# MARCH 2015

# On-Post
# Quarterly Groundwater Monitoring Report

*Prepared For*

## Department of the Army
## Camp Stanley Storage Activity
## Boerne, Texas

## September 2015

## EXECUTIVE SUMMARY

- Thirty-three wells were scheduled for sampling in March 2015. Of these planned samples, three wells were not sampled due to water levels falling below the groundwater pump. This event is considered a "snapshot" event, when all on- and off-post wells are sampled on a 9-month basis to provide a complete regional assessment of the aquifer condition.
- At CSSA, the Middle Trinity aquifer average groundwater elevations in March 2015 increased 14.41 feet from the elevations measured in December 2014. The average depth to water in the wells was 272.53 feet below top of casing (BTOC) or 969.94 feet above mean sea level (MSL). As such, the Trinity-Glen Rose Groundwater Conservation District (TGRGCD) and CSSA remain under Stage 2 severe drought water restrictions, which went into effect June 1, 2011. For the adjacent Edwards aquifer, the San Antonio Water System (SAWS) has been in Stage 2 water restrictions since May 1, 2012.
- The maximum contaminant level (MCL) was exceeded in monitoring wells CS-MW1-LGR, CS-MW16-LGR, CS-MW16-CC, and CS-MW36-LGR for tetrachloroethene (PCE) and/or trichloroethene (TCE) in March 2015.
- No wells sampled had metal detections above their corresponding MCL, action level (AL), or secondary standard (SS) in March 2015.
- A total of eight specified zones of the 4 Westbay multi-port wells (WB01-WB04) were sampled in March 2015. These wells were also profiled to collect water level data in the area. Seven of the 8 multi-port zones had PCE and/or TCE above the MCL. Zones CS-WB04-LGR-11, -10, -9, -7, and -6 reported the highest historic detections to date for PCE. Zone CS-WB01-LGR-09 also reported the first detection of vinyl chloride to date.
- The WB04-LGR-11 zone reported a concentration of 444.82 micrograms per liter (µg/L) PCE in March 2015. This zone was first sampled in September 2003, and since that time has never yielded a PCE concentration in excess of 1.18 µg/L. In fact, only 12 detections of PCE have been reported in 44 sampling events over 11 years. The abnormal result is believed to be a result of the in-situ chemical oxidation (ISCO) injections conducted on-post during September through November 2014. The well was re-sampled in May 2015 with a "typical" result of 0.28 µg/L. No other off-post wells sampled during March 2015 detected a slug of increased contamination, including adjacent private well RFR-10, which is located 150 feet from CS-WB04.
- The data quality objectives (DQOs) and the long term monitoring optimization (LTMO) are currently under review and will be submitted to the Texas Commission on Environmental Quality (TCEQ) and US Environmental Protection Agency (USEPA) for approval.

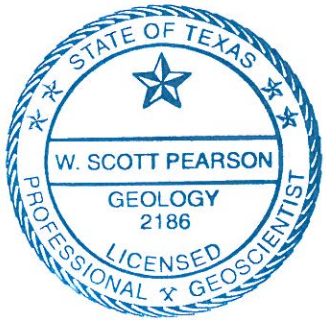
## GEOSCIENTIST CERTIFICATION

## MARCH 2015 ON-POST QUARTERLY GROUNDWATER MONITORING REPORT

## FOR

## DEPARTMENT OF THE ARMY
## CAMP STANLEY STORAGE ACTIVITY
## BOERNE, TEXAS

I, W. Scott Pearson, Professional Geologist (P.G.), hereby certify that the March 2015 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 2015, and is true and accurate to the best of my knowledge and belief.




W. Scott Pearson

W. Scott Pearson, P.G.
State of Texas
Geology License No. 2186

9-15-2015

Date

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| µg/L | microgram per liter |
| 1,1-DCE | 1,1-dichloroethene |
| §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 |
| QAPP | Quality Assurance Project Plan |
| 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 |
| *trans*-1,2-DCE | *trans*-1,2-Dichloroethene |
| UGR | Upper Glen Rose |
| USEPA | United States Environmental Protection Agency |
| VOC | Volatile Organic Compound |
| WS | Weather Station |

# MARCH 2015
# 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 2015. Laboratory analytical results are presented along with potentiometric contour maps. Results from all four 2015 quarterly monitoring events (March, June, September, and December) will be described in detail in an 2015 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 9-24, 2015.

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 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, 2010)** which provided recommendations for sampling based on a LTMO study performed for the CSSA groundwater monitoring program. LTMO study sampling frequencies were implemented on-post in December 2005, as approved by the Texas Commission on Environmental Quality (TCEQ) and the United States Environmental Protection Agency (USEPA). The LTMO evaluation was updated in 2010 using groundwater data from monitoring conducted between 2005 and 2009. It has been approved by the TCEQ and USEPA and was implemented on- and off-post in June 2011. The LTMO and DQOs are scheduled to be updated again in 2015 as part of the revision of the USEPA [§3008(h) Order. The proposed changes/updates will be submitted to the TCEQ and USEPA for their approval and they will be briefed to the public in the 2015 Annual Fact Sheet.

## 2.0 POST-WIDE FLOW DIRECTION AND GRADIENT

Fifty-five water level measurements were recorded on March 16, 2015 from on-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 2015 are shown in **Figures 2.1, 2.2, and 2.3**, respectively.

The March 2015 potentiometric surface map for LGR-screened wells **(Figure 2.1)** exhibited a wide range of groundwater elevations, from a minimum of 913.06 feet above mean sea level (MSL) at B3-EXW04 to a maximum of 1025.89 feet above MSL at CS-MW4-LGR. Groundwater elevations are generally higher in the northern and central portions of CSSA, and decrease to the southwest and southeast. As measured in all non-pumping LGR wells, the average groundwater elevation in March 2015 increased 13.16 feet from the elevations measured in December 2015. From January 1 to March 31, 2015, the weather station (WS) at Area of Concern (AOC)-65 (WS AOC-65) recorded 5.52 inches of rainfall during 30 rainfall events in this timeframe. The rainfall was sporadic with a majority of the rain falling in January (3.28 inches). One event had greater than one inch of rain, 1.57 on January 22$^{nd}$. The B-3 weather station recorded 7.95 inches of precipitation and the MW18 weather station recorded 11.42 inches for the same time period. San Antonio fell back into Stage 2 water restrictions on May 1, 2012 and the Trinity-Glen Rose Groundwater Conservation District (TGRGCD) remains in Stage 2 severe drought water restrictions, effective since June 1, 2011.

Well CS-MW4-LGR, located in the central portion of CSSA, typically has one of the highest groundwater elevations of LGR-screened wells. Under 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. In March 2015 this mounding effect was observable as the elevation in CS-MW4-LGR was 47 feet and 52 feet higher than CS-MW2-LGR and CS-MW5-LGR, respectively. Long-term monitoring has ascertained that when groundwater in the vicinity of CS-MW4-LGR rises above about 970 feet MSL, the mounding effect is evident. As measured in March 2015, the water elevation at CS-MW4-LGR was 1025.89 feet MSL, and the typical mounding effect was discernible.

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. CSSA drinking water wells CS-1, CS-10, and CS-12 are also cycled on and off to maintain the drinking water system currently in place at CSSA. Influence from the pumping of the Bioreactor wells B3-EXW01 through B3-EXW05 and CS-12 are manifested as "cones of depression" in **Figure 2.1**. 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 away from the site that cannot be directly captured by the extraction wells. Off-post water supply wells along Ralph Fair Road may also exert a subtle influence to gradients along the western and southern boundaries of the post.

# Table 2.1
# Measured Groundwater Elevation
# March 2015

| Well ID: | TOC elevation (ft MSL) | Depth to Groundwater (ft BTOC) | Groundwater Elevation (ft MSL) | Formations Screened | | | Date |
|---|---|---|---|---|---|---|---|
| | | | | LGR | BS | CC | |
| CS-1 | 1169.27 | 236.05 | 933.22 | X | | | 3/16/2015 |
| **CS-2** | **1237.59** | **256.75** | **980.84** | X | ? | | 3/16/2015 |
| CS-3 | 1240.17 | 259.72 | 980.45 | X | | | 3/16/2015 |
| CS-4 | 1229.28 | 250.82 | 978.46 | X | | | 3/16/2015 |
| **CS-9** | **1325.31** | **376.92** | **948.39** | **ALL** | | | 3/16/2015 |
| **CS-10** | **1331.51** | **379.31** | **952.20** | **ALL** | | | 3/16/2015 |
| **CS-12*** | **1274.09** | **339.02** | **935.07** | **ALL** | | | 3/16/2015 |
| **CS-13** | **1193.26** | **253.22** | **940.04** | **ALL** | | | 3/16/2015 |
| CS-D | 1236.03 | 257.82 | 978.21 | X | | | 3/16/2015 |
| CS-MWG-LGR | 1328.14 | 310.98 | 1017.16 | X | | | 3/16/2015 |
| CS-MWH-LGR | 1319.19 | 296.30 | 1022.89 | X | | | 3/16/2015 |
| CS-I | 1315.20 | 302.65 | 1012.55 | X | | | 3/16/2015 |
| CS-MW1-LGR | 1220.73 | 239.67 | 981.06 | X | | | 3/16/2015 |
| CS-MW1-BS | 1221.09 | 235.95 | 985.14 | | X | | 3/16/2015 |
| CS-MW1-CC | 1221.39 | 259.65 | 961.74 | | | X | 3/16/2015 |
| CS-MW2-LGR | 1237.08 | 257.75 | 979.33 | X | | | 3/16/2015 |
| CS-MW2-CC | 1240.11 | 283.20 | 956.91 | | | X | 3/16/2015 |
| CS-MW3-LGR | 1334.14 | 353.99 | 980.15 | X | | | 3/16/2015 |
| CS-MW4-LGR | 1209.71 | 183.82 | 1025.89 | X | | | 3/16/2015 |
| CS-MW5-LGR | 1340.24 | 366.76 | 973.48 | X | | | 3/16/2015 |
| CS-MW6-LGR | 1232.25 | 266.49 | 965.76 | X | | | 3/16/2015 |
| CS-MW6-BS | 1232.67 | 247.04 | 985.63 | | X | | 3/16/2015 |
| CS-MW6-CC | 1233.21 | 284.14 | 949.07 | | | X | 3/16/2015 |
| CS-MW7-LGR | 1202.27 | 247.59 | 954.68 | X | | | 3/16/2015 |
| CS-MW7-CC | 1201.84 | 257.53 | 944.31 | | | X | 3/16/2015 |
| CS-MW8-LGR | 1208.35 | 244.87 | 963.48 | X | | | 3/16/2015 |
| CS-MW8-CC | 1206.13 | 260.54 | 945.59 | | | X | 3/16/2015 |
| CS-MW9-LGR | 1257.27 | 266.80 | 990.47 | X | | | 3/16/2015 |
| CS-MW9-BS | 1256.73 | 266.35 | 990.38 | | X | | 3/16/2015 |
| CS-MW9-CC | 1255.95 | 273.02 | 982.93 | | | X | 3/16/2015 |
| CS-MW10-LGR | 1189.53 | 249.62 | 939.91 | X | | | 3/16/2015 |
| CS-MW10-CC | 1190.04 | 259.61 | 930.43 | | | X | 3/16/2015 |
| CS-MW11A-LGR | 1204.03 | 260.34 | 943.69 | X | | | 3/16/2015 |
| CS-MW11B-LGR | 1203.52 | dry | dry | X | | | 3/16/2015 |
| CS-MW12-LGR | 1259.07 | 282.36 | 976.71 | X | | | 3/16/2015 |
| CS-MW12-BS | 1258.37 | 274.62 | 983.75 | | X | | 3/16/2015 |
| CS-MW12-CC | 1257.31 | 282.47 | 974.84 | | | X | 3/16/2015 |
| CS-MW16-LGR* | 1244.60 | 277.70 | 966.90 | X | | | 3/16/2015 |
| CS-MW16-CC* | 1244.51 | 353.20 | 891.31 | | | X | 3/16/2015 |
| B3-EXW01* | 1245.26 | 310.50 | 934.76 | X | | | 3/16/2015 |
| B3-EXW02 | 1249.66 | 310.40 | 939.26 | X | | | 3/16/2015 |
| B3-EXW03* | 1235.11 | 281.40 | 953.71 | X | | | 3/16/2015 |
| B3-EXW04* | 1228.46 | 315.40 | 913.06 | X | | | 3/16/2015 |
| B3-EXW05 | 1279.46 | 307.45 | 972.01 | X | | | 3/16/2015 |
| CS-MW17-LGR | 1257.01 | 308.81 | 948.20 | X | | | 3/16/2015 |
| CS-MW18-LGR | 1283.61 | 336.58 | 947.03 | X | | | 3/16/2015 |
| CS-MW19-LGR | 1255.53 | 289.75 | 965.78 | X | | | 3/16/2015 |
| CS-MW20-LGR | 1209.42 | 238.79 | 970.63 | X | | | 3/16/2015 |
| CS-MW21-LGR | 1184.53 | 236.49 | 948.04 | X | | | 3/16/2015 |
| CS-MW22-LGR | 1280.49 | 343.85 | 936.64 | X | | | 3/16/2015 |
| CS-MW23-LGR | 1258.20 | 305.82 | 952.38 | X | | | 3/16/2015 |
| CS-MW24-LGR | 1253.90 | 271.71 | 982.19 | X | | | 3/16/2015 |
| CS-MW25-LGR | 1293.01 | 307.72 | 985.29 | X | | | 3/16/2015 |
| CS-MW35-LGR | 1186.97 | 244.89 | 942.08 | X | | | 3/16/2015 |
| CS-MW36-LGR | 1218.74 | 252.90 | 965.84 | X | | | 3/16/2015 |
| **FO-20** | **NA** | **NA** | **1062.05** | **ALL** | | | 3/16/2015 |
| Number of wells screened in each formation. | | | | **38** | **4** | **9** | |
| Average groundwater elevation in each formation given in feet (non pumping wells). | | | | **971.61** | **986.23** | **955.73** | |

**Notes:**

**Bold wells**: CS-2, CS-9, CS-10, CS-12, CS-13, and FO-20 are open boreholes across more than one formational u

? = 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-9, CS-10, CS-12, and CS-13 are current, inactive, or future 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 format

All measurements given in feet.

NA = Data not available

# Table 2.2
# Change in Groundwater Elevation from Previous Quarter
# March 2015

| Well ID | Dec. 2014 Elevations | Mar. 2015 Elevations | GW elevation change (Mar. minus Dec.) | Formations Screened | | |
|---|---|---|---|---|---|---|
| | | | | LGR | BS | CC |
| CS-1 | 893.17 | 933.22 | 40.05 | X | | |
| **CS-2** | **980.16** | **980.84** | **0.68** | X | ? | |
| CS-3 | 977.34 | 980.45 | 3.11 | X | | |
| CS-4 | 975.44 | 978.46 | 3.02 | X | | |
| **CS-9** | **948.05** | **948.39** | **0.34** | **ALL** | | |
| **CS-10** | **952.51** | **952.20** | **-0.31** | **ALL** | | |
| **CS-12*** | **979.59** | **935.07** | **-44.52** | **ALL** | | |
| **CS-13** | **916.12** | **940.04** | **23.92** | **ALL** | | |
| CS-D | 977.18 | 978.21 | 1.03 | X | | |
| CS-MWG-LGR | 1008.16 | 1017.16 | 9.00 | X | | |
| CS-MWH-LGR | 1009.90 | 1022.89 | 12.99 | X | | |
| CS-I | 1008.32 | 1012.55 | 4.23 | X | | |
| CS-MW1-LGR | 975.39 | 981.06 | 5.67 | X | | |
| CS-MW1-BS | 975.45 | 985.14 | 9.69 | | X | |
| CS-MW1-CC | 949.02 | 961.74 | 12.72 | | | X |
| CS-MW2-LGR | 972.44 | 979.33 | 6.89 | X | | |
| CS-MW2-CC | 942.22 | 956.91 | 14.69 | | | X |
| CS-MW3-LGR | 976.82 | 980.15 | 3.33 | X | | |
| CS-MW4-LGR | 994.60 | 1025.89 | 31.29 | X | | |
| CS-MW5-LGR | 967.26 | 973.48 | 6.22 | X | | |
| CS-MW6-LGR | 946.34 | 965.76 | 19.42 | X | | |
| CS-MW6-BS | 955.93 | 985.63 | 29.70 | | X | |
| CS-MW6-CC | 928.53 | 949.07 | 20.54 | | | X |
| CS-MW7-LGR | 942.71 | 954.68 | 11.97 | X | | |
| CS-MW7-CC | 917.77 | 944.31 | 26.54 | | | X |
| CS-MW8-LGR | 941.32 | 963.48 | 22.16 | X | | |
| CS-MW8-CC | 920.06 | 945.59 | 25.53 | | | X |
| CS-MW9-LGR | 986.89 | 990.47 | 3.58 | X | | |
| CS-MW9-BS | 987.65 | 990.38 | 2.73 | | X | |
| CS-MW9-CC | 969.45 | 982.93 | 13.48 | | | X |
| CS-MW10-LGR | 904.24 | 939.91 | 35.67 | X | | |
| CS-MW10-CC | 891.23 | 930.43 | 39.20 | | | X |
| CS-MW11A-LGR | 900.76 | 943.69 | 42.93 | X | | |
| CS-MW11B-LGR | Dry | Dry | NA | X | | |
| CS-MW12-LGR | 972.90 | 976.71 | 3.81 | X | | |
| CS-MW12-BS | 978.47 | 983.75 | 5.28 | | X | |
| CS-MW12-CC | 962.35 | 974.84 | 12.49 | | | X |
| CS-MW16-LGR* | 977.48 | 966.90 | -10.58 | X | | |
| CS-MW16-CC* | 883.49 | 891.31 | 7.82 | | | X |
| B3-EXW01* | 932.41 | 934.76 | 2.35 | X | | |
| B3-EXW02 | 953.41 | 939.26 | -14.15 | X | | |
| B3-EXW03* | 957.46 | 953.71 | -3.75 | X | | |
| B3-EXW04* | 957.88 | 913.06 | -44.82 | X | | |
| B3-EXW05 | 974.12 | 972.01 | -2.11 | X | | |
| CS-MW17-LGR | 936.27 | 948.20 | 11.93 | X | | |
| CS-MW18-LGR | 942.41 | 947.03 | 4.62 | X | | |
| CS-MW19-LGR | 959.09 | 965.78 | 6.69 | X | | |
| CS-MW20-LGR | 961.55 | 970.63 | 9.08 | X | | |
| CS-MW21-LGR | 935.56 | 948.04 | 12.48 | X | | |
| CS-MW22-LGR | 917.37 | 936.64 | 19.27 | X | | |
| CS-MW23-LGR | 922.74 | 952.38 | 29.64 | X | | |
| CS-MW24-LGR | 979.43 | 982.19 | 2.76 | X | | |
| CS-MW25-LGR | 982.33 | 985.29 | 2.96 | X | | |
| CS-MW35-LGR | 903.90 | 942.08 | 38.18 | X | | |
| CS-MW36-LGR | 944.45 | 965.84 | 21.39 | X | | |
| **FO-20** | **1051.07** | **1062.05** | **10.98** | **ALL** | | |
| Average groundwater elevation change (all wells minus pumping wells) | | | **14.41** | | | |
| Average groundwater elevation change in each formation (non pumping wells) | | | | **13.16** | **11.85** | **20.65** |

**Notes:**

**Bold wells**: CS-2, CS-9, 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-9, CS-10, CS-12, and CS-13 are current, inactive, or future 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

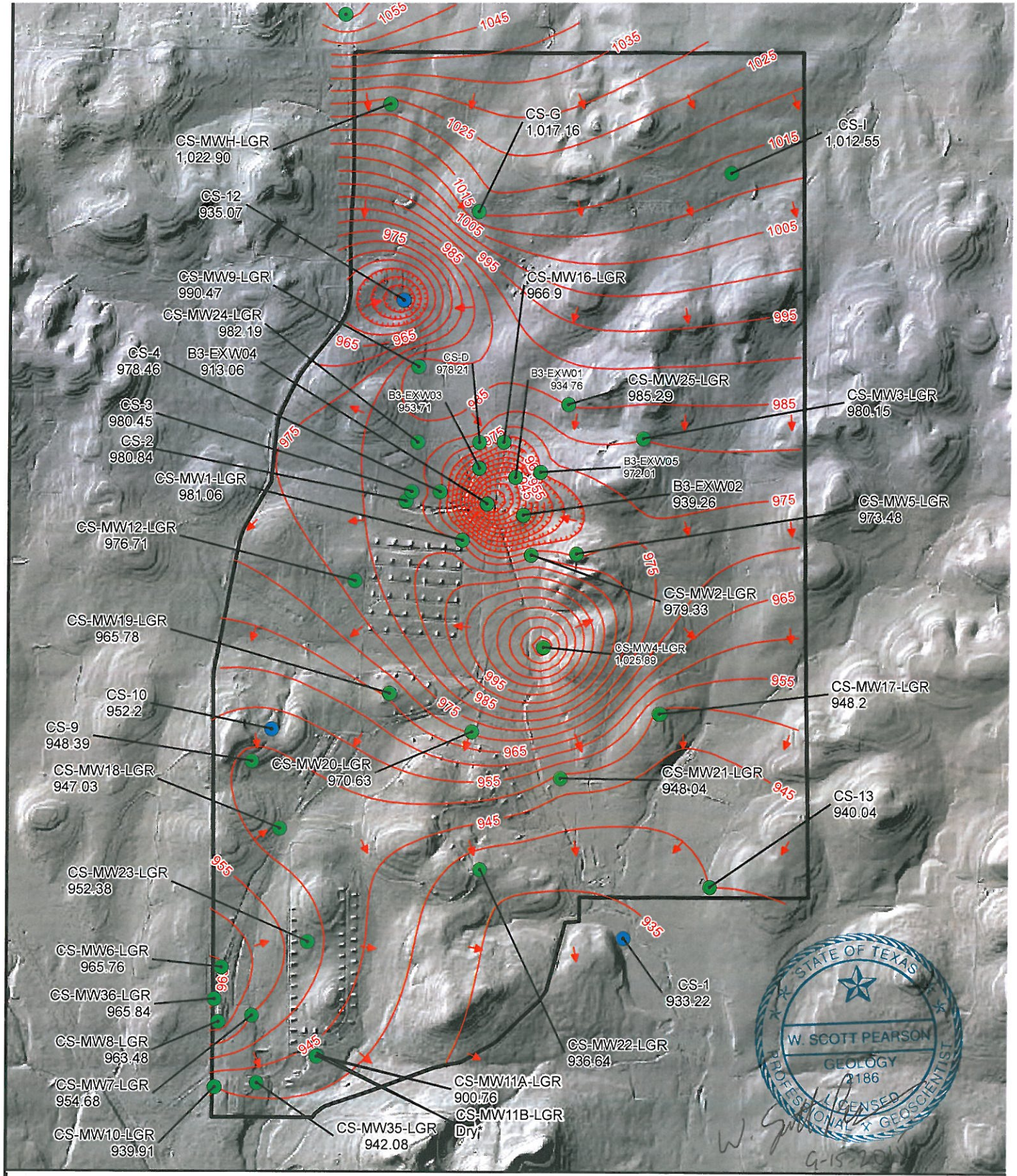


Figure 2.1

March 2015 Potentiometric Surface Map, LGR Wells

Camp Stanley Storage Activity

PARSONS

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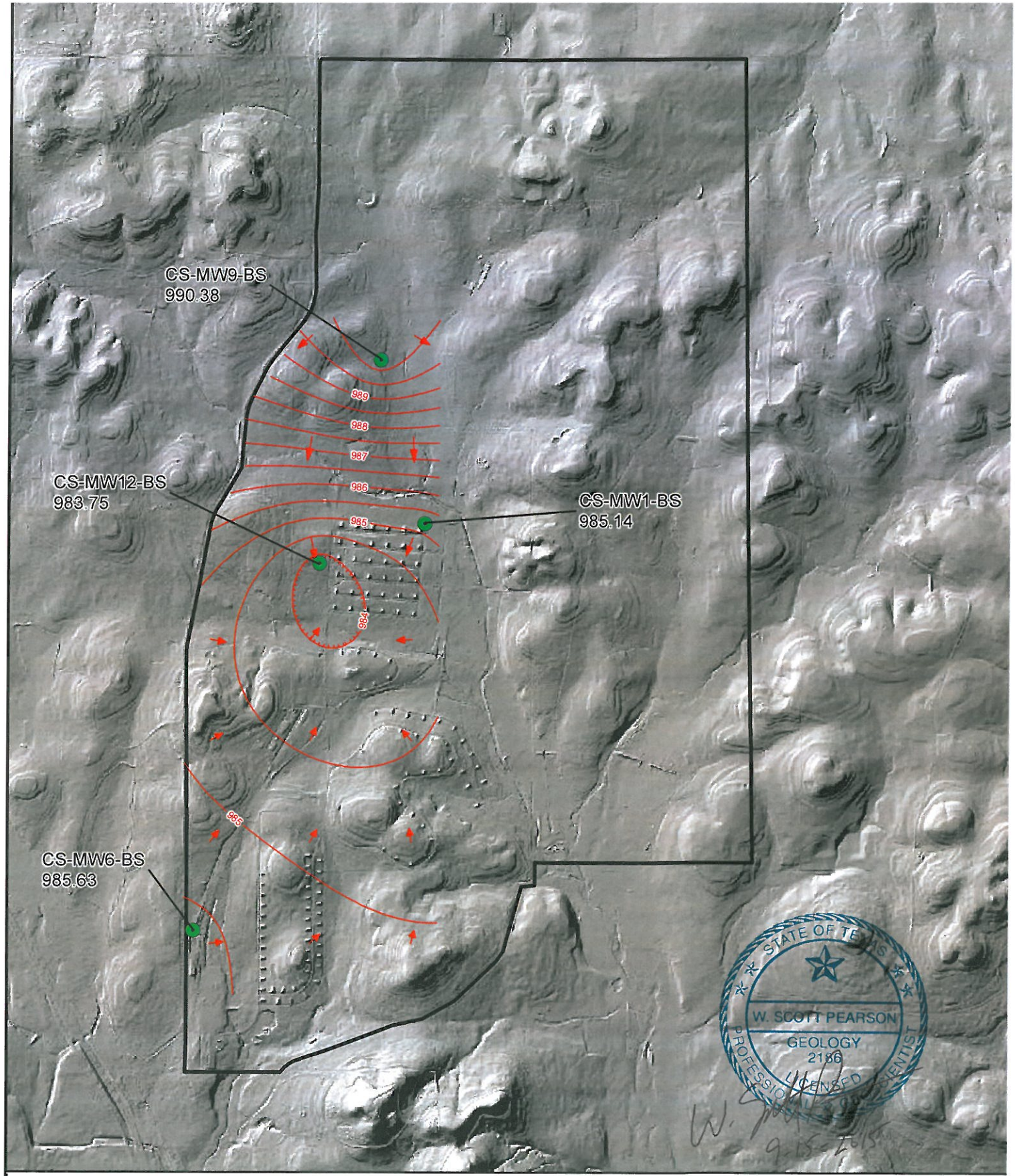


Figure 2.2

March 2015 Potentiometric Surface Map, BS Wells

Camp Stanley Storage Activity

PARSONS

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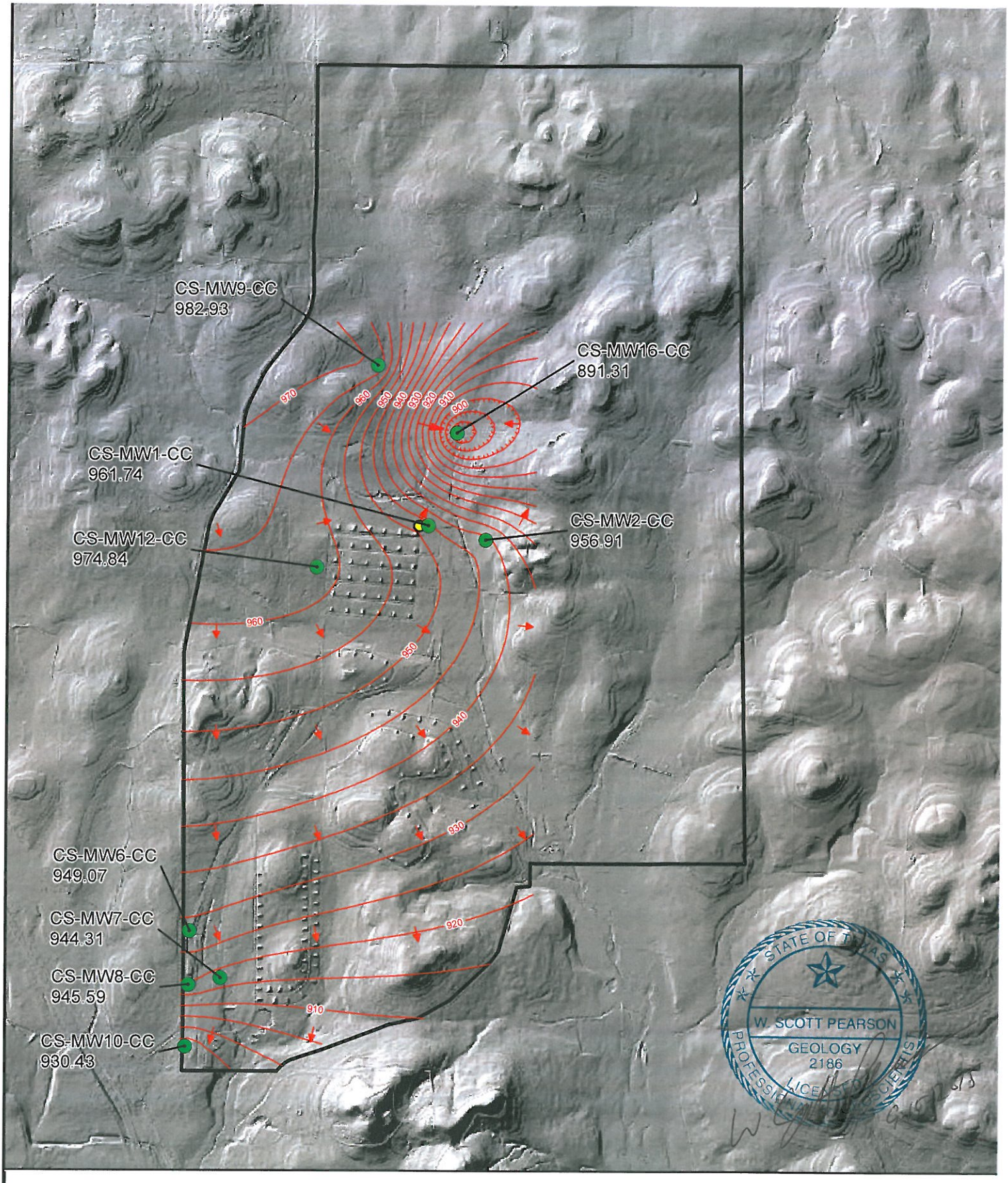


Figure 2.3

March 2015 Potentiometric Surface Map, CC Wells

Camp Stanley Storage Activity

PARSONS

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Historical groundwater monitoring at CSSA has demonstrated that the aquifer gradient typically slopes in a south-southeast direction (**Figure 2.1**); however, variable aquifer levels and well-pumping scenarios can affect the localized and regional gradients. In particular, pumping action at wells CS-1, CS-10, CS-MW16-LGR/CC, B3-EXW01 through B3-EXW05, 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-MW21-LGR. For March 2015, the overall LGR groundwater gradient is to the south-southeast at 0.0055 ft/ft.

The potentiometric surface in both the BS and CC members of the aquifer generally trend in a southerly direction as well (**Figures 2.2 and 2.3**). In **Figure 2.3**, the cone of depression within the CC segment of the aquifer is clearly evident from the pumping action of CS-MW16-CC at the Bioreactor system. The pumping action of this single well disrupts the regional flow pattern within the CC segment, and incurs measurable drawdown in well CS-MW1-CC at a distance of nearly 2,000 feet.

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. Average rain fell between December 2014 and March 2015 (approximately 6 inches) resulting in approximately 14 feet of aquifer level gain in the area. In March 2015, the basewide average level in the LGR wells was 971 feet MSL. The aquifer level as measured in the LGR-screened wells is 54 feet below the 12.25-year average of 1,023 ft MSL. The LGR has not been above the long-term "average" water elevation since March 2012.

It is worth noting that based on more than 12 years of program history, the basewide LGR groundwater level has declined by more than 122 feet. 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 8 years, the average decline rate has subdued, losing an additional 32 feet of average groundwater elevation over 7 years of prolonged drought. 2010 has been the only notable exception of above-average aquifer levels during that timeframe.

# 3.0 MARCH ANALYTICAL RESULTS

## 3.1 Monitoring Wells

Under the provisions of the groundwater monitoring DQOs and the 2010 LTMO evaluation, the schedule for sampling on-post in March 2015 included 33 wells. The samples included three production wells (CS-1, CS-10, and CS-12), one future production well (CS-13), and 29 on-post monitoring wells (see **Table 3.1)**. In conjunction with the off-post monitoring initiative (under a separate report), the March 2015 groundwater sampling constituted a "snapshot" event in which all wells are sampled on a 9-month basis to provide a regional assessment of the aquifer. The results of the snapshot events are assessed annually in the forthcoming December 2015 groundwater monitoring report.

Three wells were not sampled in March 2015. Wells CS-MW11B-LGR, CS-4, and CS-D were not sampled due to the water level falling below the sampling pump. Additional samples were collected as part of the AOC-65 in-situ chemical oxidation (ISCO) Treatability Study; these results will be reported in a separate treatability study report. **Tables 3.1** and **3.2** provide a sampling overview for March 2015 and the schedule under the LTMO recommendations. The above-listed monitoring wells were sampled using dedicated low-flow gas-operated bladder pumps. Wells CS-1, CS-10, CS-12, CS-13, CS-MW16-LGR, and CS-MW16-CC 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 2015 for the short list of volatile organic compounds (VOC) and metals (chromium, cadmium, lead, and mercury). Active and future drinking water wells CS-1, CS-10, CS-12, and CS-13 were analyzed for the short list VOCs 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**.

Tetrachloroethene (PCE) and/or Trichloroethene (TCE) were detected above the Maximum Contaminant Level (MCL) of 5 micrograms per liter (µg/L) in four on-post wells sampled this quarter: CS-MW1-LGR, CS-MW16-LGR, CS-MW16-CC, and CS-MW36-LGR. A comparison of VOC concentrations versus water level for select wells is presented in **Figure 3.2**. The overall trend for wells sampled in March 2015 (CS-MW16-LGR, CS-MW16-CC, CS-MW1-LGR and CS-MW36-LGR) was a slight to no increase in VOC concentrations coupled with a slight increase in groundwater elevation. In March 2015, no metals were detected above the MCL/AL/SS for wells sampled.

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 packages numbered 81000-#18, -#20, -#21, -#22 containing the analytical results from this sampling event, were received by Parsons April 1 through 10, 2015. Data validation was conducted and the data validation reports are presented in **Appendix C**.

**Table 3.1**
**Overview of the On-Post Monitoring Program**

| Count | Well ID | *Analytes* | *Last Sample Date* | *Jun-14 (18 mo. snapshot)* | *Sep-14* | *Dec-14* | *Mar-15 (9 mo. snapshot)* | *Sampling Frequency ** |
|---|---|---|---|---|---|---|---|---|
| 1 | CS-MW1-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Sep-14 | S | S | NS | S | Semi-annual + 9 month snapshot |
| | CS-MW1-BS | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-12 | NS | NS | NS | NS | sampled on an as needed basis |
| | CS-MW1-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Sep-14 | S | S | NS | NS | Every 18 months |
| 2 | CS-MW2-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Sep-14 | S | S | NS | S | Semi-annual + 9 month snapshot |
| | CS-MW2-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NSWL | NS | NS | Every 18 months |
| 3 | CS-MW3-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | S | Every 9 months |
| 4 | CS-MW4-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-13 | NSWL | NSWL | NS | S | Every 9 months |
| 5 | CS-MW5-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | S | Every 9 months |
| 6/ISCO | CS-MW6-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-14 | S | ISCO | S | S | Every 9 months |
| | CS-MW6-BS | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-12 | NS | NS | NS | NS | sampled on an as needed basis |
| | CS-MW6-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | NS | Every 18 months |
| 7/ISCO | CS-MW7-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-14 | S | ISCO | S | S | Every 9 months |
| | CS-MW7-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | NS | Every 18 months |
| 8/ISCO | CS-MW8-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-14 | S | S | S | S | Semi-annual + 9 month snapshot |
| | CS-MW8-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | NS | Every 18 months |
| 9 | CS-MW9-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | S | Every 9 months |
| | CS-MW9-BS | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-12 | NS | NS | NS | NS | sampled on an as needed basis |
| | CS-MW9-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | NS | Every 18 months |
| 10 | CS-MW10-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NSWL | NS | S | Semi-annual + 9 month snapshot |
| | CS-MW10-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-12 | NSWL | NS | NS | NS | Every 18 months |
| 11 | CS-MW11A-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Sep-14 | S | S | NS | S | Semi-annual + 9 month snapshot |
| 12 | CS-MW11B-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Mar-12 | NSWL | NS | NS | S | Every 9 months |
| 13 | CS-MW12-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | S | Every 9 months |
| | CS-MW12-BS | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-12 | NS | NS | NS | NS | sampled on an as needed basis |
| | CS-MW12-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | NS | Every 18 months |
| 14 | CS-MW16-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | S | Every 9 months |
| 15 | CS-MW16-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | S | Every 9 months |
| 16 | CW-MW17-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NSWL | NS | S | Every 9 months |
| 17 | CS-MW18-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-12 | NSWL | NS | NS | S | Every 9 months |
| 18 | CS-MW19-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | S | Every 9 months |
| 19 | CS-1 | VOCs & metals (As,Ba,Cr, Cu,Cd,Hg,Pb,Zn) | Dec-14 | S | S | S | S | Quarterly |
| 20 | CS-2 | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | S | Every 9 months |
| 21 | CS-4 | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-13 | NSWL | NSWL | NS | S | Semi-annual + 9 month snapshot |
| | CS-9 | VOCs & metals (Cr, Cd, Hg, Pb) | Sep-13 | NS | NS | NS | NS | pump out |
| 22 | CS-10 | VOCs & metals (As,Ba,Cr, Cu,Cd,Hg,Pb,Zn) | Dec-14 | S | S | S | S | Quarterly |
| 23 | CS-12 | VOCs & metals (As,Ba,Cr, Cu,Cd,Hg,Pb,Zn) | Dec-14 | S | S | S | S | Quarterly |
| 24 | CS-13 | VOCs & metals (As,Ba,Cr, Cu,Cd,Hg,Pb,Zn) | Dec-14 | S | S | S | S | Quarterly |
| 25 | CS-D | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-12 | NSWL | NSWL | NS | S | Semi-annual + 9 month snapshot |
| | CS-MWG-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | NS | Every 18 months |
| | CS-MWH-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | NS | Every 18 months |
| | CS-I | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | NS | Every 18 months |
| 26 | CS-MW20-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | S | Every 9 months |
| 27 | CS-MW21-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Sep-14 | S | S | NS | S | Every 9 months |
| 28 | CS-MW22-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | S | Every 9 months |
| 29 | CS-MW23-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | S | Every 9 months |
| 30 | CS-MW24-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Sep-14 | S | S | NS | S | Semi-annual + 9 month snapshot |
| 31 | CS-MW25-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Jun-14 | S | NS | NS | S | Every 9 months |
| 32 | CS-MW35-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Sep-14 | S | S | NS | S | Semi-annual + 9 month snapshot |
| 33/ISCO | CS-MW36-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-14 | S | S | S | S | Quarterly |

* New LTMO sampling frequency implemented June 2011
S = Sample
NS = No Sample
NSWL = No Sample due to low water level
ISCO = well sampled as part of treatability study

**Table 3.2 Westbay Sampling Frequency**

| Westbay Interval | Last Sample Date | Jun-14 (snapshot) | Sep-14 | Dec-14 (9 month) | Mar-15 (snapshot) | LTMO Sampling Frequency (as of June '11) | ISCO sample zones |
|---|---|---|---|---|---|---|---|
| CS-WB01-UGR-01 | Dec-04 | NS | NS | NSWL | NS | Every 9 months | ISCO |
| CS-WB01-LGR-01 | Dec-14 | NS | NS | S | NS | Every 9 months | ISCO |
| CS-WB01-LGR-02 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB01-LGR-03 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB01-LGR-04 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB01-LGR-05 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB01-LGR-06 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB01-LGR-07 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB01-LGR-08 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB01-LGR-09 | Dec-14 | S | NS | S | S | Every 9 months + snapshot | ISCO |
| CS-WB02-UGR-01 | Dec-04 | NS | NS | NSWL | NS | Every 9 months | ISCO |
| CS-WB02-LGR-01 | Dec-14 | NS | NS | S | NS | Every 9 months | ISCO |
| CS-WB02-LGR-02 | Mar-10 | NS | NS | NSWL | NS | Every 9 months | |
| CS-WB02-LGR-03 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB02-LGR-04 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB02-LGR-05 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB02-LGR-06 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB02-LGR-07 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB02-LGR-08 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB02-LGR-09 | Dec-14 | S | NS | S | S | Every 9 months + snapshot | ISCO |
| CS-WB03-UGR-01 | Dec-14 | NS | NS | S | NS | Every 9 months | ISCO |
| CS-WB03-LGR-01 | Dec-14 | NS | NS | S | NS | Every 9 months | ISCO |
| CS-WB03-LGR-02 | Oct-07 | NS | NS | NSWL | NS | Every 9 months | |
| CS-WB03-LGR-03 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB03-LGR-04 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB03-LGR-05 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB03-LGR-06 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB03-LGR-07 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB03-LGR-08 | Dec-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB03-LGR-09 | Dec-14 | S | NS | S | S | Every 9 months + snapshot | ISCO |
| CS-WB04-UGR-01 | Mar-04 | NS | NS | NSWL | NS | Every 9 months | ISCO |
| CS-WB04-LGR-01 | Sep-14 | NS | NS | NS | NS | Every 18 months | ISCO |
| CS-WB04-LGR-02 | Mar-14 | NS | NS | NS | NS | Every 18 months | |
| CS-WB04-LGR-03 | Mar-14 | NS | NS | NS | NS | Every 18 months | |
| CS-WB04-LGR-04 | Mar-14 | NS | NS | NS | NS | Every 18 months | |
| CS-WB04-LGR-06 | Dec-14 | S | NS | S | S | Every 9 months + snapshot | |
| CS-WB04-LGR-07 | Dec-14 | S | NS | S | S | Every 9 months + snapshot | |
| CS-WB04-LGR-08 | Mar-14 | NS | NS | S | NS | Every 9 months | |
| CS-WB04-LGR-09 | Dec-14 | S | NS | S | S | Every 9 months + snapshot | |
| CS-WB04-LGR-10 | Dec-14 | S | NS | S | S | Every 9 months + snapshot | |
| CS-WB04-LGR-11 | Dec-14 | S | NS | S | S | Every 9 months + snapshot | ISCO |
| CS-WB04-BS-01 | Mar-14 | NS | NS | NS | NS | Every 18 months | |
| CS-WB04-BS-02 | Mar-14 | NS | NS | NS | NS | Every 18 months | |
| CS-WB04-CC-01 | Mar-14 | NS | NS | NS | NS | Every 18 months | |
| CS-WB04-CC-02 | Mar-14 | NS | NS | NS | NS | Every 18 months | |
| CS-WB04-CC-03 | Mar-14 | NS | NS | NS | NS | Every 18 months | |

Profiling performed quarterly, in conjunction with post wide water levels.

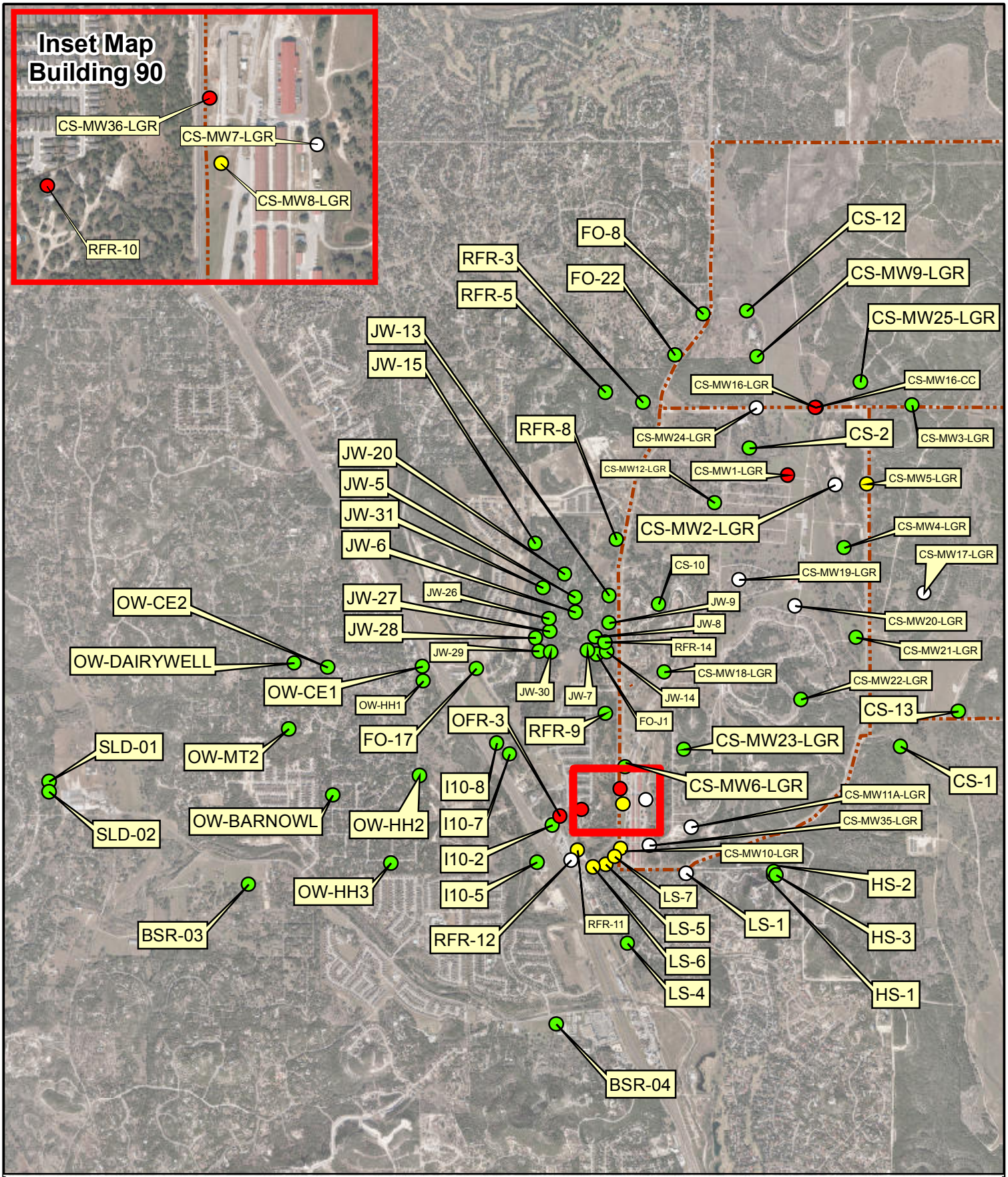



Figure 3.1

On-Post and Off-Post Well Sampling Locations for March 2015

Camp Stanley Storage Activity

PARSONS

**Table 3.3**
**March 2015 On-Post Quarterly Groundwater Results, Detected Analytes**

| Well ID | Sample Date | Arsenic | Barium | Cadmium | Chromium | Copper | Lead | Zinc | Mercury |
|---|---|---|---|---|---|---|---|---|---|
| CS-MW1-LGR | 3/10/2015 | NA | NA | -- | 0.0021F | NA | -- | NA | -- |
| CS-MW2-LGR | 3/10/2015 | NA | NA | -- | -- | NA | -- | NA | -- |
| CS-MW3-LGR | 3/13/2015 | NA | NA | -- | 0.0014F | NA | -- | NA | -- |
| CS-MW4-LGR | 3/10/2015 | NA | NA | -- | -- | NA | -- | NA | -- |
| CS-MW5-LGR | 3/10/2015 | NA | NA | -- | 0.0060F | NA | -- | NA | -- |
| CS-MW6-LGR | 3/10/2015 | NA | NA | -- | 0.0016F | NA | -- | NA | -- |
| CS-MW7-LGR | 3/10/2015 | NA | NA | -- | 0.0024F | NA | -- | NA | -- |
| CS-MW8-LGR | 3/10/2015 | NA | NA | -- | 0.0021F | NA | -- | NA | -- |
| CS-MW9-LGR | 3/13/2015 | NA | NA | -- | 0.0042F | NA | -- | NA | -- |
| CS-MW10-LGR | 3/11/2015 | NA | NA | -- | 0.0035F | NA | -- | NA | -- |
| CS-MW11A-LGR | 3/11/2015 | NA | NA | -- | 0.0020F | NA | -- | NA | -- |
| CS-MW12-LGR | 3/12/2015 | NA | NA | -- | 0.0018F | NA | -- | NA | -- |
| CS-MW16-LGR | 3/13/2015 | NA | NA | -- | -- | NA | -- | NA | 0.0002F |
| CS-MW16-CC | 3/13/2015 | NA | NA | -- | -- | NA | -- | NA | -- |
| CS-MW17-LGR | 3/18/2015 | NA | NA | -- | 0.0088F | NA | -- | NA | -- |
| CS-MW17-LGR FD | 3/18/2015 | NA | NA | -- | 0.0084F | NA | -- | NA | -- |
| CS-MW18-LGR | 3/18/2015 | NA | NA | -- | 0.0017F | NA | -- | NA | -- |
| CS-MW19-LGR | 3/12/2015 | NA | NA | -- | 0.0023F | NA | -- | NA | -- |
| CS-MW20-LGR | 3/17/2015 | NA | NA | -- | 0.0021F | NA | -- | NA | -- |
| CS-MW21-LGR | 3/13/2015 | NA | NA | -- | -- | NA | -- | NA | 0.0002F |
| CS-MW22-LGR | 3/17/2015 | NA | NA | -- | -- | NA | -- | NA | -- |
| CS-MW23-LGR | 3/17/2015 | NA | NA | -- | 0.0030F | NA | -- | NA | -- |
| CS-MW24-LGR | 3/13/2015 | NA | NA | -- | 0.0043F | NA | -- | NA | -- |
| CS-MW25-LGR | 3/13/2015 | NA | NA | -- | 0.0012F | NA | -- | NA | -- |
| CS-MW25-LGR FD | 3/13/2015 | NA | NA | -- | 0.0012F | NA | -- | NA | -- |
| CS-MW35-LGR | 3/18/2015 | NA | NA | -- | -- | NA | -- | NA | -- |
| CS-MW36-LGR | 3/10/2015 | NA | NA | -- | 0.0016F | NA | -- | NA | -- |
| CS-2 | 3/17/2015 | NA | NA | -- | 0.0019F | NA | -- | NA | -- |
| **CSSA Drinking Water Well System** | | | | | | | | | |
| CS-1 | 3/9/2015 | 0.0011F | 0.0345 | -- | 0.0011F | 0.004F | -- | 0.193 | -- |
| CS-1 FD | 3/9/2015 | -- | 0.0358 | -- | 0.0012F | 0.008F | -- | 0.218 | -- |
| CS-10 | 3/9/2015 | 0.0016F | 0.0392 | -- | -- | 0.014 | -- | 0.051 | -- |
| CS-12 | 3/9/2015 | -- | 0.0312 | -- | 0.0012F | -- | -- | 0.072 | -- |
| CS-13 | 3/9/2015 | 0.0029F | 0.0294 | -- | -- | -- | -- | 0.252 | -- |
| **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 | 1,1-DCE | cis-1,2-DCE | trans-1,2-DCE | PCE | TCE | Vinyl Chloride |
|---|---|---|---|---|---|---|---|
| CS-MW1-LGR | 3/10/2015 | -- | 20.13 | 0.27F | 16.66 | 29.71 | -- |
| CS-MW2-LGR | 3/10/2015 | -- | 0.50F | -- | -- | -- | -- |
| CS-MW3-LGR | 3/13/2015 | -- | -- | -- | -- | -- | -- |
| CS-MW4-LGR | 3/10/2015 | -- | -- | -- | -- | -- | -- |
| CS-MW5-LGR | 3/10/2015 | -- | 2.91 | -- | 1.38F | 3.09 | -- |
| CS-MW6-LGR | 3/10/2015 | -- | -- | -- | -- | -- | -- |
| CS-MW7-LGR | 3/10/2015 | -- | -- | -- | 0.87F | -- | -- |
| CS-MW8-LGR | 3/10/2015 | -- | -- | -- | 3.38 | -- | -- |
| CS-MW9-LGR | 3/13/2015 | -- | -- | -- | -- | -- | -- |
| CS-MW10-LGR | 3/11/2015 | -- | -- | -- | 1.74 | 0.48F | -- |
| CS-MW11A-LGR | 3/11/2015 | -- | -- | -- | 0.84F | -- | -- |
| CS-MW12-LGR | 3/12/2015 | -- | -- | -- | -- | -- | -- |
| CS-MW16-LGR | 3/13/2015 | -- | 87.69 | 0.30F | 78.41 | 88 | -- |
| CS-MW16-CC | 3/13/2015 | -- | 14.77 | 6.57 | 0.15F | 5.16 | -- |
| CS-MW17-LGR | 3/18/2015 | -- | -- | -- | 0.30F | -- | -- |
| CS-MW17-LGR FD | 3/18/2015 | -- | -- | -- | 0.38F | -- | -- |
| CS-MW18-LGR | 3/18/2015 | -- | -- | -- | -- | -- | -- |
| CS-MW19-LGR | 3/12/2015 | -- | -- | -- | 0.67F | -- | -- |

**Table 3.3 (cont.)**
**March 2015 On-Post Quarterly Groundwater Results, Detected Analytes**

| Well ID | Sample Date | 1,1-DCE | cis-1,2-DCE | trans-1,2-DCE | PCE | TCE | Vinyl Chloride |
|---|---|---|---|---|---|---|---|
| CS-MW20-LGR | 3/17/2015 | -- | -- | -- | **1.29F** | -- | -- |
| CS-MW21-LGR | 3/13/2015 | -- | -- | -- | -- | -- | -- |
| CS-MW22-LGR | 3/17/2015 | -- | -- | -- | -- | -- | -- |
| CS-MW23-LGR | 3/17/2015 | -- | -- | -- | -- | -- | -- |
| CS-MW24-LGR | 3/13/2015 | -- | -- | -- | **0.20F** | **0.12F** | -- |
| CS-MW25-LGR | 3/13/2015 | -- | -- | -- | -- | -- | -- |
| CS-MW25-LGR FD | 3/13/2015 | -- | -- | -- | -- | -- | -- |
| CS-MW35-LGR | 3/18/2015 | -- | -- | -- | **0.24F** | -- | -- |
| CS-MW36-LGR | 3/10/2015 | -- | **0.70F** | -- | **16.68** | **28.3** | -- |
| CS-2 | 3/17/2015 | -- | -- | -- | -- | -- | -- |
| **CSSA Drinking Water Well System** | | | | | | | |
| CS-1 | 3/9/2015 | -- | -- | -- | -- | -- | -- |
| CS-1 FD | 3/9/2015 | -- | -- | -- | -- | -- | -- |
| CS-10 | 3/9/2015 | -- | -- | -- | -- | -- | -- |
| CS-12 | 3/9/2015 | -- | -- | -- | -- | -- | -- |
| CS-13 | 3/9/2015 | -- | -- | -- | -- | -- | -- |
| **Comparison Criteria** | | | | | | | |
| **Method Detection Limit (MDL)** | | **0.12** | **0.07** | **0.08** | **0.06** | **0.05** | **0.08** |
| **Reporting Limit (RL)** | | **1.2** | **1.2** | **0.6** | **1.4** | **1** | **1.1** |
| **Max. Contaminant Level (MCL)** | | **7** | **70** | **100** | **5** | **5** | **2** |

| | |
|---|---|
| **BOLD** | ≥ MDL |
| **BOLD** | ≥ RL |
| **BOLD** | ≥ MCL |

| **Precipitation per Quarter:** | **Mar-15** |
|---|---|
| AOC-65 Weather Station (WS AOC-65): | 5.52 |
| B-3 Weather Station (WS B-3): | 7.95 |
| MW18 Weather Station (WS MW18): | 11.42 |

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 |
| NA | Not Analyzed for this parameter |

**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.

## Table 3.4
## March 2015 Westbay Results, Detected Analytes

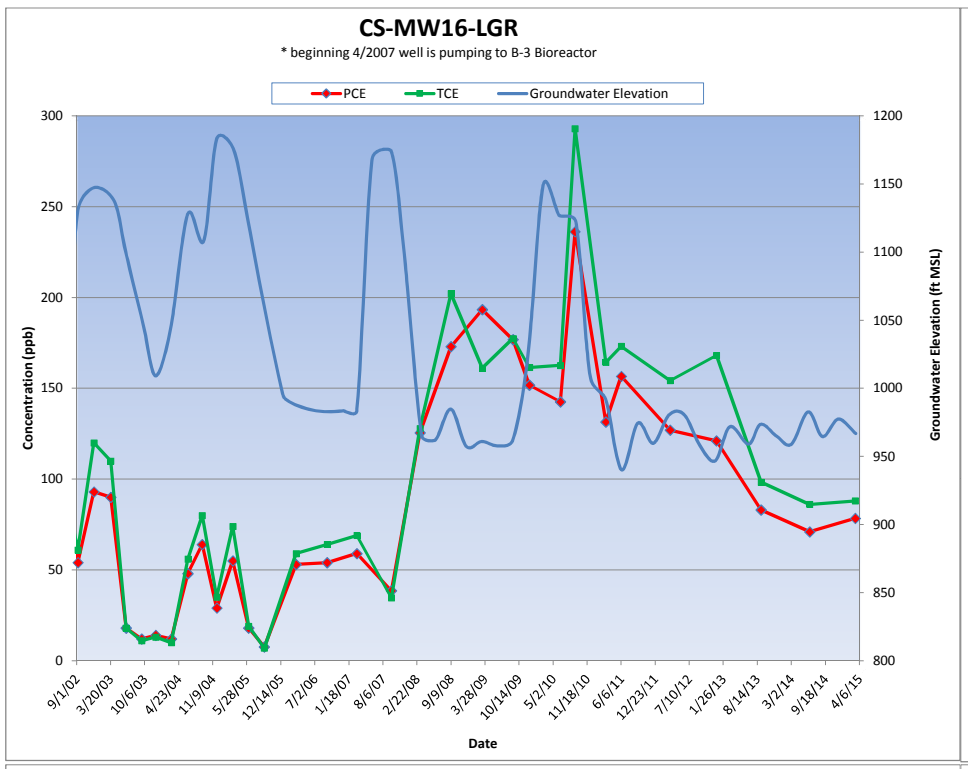
| Well ID | Date Sampled | 1,1-DCE | cis-1,2-DCE | TCE | PCE | trans-1,2-DCE | Vinyl Chloride |
|---|---|---|---|---|---|---|---|
| CS-WB01-LGR-09 | 3/23/2015 | -- | **0.35F** | **8.67** | **6.54** | -- | **0.28F** |
| CS-WB02-LGR-09 | 3/23/2015 | -- | **0.21F** | **8.03** | **7.93** | -- | -- |
| CS-WB03-LGR-09 | 3/24/2015 | -- | **1.75** | **1.2** | **0.75F** | -- | -- |
| CS-WB04-LGR-06 | 3/24/2015 | -- | **3.63** | **12.79** | **55.08** | **0.40F** | -- |
| CS-WB04-LGR-07 | 3/24/2015 | -- | **3.21** | **10.85** | **35.6** | **0.26F** | -- |
| CS-WB04-LGR-09 | 3/24/2015 | -- | **0.14F** | **10.44** | **15.58** | -- | -- |
| CS-WB04-LGR-10 | 3/24/2015 | -- | -- | **0.54F** | **7.47** | -- | -- |
| CS-WB04-LGR-11 | 3/24/2015 | -- | -- | **2.7** | **444.82*** | -- | -- |
| **Comparison Criteria** | | | | | | | |
| Method Detection Limit | **MDL** | **0.12** | **0.07** | **0.05** | **0.06** | **0.08** | **0.08** |
| Reporting Limit | **RL** | **1.2** | **1.2** | **1** | **1.4** | **0.6** | **1.1** |
| Max. Contaminant Level | **MCL** | **7** | **70** | **5** | **5** | **100** | **2** |

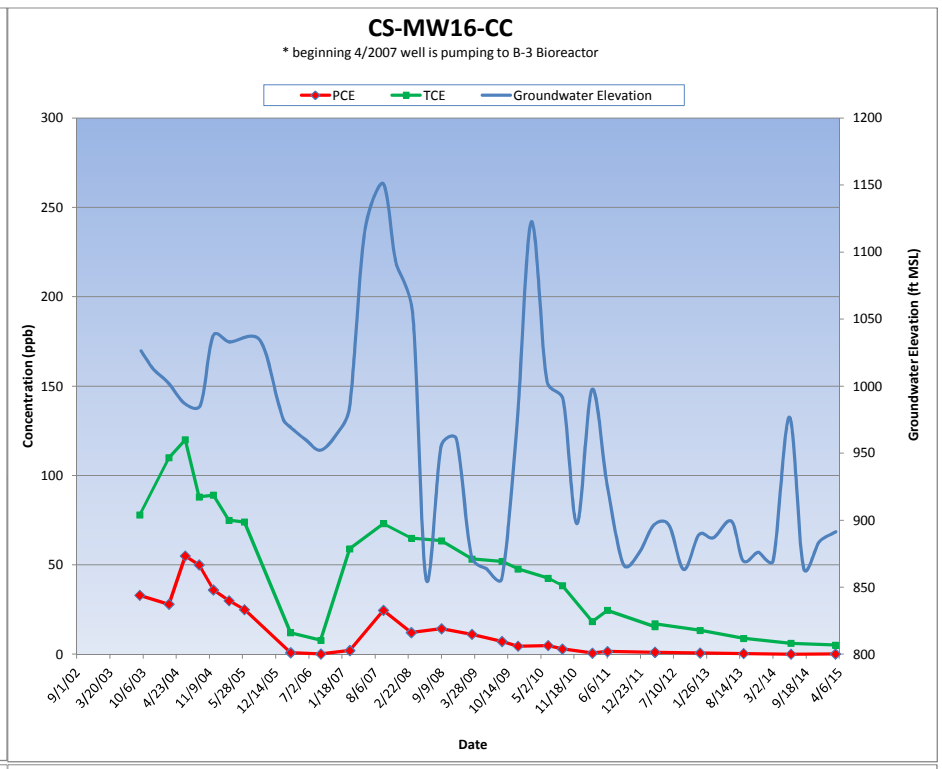
**Data Qualifiers**

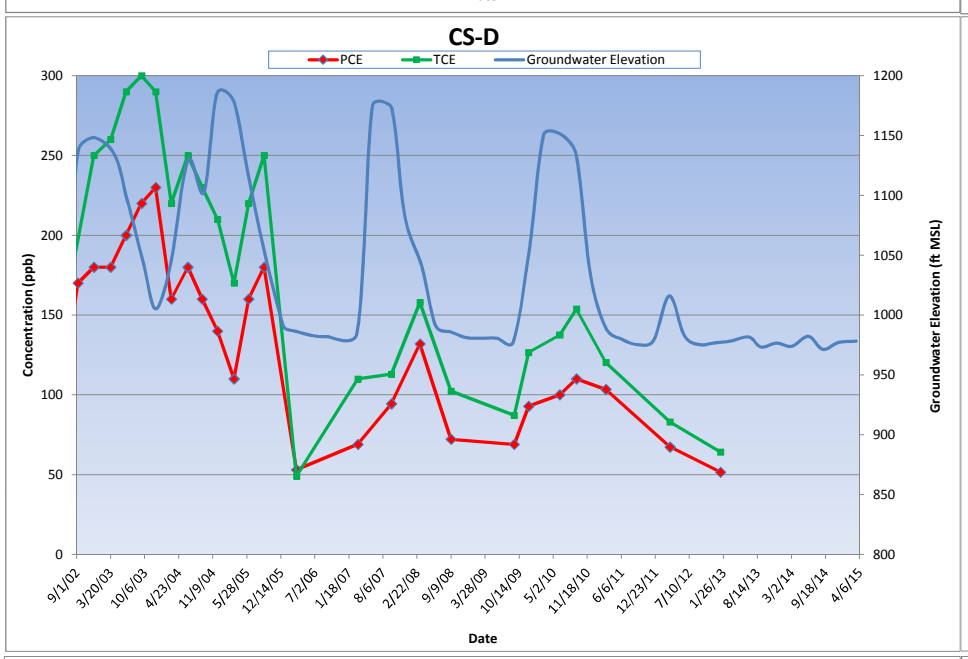
'--' indicates the result was non-detect.
F-The analyte was positively identified but the associated numerical value is below the RL.
* dilution of 20 run for this sample.
** dilution of 1000 run for this sample.
All values are reported in µg/L.
DCE - dichloroethene
TCE - trichloroethene
PCE - tetrachloroethene

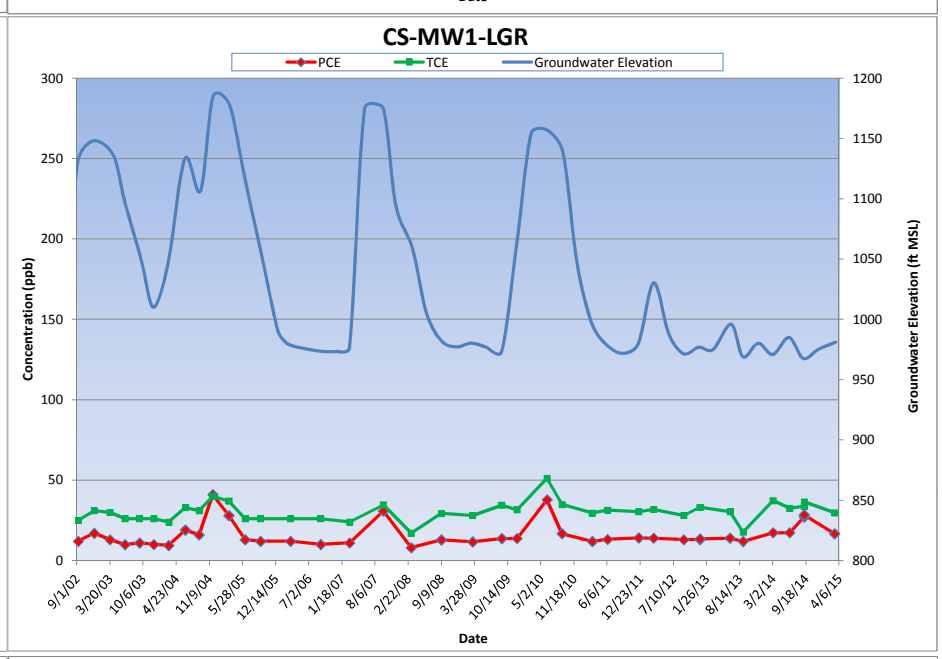
| | |
|---|---|
| **BOLD** | ≥ MDL |
| **BOLD** | ≥ RL |
| **BOLD** | ≥ MCL |

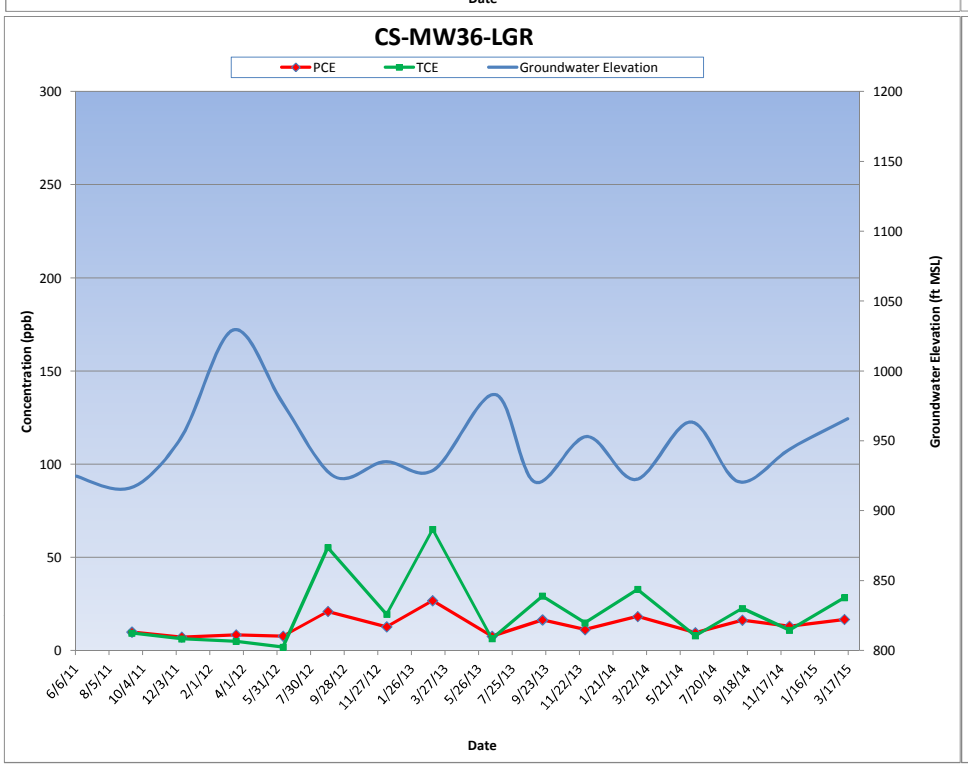
**Figure 3.2**
**On-Post Cumulative Analytical vs. Groundwater Elevation**

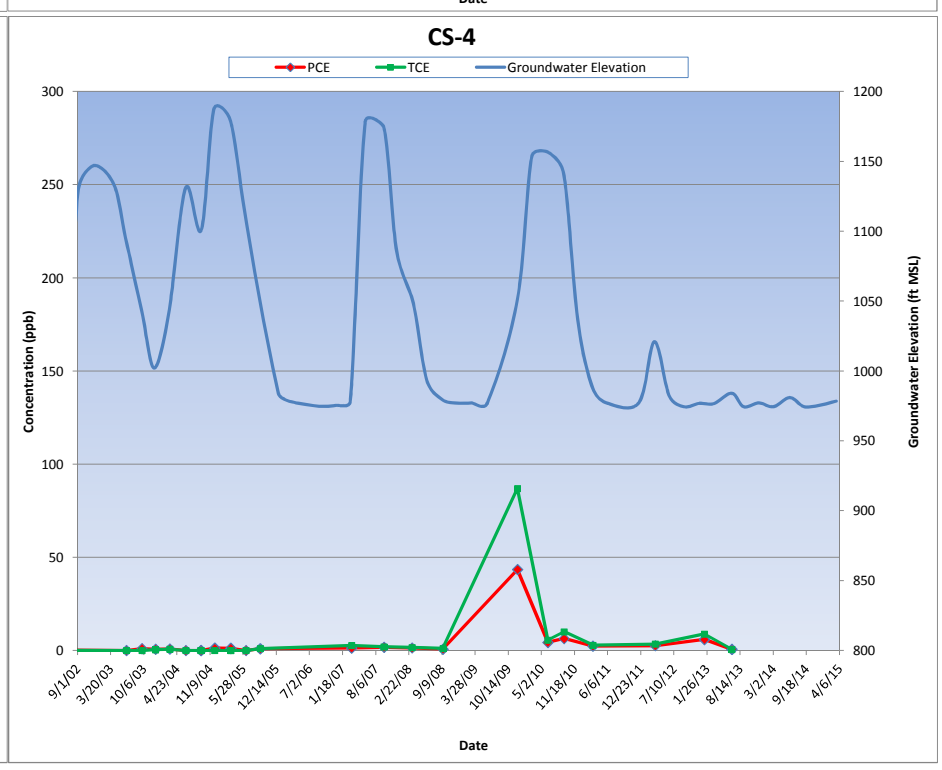



NOTE: Sampling dates are indicated by the squares on the trend line.

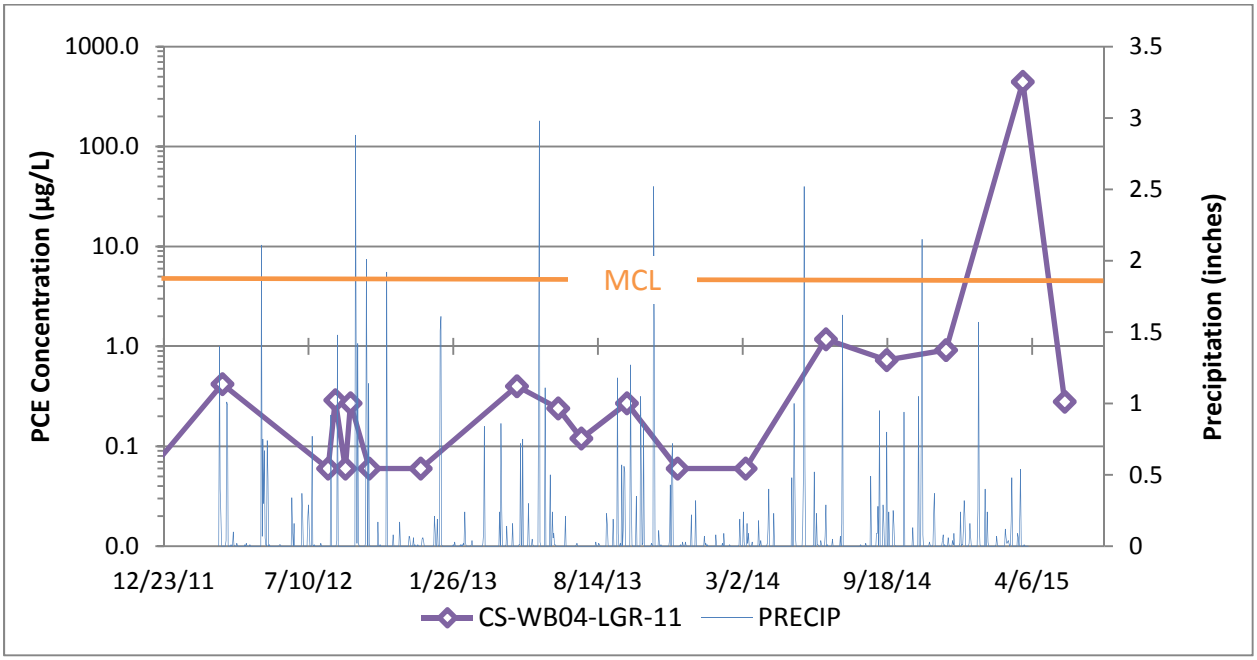
## 3.2 Westbay-equipped Wells

Under the provisions of the groundwater monitoring LTMO recommendations, 8 zones in the AOC-65 Westbay wells (CS-WB01, CS-WB02, CS-WB03, and CS-WB04) were scheduled for sampling in March 2015. These wells were also profiled to capture water level readings. These Westbay wells are located in the vicinity of AOC-65, and are part of the basewide quarterly groundwater monitoring program. The Upper Glen Rose (UGR)/LGR zones are sampled on a 9-month schedule, and the BS/CC zones are sampled on an 18-month schedule, as recommended in the LTMO. The sampling of these wells began in September 2003.

Of the 8 zones sampled in March 2015, 7 zones had PCE and/or TCE above the applicable MCL. The 5 zones in WB04 reported the highest PCE detections to date and zones WB04-LGR-10 and -11 were above the MCL for the first time since sampling began in 2003. Selected zones were also sampled as part of the AOC-65 ISCO Treatability Study; these results will be reported in a separate treatability study report.

Of particular note, the off-post WB04-LGR-11 zone reported a concentration of 444.82 µg/L PCE in March 2015. This zone was first sampled in September 2003, and since that time has never yielded a PCE concentration in excess of 1.18 µg/L. In fact, only 12 detections of PCE have been reported in 44 sampling events over 11 years. The well was re-sampled in May 2015, with a "typical" result of 0.28 µg/L. The abnormal result is believed to be a result of the ISCO injections conducted on-post during September through November 2014. It is hypothesized that the ISCO treatment released a slug of groundwater impacted with elevated PCE concentrations. The affect was not measured at any off-post well location, including an adjacent private well (RFR-10), located approximately 150 feet from CS-WB04.

**Figure 3.3 Historical PCE Concentrations at CS-WB04-LGR-11**



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 2015 SUMMARY

- A total of 33 wells were planned to be sampled in March 2015. Three of these wells (CS-MW11B-LGR, CS-4, and CS-D) were not sampled due to water levels falling below the sampling pump.
- From January 1 to March 31, 2015, CSSA's AOC-65 weather station recorded 5.52 inches of rain. The rainfall was sporadic with a majority of the rain falling in January, 3.28 inches. One event had greater than one inch of rain, 1.57, on January 22nd. The SWMU B-3 weather station measured 7.95 inches of precipitation and the MW18 weather station measured 11.42 inches for the same time period. This is a slight increase in quarterly rainfall from last quarter which measured 7.38 inches at AOC-65 and 9.34 inches at B-3. The MW18 weather station did not come online until mid September 2014.
- The Middle Trinity aquifer levels increased an average of 14.41 feet per non-pumping wells since last quarter. The average water level in March 2015 (excluding pumping wells) was 272.53 feet BTOC (969.94 feet MSL).
- VOCs were detected above the MCL in wells CS-MW1-LGR, CS-MW16-LGR, CS-MW16-CC, and CS-MW36-LGR. The VOC levels in CS-MW36-LGR showed a moderate increase from the previous sampling event. The VOC levels in CS-MW1-LGR decreased from last sampling event and levels in CS-MW16-LGR showed a slight increase **(see Figure 3.2)**.
- Well CS-MW24-LGR reported its first detection of PCE and TCE (below the reporting limit [RL]), since the well was installed in 2007.
- There were no metals detected above the MCL/AL/SS in wells sampled in March 2015.
- The 8 LTMO selected zones in Westbay Wells (WB01-WB04), in the vicinity of AOC-65, were sampled in March 2015. These wells were also profiled to collect water level data in the area.
- Seven of the 8 Westbay Well zones sampled in March 2015 had PCE and/or TCE above the MCL. Zones CS-WB04-LGR-11, -10, -9, -7, and -6 reported the highest historic detections to date for PCE. Zone CS-WB01-LGR-09 also reported the first detection of vinyl chloride to date.
- It should be noted that an ISCO injection was performed at AOC-65 September 22nd through November 6th, 2014. This included the application of approximately 100,000 gallons of chemical oxidants (activated persulfate solution) within the AOC-65 infiltration gallery to destroy contaminants. Once applied, the oxidant solution follows similar subsurface flow paths as contaminants and precipitation, destroying and releasing contaminants encountered (including PCE) from the host rock until the solution reactivity has been consumed. Contaminants mobilized from the host rock during this process are more readily transported downgradient following significant rain events when the flow paths are saturated.
- The WB04-LGR-11 zone reported a concentration of 444.82 µg/L PCE in March 2015. This zone was first sampled in September 2003, and since that time has never yielded a PCE concentration in excess of 1.18 µg/L. In fact, only 12 detections of PCE have been

reported in 44 sampling events over 11 years. The abnormal result is believed to be a result of the ISCO injections conducted on-post during September through November 2014. The well was re-sampled in May 2015 with a "typical" result of 0.28 µg/L. No other off-post well monitored in March 2015 detected a temporal slug of increased VOC contamination, including the adjacent private well, RFR-10.

- The groundwater project DQOs and LTMO, last revised in 2010, are scheduled to be updated in 2015.

# 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, 2015. | 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, 2015 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 9 or 18 months and 8 selected zones are sampled during the 'snapshot' event. | 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-MW24-LGR. 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, and CS-10. Data was also downloaded from the AOC-65, B-3, and MW18 weather stations. Water levels will be graphed at these wells against precipitation data through December 2015 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 30 of 49 CSSA wells. Wells CS-MW11B-LGR, CS-4, and CS-D were not sampled due to the water level falling below the pump. The 4 BS wells are no longer sampled 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-2, CS-4, CS-MW1-LGR, CS-MW2-LGR, CS-MW3-LGR, CS-MW4-LGR, CS-MW5-LGR, CS-MW6-LGR, CS-MW7-LGR, CS-MW8-LGR, CS-MW9-LGR, CS-MW10-LGR, CS-MW11A-LGR, CS-MW12-LGR, CS-MW16-LGR, CS-MW16-CC, CS-MW17-LGR, CS-MW18-LGR, CS-MW19-LGR, CS-MW20-LGR, CS-MW21-LGR, CS-MW22-LGR, CS-MW23-LGR, CS-MW24-LGR, CS-MW25-LGR, CS-MW35-LGR, and CS-MW36-LGR. Samples were analyzed for the short list of VOCs using USEPA method SW8260B, and metals (cadmium, lead, mercury, and chromium). The drinking water wells (CS-1, CS-10, CS-12 and CS-13) were sampled for the short list of VOCs and additional metals (arsenic, barium, copper, 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. |

| Activity | Objectives | Action | Objective Attained? | Recommendations |
|---|---|---|---|---|
| Contamination Characterization (Ground Water Contamination) (Continued) | 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. | **ANALYTE** / **RL (µg /L)** / **MCL(µg/L)**<br>1,1-DCE 1.2 7<br>*cis*-1,2-DCE 1.2 70<br>*trans*-1,2-DCE 0.6 100<br>PCE 1.4 5<br>TCE 1.0 5<br>Vinyl chloride 1.1 2 | Yes. | Continue sampling. |
| | | **ANALYTE** / **RL (µg/L)** / **MCL/AL (µg /L)**<br>Barium 5 2,000<br>Chromium 10 100<br>Copper 10 1,300<br>Zinc 50 5,000<br>Arsenic 30 10<br>Cadmium 7 5<br>Lead 25 15<br>Mercury 1 2 | Yes. | Continue sampling. |
| | Meet CSSA QAPP quality assurance requirements. | Samples were analyzed in accordance with the CSSA QAPP and approved variances. Parsons chemists verified all data. | Yes. | NA |
| | | All data flagged with a "U," "J," "M," and "F" are usable for characterizing contamination. All "R" flagged data are considered unusable. | Yes. | NA |

| 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 2015

**Appendix B**
**March 2015 Quarterly On-Post Groundwater Monitoring Analytical Results**

| Well ID | Sample Date | Arsenic | Barium | Cadmium | Chromium | Copper | Lead | Zinc | Mercury |
|---|---|---|---|---|---|---|---|---|---|
| CS-MW1-LGR | 3/10/2015 | NA | NA | 0.0005U | **0.0021F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW2-LGR | 3/10/2015 | NA | NA | 0.0005U | 0.0010U | NA | 0.0019U | NA | 0.0001U |
| CS-MW3-LGR | 3/13/2015 | NA | NA | 0.0005U | **0.0014F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW4-LGR | 3/10/2015 | NA | NA | 0.0005U | 0.0010U | NA | 0.0019U | NA | 0.0001U |
| CS-MW5-LGR | 3/10/2015 | NA | NA | 0.0005U | **0.0060F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW6-LGR | 3/10/2015 | NA | NA | 0.0005U | **0.0016F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW7-LGR | 3/10/2015 | NA | NA | 0.0005U | **0.0024F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW8-LGR | 3/10/2015 | NA | NA | 0.0005U | **0.0021F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW9-LGR | 3/13/2015 | NA | NA | 0.0005U | **0.0042F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW10-LGR | 3/11/2015 | NA | NA | 0.0005U | **0.0035F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW11A-LGR | 3/11/2015 | NA | NA | 0.0005U | **0.0020F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW12-LGR | 3/12/2015 | NA | NA | 0.0005U | **0.0018F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW16-LGR | 3/13/2015 | NA | NA | 0.0005U | 0.0010U | NA | 0.0019U | NA | **0.0002F** |
| CS-MW16-CC | 3/13/2015 | NA | NA | 0.0005U | 0.0010U | NA | 0.0019U | NA | 0.0001U |
| CS-MW17-LGR | 3/18/2015 | NA | NA | 0.0005U | **0.0088F** | NA | 0.0019U | NA | 0.0001M |
| CS-MW17-LGR FD | 3/18/2015 | NA | NA | 0.0005U | **0.0084F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW18-LGR | 3/18/2015 | NA | NA | 0.0005U | **0.0017F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW19-LGR | 3/12/2015 | NA | NA | 0.0005U | **0.0023F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW20-LGR | 3/17/2015 | NA | NA | 0.0005U | **0.0021F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW21-LGR | 3/13/2015 | NA | NA | 0.0005U | 0.0010U | NA | 0.0019U | NA | **0.0002F** |
| CS-MW22-LGR | 3/17/2015 | NA | NA | 0.0005U | 0.0010U | NA | 0.0019U | NA | 0.0001U |
| CS-MW23-LGR | 3/17/2015 | NA | NA | 0.0005U | **0.0030F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW24-LGR | 3/13/2015 | NA | NA | 0.0005U | **0.0043F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW25-LGR | 3/13/2015 | NA | NA | 0.0005U | **0.0012F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW25-LGR FD | 3/13/2015 | NA | NA | 0.0005U | **0.0012F** | NA | 0.0019U | NA | 0.0001U |
| CS-MW35-LGR | 3/18/2015 | NA | NA | 0.0005U | 0.0010U | NA | 0.0019U | NA | 0.0001U |
| CS-MW36-LGR | 3/10/2015 | NA | NA | 0.0005U | **0.0016F** | NA | 0.0019U | NA | 0.0001U |
| CS-2 | 3/17/2015 | NA | NA | 0.0005U | **0.0019F** | NA | 0.0019U | NA | 0.0001U |
| **CSSA Drinking Water Well System** | | | | | | | | | |
| CS-1 | 3/9/2015 | **0.0011F** | **0.0345** | 0.0005U | **0.0011F** | **0.004F** | 0.0019U | **0.193** | 0.0001U |
| CS-1 FD | 3/9/2015 | 0.0002U | **0.0358** | 0.0005U | **0.0012F** | **0.008F** | 0.0019U | **0.218** | 0.0001U |
| CS-10 | 3/9/2015 | **0.0016F** | **0.0392** | 0.0005U | 0.0010U | **0.014** | 0.0019U | **0.051** | 0.0001U |
| CS-12 | 3/9/2015 | 0.0002U | **0.0312** | 0.0005U | **0.0012F** | 0.003U | 0.0019U | **0.072** | 0.0001U |
| CS-13 | 3/9/2015 | **0.0029F** | **0.0294** | 0.0005U | 0.0010U | 0.003U | 0.0019U | **0.252** | 0.0001U |

**Appendix B (cont.)**
**March 2015 Quarterly On-Post Groundwater Monitoring Analytical Results**

| Well ID | Sample Date | 1,1-DCE | cis-1,2-DCE | trans-1,2-DCE | PCE | TCE | Vinyl Chloride |
|---|---|---|---|---|---|---|---|
| CS-MW1-LGR | 3/10/2015 | 0.12U | **20.13** | **0.27F** | **16.66** | **29.71** | 0.08U |
| CS-MW2-LGR | 3/10/2015 | 0.12U | **0.50F** | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-MW3-LGR | 3/13/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-MW4-LGR | 3/10/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-MW5-LGR | 3/10/2015 | 0.12U | **2.91** | 0.08U | **1.38F** | **3.09** | 0.08U |
| CS-MW6-LGR | 3/10/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-MW7-LGR | 3/10/2015 | 0.12U | 0.07U | 0.08U | **0.87F** | 0.05U | 0.08U |
| CS-MW8-LGR | 3/10/2015 | 0.12U | 0.07U | 0.08U | **3.38** | 0.05U | 0.08U |
| CS-MW9-LGR | 3/13/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-MW10-LGR | 3/11/2015 | 0.12U | 0.07U | 0.08U | **1.74** | **0.48F** | 0.08U |
| CS-MW11A-LGR | 3/11/2015 | 0.12U | 0.07U | 0.08U | **0.84F** | 0.05U | 0.08U |
| CS-MW12-LGR | 3/12/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-MW16-LGR | 3/13/2015 | 0.12U | **87.69** | **0.30F** | **78.41** | **88** | 0.08U |
| CS-MW16-CC | 3/13/2015 | 0.12U | **14.77** | **6.57** | **0.15F** | **5.16** | 0.08U |
| CS-MW17-LGR | 3/18/2015 | 0.12U | 0.07U | 0.08U | **0.30F** | 0.05U | 0.08U |
| CS-MW17-LGR FD | 3/18/2015 | 0.12U | 0.07U | 0.08U | **0.38F** | 0.05U | 0.08U |
| CS-MW18-LGR | 3/18/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-MW19-LGR | 3/12/2015 | 0.12U | 0.07U | 0.08U | **0.67F** | 0.05U | 0.08U |
| CS-MW20-LGR | 3/17/2015 | 0.12U | 0.07U | 0.08U | **1.29F** | 0.05U | 0.08U |
| CS-MW21-LGR | 3/13/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-MW22-LGR | 3/17/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-MW23-LGR | 3/17/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-MW24-LGR | 3/13/2015 | 0.12U | 0.07U | 0.08U | **0.20F** | **0.12F** | 0.08U |
| CS-MW25-LGR | 3/13/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-MW25-LGR FD | 3/13/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-MW35-LGR | 3/18/2015 | 0.12U | 0.07U | 0.08U | **0.24F** | 0.05U | 0.08U |
| CS-MW36-LGR | 3/10/2015 | 0.12U | **0.70F** | 0.08U | **16.68** | **28.3** | 0.08U |
| CS-2 | 3/17/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| **CSSA Drinking Water Well System** | | | | | | | |
| CS-1 | 3/9/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-1 FD | 3/9/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-10 | 3/9/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-12 | 3/9/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-13 | 3/9/2015 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |

| | |
|---|---|
| **BOLD** | ≥ MDL |
| **BOLD** | ≥ RL |
| **BOLD** | ≥ 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 |
| AL | Action Level |
| SS | Secondary Standard |
| NA | Not Analyzed for this parameter |

**Data Qualifiers**

U-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.

# APPENDIX C

# QUARTERLY WESTBAY ANALYTICAL RESULTS MARCH 2015

## Appendix C
## March 2015 Quarterly WestbayAnalytical Results

| Well ID | Date Sampled | 1,1-DCE | cis-1,2-DCE | TCE | PCE | trans-1,2-DCE | Vinyl Chloride |
|---|---|---|---|---|---|---|---|
| CS-WB01-LGR-09 | 3/23/2015 | <0.12 | **0.35F** | **8.67** | **6.54** | <0.08 | **0.28F** |
| CS-WB02-LGR-09 | 3/23/2015 | <0.12 | **0.21F** | **8.03** | **7.93** | <0.08 | <0.08 |
| CS-WB03-LGR-09 | 3/24/2015 | <0.12 | **1.75** | **1.2** | **0.75F** | <0.08 | <0.08 |
| CS-WB04-LGR-06 | 3/24/2015 | <0.12 | **3.63** | **12.79** | **55.08** | **0.40F** | <0.08 |
| CS-WB04-LGR-07 | 3/24/2015 | <0.12 | **3.21** | **10.85** | **35.6** | **0.26F** | <0.08 |
| CS-WB04-LGR-09 | 3/24/2015 | <0.12 | **0.14F** | **10.44** | **15.58** | <0.08 | <0.08 |
| CS-WB04-LGR-10 | 3/24/2015 | <0.12 | <0.07 | **0.54F** | **7.47** | <0.08 | <0.08 |
| CS-WB04-LGR-11 | 3/24/2015 | <0.12 | <0.07 | **2.7** | **444.82*** | <0.08 | <0.08 |

**Data Qualifiers**

F-The analyte was positively identified but the associated numerical value is below the RL.
* The analyte was run at a dilution of 20.
** The analyte was run at a dilution of 1000.
All values are reported in µg/L.
DCE - dichloroethene
TCE - trichloroethene
PCE - tetrachloroethene

**BOLD** ≥ MDL
**BOLD** ≥ RL
**BOLD** ≥ MCL

# APPENDIX D

# DATA VALIDATION REPORT

## SDG 75760
## SDG 75791
## SDG 75832
## SDG 75902

**DATA VERIFICATION SUMMARY REPORT**

**for on- and off-post samples collected from**

**CAMP STANLEY STORAGE ACTIVITY**

**BOERNE, TEXAS**

Data Verification by: Tammy Chang
Parsons - Austin

## INTRODUCTION

The following data verification summary report covers groundwater samples and the associated field quality control (QC) sample collected from on-post and off-post Camp Stanley Storage Activity (CSSA) from March 4 to 9, 2015. The samples were assigned to the following Sample Delivery Group (SDG). All samples were analyzed for volatile organic compounds (VOCs) and all on-post groundwater samples were also analyzed for metals including arsenic, barium, cadmium, chromium, copper, lead, zinc, and mercury.

75760

The field QC samples associated with this SDG were one set of matrix spike/matrix spike duplicate (MS/MSD), four sets of parent/field duplicate (FD), and one trip blank (TB). TB was analyzed for VOC only. 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. The samples in this SDG were shipped to the laboratory in one cooler. The cooler was received by the laboratory at a temperature of 2.0 ºC, which was within the 2-6ºC range recommended by the CSSA QAPP.

## 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 thirty-two (32) samples, including four (4) on-post groundwater samples, twenty-one (21) off-post groundwater samples, four (4) FDs, one pair of MS/MSD, and one (1) TB. All samples were collected from March 4 to 9, 2015 and analyzed for a reduced list of VOCs which included: 1,1-dichloroethene, *cis*-1,2-dichloroethene, tetrachloroethene, *trans*-1,2-dichloroethene, trichloroethene, and vinyl chloride.

The VOC analyses were performed using United States Environmental Protection Agency (USEPA) SW846 Method 8260B. The samples were analyzed in four analytical batches (#194967, #194961, #194968, and #194917) under two sets of initial calibration (ICAL), one for each instrument. 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 four laboratory control spike (LCS) samples and the surrogate spikes. MS/MSD analyses were performed with sample CS-12.

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

### Precision

Precision was evaluated based on the relative percent difference (%RPD) of MS/MSD and four sets of parent/FD. Samples OW-HH2, FO-8, JW-27, and CS-1 were collected in duplicate.

%RPDs of the MS/MSD results were compliant.

None of the target compounds were detected at or above the reporting limit for all four sets of parent/FD.

### 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 trip and laboratory blanks for cross contamination of samples during transit or 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 for both sets of curves.
- All four LCSs were prepared using a secondary source standard. All second source verification criteria were met.
- All initial calibration verification (ICV) criteria were met.
- All continuing calibration verification (CCV) criteria were met.
- All internal standard criteria were met.

There were four method blanks and one TB associated with the VOC analyses in this SDG. All five blanks were non-detect for all target VOCs. No target VOC was detected at or above the associated MDL in the blanks.

**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 seven (7) groundwater samples including four (4) on-post drinking water well samples, one FD, and one pair of MS/MSD. All samples were collected on March 9, 2015 and analyzed for arsenic, barium, cadmium, chromium, copper, lead and zinc.

The ICP-AES metals analyses were performed using USEPA SW846 Method 6010B. These on-post well 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 #195354. All analyses were performed undiluted.

**Accuracy**

Accuracy was evaluated using the percent recovery obtained from the LCS, MS, and MSD. Sample CS-12 was designated for MS/MSD analyses.

All LCS, MS, and 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-1 was collected in duplicate.

All %RPDs of MS/MSD results were compliant.

Only barium and zinc were detected above the reporting limits in both parent and FD samples. The %RPD was 3.7% for barium and 12% which met the 20%RPD requirement. No flags were applied.

**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.
- No dilution test was required, as per the CSSA QAPP.

One method blank and several calibration blanks were analyzed in association with the ICP-AES analyses in this SDG. All blanks were 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 seven (7) groundwater samples including four (4) on-post drinking water well samples, one FD, and one pair of MS/MSD. All samples were collected on March 9, 2015 and analyzed for mercury.

The mercury analyses were performed using USEPA SW846 Method 7470A. These on-post well samples were 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 #195343. The analyses were performed undiluted.

### Accuracy

Accuracy was evaluated using the percent recovery obtained from the LCS, MS and MSD samples. Sample CS-12 was designated as the parent sample for the MS/MSD analyses.

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

### Precision

Precision was measured based on the %RPD of MS/MSD and parent/FD sample results. Sample CS-1 was collected in duplicate.

The %RPD of the MS/MSD was compliant.

Mercury was not detected in the parent and FD samples.

### 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 calibration verification 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 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 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 90%.

**DATA VERIFICATION SUMMARY REPORT**

**for on- and off-post samples collected from**

**CAMP STANLEY STORAGE ACTIVITY**

**BOERNE, TEXAS**

Data Verification by: Tammy Chang
Parsons - Austin

## INTRODUCTION

The following data verification summary report covers groundwater samples and the associated field quality control (QC) sample collected from on-post and off-post Camp Stanley Storage Activity (CSSA) on March 10 and 11, 2015. The samples were assigned to the following Sample Delivery Group (SDG). All off-post samples were analyzed for volatile organic compounds (VOCs) and all on-post samples were analyzed for VOCs and metals including cadmium, chromium, lead, and mercury.

75791

The field QC samples associated with this SDG were one set of matrix spike/matrix spike duplicate (MS/MSD) and two trip blanks (TBs). TBs were analyzed for VOC only. 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. The samples in this SDG were shipped to the laboratory in two coolers. The coolers were received by the laboratory at a temperature of 3.0 ºC and 3.5ºC, which were both within the 2-6ºC range recommended by the CSSA QAPP.

## 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 nineteen (19) samples, including ten (10) on-post groundwater samples, five (5) on-post groundwater samples, one pair of MS/MSD, and two (2) TBs. All samples were collected on March 10 and 11, 2015 and analyzed for a reduced list of VOCs which included: 1,1-dichloroethene, *cis*-1,2-dichloroethene, tetrachloroethene, *trans*-1,2-dichloroethene, trichloroethene, and vinyl chloride.

The VOC analyses were performed using United States Environmental Protection Agency (USEPA) SW846 Method 8260B. The samples were analyzed in one batch (#194942) under one set of 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 spike (LCS) sample and the surrogate spikes. MS/MSD analyses were performed with sample HS-2.

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

### Precision

Precision was evaluated based on the relative percent difference (%RPD) of MS/MSD.

%RPDs of the MS/MSD results were compliant.

### 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 trip and laboratory blanks for cross contamination of samples during transit or 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 for both sets of curves.

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

There were one method blank and two TBs associated with the VOC analyses in this SDG. All three blanks were non-detect for all target VOCs. No target VOC was detected at or above the associated MDL in the blanks.

**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 ten (10) on-post groundwater samples which were collected on March 10 and 11, 2015 and analyzed for cadmium, chromium, and lead.

The ICP-AES metals analyses were performed using USEPA SW846 Method 6010B. These on-post well 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 #195356. All analyses were performed undiluted.

**Accuracy**

Accuracy was evaluated using the percent recovery obtained from the LCS.

All LCS recoveries were within acceptance criteria.

**Precision**

Precision could not be measured due to the lack of duplicate analysis in this batch.

**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.
- No dilution test was required, as per the CSSA QAPP.

One method blank and several calibration blanks were analyzed in association with the ICP-AES analyses in this SDG. All blanks were 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 ten (10) on-post groundwater samples collected on March 10 and 11, 2015 and analyzed for mercury.

The mercury analyses were performed using USEPA SW846 Method 7470A. These on-post well samples were 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 #195343. The analyses were performed undiluted.

**Accuracy**

Accuracy was evaluated using the percent recovery obtained from the LCS.

The LCS recovery was within acceptance criteria.

**Precision**

Precision could not be measured due to the lack of duplicate analysis in this analytical batch.

**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 calibration verification 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 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 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 90%.

**DATA VERIFICATION SUMMARY REPORT**

**for on-post samples collected from**

**CAMP STANLEY STORAGE ACTIVITY**

**BOERNE, TEXAS**

Data Verification by: Tammy Chang
Parsons - Austin

## INTRODUCTION

The following data verification summary report covers groundwater samples and the associated field quality control (QC) sample collected from Camp Stanley Storage Activity (CSSA) on March 12 and 13, 2015. The samples were assigned to the following Sample Delivery Group (SDG). All off-post samples were analyzed for volatile organic compounds (VOCs) and all on-post samples were analyzed for VOCs and metals including cadmium, chromium, lead, and mercury.

75832

The field QC samples associated with this SDG were one set of parent/field duplicate (FD) and one trip blank (TB). TBs were analyzed for VOC only. 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. The samples in this SDG were shipped to the laboratory in one cooler. The cooler was received by the laboratory at a temperature of 3.0 ºC, which was within the 2-6ºC range recommended by the CSSA QAPP.

## 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 eleven (11) samples, including nine (9) on-post groundwater samples, one FD, and one (1) TB. All samples were collected on March 12 and 13, 2015 and analyzed for a reduced list of VOCs which included: 1,1-dichloroethene, *cis*-1,2-dichloroethene, tetrachloroethene, *trans*-1,2-dichloroethene, trichloroethene, and vinyl chloride.

The VOC analyses were performed using United States Environmental Protection Agency (USEPA) SW846 Method 8260B. The samples were analyzed in one batch (#195104) under one set of 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 spike (LCS) sample and the surrogate spikes.

All LCS and surrogate spike recoveries were within acceptance criteria.

### Precision

Precision was evaluated based on the relative percent difference (%RPD) of parent and FD sample results. Sample CS-MW25-LGR was collected in duplicate.

None of the target compounds were detected at or above the reporting limit in the parent and FD samples; therefore, the %RPD calculations were not applicable.

### 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 trip and laboratory blanks for cross contamination of samples during transit or 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 for both sets of curves.

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

There were one method blank and one TB associated with the VOC analyses in this SDG. Both blanks were non-detect for all target VOCs. No target VOC was detected at or above the associated MDL in the blanks.

**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 ten (10) on-post groundwater samples which were collected on March 12 and 13, 2015 and analyzed for cadmium, chromium, and lead.

The ICP-AES metals analyses were performed using USEPA SW846 Method 6010B. These on-post well 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 #195498. All analyses were performed undiluted.

**Accuracy**

Accuracy was evaluated using the percent recovery obtained from the LCS.

All LCS recoveries were within acceptance criteria.

**Precision**

Precision was evaluated based on the %RPD of parent and FD sample results. Sample CS-MW25-LGR was collected in duplicate.

None of the three target metals were detected at or above the reporting limit in both parent and FD samples, the %RPD calculations were not applicable.

**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.
- No dilution test was required, as per the CSSA QAPP.

One method blank and several calibration blanks were analyzed in association with the ICP-AES analyses in this SDG. All blanks were 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 ten (10) on-post groundwater samples collected on March 12 and 13, 2015 and analyzed for mercury.

The mercury analyses were performed using USEPA SW846 Method 7470A. These on-post well samples were 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 #195523. The analyses were performed undiluted.

**Accuracy**

Accuracy was evaluated using the percent recovery obtained from the LCS.

The LCS recovery was within acceptance criteria.

**Precision**

Precision was evaluated based on the %RPD of the parent and FD sample results. Mercury was not detected at or above the reporting limit in the parent or FD samples.

**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 calibration verification 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 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 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 90%.

**DATA VERIFICATION SUMMARY REPORT**

**for on- and off-post samples collected from**

**CAMP STANLEY STORAGE ACTIVITY**

**BOERNE, TEXAS**

Data Verification by: Tammy Chang
Parsons - Austin

## INTRODUCTION

The following data verification summary report covers groundwater samples and the associated field quality control (QC) sample collected from on-post and off-post Camp Stanley Storage Activity (CSSA) on March 17 and 18, 2015. The samples were assigned to the following Sample Delivery Group (SDG). All off-post samples were analyzed for volatile organic compounds (VOCs) and all on-post samples were analyzed for VOCs and metals including cadmium, chromium, lead, and mercury.

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The field QC samples associated with this SDG were one set of matrix spike/matrix spike duplicate (MS/MSD), two pairs of parent/field duplicate (FD) samples, and one trip blank (TB). TB was analyzed for VOC only. 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. The samples in this SDG were shipped to the laboratory in one cooler. The cooler was received by the laboratory at a temperature of 2.5ºC which was within the 2-6ºC range recommended by the CSSA QAPP.

## 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 fourteen (14) samples, including seven (7) on-post groundwater samples, one (1) off-post groundwater sample, one pair of MS/MSD, two (2) FDs, and one (1) TB. All samples were collected on March 17 and 18, 2015 and analyzed for a reduced list of VOCs which included: 1,1-dichloroethene, *cis*-1,2-dichloroethene, tetrachloroethene, *trans*-1,2-dichloroethene, trichloroethene, and vinyl chloride.

The VOC analyses were performed using United States Environmental Protection Agency (USEPA) SW846 Method 8260B. The samples were analyzed in one batch (#195563) under one set of 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 spike (LCS) sample, MS/MSD, and the surrogate spikes. MS/MSD analyses were performed with sample CS-MW17-LGR.

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

### Precision

Precision was evaluated based on the relative percent difference (%RPD) of MS/MSD and parent/FD sample results. Samples JW-9 and CS-MW17-LGR were collected in duplicate.

%RPDs of the MS/MSD results were compliant.

None of the target VOCs were detected at or above the reporting limit in both sets of parent/FD samples. %RPD calculations were not applicable.

### 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 trip and laboratory blanks for cross contamination of samples during transit or 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 for both sets of curves.
- The LCS was prepared using a secondary source. All second source verification criteria were met.
- All initial calibration verification (ICV) criteria were met.
- All continuing calibration verification (CCV) criteria were met.
- All internal standard criteria were met.

There were one method blank and one TB associated with the VOC analyses in this SDG. Both blanks were non-detect for all target VOCs. No target VOC was detected at or above the associated MDL in the blanks.

**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 ten (10) on-post groundwater samples which were collected on March 17 and 18, 2015 and analyzed for cadmium, chromium, and lead.

The ICP-AES metals analyses were performed using USEPA SW846 Method 6010B. These on-post well 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 #195532. All analyses were performed undiluted.

**Accuracy**

Accuracy was evaluated using the percent recovery obtained from the LCS, MS and MSD. Sample CS-MW17-LGR was designated as the parent sample for the MS/MSD analyses.

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

**Precision**

Precision was evaluated based on the %RPD of MS/MSD and parent/FD results.

All %RPDs of MS/MSD were compliant. None of the three target metals were detected at or above the reporting limit.

**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.
- No dilution test was required, as per the CSSA QAPP.

One method blank and several calibration blanks were analyzed in association with the ICP-AES analyses in this SDG. All blanks were 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 ten (10) on-post groundwater samples collected on March 17 and 18, 2015 and analyzed for mercury.

The mercury analyses were performed using USEPA SW846 Method 7470A. These on-post well samples were 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 #195523. The analyses were performed undiluted.

**Accuracy**

Accuracy was evaluated using the percent recovery obtained from the LCS, MS and MSD. Sample CS-MW17-LGR was designated as the parent sample for the MS/MSD analyses.

The LCS recovery was within acceptance criteria.

%R of the MS was 115% and MSD was 125% with control limits of 77-120%. Parent sample result was flagged with "M" according to the CSSA QAPP.

**Precision**

Precision was evaluated based on the %RPD of MS/MSD and parent/FD sample results. Sample CS-MW17-LGR was collected in duplicate.

%RPD of MS/MSD results was compliant.

Mercury was not detected in the parent or FD samples; therefore, the %RPD calculation was not applicable.

**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 calibration verification 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 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 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 90%.