MARCH 2020

On-Post
Quarterly Groundwater Monitoring Report

Prepared For

Department of the Army
Camp Stanley Storage Activity
Boerne, Texas

May 2020

EXECUTIVE SUMMARY

- Groundwater samples were collected from 4 on-post drinking water wells scheduled for sampling at Camp Stanley Storage Activity (CSSA) in March 2020.
- CSSA experienced below average rainfall during the first quarter of 2020 but the aquifer experienced a slight increase from December 2019 to March 2020. This could possibly be due to the 0.42 inches of rain that fell 2 days prior to post wide water levels being collected on March 6th. The CSSA weather station (WS) at AOC-65 recorded 5.07 inches of rainfall from January to March. The average rainfall for the Boerne area from January to March is 7.36 inches.
- At CSSA, the Middle Trinity aquifers' average groundwater elevation in March 2020 increased 2.43 feet from the elevations measured in December 2019. The average depth to water in the wells was 249.22 feet below top of casing (BTOC) or 993.45 feet above mean sea level (MSL). As such, the Trinity-Glen Rose Groundwater Conservation District (TGRGCD) remained in 'year-round' conservation measures. For the adjacent Edwards aquifer, the San Antonio Water System (SAWS) has also remained in 'year-round' water restrictions implemented October 2, 2018.
- The maximum contaminant level (MCL) for VOCs was not exceeded in any wells sampled in March 2020.
- No wells sampled had metal detections above their corresponding MCL, action level (AL), or secondary standard (SS) in March 2020.
- No Westbay Well zones were scheduled for sampling in March 2020. However, these wells were profiled to capture water level data for the area.
- All samples collected in March 2020 were in accordance with the 2015 long term monitoring optimization (LTMO) report that has been approved by the TCEQ and USEPA.

GEOSCIENTIST CERTIFICATION

MARCH 2020 ON-POST QUARTERLY GROUNDWATER MONITORING REPORT

FOR

DEPARTMENT OF THE ARMY
CAMP STANLEY STORAGE ACTIVITY
BOERNE, TEXAS

I, Adrien Lindley, Professional Geologist (P.G.), hereby certify that the March 2020 On-Post Quarterly Groundwater Monitoring Report for the Camp Stanley Storage Activity installation in Boerne, Texas accurately represents the site conditions of the subject area. This certification is limited only to geoscientific products contained in the subject report and is made on the basis of written and oral information provided by the CSSA Environmental Office, laboratory data provided by APPL Laboratories, and field data obtained during groundwater monitoring conducted at the site in March 2020 and is true and accurate to the best of my knowledge and belief.

Adrien Lindley, P.G.
State of Texas
Geology License No. 10487

6/11/2020
Date

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ACRONYMS AND ABBREVIATIONS

µg/L	microgram per liter
§3008(h) Order	RCRA 3008(h) Administrative Order on Consent
AL	Action Level
AOC	Area of Concern
APPL	Agriculture and Priority Pollutants Laboratories, Inc.
BS	Bexar Shale
BTOC	below top of casing
CC	Cow Creek
cis-1,2-DCE	*cis*-1,2-Dichloroethene
COC	constituents of concern
CSSA	Camp Stanley Storage Activity
DQO	Data Quality Objectives
HSP	Health and Safety Plan
ISCO	In-Situ Chemical Oxidation
LGR	Lower Glen Rose
LTMO	Long-Term Monitoring Optimization
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MSL	mean sea level
NA	Not Available
PCE	Tetrachloroethene
P.G.	Professional Geologist
Parsons	Parsons Government Services, Inc.
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RL	Reporting Limit
SAP	Sampling and Analysis Plan
SAWS	San Antonio Water System
SS	Secondary Standard
SWMU	Solid Waste Management Units
TCE	Trichloroethene
TCEQ	Texas Commission on Environmental Quality
TGRGCD	Trinity-Glen Rose Groundwater Conservation District
UGR	Upper Glen Rose
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WS	Weather Station

MARCH 2020
GROUNDWATER MONITORING REPORT
CAMP STANLEY STORAGE ACTIVITY, TEXAS

1.0 INTRODUCTION

This report presents results from the on-post quarterly sampling performed at Camp Stanley Storage Activity (CSSA) in March 2020. Laboratory analytical results are presented along with potentiometric contour maps. Results from all four 2020 quarterly monitoring events (March, June, September, and December) will be described in detail in the 2020 Annual Report. The Annual Report will also provide an interpretation of all analytical results and an evaluation of any temporal or spatial trends observed in the groundwater contaminant plume during investigations. For this specific quarter, groundwater monitoring was performed March 6^{th} through 11^{th}, 2020 by Parsons Government Services, Inc. (Parsons).

Current objectives of the groundwater monitoring program are to determine groundwater flow direction and elevations, determine groundwater contaminant concentrations for characterization purposes, and identify meteorological and seasonal variations in physical and chemical properties. **Appendix A** identifies the data quality objectives (DQOs) for CSSA's groundwater monitoring program, along with an evaluation of whether each DQO was attained. The objectives listed in **Appendix A** also reference appropriate sections of the Resource Conservation and Recovery Act (RCRA) **§3008(h) Administrative Order on Consent** [§3008(h) Order].

The CSSA groundwater monitoring program follows the provisions of the groundwater monitoring program DQOs as well as the recommendations of the **Three-Tiered Long Term Monitoring Network Optimization (LTMO) Evaluation (Parsons, 2015)** which provided recommendations for sampling based on an LTMO study performed for the CSSA groundwater monitoring program. The LTMO evaluation was updated in 2015 using groundwater data from monitoring conducted between 2010 and 2015. The proposed LTMO changes/updates were approved by the TCEQ and USEPA April 22 and May 5, 2016, respectively. These changes were briefed to the public in the 2016 Annual Fact Sheet. The updated LTMO study sampling frequencies were implemented in December 2016. The groundwater program is currently drafting a subsequent update to the LTMO based on data collected from 2015 to 2019.

2.0 POST-WIDE FLOW DIRECTION AND GRADIENT

Due to below average rainfall in 2019 the aquifer levels sustained a net loss of 136.22 feet in average water level elevation beneath CSSA and decreased to 33.67 feet below the 15-year average (2005-2019). In the first quarter of 2020 the rainfall recorded was below average, 5.07 inches at the AOC-65 WS. The average rainfall for January through March for the Boerne area is 7.36 inches. However, the aquifer sustained a net gain of 2.43 inches. This could be explained by the 0.41 inches of rain that fell on March 4th, two days prior to the collection of post-wide water levels on March 6th. The San Antonio Water System (SAWS) restrictions remain in 'year-round watering' since October 2, 2018 and the Trinity-Glen Rose Groundwater Conservation District (TGRGCD) also remained in 'year-round' watering restrictions.

The 30-year precipitation normal for the San Antonio area for the three-month period of January through March is 6.15 inches of rainfall. Over the 3-month period of record, the AOC-65 weather station at CSSA, recorded 5.07 inches of rainfall (2.19 inches in January, 1.32 inches in February, and 1.56 inches in March). The B-3 WS did not record a complete set of data due to clogging of the rain bucket. Of the 28 rain events at the AOC-65 WS during this timeframe, no events had a daily rainfall total in excess of 1 inch.

Fifty-six water level measurements were recorded on March 6, 2020 from on- and off-post monitoring wells completed in the Lower Glen Rose (LGR), Bexar Shale (BS), and Cow Creek (CC) formational members of the Middle Trinity Aquifer (**Tables 2.1 and 2.2**). The groundwater potentiometric surface maps illustrating groundwater elevations from the LGR, BS, and CC zones in March 2020 are shown in **Figures 2.1, 2.2, and 2.3**, respectively.

The March 2020 potentiometric surface map for LGR-screened wells (**Figure 2.1**) exhibits a wide range of groundwater elevations, from a minimum of 937.21 feet above mean sea level (MSL) at B3-EXW01 to a maximum of 1034.20 feet above MSL at CS-MWG-LGR. Groundwater elevations are generally higher in the northern and central portions of CSSA and decrease to the southeast. As measured in all non-pumping wells, the average groundwater elevation measured in March 2020 was 993.45 feet above MSL. This is 33.25 feet below the 15-year average LGR groundwater elevation for the area (1026.79 feet) (**Figure 2.4**). Also shown in that figure is the 3-month precipitation total (4.46 inches) recorded at the San Antonio International Airport weather station (KSAT) and the resultant aquifer response. In March, an average decrease in LGR groundwater elevation of 0.66 feet was observed within CSSA LGR monitoring wells from the previous quarter.

Well CS-MW4-LGR, located in the central portion of CSSA, typically has one of the highest groundwater elevations of LGR-screened wells. During average and above-average aquifer elevations, the groundwater level is 20 to 30 feet higher than the nearest comparable wells (CS-MW2-LGR and CS-MW5-LGR), creating a pronounced groundwater mound in the central portion of the facility. Long-term monitoring has ascertained that when groundwater near CS-MW4-LGR rises above about 970 feet MSL, the mounding effect is evident. In September 2019, mounding was observed as the groundwater elevation at CS-MW4-LGR (1,031.26 feet MSL) was 41 feet higher than at CS-MW2-LGR (989.88 feet MSL), and 44 feet higher than CS-MW5-LGR (987.19 feet MSL).

Table 2.1
Measured Groundwater Elevation
March 2020

Well ID:	TOC elevation (ft MSL)	Depth to Groundwater (ft BTOC)	Groundwater Elevation (ft MSL)	Formations Screened LGR	BS	CC	Date
CS-1	1169.27	204.17	965.10		ALL		3/6/2020
CS-2	**1237.59**	**256.29**	981.30	X	?		3/6/2020
CS-3	1240.17	254.92	985.25	X			3/6/2020
CS-4	1229.28	244.97	984.31	X			3/6/2020
CS-10	**1331.51**	**355.70**	975.81		ALL		3/6/2020
CS-12	**1274.09**	**265.50**	1008.59		ALL		3/6/2020
CS-13	**1193.26**	**228.96**	964.30		ALL		3/6/2020
CS-D	1236.03	252.62	983.41	X			3/6/2020
CS-MWG-LGR	1328.14	293.94	1034.20	X			3/6/2020
CS-MWH-LGR	1319.19	288.62	1030.57	X			3/6/2020
CS-I	1315.20	293.73	1021.47	X			3/6/2020
CS-MW1-LGR	1220.73	231.29	989.44	X			3/6/2020
CS-MW1-BS	1221.09	230.38	990.71		X		3/6/2020
CS-MW1-CC	1221.39	229.90	991.49			X	3/6/2020
CS-MW2-LGR	1237.08	247.20	989.88	X			3/6/2020
CS-MW2-CC	1240.11	247.57	992.54			X	3/6/2020
CS-MW3-LGR	1334.14	344.40	989.74	X			3/6/2020
CS-MW4-LGR	1209.71	178.45	1031.26	X			3/6/2020
CS-MW5-LGR	1340.24	353.05	987.19	X			3/6/2020
CS-MW6-LGR	1232.25	228.85	1003.40	X			3/6/2020
CS-MW6-BS	1232.67	242.85	989.82		X		3/6/2020
CS-MW6-CC	1233.21	244.62	988.59			X	3/6/2020
CS-MW7-LGR	1202.27	209.97	992.30	X			3/6/2020
CS-MW7-CC	1201.84	217.76	984.08			X	3/6/2020
CS-MW8-LGR	1208.35	208.15	1000.20	X			3/6/2020
CS-MW8-CC	1206.13	220.80	985.33			X	3/6/2020
CS-MW9-LGR	1257.27	265.00	992.27	X			3/6/2020
CS-MW9-BS	1256.73	260.25	996.48		X		3/6/2020
CS-MW9-CC	1255.95	252.72	1003.23			X	3/6/2020
CS-MW10-LGR	1189.53	210.89	978.64	X			3/6/2020
CS-MW10-CC	1190.04	217.08	972.96			X	3/6/2020
CS-MW11A-LGR	1204.03	224.12	979.91	X			3/6/2020
CS-MW11B-LGR	1203.52	203.25	1000.27	X			3/6/2020
CS-MW12-LGR	1259.07	273.20	985.87	X			3/6/2020
CS-MW12-BS	1258.37	262.56	995.81		X		3/6/2020
CS-MW12-CC	1257.31	259.05	998.26			X	3/6/2020
CS-MW16-LGR	1244.60	260.49	984.11	X			3/6/2020
CS-MW16-CC*	1244.51	333.77	910.74			X	3/6/2020
B3-EXW01*	1245.26	308.05	937.21	X			3/6/2020
B3-EXW02*	1249.66	298.10	951.56	X			3/6/2020
B3-EXW03*	1235.11	266.48	968.63	X			3/6/2020
B3-EXW04	1228.46	241.47	986.99	X			3/6/2020
B3-EXW05	1279.46	296.38	983.08	X			3/6/2020
CS-MW17-LGR	1257.01	275.20	981.81	X			3/6/2020
CS-MW18-LGR	1283.61	301.15	982.46	X			3/6/2020
CS-MW19-LGR	1255.53	265.20	990.33	X			3/6/2020
CS-MW20-LGR	1209.42	215.58	993.84	X			3/6/2020
CS-MW21-LGR	1184.53	202.10	982.43	X			3/6/2020
CS-MW22-LGR	1280.49	302.65	977.84	X			3/6/2020
CS-MW23-LGR	1258.20	270.49	987.71	X			3/6/2020
CS-MW24-LGR	1253.90	269.34	984.56	X			3/6/2020
CS-MW25-LGR	1293.01	300.05	992.96	X			3/6/2020
CS-MW35-LGR	1186.97	208.28	978.69	X			3/6/2020
CS-MW36-LGR	1218.74	216.16	1002.58	X			3/6/2020
CS-MW37-LGR	1205.83	220.32	985.51	X			3/6/2020
FO-20	1327.00	264.51	1062.49		ALL		3/6/2020
Number of wells screened in each formation.				**38**	**4**	**9**	
Average groundwater elevation in each formation given in feet (non pumping wells).				**992.63**	**993.21**	**989.56**	

Notes:

Bold wells: CS-2, CS-10, CS-12, CS-13, and FO-20 are open boreholes across more than one formational unit.

? = Exact screening information unknown for this well.

Shaded wells are routinely pumped for either domestic, livestock, or environmental remediation purposes, and therefore are not used in calculating statistics.

CS-1, CS-10, CS-12, and CS-13 are current active drinking water wells.

CS-MW16-LGR, CS-MW16-CC, B3-EXW01 through B3-EXW05 pumps are cycling continuously to feed the B-3 Bioreactor.

* = submersible pump running at time of water level measurement.

Formational average groundwater elevation is calculated from non-pumping wells screened in only one formation.

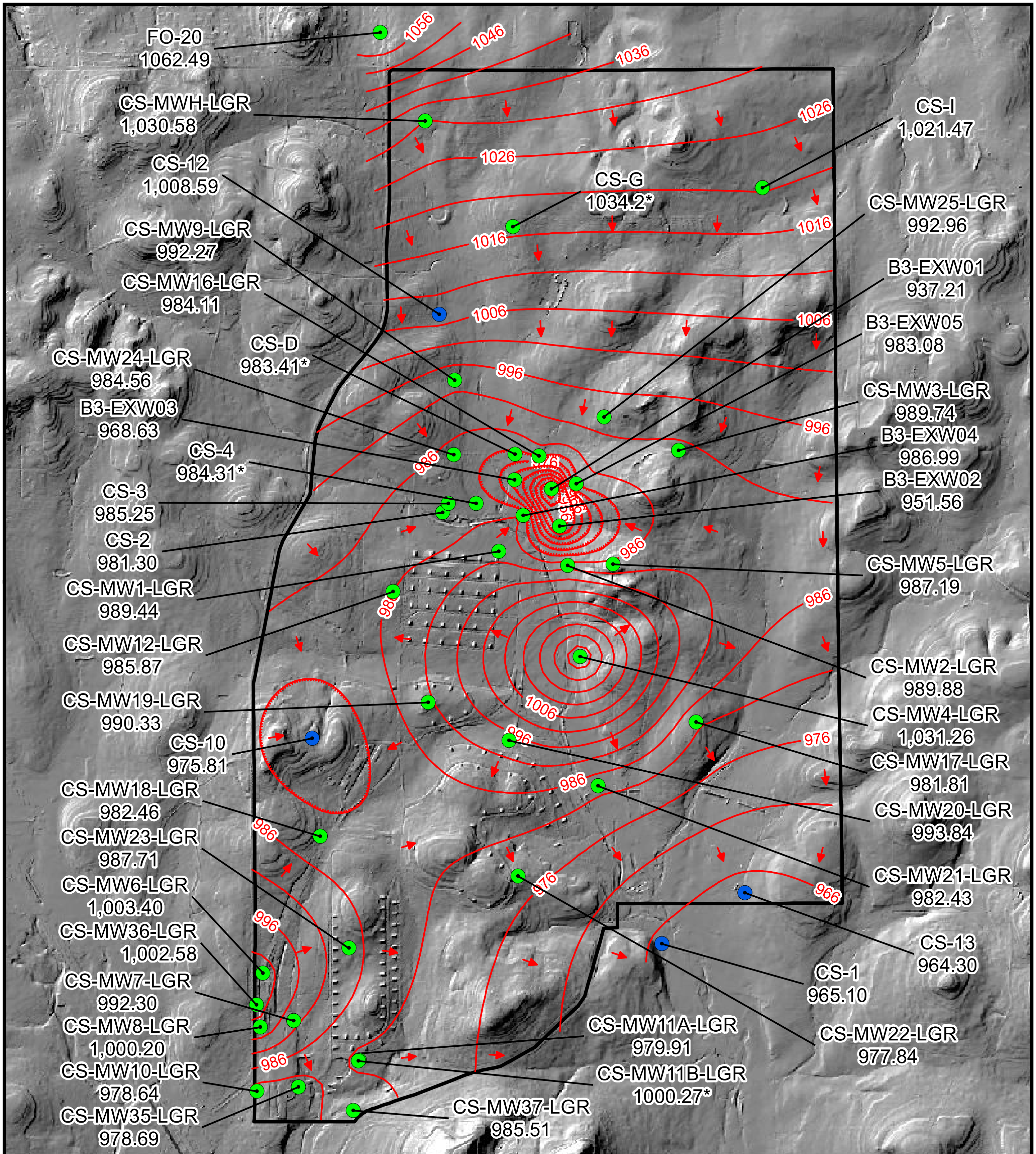
All measurements given in feet.

NA = Data not available

Table 2.2
Change in Groundwater Elevation from Previous Quarter
March 2020

Well ID	Dec. 2019 Elevations	Mar. 2020 Elevations	GW elevation change (Mar. minus Dec.)	Formations Screened LGR	BS	CC
CS-1*	927.41	965.10	37.69	ALL		
CS-2	981.41	981.30	-0.11	X	?	
CS-3	986.21	985.25	-0.96	X		
CS-4	985.00	984.31	-0.69	X		
CS-10	985.03	975.81	-9.22	ALL		
CS-12	1007.98	1008.59	0.61	ALL		
CS-13	970.67	964.30	-6.37	ALL		
CS-D	986.00	983.41	-2.59	X		
CS-MWG-LGR	1035.74	1034.20	-1.54	X		
CS-MWH-LGR	1029.43	1030.57	1.14	X		
CS-I	1026.22	1021.47	-4.75	X		
CS-MW1-LGR	991.25	989.44	-1.81	X		
CS-MW1-BS	1004.24	990.71	-13.53		X	
CS-MW1-CC	1003.21	991.49	-11.72			X
CS-MW2-LGR	996.97	989.88	-7.09	X		
CS-MW2-CC	1006.88	992.54	-14.34			X
CS-MW3-LGR	993.57	989.74	-3.83	X		
CS-MW4-LGR	1029.15	1031.26	2.11	X		
CS-MW5-LGR	996.02	987.19	-8.83	X		
CS-MW6-LGR	996.87	1003.40	6.53	X		
CS-MW6-BS	996.71	989.82	-6.89		X	
CS-MW6-CC	995.94	988.59	-7.35			X
CS-MW7-LGR	989.16	992.30	3.14	X		
CS-MW7-CC	989.53	984.08	-5.45			X
CS-MW8-LGR	995.06	1000.20	5.14	X		
CS-MW8-CC	991.25	985.33	-5.92			X
CS-MW9-LGR	989.74	992.27	2.53	X		
CS-MW9-BS	997.53	996.48	-1.05		X	
CS-MW9-CC	1006.50	1003.23	-3.27			X
CS-MW10-LGR	975.48	978.64	3.16	X		
CS-MW10-CC	969.83	972.96	3.13			X
CS-MW11A-LGR	980.40	979.91	-0.49	X		
CS-MW11B-LGR	NA	1000.27	NA	X		
CS-MW12-LGR	987.99	985.87	-2.12	X		
CS-MW12-BS	1008.62	995.81	-12.81		X	
CS-MW12-CC	1004.79	998.26	-6.53			X
CS-MW16-LGR	987.62	984.11	-3.51	X		
CS-MW16-CC*	920.03	910.74	-9.29			X
B3-EXW01*	988.75	937.21	-51.54	X		
B3-EXW02*	993.26	951.56	-41.70	X		
B3-EXW03*	982.66	968.63	-14.03	X		
B3-EXW04	988.43	986.99	-1.44	X		
B3-EXW05	990.79	983.08	-7.71	X		
CS-MW17-LGR	987.26	981.81	-5.45	X		
CS-MW18-LGR	983.88	982.46	-1.42	X		
CS-MW19-LGR	993.32	990.33	-2.99	X		
CS-MW20-LGR	997.82	993.84	-3.98	X		
CS-MW21-LGR	987.92	982.43	-5.49	X		
CS-MW22-LGR	983.14	977.84	-5.30	X		
CS-MW23-LGR	986.08	987.71	1.63	X		
CS-MW24-LGR	985.21	984.56	-0.65	X		
CS-MW25-LGR	994.19	992.96	-1.23	X		
CS-MW35-LGR	976.01	978.69	2.68	X		
CS-MW36-LGR	996.08	1002.58	6.50	X		
CS-MW37-LGR	983.03	985.51	2.48	X		
FO-20	**1059.30**	**1062.49**	**3.19**	ALL		
Average groundwater elevation change (all wells minus pumping wells)			**-2.43**			
Average groundwater elevation change in each formation (non pumping wells)				**-0.65**	**-8.57**	**-6.43**

Notes:
Bold wells: CS-2, CS-10, CS-12, CS-13, and FO-20 are open boreholes across more than one formational unit.
? = Exact screening information unknown for this well.
Shaded wells are routinely pumped for either domestic, livestock, or environmental remediation purposes, and therefore are not used in calculating statistics.
CS-1, CS-10, CS-12, and CS-13 are current active drinking water wells.
CS-MW16-LGR, CS-MW16-CC, B3-EXW01 through B3-EXW05 pumps are cycling continuously to feed the B-3 Bioreactor.
* = submersible pump running at time of water level measurement.
Formational average groundwater elevation change is calculated from non-pumping wells screened in only one formation.
All measurements given in feet.
NA = Data not available



Flow direction

Outer fence

LGR Groundwater Contours

LGR Wells and groundwater elevation (ft above msl)

Drinking water wells (may be completed in LGR, BS, and/or CC)

N

0 0.5 Miles

* Not a fully penetrating well into LGR. Groundwater elevation not used in contouring

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Figure 2.1

March 2020 Potentiometric Surface Map, LGR Wells

Camp Stanley Storage Activity

PARSONS

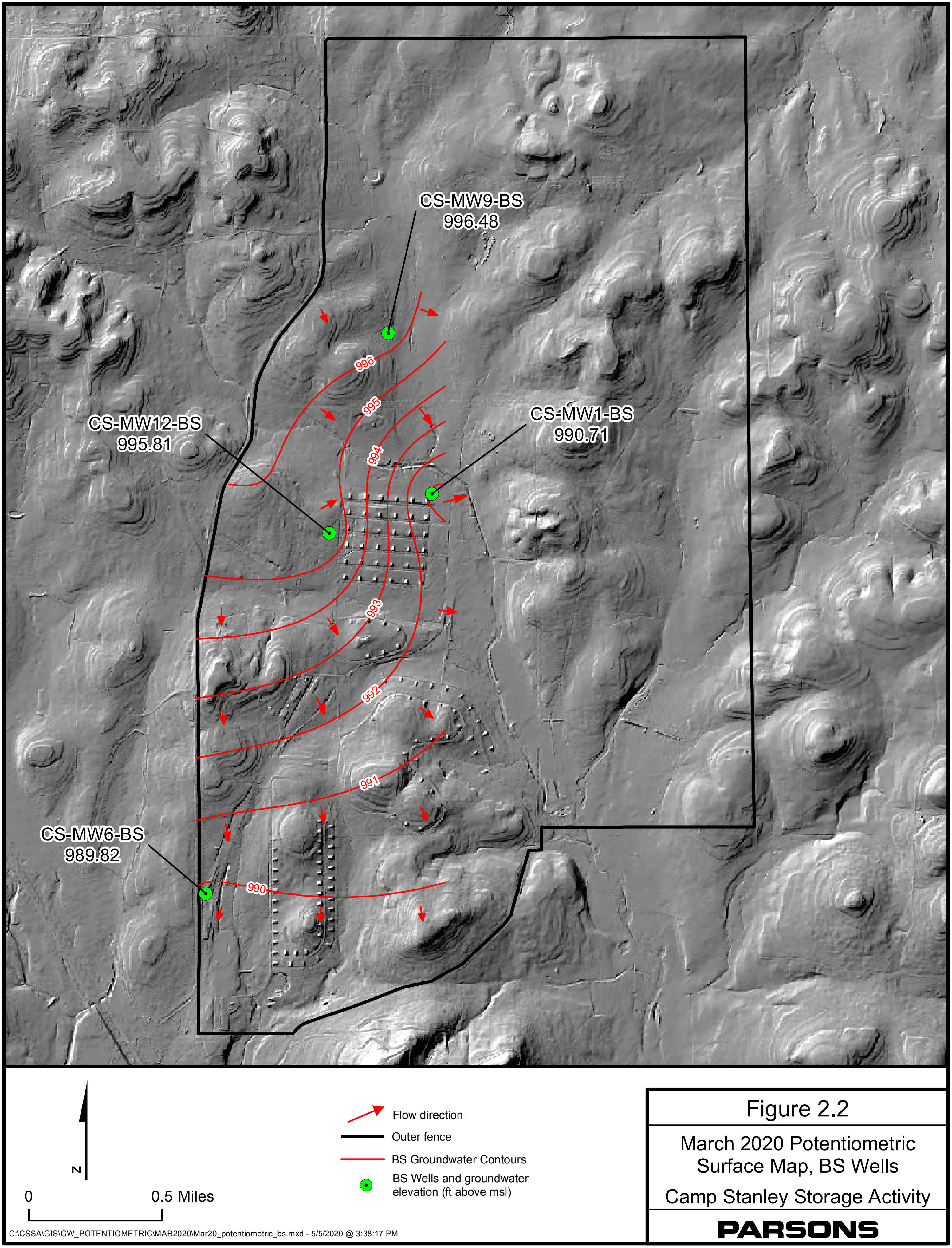

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Figure 2.2

March 2020 Potentiometric Surface Map, BS Wells

Camp Stanley Storage Activity

PARSONS

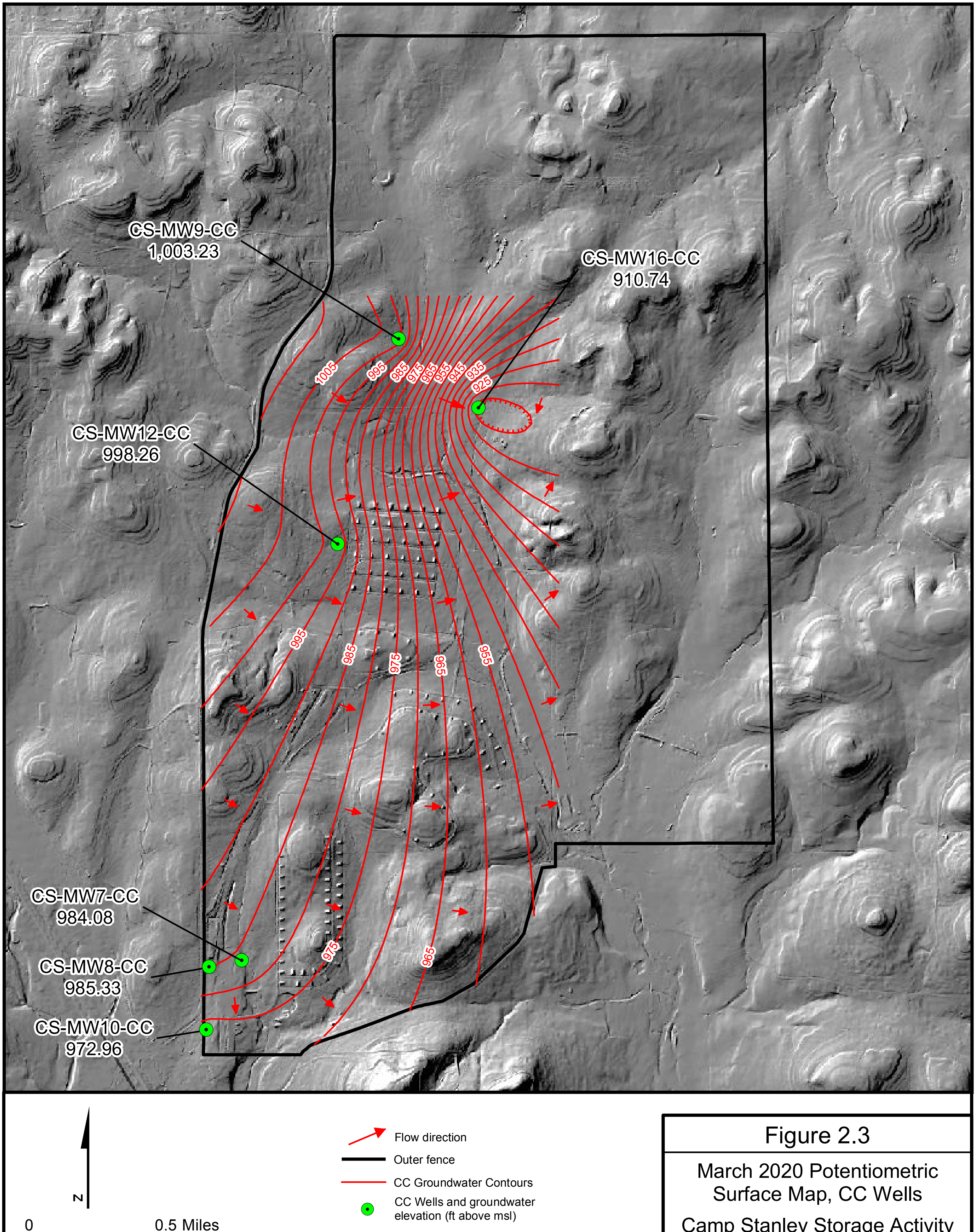

Figure 2.3

March 2020 Potentiometric Surface Map, CC Wells

Camp Stanley Storage Activity

PARSONS

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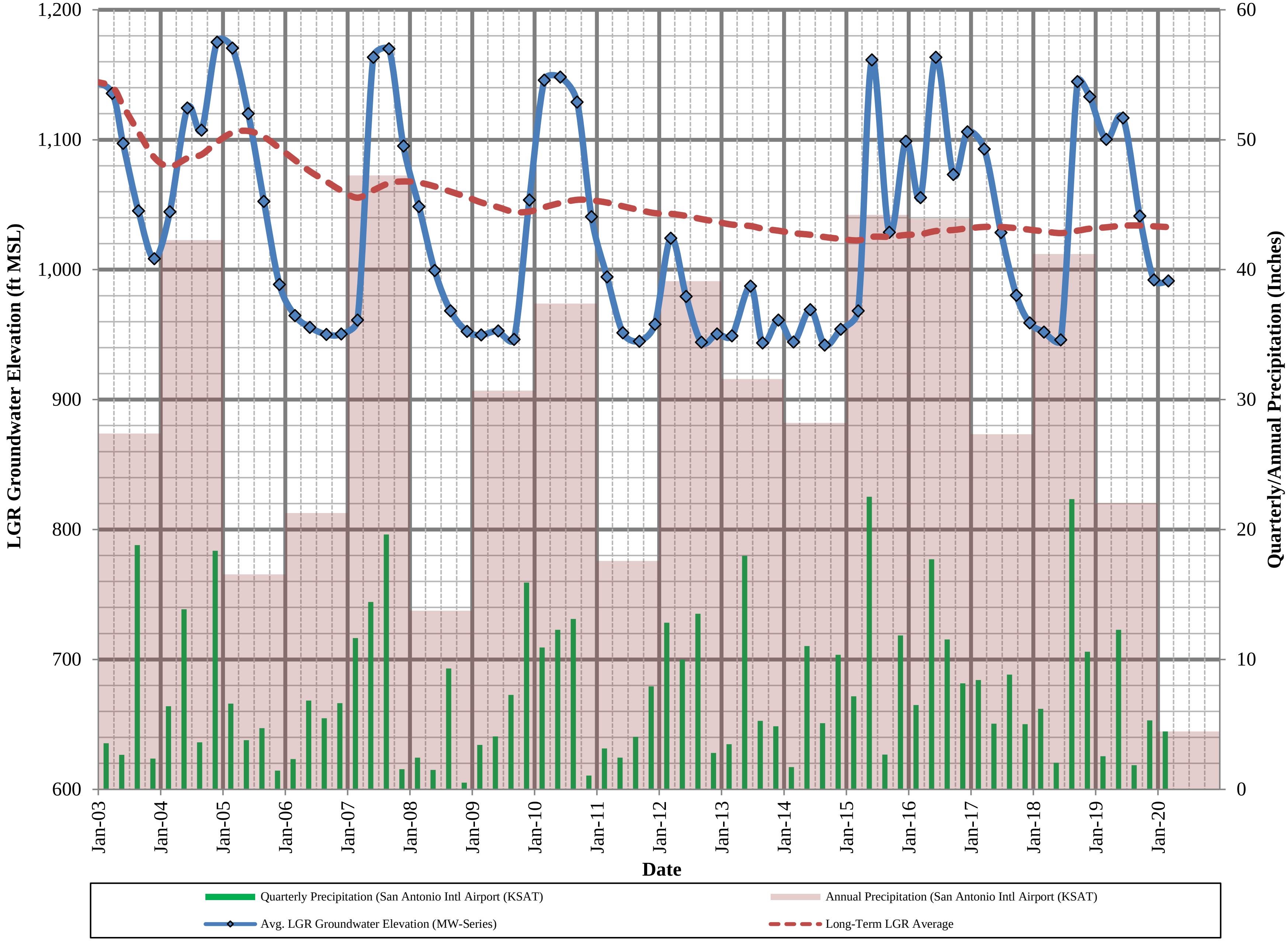
Figure 2.4 - Average LGR Groundwater Elevations and Quarterly/Annual Precipitation



J:\CSSA Program\Restoration\Groundwater\Surfer GW Files\Cumulative GW Map Elevations3.xlsx AVG LGR Chart

It should be noted that well pumping on and around CSSA affects the potentiometric surface. On-post wells CS-MW16-LGR, CS-MW16-CC, B3-EXW01, B3-EXW02, B3-EXW03, B3-EXW04, and B3-EXW05 are cyclically pumped as part of the Bioreactor remediation system at Solid Waste Management Unit (SWMU) B-3. These remediation wells provide groundwater to the Bioreactor system and are automatically operated based upon water level within each well and availability within the storage tanks. Influences from the pumping of the Bioreactor wells B3-EXW01 through B3-EXW05 may be manifested as "cones of depression". The typical "cone of depression" is observed in the March 2020 LGR potentiometric surface map. The Bioreactor cone of depression is induced into the aquifer to extract contaminated water within its direct zone of influence, and otherwise retard the flow of the groundwater that cannot be directly captured by the extraction wells away from the site.

CSSA drinking water wells CS-1, CS-10, CS-12, and CS-13 are also cycled on and off to maintain the drinking water system currently in place at CSSA and, as a result, may manifest a cone of depression. Additionally, off-post water supply wells along Ralph Fair Road may also exert a subtle influence on gradients along the western and southern boundaries of the post. In March, a slight depression is observed centered on the drinking water well CS-10, however, no discernable off-post influences on the LGR potentiometric surface are observed.

Historical groundwater monitoring at CSSA has demonstrated that the aquifer gradient typically slopes in a south-southeast direction; however, variable aquifer levels and well-pumping scenarios can affect the localized and regional gradients (**Figure 2.1**). The below average precipitation recorded during the quarter have resulted in a minimal decrease in water levels from those recorded in December 2019. The typical south-southeasterly gradient is observed in the northern and southern portions of the post in March 2020. In the central portion of the post, groundwater flow is interrupted by the cone of depression centered on bioreactor extraction wells and the groundwater mound at CS-MW4-LGR. In the southwest corner of the post a more easterly component of groundwater flow is observed.

Pumping action at wells CS-1, CS-10, CS-12, CS-13, CS-MW16-LGR/CC, B3-EXW01 through B3-EXW05, CS-MWH-LGR, CS-I, and even off-post wells (Fair Oaks Ranch) can significantly alter the LGR groundwater gradient. The regional gradient calculation, an overall groundwater gradient averaged across CSSA, is measured from CS-MWH-LGR to CS-1 (0.0040928 ft/ft) indicating a southeasterly flow, however, flow is interrupted by a cone of depression in the north and mounding in the central portion of the post. At the southern end of the post a more steeply dipping south-southeasterly gradient of 0.0119033 ft/ft is observed, as measured between CS-MW4-LGR (top of the groundwater mound) and CS-1.

Under normal conditions, the potentiometric surface in both the BS and CC members of the aquifer generally trend in a southerly direction, similar to the LGR, but during periods of above-average water levels or intense aquifer recharge, an eastward component in both the BS and CC may develop. In March 2020, the average groundwater elevation of the BS was 993.21 feet MSL, and groundwater flow was mainly to the southeast in the northern portion of the post and to the south in the southern portion of the post (**Figure 2.2**).

A review of historical data has shown that the CC potentiometric surface develops a predominantly easterly gradient when the average CC groundwater elevation is higher than 995 feet MSL. Below 995 feet MSL, the gradient resumes a more southerly flow direction. In March

2020, the average groundwater elevation for all non-pumping CC wells was 989.61 feet MSL. Although an easterly gradient is depicted in **Figure 2.3**, it is strongly influenced by the cone of depression observed at CS-MW16-CC due to pumping for bioreactor operations and a lack of other CC wells in the eastern portion of the post that could help define the limits of effects due to pumping at this well.

Groundwater elevations have been measured and recorded since 1992. Previous droughts resulted in water levels decreasing substantially in 1996, 1999, 2000, 2006, 2008, 2009, 2011 through 2014 and most recently from June 2017 to August 2018. In 2015, approximately 44 inches of rainfall in the San Antonio area ended the drought cycle, resulting in a net gain of 145 feet in aquifer level over the course of the year. In 2017, approximately 28 inches of rainfall was recorded in the San Antonio area, about 4 inches below the 30-year annual average. In 2018, historic rainfalls in the third quarter and above-average rains in the fourth quarter contributed to an average LGR groundwater elevation of 1,133.18 feet MSL by December (101.62 feet above the 16-year long-term average). Below average rainfall in the third and fourth quarters of 2019 resulted in a 124.76-foot decline in water level elevation from June to December. Slightly below average rainfall during the first quarter of 2020 has resulted in only a marginal decline in water level elevation since December 2019 (0.66-foot loss). Currently, the groundwater elevation is 41.4 feet below the long-term average of 1032.76 feet (now at 17.25years).

It is worth noting that, based on more than 17.25 years of program history, the post wide LGR groundwater level has declined by 112.58 feet (see **Figure 2.4**). As can be expected with sparse data sets, the largest rate of change/decline (90 feet) came during the initial 4 years of the groundwater monitoring program. Over the past 10 years, the average decline rate has subdued, losing an additional 18.57 feet of average groundwater elevation. This 10-year period included 6 years of prolonged drought and four years of above average precipitation (2010, 2015, 2016, and 2018). The past 17.25-year history of CSSA groundwater monitoring indicates that the aquifer level is “below average” approximately 62.9 percent of the time. Over the last three years (12 monitoring events), the aquifer has been “below average” 58.3 percent of the time.

3.0 MARCH ANALYTICAL RESULTS

3.1 Monitoring Wells

Under the provisions of the groundwater monitoring DQOs and the 2015 LTMO evaluation, the schedule for sampling on-post in March 2020 included 4 wells. The 4 wells sampled included drinking water production wells: CS-1, CS-10, CS-12, and CS-13 (see **Table 3.1)**. In conjunction with the off-post monitoring initiative (under a separate report) the March 2020 groundwater sampling constituted a "quarterly" event as outlined in the 2015 LTMO schedule, which was implemented in December 2016.

All 4 wells scheduled for monitoring in March 2020 were sampled. Additional samples were collected as part of the AOC-65 in-situ chemical oxidation (ISCO) and SWMU B-3 bioreactor Corrective Measures operations; these results will be documented in separate reports. **Tables 3.1** and **3.2** provide a sampling overview for March 2020 and the schedule under the LTMO recommendations. The wells listed in **Table 3.1** are sampled using dedicated low-flow gas-operated bladder pumps. Wells CS-1, CS-10, CS-12, and CS-13 were sampled using dedicated electric submersible pumps. **Figure 3.1** shows well sampling locations.

Wells sampled by low-flow pumps were purged until the field parameters of pH, temperature, and conductivity stabilized. The on-post monitoring wells were sampled in March 2020 for volatile organic compounds (VOCs) analytes which include *cis*-1,2-dichloroethene (*cis*-1,2-DCE), tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride. Effective in September 2016 per the recently-approved DQOs, metals are no longer obtained from on-post monitoring wells. Metals analyses will continue to be collected from active groundwater remediation sites (AOC-65 and B-3), as well as on-post drinking water wells. As such, active drinking water wells CS-1, CS-10, CS-12, and CS-13 were analyzed for the same VOC analytes and metals (arsenic, barium, chromium, copper, zinc, cadmium, mercury, and lead).

Samples were analyzed by Agriculture & Priority Pollutant Laboratories (APPL) in Clovis, California. All detected concentrations of VOCs and metals are presented in **Table 3.3**. Full analytical results are presented in **Appendix B**.

No wells sampled this quarter had VOCs detected above the applicable Maximum Contaminant Levels (MCL). A comparison of VOC concentrations versus water level for select wells is presented in **Figure 3.2**. The overall trend for CS-D, CS-MW1-LGR, CS-MW5-LGR, CS-MW36-LGR last sampled in December 2019 was a slight increase in VOC concentrations with a significant decrease in groundwater elevation. CS-MW5-LGR has been sampled since 2001, but it did not show concentrations of PCE and TCE above the MCL until December 2015. PCE and TCE remained above the MCL through 2017 then dropped back below in 2018. TCE was detected above the MCL again in December 2019. This quarter the overall groundwater elevation in all wells indicates the depleted aquifer began a slight recovery from the average rainfall that fell in early 2020. Wells presented in **Figure 3.2** are sampled every 15 months according to the current LTMO, with the next scheduled event occurring in March 2021. It should be noted that well CS-4, depicted in figure 3.2, is currently out of service. Attempts to rehabilitate this CS-4 were unsuccessful and the well is scheduled for abandonment. Replacement options for this well are currently being evaluated.

Table 3.1
Overview of the On-Post Monitoring Program

Count	Well ID	*Analytes*	*Last Sample Date*	*Jun-19*	*Sep-19*	*Dec-19 (30-month)*	*Mar-20*	*Sampling Frequency**
	CS-MW1-LGR	VOCs	Dec-19	NS	NS	S	NS	15 months
	CS-MW1-BS	VOCs	Dec-12	NS	NS	NS	NS	as needed
	CS-MW1-CC	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW2-LGR	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW2-CC	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW3-LGR	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW4-LGR	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW5-LGR	VOCs	Dec-19	NS	NS	S	NS	15 months
	CS-MW6-LGR	VOCs	Dec-19	NS	NS	S	NS	15 months
	CS-MW6-BS	VOCs	Dec-12	NS	NS	NS	NS	as needed
	CS-MW6-CC	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW7-LGR	VOCs	Dec-19	NS	NS	S	NS	15 months
	CS-MW7-CC	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW8-LGR	VOCs	Dec-19	NS	NS	S	NS	15 months
	CS-MW8-CC	VOCs	Dec-19	NS	NS	S	NS	15 months
	CS-MW9-LGR	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW9-BS	VOCs	Dec-12	NS	NS	NS	NS	as needed
	CS-MW9-CC	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW10-LGR	VOCs	Dec-19	NS	NS	S	NS	15 months
	CS-MW10-CC	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW11A-LGR	VOCs	Dec-19	NS	NS	S	NS	15 months
	CS-MW11B-LGR	VOCs	Sep-18	NS	NS	NS (dry)	NS	15 months
	CS-MW12-LGR	VOCs	Dec-19	NS	NS	S	NS	15 months
	CS-MW12-BS	VOCs	Dec-12	NS	NS	NS	NS	as needed
	CS-MW12-CC	VOCs	Dec-19	NS	NS	S	NS	30 months
	CW-MW17-LGR	VOCs	Dec-19	NS	NS	S	NS	15 months
	CS-MW18-LGR	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW19-LGR	VOCs	Dec-19	NS	NS	S	NS	30 months
1	CS-1	VOCs & metals (As,Ba,Cr, Cu,Cd,Hg,Pb,Zn)	Dec-19	S	S	S	S	Quarterly
	CS-2	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-4	VOCs	Sep-18	NS	NS	NS (pump out)	NS	15 months
2	CS-10	VOCs & metals (As,Ba,Cr, Cu,Cd,Hg,Pb,Zn)	Dec-19	S	S	S	S	Quarterly
3	CS-12	VOCs & metals (As,Ba,Cr, Cu,Cd,Hg,Pb,Zn)	Dec-19	S	S	S	S	Quarterly
4	CS-13	VOCs & metals (As,Ba,Cr, Cu,Cd,Hg,Pb,Zn)	Dec-19	S	S	S	S	Quarterly
	CS-D	VOCs	Dec-19	NS	NS	S	NS	15 months
	CS-MWG-LGR	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MWH-LGR	VOCs	Jun-17	NS	NS	NS (pump out)	NS	30 months
	CS-I	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW20-LGR	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW21-LGR	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW22-LGR	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW23-LGR	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW24-LGR	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW25-LGR	VOCs	Dec-19	NS	NS	S	NS	30 months
	CS-MW35-LGR	VOCs	Dec-19	NS	NS	S	NS	15 months
	CS-MW36-LGR	VOCs	Dec-19	NS	NS	S	NS	15 months
	CS-MW37-LGR	VOCs	Dec-19	NS	NS	S	NS	15 months

* New LTMO sampling frequency to be implemented in December 2016
S = Sample
NS = No Sample
NSWL = No Sample due to low water level

Table 3.2 Westbay Sampling Frequency

Westbay Interval	Last Sample Date	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19 (30-month)	Mar-20	LTMO Sampling Frequency (as of Dec. 2016)
CS-WB01-UGR-01	Sep-18	NS	NS	NS	NS	NS (dry)	NS	15 months
CS-WB01-LGR-01	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB01-LGR-02	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB01-LGR-03	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB01-LGR-04	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB01-LGR-05	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB01-LGR-06	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB01-LGR-07	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB01-LGR-08	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB01-LGR-09	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB02-UGR-01	Dec-04	NS	NS	NS	NS	NS	NS	15 months (port clogged NS)
CS-WB02-LGR-01	Sep-18	NS	NS	NS	NS	NS (dry)	NS	15 months
CS-WB02-LGR-02	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB02-LGR-03	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB02-LGR-04	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB02-LGR-05	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB02-LGR-06	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB02-LGR-07	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB02-LGR-08	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB02-LGR-09	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB03-UGR-01	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB03-LGR-01	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB03-LGR-02	Jun-16	NS	NS	NS	NS	NS (dry)	NS	15 months
CS-WB03-LGR-03	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB03-LGR-04	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB03-LGR-05	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB03-LGR-06	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB03-LGR-07	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB03-LGR-08	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB03-LGR-09	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB04-UGR-01	Nov-04	NS	NS	NS	NS	NS (dry)	NS	15 months
CS-WB04-LGR-01	Dec-19	NS	NS	NS	NS	S	NS	30 months
CS-WB04-LGR-02	Mar-10	NS	NS	NS	NS	NS (dry)	NS	30 months
CS-WB04-LGR-03	Dec-19	NS	NS	NS	NS	S	NS	30 months
CS-WB04-LGR-04	Dec-19	NS	NS	NS	NS	S	NS	30 months
CS-WB04-LGR-06	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB04-LGR-07	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB04-LGR-08	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB04-LGR-09	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB04-LGR-10	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB04-LGR-11	Dec-19	NS	NS	NS	NS	S	NS	15 months
CS-WB04-BS-01	Dec-19	NS	NS	NS	NS	S	NS	30 months
CS-WB04-BS-02	Dec-19	NS	NS	NS	NS	S	NS	30 months
CS-WB04-CC-01	Dec-19	NS	NS	NS	NS	S	NS	30 months
CS-WB04-CC-02	Dec-19	NS	NS	NS	NS	S	NS	30 months
CS-WB04-CC-03	Dec-19	NS	NS	NS	NS	S	NS	30 months

Profiling performed quarterly, in conjunction with post wide water levels.
S = Sample
NS = No Sample
NSWL = No sample due to low water level

N
W
E
S

0 0.25 0.5
Miles

Sampled Wells March 2020

- > MCL (VOC's) only
- > RL (VOC's) only
- > MDL (VOC's) only
- ND

C:\CSSA\GIS\MXD\GW_QUARTERLY\Mar20_Sampled_Wells_fig2_color-coded_labels.mxd 4/9/2020 5:41:31 PM wayne.simoneau@parsons.com

Figure 3-1

On-Post and Off-Post Well Sampling Locations for March 2020

Camp Stanley Storage Activity

PARSONS

Table 3.3
March 2020 On-Post Quarterly Groundwater Results, Detected Analytes

Well ID	Sample Date	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Zinc	Mercury
CSSA Drinking Water Well System									
CS-1	3/9/2020	--	**0.0347**	--	--	**0.009F**	--	**0.115**	--
CS-10	3/9/2020	--	**0.0355**	--	--	**0.007F**	**0.0021F**	**0.165**	--
CS-12	3/9/2020	--	**0.0282**	--	--	--	--	**0.242**	--
CS-13	3/9/2020	--	**0.0311**	--	--	**0.018**	--	**0.286**	--
CS-13 FD	3/9/2020	--	**0.0303**	--	--	**0.053**	**0.0033F**	**0.290**	--
Comparison Criteria									
Method Detection Limit (MDL)		**0.00022**	**0.0003**	**0.0005**	**0.001**	**0.003**	**0.0019**	**0.008**	**0.0001**
Reporting Limit (RL)		**0.03**	**0.005**	**0.007**	**0.01**	**0.01**	**0.025**	**0.05**	**0.001**
Max. Contaminant Level (MCL)		**0.01**	**2**	**0.005**	**0.1**	**AL=1.3**	**AL=0.015**	**SS=5.0**	**0.002**

Well ID	Sample Date	cis-1,2-DCE	PCE	TCE	Vinyl Chloride
CSSA Drinking Water Well System					
CS-1	3/9/2020	--	--	--	--
CS-10	3/9/2020	--	--	--	--
CS-12	3/9/2020	--	--	--	--
CS-13	3/9/2020	--	--	--	--
CS-13 FD	3/9/2020	--	--	--	--
Comparison Criteria					
Method Detection Limit (MDL)		**0.07**	**0.06**	**0.05**	**0.08**
Reporting Limit (RL)		**1.2**	**1.4**	**1**	**1.1**
Max. Contaminant Level (MCL)		**70**	**5**	**5**	**2**

BOLD	≥ MDL
BOLD	≥ RL
BOLD	≥ MCL

Precipitation per Quarter:	Mar-20
AOC-65 Weather Station (AOC-65 WS)	5.07
B-3 Weather Station (B-3 WS)	NA

All samples were analyzed by APPL, Inc.
VOC data reported in ug/L & metals data reported in mg/L.

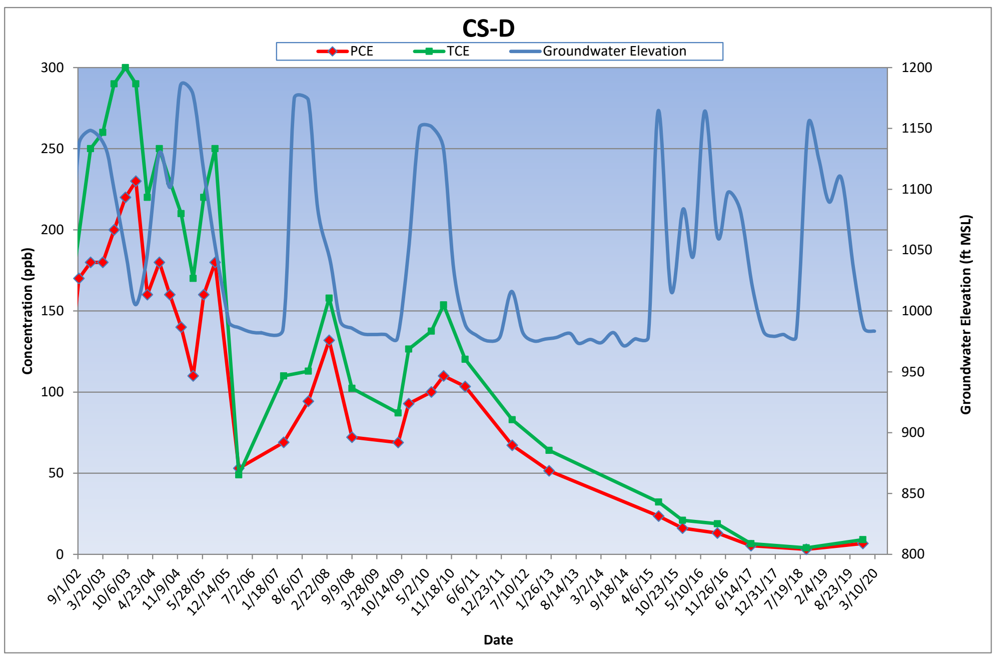
Abbreviations/Notes:

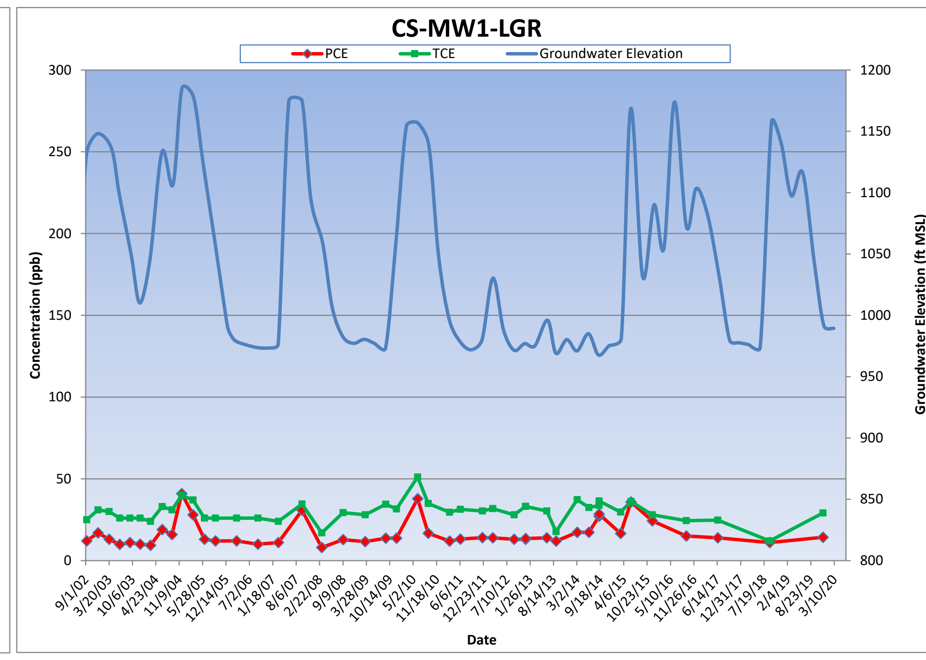
FD	Field Duplicate
TCE	Trichloroethene
PCE	Tetrachloroethene
DCE	Dichloroethene
AL	Action Level
SS	Secondary Standard

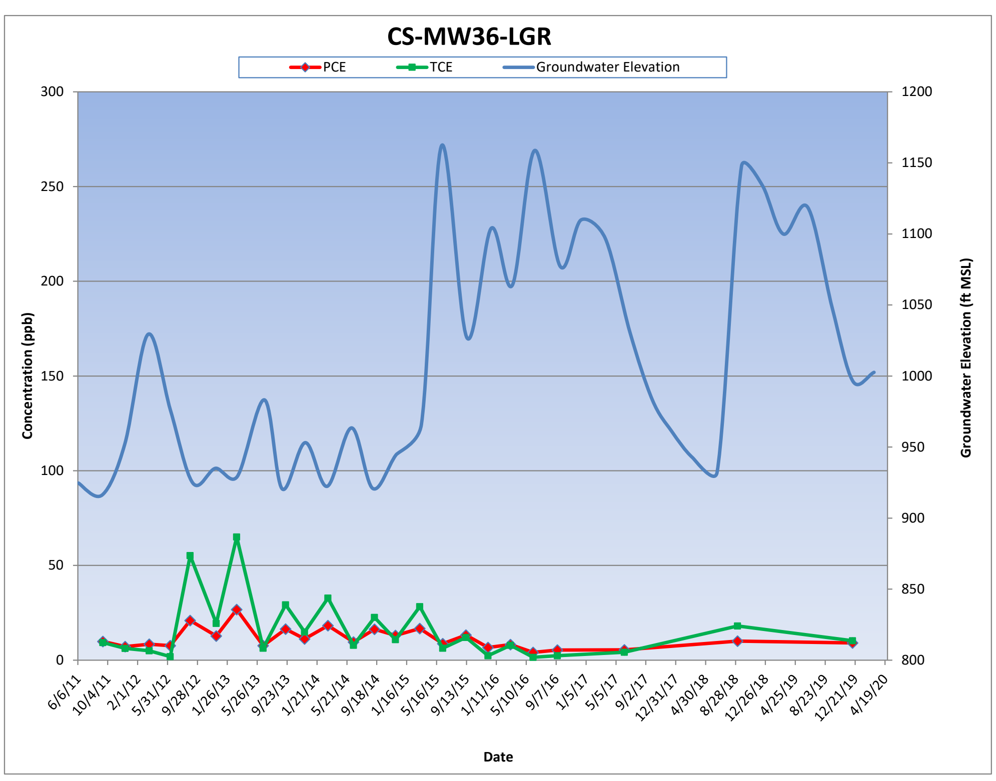
Data Qualifiers:

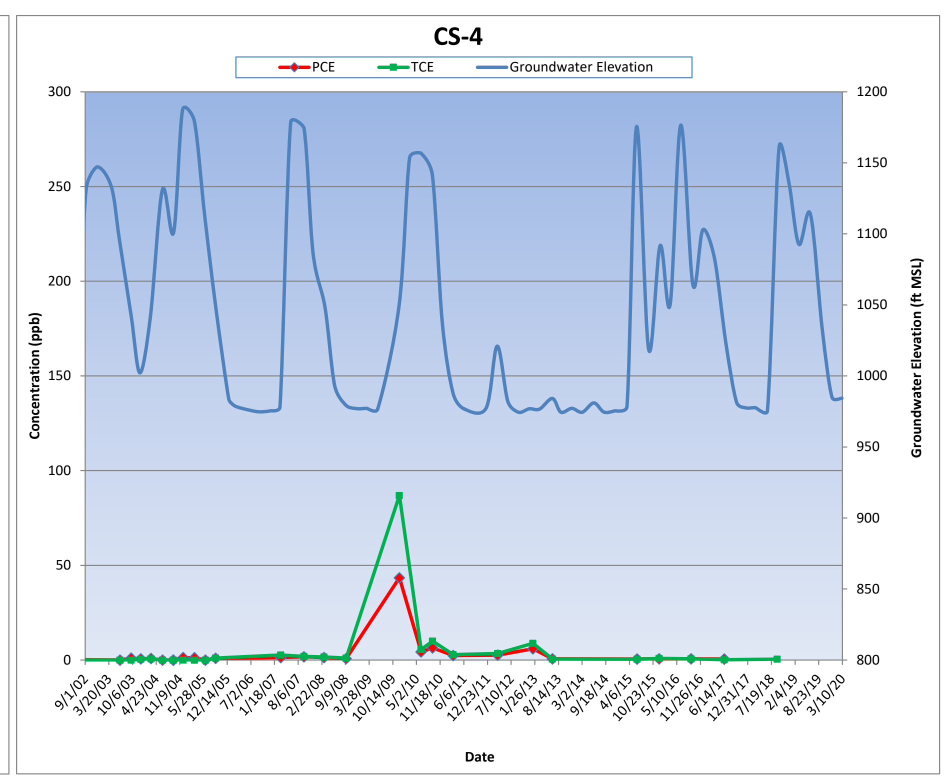
--The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.
F-The analyte was positively identified but the associated numerical value is below the RL.
J - Analyte detected, concentration estimated.
NA - data not available

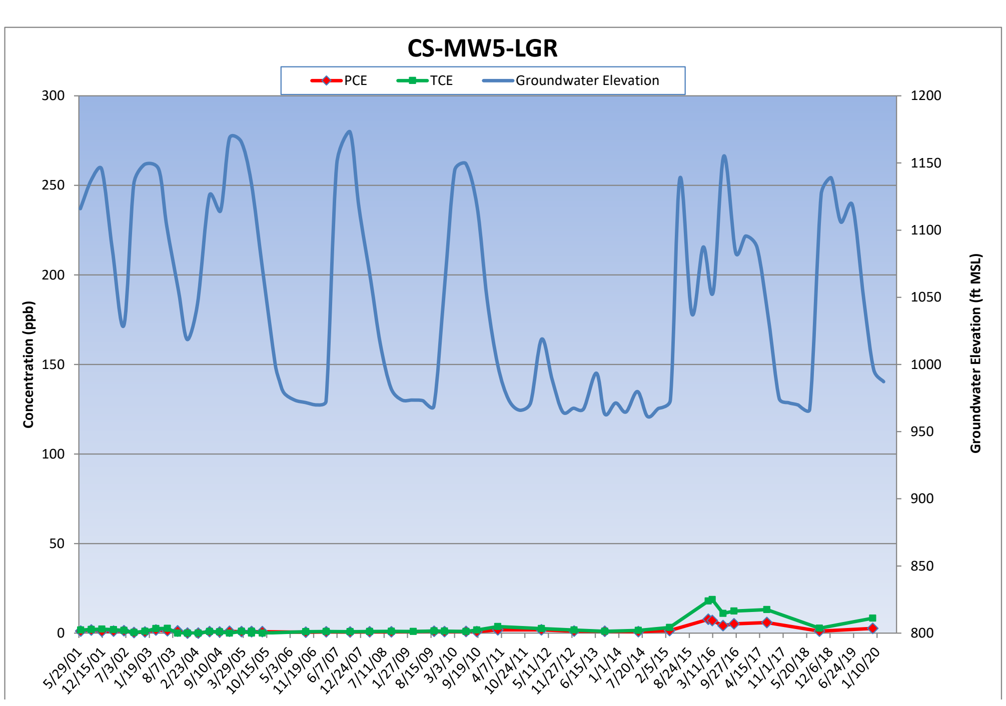
Figure 3.2
On-Post Cumulative Analytical vs. Groundwater Elevation











NOTE: Sampling dates are indicated by the squares on the trend line.

Results from on-post monitoring wells are considered definitive data and are subject to data validation and verification under provisions of the CSSA Quality Assurance Project Plan (QAPP). Parsons data package numbered 110201-#50 containing the analytical results from this sampling event, were received by Parsons March 30, 2020. Data validation was conducted, and data validation reports are presented in **Appendix D**.

3.2 Westbay-equipped Wells

The latest updated LTMO schedule was implemented in December 2016. In March 2020, no Westbay Well zones were scheduled for sampling. However, these wells (CS-WB01, CS-WB02, CS-WB03, and CS-WB04) were profiled to capture water level data. These Westbay wells are located in the vicinity of AOC-65 and are part of the post-wide quarterly groundwater monitoring program. Per the approved 2015 LTMO, the Upper Glen Rose (UGR)/LGR zones are to be sampled on a 15-month schedule and the BS/CC zones are sampled on a 30-month schedule. The sampling of these wells began in September 2003.

There are four other Westbay wells (CS-WB05, CS-WB06, CS-WB07, and CS-WB08) that are located at the SWMU B-3 remediation site. Those wells are sampled on a separate schedule in association with the SWMU B-3 bioreactor monitoring. Results for those wells are presented in the SWMU B-3 Performance Status Reports.

4.0 MARCH 2020 SUMMARY

- Groundwater samples were collected from 4 on-post wells scheduled for monitoring in March 2020 at CSSA.
- From January 1st through March 31st, 2020, CSSA's AOC-65 weather station recorded 5.07 inches of rainfall and the SWMU B-3 weather station did not record a complete set of data due to clogging of the rain bucket. The rainfall was spread out somewhat evenly over the 3-month period, with just under half of the rain falling in January. The AOC-65 WS recorded 2.19 inches in January, 1.32 inches in February, and 1.56 inches in March. No events had greater than one inch of daily rainfall during this period.
- The Middle Trinity aquifer levels (LGR, BS, and CC) increased an average of 2.43 feet per non-pumping well since last quarter. The average water level in March 2020 (excluding pumping wells) was 249.22 feet BTOC (993.45 feet MSL).
- No VOCs were detected above the MCL in wells sampled in March 2020. (**Table 3.3**).
- There were no metals detected above the MCL/AL/SS in the wells sampled in March 2020.
- Westbay Wells 01-04 were not sampled in March 2020 per LTMO sampling schedule. However, these wells were profiled to capture water level data in the area. These wells are scheduled to be sampled in March 2021.

APPENDIX A

EVALUATION OF DATA QUALITY OBJECTIVES ATTAINMENT

Appendix A Evaluation of Data Quality Objectives Attainment

Activity	Objectives	Action	Objective Attained?	Recommendations
Field Sampling	Conduct field sampling in accordance with procedures defined in the project work plan, SAP, QAPP, HSP, and LTMO recommendations.	All sampling was conducted in accordance with the procedures described in the project plans.	Yes.	NA
Characterization of Environmental Setting (Hydrogeology)	Prepare water-level contour and/or potentiometric maps for each formation of the Middle Trinity Aquifer (3.5.3).	Potentiometric surface maps were prepared based on water levels measured in each of CSSA's wells screened in three formations on March 6, 2020.	To the extent possible with data available. Due to the limited data available and the fact that wells are completed across multiple water-bearing units, potentiometric maps should only be used for regional water flow direction, not local. Ongoing pumping in the CSSA area likely affects the natural groundwater flow direction.	As additional wells are installed screened in distinct formations, future evaluations will eliminate reliance on wells screened across multiple formations.
	Describe the flow system, including the vertical and horizontal components of flow (2.1.9).	Potentiometric maps were created using March 6, 2020 water level data, and horizontal flow direction was tentatively identified. Insufficient data are currently available to determine vertical component of flow.	As described above, due to the lack of aquifer-specific water level information, potentiometric surface maps should only be used as an estimate of regional flow direction.	Same as above.
	Define formation(s) in the Middle Trinity Aquifer are impacted by the VOC contaminants (2.1.3).	Quarterly groundwater monitoring provides information on Middle Trinity Aquifer impacts. Monitoring wells equipped with Westbay® - multi-port samplers are sampled every 15 or 30 months.	Yes.	Continue sampling.

Activity	Objectives	Action	Objective Attained?	Recommendations
Characterization of Environmental Setting (Hydrogeology) (Continued)	Identify any temporal changes in hydraulic gradients due to seasonal influences (2.1.5).	Downloaded data from continuous-reading transducers in wells: CS-MW4-LGR, CS-MW9-LGR, CS-MW12-LGR, CS-MW12-CC, and CS-MW8-CC. Additional continuous reading transducers were added to the program through the SCADA project. The following wells can be uploaded to see real time water level data: CS-MW16-LGR, CS-MW16-CC, CS-1, CS-12, CS-13, and CS-10. Data was also downloaded from the AOC-65 and B-3 weather stations. Water levels will be graphed at these wells against precipitation data through December 2020 and included in the annual groundwater report.	Yes.	Continue collection of transducer data and possibly install transducers in other cluster wells.
Contamination Characterization (Ground Water Contamination)	Characterize the horizontal and vertical extent of any immiscible or dissolved plume(s) originating from the Facility (3.1.2).	Samples for laboratory analysis were collected from all 4 CSSA drinking water wells. The 4 BS wells are sampled on an ‘as needed’ basis as part of the groundwater program.	The horizontal and vertical extent of groundwater contamination is continuously monitored.	Continue groundwater monitoring and construct additional wells as necessary.
	Determine the horizontal and vertical concentration profiles of all constituents of concern (COC) in the groundwater that are measured by USEPA-approved procedures (3.1.2). COCs are those chemicals that have been detected in groundwater in the past and their daughter (breakdown) products.	Groundwater samples were collected from wells: CS-1, CS-10, CS-12, and CS-13. Samples were analyzed for the short list of VOCs using USEPA method SW8260B. The drinking water wells were also sampled for metals (arsenic, barium, chromium, copper, cadmium, mercury, lead, and zinc). Analyses were conducted in accordance with the CSSA QAPP and approved variances. All reporting limits (RL) were below MCLs, as listed below:	Yes.	Continue sampling.

<table>
<tr><th>Activity</th><th>Objectives</th><th>Action</th><th>Objective Attained?</th><th>Recommendations</th></tr>
<tr><td rowspan="4">Contamination Characterization (Ground Water Contamination) (Continued)</td><td rowspan="2">Determine the horizontal and vertical concentration profiles of all constituents of concern (COC) in the groundwater that are measured by USEPA-approved procedures (3.1.2). COCs are those chemicals that have been detected in groundwater in the past and their daughter (breakdown) products.</td><td>ANALYTE | RL (µg /L) | MCL(µg/L)
cis-1,2-DCE | 1.2 | 70
PCE | 1.4 | 5
TCE | 1.0 | 5
Vinyl chloride | 1.1 | 2</td><td>Yes.</td><td>Continue sampling.</td></tr>
<tr><td>ANALYTE | RL (µg/L) | MCL/AL (µg /L)
Barium | 5 | 2,000
Chromium | 10 | 100
Copper | 10 | 1,300
Zinc | 50 | 5,000
Arsenic | 30 | 10
Cadmium | 7 | 5
Lead | 25 | 15
Mercury | 1 | 2</td><td>Yes.</td><td>Continue sampling.</td></tr>
<tr><td rowspan="2">Meet CSSA QAPP quality assurance requirements.</td><td>Samples were analyzed in accordance with the CSSA QAPP and approved variances. Parsons chemists verified all data.</td><td>Yes.</td><td>NA</td></tr>
<tr><td>All data flagged with a “U,” “J,” “M,” and “F” are usable for characterizing contamination. All “R” flagged data are considered unusable.</td><td>Yes.</td><td>NA</td></tr>
</table>

Activity	Objectives	Action	Objective Attained?	Recommendations
Contamination Characterization (Ground Water Contamination) (Continued)	Meet CSSA QAPP quality assurance requirements. (Continued)	Previously, a method detection limit (MDL) study for arsenic, cadmium, and lead was not performed within a year of the analyses, as required by the AFCEE QAPP.	The laboratory performed new MDL studies in February 2001 for these metals and the new MDL values were found to be almost identical to the previous MDLs and all met the associated AFCEE QAPP requirements. MDLs for these three metals are well below MCLs. In addition, the laboratory performed daily calibrations and RL verifications for these metals, both of which demonstrate the laboratory's ability to detect and quantitate these metals at RL levels. These daily analyses also indicate that concentrations above the laboratory RL for these compounds were not affected by the expired MDL study.	Use results for groundwater characterization purposes.
Remediation	Determine goals and create cost-effective and technologically appropriate methods for remediation (2.2.1).	Continued data collection will provide analytical results for accomplishing this objective.	Ongoing.	Continue sampling and evaluation, including quarterly groundwater monitoring teleconferences to address remediation.
	Determine placement of new wells for monitoring (2.3.1, 3.6)	Sampling frequency and sample locations to be monitored (including any new wells) will be based on trend data from monitoring event(s) (3.1.5).	Ongoing.	Continue quarterly groundwater teleconferences to discuss sampling frequency and placement of new monitor wells.
Project schedule/ Reporting	Produce a quarterly monitoring project schedule as a road map for sampling, analysis, validation, verification, reviews, and reports.	Prepare schedules and sampling guidelines prior to each quarterly sampling event.	Yes.	Continue sampling schedule preparation each quarter.

APPENDIX B

QUARTERLY ON-POST GROUNDWATER MONITORING ANALYTICAL RESULTS MARCH 2020

Appendix B
Quarterly On-Post Groundwater Monitoring Analytical Results, March 2020

Well ID	Sample Date	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Zinc	Mercury
CSSA Drinking Water Well System									
CS-1	3/9/2020	0.00022U	**0.0347**	0.0005U	0.0010U	**0.009F**	0.0019U	**0.115**	0.0001U
CS-10	3/9/2020	0.00022U	**0.0355**	0.0005U	0.0010U	**0.007F**	**0.0021F**	**0.165**	0.0001U
CS-12	3/9/2020	0.00022U	**0.0282**	0.0005U	0.0010U	0.003U	0.0019U	**0.242**	0.0001U
CS-13	3/9/2020	0.00022U	**0.0311**	0.0005U	0.0010U	**0.018**	0.0019U	**0.286**	0.0001U
CS-13 FD	3/9/2020	0.00022U	**0.0303**	0.0005U	0.0010U	**0.053**	**0.0033F**	**0.290**	0.0001U
Comparison Criteria									
Method Detection Limit (MDL)		**0.00022**	**0.0003**	**0.0005**	**0.001**	**0.003**	**0.0019**	**0.008**	**0.0001**
Reporting Limit (RL)		**0.03**	**0.005**	**0.007**	**0.01**	**0.01**	**0.025**	**0.05**	**0.001**
Max. Contaminant Level (MCL)		**0.01**	**2**	**0.005**	**0.1**	**AL=1.3**	**AL=0.015**	**SS=5.0**	**0.002**

Well ID	Sample Date	cis-1,2-DCE	PCE	TCE	Vinyl Chloride
CSSA Drinking Water Well System					
CS-1	3/9/2020	0.07U	0.06U	0.05U	0.08U
CS-10	3/9/2020	0.07U	0.06U	0.05U	0.08U
CS-12	3/9/2020	0.07U	0.06U	0.05U	0.08U
CS-13	3/9/2020	0.07U	0.06U	0.05U	0.08U
CS-13 FD	3/9/2020	0.07U	0.06U	0.05U	0.08U
Comparison Criteria					
Method Detection Limit (MDL)		**0.07**	**0.06**	**0.05**	**0.08**
Reporting Limit (RL)		**1.2**	**1.4**	**1.0**	**1.1**
Max. Contaminant Level (MCL)		**70**	**5**	**5**	**2**

BOLD	≥ MDL
BOLD (blue)	≥ RL
BOLD (red)	≥ MCL

All samples were analyzed by APPL, Inc.
VOC data reported in ug/L & metals data reported in mg/L.

Abbreviations/Notes:

FD	Field Duplicate
TCE	Trichloroethene
PCE	Tetrachloroethene
DCE	Dichloroethene

Data Qualifiers:

F-The analyte was positively identified but the associated numerical value is below the RL.
J - Analyte detected, concentration estimated.
U-The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.
NA - data not available

APPENDIX C

DATA VALIDATION REPORT
SDG 91624

DATA VERIFICATION SUMMARY REPORT

for groundwater samples collected from

CAMP STANLEY STORAGE ACTIVITY

BOERNE, TEXAS

Data Verification by: Sandra de las Fuentes
Parsons - Austin

INTRODUCTION

The following data verification summary report covers six water samples collected from Camp Stanley Storage Activity (CSSA) on March 9, 2020. The samples were assigned to the following Sample Delivery Group (SDG).

91624

The field QC sample associated with this SDG was one trip blank (TB), one matrix spike/matrix spike duplicate (MS/MSD) set, and one field duplicate (FD). No ambient blanks were collected. During the initiation of this project, it was determined that ambient blanks were not necessary due to the absence of a source at these sites.

All samples were collected by Parsons and analyzed by APPL, Inc. following the procedures outlined in the Statement of Work and CSSA QAPP, Version 1.0. Samples in this SDG were shipped to the laboratory in a single cooler, which was received by the laboratory at a temperature of 2.4ºC.

SAMPLE IDs AND REQUESTED PARAMETERS

Sample ID	Matrix	VOCs	Metals	Mercury	Comments
TB-1	Water	X			Trip Blank
CS-12	Water	X	X	X	MS/MSD
CS-13	Water	X	X	X	
CS-13-FD	Water	X	X	X	FD of CS-13
CS-1	Water	X	X	X	
CS-10	Water	X	X	X	

EXTRACTION, ANALYTICAL, AND REPORTING DETAILS

Parameter	Matrix	Prep Method	Analytical Method	Units
VOC	WATER	SW5030B	SW8260B	µg/L
METALS	WATER	SW3010A	SW6010B	mg/L

Parameter	Matrix	Prep Method	Analytical Method	Units
MERCURY	WATER	SW7470A	SW7470A	mg/L

EVALUATION CRITERIA

The data submitted by the laboratory has been reviewed and verified following the guidelines outlined in the CSSA QAPP, Version 1.0. Information reviewed in the data package included sample results; field and laboratory quality control samples; calibrations; case narratives; raw data; chain-of-custody (COC) forms and the sample receipt checklist. The findings presented in this report are based on the reviewed information, and whether the guidelines in the CSSA QAPP, Version 1.0, were met.

VOLATILES

General

The volatiles portion of this data package consisted of four (4) groundwater samples, one (1) TB and one (1) FD. All samples were collected on March 9, 2020 and analyzed for a reduced list of VOCs which included: *cis*-1,2-dichloroethene (cis 1,2-DCE), tetrachloroethene, trichloroethene (TCE), and vinyl chloride.

The VOC analyses were performed using United States Environmental Protection Agency (USEPA) SW846 Method 8260B. The samples were analyzed in one analytical batch, #250738, under one initial calibration (ICAL). All samples were analyzed following the procedures outlined in the CSSA QAPP and were prepared and analyzed within the holding time required by the method. All analyses were performed undiluted.

Accuracy

Accuracy was evaluated using the percent recovery (%R) obtained from the laboratory control sample (LCSs), MS/MSD, and the surrogate spikes. Sample CS-12 was designated as the MS/MSD on the COC.

All LCS, MS/MSD, and surrogate spike recoveries were within acceptance criteria.

Precision

Precision was evaluated using the relative percent difference (RPD) obtained from the MS/MSD results. Precision was further evaluated by comparing the field duplicate analyte results. Sample CS-MW13-FD was collected and analyzed as the field duplicate of CS-MW13.

The MS/MSD RPDs were within acceptance criteria.

All FD/parent sample results were non-detect; therefore, RPD could not be evaluated.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the CSSA QAPP;

- Comparing actual analytical procedures to those described in the CSSA QAPP;
- Evaluating holding times; and
- Examining laboratory blank and TB for cross contamination of samples during sample collection, transportation, and analysis.

All samples in this data package were analyzed following the COC and the analytical procedures described in the CSSA QAPP, Version 1.0. All samples were prepared and analyzed within the holding time required by the method.

- All instrument performance check criteria were met.
- All initial calibration criteria were met.
- All initial calibration verification (ICV) criteria were met. The ICV was prepared using a secondary source standard.
- All continuing calibration verification (CCV) criteria were met.
- All internal standard criteria were met.

One method blank was associated with the VOC analyses in this SDG. The MB was non-detect for all target VOCs.

There was one trip blank sample associated with the VOC analyses in this SDG. The TB was also non-detect for all target VOCs.

Completeness

Completeness has been evaluated in accordance with the CSSA QAPP. The number of usable results has been divided by the number of possible individual analyte results and expressed as a percentage to determine the completeness of the data set.

All VOC results for the samples in this SDG were considered usable. The completeness for this SDG is 100%, which meets the minimum acceptance criteria of 95%.

ICP-AES METALS

General

The ICP-AES portion of this SDG consisted of four (4) groundwater samples, one (1) MS/MSD and one (1) FD. All samples were collected on March 9, 2020. The samples were analyzed for arsenic, barium, cadmium, chromium, copper, lead, and zinc.

The ICP-AES metals analyses were performed using USEPA SW846 Method 6010B. All samples were analyzed following the procedures outlined in the CSSA QAPP and were prepared and analyzed within the holding time required by the method.

The samples for ICP-AES metals were digested in batch #251201. All analyses were performed undiluted.

Accuracy

Accuracy was evaluated using the percent recovery obtained from the LCS, LCSD, MS, and MSD. Sample CS-12 was designated as the MS/MSD on the COC.

All LCS, LCSD, MS, and MSD recoveries were within acceptance.

Precision

Precision was measured based on the RPD of MS/MSD results and parent/FD sample results. Sample CS-13-FD was collected and analyzed as the field duplicate of CS-13.

All RPDs were compliant for the MS/MSD.

All target metals were detected above the reporting limit (RL) in the parent and FD samples, and met criteria as follows, except:

Metal	Parent (mg/kg)	FD (mg/kg)	RPD	Criteria (RPD)
Barium	0.0311	0.0303	2.6	≤20
Copper	0.018	0.053	98.6	
Zinc	0.286	0.290	1.4	

Copper was qualified as estimated and flagged "J" in the parent and FD due to the high reproducibility noted. It should be noted the data validator requested that the laboratory double check the copper results and the review did not uncover any issues. Parsons followed up with a request to re-digest and re-analyze of both parent and FD samples for copper only. The re-analyses were prepared on April 7th and analyzed on April 9th. The reruns confirmed the original copper results.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the CSSA QAPP;
- Comparing actual analytical procedures to those described in the CSSA QAPP;
- Evaluating preservation and holding times; and
- Examining laboratory blank for cross contamination of samples during analysis.

All samples were analyzed following the COC and the analytical procedures described in the CSSA QAPP, Version 1.0, prepared and analyzed within the holding time required by the method.

- All initial calibration criteria were met.
- All second source verification criteria were met. The ICV was prepared using a secondary source.
- All CCV criteria were met.
- All interference check (ICSA/ICSAB) criteria were met.
- Dilution test (DT) was not applicable since all target metals met criteria in the MS/MSD.

- Post digestion spike (PDS) was also not applicable since all target metals met criteria in the MS/MSD samples.

- The initial calibration blank (ICB) was non-detect for all target metals. The two continuing calibration blank (CCB) samples reported low concentrations of lead, below the reporting limit. No corrective action was necessary since qualifiers are only applied when blank results are above the reporting limits.

One method blank was analyzed in association with the ICP-AES analyses in this SDG. The method blank was free of target metals at or above the RL.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All ICP-AES metals results for the samples in this SDG were considered usable. The completeness for the ICP metals portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

MERCURY

General

The mercury portion of this SDG consisted of four (4) groundwater samples, one (1) MS/MSD and one (1) FD. All samples were collected on March 9, 2020 and were analyzed for mercury.

The mercury analyses were performed using USEPA SW846 Method 7470A. The sample was analyzed following the procedures outlined in the CSSA QAPP, prepared and analyzed within the holding time required by the method.

The mercury samples were prepared in batch #251028. All analyses were performed undiluted.

Accuracy

Accuracy was evaluated using the percent recovery obtained from the LCS and MS/MSD.

The LCS and MS/MSD recoveries were within acceptance criteria.

Precision

Precision was measured based on the RPD of MS/MSD results and parent/FD sample results. Sample CS-13-FD was collected and analyzed as the field duplicate of CS-13.

All RPDs were compliant for the MS/MSD.

The FD/parent sample results were non-detect; therefore, FD RPD could not be evaluated.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the CSSA QAPP;
- Comparing actual analytical procedures to those described in the CSSA QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

All samples were analyzed following the COC and the analytical procedures described in the CSSA QAPP, prepared and analyzed within the holding times required by the method.

- All initial calibration criteria were met.
- All second source verification criteria were met. The ICV was prepared using a secondary source.
- All CCV criteria were met.

There was one method blank and several calibration blanks associated with the mercury analyses in this SDG. All blanks were free of mercury at or below the RL.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

Mercury result for the samples in this SDG was considered usable. The completeness for the mercury portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.