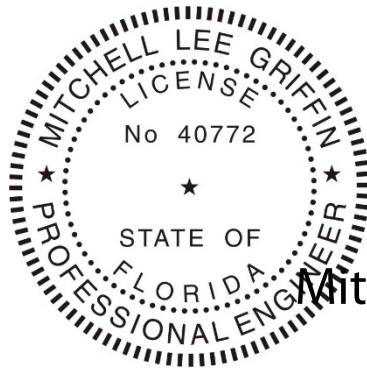


2019 Annual Groundwater Monitoring and Corrective Action Report: OUC Stanton Energy Center CCR

PREPARED FOR: Orlando Utility Commission
PREPARED BY: CH2M HILL Engineers, Inc.
DATE: January 30, 2020
PROJECT NUMBER: D3292400.A.PN.OE.09_AR

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Purpose

On April 17, 2015, the United States Environmental Protection Agency (EPA) published the final rule for the Coal Combustion Residuals (CCR) Rule, Subtitle D of 40 Code of Federal Regulations (CFR) 257. The CCR Rule established national minimum criteria for CCR disposal and became effective October 19, 2015. The CCR Rule applies to Orlando Utilities Commission (OUC) Stanton Energy Center (SEC) because of the disposal of CCR material generated from the combustion of coal at this facility. This technical memorandum fulfills the reporting requirements associated with the annual groundwater monitoring and corrective action report, Section 257.90 (2)(e), CFR.

The CCR Rule includes: deadlines for the establishment of a groundwater monitoring system, sampling and analysis of groundwater requirements, the statistical analysis of the groundwater quality data, and specifying corrective actions (if necessary) for facilities disposing of CCR. The CCR Groundwater Monitoring and Corrective Action program is described in Sections 257.90 through 257.98 of the CCR Rule:

- Applicability (§257.90)
- Groundwater Monitoring Systems (§257.91)
- Groundwater Sampling and Analysis Requirements (§257.93)
- Detection Monitoring Program (§257.94)
- Assessment Monitoring Program (§257.95)
- Assessment of Corrective Measures (§257.96)
- Selection of Remedy (§257.97)
- Implementation of Corrective Action Program (§257.98)

Monitoring requirements for compliance are included in §257 sub-sections. How OUC met the requirements of the CCR program is described in the 2017 annual report (CH2M, 2018). The first annual report contained the results of the Groundwater Monitoring and Corrective Action program from July 2015 through December 2017. Subsequent OUC SEC annual reports were intended to only describe the status of the program for the given year in accordance with §257.90(e) (Table 1). This technical memorandum provides the required 2019 documentation to demonstrate the OUC SEC's compliance with the CCR Rule annual groundwater monitoring and corrective action report.

Table 1. Annual Groundwater Monitoring and Corrective Action Report (§257.90(e))

2019 Coal Combustion Residuals Annual Groundwater Monitoring and Corrective Action Report

Requirement	Response
A map, aerial image, or diagram showing the CCR unit and the background (or up-gradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit.	These are shown in Figures 2 and 3 in the background section
Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken.	No changes to the wells during this period
In addition to the monitoring data obtained under §257.90 through §257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs.	See results section
A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels).	See discussion section
Other information required to be included in the annual report as specified in §257.90 through §257.98.	Part of discussion and conclusions

Background and Setting

SEC is located 12 miles southeast of Orlando, Florida. OUC has been operating SEC since 1987 and dry-managing CCRs in landfills on the west side of the property. The original, now closed, landfill received CCR from July 1987 through August 28, 2015. From the period of May 28 through August 15, 2015, the CCR directed to the closed landfill was used to form part of the landfill cap. The cap was completed with 2 feet of soil and then sodded to stabilize the soil. The old landfill is exempt from the CCR Rule because it ceased operations prior to implementation. The old landfill has been closed (hereinafter “closed landfill”), and is undergoing post-closure monitoring under OUC's Conditions of Certification with the Florida Department of Environmental Protection (FDEP). The closed landfill has a 6.42-megawatt solar power generation farm installed over its top.

The new landfill (hereinafter “active landfill”) began receiving CCR in May 28, 2015 as a monofill that receives CCR produced by the SEC coal-fired power generating process. The new landfill is positioned immediately west of and adjacent to the closed landfill and immediately east of Innovation Way which is the approximate SEC western property boundary, Figure 1. The design standards for the active landfill were compliant with Florida's municipal solid waste landfill requirements under Chapter 62-701, Florida Administrative Code. The active landfill is fully double-lined and does not discharge into the surficial groundwater.

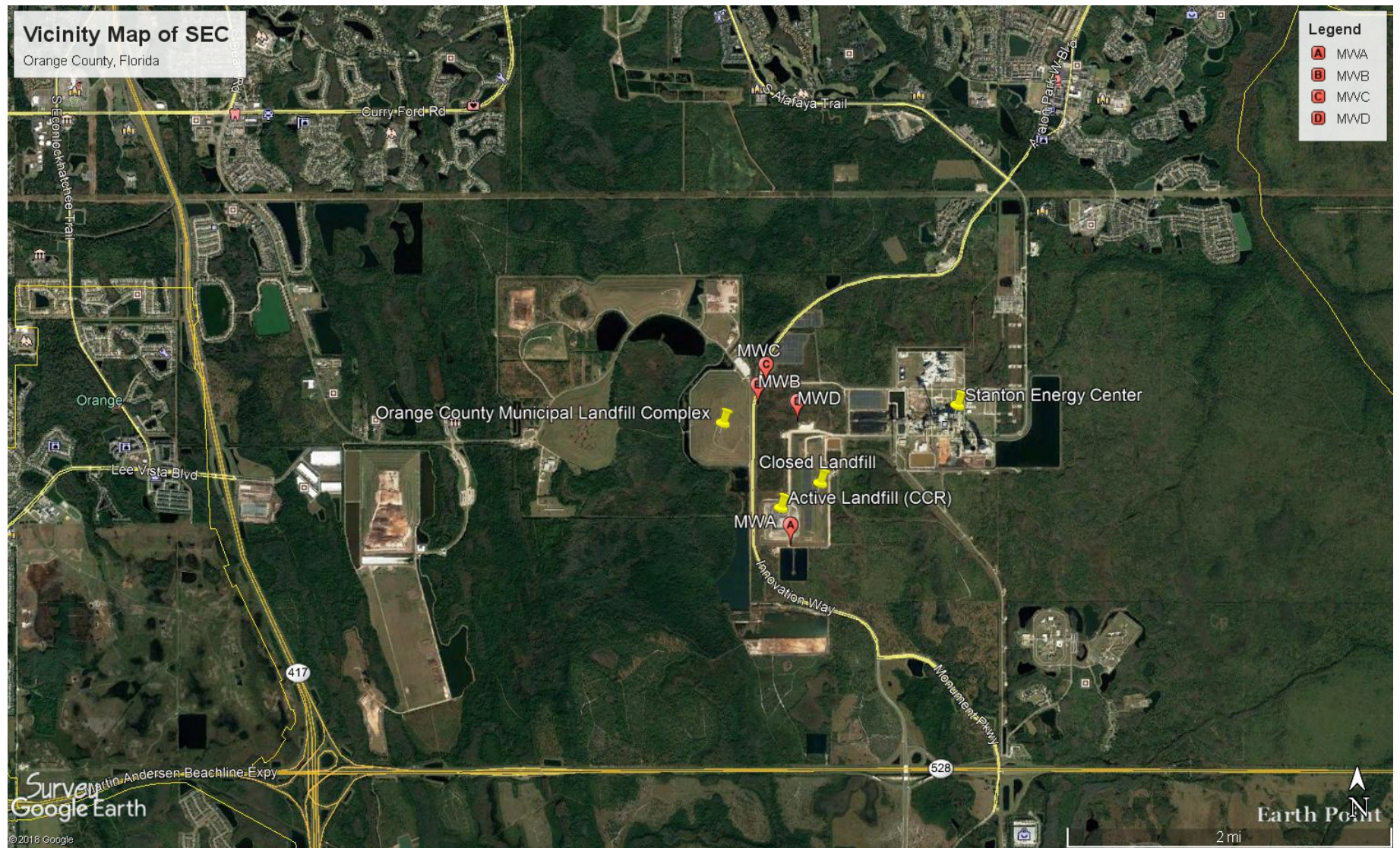


Figure 1. General Vicinity Map of OUC SEC and Landfills
2019 Coal Combustion Residuals Annual Groundwater Monitoring and Corrective Action Report

Groundwater conditions at SEC are regulated under two separate programs: the FDEP Power Plant Siting Act and the U.S. Environmental Protection Agency (EPA) CCR Rule. The FDEP monitoring program has been active since August 1986, while the CCR monitoring program began in October 2015. OUC has made a conscious effort to keep these programs separate because different regulatory requirements, different groundwater quality standards, and different monitored constituents. However, the groundwater conditions at the two adjacent landfills are common.

Monitoring well locations were selected based on the groundwater gradient characteristics and the positions of the active and closed landfills, but were also constrained by the western site boundary. The Orange County municipal solid waste landfill is immediately west of SEC. The physical constraints, the history of FDEP's groundwater monitoring and other investigation results were used to locate the monitoring wells for the CCR program. The western property boundary is the regional groundwater up-gradient edge of the SEC site (Figures 2 and 3). The surficial aquifer groundwater near the active SEC CCR landfill is generally flowing outward from an apparent local groundwater level high under the closed coal residual landfill (especially evident at the end of the wet season in Figure 3). The active SEC CCR landfill is located adjacent to the closed one, and the surficial groundwater gradient is toward the southwest initially, but the overall site gradient is still toward the northeast. Thus, the groundwater quality conditions near the active landfill and monitored under the CCR program do not represent unaffected background conditions; they represent baseline conditions from the beginning of the CCR groundwater monitoring program.

No problems were encountered in the CCR monitoring program from July 2015 through 2019. Key program activities for 2019 were to prepare an annual report and upload the document to the OUC CCR website by January 31, 2020, and continue with CCR detection monitoring.

CCR Groundwater Data Screening and Decision Process through the Assessment Monitoring Program

The groundwater data and screening and decision process was derived from §257.90 through §257.98 of the CCR Rule. A summary of the monitoring process is:

1. Collect CCR period background water quality data, Appendix III and IV constituents. This step occurred between September 9, 2015 and July 20, 2017 at SEC and is completed.
2. Identify method(s) to evaluate the data for statistically significant trend changes for each well and constituent for Appendix III and IV constituents by well. This step was completed and documented in an October 2017 report.
3. Quantify criteria that define the limits for statistically significant change from background for each Appendix III and IV constituent by well. This was completed and documented in the 2017 annual report.
4. Establish a groundwater protection standard for each Appendix IV constituent [§257.95(h)]. Note that the CCR Rule does not list Appendix III constituents to establish groundwater protection standards. This was completed and documented in the 2017 annual report.
5. Collect detection program water quality data, Appendix III constituents (§257.94). The detection monitoring program sampling results are presented in the 2017, 2018, and 2019 annual reports.
6. Assess groundwater flow direction and rate. The detection monitoring program sampling results are presented in the 2017, 2018, and 2019 annual reports.



Figure 2. 2019 First Semi-Annual Event Groundwater Levels
2019 Coal Combustion Residuals Annual Groundwater Monitoring and Corrective Action Report

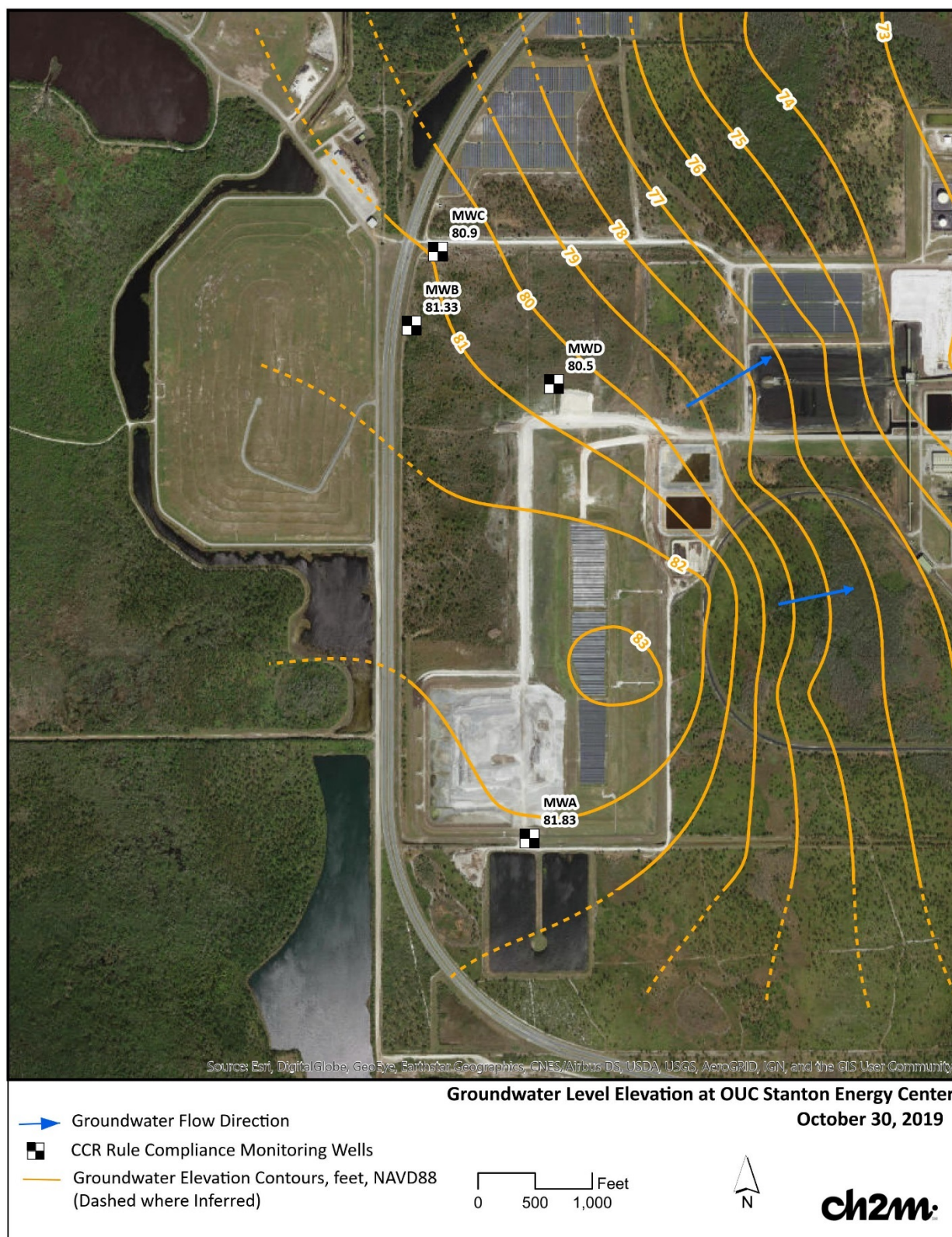


Figure 3. 2019 Second Semi-Annual Event Groundwater Levels
2019 Coal Combustion Residuals Annual Groundwater Monitoring and Corrective Action Report

7. Compare detection program water quality data to the statistical trend criteria to evaluate for no significant trend change, or a significant trend change, from the background water quality data.
 - a. If the result is no significant trend change then continue with detection program monitoring
 - b. If the result is a significant trend change may be indicated, then resample within 90 days
 - i. Compare data to the statistical criteria for no significant trend change or significant trend change
 1. If the result is no significant trend change then continue with detection program monitoring
 2. If the result is significant trend change of one or more constituents at the waste boundary [§257.94(e)]
 - a. Establish an assessment monitoring program and post a notification on the CCR Web site that an assessment monitoring program has been established, or
 - b. Demonstrate that a source other than the CCR unit caused the significant increase within 90 days. Continue with the detection monitoring program.
 - c. After approximately 3 years of detection program monitoring reassess the statistical analyses of the groundwater water quality trends against the background data to identify if changes are needed.
8. Assessment monitoring program (§257.95)
 - a. Within 90 days of establishing an assessment monitoring program sample the groundwater for Appendix IV constituents, and then sample annually thereafter.
 - b. The number of samples, N, needs to be sufficient to support the statistical evaluation of the data [§257.93(e)]. The owner may demonstrate that an alternative sampling frequency is necessary during the active life and post-closure of the CCR unit based on site conditions; however, sample no less frequently than annually.
 - c. After obtaining the results from the above, within 90 days sample all wells for Appendix III and IV constituents, at least semi-annually. The number of samples, N, needs to be sufficient to support the statistical evaluation of the data [§257.93(e)].
 - i. Establish groundwater protection standards consistent with [§257.95(h)] as described in Item 4, above.
 - ii. If the sampling results for the Appendix III and IV constituents are below the established groundwater protection standards for two consecutive sampling events, the monitoring program may return to detection monitoring (Appendix III constituents). Notification that the detection monitoring program is resuming must be posted on the CCR Web site.
 - iii. If concentrations of one or more constituents are above background but below the groundwater protection standard continue with the assessment monitoring program.
 - iv. If concentrations of one or more constituents are statistically significant concentrations above the groundwater protection standard, post a notification

on the CCR Web site [§257.95(g)] and characterize the nature of the release [§257.95(g)(1)].

The 2017 and 2018 results and analysis indicated that calcium, chloride, pH (low) and total dissolved solids (TDS) from MW-B, and calcium and chloride from MW-D fell outside the statistical confidence intervals. This did not mean that there was a problem, but continued scrutiny was needed to assess site conditions. Continued detection monitoring was conducted in 2019.

Results of the Detection Monitoring Program – 2019

Monitoring Wells

The SEC CCR active landfill groundwater monitoring system consists of 4 surficial aquifer monitoring wells. These wells are named MW-A, MW-B, MW-C, and MW-D. The monitoring wells are about 20 to 25 feet deep into the surficial aquifer. MW-A has an approximate 10-foot deeper installation depth because the land surface elevation at its location is approximately 10 feet higher than at the other wells. The horizon for the monitoring interval for MW-A is the same as the interval for MW-B, MW-C, and MW-D. MW-A is the up-gradient well and the other wells are downgradient based on local groundwater levels.

Groundwater Levels and Flow

Groundwater levels in the monitoring wells were collected with each sampling event and groundwater level elevation maps were prepared. Table 2 presents the well location and water level data. Figure 4 shows a chart of the semi-annual groundwater elevations. The semi-annual groundwater level maps are provided in Figures 2 and 3. In general, there are no major changes in groundwater levels and flow patterns across the site since 2015. The 2018 values were like those measured in 2016, while 2017 showed some larger variations. The 2019 levels were about 0.3- to 0.7-foot higher than 2018 levels for the dry and wet seasons, respectively. These were still within the range of levels monitored during the entire program, since 2015 (Figure 4). Overall, there is no substantial trend in groundwater levels as the 2019 levels were similar to the fall 2015 levels (less than 1-foot difference).

Table 2. Background and Operations Period Groundwater Levels – MW-A, MW-B, MW-C, and MW-D, OUC Stanton Energy Center

2019 Coal Combustion Residuals Annual Groundwater Monitoring and Corrective Action Report

DATE	Well	Florida State Plane East Zone (901)		Elevation TOC (feet, NAVD 88)	Depth to Water (feet)	Water Level Elevation (feet, NAVD 88)
		Northing (feet)	Easting (feet)			
10/30/2015	MW-A	1504260	597643.8	95.77	13.6	82.17
4/29/2016					13.96	81.81
10/31/2016					13.53	82.24
4/25/2017					15.64	80.13
10/31/2017					13.31	82.46
4/27/2018					15.16	80.61
10/30/2018					14.20	81.57
4/29/2019					14.82	80.95
10/31/2019					13.94	81.83
10/30/2015					4.86	81.19
4/29/2016					5.20	80.85

Table 2. Background and Operations Period Groundwater Levels – MW-A, MW-B, MW-C, and MW-D, OUC Stanton Energy Center

2019 Coal Combustion Residuals Annual Groundwater Monitoring and Corrective Action Report

DATE	Well	Florida State Plane East Zone (901)		Elevation TOC (feet, NAVD 88)	Depth to Water (feet)	Water Level Elevation (feet, NAVD 88)
		Northing (feet)	Easting (feet)			
10/31/2016	MW-B	1508750	596609.8	86.05	4.90	81.15
4/25/2017					7.25	78.80
10/31/2017					4.41	81.64
4/27/2018					6.17	79.88
10/30/2018					5.59	80.46
4/29/2019					5.74	80.31
10/31/2019					4.72	81.33
10/30/2015	MW-C	1509398	596841.6	86.84	6.22	80.62
4/29/2016					6.56	80.28
10/31/2016					6.14	80.70
4/25/2017					8.36	78.48
10/31/2017					5.67	81.17
4/27/2018					7.35	79.49
10/30/2018					6.90	79.94
4/29/2019					6.95	79.89
10/31/2019					5.94	80.90
10/30/2015	MW-D	1508237	597858.3	85.10	4.89	80.21
4/29/2016					5.58	79.52
10/31/2016					5.14	79.96
4/25/2017					7.44	77.66
10/31/2017					3.96	81.14
4/27/2018					5.79	79.31
10/30/2018					5.43	79.67
4/29/2019					5.65	79.45
10/31/2019					4.60	80.50

TOC – Top of casing

NAVD 88 – North American Vertical Datum of 1988

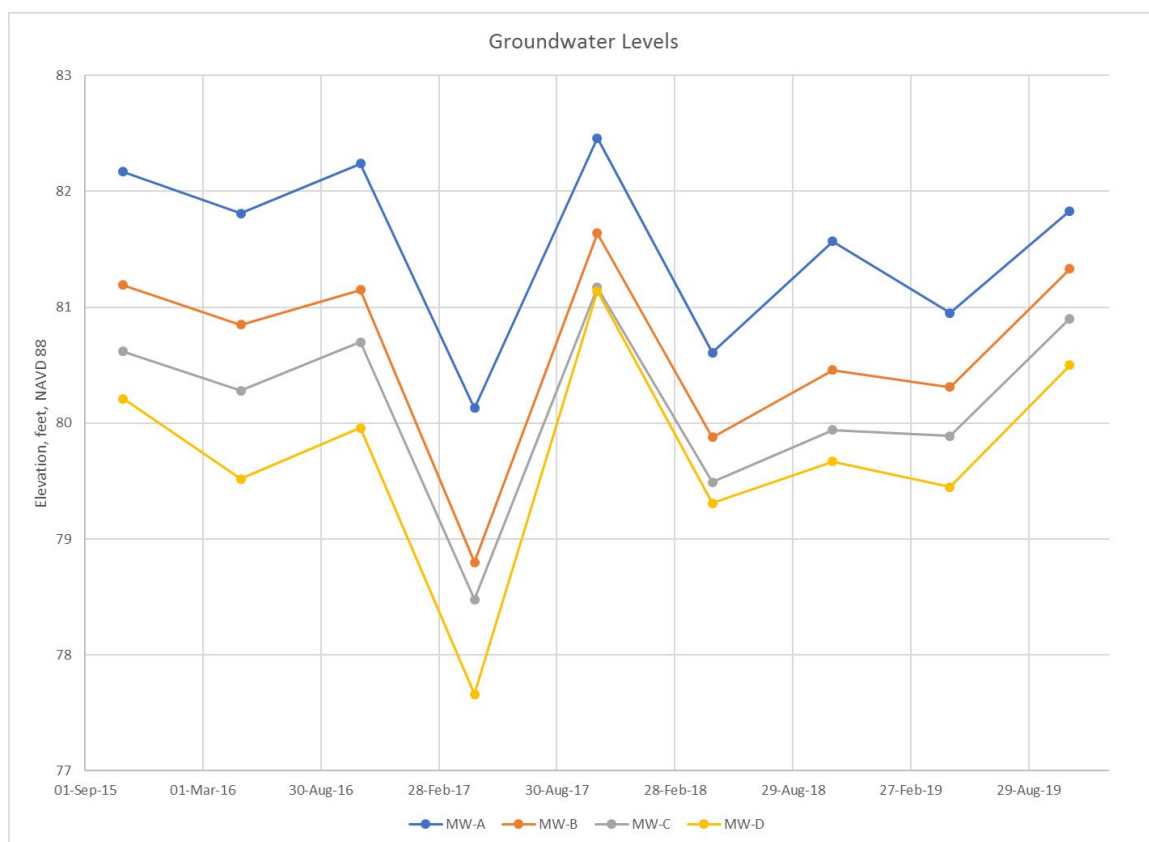


Figure 4. Quarterly Groundwater Levels

2019 Coal Combustion Residuals Annual Groundwater Monitoring and Corrective Action Report

Groundwater Sampling and Laboratory Analysis

The detection monitoring program began with establishing background groundwater quality conditions that consisted of collecting and analyzing quarterly samples between September 2015 and July 2017 for Appendix III and IV constituents. Sampling events to establish background water quality conditions were completed by October 17, 2017 in accordance with §257.94(b). MW-A is the background well and MW-B, MW-C, and MW-D are the three wells to monitor for compliance with the CCR.

Based on the October 2017 results, OUC resampled MW-B for calcium, chloride, pH (low), and TDS; and MW-D for calcium and chloride on January 25, 2018. The resampled data were evaluated against the October 30, 2017 background sample results to determine the next action. Two parameters were confirmed to be potential statistical significant increase (SSI), pH and total dissolved solids (TDS) in MW-B. The apparently confirmed well-constituent pairs identified for a SSI at well MW-B may not be a SSI due to lack of a sufficient quantity of background data. Until more data are collected a reliable test to detect the existence of a trend cannot be made and there are higher chances of making a false positive error.

Many of the parameters being monitored had trends noted during the CCR background period. In the past, the upper probability limits (UPL, and lower probability limit [LPL] for pH) were tested by modifying the baseline UPL/LPL with the trend parameter. This made the limits slope with time, and in some instances the limits approached zero - which is not feasible. Because it was difficult to see the change over time when both the observed data and probability limits both vary, for this annual report, the UPL/LPL were held constant and the observed data were adjusted by the trend parameters (that is, "detrended" by applying the slope parameter to the observed data as shown by example on the bottom of Table 3). Time series plots were created to show the change in the observations over time against a constant limit. These plots are discussed further in the next section.

Table 3. Detection Monitoring Parameters Tolerance Limits and Trend Parameters*2019 Coal Combustion Residuals Annual Groundwater Monitoring and Corrective Action Report*

Well	Constituent	UPL	LPL	Unit	Limit Trend Slope	Detrended
MW-B	Boron	41.2		ug/L	0.1064	Y
	Calcium	30000		ug/L	-37.26	Y
	Chloride	123000		ug/L	-127.1	Y
	Fluoride	230		ug/L		
	pH	4.55	3.87	pH Units	0.0008951	Y
	Sulfate	61300		ug/L		
	TDS	292000		ug/L	-195.8	Y
MW-C	Boron	31.1		ug/L		
	Calcium	8370		ug/L		
	Chloride	8550		ug/L	12.5	Y
	Fluoride	100		ug/L		
	pH	5.73	5.03	pH Units	-0.0004337	Y
	Sulfate	2370		ug/L		
	TDS	70800		ug/L		
MW-D	Boron	32.6		ug/L		
	Calcium	5730		ug/L	-3.194	Y
	Chloride	18000		ug/L	11.3	Y
	Fluoride	120		ug/L		
	pH	6.23	4.92	pH Units	-0.002029	Y
	Sulfate	330		ug/L		
	TDS	114000		ug/L		

UPL and LPL are the upper and lower probability limits. These are also referred to as the tolerance levels.

µg/L = micrograms per liter

“Detrended” means that the data need to be adjusted for the trend. The trend is applied to the days since the baseline period began (9/9/2015) to the observed data. The trend’s case is opposite when applied to the data; for example, boron March 28, 2019 adjustment is $-0.1064 \times 1296 \text{ days} = -138 \text{ ug/L}$. The detrended March boron value is $112 - 138 = -26 \text{ ug/L}$.

The 2019 semi-annual sampling results are shown in Table 3 (and Appendix A). The following results are noted:

- Based on the March 28, 2019 compliance monitoring sampling event, initial SSIs were identified at all 3 wells for up to 6 well-constituent pairs:
 - Well MW-B for calcium, chloride, and TDS. No retesting was done because the sampled concentrations were not high when compared to the baseline data and were outside of their limits because of the trend adjustment. When looking at the results over time, these trends need to be re-evaluated with additional data.
 - Well MW-C for calcium, chloride, fluoride, and TDS. Retesting was conducted for fluoride because of an interference in the lab sample. The retest indicated fluoride concentrations below the laboratory detection limit. After retesting, only TDS remained as an SSI.
 - Well MW-D for calcium, chloride, fluoride, pH, sulfate, and TDS. Retesting was conducted and fluoride concentrations were below laboratory detection limits. Calcium, chloride, sulfate, and TDS were above their upper probability limits. Also, pH was lower than the lower probability limit which was also part of a longer-term trend at the site that should be re-evaluated with additional data.
- Based on the September 17, 2019 compliance monitoring sampling event, initial SSIs were identified at all 3 wells for 10 well-constituent pairs:
 - Well MW-B for calcium, chloride, pH, and TDS
 - Well MW-C for calcium, pH, and TDS

- Well MW-D for calcium, chloride, and pH. TDS concentrations were unusually low compared to historic levels, so it was retested to verify. Retests were conducted on calcium, chloride, and TDS and high values in excess of their upper probability limits were verified for calcium and TDS.

Table 3. Summary of 2019 Annual Data Detection Monitoring Results

2019 Coal Combustion Residuals Annual Groundwater Monitoring and Corrective Action Report

Well	Constituents	Units	LPL	UPL	Trend	First Semi-Annual Sampling Event on 3/28/2019					Second Semi-Annual Sampling Event on 9/17/2019				
						Observed Value	Detrended Observed Value	Retest Values	Detrended Retest Value	Potential SSI	Observed Value	Detrended Observed Value	Retest Values	Detrended Retest Value	Potential SSI
MW-B	Boron	µg/L		41.2	Yes	112	-26			No	97.8	-59			No
	Calcium	µg/L		30000	Yes	4310	52599	X		Yes	11100	65850	X		Yes
	Chloride	µg/L		123000	Yes	17700	182422	X		Yes	47500	234261	X		Yes
	Fluoride	µg/L		230	No	200				No	100				No
	pH	pH Units	3.87	4.55	Yes	4.36	3.20			No	4.41	3.09	X		Yes
	Sulfate	µg/L		61300	No	45400				No	45000				No
	TDS	µg/L		292000	Yes	116000	369757	X		Yes	182000	469709	X		Yes
MW-C	Boron	µg/L		31.1	No	20				No	20				No
	Calcium	µg/L		8370	No	8460		8010		No	11100		X		Yes
	Chloride	µg/L		8550	Yes	22700	6500			No	21400	3033			No
	Fluoride	µg/L		100	No	80		100		No	70				No
	pH	pH Units	5.03	5.73	Yes	4.93	5.49			No	5.32	5.96	X		Yes
	Sulfate	µg/L		2370	No	2380		270		No	180				No
	TDS	µg/L		70800	No	85000		X		Yes	86000		X		Yes
MW-D	Boron	µg/L		32.6	No	20				No	20				No
	Calcium	µg/L		5730	Yes	9670	13809	32600	37163	Yes	7930	12623	56800	61652	Yes
	Chloride	µg/L		18000	Yes	55400	40755	111000	94858	Yes	21800	5195	185000	167835	No
	Fluoride	µg/L		120	No	40		100		No	60				No
	pH	pH Units	4.92	6.23	Yes	4.56	7.19	X		Yes	5	7.98	X		Yes
	Sulfate	µg/L		330	No	1000		650		Yes	260				No
	TDS	µg/L		114000	No	153000		338000		Yes	74000		476000		No

X- indicates potential retest candidates

Numbers in red indicates where retest was required

SSI = statistically significant increase

Data Discussion

Considering the original baseline date and the 2017 through 2019 data, the original trends estimated on the smaller background dataset seemed to be inaccurate for some constituents: MW-B boron, MW-B pH, MW-D pH, and MW-B sulfate. Figure 5 shows the detrended data over time. Since these few parameters have consistent trends, it is possible that their original analysis was not representative. For accurate trends, the time series plots of the detrended data should be relatively flat, like it is for MW-C pH. MW-B sulfate had no trend in the original analysis, but it appears to be trending given the larger dataset. Once the data set contains about 20 samples, the trend analysis should be re-conducted and, if found significant, it should be considered while determining the background levels.

For other data, the time series plot indicated that there could have been a change occurring around 2017. The chlorides, calcium, and TDS concentrations started to raise in mid-2017 in MW-B and MW-D by 2018 (Figure 6). This change in trend has continued and is raising at similar rates. This indicates that there is a potential new source of these inorganic minerals.

Potential Alternative Sources Review

MW-B and MW-D are not close to the new, double-lined CCR landfill subject to this regulation. MW-B is about 3,125 linear feet and MW-D is about 2,600 linear feet from the new landfill. The rise in calcium, chloride, and TDS concentrations measured in these monitoring wells started in mid-2017, approximately 780 days from the initiation of storing material in the new landfill. The calculated groundwater flow rate in the western part of the site is approximately 5 feet per year under the prevailing gradient. The groundwater travel time from the northern edge of active cell of the new landfill to either monitoring well is expected to be several hundred years.

MW-B is closer to the western boundary of the property than MW-D and the water level elevation in MW-B is consistently about 1-foot higher than the elevation in MW-D (Table 2 and Figure 4). Since MW-B chlorides, calcium, and TDS concentrations appeared to rise sooner than at MW-D, it is possible that there is an influence entering offsite from the west. MW-D is not directly downgradient of MW-B. MW-C is much closer to MW-B and is downgradient, yet it is not experiencing a similar rise in calcium, chlorides, or TDS (a slight rise, but not as much). As discussed in the 2018 Annual Report, there is also limerock stored near MW-D which could be a source of the type of constituents observed rising.

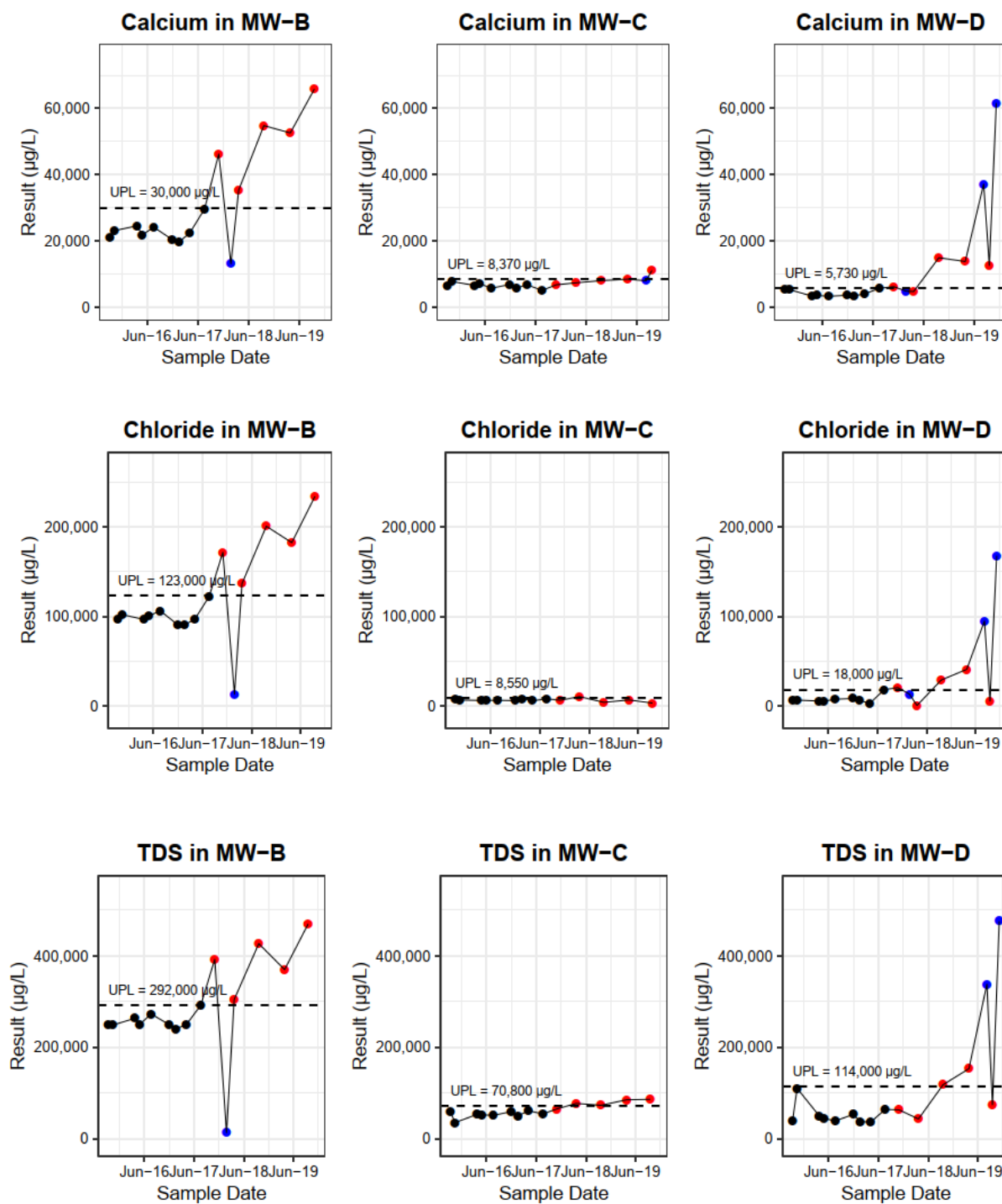
A review of the SEC site indicated that OUC began storing limerock near MW-D during 2015 (Figure 7), shortly after the monitoring wells were established. The position of the northwest corner of the pile was approximately 185 feet southeast of MW-D in 2016. The size of the limerock stockpiling operation has increased from 2016 to 2018 (Figure 8). In December 2018, the northwest corner of the pile was located approximately 85 feet southeast of MW-D. Stormwater runoff from the stockpile tends to pond in the fields near the wells and could contribute to the groundwater quality monitored in MW-D. The potential impact from this source should have increased concentrations in MW-D before MW-B and perhaps at a greater magnitude. So, it is not clear if the limerock is the sole source. However, given the type of minerals that increased, the limerock is highly likely to have contributed to some impact.

Furthermore, this alternative potential source of calcium, chloride, and TDS does not represent the potential effects of CCR management. The limerock is used to stabilize roads at the site. The possible mechanism for the limerock pile to impact groundwater quality at MW-D and MW-B is stormwater runoff from the stockpile to the surrounding area, overland flow in the field north of the pile, and infiltration of the runoff near MW-D and MW-B. Standing water was routinely observed in the field to the north of the main stockpile after rain events. Overland flow travel times for water are significantly less than groundwater travel times. The closeness of the limerock pile to MW-D, observation of standing water in the field north of the limerock pile, and the long groundwater travel time from the new landfill

to MW-D strongly indicates that the alternate source of the groundwater concentration increases at MW-D is the limerock pile.

In December 2019, OUC began to relocate the limerock stockpile to the top of the closed landfill, over-excavate the base of the pile area to native soil, and restore the site with clean fill and sod as the alternate source remedy. With this change the groundwater quality data at MW-D and MW-B should be monitored for positive changes in response to the removal of the limerock pile and restoration of the site. It may take some time (1 to 2 years) to see a significant change in the groundwater concentrations, depending on the rainfall volumes.

Figure 5. Candidate Well-Constituent Pairs that are Candidates Additional Analysis for Trend
2019 Coal Combustion Residuals Annual Groundwater Monitoring and Corrective Action Report



Black dots are background data; red dots are detection data; blue dots are resampled data

Figure 6. Candidate Well-Constituent Pairs that are Candidates Additional Analysis for Alternative Sources
2019 Coal Combustion Residuals Annual Groundwater Monitoring and Corrective Action Report



Figure 7. Location of Limerock Stockpile Relative to MW-D in 2016
2019 Coal Combustion Residuals Annual Groundwater Monitoring and Corrective Action Report



Figure 8. Location of Limerock Stockpile Relative to MW-D in 2018
2019 Coal Combustion Residuals Annual Groundwater Monitoring and Corrective Action Report

Conclusion

The general purpose of the 2019 annual report is to document the results of the CCR detection monitoring conducted at OUC SEC. The results indicated that analyses of several parameter fell outside the expected statistical significance interval based on the original background analysis of the CCR data. None of these values exceed or constitute a violation of groundwater standards levels. These statistically significant increases are derived from a comparison of the results to a statistical analysis of a limited number of background readings.

If an SSI is verified using the detection monitoring program, the site assessment monitoring program must be initiated for all monitoring wells within 90 days and continue at semiannual frequency. Alternately, the owner of the facility must demonstrate that a source other than the CCR unit is responsible for the increase. A review of the site conditions indicates that the limerock pile contributes to concentration increases in MW-D. . Based on the review of the data against projected trends, potential sources of constituents from surrounding land uses, and the principal component analysis (PCA) conducted in 2018, it is concluded that SSIs of constituents are not verified to be from the CCR and it is not appropriate to proceed to assessment monitoring.

The limerock pile located near MW-D is in the process of being removed and land restored. The concentrations of calcium, chlorides and TDS concentrations will continue to be monitored to determine if the removal of the limerock pile has an effect on these concentrations.. When additional data are available (about another 2 years), the trend analysis will be repeated to evaluate the trends estimates made with the limited data and to evaluate positive changes from the limerock removal. Continuation of the detection monitoring program is appropriate.

References

For detailed discussions of multivariate statistical methods and underlying mathematical theory, the reader is referred to the books by Jolliffe (1986) and Johnson and Wichern (2007).

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Appendix A Laboratory Analysis Results

OUC Stanton CCR Monitoring Well Results, 2019								
Location ID	Sample Date	Parameter Name	MCL	Final Result Text	Final Result Units	Final Reporting Limit	Final Detection Limit	Qualifier Flag
MW-B	3/28/2019	Boron	none	112	µg/L	50	50	
MW-B	9/17/2019	Boron	none	97.8	µg/L	50	20	
MW-B	3/28/2019	Calcium	none	4310	µg/L	500	500	
MW-B	9/17/2019	Calcium	none	11100	µg/L	500	39	
MW-B	3/28/2019	Chloride	250000	17700	µg/L	10000	10000	
MW-B	9/17/2019	Chloride	250000	47500	µg/L	5000	950	
MW-B	3/28/2019	Field pH	none	4.36	µg/L			
MW-B	9/17/2019	Field pH	none	4.41	pH Units			
MW-B	3/28/2019	Fluoride	4000	200 U	µg/L	1000	1000	U
MW-B	9/17/2019	Fluoride	4000	100 U	µg/L	500	100	U
MW-B	3/28/2019	Sulfate	250000	45400	µg/L	3900	3900	
MW-B	9/17/2019	Sulfate	250000	45000	µg/L	1950	650	
MW-B	3/28/2019	Total Dissolved Solids	500000	116000	µg/L	5000	5000	
MW-B	9/17/2019	Total Dissolved Solids	500000	182000	µg/L	5000	5000	
MW-C	3/28/2019	Boron	none	20 U	µg/L	50	50	U
MW-C	9/17/2019	Boron	none	20 U	µg/L	50	20	U
MW-C	3/28/2019	Calcium	none	8460	µg/L	500		
MW-C	8/7/2019	Calcium	none	8010	µg/L	500	100	
MW-C	9/17/2019	Calcium	none	11100	µg/L	500	39	
MW-C	3/28/2019	Chloride	250000	22700	µg/L	1000	1000	
MW-C	9/17/2019	Chloride	250000	21400	µg/L	1000	190	
MW-C	3/28/2019	Field pH	none	4.93	µg/L			
MW-C	9/17/2019	Field pH	none	5.32	pH Units			
MW-C	3/28/2019	Fluoride	4000	80 I	µg/L	100	100	I
MW-C	8/7/2019	Fluoride	4000	100	µg/L	100	20	
MW-C	9/17/2019	Fluoride	4000	70	µg/L	100	20	I
MW-C	3/28/2019	Sulfate	250000	2380	µg/L	390	390	
MW-C	8/7/2019	Sulfate	250000	270	µg/L	390	130	I
MW-C	9/17/2019	Sulfate	250000	180	µg/L	390	130	I
MW-C	3/28/2019	Total Dissolved Solids	500000	85000	µg/L	5000	5000	
MW-C	9/17/2019	Total Dissolved Solids	500000	86000	µg/L	5000	5000	
MW-D	3/28/2019	Boron	none	20 U	µg/L	50	50	
MW-D	9/17/2019	Boron	none	20 U	µg/L	50	20	U
MW-D	3/28/2019	Calcium	none	9670	µg/L	500	500	
MW-D	8/7/2019	Calcium	none	32600	µg/L	500	100	
MW-D	9/17/2019	Calcium	none	7930	µg/L	500	39	
MW-D	3/28/2019	Chloride	250000	555400	µg/L	2000	2000	

OUC Stanton CCR Monitoring Well Results, 2019								
Location ID	Sample Date	Parameter Name	MCL	Final Result Text	Final Result Units	Final Reporting Limit	Final Detection Limit	Qualifier Flag
MW-D	8/7/2019	Chloride	250000	111000	µg/L	5000	950	
MW-D	9/17/2019	Chloride	250000	21800	µg/L	2000	380	
MW-D	3/28/2019	Field pH	none	4.56	µg/L			
MW-D	9/17/2019	Field pH	none	5	pH Units			
MW-D	3/28/2019	Fluoride	4000	40 I	µg/L	100	100	I
MW-D	8/7/2019	Fluoride	4000	100 U	µg/L	500	100	U
MW-D	9/17/2019	Fluoride	4000	60	µg/L	200	40	I
MW-D	3/28/2019	Sulfate	250000	1000	µg/L	390	390	
MW-D	8/7/2019	Sulfate	250000	650 U	µg/L	1950	650	U
MW-D	9/17/2019	Sulfate	250000	260 U	µg/L	780	260	U
MW-D	3/28/2019	Total Dissolved Solids	500000	153000	µg/L	5000	5000	
MW-D	8/7/2019	Total Dissolved Solids	500000	338000	µg/L	5000	5000	
MW-D	9/17/2019	Total Dissolved Solids	500000	74000	µg/L	5000	5000	
MW-D	11/6/2019	Total Dissolved Solids	500000	476000	µg/L	5000	5000	
MW-D	11/6/2019	Chloride	250000	185000	µg/L	1900	1900	
MW-D	11/6/2019	Calcium	none	56800	µg/L	160	160	

Flags: U = Results below method detection limit; I = The reported value is greater than or equal to the laboratory method detection limit but less than the laboratory practical quantitation limit.