Chloride, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

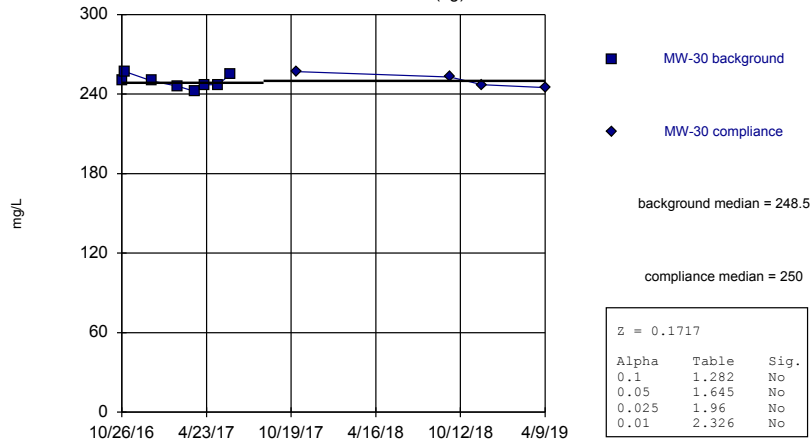
MW-27



Constituent: Chloride, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

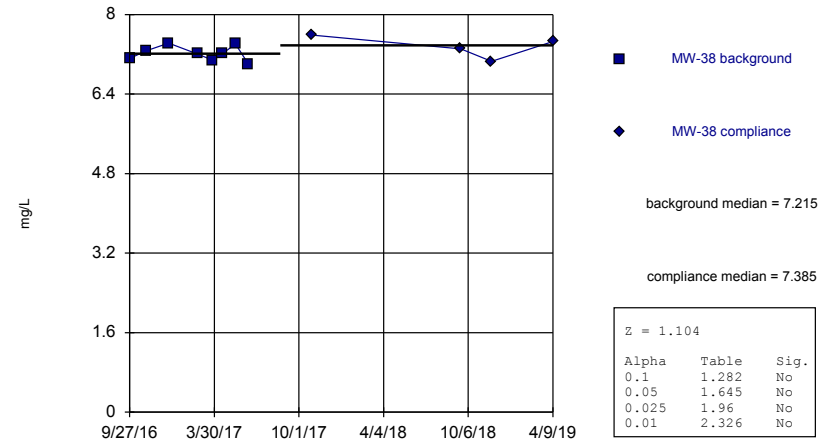
MW-30 (bg)



Constituent: Chloride, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

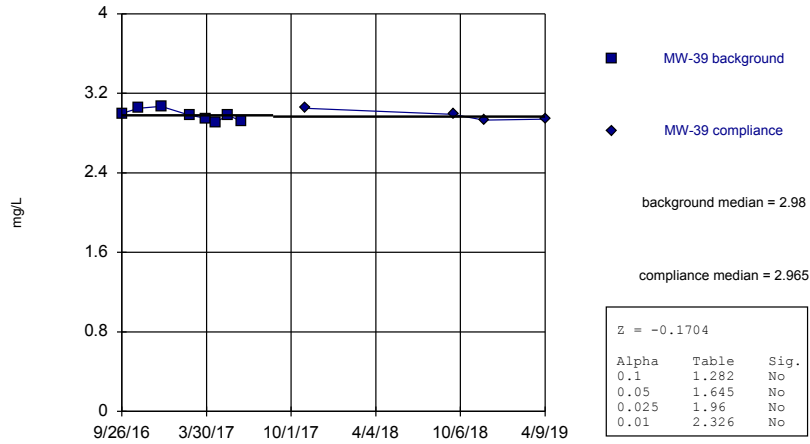
MW-38



Constituent: Chloride, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

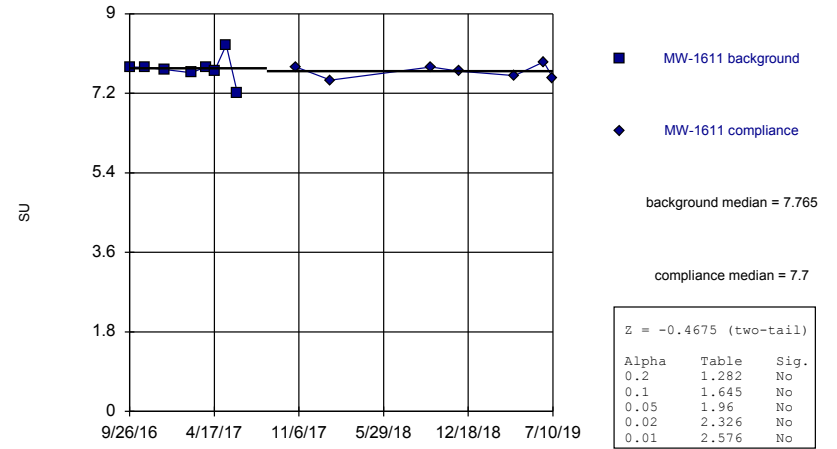
MW-39



Constituent: Chloride, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

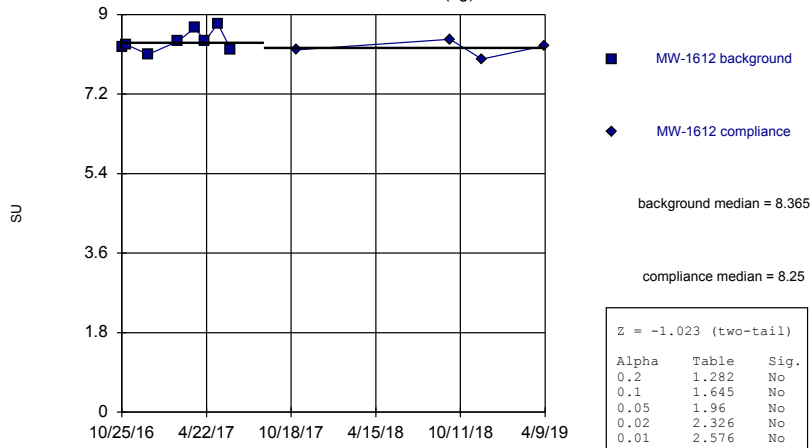
MW-1611



Constituent: pH, field Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

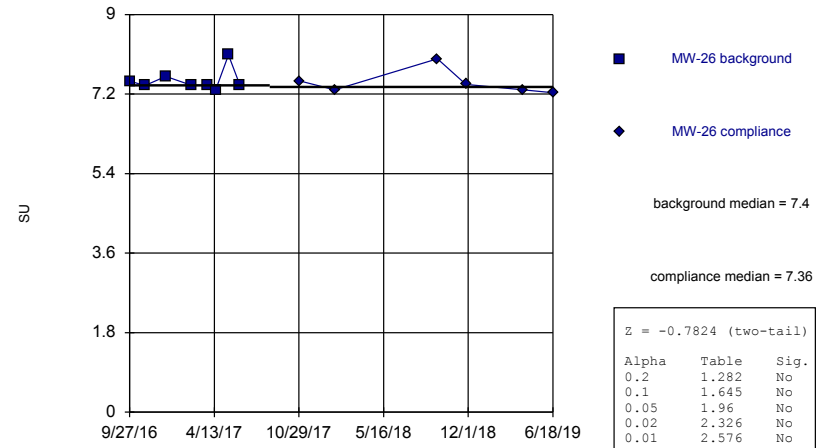
MW-1612 (bg)



Constituent: pH, field Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

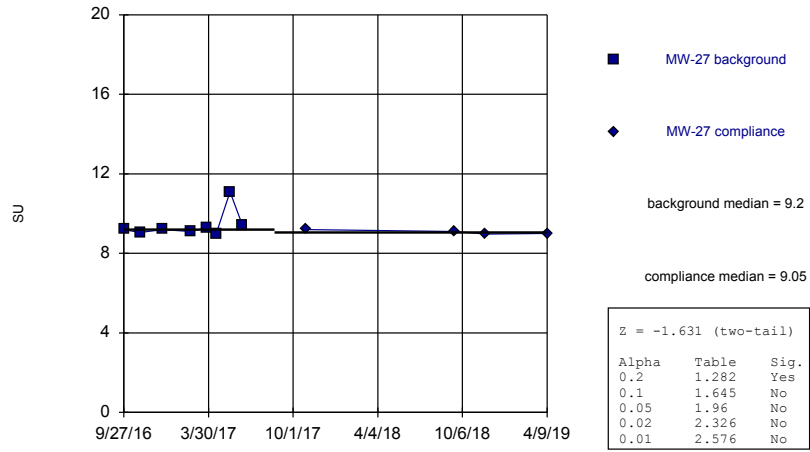
Mann-Whitney (Wilcoxon Rank Sum)

MW-26



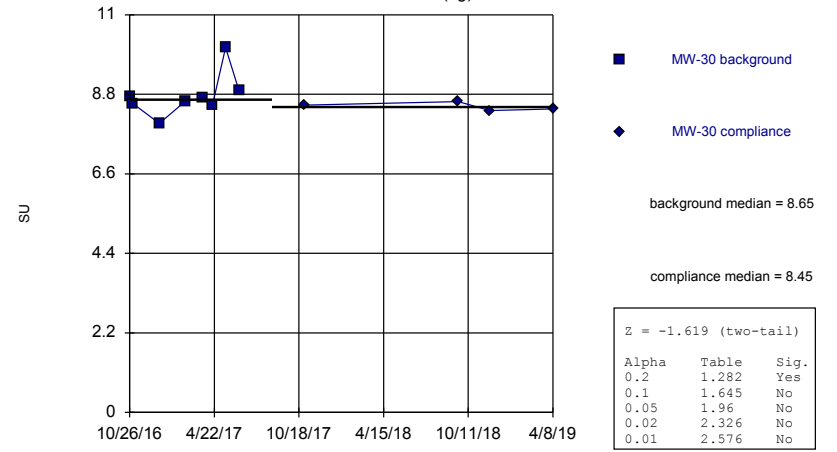
Constituent: pH, field Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)
MW-27



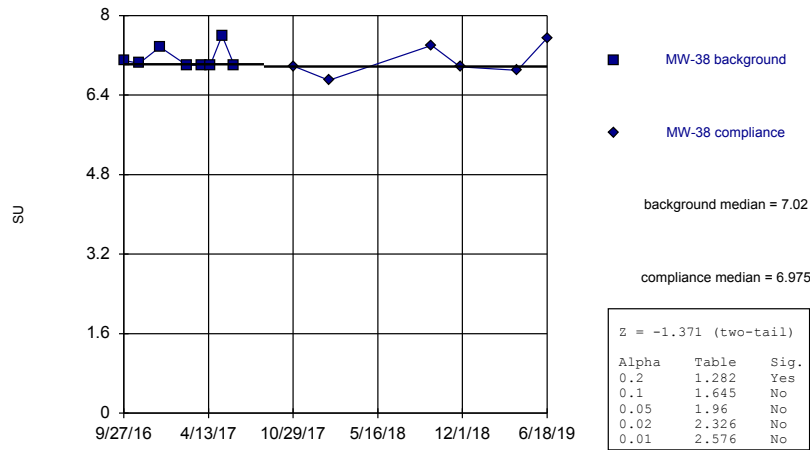
Constituent: pH, field Analysis Run 10/15/2019 2:38 PM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)
MW-30 (bg)



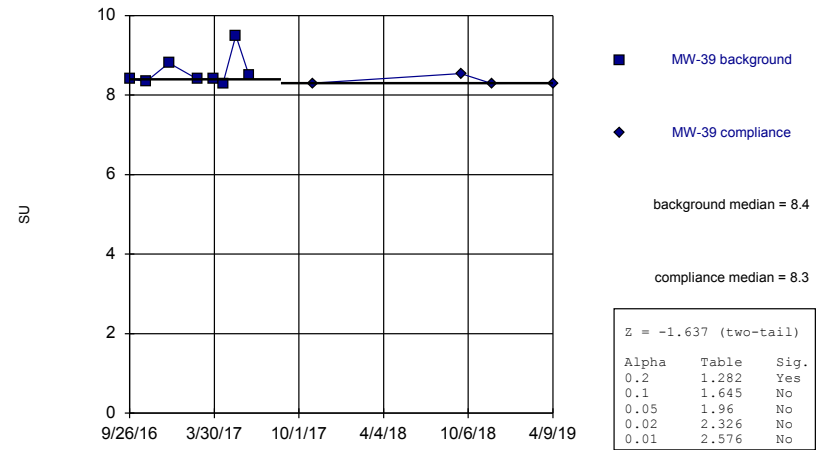
Constituent: pH, field Analysis Run 10/15/2019 2:38 PM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)
MW-38



Constituent: pH, field Analysis Run 10/15/2019 2:38 PM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

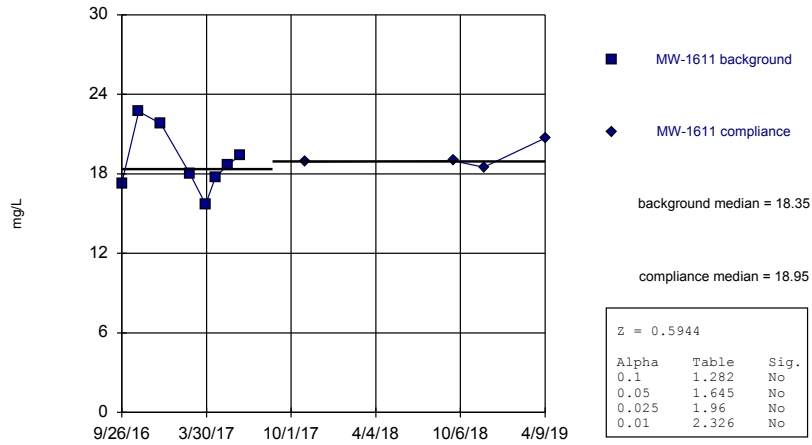
Mann-Whitney (Wilcoxon Rank Sum)
MW-39



Constituent: pH, field Analysis Run 10/15/2019 2:38 PM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

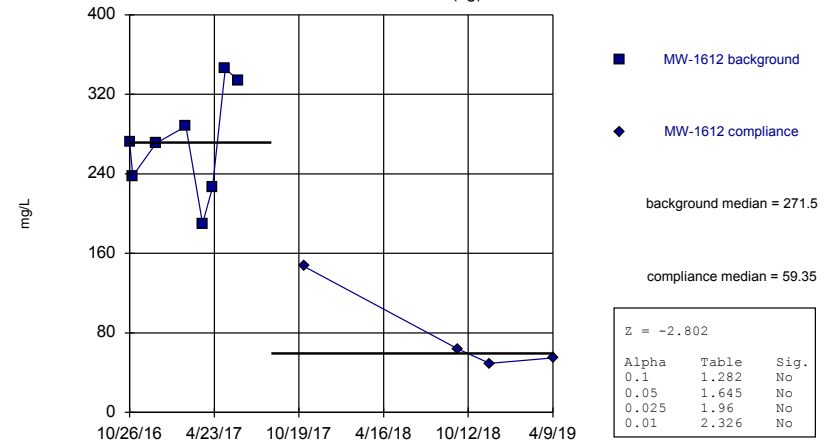
MW-1611



Constituent: Sulfate, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

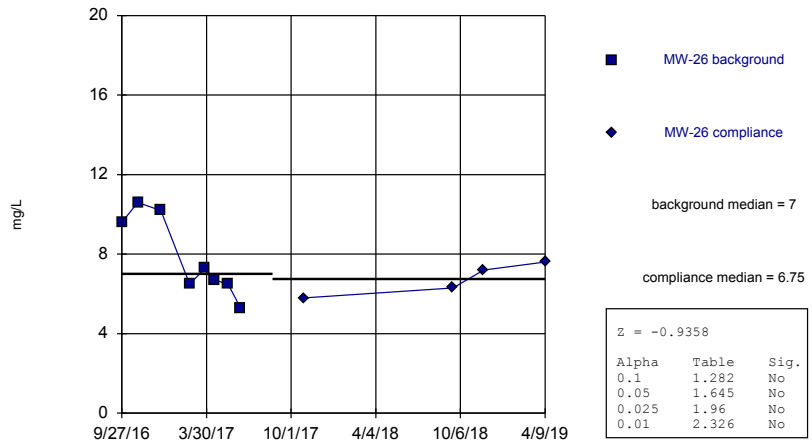
MW-1612 (bg)



Constituent: Sulfate, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

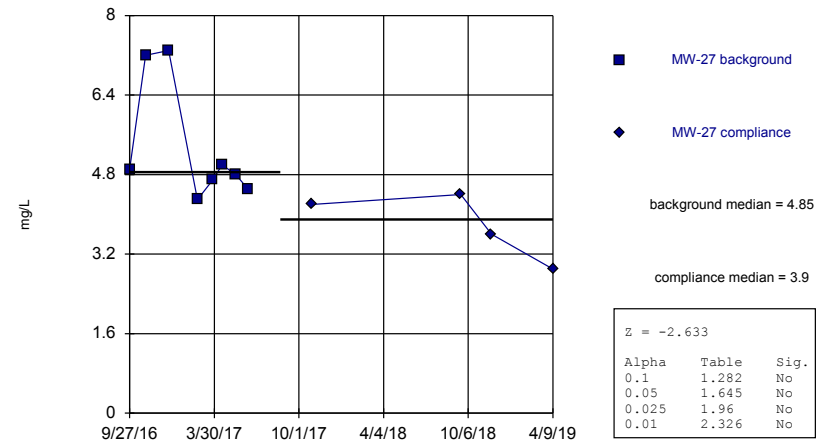
MW-26



Constituent: Sulfate, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

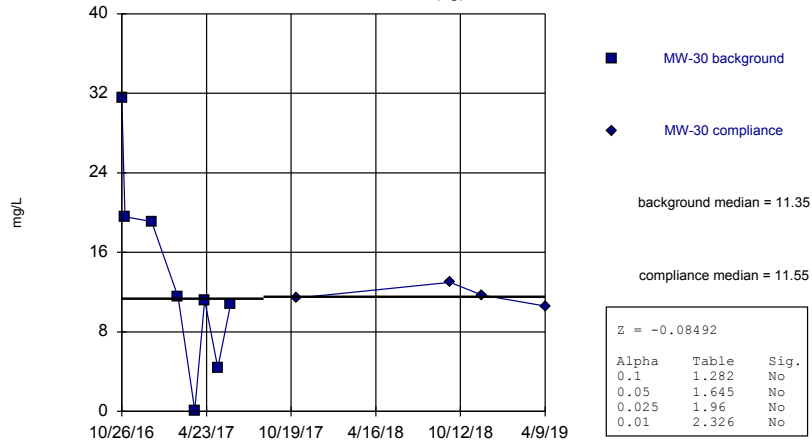
MW-27



Constituent: Sulfate, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

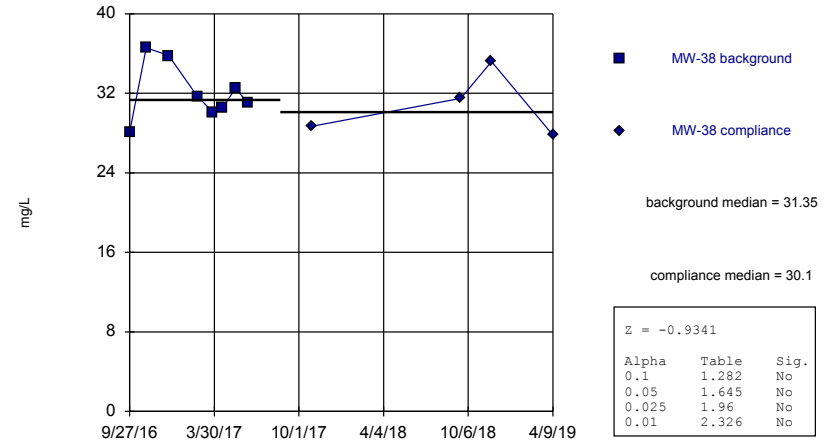
MW-30 (bg)



Constituent: Sulfate, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

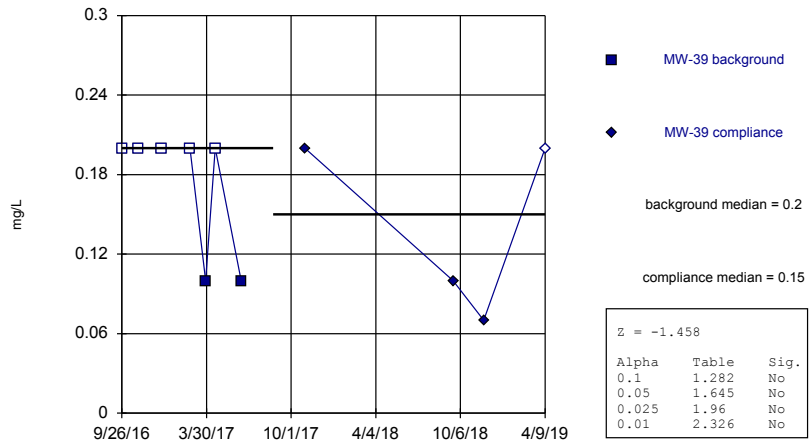
MW-38



Constituent: Sulfate, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)

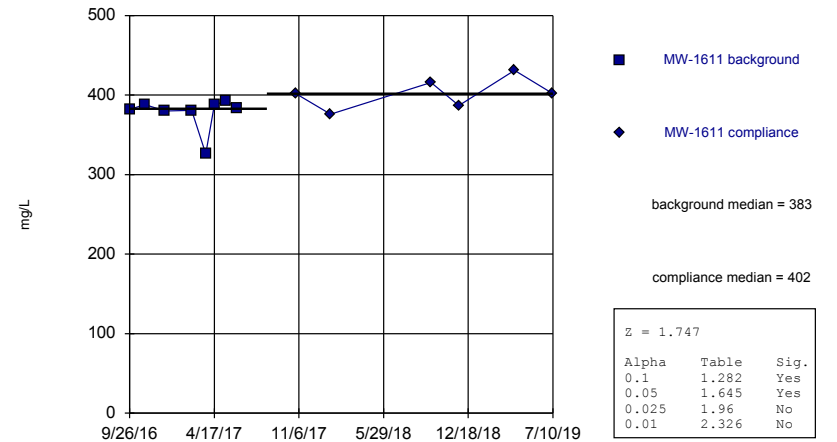
MW-39



Constituent: Sulfate, total Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

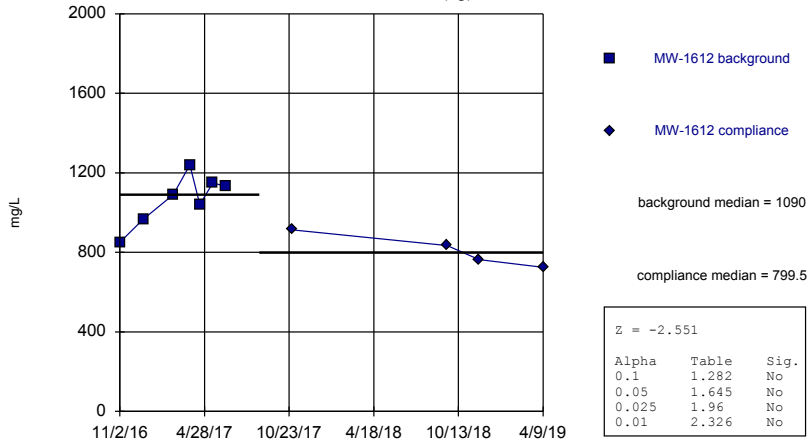
Mann-Whitney (Wilcoxon Rank Sum)

MW-1611



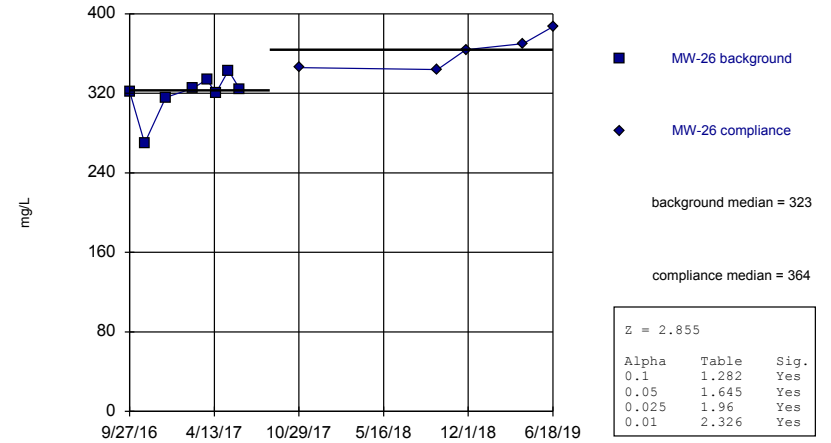
Constituent: Total Dissolved Solids [TDS] Analysis Run 10/15/2019 2:38 PM View: Intrawell
 Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)
MW-1612 (bg)



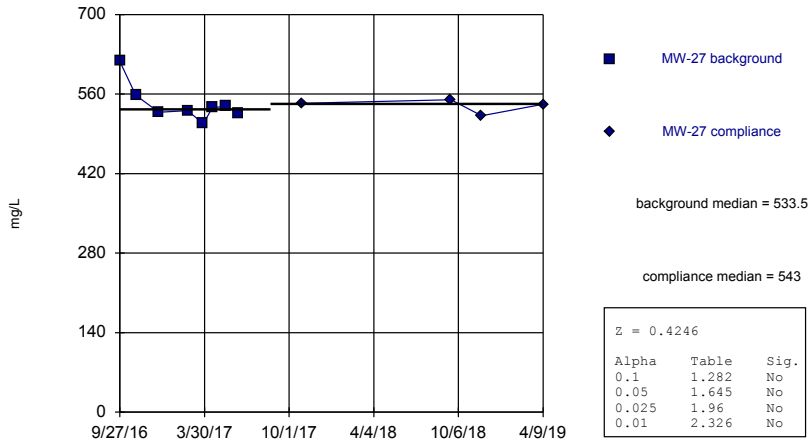
Constituent: Total Dissolved Solids [TDS] Analysis Run 10/15/2019 2:38 PM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)
MW-26



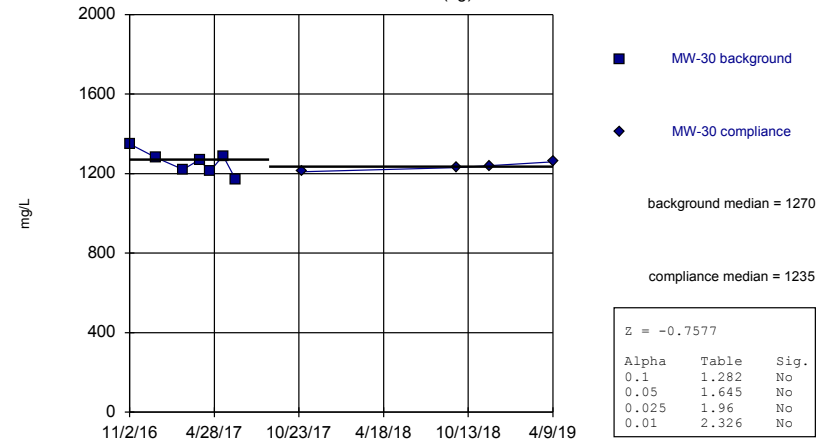
Constituent: Total Dissolved Solids [TDS] Analysis Run 10/15/2019 2:38 PM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)
MW-27



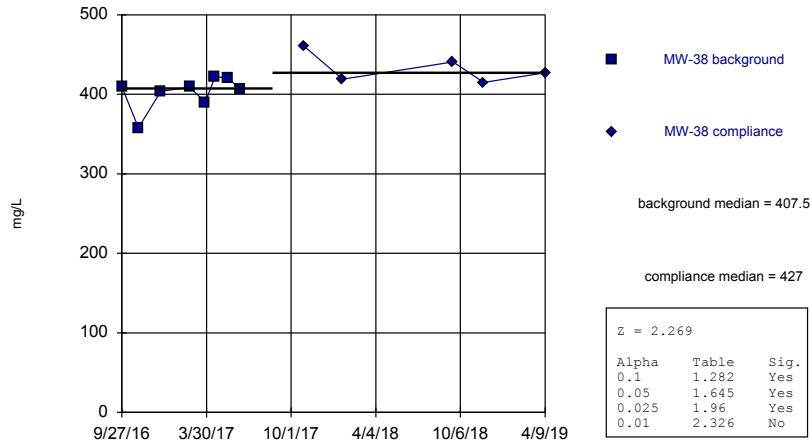
Constituent: Total Dissolved Solids [TDS] Analysis Run 10/15/2019 2:38 PM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)
MW-30 (bg)



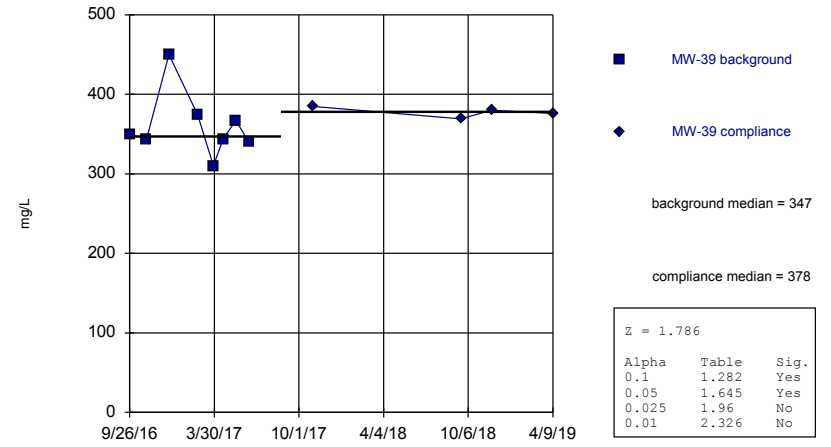
Constituent: Total Dissolved Solids [TDS] Analysis Run 10/15/2019 2:38 PM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)
MW-38



Constituent: Total Dissolved Solids [TDS] Analysis Run 10/15/2019 2:38 PM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Mann-Whitney (Wilcoxon Rank Sum)
MW-39



Constituent: Total Dissolved Solids [TDS] Analysis Run 10/15/2019 2:38 PM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

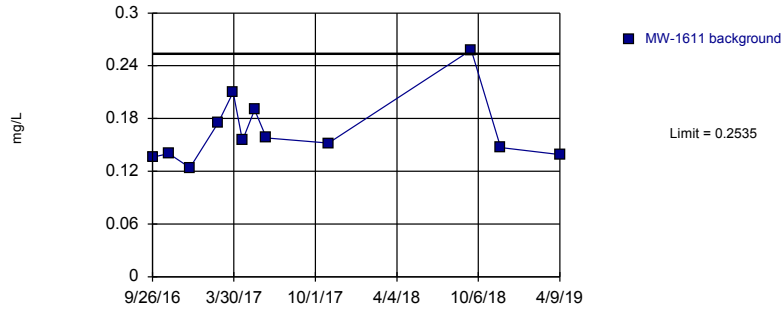
FIGURE E: INTRAWELL PREDICTION
LIMITS

Intrawell Prediction Limit Summary Table - All Results

Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill Printed 11/22/2019, 9:16 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-1611	0.2535	n/a	n/a	1 future	n/a	12	0.1653	0.03797	0	None	No	0.001504	Param Intra 1 of 2
Boron, total (mg/L)	MW-1612	0.7307	n/a	n/a	1 future	n/a	12	0.5384	0.08279	0	None	No	0.001504	Param Intra 1 of 2
Boron, total (mg/L)	MW-26	0.2535	n/a	n/a	1 future	n/a	12	0.1496	0.04475	0	None	No	0.001504	Param Intra 1 of 2
Boron, total (mg/L)	MW-27	0.3952	n/a	n/a	1 future	n/a	12	0.2978	0.04195	0	None	No	0.001504	Param Intra 1 of 2
Boron, total (mg/L)	MW-30	0.3734	n/a	n/a	1 future	n/a	12	0.2868	0.03727	0	None	No	0.001504	Param Intra 1 of 2
Boron, total (mg/L)	MW-38	0.1038	n/a	n/a	1 future	n/a	12	0.04767	0.02417	0	None	No	0.001504	Param Intra 1 of 2
Boron, total (mg/L)	MW-39	0.2125	n/a	n/a	1 future	n/a	12	0.1573	0.02381	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	MW-1611	26.2	n/a	n/a	1 future	n/a	14	n/a	n/a	0	n/a	n/a	0.008612	NP Intra (normality) 1 of 2
Calcium, total (mg/L)	MW-1612	13.46	n/a	n/a	1 future	n/a	12	7.524	2.557	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	MW-26	64.85	n/a	n/a	1 future	n/a	13	55.02	4.312	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	MW-27	1.887	n/a	n/a	1 future	n/a	11	1.4	0.2028	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	MW-30	16.6	n/a	n/a	1 future	n/a	12	n/a	n/a	0	n/a	n/a	0.01077	NP Intra (normality) 1 of 2
Calcium, total (mg/L)	MW-38	58.63	n/a	n/a	1 future	n/a	13	51.32	3.209	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	MW-39	12.4	n/a	n/a	1 future	n/a	12	n/a	n/a	0	n/a	n/a	0.01077	NP Intra (normality) 1 of 2
Chloride, total (mg/L)	MW-1611	10.41	n/a	n/a	1 future	n/a	13	9.078	0.5843	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	MW-1612	47.58	n/a	n/a	1 future	n/a	12	25.08	9.687	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	MW-26	7.267	n/a	n/a	1 future	n/a	13	5.813	0.638	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	MW-27	1.902	n/a	n/a	1 future	n/a	12	1.634	0.1156	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	MW-30	261	n/a	n/a	1 future	n/a	12	249.7	4.887	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	MW-38	7.685	n/a	n/a	1 future	n/a	12	7.264	0.1812	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	MW-39	3.106	n/a	n/a	1 future	n/a	12	2.981	0.05384	0	None	No	0.001504	Param Intra 1 of 2
pH, field (SU)	MW-1611	8.081	7.284	n/a	1 future	n/a	14	7.683	0.1783	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	MW-1612	8.756	7.849	n/a	1 future	n/a	11	8.303	0.1891	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	MW-26	8	7.23	n/a	1 future	n/a	13	n/a	n/a	0	n/a	n/a	0.01938	NP Intra (normality) 1 of 2
pH, field (SU)	MW-27	9.463	8.816	n/a	1 future	n/a	11	9.139	0.1348	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	MW-30	9.095	7.967	n/a	1 future	n/a	11	8.531	0.235	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	MW-38	7.601	6.554	n/a	1 future	n/a	13	7.078	0.2298	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	MW-39	8.79	8.058	n/a	1 future	n/a	11	2.13	0.01812	0	None	ln(x)	0.000752	Param Intra 1 of 2
Sulfate, total (mg/L)	MW-1611	23.54	n/a	n/a	1 future	n/a	12	19.03	1.94	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	MW-1612	453.3	n/a	n/a	1 future	n/a	12	206.7	106.2	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	MW-26	11.5	n/a	n/a	1 future	n/a	12	7.467	1.739	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	MW-27	7.785	n/a	n/a	1 future	n/a	12	4.817	1.278	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	MW-30	31.21	n/a	n/a	1 future	n/a	12	12.91	7.883	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	MW-38	38.46	n/a	n/a	1 future	n/a	12	31.63	2.941	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	MW-39	0.2	n/a	n/a	1 future	n/a	11	n/a	n/a	54.55	n/a	n/a	0.01276	NP Intra (NDs) 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1611	440.8	n/a	n/a	1 future	n/a	14	388.2	23.52	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-1612	1381	n/a	n/a	1 future	n/a	11	973.1	169.8	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-26	402.3	n/a	n/a	1 future	n/a	13	335.8	29.2	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-27	605.7	n/a	n/a	1 future	n/a	12	23.27	0.5773	0	None	sqrt(x)	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-30	1366	n/a	n/a	1 future	n/a	11	1248	48.95	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-38	469.3	n/a	n/a	1 future	n/a	13	414	24.27	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW-39	445	n/a	n/a	1 future	n/a	12	365.8	34.14	0	None	No	0.001504	Param Intra 1 of 2

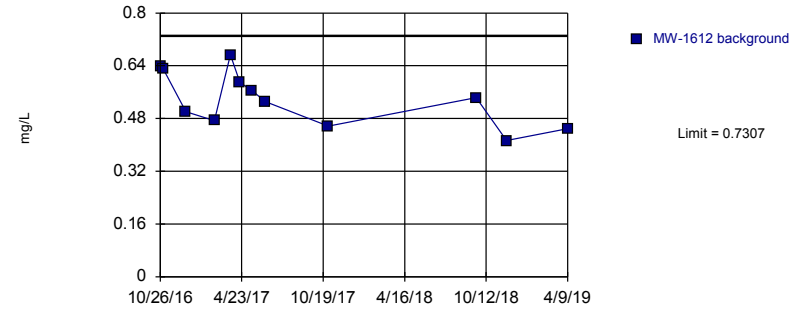
Prediction Limit
Intrawell Parametric, MW-1611



Background Data Summary: Mean=0.1653, Std. Dev.=0.03797, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.857, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Boron, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

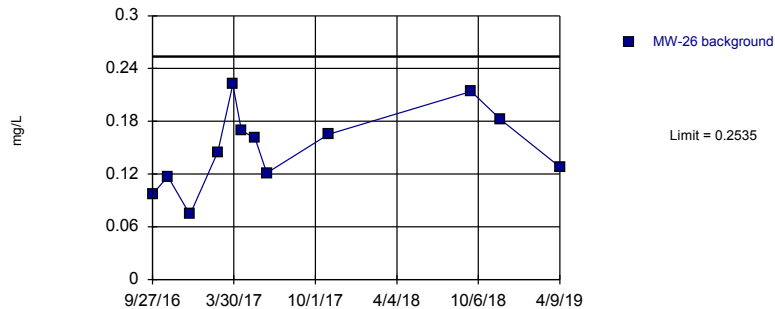
Prediction Limit
Intrawell Parametric, MW-1612 (bg)



Background Data Summary: Mean=0.5384, Std. Dev.=0.08279, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9659, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Boron, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

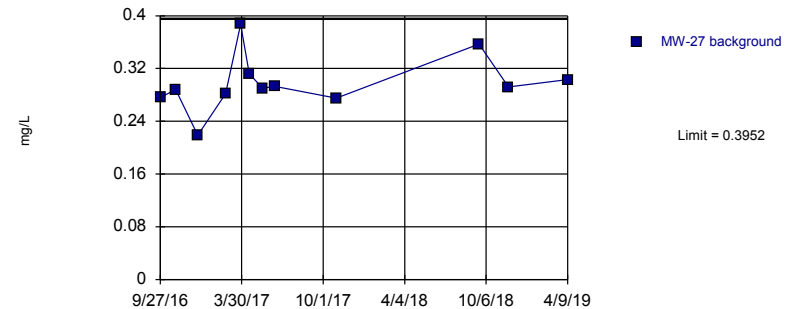
Prediction Limit
Intrawell Parametric, MW-26



Background Data Summary: Mean=0.1496, Std. Dev.=0.04475, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9767, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Boron, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

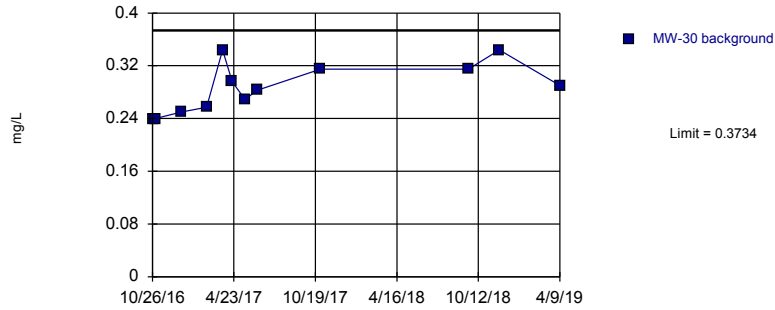
Prediction Limit
Intrawell Parametric, MW-27



Background Data Summary: Mean=0.2978, Std. Dev.=0.04195, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8939, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Boron, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

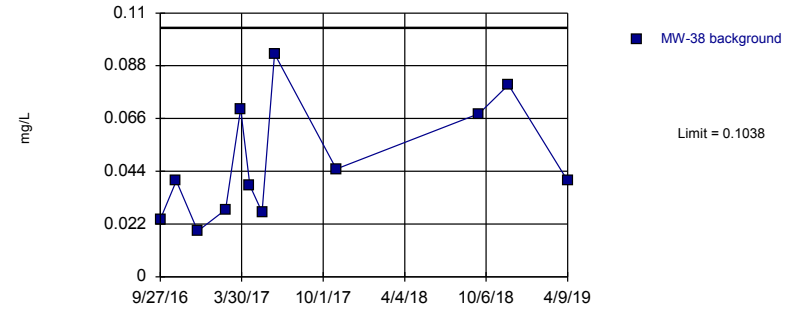
Prediction Limit
Intrawell Parametric, MW-30 (bg)



Background Data Summary: Mean=0.2868, Std. Dev.=0.03727, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9304, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Boron, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

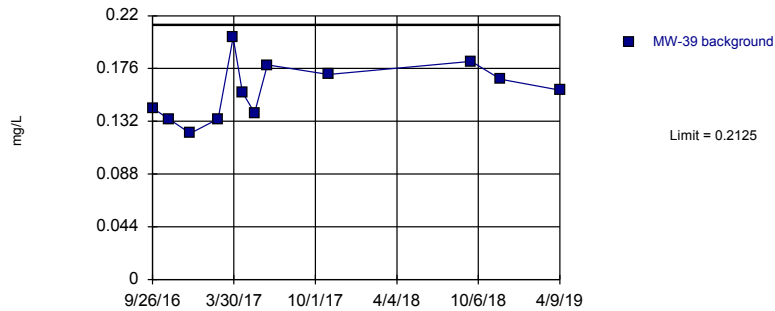
Prediction Limit
Intrawell Parametric, MW-38



Background Data Summary: Mean=0.04767, Std. Dev.=0.02417, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9039, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Boron, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

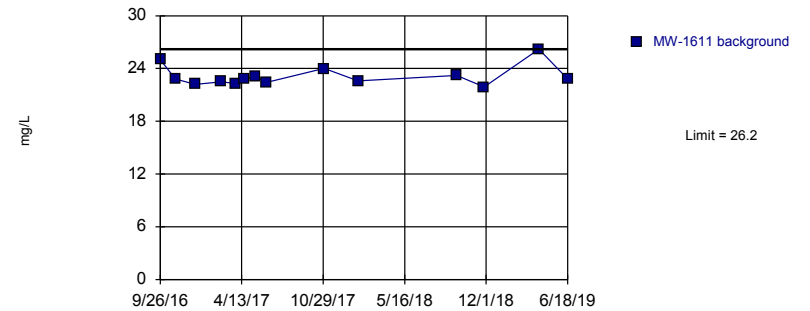
Prediction Limit
Intrawell Parametric, MW-39



Background Data Summary: Mean=0.1573, Std. Dev.=0.02381, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9677, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Boron, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

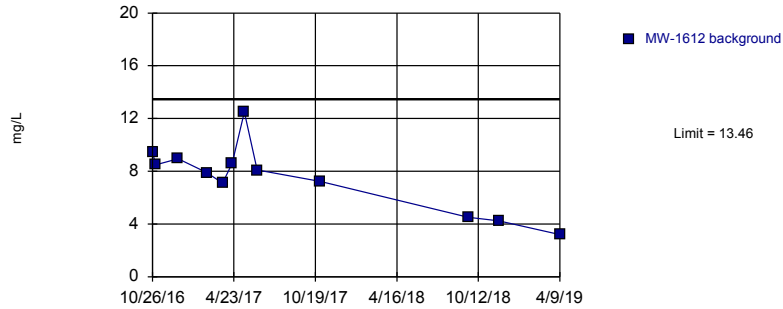
Prediction Limit
Intrawell Non-parametric, MW-1611



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 14 background values. Well-constituent pair annual alpha = 0.01715. Individual comparison alpha = 0.008612 (1 of 2). Assumes 1 future value.

Constituent: Calcium, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

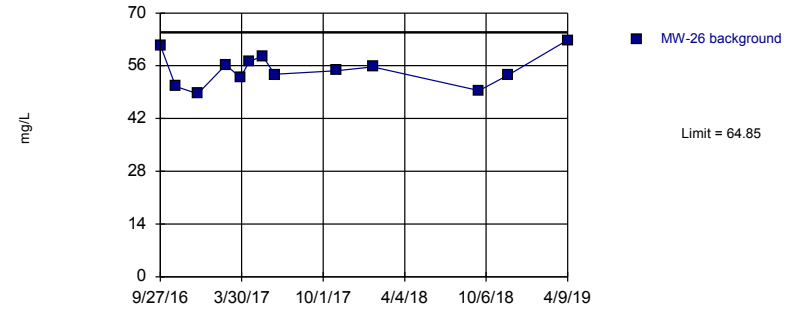
Prediction Limit
Intrawell Parametric, MW-1612 (bg)



Background Data Summary: Mean=7.524, Std. Dev.=2.557, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9419, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

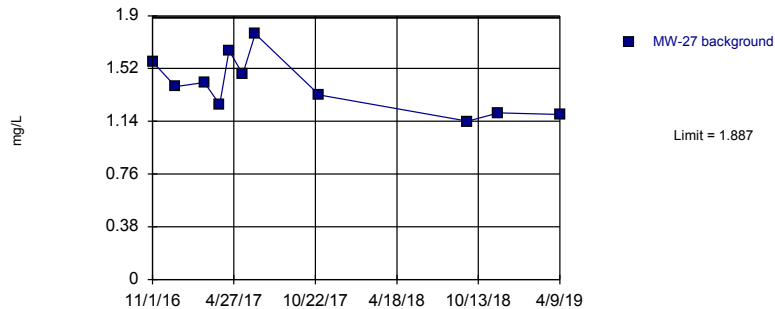
Prediction Limit
Intrawell Parametric, MW-26



Background Data Summary: Mean=55.02, Std. Dev.=4.312, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9682, critical = 0.814. Kappa = 2.279 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

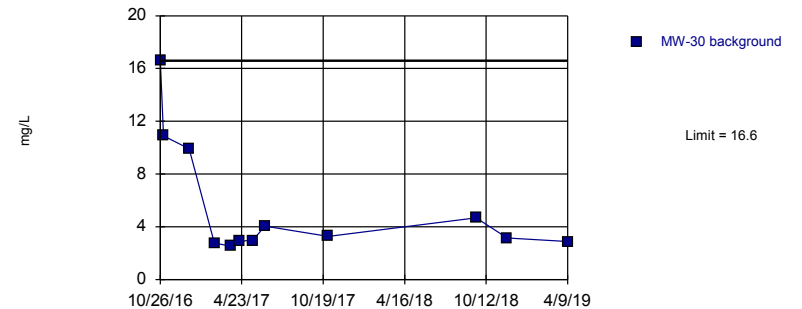
Prediction Limit
Intrawell Parametric, MW-27



Background Data Summary: Mean=1.4, Std. Dev.=0.2028, n=11. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9546, critical = 0.792. Kappa = 2.4 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

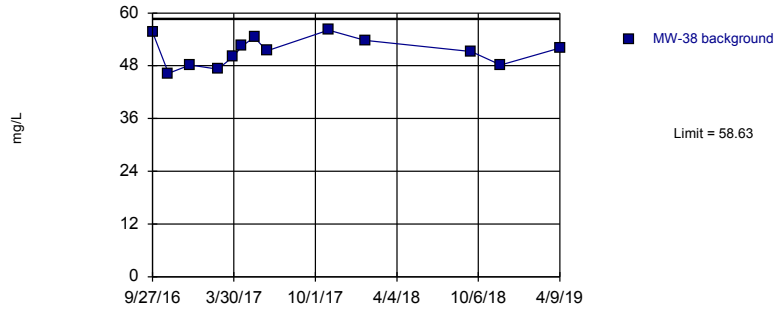
Prediction Limit
Intrawell Non-parametric, MW-30 (bg)



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 12 background values. Well-constituent pair annual alpha = 0.02143. Individual comparison alpha = 0.01077 (1 of 2). Assumes 1 future value.

Constituent: Calcium, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

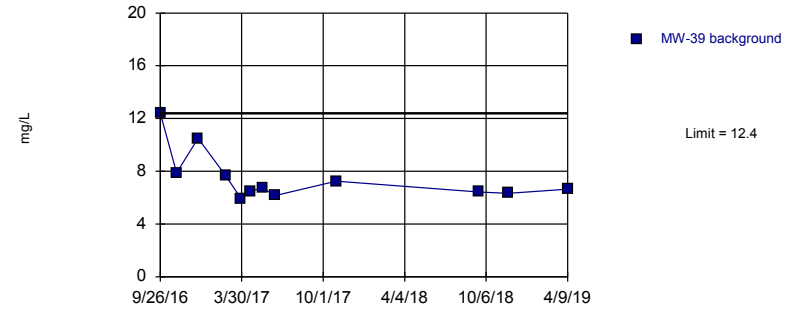
Prediction Limit
Intrawell Parametric, MW-38



Background Data Summary: Mean=51.32, Std. Dev.=3.209, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9565, critical = 0.814. Kappa = 2.279 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

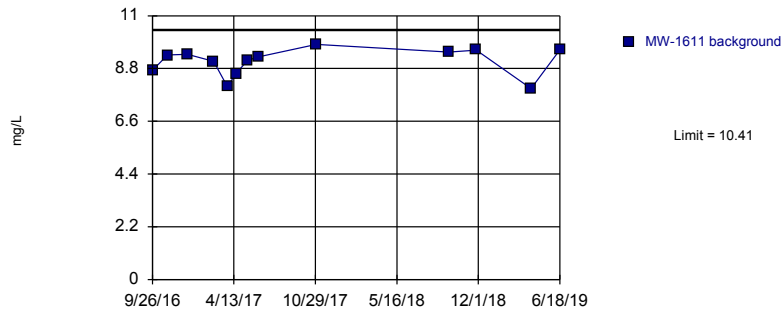
Prediction Limit
Intrawell Non-parametric, MW-39



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 12 background values. Well-constituent pair annual alpha = 0.02143. Individual comparison alpha = 0.01077 (1 of 2). Assumes 1 future value.

Constituent: Calcium, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

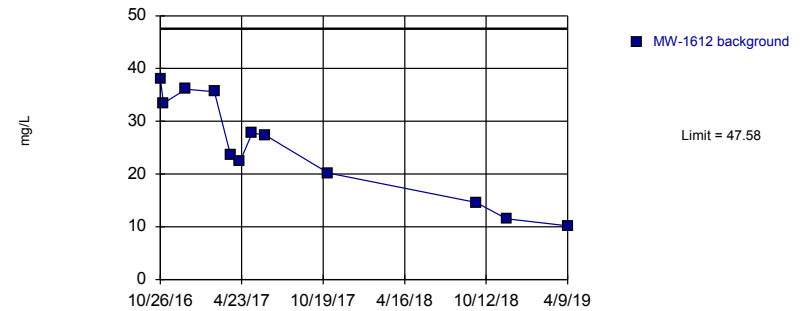
Prediction Limit
Intrawell Parametric, MW-1611



Background Data Summary: Mean=9.078, Std. Dev.=0.5843, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8886, critical = 0.814. Kappa = 2.279 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

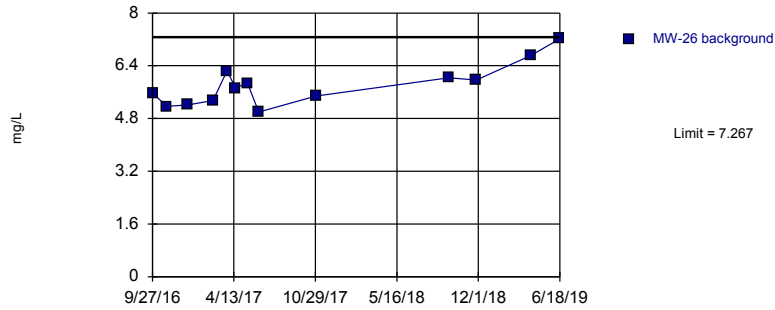
Prediction Limit
Intrawell Parametric, MW-1612 (bg)



Background Data Summary: Mean=25.08, Std. Dev.=9.687, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9363, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

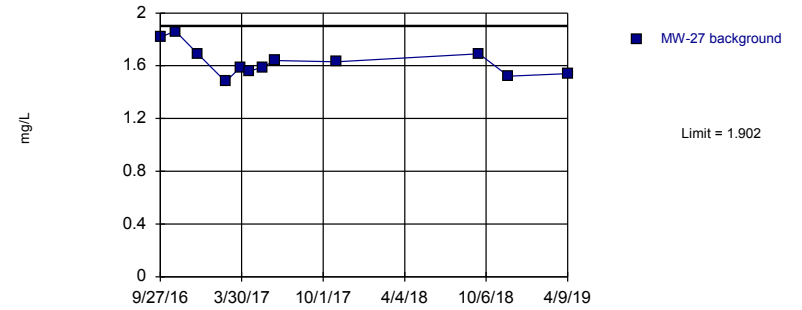
Prediction Limit Intrawell Parametric, MW-26



Background Data Summary: Mean=5.813, Std. Dev.=0.638, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.938, critical = 0.814. Kappa = 2.279 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

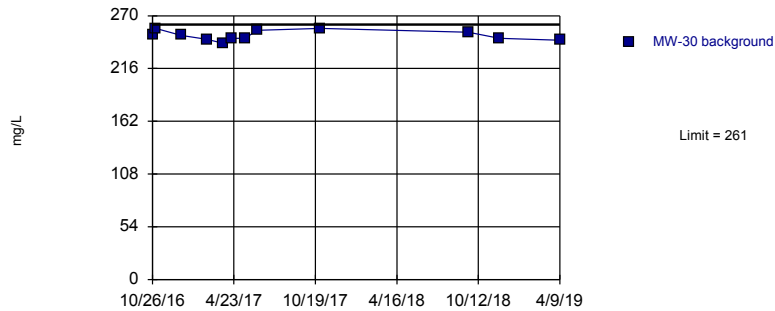
Prediction Limit Intrawell Parametric, MW-27



Background Data Summary: Mean=1.634, Std. Dev.=0.1156, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9292, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

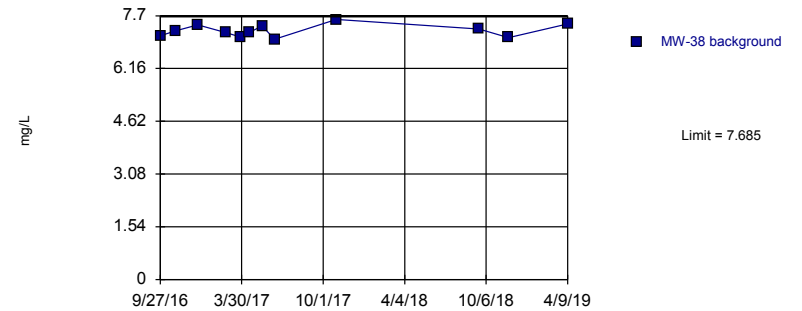
Prediction Limit Intrawell Parametric, MW-30 (bg)



Background Data Summary: Mean=249.7, Std. Dev.=4.887, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9305, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

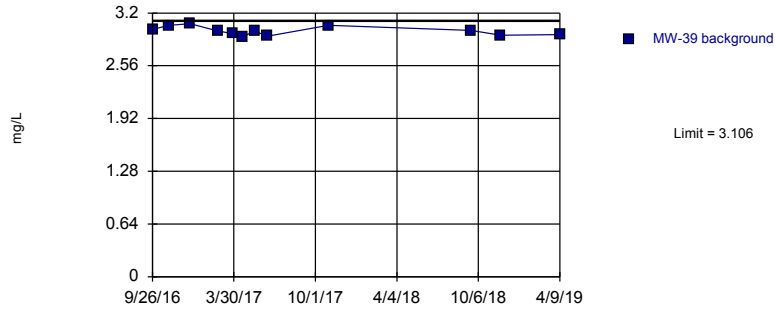
Prediction Limit Intrawell Parametric, MW-38



Background Data Summary: Mean=7.264, Std. Dev.=0.1812, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9616, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

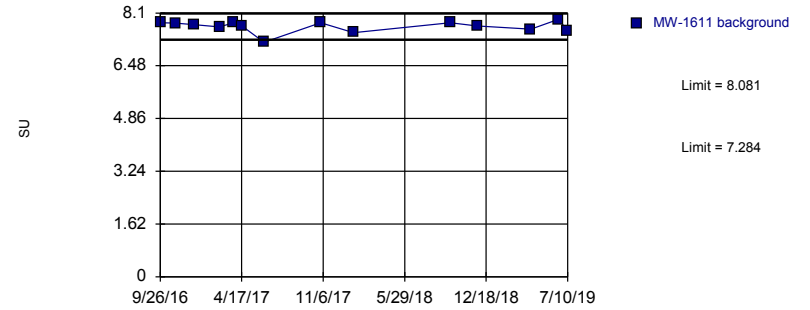
Prediction Limit
Intrawell Parametric, MW-39



Background Data Summary: Mean=2.981, Std. Dev.=0.05384, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9297, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

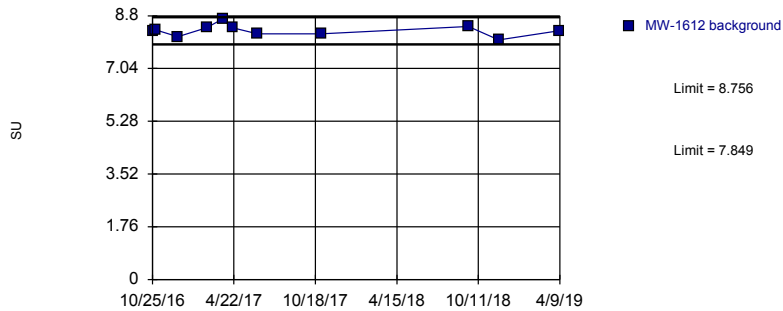
Prediction Limit
Intrawell Parametric, MW-1611



Background Data Summary: Mean=7.683, Std. Dev.=0.1783, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8528, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

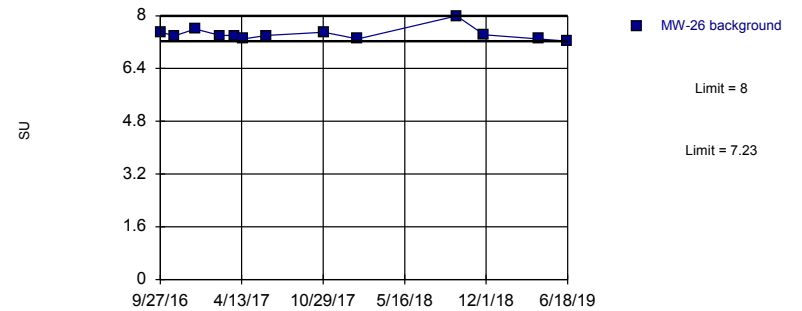
Prediction Limit
Intrawell Parametric, MW-1612 (bg)



Background Data Summary: Mean=8.303, Std. Dev.=0.1891, n=11. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9684, critical = 0.792. Kappa = 2.4 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

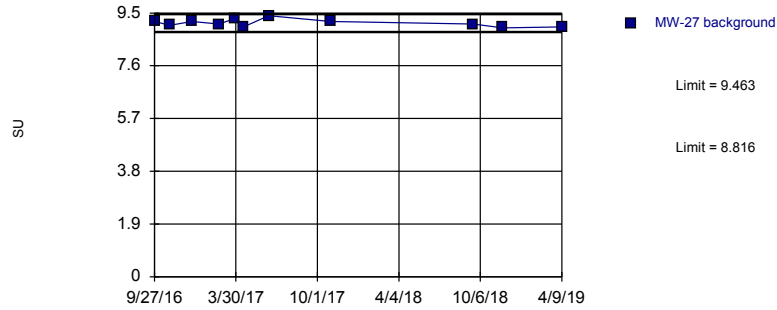
Prediction Limit
Intrawell Non-parametric, MW-26



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. Limits are highest and lowest of 13 background values. Well-constituent pair annual alpha = 0.03858. Individual comparison alpha = 0.01938 (1 of 2). Assumes 1 future value.

Constituent: pH, field Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

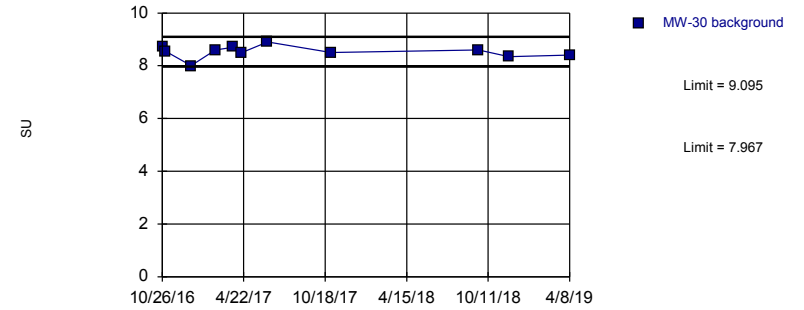
Prediction Limit
Intrawell Parametric, MW-27



Background Data Summary: Mean=9.139, Std. Dev.=0.1348, n=11. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9363, critical = 0.792. Kappa = 2.4 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

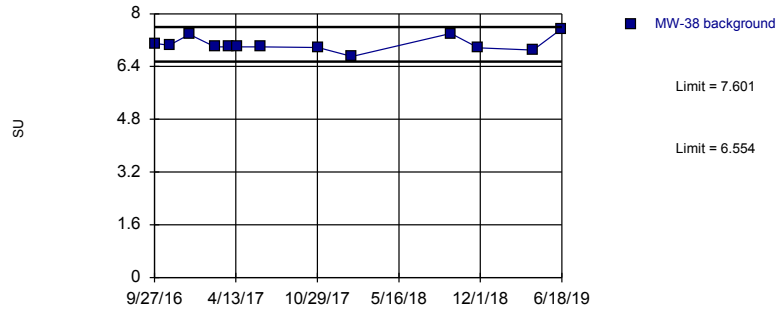
Prediction Limit
Intrawell Parametric, MW-30 (bg)



Background Data Summary: Mean=8.531, Std. Dev.=0.235, n=11. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9453, critical = 0.792. Kappa = 2.4 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

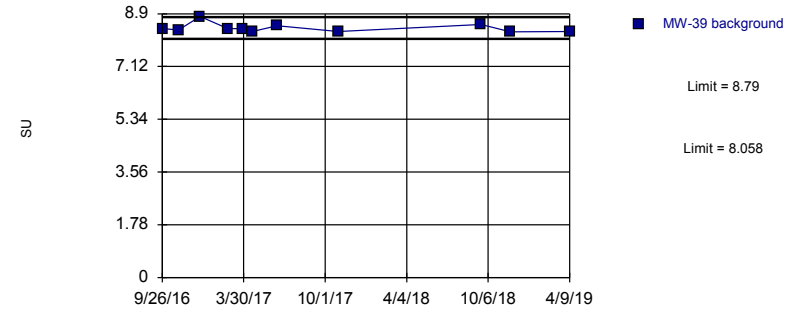
Prediction Limit
Intrawell Parametric, MW-38



Background Data Summary: Mean=7.078, Std. Dev.=0.2298, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8713, critical = 0.814. Kappa = 2.279 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

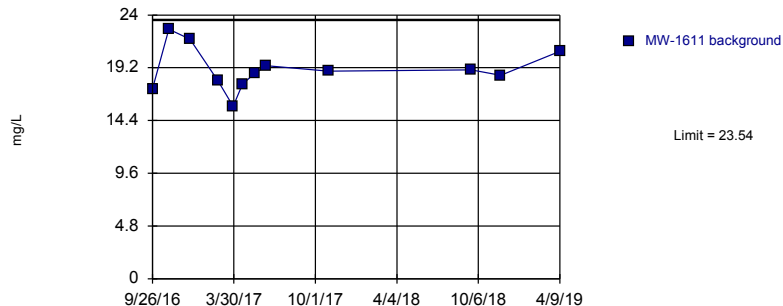
Prediction Limit
Intrawell Parametric, MW-39



Background Data Summary (based on natural log transformation): Mean=2.13, Std. Dev.=0.01812, n=11. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.793, critical = 0.792. Kappa = 2.4 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

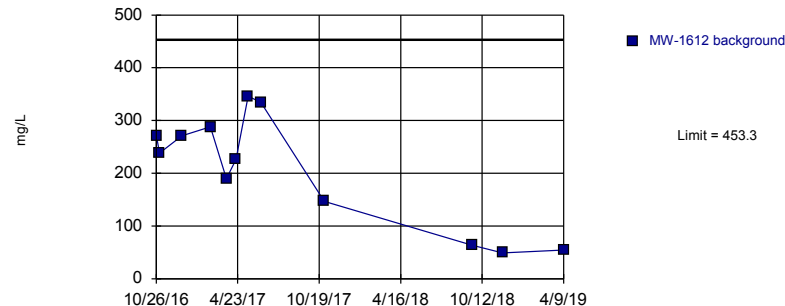
Prediction Limit Intrawell Parametric, MW-1611



Background Data Summary: Mean=19.03, Std. Dev.=1.94, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9612, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

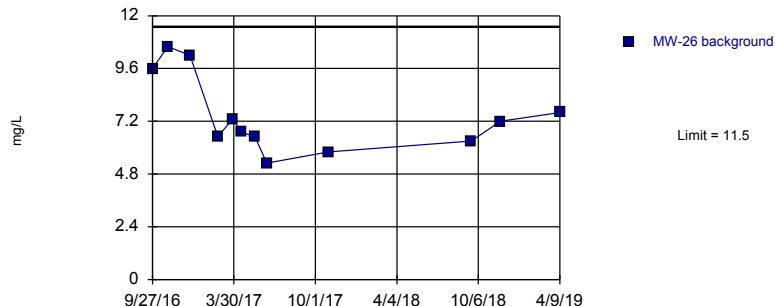
Prediction Limit Intrawell Parametric, MW-1612 (bg)



Background Data Summary: Mean=206.7, Std. Dev.=106.2, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9076, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

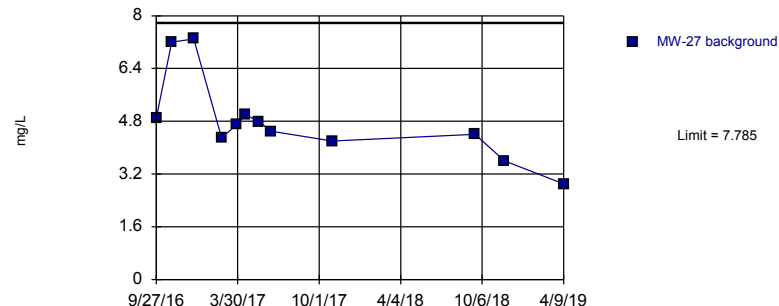
Prediction Limit Intrawell Parametric, MW-26



Background Data Summary: Mean=7.467, Std. Dev.=1.739, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8779, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

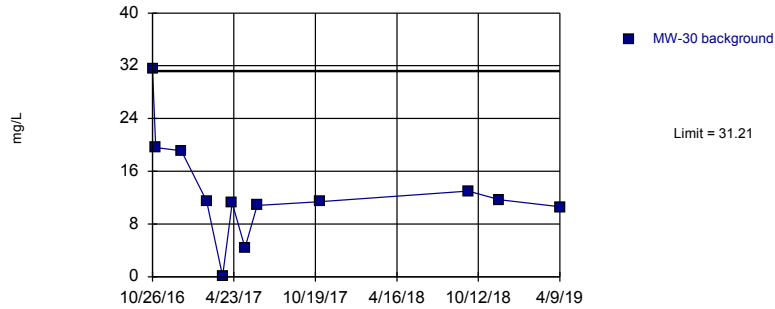
Prediction Limit Intrawell Parametric, MW-27



Background Data Summary: Mean=4.817, Std. Dev.=1.278, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.86, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 11/22/2019 9:12 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

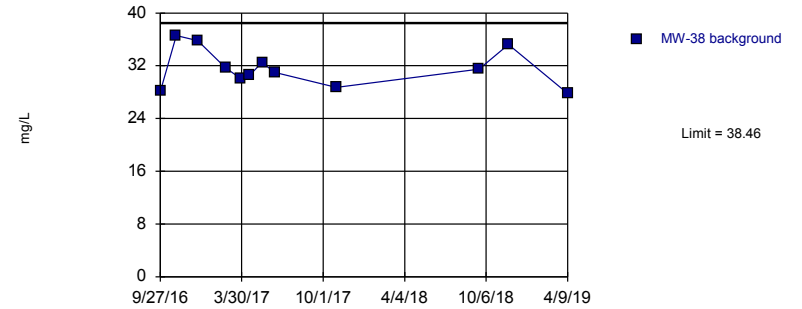
Prediction Limit
Intrawell Parametric, MW-30 (bg)



Background Data Summary: Mean=12.91, Std. Dev.=7.883, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.888, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 11/22/2019 9:13 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

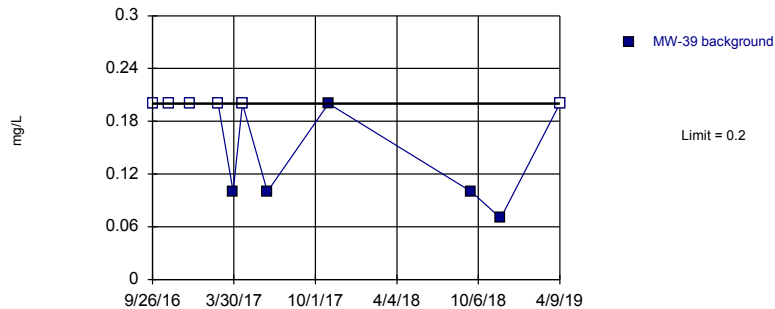
Prediction Limit
Intrawell Parametric, MW-38



Background Data Summary: Mean=31.63, Std. Dev.=2.941, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9291, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 11/22/2019 9:13 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

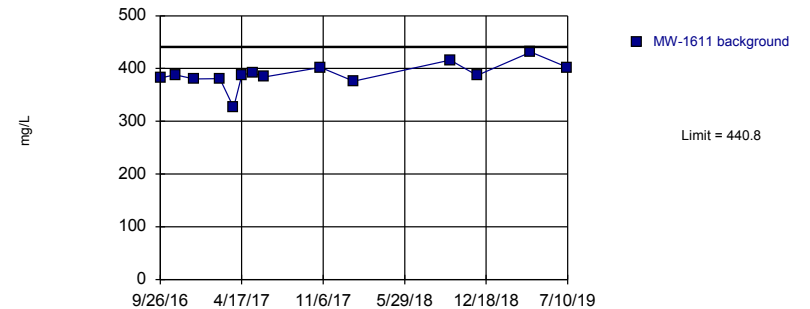
Prediction Limit
Intrawell Non-parametric, MW-39



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 11 background values. 54.55% NDs. Well-constituent pair annual alpha = 0.02537. Individual comparison alpha = 0.01276 (1 of 2). Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 11/22/2019 9:13 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

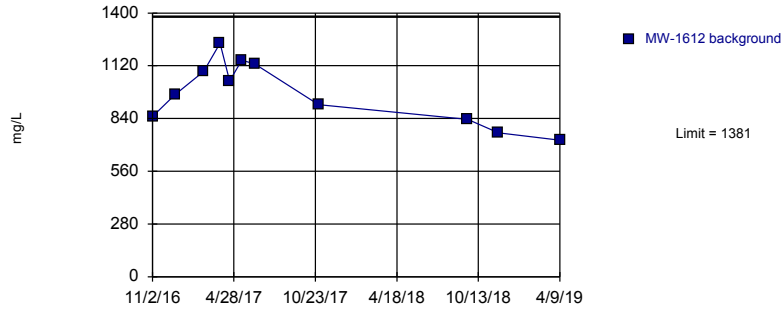
Prediction Limit
Intrawell Parametric, MW-1611



Background Data Summary: Mean=388.2, Std. Dev.=23.52, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.871, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/22/2019 9:13 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

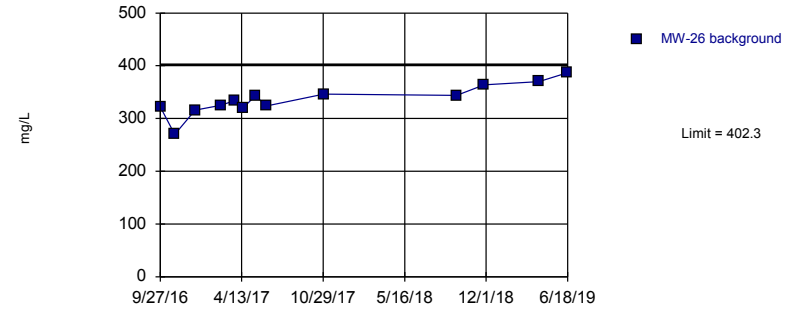
Prediction Limit
Intrawell Parametric, MW-1612 (bg)



Background Data Summary: Mean=973.1, Std. Dev.=169.8, n=11. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9601, critical = 0.792. Kappa = 2.4 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/22/2019 9:13 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

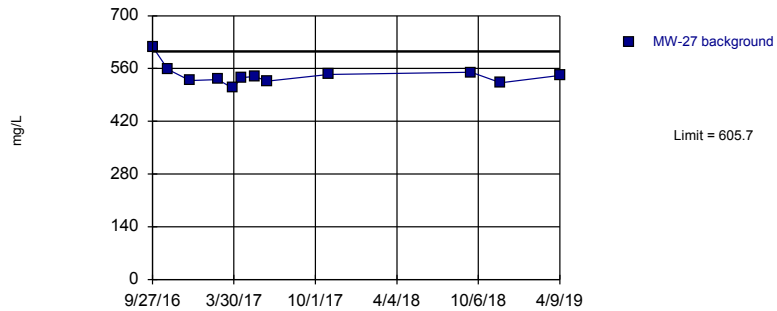
Prediction Limit
Intrawell Parametric, MW-26



Background Data Summary: Mean=335.8, Std. Dev.=29.2, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.949, critical = 0.814. Kappa = 2.279 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/22/2019 9:13 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

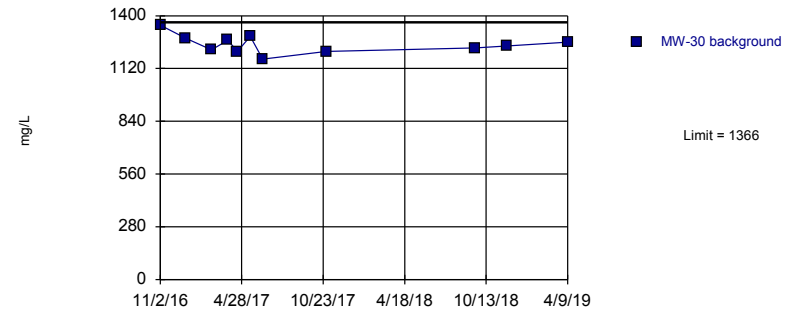
Prediction Limit
Intrawell Parametric, MW-27



Background Data Summary (based on square root transformation): Mean=23.27, Std. Dev.=0.5773, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8148, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/22/2019 9:13 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

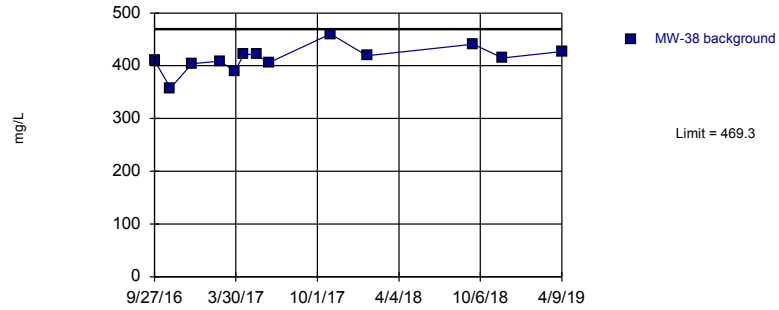
Prediction Limit
Intrawell Parametric, MW-30 (bg)



Background Data Summary: Mean=1248, Std. Dev.=48.95, n=11. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9691, critical = 0.792. Kappa = 2.4 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/22/2019 9:13 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

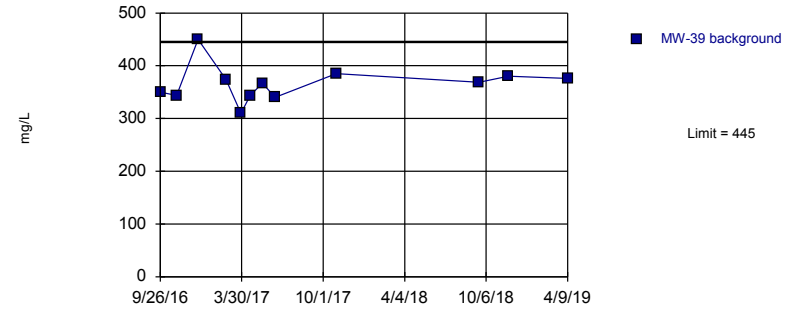
Prediction Limit
Intrawell Parametric, MW-38



Background Data Summary: Mean=414, Std. Dev.=24.27, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9442, critical = 0.814. Kappa = 2.279 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/22/2019 9:13 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Prediction Limit
Intrawell Parametric, MW-39



Background Data Summary: Mean=365.8, Std. Dev.=34.14, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8998, critical = 0.805. Kappa = 2.322 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/22/2019 9:13 AM View: Intrawell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

FIGURE F: TREND TESTS

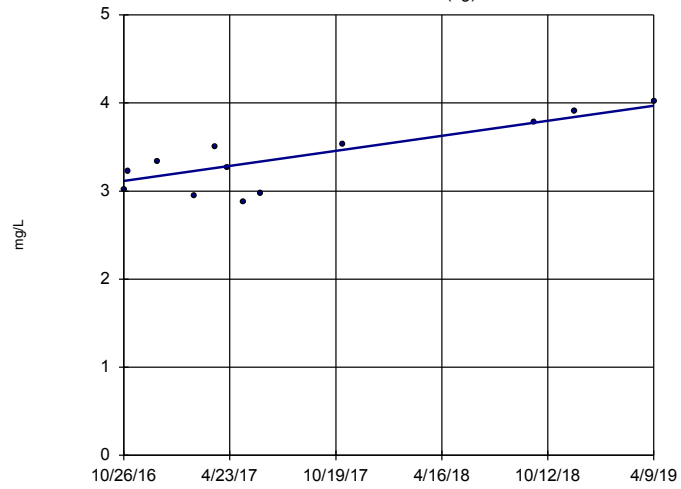
Interwell Trend Tests Summary Table - All Results

Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill Printed 10/15/2019, 2:27 PM

<u>Constituent</u>	<u>Well</u>	<u>Slope</u>	<u>Calc.</u>	<u>Critical</u>	<u>Sig.</u>	<u>N</u>	<u>%NDs</u>	<u>Normality</u>	<u>Xform</u>	<u>Alpha</u>	<u>Method</u>
Fluoride, total (mg/L)	MW-1612 (bg)	0.3469	34	38	No	12	0	n/a	n/a	0.01	NP
Fluoride, total (mg/L)	MW-30 (bg)	-0.01567	-6	-34	No	11	0	n/a	n/a	0.01	NP

Sen's Slope Estimator

MW-1612 (bg)

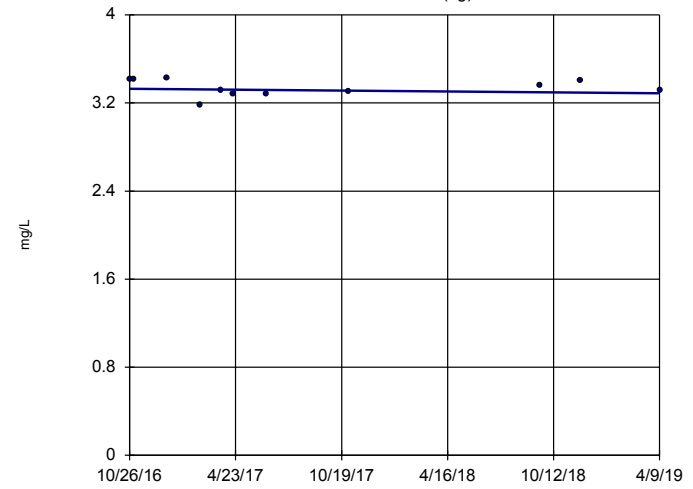


n = 12
Slope = 0.3469
units per year.
Mann-Kendall
statistic = 34
critical = 38
Trend not sig-
nificant at 99%
confidence level
($\alpha = 0.005$ per
tail).

Constituent: Fluoride, total Analysis Run 10/15/2019 2:27 PM View: Interwell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

Sen's Slope Estimator

MW-30 (bg)



n = 11
Slope = -0.01567
units per year.
Mann-Kendall
statistic = -6
critical = -34
Trend not sig-
nificant at 99%
confidence level
($\alpha = 0.005$ per
tail).

Constituent: Fluoride, total Analysis Run 10/15/2019 2:27 PM View: Interwell
Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill

FIGURE G: INTERWELL PREDICTION
LIMITS

Interwell Prediction Limit Summary Table - All Results

Mountaineer Landfill Client: Geosyntec Data: Mountaineer Landfill Printed 10/15/2019, 2:32 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Fluoride, total (mg/L)	n/a	3.912	n/a	n/a	5 future	n/a	23	3.351	0.279	0	None	No	0.001504	Param Inter 1 of 2

Memorandum

Date: August 3, 2020
To: David Miller (AEP)
Copies to: Benjamin Kepchar (AEP)
From: Allison Kreinberg (Geosyntec)
Subject: Evaluation of Detection Monitoring Data at
Mountaineer Plant's Landfill (LF)

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 Subpart D, "CCR rule"), the first semi-annual detection monitoring event of 2020 at the Landfill (LF), an existing CCR unit at the Mountaineer Power Plant located in New Haven, West Virginia, was completed on May 15, 2020. Based on the results, verification sampling was completed on July 8, 2020.

Background values for the LF were previously calculated in January 2018. After a minimum of four detection monitoring events, the results of those events were compared to the existing background dataset, and the background dataset was updated as appropriate. Revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the calculation of these revised background values are described in Geosyntec's *Statistical Analysis Summary* report, dated January 6, 2020.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is only concluded if both samples in a series of two exceeds the UPL. In practice, if the initial result did not exceed the UPL, a second sample was not collected or analyzed.

Detection monitoring results and the relevant background values are compared in Table 1. No SSIs were observed at the Mountaineer LF CCR unit, and as a result the Mountaineer LF will remain in detection monitoring.

Evaluation of Detection Monitoring Data – Mountaineer LF
August 3, 2020
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The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). A certification of these statistics by a qualified professional engineer is provided in Attachment A.

**Table 1: Detection Monitoring Data Evaluation
Mountaineer - Landfill**

Geosyntec Consultants, Inc.

Parameter	Unit	Description	MW-26		MW-27		MW-38	MW-39		MW-1611
			5/15/2020	7/8/2020	5/15/2020	7/8/2020	5/15/2020	5/15/2020	7/8/2020	5/15/2020
Boron	mg/L	Intrawell Background Value (UPL)	0.254		0.395		0.104	0.213		0.254
		Analytical Result	0.100	--	0.100	--	0.02	0.148	--	0.135
Calcium	mg/L	Intrawell Background Value (UPL)	64.9		1.89		58.6	12.4		26.2
		Analytical Result	55.6	--	54.5	1.20	44.7	6.15	--	24.0
Chloride	mg/L	Intrawell Background Value (UPL)	7.27		1.90		7.69	3.11		10.4
		Analytical Result	1.72	--	6.06	1.63	7.50	3.11	--	9.35
Fluoride	mg/L	Interwell Background Value (UPL)	3.91							
		Analytical Result	2.56	--	0.14	--	0.35	0.84	--	0.61
pH	SU	Intrawell Background Value (UPL)	8.0		9.5		7.6	8.8		8.1
		Intrawell Background Value (LPL)	7.2		8.8		6.6	8.1		7.3
		Analytical Result	7.1	7.4	8.8	9.1	6.7	7.9	8.4	7.3
Sulfate	mg/L	Intrawell Background Value (UPL)	11.5		7.79		38.5	0.200		23.5
		Analytical Result	3.9	--	7.0	--	33.5	0.2	--	20.8
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	402		606		469	445		441
		Analytical Result	547	366	359	--	404	374	--	404

Notes:

UPL: Upper prediction limit

LPL: Lower prediction limit

Bold values exceed the background value.

Background values are shaded gray.

--: Not analyzed

ATTACHMENT A

Certification by a Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

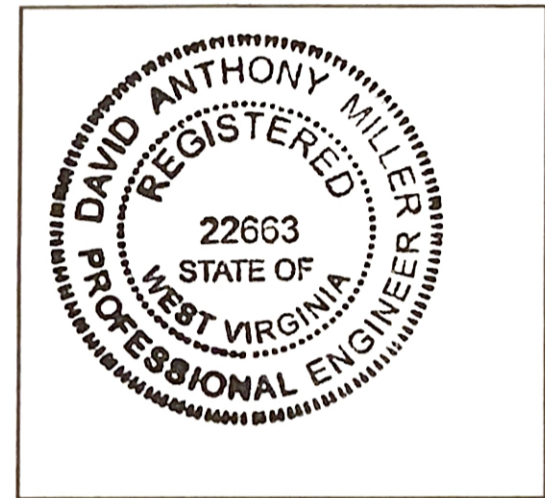
I certify that the selected statistical method, described above and in the January 6, 2020 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Mountaineer LF CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature



22663

License Number

WEST VIRGINIA

Licensing State

08.07.2020

Date

APPENDIX 3 – Alternative Source Demonstrations

No alternative source demonstrations were necessary in 2020.

APPENDIX 4 - Notices for Monitoring Program Transitions

Not applicable at this time.

APPENDIX 5 - Well Installation/Decommissioning Logs

Not applicable at this time.