2015 ANNUAL GROUNDWATER REPORT

Prepared For

Camp Stanley Storage Activity
Boerne, Texas

Prepared By
PARSONS

Austin, Texas

May 2016

EXECUTIVE SUMMARY

This report provides an evaluation of results from groundwater monitoring conducted in 2015 at Camp Stanley Storage Activity (CSSA). Groundwater monitoring was performed on-post and off-post during the months of March, June, September, and December 2015. The CSSA groundwater monitoring program objectives 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. This report describes the physical and chemical characteristics of the groundwater monitoring results and changes occurring to the program during 2015.

- After enduring one of the most severe droughts in Central Texas history in 2011, followed by average to below average rainfall from 2012 to 2014, the Middle Trinity aquifer started 2015 in a depleted state. In 2015, rainfall total measured at CSSA was 53.51 inches from the B-3 Weather Station (WS). This total was approximately 16.98 inches above the 30-year average of 36.53 inches for the Boerne weather station monitored by the National Weather Service (NWS). During the same timeframe, 44.22 inches of rain fell at the San Antonio International Airport.

- From March to June 2015, the average water level in the underlying aquifer increased 176.73 feet in response to 18.62 inches of rainfall during that timeframe. The aquifer levels receded between June and September 2015, which received 6.76 inches of rainfall for the 3-month period. By September 2015, the average aquifer elevation had increased by 71.97 feet. A total of 20.18 inches fell during the remainder of the year, with 12.92 inches coming in October. That end-of-year precipitation resulted in a 68.26 foot increase in the average aquifer elevation. CSSA received above average annual precipitation in 2015; the Middle Trinity aquifer sustained a net gain of 140.23 feet in the average aquifer elevation beneath CSSA, and rebounded more than 72 feet above its 13-year average (2002 through 2015).

- Both on- and off-post groundwater samples were collected quarterly in 2015 (March, June, September, and December) in accordance with the approved CSSA Long-Term Monitoring Optimization (LTMO) program. A key element of the CSSA LTMO program is the “snapshot” event which occurs every nine months. During these events, all on- and off-post wells are sampled to produce an area-wide dataset to describe aquifer contaminant conditions. In 2015, the snapshot events occurred in March and December. Results from March, June, and September 2015 have been reported in previous quarterly reports. December 2015 data is presented in this annual report.

- In 2015, a total of 93 samples were collected from 44 on-post wells. Contaminant concentrations above drinking water standards were detected at 5 on-post wells. Wells (CS-MW16-LGR, CS-MW16-CC, CS-MW1-LGR, CS-MW5-LGR, and CS-MW36-LGR) exceeded drinking water standards for volatile organic compounds (VOCs). No wells exceeded drinking water standards for metals in 2015.

- A total of 55 samples were collected from 39 Westbay zones in 2015. VOC concentrations above drinking water standards were detected in a total of 19 zones at all four Westbay locations.
- In 2015, a total of 131 samples were collected from 53 off-post wells and 6 granular activated carbon (GAC) wellhead treatment locations. VOC concentrations above drinking water standards were detected at two off-post wells (OFR-3 and RFR-10). OFR-3 and RFR-10 had GAC units installed at the wellheads in 2002 and 2001 respectively. These GAC filtration units remove VOC contamination prior to use. Samples collected after the treatment systems (post-GAC samples) continue to show that all VOC are being removed from those wells, and the treatment is effective. Off-post wells were not sampled for metals content as part of the groundwater program.

GEOSCIENTIST CERTIFICATION

2015 Annual Groundwater Monitoring Report

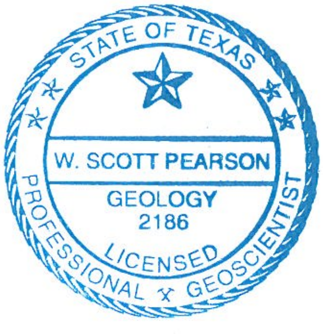
For

Department of the Army
Camp Stanley Storage Activity
Boerne, Texas

I, W. Scott Pearson, P.G., hereby certify that the 2015 Annual 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 Camp Stanley Storage Activity Environmental Office, laboratory data provided by APPL, and field data obtained during groundwater monitoring conducted at the site in 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



May 24, 2016

Date

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

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
CC	Cow Creek
cis-1,2-DCE	*cis*-1,2-Dichloroethene
COC	Contaminants Of Concern
CSSA	Camp Stanley Storage Activity
DCP	Drought Contingency Plan
DQO	Data Quality Objectives
DVR	Data Validation Report
EXW	Extraction Well
GAC	Granular Activated Carbon
GPM	Gallons Per Minute
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
NCDC	National Climatic Data Center
NWS	National Weather Service
PCE	Tetrachloroethene
Plan	CSSA Off-Post Monitoring Program and Response Plan
QAPP	Quality Assurance Program Plan
RCRA	Resource Conservation and Recovery Act
RL	Reporting Limit
SAWS	San Antonio Water System
SCADA	Supervisory Control and Data Acquisition
SS	Secondary Standard
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TCEQ	Texas Commission on Environmental Quality
TGRGCD	Trinity-Glen Rose Groundwater Conservation District

ACRONYMS AND ABBREVIATIONS *(continued)*

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

1.0 INTRODUCTION

This report provides an evaluation of results from groundwater monitoring conducted in 2015 at Camp Stanley Storage Activity (CSSA). Groundwater monitoring was performed on-post and off-post during the months of March, June, September, and December 2015. All wells sampled in 2015 are shown on **Figure 1.1**. This report describes the physical and chemical characteristics of the groundwater monitoring results and changes occurring to the program during 2015.

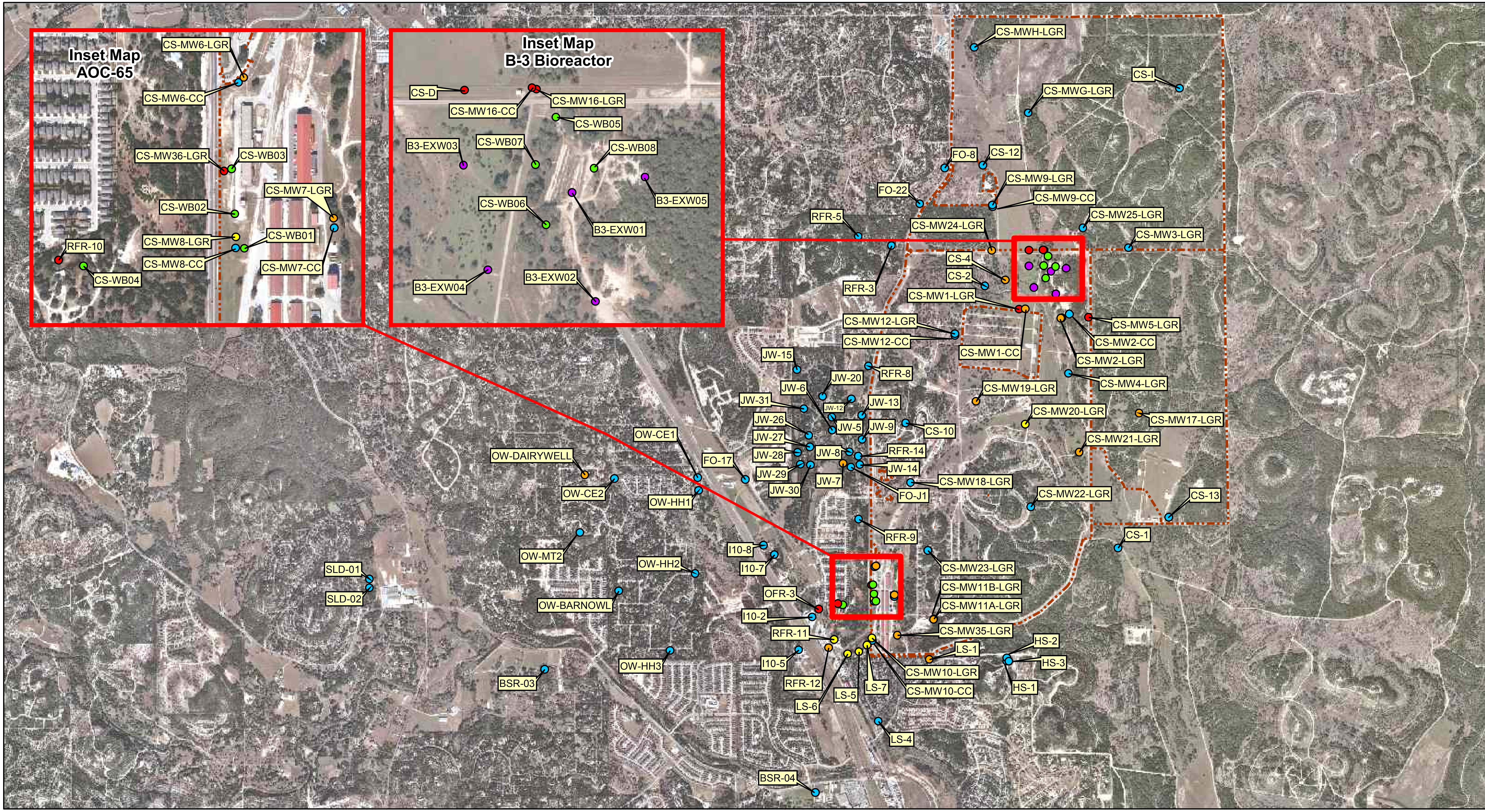
1.1 On-Post Groundwater Monitoring

The current objectives of the CSSA on-post groundwater monitoring program are to monitor groundwater flow direction trends and elevations, determine groundwater contaminant concentrations for characterization purposes, and identify meteorological and seasonal variations in physical and chemical properties of the groundwater. The objectives incorporate and comply with the Resource Conservation and Recovery Act (RCRA) §3008(h) Administrative Order on Consent (§3008(h) Order) issued by the United States Environmental Protection Agency (USEPA) on May 5, 1999.

On-post groundwater monitoring was initiated in 1992 in response to volatile organic compound (VOC) contamination detected in CSSA drinking water supply well CS-MW16-LGR and continued periodically until the current CSSA quarterly groundwater monitoring program for on-post wells was initiated in December 1999.

The CSSA groundwater monitoring program follows the provisions of the groundwater monitoring program *Final Data Quality Objectives (DQO) for the Groundwater Monitoring Program* (Parsons 2010a) in **Appendix A**, as well as the recommendations of the *Three-Tiered Long Term Monitoring Network Optimization Evaluation* (Parsons 2010b) which provided recommendations for sampling based on a long-term monitoring optimization (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 USEPA. The LTMO evaluation was updated in 2010 using groundwater data from monitoring conducted between 2005 and 2009. It was approved by the TCEQ and USEPA and was implemented on- and off-post in June 2011 (**Appendix J**). Currently the DQOs and LTMO have been updated to include data from monitoring conducted between 2010 and 2014. The updated LTMO was submitted to the regulators in January 2016, and was followed by the revised DQOs in February 2016. The implementation of the findings will take effect upon approval of the USEPA and the TCEQ.

A comprehensive summary of the results from the 2015 on-post groundwater sampling events is presented in **Appendix B**. **Appendices C** and **D** present Westbay analytical results in tabular and graphical format, respectively. Abbreviated tables showing only the detected compounds are included in the groundwater results discussions in Section 2.2.1 of this report. **Appendix E** presents the CSSA Drought Contingency Plan (DCP) trigger levels, and **Appendix F** includes the potentiometric groundwater maps.



Aerial Photo Date: 2013

0 0.5 1 2 Miles

- Wells with VOC concentrations > MCL
- Wells with VOC concentrations between RL and MCL
- Wells with VOC concentrations < RL
- Non-detect
- Mulit-port Westbay Wells
- Other wells
- Fence Line

MCL= maximum contaminant level
RL= laboratory analytical reporting limit

Figure 1.1

2015 Sampled On-Post and Off-Post Groundwater Wells
Camp Stanley Storage Activity

PARSONS

C:\CSSA\GIS\MXD\ANNUAL_GW_FACT_SHEET\fig1.1_2015_sampled_wells_annual_gw_report.mxd - 2/22/2016 @ 2:49:01 PM

Off-post results for groundwater sampling and Granular Activated Carbon (GAC) maintenance are included as **Appendices G** and **H**. Laboratory data packages for 2015 were submitted to CSSA in electronic format separately from this report. **Appendix I** presents the associated data validation reports (DVR) for the December 2015 analytical package submittals. The March, June, and September DVRs are included with the quarterly groundwater reports.

1.2 Off-Post Groundwater Monitoring

The primary objective of the off-post groundwater monitoring program is to determine whether concentrations of VOCs detected in off-post public and private drinking water wells exceed safe drinking water standards. In off-post groundwater, the primary contaminants of concern (COC) are tetrachloroethene (PCE) and trichloroethene (TCE). A secondary objective of the off-post groundwater monitoring program is to determine the lateral and vertical extent of the contaminant plumes associated with past releases near Area of Concern (AOC)-65 or from Solid Waste Management Units (SWMU) B-3 and O-1. A third objective of the off-post groundwater monitoring program is to assess whether there are apparent trends in contaminant levels (decreasing or increasing) over time in the sampled wells.

CSSA was required by the §3008(h) Order to identify and locate both privately and publicly owned groundwater wells within ¼-mile of CSSA. The Offsite Well Survey Report (Parsons 2001) was submitted to fulfill this requirement. This survey was updated in 2010 to capture any new wells that have been added in the area and to extend the ¼-mile to ½-mile of CSSA. In total, 97 well locations are identified in the updated 2010 Well Survey. A total of 47 locations (45 active and 2 plugged) were identified within a ¼-mile radius, and another 39 locations (33 active and 6 plugged) are believed to exist between ¼ to ½-mile away from CSSA. Finally, a total of 11 locations (10 active and 1 plugged) were identified in a special interest area beyond the ½-mile survey that is considered to be downgradient of the CSSA VOC plumes.

After the 2010 Well Survey, the USEPA requested that CSSA identify additional wells beyond the ½-mile border to the south and west of the post. As a result, CSSA identified and added five wells that follow the Boerne Stage Road corridor, ranging in distance between 0.75 and 3 miles from CSSA. One of these wells (SLD-01) had a second detection below the reporting limit (RL) in September 2014. This well was sampled quarterly in 2015 and no VOCs related to CSSA's groundwater investigation were identified in the water sample from this well. In accordance with the current DQO's, SLD-01 will be moved to the 9 month sampling schedule.

Additional background information regarding off-post private and public water supply wells is located in the ***CSSA Environmental Encyclopedia, Volume 5 Groundwater***. Some off-post wells were initially sampled in 1995 and quarterly sampling of off-post wells began in 2001 in accordance with the *Off-Post Monitoring Program and Response Plan* (CSSA 2002a) (Plan).

Under the Plan, the following criteria are used to determine the action levels for detected VOCs and to determine which off-post wells are sampled:

- If VOC contaminant levels are ≥90 percent of the maximum contaminant levels (MCL) based on preliminary data received from the laboratory and the well is used as a potable water source, the well will be taken offline and bottled water will be supplied within 24 hours after receipt of the data. For PCE and TCE, 90 percent of the MCL is 4.5 micrograms per liter (µg/L). A confirmation sample will be collected from the well within 14 days of receipt of the final validated analytical report. If the confirmation sample confirms COCs are at or above 90 percent of the MCLs, the well will be evaluated, and either installation of an appropriate method for wellhead treatment or connection to an alternative water source will be performed.
- If VOC contaminant levels are ≥80 but ≤90 percent of the MCL (>4.0 and <4.5 µg/L for PCE and TCE) during any single monitoring event based on preliminary data from the laboratory, and the well is used as a potable water source, it will be monitored monthly. If the monthly follow-up sampling confirms that COCs are ≥80 but ≤90 percent of the MCL, it will continue to be sampled monthly until the VOC levels fall below the 80 percent value.
- If any COC is detected at levels greater than or equal to the analytical method detection limit (MDL) (historically 0.06 µg/L for PCE and 0.05 µg/L for TCE), and <80 percent of the MCL, the well will be sampled on a quarterly basis. This sampling will be conducted concurrently with on-post sampling events and will be used to develop historical trends in the area. Quarterly sampling will continue for a minimum of 1 year, after which the sampling frequency will be reviewed and may be decreased.
- If COCs are not detected during the initial sampling event (i.e., no VOC contaminant levels above the MDL), further sampling of the well will be reconsidered. A well with no detectable VOCs may be removed from the sampling list. However, if analytical data suggest future plume migration could negatively influence the well, it will be re-sampled as needed. The well owner, USEPA, and TCEQ will be apprised of any re-sampling decisions regarding the non-detect wells.
- For locations where a wellhead treatment system has been installed, post-treatment samples will be collected and analyzed after initial system start-up and at 6-month intervals to confirm the system is effectively removing VOCs.

A comprehensive summary of the results from the 2015 off-post groundwater sampling events is presented in **Appendix G**. Abbreviated tables showing only the detected compounds are included in the groundwater results discussions in Section 2.2.2 of this report. **Appendix H** summarizes pre- and post-GAC filtration system sampling results.

The cumulative historical results from both on- and off-post groundwater monitoring are presented in summary tables located in the Introduction to the *On-Post and Off-Post Quarterly Groundwater Monitoring Program* (Tables 6 through 9), ***CSSA Environmental Encyclopedia, Volume 5 Groundwater.***

2.0 GROUNDWATER MONITORING RESULTS

2.1 Physical Characteristics

2.1.1 Water Level Measurements

Water level measurements were recorded prior to sampling during the March, June, September, and December 2015 events. A total of 56 water level measurements made from all monitoring wells and drinking water wells listed are in **Table 2.1**. Water levels from one off-post well (FO-20) are used to develop the northern perimeter of the gradient maps. Well CS-9 was plugged and abandoned in August 2015; therefore water level measurements were not collected in September or December 2015. Water levels were measured by either e-line indicator or collected from a permanently installed transducer.

Water level elevations and quarterly elevation changes are summarized in **Table 2.1**. The average groundwater elevation measurements for each of the Lower Glen Rose (LGR), Bexar Shale (BS), and Cow Creek (CC) intervals of the Middle Trinity aquifer are provided in **Table 2.2**. The averages were calculated using groundwater elevations from wells screened in only one of the three intervals. Water elevations from 7 wells completed with open boreholes over multiple formations were not used. The rain that fell in 2015 was 17 inches above the average rainfall for the area.

CSSA operates three weather stations to monitor and record climatic conditions across the post, although the rain gauges at locations AOC-65-WS and MW18-WS have calibration issues with their rain gauges. For the purposes of this discussion, the CSSA precipitation record has been utilized from the B-3-WS located at the northern end of the inner cantonment. For longer term precipitation data, this report also utilizes precipitation data from the San Antonio International Airport (KSAT) because of the completeness and accuracy of the data.

The total amount of precipitation that fell in 2015 was 53.51 inches at the B-3 WS, which was well above the measured 21.6 inches (AOC-65 WS) and 25.28 inches (B-3 WS) that fell in 2014. For the same 2015 time period, 44.22 inches of precipitation was measured at the KSAT location at the international airport. The aquifer has finally shown signs of recovery from the 2011 drought which only recorded 17 inches of rainfall that year, as measured by the CSSA and KSAT weather stations. Aquifer elevations have returned to levels not seen since 2010. According to the National Weather Service (NWS), the 30-year average (1986-2015) for the Boerne, TX weather station is 36.53 inches.

The aquifer levels rebounded significantly between January and June 2015, which received 32 inches of rainfall for the 6-month period (B-3 WS). May recorded the second highest monthly rainfall total of the year, 12.90 inches, with the Memorial Day flood contributing a significant portion of this rainfall. As a result, quarterly groundwater monitoring showed average aquifer levels increased by 191.14 feet from December 2014 to June 2015. From July through September the rain virtually stopped, recording only 1.85 inches of rainfall over that 3-month period. This in turn caused a sharp drop in the aquifer of 119.17 feet from June to September 2015. A total of 20 inches of rain fell throughout the remainder of the year (October through December). The highest annual

Table 2.1
Summary of Groundwater Elevations and Changes, 2015

Well ID	TOC elevation (ft MSL)	March 2015 Elevations	June 2015 Elevations	September 2015 Elevations	December 2015 Elevations	Groundwater Elevation Change				Formations Screened		
						December 14 minus March 15	June minus March	September minus June	December minus September	LGR	BS	CC
CS-1	**1169.27**	**933.22**	**1037.49**	**1002.17**	**1025.97**	**40.05**	**104.27**	**-35.32**	**23.80**	**ALL**		
CS-2	**1237.59**	**980.84**	**1187.80**	**1015.34**	**1096.16**	**0.68**	**206.96**	**-172.46**	**80.82**	**X**	**?**	
CS-3	1240.17	980.45	1178.14	1018.89	1095.19	3.11	197.69	-159.25	76.30	**X**		
CS-4	**1229.28**	**978.46**	**1175.42**	**1018.78**	**1091.68**	**3.02**	**196.96**	**-156.64**	**72.90**	**X**		
CS-9	**1325.31**	**948.39**	**1171.33**	**NA**	**NA**	**0.34**	**222.94**	**NA**	**NA**	**ALL**		
CS-10	**1331.51**	**952.20**	**1164.61**	**1021.51**	**1099.71**	**-0.31**	**212.41**	**-143.10**	**78.20**	**ALL**		
CS-12	**1274.09**	**935.07**	**1122.69**	**1019.19**	**1101.29**	**-44.52**	**187.62**	**-103.50**	**82.10**	**ALL**		
CS-13	**1193.26**	**940.04**	**1108.48**	**1018.01**	**1075.42**	**23.92**	**168.44**	**-90.47**	**57.41**	**ALL**		
CS-D	1236.03	978.21	1164.55	1016.61	1083.64	1.03	186.34	-147.94	67.03	**X**		
CS-MWG-LGR	1328.14	1017.16	1138.50	1043.85	1112.94	9.00	121.34	-94.65	69.09	**X**		
CS-MWH-LGR	1319.19	1022.89	1157.21	1019.09	1119.87	12.99	134.32	-138.12	100.78	**X**		
CS-I*	1315.20	1012.55	1149.40	1042.55	1108.17	4.23	136.85	-106.85	65.62	**X**		
CS-MW1-LGR	1220.73	981.06	1168.48	1031.45	1090.07	5.67	187.42	-137.03	58.62	**X**		
CS-MW1-BS	1221.09	985.14	1041.73	1045.67	1054.87	9.69	56.59	3.94	9.20		**X**	
CS-MW1-CC	1221.39	961.74	1084.70	1001.98	1063.41	12.72	122.96	-82.72	61.43			**X**
CS-MW2-LGR	1237.08	979.33	1147.14	1039.76	1087.87	6.89	167.81	-107.38	48.11	**X**		
CS-MW2-CC	1240.11	956.91	1044.09	1010.70	1047.08	14.69	87.18	-33.39	36.38			**X**
CS-MW3-LGR	1334.14	980.15	1138.42	1031.70	1089.98	3.33	158.27	-106.72	58.28	**X**		
CS-MW4-LGR	1209.71	1025.89	1183.06	1101.78	1155.77	31.29	157.17	-81.28	53.99	**X**		
CS-MW5-LGR	1340.24	973.48	1138.52	1037.77	1087.39	6.22	165.04	-100.75	49.62	**X**		
CS-MW6-LGR	1232.25	965.76	1163.96	1028.70	1104.45	19.42	198.20	-135.26	75.75	**X**		
CS-MW6-BS	1232.67	985.63	1129.85	1091.21	1094.48	29.70	144.22	-38.64	3.27		**X**	
CS-MW6-CC	1233.21	949.07	1130.37	1025.99	1098.53	20.54	181.30	-104.38	72.54			**X**
CS-MW7-LGR	1202.27	954.68	1163.95	1019.77	1098.82	11.97	209.27	-144.18	79.05	**X**		
CS-MW7-CC	1201.84	944.31	1136.44	1019.79	1096.87	26.54	192.13	-116.65	77.08			**X**
CS-MW8-LGR	1208.35	963.48	1161.15	1025.28	1102.91	22.16	197.67	-135.87	77.63	**X**		
CS-MW8-CC	1206.13	945.59	1135.13	1021.13	1097.63	25.53	189.54	-114.00	76.50			**X**
CS-MW9-LGR	1257.27	990.47	1177.86	1019.14	1100.40	3.58	187.39	-158.72	81.26	**X**		
CS-MW9-BS	1256.73	990.38	1156.21	1034.91	1107.93	2.73	165.83	-121.30	73.02		**X**	
CS-MW9-CC	1255.95	982.93	1123.46	1005.92	1090.25	13.48	140.53	-117.54	84.33			**X**
CS-MW10-LGR	1189.53	939.91	1152.43	1006.93	1095.20	35.67	212.52	-145.50	88.27	**X**		
CS-MW10-CC	1190.04	930.43	1149.35	1001.49	1091.06	39.20	218.92	-147.86	89.57			**X**
CS-MW11A-LGR	1204.03	943.69	1157.10	1012.29	1083.42	42.93	213.41	-144.81	71.13	**X**		
CS-MW11B-LGR	1203.52	Dry	1061.08	1017.41	1076.73	NA	NA	-43.67	59.32	**X**		
CS-MW12-LGR	1259.07	976.71	1176.01	1024.09	1102.05	3.81	199.30	-151.92	77.96	**X**		
CS-MW12-BS	1258.37	983.75	1107.99	1049.37	1094.42	5.28	124.24	-58.62	45.05		**X**	
CS-MW12-CC	1257.31	974.84	1116.75	1008.58	1085.91	12.49	141.91	-108.17	77.33			**X**
CS-MW16-LGR*	1244.60	966.90	1154.65	1021.24	1041.29	-10.58	187.75	-133.41	20.05	**X**		
CS-MW16-CC*	1244.51	891.31	1075.62	904.30	955.04	7.82	184.31	-171.32	50.74			**X**
B3-EXW01*	1245.26	934.76	978.86	1005.06	956.26	2.35	44.10	26.20	-48.80	**X**		
B3-EXW02*	1249.66	939.26	1129.36	938.16	997.26	-14.15	190.10	-191.20	59.10	**X**		
B3-EXW03*	1235.11	953.71	1186.41	973.21	1095.41	-3.75	232.70	-213.20	122.20	**X**		
B3-EXW04*	1228.46	913.06	1190.06	922.61	956.86	-44.82	277.00	-267.45	34.25	**X**		
B3-EXW05*	1279.46	972.01	1128.16	1025.76	1010.11	-2.11	156.15	-102.40	-15.65	**X**		
CS-MW17-LGR	1257.01	948.2	1150.73	1029.06	1097.49	11.93	202.53	-121.67	68.43	**X**		
CS-MW18-LGR	1283.61	947.03	1169.26	1021.81	1102.74	4.62	222.23	-147.45	80.93	**X**		
CS-MW19-LGR	1255.53	965.78	1173.93	1042.08	1114.49	6.69	208.15	-131.85	72.41	**X**		
CS-MW20-LGR	1209.42	970.63	1171.03	1050.95	1119.57	9.08	200.40	-120.08	68.62	**X**		
CS-MW21-LGR	1184.53	948.04	1157.21	1030.75	1102.00	12.48	209.17	-126.46	71.25	**X**		
CS-MW22-LGR	1280.49	936.64	1158.46	1022.52	1097.27	19.27	221.82	-135.94	74.75	**X**		
CS-MW23-LGR	1258.20	952.38	1167.90	1019.80	1093.92	29.64	215.52	-148.10	74.12	**X**		
CS-MW24-LGR	1253.90	982.19	1181.90	1015.92	1095.07	2.76	199.71	-165.98	79.15	**X**		
CS-MW25-LGR	1293.01	985.29	1149.39	1029.06	1093.64	2.96	164.10	-120.33	64.58	**X**		
CS-MW35-LGR	1186.97	942.08	1154.44	1009.62	1093.52	38.18	212.36	-144.82	83.90	**X**		
CS-MW36-LGR	1218.74	965.84	1162.06	1026.84	1103.89	21.39	196.22	-135.22	77.05	**X**		
FO-20	**NA**	**1062.05**	**1170.12**	**1045.25**	**1132.24**	**10.98**	**108.07**	**-124.87**	**86.99**	**ALL**		
Average groundwater elevation change (all wells minus pumpers):						**14.41**	**176.73**	**-119.17**	**68.69**			
Net change in average groundwater elevation since December 2014:						**140.67**						

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 is calculated from non-pumping wells screened in only one formation.

All measurements given in feet.

NA = Data not available

Table 2.2
Summary of Groundwater Elevation by Formation, 2015

		2015 Groundwater Elevations				Formations Screened		
Well ID	**TOC elevation**	**March**	**June**	**September**	**December**	**LGR**	**BS**	**CC**
CS-1*	**1169.27**	**933.22**	**1037.49**	**1002.17**	**1025.97**	**ALL**		
CS-2	**1237.59**	**980.84**	**1187.80**	**1015.34**	**1096.16**	**X**	**?**	
CS-3	1240.17	980.45	1178.14	1018.89	1095.19	**X**		
CS-4	**1229.28**	**978.46**	**1175.42**	**1018.78**	**1091.68**	**X**		
CS-9	**1325.31**	**948.39**	**1171.33**	**NA**	**NA**	**ALL**		
CS-10*	**1331.51**	**952.20**	**1164.61**	**1021.51**	**1099.71**	**ALL**		
CS-12*	**1274.09**	**935.07**	**1122.69**	**1019.19**	**1101.29**	**ALL**		
CS-13	**1193.26**	**940.04**	**1108.48**	**1018.01**	**1075.42**	**ALL**		
CS-D	1236.03	978.21	1164.55	1016.61	1083.64	**X**		
CS-MWG-LGR	1328.14	1017.16	1138.50	1043.85	1112.94	**X**		
CS-MWH-LGR	1319.19	1022.89	1157.21	1019.09	1119.87	**X**		
CS-I*	1315.20	1012.55	1149.40	1042.55	1108.17	**X**		
CS-MW1-LGR	1220.73	981.06	1168.48	1031.45	1090.07	**X**		
CS-MW1-BS	1221.09	985.14	1041.73	1045.67	1054.87		**X**	
CS-MW1-CC	1221.39	961.74	1084.70	1001.98	1063.41			**X**
CS-MW2-LGR	1237.08	979.33	1147.14	1039.76	1087.87	**X**		
CS-MW2-CC	1240.11	956.91	1044.09	1010.70	1047.08			**X**
CS-MW3-LGR	1334.14	980.15	1138.42	1031.70	1089.98	**X**		
CS-MW4-LGR	1209.71	1025.89	1183.06	1101.78	1155.77	**X**		
CS-MW5-LGR	1340.24	973.48	1138.52	1037.77	1087.39	**X**		
CS-MW6-LGR	1232.25	965.76	1163.96	1028.70	1104.45	**X**		
CS-MW6-BS	1232.67	985.63	1129.85	1091.21	1094.48		**X**	
CS-MW6-CC	1233.21	949.07	1130.37	1025.99	1098.53			**X**
CS-MW7-LGR	1202.27	954.68	1163.95	1019.77	1098.82	**X**		
CS-MW7-CC	1201.84	944.31	1136.44	1019.79	1096.87			**X**
CS-MW8-LGR	1208.35	963.48	1161.15	1025.28	1102.91	**X**		
CS-MW8-CC	1206.13	945.59	1135.13	1021.13	1097.63			**X**
CS-MW9-LGR	1257.27	990.47	1177.86	1019.14	1100.40	**X**		
CS-MW9-BS	1256.73	990.38	1156.21	1034.91	1107.93		**X**	
CS-MW9-CC	1255.95	982.93	1123.46	1005.92	1090.25			**X**
CS-MW10-LGR	1189.53	939.91	1152.43	1006.93	1095.20	**X**		
CS-MW10-CC	1190.04	930.43	1149.35	1001.49	1091.06			**X**
CS-MW11A-LGR	1204.03	943.69	1157.10	1012.29	1083.42	**X**		
CS-MW11B-LGR	1203.52	Dry	1061.08	1017.41	1076.73	**X**		
CS-MW12-LGR	1259.07	976.71	1176.01	1024.09	1102.05	**X**		
CS-MW12-BS	1258.37	983.75	1107.99	1049.37	1094.42		**X**	
CS-MW12-CC	1257.31	974.84	1116.75	1008.58	1085.91			**X**
CS-MW16-LGR*	1244.60	966.90	1154.65	1021.24	1041.29	**X**		
CS-MW16-CC*	1244.51	891.31	1075.62	904.30	955.04			**X**
B3-EXW01*	1245.26	934.76	978.86	1005.06	956.26	**X**		
B3-EXW02*	1249.66	939.26	1129.36	938.16	997.26	**X**		
B3-EXW03*	1235.11	953.71	1186.41	973.21	1095.41	**X**		
B3-EXW04*	1228.46	913.06	1190.06	922.61	956.86	**X**		
B3-EXW05*	1279.46	972.01	1128.16	1025.76	1010.11	**X**		
CS-MW17-LGR	1257.01	948.2	1150.73	1029.06	1097.49	**X**		
CS-MW18-LGR	1283.61	947.03	1169.26	1021.81	1102.74	**X**		
CS-MW19-LGR	1255.53	965.78	1173.93	1042.08	1114.49	**X**		
CS-MW20-LGR	1209.42	970.63	1171.03	1050.95	1119.57	**X**		
CS-MW21-LGR	1184.53	948.04	1157.21	1030.75	1102.00	**X**		
CS-MW22-LGR	1280.49	936.64	1158.46	1022.52	1097.27	**X**		
CS-MW23-LGR	1258.20	952.38	1167.90	1019.80	1093.92	**X**		
CS-MW24-LGR	1253.90	982.19	1181.90	1015.92	1095.07	**X**		
CS-MW25-LGR	1293.01	985.29	1149.39	1029.06	1093.64	**X**		
CS-MW35-LGR	1186.97	942.08	1154.44	1009.62	1093.52	**X**		
CS-MW36-LGR	1218.74	965.84	1162.06	1026.84	1103.89	**X**		
FO-20	**NA**	**1062.05**	**1170.12**	**1045.25**	**1132.24**	**ALL**		
Average groundwater elevation by formation, each event:	**LGR:**	**971.61**	**1159.57**	**1027.57**	**1099.60**	**Average groundwater elevation by formation all of 2015:**		**1064.59**
	BS:	**986.23**	**1108.95**	**1055.29**	**1087.93**			**1059.60**
	CC:	**955.73**	**1115.04**	**1011.95**	**1083.84**			**1041.64**

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 is calculated from non-pumping wells screened in only one formation.

All measurements given in feet.

NA = Data not available

monthly rainfall of 12.92 inches occurred in October, with 8.3 inches falling on the Halloween weekend. That end-of-year precipitation resulted in a 68.69-foot increase in the average aquifer elevation since September. Through all the hydrologic cycles of 2015, the overall groundwater levels in the Middle Trinity aquifer increased 140.67 feet from January through December 2015, as shown in **Table 2.1**. **Figure 2.1** presents a 14-year history of the quarterly groundwater elevation measurements in the LGR segment of the aquifer in relation to quarterly and annual precipitation measured at the KSAT weather station.

Based on 2015 quarterly aquifer level measurements, **Figure 2.2** shows the relationships of the water level in each portion of the aquifer at CSSA cluster wells (CS-MW1, CS-MW2, CS-MW6, CS-MW7, CS-MW8, CS-MW9, CS-MW10, and CS-MW12). The general trend in **Figure 2.2** shows that at an individual location, the head in the LGR well is typically greater than in the CC well. The amount of dissimilarity between water levels within a cluster is a good indicator of the degree of hydraulic separation between the formational units. Theoretically, intervals that are well connected hydraulically will have the same or very similar groundwater elevation.

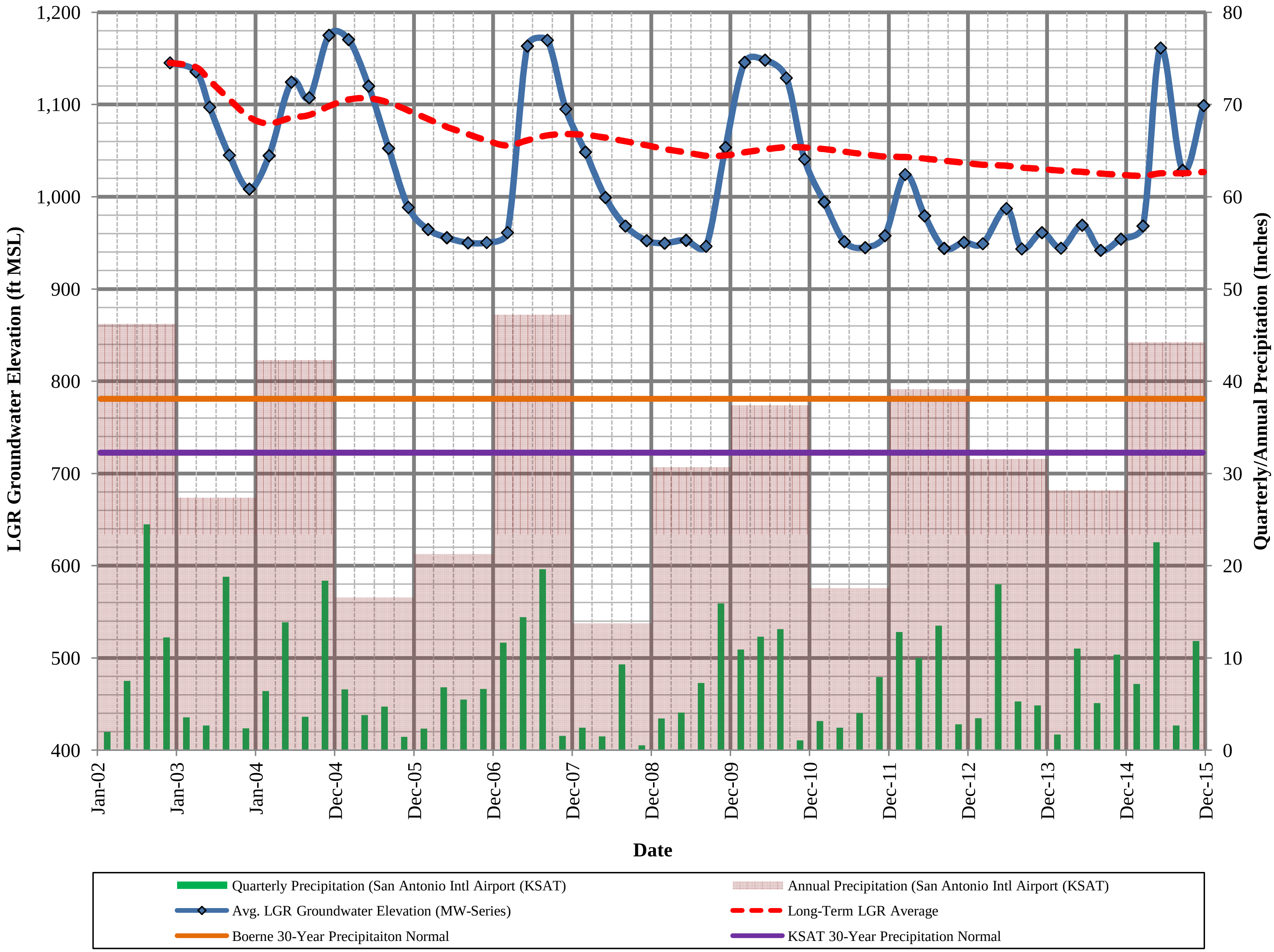
In 2015, well clusters in the southern portion of the post (CS-MW6, CS-MW7, CS-MW8, and CS-MW10) show less hydraulic head separation between the LGR and CC production zones than cluster wells to the north (CS-MW1, CS-MW2, CS-MW9, and CS-MW12). The other notable trend in this graphic is that much more drastic declines in groundwater levels occurred in the southern portion of post (CS-MW6, CS-MW7, CS-MW8, and CS-MW10), as compared to the more central and northern well clusters.

Under more favorable hydrologic conditions, the groundwater elevation in the BS typically falls between the LGR and CC elevations; this was not evident in 2015. As seen in Figure 2.1, when water levels decrease as they did during the third quarter of 2015, the BS groundwater elevation is generally higher than both of its counterparts. This phenomenon has been observed before in the cluster wells, and is attributed to the low draining potential of the less permeable BS matrix during continual aquifer declines. Conversely, during recharge events, the groundwater in the BS wells will lag behind the LGR and CC wells. This is depicted in the second quarter of 2015 and seems to be typical for the area.

2.1.2 Weather Station and Transducer Data

Of the 56 wells listed on **Table 2.1**, 18 are equipped with transducers to continuously log groundwater levels and 12 are providing telemetry directly to the Supervisory Control and Data Acquisition (SCADA) system. As previously noted, three weather stations are in place at CSSA, B-3 WS is located next to the B3-EXW01 well in the north-central region of CSSA, and AOC-65 WS in the southwest corner of CSSA at AOC-65. The third weather station CS-MW18 WS was installed in 2014 next to well CS-MW18-LGR, also in the southwest portion of CSSA. All weather stations record meteorological data, including precipitation, wind speed, wind direction, temperature, etc. The data are recorded to evaluate whether trends in rainfall and groundwater recharge. However, for the purposes of this report the data from the B-3-WS is used because it has the highest degree of accuracy and reliability.

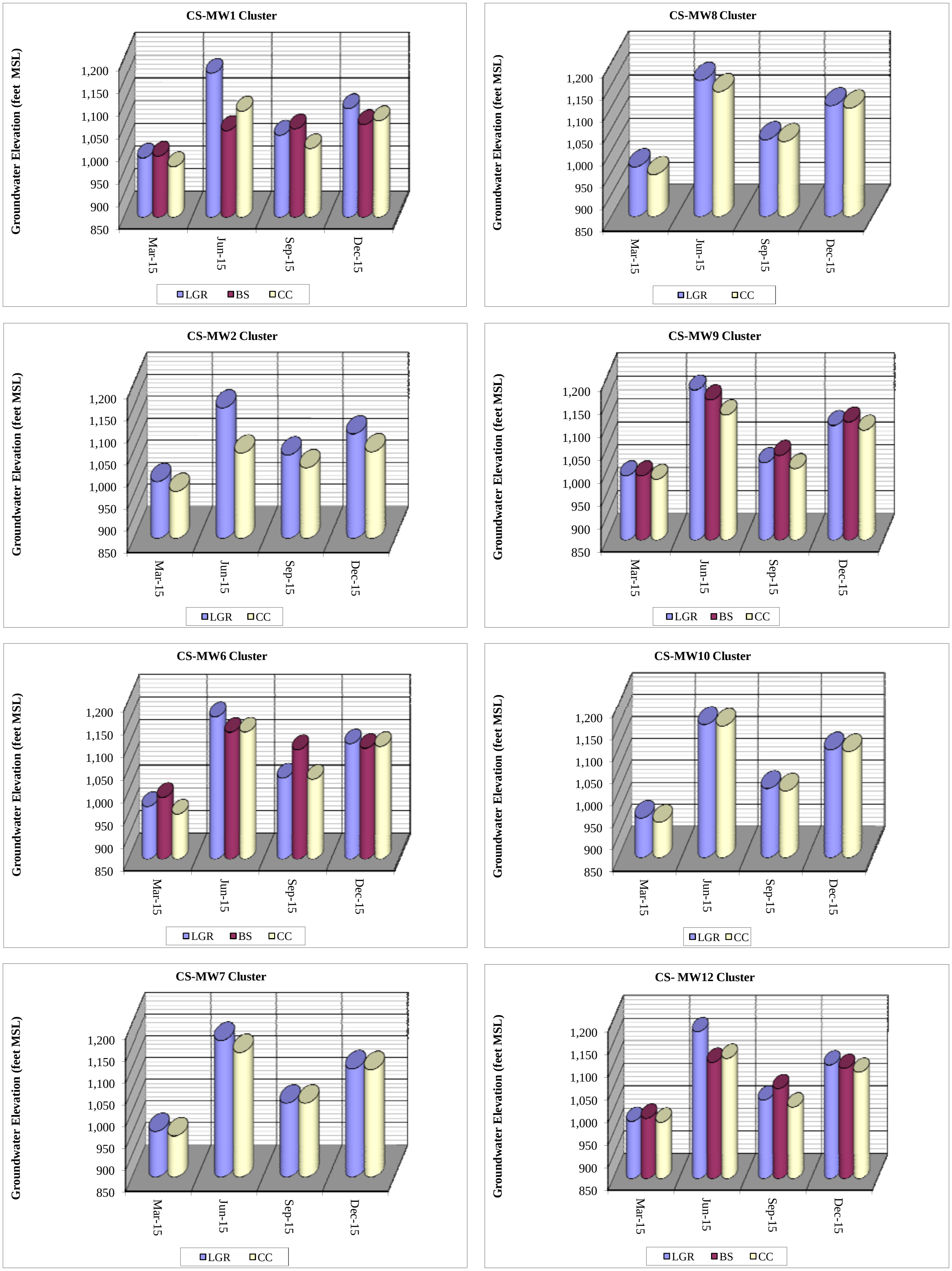
Figure 2.1 - Average LGR Groundwater Elevations and Quarterly/Annual Precipitation



J:\CSSA Program\Restoration\Groundwater\Weather Station Data\KSAT-Airport Weather History\KSAT Weather Summary.xlsx

Fig 2.1 2015 Annual

Figure 2.2
Comparison of Groundwater Elevations within Well Clusters



Continuous aquifer level data (January 1st through December 31st, 2015) collected from five wells screened within the LGR, and two wells screened within the CC are presented on **Figure 2.3** as well as the corresponding daily precipitation values. The wells presented in this figure are equipped with transducers set to record continuous water level measurements. Both CS-MW16-LGR and CS-MW16-CC are omitted from this graphic since they are actively pumping wells for the Bioreactor system, and therefore do not reflect static aquifer conditions. The active drinking water wells and the B3-EXW extraction wells were also omitted for the same reason. As in the past, the groundwater elevations indicate recharge of the LGR formation immediately after precipitation.

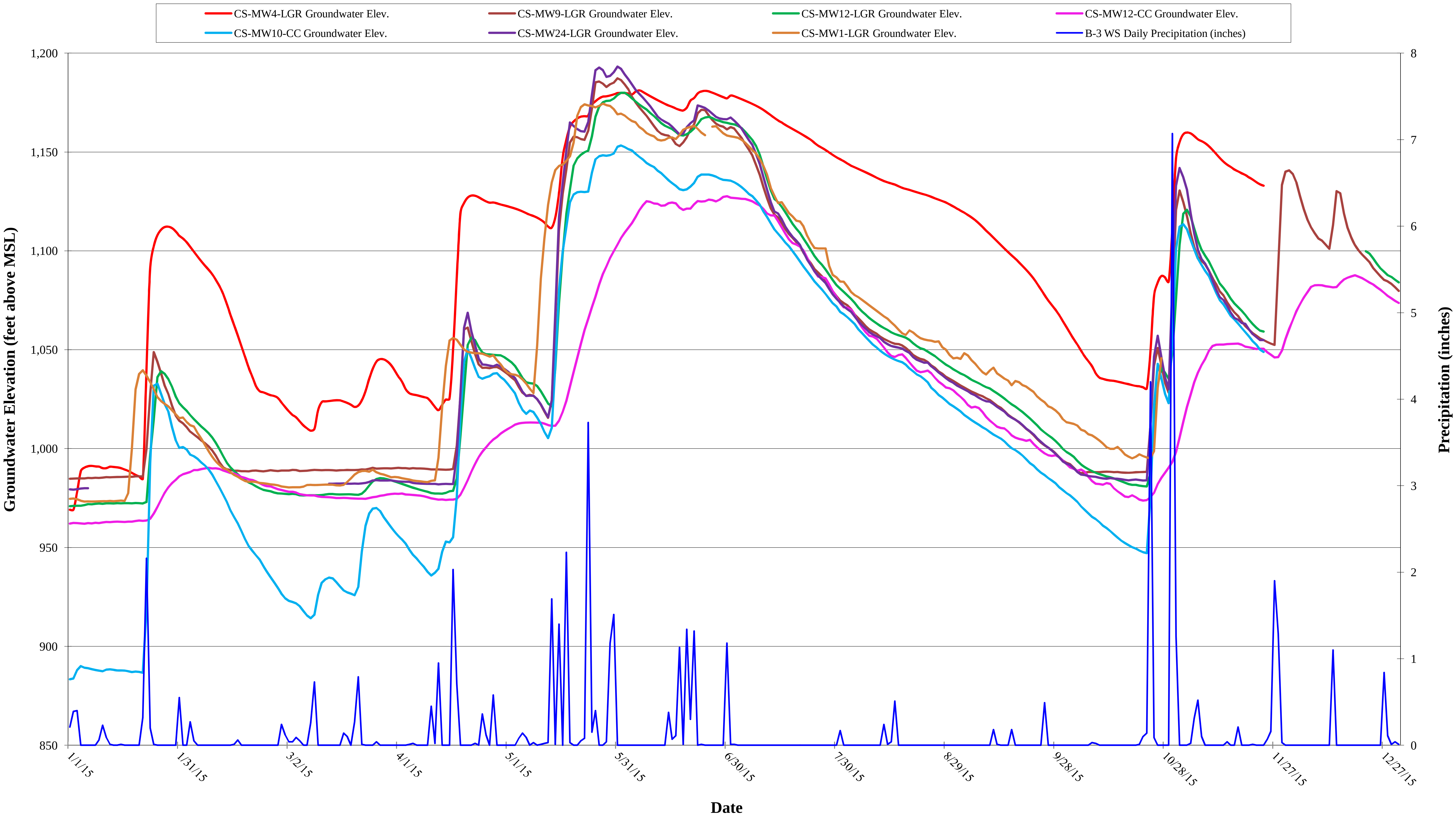
CSSA B-3 WS reported 109 rainfall events with a total precipitation of 53.51 inches. The rainfall in 2015 started off above average in January then tapered off in February. It picked back up in March and then peaked in May during the Memorial Day flood. The month of May had a rainfall total of 12.90 inches. The rain virtually stopped the months of July, August, and September with a total rainfall recorded for those 3 months of 1.85 inches. October turned out to be another month of well above average rainfall with totals of 12.92 inches. May and October (12.9 inches) reported the highest monthly rainfall amounts and August (0.80 inches) had the lowest rainfall total recorded. During the same timeframe, 44.22 inches of rainfall was measured at the San Antonio International Airport, and 50.09 inches of rainfall was measured in Boerne, TX.

Based upon 30-year precipitation data (1986-2015), 2015 rainfall totals at CSSA ended about 16.98 inches above the Boerne National Weather Service (NWS) weather station average of 36.53 inches. For the same timeframe, the San Antonio NWS weather station reports a 30-year average of 32.54, which was 20.97 inches below the CSSA B-3 WS. Currently the San Antonio Water System (SAWS) is in the ‘year-round conservation’ stage and the Trinity Glen Rose Groundwater Conservation District (TGRGCD) is in ‘Stage 1’ water restrictions.

Table 2.3 shows the total precipitation received each quarter, average groundwater elevations in each formation, the average groundwater elevation change in each formation, the approximate gradient, and approximate gradient flow direction for all monitoring events.

Referring back to Figure 2.1, the latter half of 2009 marked the end of a drought cycle that had begun at the end of 2006. Major precipitation events in August and September 2009 recharged the aquifer and began a trend that continued through May 2010. The aquifer surge experienced in the first five months was negated by a summer dry period through August 2010. Rainfall amounts declined September 2010 through September 2011, resulting in regional aquifer level decline of approximately 195 feet. There was an increase in rainfall late in 2011 but due to the already depressed aquifer the drought conditions persisted into 2012. Although an average amount of rain fell in 2012 and 2013, the aquifer rebound was minimal. The below average rainfall in 2014 allowed the aquifer to drop an additional 5 feet over the 12-month period. In 2015 above average rainfall allowed the aquifer to recover 140 feet, bringing the San Antonio area out of the severe drought that began in late 2010.

Figure 2.3, Selected Wells Groundwater Elevations vs Precipitation Data



J:\CSSA Program\Restoration\Groundwater\GW Monitoring Reports\2015\Annual Report\Figure 2-2 Transducer-WS Data.xlsx

Table 2.3
Precipitation, Groundwater Elevation and Gradient

Quarterly Report (Month, year)	Total Quarterly precipitation (inches) B-3 WS	Total Quarterly precipitation (inches) AOC-65 WS	Average GW elevation Change (feet)	CS-MW18-LGR GW Elevation Change (feet)	in each Formation (ft/MSL)			Approximate gradient (ft/ft)	Approximate gradient flow direction
					Lower Glen Rose	Bexar Shale	Cow Creek		
September-99	7.52	--	-188.4	--	979.80	--	--	0.007	Southwest
December-99	2.84	--	-4.9	--	973.10	--	--	0.004	Southwest
March-00	3.58	--	-9.3	--	970.94	--	--	0.009	South-southeast
June-00	11.1	--	11.77	--	976.27	--	--	0.006	Southeast
September-00	1.96	--	-6.34	--	967.03	--	--	0.006	Southeast
December-00	14.48	--	122.99	--	1118.59	--	--	0.005	South-southeast
March-01	10.13	--	53.19	--	1157.20	--	--	0.0125	Southeast
June-01	6.58	--	-47.5	--	1104.00	1106.85	1093.89	0.007	Southeast
September-01	14.73	--	23.96	--	1140.55	1098.18	1095.75	0.0067	Southeast
December-01	10.16	--	15.46	--	1149.68	1131.36	1125.63	0.0092	Southeast
March-02	2.25	--	-70.97	--	1077.91	1064.46	1059.27	0.0086	Southeast
June-02	4.46	--	-48.29	--	1030.51	1022.51	994.02	0.0137	South-southeast
September-02	30.98	--	104.5	--	1130.87	1129.21	1098.34	0.017	South-southeast
December-02	12.91	--	19.48	-2.84	1143.98	1148.26	1133.11	0.0061	South-southeast
March-03	6.22	6.68	-8.47	-1.99	1135.18	1140.52	1122.95	0.012	South-southeast
June-03	4.67	4.64	-41.08	-40.06	1097.87	1095.36	1069.02	0.0022	South-southwest
September-03	8.05	10.28	-52.85	-54.54	1046.77	1060.39	1025.61	0.0045	South-southwest
December-03	2.79	2.92	-32.85	-40.46	1011.38	1029.39	1002.07	0.0095	South-southwest
March-04	6.35	5.93	22.89	36.7	1043.68	1026.20	1017.98	0.0046	South-southwest
June-04	12.95	12.33	71.91	88.99	1121.80	1101.85	1074.56	0.0012	South-southwest
September-04	14.3	14.57	-8.05	-21.66	1106.43	1110.17	1074.96	0.003	South-southeast
December-04	21.04	23.12	63.07	76.62	1173.98	1159.46	1135.16	0.004	South-southeast
March-05	7.38	6.48	-6.47	-7.11	1168.46	1151.60	1127.58	0.00436	South-southeast
June-05	NA	5.29	-45.93	-61.3	1119.19	1125.27	1082.40	0.0041	South-southeast
September-05	NA	5.93	-61.24	-64.87	1054.88	1077.87	1033.65	0.0068	South-southwest
December-05	NA	2.41	-57.9	-69.24	994.23	1023.45	980.25	0.0054	South-southwest
March-06	2.52	1.11	-24.81	-33.89	974.10	990.23	948.80	0.0084	South-southwest
June-06	7.65	11.18	-9.46	-1.4	966.16	983.47	933.59	0.0104	South-southwest
September-06	3.42	3.12	-6.66	-4.81	961.07	979.78	922.34	0.0099	South
December-06	4.68	5.9	2.48	3.02	958.87	979.73	933.37	0.0099	South
March-07	9.83		14.53	-1.27	969.87	992.53	958.06	0.0079	South
June-07	11.99		182.09	234.13	1162.17	1119.36	1128.32	0.0016	Southeast
September-07	29.4		15.56	0.54	1168.77	1168.14	1154.47	0.0019	South
December-07	1.95		-70.45	-87.12	1095.68	1101.19	1088.93	0.0052	South-southeast
March-08	2.17	2.31	-42.45	-43.22	1050.23	1053.76	1047.78	0.0072	South
June-08	1.9	2.69	-51.71	-52.47	1002.44	1015.93	966.67	0.0047	South
September-08	6.06	6.95	-27.49	-45.80	976.18	991.62	953.41	0.0058	South
December-08	1.69	1.74	-15.48	-5.06	961.10	981.76	934.26	0.0080	South-southeast
March-09	2.58	3.16	-4.25	-2.15	957.48	973.36	916.24	0.0073	South-southeast
June-09	3.77	4.41	1.25	1.53	959.75	971.67	914.68	0.0059	South-southeast
September-09	NA	7.41	-7.76	-5.48	953.49	967.07	903.39	0.0054	South-southeast
December-09	NA	14.63	101.24	114.02	1051.77	1040.48	1026.64	0.00002	South
March-10	9.23	NA	91.51	100.05	1144.36	1128.84	1131.78	0.00052	South-southeast
June-10	NA	10.66	3.97	3.40	1147.52	1145.30	1114.38	0.00078	South-southeast
September-10	NA	10.91	-37.77	-15.95	1126.83	1070.13	1059.82	0.00085	South-southeast
December-10	NA	4.45	-63.93	-97.99	1045.26	1060.79	1011.76	0.00029	South-southeast
March-11	NA	2.57	-41.89	-52.73	997.07	1020.56	994.18	0.00314	South-southeast
June-11	0.91	0.83	-41.80	-46.77	957.42	983.63	917.00	0.00532	South-southeast
September-11	2.29	2.13	-8.81	-3.15	952.98	970.34	900.90	0.00533	South-southeast
December-11	9.85	11.71	14.73	8.05	963.15	972.51	922.89	0.00536	South-southeast
March-12	NA	8.58	57.04	75.20	1021.21	992.83	975.99	0.00066	South-southeast
June-12	NA	5.83	-30.83	-54.76	981.01	1012.98	964.88	0.00326	South-southeast
September-12	NA	9.95	-36.51	-26.02	952.92	975.91	909.63	0.00455	South-southeast
December-12	NA	7.12	8.92	4.15	957.47	984.75	930.15	0.00550	South-southeast
March-13	4.88	4.79	-2.93	-2.05	954.43	977.59	933.99	0.00605	South-southeast
June-13	12.26	9.57	34.90	24.00	989.52	999.66	974.67	0.00350	South-southeast
September-13	5.03	3.92	-43.40	-26.95	947.00	974.20	918.61	0.00541	South-southeast
December-13	11.84	10.92	16.28	7.70	964.12	974.92	939.82	0.00506	South-southeast
March-14	0.96	1.10	-12.81	-6.03	950.62	970.44	926.47	0.00620	South-southeast
June-14	8.73	8.03	22.53	11.46	972.10	984.11	960.81	0.00513	South-southeast
September-14	6.25	5.09	-26.88	-13.86	947.85	970.50	916.54	0.00550	South-southeast
December-14	9.34	7.38	11.64	7.35	958.45	974.38	935.08	0.00544	South-southeast

Table 2.3 (cont.)
Precipitation, Groundwater Elevation and Gradient

Quarterly Report (Month, year)	Total Quarterly precipitation (inches) B-3 WS	Total Quarterly precipitation (inches) AOC-65 WS	Average GW elevation Change (feet)	CS-MW18-LGR GW Elevation Change (feet)	in each Formation (ft/MSL)			Approximate gradient (ft/ft)	Approximate gradient flow direction
					Lower Glen Rose	Bexar Shale	Cow Creek		
March-15	7.95	5.52	14.41	4.62	971.61	986.23	955.73	0.00550	South-southeast
June-15	18.62	15.44	176.73	222.23	1162.97	1108.95	1115.04	0.00052*	South-southeast
September-15	6.76	3.66	-119.17	-147.45	1027.92	1055.29	1011.95	0.0053*	South-southeast
December-15	20.18	13.87	68.26	80.93	1100.39	1087.93	1083.84	0.00131	South-southeast

GW = groundwater, ft MSL = feet above mean sea level, ft/ft = feet per foot, WS = weather station

NA = Data not available due to weather station outage.

2007 precipitation data was combined to fill in data gaps due to multiple weather station outages during SCADA installation.

* alternate wells were used in calculating gradient to generally describe the regional gradient

2.1.3 Potentiometric Data

The groundwater gradient/potentiometric surface figures presented **Appendix F** incorporate measured groundwater elevations from the LGR, BS, and CC screened wells. The drought conditions which began in late 2010 persisted in 2011 and 2012, showed minor improvement in 2013, back on a downward trend in 2014, then a significant recovery in 2015. The 2011 record low yearly rainfall total of 17 inches sent Bexar County and surrounding areas into one of the worst droughts in Texas history. An above average amount of rain fell in 2015 and allowed the aquifers to recover to normal conditions. As shown in **Appendix F**, water levels at CSSA can vary greatly. This variability is associated with several factors:

- A low storage capacity for groundwater within the primary porosity (interstitial voids between grains) of the limestone matrix, which is inherent to carbonate mudstone aquifers. These aquifers with lower storage capacities are more susceptible to widely fluctuating groundwater levels (as compared to a well-sorted sand matrix). Within the Middle Trinity aquifer and other regional carbonate aquifers, their groundwater yield is mostly derived from secondary porosity features resulting from faults, fractures, and chemical dissolution of the bedrock (karst).
- Differences in well completion depths and formations screened;
- Differences in recharge rates due to increased secondary porosity associated with the Salado Creek area;
- Differences in recharge rates due to increased secondary porosity associated with local fault zones;
- Pumping from on- and off-post public and private water supply wells; and
- Locations of major faults or fractures.

2.1.4 Post-wide Flow Direction and Gradient

An overall average 2015 calculated LGR groundwater gradient is to the south-southeast at 0.00316 ft/ft. Depending which quadrant of the post the measurement is taken, the groundwater gradient varied seasonally from 0.00052 ft/ft (June 2015) to 0.0055 ft/ft (March 2015). General groundwater flow directions and average gradients calculated during past monitoring events are provided in **Table 2.3** for comparison.

<u>Lower Glen Rose</u>

The 2015 potentiometric surface maps for LGR-screened wells **(Appendices F.1, F.4, F.7** and **F.10)** exhibited a wide range of groundwater elevations. To illustrate, the average groundwater elevation in the LGR segment of the aquifer varied by more than 200 feet over the course of the year. In fact, those ranges occurred within the first six months of the year. Groundwater elevations are generally higher in the northern and central portions of CSSA, and decrease to the south. This is consistent with the natural dip of the formations and the greater fault displacement in the southern portion of CSSA. The removal of well CS-G from the gridding process negates a mounding effect due to perched groundwater that is present at that well, and misleadingly disrupts the normal southerly and easterly components of the North Pasture. This well, along with open borehole completions in wells CS-D, CS-2, and CS-4 are not fully penetrating into the LGR, and therefore are not considered within this map.

Between the December 2014 and March 2015 monitoring events, the LGR groundwater regionally increased 14.2 feet as the region continued to come out of a 4-year drought. As shown in **Table 2.1**, LGR groundwater levels rebounded by an average of 193 feet in response to approximately 24 inches of rainfall occurring between April and June 2015, with half of that coming in May 2015. The effect to the aquifer elevation can be seen by comparing the March 2015 (**Appendix F.1)** and June 2015 (**Appendix F.4)**. By September 2015 (**Appendix F.7**), the LGR segment had lost most of its springtime gains, and the aquifer receded 132.8 feet in response to only 1.85 inches of rainfall during the third quarter of 2015. Another 19.7 inches of rainfall in the final quarter of 2015 (13 inches in October 2015) garnered another 70.2-foot aquifer gain by the December 2015 monitoring event (**Appendix F.10**). Overall, the LGR segment gained approximately 140 feet of aquifer elevation over the 12-month period between December 2014 and December 2015.

A typical feature as seen in **Appendix F.1** and **F.7** is the groundwater mounding effect centered on CS-MW4-LGR in the central portion of the base. This is a typical feature during non-drought conditions when the surrounding groundwater elevation is above approximately 970 feet mean sea level (MSL). Unlike the general trend at CSSA, groundwater flow appears to radiate outward from CS-MW4-LGR. Presumably this region has a strong hydraulic connection to significant perched water either associated with Salado Creek or the hillsides to the east.

Historical data has shown that this mounding effect can either be muted or completely removed under distressed aquifer levels. Although this was not the case in 2015, more recent occurrences did happen in March and September 2014 (**2014 Annual Groundwater Report - Appendices F.1 and F.7**); this mounding effect subsides as the average groundwater elevation approaches the elevation of the basal production zone of the aquifer.

The groundwater drawdown due to the cyclic pumping of CS-MW16-LGR, B3-EXW01-LGR, B3-EXW02-LGR, B3-EXW03-LGR, B3-EXW04-LGR, B3-EXW05-LGR (Bioreactor System) is a recurring feature in the central portion of the post (**Appendices F.1, F.4, F.7,** and **F.10**). As seen in these figures, the resultant groundwater "cone of depression" can vary due to combination of extraction wells actively pumping during the water level gauging effort. But as a collective system, they are effective in maintaining a zone of capture around the remediation system and re-injecting groundwater into the Bioreactor.

Depending on the current pumping rates at the time of measurement, groundwater in the vicinity of the Bioreactor may be depressed by as much as 50 to 150 feet, as measured between a currently active extraction well (EXW) and other surrounding wells (**Appendix F.4)**. Groundwater in the inner cantonment also shows a drawdown effect from the pumping of water supply well CS-12 and is most notable in March and June 2015 (**Appendix F.1 and F.4**).

<u>Bexar Shale</u>

Currently, groundwater head information is limited to four data points (CS-MW1-BS, CS-MW6-BS, CS-MW9-BS, and CS-MW12-BS). Given the paucity of well control, at best, the BS groundwater maps should be considered qualitative. The BS appears to have very limited groundwater that is likely associated with fracturing. Fractured bedrock such as this often results in discordant water levels between neighboring points and may not be a true indicator of flow direction. The appropriateness of preparing potentiometric surface maps for the BS is debatable, but these maps have been generated for completeness. Potentiometric maps for the Bexar Shale in 2015 are presented in **Appendices F.2, F.5, F.8** and **F.11**.

Compared to the LGR and CC segments, the BS aquitard fluctuates significantly less in response to both recharge and drought. During the four monitoring periods in 2015, the quarterly water elevation change was approximately 50 percent of that measured in the LGR segment. During a drought-busting year, the net gain of the BS segment between December 2014 and December 2015 was 113.6 feet. Conversely, over the course of 12 months of drought between December 2013 and December 2014, the net loss for the BS segment was 0.5 feet. Historical data has shown for a given precipitation event, the BS water level will "peak" anywhere between 15 and 30 days after the LGR and CC has already crested for the same rain event.

From a historical perspective, the potentiometric surface maps for BS-screened wells often exhibit groundwater flow in multiple directions. Generally these flow directions are to the south, east, and occasionally to the north. However in 2015, the gradient of the BS potentiometric are all in a southerly direction. The June and December 2015 measurement (**Appendix F.5 and F.11**) do indicate a component of easterly flow during a periods of aquifer recharge. Conversely, the map for June 2015 (**Appendix, F.8**) shows a gradient flow predominately toward the north during the summer months when only 1.85 inches of precipitation fell at the post, and the BS groundwater elevation declined by 54 feet.

Cow Creek

As with the BS, the postwide monitoring of the CC groundwater is limited due to the small number of wells completed only in the CC. Four of the nine CC wells are concentrated in the vicinity of AOC-65. In March, during its lowest groundwater elevation of the year, the CC groundwater exhibited a strong southerly gradient (**Appendix F.3**). But when groundwater was at its highest elevations in June and December 2015 (**Appendices F.6** and **F.12**), the predominant gradient was to the east. The June 2015 potentiometric map is also the best example of the natural groundwater gradient since it is not under the direct influence of routine pumping action at well CS-MW16-CC. In contrast, the September 2015 CC groundwater map (**Appendix F.9**) shows a mixture of easterly and northerly gradients that are induced by a well-developed cone of depression originating from extraction well CS-MW16-CC.

Throughout 2015, the effects of continuous pumping of CS-MW16-CC influenced groundwater gradients significantly in the CC interval near the Bioreactor. Prior studies have shown measurable pumping influence within the CC at distances of more than 2,000 feet from a CC pumping well, as measured at CS-MW1-CC. The effects of this pumping are visible in three of the quarterly monitoring events of 2015 (**Appendices F.3, F.9** and **F.12**) which clearly show the cone of depression surrounding CS-MW16-CC.

The CC responds almost as quickly as the LGR to a recharge event, presumably because of direct infiltration on the outcrop areas to the north of CSSA. However, the recharge rate is somewhat slower than the LGR, and the crest of a precipitation response may come 15 days later than what is observed in the LGR. Typically, the CC aquifer elevation response to recharge is less than the LGR segment. After the 12 month period between December 2014 and December 2015, the net gain of the CC segment was 149 feet.

2.2 Chemical Characteristics

2.2.1 On-Post Analytical Results

The LTMO study implemented in December 2005, updated in 2010, and in the process of a third update completed in 2015 determines the frequency that on-post wells are sampled. An overview of sampling frequencies for on-post wells is given in **Table 2.4**. Ninety-six on-post samples from 44 wells were scheduled to be collected in 2015 (33 in March, 14 in June, 5 in September, and 44 in December). Three of the 96 samples could not be collected due to low water levels.

The wells were sampled using either dedicated low-flow pumps, high capacity submersible pumps, or dedicated solar-powered submersible pump (well CS-I). Samples were collected after field parameters (pH, temperature, conductivity) stabilized during well purging. Field parameters were recorded in the field logbook for each sampling event.

Groundwater samples were submitted to Agriculture & Priority Pollutants Laboratories, Inc. (APPL) of Clovis, California for analysis. The analytical program for on-post monitoring wells includes short-list VOC analysis and metals. The short list of VOC analytes included: 1,1-Dichloroethene (1,1-DCE), *cis*-1.2-Dichloroethene (*cis*-1,2-DCE), *trans*-1,2-DCE (*trans*-1,2-DCE), PCE, TCE, and vinyl chloride.

Under the provisions of the groundwater monitoring LTMO study and DQOs, all on-post monitoring wells are sampled for chromium, cadmium, mercury, and lead. To meet drinking water compliance requirements, drinking water wells are sampled for additional metals arsenic, barium, copper, and zinc.

Each sample is evaluated against either being qualitatively detected in trace amounts above the method detection limit (MDL [F-flagged data]), quantitatively detected above the laboratory reporting limit (RL), or in exceedance of regulatory maximum contaminant level (MCL), action level (AL), or secondary standard (SS) comparison criteria. It is important to note that the RL value is significantly less than the promulgated groundwater standard criteria, and therefore the occurrence of a constituent above the RL does not necessarily indicate that there is an immediate concern, especially with the naturally occurring inorganics (metals) in groundwater. The only exception to this generalization is lead, where the RL (0.025 mg/L) is greater than the AL (0.015 mg/L).

Three groundwater samples were not collected in 2015. Samples from CS-MW11B-LGR, CS-4, and CS-D were not collected in March due to water levels falling below the dedicated low-flow QED pumps.

2.2.1.2 On-Post Monitoring Wells with COC Detections above the MCL

Some wells sampled had concentrations detected that exceeded MCLs. The MCLs for some COCs were exceeded in wells CS-MW16-LGR, CS-MW16-CC, CS-MW1-LGR, CS-MW5-LGR, CS-D, and CS-MW36-LGR in 2015. The respective comparison criteria (MCLs, SS, or AL) for each compound are included in **Table 2.5**. The detected concentrations are summarized as follows:

Table 2.4
Overview of On-Post Sampling for 2015

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

Notes/Abrreviations:
* New LTMO sampling frequency implemented June 2011
S = Sample
NS = No Sample
NSWL = No Sample due to low water level
+ = samples not on the schedule but added to the sampling event

Table 2.5
2015 On-post Groundwater COCs and Metals Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
Laboratory Detection Limits & Maximum Contaminant Level							
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
CS-MW1-LGR	3/10/2015	--	20.13	0.27F	16.66	29.71	--
	6/8/2015	--	46.36	0.81	35.77	36.16	--
	12/7/2015	--	33.28	0.69	24.31	28.00	--
CS-MW1-CC	12/7/2015	--	--	--	0.10F	--	--
CS-MW2-LGR	3/10/2015	--	0.50F	--	--	--	--
	6/8/2015	--	0.54F	--	--	--	--
	12/8/2015	--	0.37F	--	--	--	--
CS-MW2-CC	12/8/2015	--	--	--	--	--	--
CS-MW3-LGR	3/13/2015	--	--	--	--	--	--
	12/8/2015	--	--	--	--	--	--
CS-MW4-LGR	3/10/2015	--	--	--	--	--	--
	12/8/2015	--	--	--	--	--	--
CS-MW5-LGR	3/10/2015	--	2.91	--	1.38F	3.09	--
	2/3/2016	--	16.12	0.43F	7.68	17.93	--
CS-MW6-LGR	3/10/2015	--	--	--	--	--	--
	12/9/2015	--	--	--	0.26F	--	--
CS-MW6-CC	12/9/2015	--	--	--	--	--	--
CS-MW7-LGR	3/10/2015	--	--	--	0.87F	--	--
	12/9/2015	--	--	--	0.81F	--	--
CS-MW7-CC	12/9/2015	--	--	--	--	--	--
CS-MW8-LGR	3/10/2015	--	--	--	3.38	--	--
	6/10/2015	--	--	--	2.44	--	--
	12/9/2015	--	--	--	2.74	--	--
CS-MW8-CC	12/9/2015	--	--	--	--	--	--
Duplicate	12/9/2015	--	--	--	--	--	--
CS-MW9-LGR	3/13/2015	--	--	--	--	--	--
	12/15/2015	--	--	--	--	--	--
CS-MW9-CC	12/15/2015	--	--	--	--	--	--
CS-MW10-LGR	3/11/2015	--	--	--	1.74	0.48F	--
	6/9/2015	--	--	--	1.86	0.44F	--
	12/10/2015	--	--	--	2.02	0.43F	--
CS-MW10-CC	12/9/2015	--	--	--	--	--	--
CS-MW11A-LGR	3/11/2015	--	--	--	0.84F	--	--
	6/9/2015	--	--	--	0.96F	--	--
	12/10/2015	--	--	--	0.81F	--	--
CS-MW11B-LGR	12/14/2015	--	--	--	1.12F	--	--
CS-MW12-LGR	3/12/2015	--	--	--	--	--	--
	12/14/2015	--	--	--	--	--	--
CS-MW12-CC	12/14/2015	--	--	--	--	--	--
CS-MW16-LGR	3/13/2015	--	87.69	0.30F	78.41	88	--
	12/16/2015	--	110.97	0.62	83.2	114.21	--
Duplicate	12/16/2015	--	111.87	0.48F	85.07	113.04	--
CS-MW16-CC	3/13/2015	--	14.77	6.57	0.15F	5.16	--
	12/16/2015	--	15.9	6.68	--	4.27	--

Table 2.5 (cont.)
2015 On-post Groundwater COCs and Metals Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
Laboratory Detection Limits & Maximum Contaminant Level							
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**
CS-MW17-LGR	3/18/2015	--	--	--	**0.30F**	--	--
Duplicate	3/18/2015	--	--	--	**0.38F**	--	--
	12/16/2015	--	**0.39F**	--	**0.66F**	--	--
CS-MW18-LGR	3/18/2015	--	--	--	--	--	--
	12/14/2015	--	--	--	--	--	--
CS-MW19-LGR	3/12/2015	--	--	--	**0.67F**	--	--
	12/14/2015	--	--	--	**0.67F**	--	--
Duplicate	12/14/2015	--	--	--	**0.65F**	--	--
CS-MW20-LGR	3/17/2015	--	--	--	**1.29F**	--	--
	12/17/2015	--	**0.32F**	--	**1.55**	--	--
CS-MW21-LGR	3/13/2015	--	--	--	--	--	--
	12/17/2015	--	**0.25F**	--	--	--	--
CS-MW22-LGR	3/17/2015	--	--	--	--	--	--
	12/18/2015	--	--	--	--	--	--
CS-MW23-LGR	3/17/2015	--	--	--	--	--	--
	12/14/2015	--	--	--	--	--	--
CS-MW24-LGR	3/13/2015	--	--	--	**0.20F**	**0.12F**	--
	6/8/2015	--	--	--	--	--	--
	12/14/2015	--	--	--	--	--	--
CS-MW25-LGR	3/13/2015	--	--	--	--	--	--
Duplicate	3/13/2015	--	--	--	--	--	--
	2/3/2016	--	--	--	--	--	--
CS-MW35-LGR	3/18/2015	--	--	--	**0.24F**	--	--
	6/9/2015	--	--	--	**0.91F**	--	--
	12/14/2015	--	--	--	**0.85F**	--	--
CS-MW36-LGR	3/10/2015	--	**0.70F**	--	**16.68**	**28.3**	--
	6/10/2015	--	--	--	**8.7**	**6.28**	--
	9/11/2015	--	**0.36F**	--	**13.21**	**12.01**	--
	12/9/2015	--	--	--	**6.71**	**2.34**	--
CS-D	6/8/2015	--	**22.82**	--	**23.56**	**32.24**	--
	12/17/2015	--	**14.95**	**0.19F**	**16.19**	**20.96**	--
CS-2	3/17/2015	--	--	--	--	--	--
	12/14/2015	--	--	--	--	--	--
CS-4	6/10/2015	--	--	--	**0.57F**	**0.48F**	--
	12/14/2015	--	**0.39F**	--	**0.65F**	**0.85F**	--
CS-MWG-LGR	2/3/2016	--	--	--	--	--	--
CS-MWH-LGR	2/3/2016	--	--	--	--	--	--
CS-I	2/3/2016	--	--	--	--	--	--
CSSA Drinking Water Well System							
CS-1	3/9/2015	--	--	--	--	--	--
Duplicate	3/9/2015	--	--	--	--	--	--
	6/11/2015	--	--	--	--	--	--
	9/15/2015	--	--	--	--	--	--
	12/18/2015	--	--	--	--	--	--

Table 2.5 (cont.)
2015 On-post Groundwater COCs and Metals Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
Laboratory Detection Limits & Maximum Contaminant Level							
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**
CS-10	3/9/2015	--	--	--	--	--	--
	6/15/2015	--	--	--	--	--	--
Duplicate	6/15/2015	--	--	--	--	--	--
	9/15/2015	--	--	--	--	--	--
	12/18/2015	--	--	--	--	--	--
Duplicate	12/18/2015	--	--	--	--	--	--
CS-12	3/9/2015	--	--	--	--	--	--
	6/15/2015	--	--	--	--	--	--
	9/15/2015	--	--	--	--	--	--
	12/18/2015	--	--	--	--	--	--
CS-13	3/9/2015	--	--	--	--	--	--
	6/15/2015	--	--	--	--	--	--
	9/14/2015	--	--	--	--	--	--
Duplicate	9/14/2015	--	--	--	--	--	--
	12/18/2015	--	--	--	--	--	--

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

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

Abbreviations/Notes:

Duplicate	Field Duplicate
TCE	Trichloroethene
PCE	Tetrachloroethene
DCE	Dichloroethene

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.

Table 2.5 (cont.)
2015 On-post Groundwater COCs and Metals Analytical Results

Well ID	Sample Date	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Zinc	Mercury
Laboratory Detection Limits & Maximum Contaminant Levels									
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
CS-MW1-LGR	3/10/2015	NA	NA	--	**0.0021F**	NA	--	NA	--
	6/8/2015	NA	NA	--	**0.0012F**	NA	--	NA	--
	12/7/2015	NA	NA	--	**0.0014F**	NA	--	NA	--
CS-MW1-CC	12/7/2015	NA	NA	--	--	NA	--	NA	--
CS-MW2-LGR	3/10/2015	NA	NA	--	--	NA	--	NA	--
	6/8/2015	NA	NA	--	--	NA	--	NA	--
	12/8/2015	NA	NA	--	--	NA	--	NA	--
CS-MW2-CC	12/8/2015	NA	NA	--	--	NA	--	NA	--
CS-MW3-LGR	3/13/2015	NA	NA	--	**0.0014F**	NA	--	NA	--
	12/8/2015	NA	NA	--	--	NA	--	NA	--
CS-MW4-LGR	3/10/2015	NA	NA	--	--	NA	--	NA	--
	12/8/2015	NA	NA	--	--	NA	--	NA	--
CS-MW5-LGR	3/10/2015	NA	NA	--	**0.0060F**	NA	--	NA	--
	12/17/2015	NA	NA	--	--	NA	--	NA	--
CS-MW6-LGR	3/10/2015	NA	NA	--	**0.0016F**	NA	--	NA	--
	12/9/2015	NA	NA	--	**0.0011F**	NA	--	NA	--
CS-MW6-CC	12/9/2015	NA	NA	--	--	NA	--	NA	--
CS-MW7-LGR	3/10/2015	NA	NA	--	**0.0024F**	NA	--	NA	--
	12/9/2015	NA	NA	--	**0.0014F**	NA	--	NA	--
CS-MW7-CC	12/9/2015	NA	NA	--	--	NA	--	NA	--
CS-MW8-LGR	3/10/2015	NA	NA	--	**0.0021F**	NA	--	NA	--
	6/10/2015	NA	NA	--	--	NA	--	NA	--
	12/9/2015	NA	NA	--	**0.0011F**	NA	--	NA	--
CS-MW8-CC	12/9/2015	NA	NA	--	**0.0015F**	NA	--	NA	--
Duplicate	12/9/2015	NA	NA	--	**0.0012F**	NA	--	NA	--
CS-MW9-LGR	3/13/2015	NA	NA	--	**0.0042F**	NA	--	NA	--
	12/15/2015	NA	NA	--	--	NA	**0.0021F**	NA	--
CS-MW9-CC	12/15/2015	NA	NA	--	--	NA	--	NA	--
CS-MW10-LGR	3/11/2015	NA	NA	--	**0.0035F**	NA	--	NA	--
	6/9/2015	NA	NA	--	**0.0013F**	NA	--	NA	--
	12/10/2015	NA	NA	--	**0.0018F**	NA	--	NA	--
CS-MW10-CC	12/9/2015	NA	NA	--	--	NA	--	NA	--
CS-MW11A-LGR	3/11/2015	NA	NA	--	**0.0020F**	NA	--	NA	--
	6/9/2015	NA	NA	--	--	NA	--	NA	--
	12/10/2015	NA	NA	--	--	NA	--	NA	--
CS-MW11B-LGR	12/14/2015	NA	NA	--	**0.0166**	NA	**0.0025F**	NA	--
CS-MW12-LGR	3/12/2015	NA	NA	--	**0.0018F**	NA	--	NA	--
	12/14/2015	NA	NA	--	**0.0011F**	NA	**0.0025F**	NA	--
CS-MW12-CC	12/14/2015	NA	NA	--	--	NA	**0.0035F**	NA	--
CS-MW16-LGR	3/13/2015	NA	NA	--	--	NA	--	NA	**0.0002F**
	12/16/2015	NA	NA	--	--	NA	--	NA	--
Duplicate	12/16/2015	NA	NA	--	--	NA	--	NA	--
CS-MW16-CC	3/13/2015	NA	NA	--	--	NA	--	NA	--
	12/16/2015	NA	NA	--	--	NA	--	NA	--
CS-MW17-LGR	3/18/2015	NA	NA	--	**0.0088F**	NA	--	NA	0.0001M
Duplicate	3/18/2015	NA	NA	--	**0.0084F**	NA	--	NA	--
	12/16/2015	NA	NA	--	**0.0014F**	NA	--	NA	--
CS-MW18-LGR	3/18/2015	NA	NA	--	**0.0017F**	NA	--	NA	--
	12/14/2015	NA	NA	--	--	NA	**0.0042F**	NA	--
CS-MW19-LGR	3/12/2015	NA	NA	--	**0.0023F**	NA	--	NA	--
	12/14/2015	NA	NA	--	**0.0014F**	NA	**0.0024F**	NA	--
Duplicate	12/14/2015	NA	NA	--	**0.0014F**	NA	--	NA	--
CS-MW20-LGR	3/17/2015	NA	NA	--	**0.0021F**	NA	--	NA	--
	12/17/2015	NA	NA	--	**0.0018F**	NA	--	NA	--
CS-MW21-LGR	3/13/2015	NA	NA	--	--	NA	--	NA	**0.0002F**
	12/17/2015	NA	NA	--	--	NA	--	NA	--
CS-MW22-LGR	3/17/2015	NA	NA	--	--	NA	--	NA	--
	12/18/2015	NA	NA	--	--	NA	--	NA	--
CS-MW23-LGR	3/17/2015	NA	NA	--	**0.0030F**	NA	--	NA	--
	12/14/2015	NA	NA	--	--	NA	**0.0022F**	NA	--

Table 2.5 (cont.)
2015 On-post Groundwater COCs and Metals Analytical Results

Well ID	Sample Date	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Zinc	Mercury
Laboratory Detection Limits & Maximum Contaminant Levels									
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**
CS-MW24-LGR	3/13/2015	NA	NA	--	**0.0043F**	NA	--	NA	--
	6/8/2015	NA	NA	--	--	NA	--	NA	--
	12/14/2015	NA	NA	--	--	NA	**0.0033F**	NA	--
CS-MW25-LGR	3/13/2015	NA	NA	--	**0.0012F**	NA	--	NA	--
Duplicate	3/13/2015	NA	NA	--	**0.0012F**	NA	--	NA	--
	12/16/2015	NA	NA	--	**0.0015F**	NA	--	NA	--
CS-MW35-LGR	3/18/2015	NA	NA	--	--	NA	--	NA	--
	6/9/2015	NA	NA	--	--	NA	--	NA	--
	12/14/2015	NA	NA	--	**0.0011F**	NA	--	NA	--
CS-MW36-LGR	3/10/2015	NA	NA	--	**0.0016F**	NA	--	NA	--
	6/10/2015	NA	NA	--	--	NA	--	NA	--
	9/11/2015	NA	NA	--	**0.0126**	NA	--	NA	--
	12/9/2015	NA	NA	--	**0.0043F**	NA	--	NA	--
CS-D	6/8/2015	NA	NA	--	--	NA	--	NA	--
	12/17/2015	NA	NA	--	--	NA	--	NA	--
CS-2	3/17/2015	NA	NA	--	**0.0019F**	NA	--	NA	--
	12/14/2015	NA	NA	--	--	NA	--	NA	--
CS-4	6/10/2015	NA	NA	--	--	NA	--	NA	--
	12/14/2015	NA	NA	--	--	NA	**0.0023F**	NA	--
CS-MWG-LGR	12/16/2015	NA	NA	--	--	NA	--	NA	--
CS-MWH-LGR	12/16/2015	NA	NA	--	--	NA	--	NA	--
CS-I	12/16/2015	NA	NA	--	--	NA	--	NA	--
CSSA Drinking Water Well System									
CS-1	3/9/2015	**0.0011F**	**0.0345**	--	**0.0011F**	**0.004F**	--	**0.193**	--
Duplicate	3/9/2015	--	**0.0358**	--	**0.0012F**	**0.008F**	--	**0.218**	--
	6/11/2015	**0.00167F**	**0.038**	--	--	**0.009F**	--	**0.235**	--
	9/15/2015	**0.0008F**	**0.0324**	--	--	--	--	**0.148**	--
	12/18/2015	**0.00260F**	**0.0334**	--	--	--	--	**0.197**	--
CS-10	3/9/2015	**0.0016F**	**0.0392**	--	--	**0.014**	--	**0.051**	--
	6/15/2015	**0.00172F**	**0.0396**	--	**0.0014F**	**0.008F**	--	**0.063**	--
Duplicate	6/16/2015	**0.00135F**	**0.0379**	--	--	**0.008F**	--	**0.056**	--
	9/15/2015	**0.0008F**	**0.037**	--	--	**0.005F**	--	**0.062**	--
	12/18/2015	**0.00203F**	**0.035**	--	--	**0.005F**	--	**0.032F**	--
Duplicate	12/18/2015	**0.00218F**	**0.0365**	--	--	**0.004F**	--	**0.034F**	--
CS-12	3/9/2015	--	**0.0312**	--	**0.0012F**	--	--	**0.072**	--
	6/15/2015	**0.00199F**	**0.0298**	--	--	**0.006F**	--	**0.077**	--
	9/15/2015	--	**0.0282**	--	--	**0.096**	--	**0.126**	--
	12/18/2015	**0.0026F**	**0.0292**	--	--	**0.007F**	--	**0.090**	--
CS-13	3/9/2015	**0.0029F**	**0.0294**	--	--	--	--	**0.252**	--
	6/15/2015	**0.0029F**	**0.0304**	--	--	**0.004F**	--	**0.522**	--
	9/14/2015	**0.0058F**	**0.0272**	--	**0.0011F**	**0.013**	--	**0.232**	--
Duplicate	9/14/2015	**0.0044F**	**0.0274**	--	**0.0011F**	**0.009F**	--	**0.242**	--
	12/18/2015	**0.0028F**	**0.0282**	--	**0.0011F**	**0.007F**	--	**0.300**	--

Bold ≥ MCL
Bold ≥ RL
Bold ≥ MDL

All samples were analyzed by APPL, Inc. using laboratory method SW8260B.
VOC data reported in µg/L & metals data reported in mg/L.

Abbreviations/Notes:

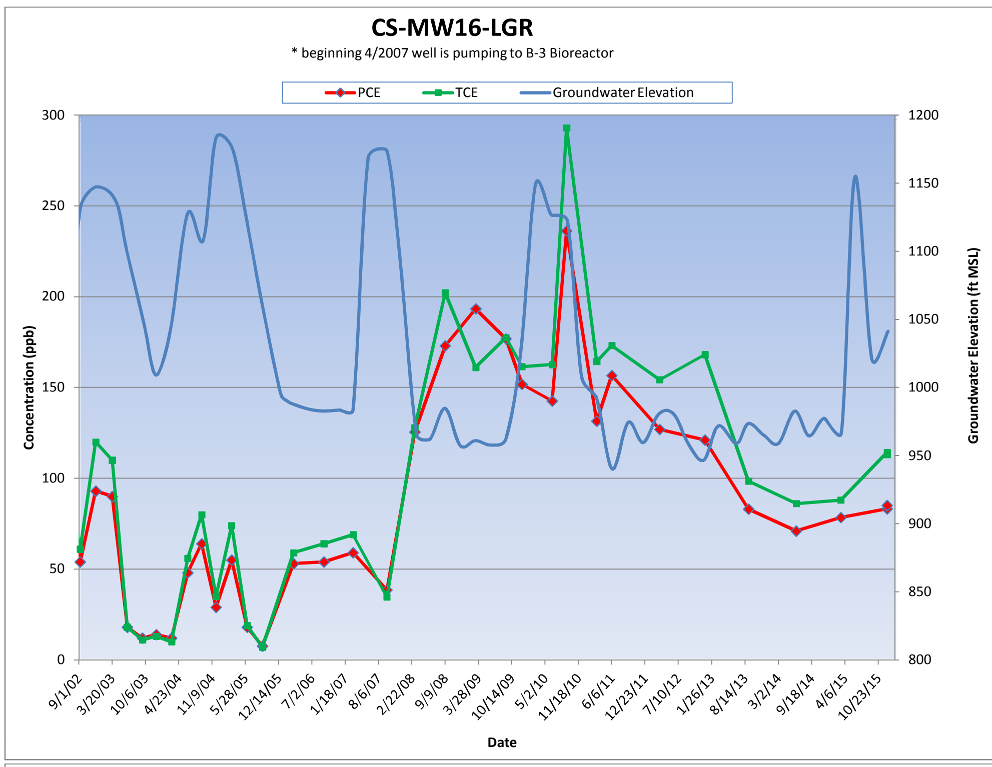
µg/L	micrograms per liter
mg/L	milligrams per liter
Duplicate	Field Duplicate
AL	Action Level
SS	Secondary Standard

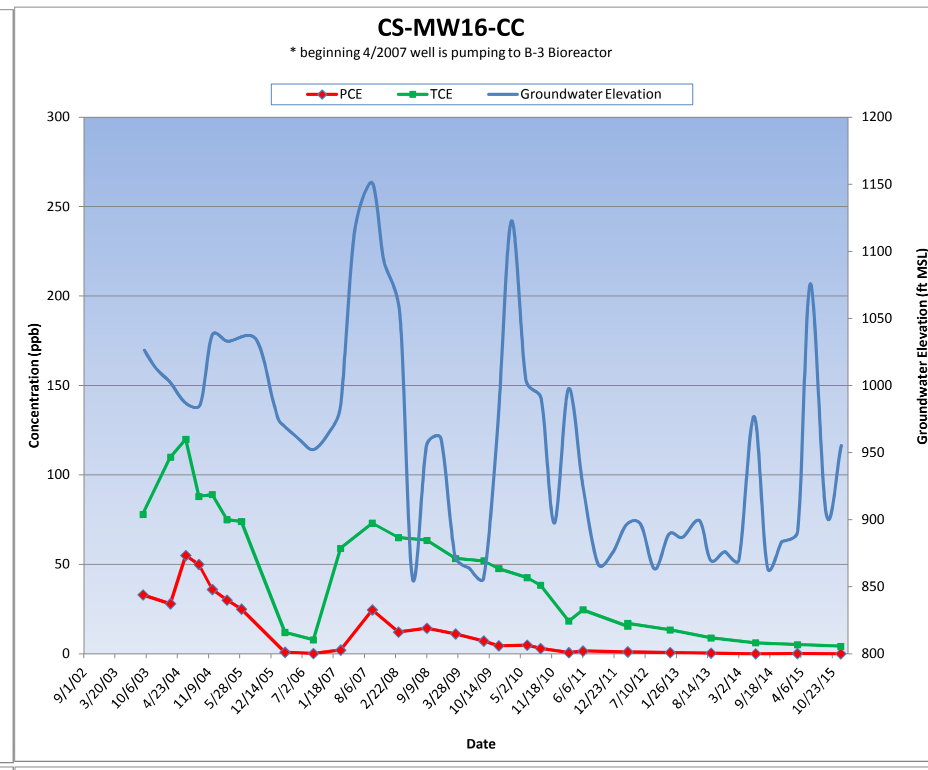
Data Qualifiers:
F-The analyte was positively identified but the associated numerical value is below the RL.
M = There was possible interference from the sample itself, the M flagged result is usable and defensible.
U-The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.

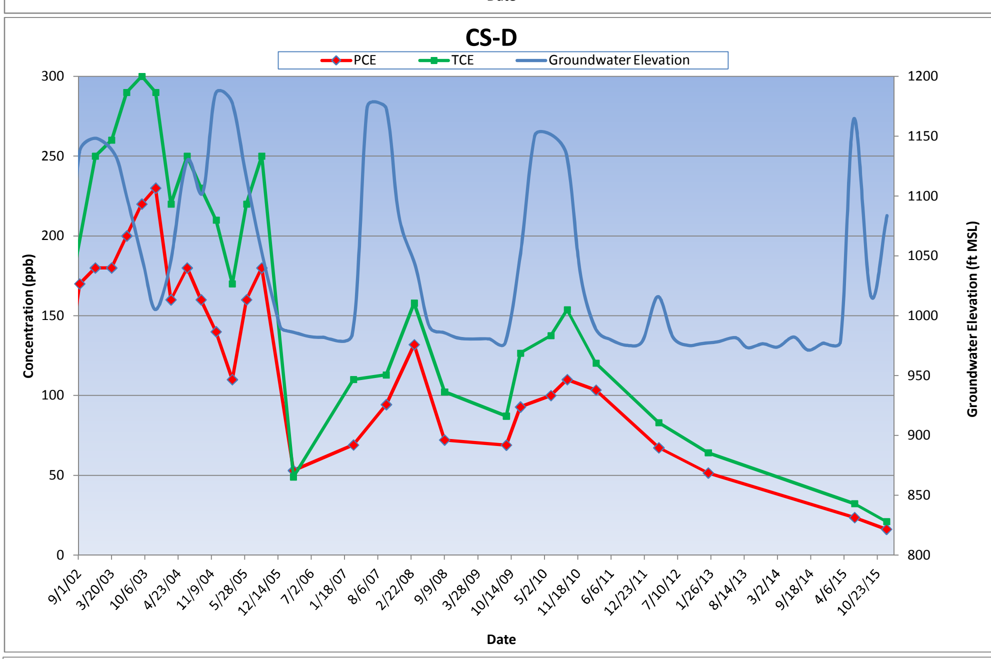
- **CS-MW16-LGR –** This well was sampled twice in 2015. Concentrations of PCE, TCE, and *cis*-1,2-DCE exceeded their MCLs during the March and September sampling events. *Trans*-1,2-DCE was also detected below the MCL in both sampling events. The pump in well CS-MW16-LGR was engaged April 24, 2007 to pump water into the SWMU B-3 Bioreactor. The well has been cycling continuously since the bioreactor injection was initiated in 2007. In 2015 the average gallons pump per day was about 15,134 gallons. The pumping of this well increased significantly, due to above average rainfall, from the 2014 average daily pumping rate of 4,778 gallons. The pumping rate was adjusted throughout the year to maximize the cycle lengths and the amount of water extracted from this well.
- **CS-MW16-CC –** This well was sampled twice in 2015. Concentrations of TCE exceeded the MCL in March and fell just below the MCL in December 2015. *Cis*-1,2-DCE, *trans*-1,2-DCE, and PCE were also detected below their respective MCLs in 2015. The pump in well CS-MW16-CC was engaged April 24, 2007 to pump water onto the SWMU B-3 Bioreactor. The well has been cycling continuously along with CS-MW16-LGR since the bioreactor injection began in 2007. In 2015 the average gallons pumped per day was approximately 13,796 gallons. VOC levels in 2015 remain at the low end of the historical concentration range for this well. Since the Bioreactor inception in 2007, there has been a continual decrease of PCE, TCE, and *cis*-1,2-DCE, with only TCE now barely exceeding the MCL. Only *trans*-1,2-DCE has shown an increase in concentration, but at a concentration less than 7 percent of the MCL.
- **CS-MW1-LGR –** This well was sampled three times in 2015. PCE and TCE concentrations were above their MCLs in March, June, and December 2015. *Cis*-1,2-DCE and *trans*-1,2-DCE were also detected below the MCL in all three quarters in 2015. Chromium was also detected below the applicable RL in all three events in 2015.
- **CS-MW5-LGR –** This well was sampled twice in 2015. PCE and TCE concentrations were above their MCLs in February 2016 (resample from the December event). *Cis*-1,2-DCE and *trans*-1,2-DCE were also detected below the MCL in 2015. Chromium was also detected below the applicable RL in March 2015. This was the first instance of PCE and TCE being above the MCL since monitoring began at this well in June 2001.
- **CS-MW36-LGR –** This well was sampled during all four events in 2015. PCE was above the MCL in all four events. TCE was above the MCL in all events except December which it fell below the MCL. *Cis*-1,2-DCE was also detected below the MCL in March and September 2015. Chromium was detected below the RL in March and December but above the RL in September 2015.

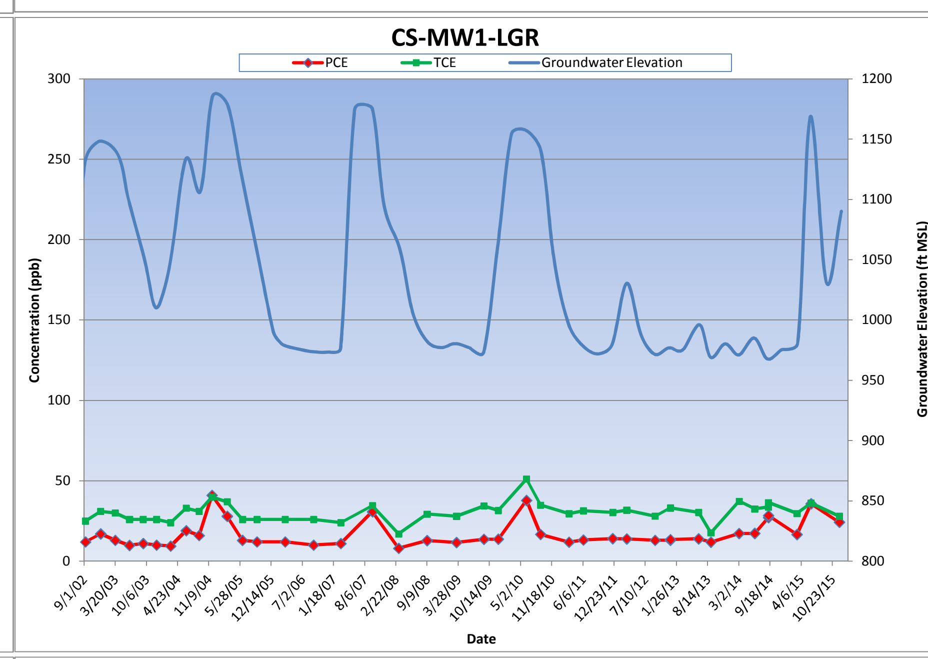
Concentration trends are illustrated on **Figure 2.4** for wells CS-MW16-LGR, CS-MW16-CC, CS-D, CS-MW1-LGR, CS-MW5-LGR, CS-MW36-LGR, and CS-4. These wells were selected because they have historical detections of PCE and TCE that approach and/or exceed MCLs. **Figure 2.4** also includes groundwater elevation data from each respective well to determine if there are correlations between VOC concentrations and water level. This figure suggests that CS-MW1-LGR has the most direct correlation between

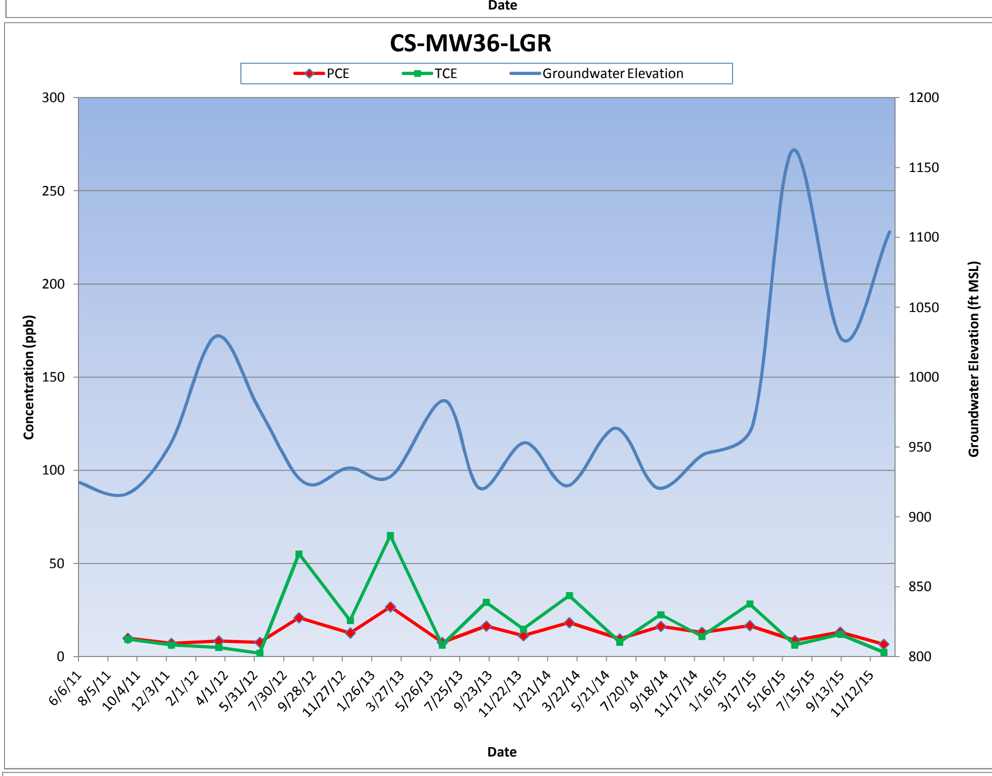
Figure 2.4
On-Post Cumulative Analytical vs. Groundwater Elevation

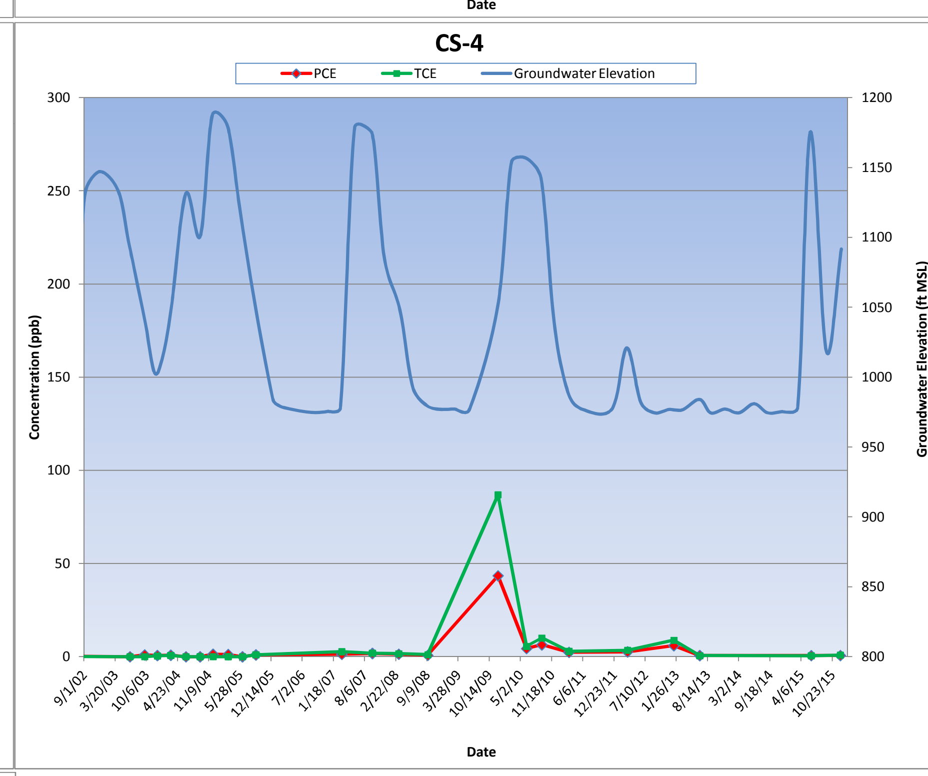


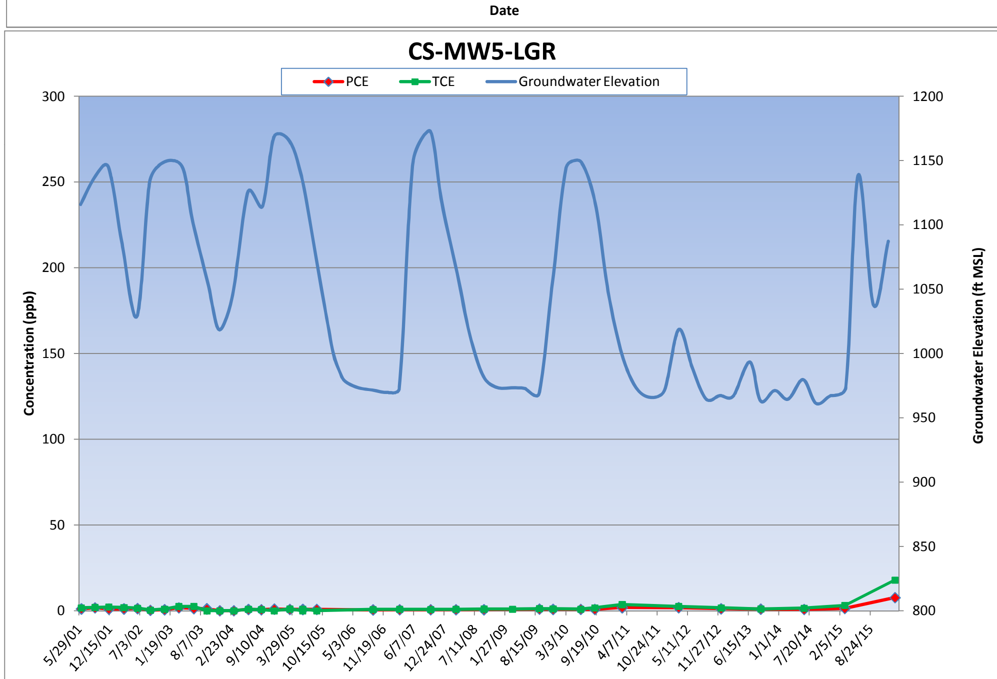












NOTE: Sampling dates are indicated by the squares on the trend line.

PCE/TCE concentration and groundwater recharge events. After that, discernible trends are less evident. Quarterly monitoring of CS-MW16-LGR and CS-D seems to indicate that increases in VOC concentrations lag recharge events by roughly six to nine months.

Notable trends in other wells appear to be related more to remedial activities than precipitation/recharge events. Concentrations at CS-MW16-CC decreased between March 2004 and June 2005 during a 15-month pump test of that well. Then concentrations increased in early 2007 during a time that roughly corresponds to the start-up of SWMU B-3 Bioreactor operations. Since that time, groundwater has been continually pumped from CS-MW16-CC and applied to the bioreactor as a remedial alternative. During that timeframe, VOC concentrations have steadily decreased, with little fluctuation attributable to precipitation. It is debatable whether the CS-MW36-LGR concentrations have responded to the in-situ chemical oxidation (ISCO) injections at AOC-65 in August 2012, May-June 2013, September-October 2014, and August-November 2015. The singular PCE/TCE peak at CS-4 has been attributed to the SWMU B-3 flood test in September 2009.

The VOC concentrations at CS-MW5-LGR have historically been below the MCLs since the well's inception in 2001. However, PCE, TCE, and *cis*-1,2-DCE all increased five-fold in the most recent 2015 sampling event (and confirmed in February 2016). The recent significant increase in contamination in well CS-MW5-LGR could be a result of the above average rainfall in 2015. This area has not seen above average rainfall since before the historical drought of 2011. This coupled with remedial activities at the SWMU B-3 bioreactor to the west of this well may have contributed to this increase. This well will return to quarterly monitoring in 2016 to track the progression of VOC concentrations at this location.

2.2.1.3 On-Post Monitoring Wells with COC Detections below the MCL

Groundwater monitoring results included wells where COCs were detected at levels below the applicable MCLs, SS, or ALs but above reporting limit (RLs). These included wells CS-MW8-LGR, CS-MW10-LGR, CS-MW11B-LGR, and CS-MW20-LGR. The detections below the MCLs/ALs but above RLs are summarized as follows:

- **CS-MW8-LGR** - PCE was detected in March, June, and December 2015; all detections were above the RL but below the MCL. Low levels of chromium were also detected below the RL in March and December 2015.
- **CS-MW10-LGR** – PCE (above RL) and TCE (below RL) concentrations were detected below their MCLs in March, June, and December 2015. Chromium was also reported below the RL in March, June, and December 2015.
- **CS-MW11B-LGR** – PCE was detected below the RL in December 2015. However concentrations of chromium were detected above the RL in December 2015.
- **CS-MW20-LGR** – PCE concentrations were detected below the RL in March then above the RL in December 2015. *Cis*-1,2-DCE was also detected, below the RL, for the first time in this well. Chromium was also reported below the RL in March and December 2015.

2.2.1.4 On-Post Monitoring Wells with COC Detections below the Reporting Limits

The on-post results include detections in wells for which the analyte is identified, but at a concentration below the RL. These results are assigned an "F" flag under the CSSA Quality Assurance Project Plan (QAPP). In 2015, this included wells CS-2, CS-4, CS-MW1-CC, CS-MW2-LGR, CS-MW3-LGR, CS-MW6-LGR, CS-MW7-LGR, CS-MW8-CC, CS-MW9-LGR, CS-MW11A-LGR, CS-MW12-LGR, CS-MW12-CC, CS-MW17-LGR, CS-MW18-LGR, CS-MW19-LGR, CS-MW21-LGR, CS-MW23-LGR, CS-MW24-LGR, CS-MW25-LGR, and CS-MW35-LGR. The detections below the reporting limit are summarized as follows:

- **CS-2 –** No VOCs were detected in this well in 2015. However, chromium was detected below the RL in March. Chromium was not detected during the December 2015 sampling event.
- **CS-4 –** This well was sampled twice in 2015. PCE and TCE were detected below the RL in June and December. *Cis*-1,2-DCE was also detected below the RL in December 2015. Lead was detected below the RL in December 2015.
- **CS-MW1-CC –** Low levels of PCE were detected in this well in December 2015. This is the first PCE detection in this well since sampling began in 2003. However no metals were detected in this well in 2015.
- **CS-MW2-LGR –** This well was sampled three times in 2015. *Cis*-1,2-DCE was detected below the RL in March, June, and December 2015. However no metals were detected in this well in 2015.
- **CS-MW3-LGR –** No VOCs were detected in this well 2015. Chromium was detected below the RL in March but non-detect in December 2015.
- **CS-MW6-LGR –** This well was sampled twice in 2015. PCE was not detected in March but low levels were detected in December 2015. Chromium was also detected below the RL during both sampling events in 2015.
- **CS-MW7-LGR –** PCE was detected below the RL in March and December 2015. Low levels of chromium were also detected below the RL in both sampling events.
- **CS-MW8-CC –** No VOCs were detected in this well 2015. Chromium was detected below the RL in December 2015 in both the normal sample and the field duplicate.
- **CS-MW9-LGR –** No VOCs were detected in this well 2015. Chromium was detected below the RL in March and lead was below the RL and AL in December 2015.
- **CS-MW11A-LGR –** PCE was detected below the RL in March, June, and December 2015. Chromium was also detected below the RL in the March 2015 event.
- **CS-MW12-LGR –** No VOCs were detected in this well 2015. Chromium was detected below the RL in March and December as well as lead (below RL and AL) in December 2015.
- **CS-MW12-CC –** No VOCs were detected in this well 2015. Lead was detected below the RL and AL in December 2015.
- **CS-MW17-LGR –** PCE was detected below the RL in March and December 2015. *Cis*-1,2-DCE was also detected below the RL in December. This was the first detection

of *cis*-1,2-DCE since sampling of this well began in 2002. Chromium was also detected below the RL in both 2015 sampling events.

- **CS-MW18-LGR –** No VOCs were detected in this well in March or December 2015. However, chromium was detected below the RL in March and lead (below RL and AL) in December 2015.
- **CS-MW19-LGR –** PCE was detected below the RL in March and December 2015. Chromium was also detected below the RL in both sampling events. Lead was detected below the RL and AL in the December normal sample but not detected in the field duplicate.
- **CS-MW21-LGR –** *Cis*-1,2-DCE was detected in this well in December 2015. This was the first historical detection of *cis*-1,2-DCE. Mercury was detected below the RL in March 2015.
- **CS-MW23-LGR –** No VOCs were detected in this well in March or December 2015. Chromium was detected (below RL) in March and lead was detected (below RL and AL) in December 2015.
- **CS-MW24-LGR –** This well was sampled in March, June, and December 2015. Low levels of PCE and TCE were detected in March. Chromium was also detected in March (below RL) and lead was detected (below RL and AL) in December 2015.
- **CS-MW25-LGR –** Chromium was detected in this well in March and December 2015 below the RL.
- **CS-MW35-LGR –** PCE was detected below the RL in March, June, and December 2015. Chromium was also detected below the RL in December 2015.

2.2.1.5 On-Post Monitoring Wells with No COC Detections

Of the 44 monitoring wells sampled in 2015, 35 wells reported COC detections. A total of 9 wells (CS-MW4-LGR, CS-MW6-CC, CS-MW7-CC, CS-MW9-CC, CS-MW10-CC, CS-MW22-LGR, CS-MWG-LGR, CS-MWH-LGR, and CS-I) reported no VOC or metals detections. Three wells were not sampled in March 2015 due to the water level falling below the pump depth (CS-MW11B-LGR, CS-4, and CS-D). In June, September, and December all scheduled samples were collected (**Table 2.4**). Details on the RL, MDLs, field duplicates, MCLs, etc., are described in the tables of detections (**Table 2.5**) and in **Appendix B**.

2.2.1.6 Drinking Water Supply Well Results

Three active CSSA drinking water supply wells (CS-1, CS-10, and CS-12) and one future drinking water well (CS-13) were analyzed for VOCs and the 8 metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, and zinc) in 2015. In August-September, former drinking water wells CS-9 and CS-11 were plugged and abandoned. Under the LTMO study, the drinking water supply wells are scheduled to be sampled quarterly (**Table 2.4 & Appendix B**). The detections are summarized as follows:

- **CS-1 –** No VOCs were detected during the 4 quarterly events in 2015. Barium and zinc were above their applicable RLs in all four quarters in 2015. Arsenic, chromium, and copper were also detected below the RL in 2015.

- **CS-10 –** No VOCs were detected during the 4 quarterly events in 2015. Barium, copper, and zinc were detected above the RLs in 2015. Arsenic and chromium were also detected below their applicable RL in 2015.
- **CS-12 –**No VOCs were detected in this well in 2015. Barium, copper, and zinc were detected above their applicable RLs in 2015. Arsenic and chromium were detected below their applicable RLs in 2015.
- **CS-13 –** No VOCs were detected in this well in 2015. Barium, copper, and zinc were detected above their applicable RLs in 2015. Arsenic and chromium were detected below their applicable RL's.

CSSA revised its postwide DCP in December 2015. The basic premise of the DCP is to adopt the Trinity-Glen Rose Groundwater Conservation District (TGRGCD) rules and regulations for the conservation of the local groundwater resource. The proposed CSSA DCP adopts the trigger levels and water use restrictions set forth by the TGRGCD agency. In addition, CSSA has created its own trigger levels and additional site-specific water-use restrictions to better manage the resource and maintain the overall mission of the facility.

Specifically, the water level trigger levels specific to a TGRGCD index well, FO-20, have been "best fit" to corresponding water levels at production wells CS-1, CS-10, and CS-12; as well as monitoring well CS-MW18-LGR. Over the coming year, these proposed trigger levels will be monitored and adjusted accordingly to match the timeframe at which the TGRGCD declare specific drought stage levels. These DCP triggers and water-use restrictions are included in **Appendix E**.

2.2.1.7 Westbay®-equipped Well Results

Eight wells equipped with the Westbay multi-port interval sampling equipment have been installed at CSSA. Four wells (CS-WB05, CS-WB06, CS-WB07, and CS-WB08) are sampled as part of the SWMU B-3 bioreactor treatability study and are not addressed in this report. The remaining four wells (CS-WB01, CS-WB02, CS-WB03, and CS-WB04) are part of the postwide groundwater monitoring program and are included in this report. Under the provisions of the groundwater monitoring DQOs and the 2010 updated LTMO study, the schedule for sampling CS-WB01, CS-WB02, and CS-WB03 is every 9 months with 3 additional LTMO-selected zones sampled with the 9 month snapshot event. The schedule for sampling CS-WB04 Upper Glen Rose (UGR), LGR, BS, and CC zones is every 18 months with 7 of those zones sampled every 9 months and an additional 5 LTMO-selected zones sampled with the 9 month snapshot event. An overview of sampling frequencies for Westbay wells only is given in **Table 2.6**.

Samples were collected from the 8 LTMO-selected zones during the March and December 2015 events. All 46 zones with water were sampled in September 2015 with the 9 month snapshot event. In June 2015 no Westbay samples were collected. Samples were analyzed for PCE, TCE, *cis*-1,2-DCE, *trans*-1,2-DCE, 1,1-DCE, vinyl chloride and analyzed by APPL. Per the DQOs, the Westbay data are used for screening purposes only, and therefore no quality assurance/quality control samples are collected with the Westbay samples. All intervals with detections of COCs are presented in **Table 2.7**. Full analytical results are presented in **Appendix C**. **Appendix D** illustrates the historical contaminant concentrations and groundwater elevations for each Westbay zone.

Table 2.6
Overview of Westbay Sampling for 2015

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

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

Table 2.7
2015 Westbay® Groundwater COCs Analytical Results

Well ID	Date Sampled	1,1-DCE (1,1-dichloroethene)	cis-1,2-DCE (cis-1,2-dichloroethene)	TCE (trichloroethene)	PCE (tetrachloroethene)	trans-1,2-DCE (trans-1,2-dichloroethene)	Vinyl Chloride
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
CS-WB01-LGR-01	9/16/2015	--	--	0.26F	1.30F	--	--
CS-WB01-LGR-02	9/16/2015	--	--	2.26	11.09	--	--
CS-WB01-LGR-03	9/16/2015	--	--	8.37	2.87	--	--
CS-WB01-LGR-04	9/16/2015	--	0.61F	--	--	--	--
CS-WB01-LGR-05	9/16/2015	--	0.24F	0.88F	--	--	--
CS-WB01-LGR-06	9/16/2015	--	0.92F	1.58	--	--	--
CS-WB01-LGR-07	9/16/2015	--	5.23	13.68	14.83	--	--
CS-WB01-LGR-08	9/16/2015	--	8.57	7.86	0.68F	0.31F	--
CS-WB01-LGR-09	3/23/2015	--	0.35F	8.67	6.54	--	0.28F
	9/16/2015	--	0.60F	14.37	12.41	--	--
	12/2/2015	--	0.58F	19.05	16.96	--	--
CS-WB02-LGR-03	9/23/2015	--	--	0.26F	2.47	--	--
CS-WB02-LGR-04	9/23/2015	--	--	5.74	3.38	--	--
CS-WB02-LGR-05	9/23/2015	--	0.17F	1.84	0.79F	--	--
CS-WB02-LGR-06	9/23/2015	--	0.43F	2.39	4.61	0.23F	--
CS-WB02-LGR-07	9/23/2015	--	0.29F	1.22	0.34F	--	--
CS-WB02-LGR-08	9/23/2015	--	2.45	0.54F	--	0.39F	--
CS-WB02-LGR-09	3/23/2015	--	0.21F	8.03	7.93	--	--
	9/23/2015	--	0.20F	7.31	9.43	--	--
	12/2/2015	--	0.18F	11.24	14.18	--	--
CS-WB03-UGR-01	9/21/2015	--	21.70F**	216.25**	23737.01***	--	--
CS-WB03-LGR-01	9/21/2015	--	0.85F	26.33	621.09*	--	--
CS-WB03-LGR-03	9/21/2015	--	--	1.96	7.28	--	--
CS-WB03-LGR-04	9/21/2015	--	--	5.67	18.61	--	--
CS-WB03-LGR-05	9/21/2015	--	--	2.44	16.74	--	--
CS-WB03-LGR-06	9/21/2015	--	5.53	--	--	--	--
CS-WB03-LGR-07	9/21/2015	--	2.6	5.43	1.71	--	--
CS-WB03-LGR-08	9/21/2015	--	2.4	0.39F	--	--	--
CS-WB03-LGR-09	3/24/2015	--	1.75	1.2	0.75F	--	--
	9/17/2015	--	0.49F	4.39	4.61	--	--
	12/2/2015	--	0.20F	3.84	3.25	--	--

Table 2.7 (cont)
2015 Westbay® Groundwater COCs Analytical Results

Well ID	Date Sampled	1,1-DCE (1,1-dichloroethene)	cis-1,2-DCE (cis-1,2-dichloroethene)	TCE (trichloroethene)	PCE (tetrachloroethene)	trans-1,2-DCE (trans-1,2-dichloroethene)	Vinyl Chloride
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**
CS-WB04-LGR-01	9/22/2015	--	--	--	**1.67**	--	--
CS-WB04-LGR-03	9/22/2015	--	--	--	**0.34F**	--	--
CS-WB04-LGR-04	9/22/2015	--	**0.27F**	**0.16F**	**0.40F**	--	--
CS-WB04-LGR-06	3/24/2015	--	**3.63**	**12.79**	**55.08**	**0.40F**	--
	9/22/2015	--	**5.1**	**12.09**	**16.68**	**0.25F**	--
	12/3/2015	--	**3.32**	**11.62**	**36.28**	**0.30F**	--
CS-WB04-LGR-07	3/24/2015	--	**3.21**	**10.85**	**35.6**	**0.26F**	--
	9/22/2015	--	**35.47**	**13.03**	**2.01**	**0.25F**	--
	12/3/2015	--	**22**	**20.36**	**2.72**	**0.29F**	--
CS-WB04-LGR-08	9/22/2015	--	**0.47F**	**0.75F**	**0.82F**	--	--
CS-WB04-LGR-09	3/24/2015	--	**0.14F**	**10.44**	**15.58**	--	--
	9/22/2015	--	--	**6.33**	**10.03**	--	--
	12/3/2015	--	**0.08F**	**7.94**	**11.64**	--	--
CS-WB04-LGR-10	3/24/2015	--	--	**0.54F**	**7.47**	--	--
	9/22/2015	--	--	**0.59F**	**2.2**	--	--
	12/3/2015	--	--	**0.53F**	**2.37**	--	--
CS-WB04-LGR-11	3/24/2015	--	--	**2.7**	**444.82***	--	--
	9/22/2015	--	--	--	**1.5**	--	--
	12/3/2015	--	--	**0.12F**	**22.11**	--	--
CS-WB04-BS-01	9/22/2015	--	--	--	**0.46F**	--	--
CS-WB04-BS-02	9/22/2015	--	--	--	**0.94F**	--	--
CS-WB04-CC-01	9/22/2015	--	**1.02F**	--	**0.84F**	--	--
CS-WB04-CC-02	9/22/2015	--	**0.21F**	--	**1.29F**	--	--
CS-WB04-CC-03	9/22/2015	--	**0.17F**	--	**6.66**	--	--

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 10.
** The analyte was run at a dilution of 100.
*** The analyte was run at a dilution of 500.
All values are reported in µg/L.

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

Additional samples were collected from the Westbay wells in conjunction with the normal quarterly groundwater monitoring in 2015. An ongoing ISCO treatability study was conducted at AOC-65 between August and November 2015. The results of this effort are currently being tabulated and will be reported in a separate treatability study document.

Due to a decrease in groundwater elevations, certain zones (CS-WB01-UGR-01, CS-WB02-UGR-01, CS-WB02-LGR-01, CS-WB02-LGR-02, CS-WB03-LGR-02, CS-WB04-UGR-01, and CS-WB04-LGR-02) could not be sampled in September because they were dry. CS-WB04-LGR-05 was not sampled due to a non-operational sampling port. The remaining 55 zones scheduled for sampling contained water and were sampled. The Westbay-equipped wells are sampled using Westbay Instruments, Inc., equipment and sampling methods.

The following Westbay intervals (shown in their general stratigraphic position) reported detections of PCE and/or TCE above the MCL in 2015.

CS-WB01	CS-WB02	CS-WB03	CS-WB04
-	-	• UGR-01	-
-	-	• LGR-01	-
• LGR-02	-	-	-
• LGR-03	-	• LGR-03	-
-	• LGR-04	• LGR-04	-
-	-	• LGR-05	-
-	-	-	• LGR-06
• LGR-07	-	• LGR-07	• LGR-07
• LGR-08	-	-	-
• LGR-09	• LGR-09	-	• LGR-09
			• LGR-10
			• LGR-11
			• CC-03

Figures 2.5 and **2.6** present the September 2015 vertical distribution of the VOC plume within the multi-port wells for the most pervasive contaminants, PCE and TCE. The following discussion presents general observations that have been noted since the inception of Westbay monitoring at AOC-65.

In 2015, the VOC plume originating from AOC-65 is generally similar in concentration and distribution as in prior years. Near the source area (CS-WB03 and –WB02), the solvent contamination is persistent throughout the entire thickness of the LGR, with the greatest concentrations near the land surface; however non-detections of PCE within the LGR-08 zone in the source area and detections below the reporting limit in this zone at CS-WB01 and CS-WB04 (to the south and west of the source area) result in two PCE plumes separated by the LGR-08 zone. As the plume disperses to the south and west, the contaminants seem to preferentially migrate in stratified lobes (LGR-01, -02, and -03), (LGR-06 and -07) and LGR-09.

The BS and CC zones at CS-WB04 are sampled every 18 months, and included the September 2015 event. In prior years the BS and CC zones at CS-WB04 generally had little

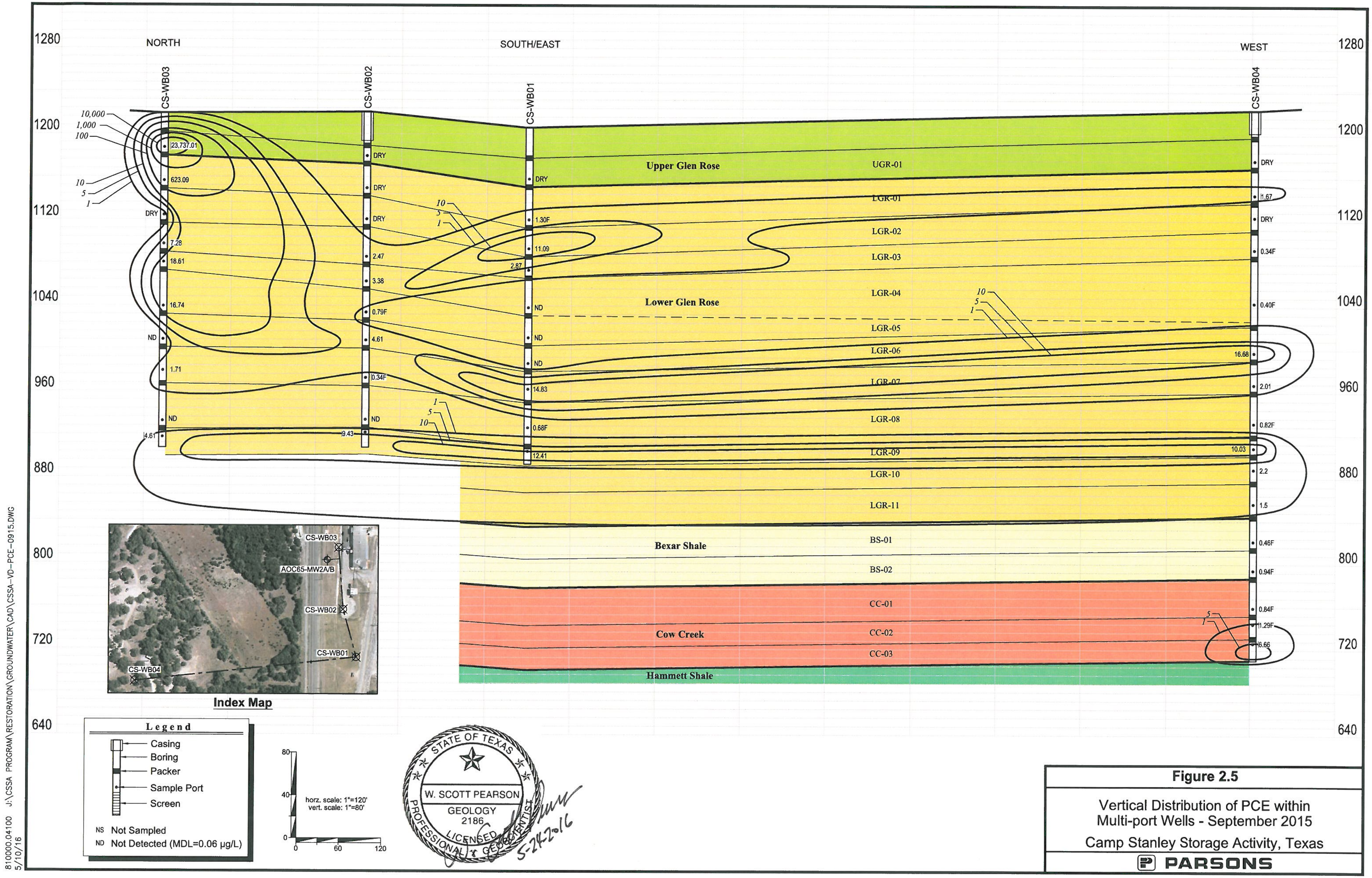


Figure 2.5

Vertical Distribution of PCE within Multi-port Wells - September 2015

Camp Stanley Storage Activity, Texas

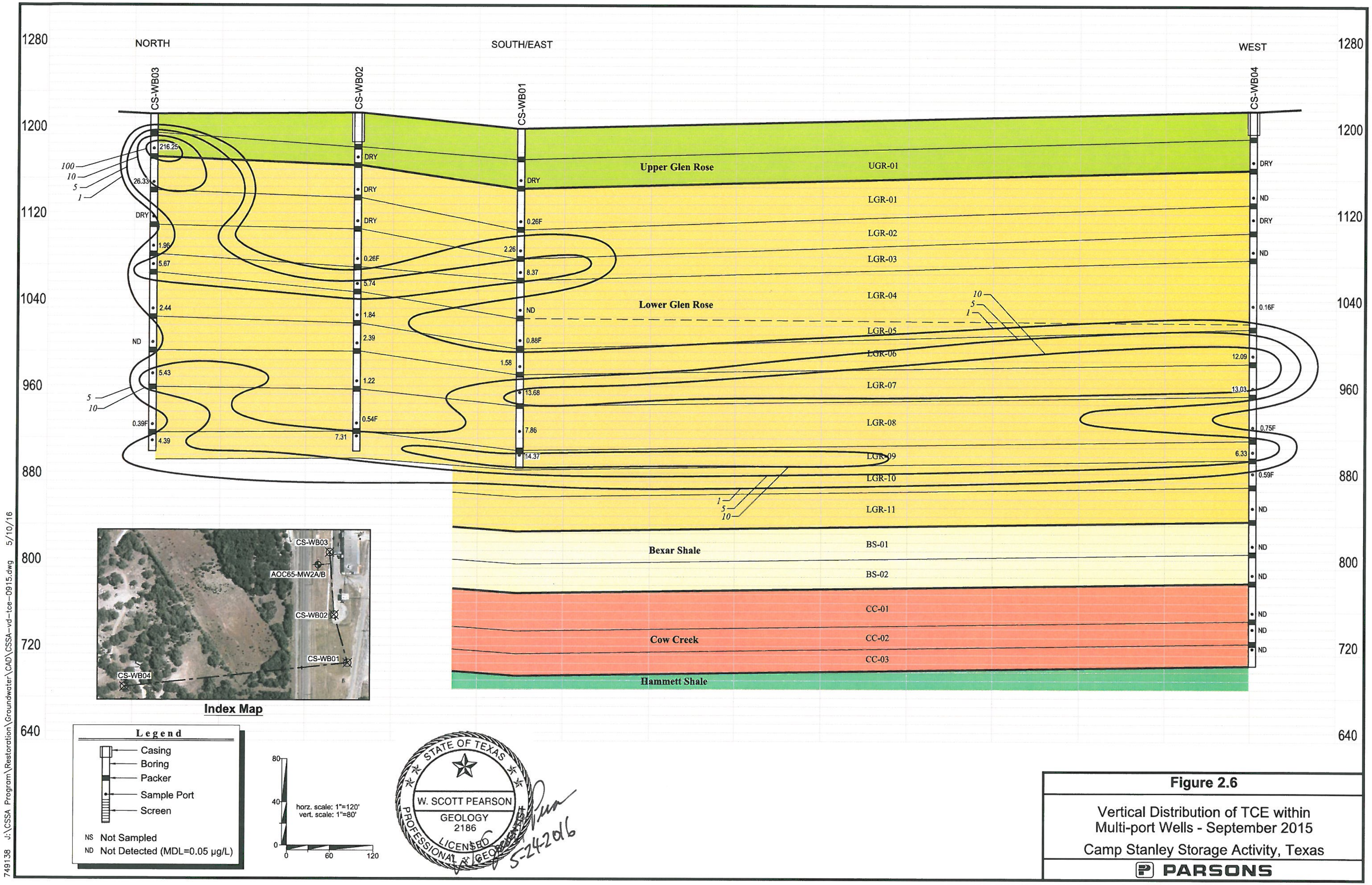


Figure 2.6

Vertical Distribution of TCE within Multi-port Wells - September 2015

Camp Stanley Storage Activity, Texas

PARSONS

to no contamination present. In 2011, only trace detections of *cis*-1,2-DCE were reported in CS-WB04-BS-02 and –CC-01 intervals. But in 2012, the trace detections also included PCE in all five BS (2) and CC (3) zones. In March 2014 one zone showed a trace detection of *cis*-1,2-DCE (0.69F µg/L) in the –CC-01 interval. In September 2015, PCE was again detected in all five –BS and –CC zones. Zone CC-03 reported its highest detection of PCE to date (6.66 µg/L), with levels now above the MCL. *Cis*-1,2-DCE was also detected in all 3 –CC zones in September 2015. The contention is that the trace contamination in the BS and CC at CS-WB04 is the result of the vertical mixing of contaminated LGR water within the nearby RFR-10 wellbore under a naturally downward vertical gradient. The last time VOCs have been seen distributed across most of the BS and CC zones was March 2009 and September 2012 when the aquifer was in a depressed condition.

CS-WB03 is located closest to the Building 90 source area, and consistently records the highest concentrations of contaminants (**Appendix D.3**). The upper zones (CS-WB03-LGR-01 and -LGR-02) are typically dry and have water only after significant rain. Because of frequent droughts and set sampling schedules, these zones have been sampled only a handful of times. In 2015, the UGR and LGR-01 zones contained water in the uppermost intervals of CS-WB03, with the underlying LGR-02 zone being dry. Contamination is still present in the UGR zone with a significant increase in concentration from December (7,632 µg/L) 2014 to September (23,737 µg/L) 2015. This level is approaching the historical high concentration of 30,000 µg/L reported in March 2008. In September 2015, LGR-01 reported concentrations of PCE (621.09 µg/L) and TCE (26.33 µg/L) well above the MCLs. In December 2011, *cis*-1,2-DCE was detected in zone CS-WB03-LGR-06. Since then there have been six consecutive detections increasing in concentration and levels have ranged from 0.25 to 5.53 µg/L. Zone -08 had no detection of PCE for the second consecutive time in the history of sampling this zone. Between February 2005 and September 2010, no *cis*-1,2-DCE had been reported in CS-WB03-LGR-09. Beginning in March 2011, a trace detection was reported in that zone, followed by thirteen consecutive sampling events that ranged in concentration between 0.20 µg/L and 45.73 µg/L. At the same time, TCE detections have fallen and stayed below the MCL. Since March 2012 PCE has dropped below the MCL and has showed a steady decline through 2013. In 2015 PCE ranged from 0.75 to 4.61 µg/L. The reason for these changes is likely a result of a biodegradation mechanism.

Historical results indicate that a persistent source of contamination still exists, and that periodic flushing by intense rainfall can mobilize these perched contaminants that are probably otherwise bound to the matrix during the rest of the year. Likewise, preliminary indications from the ISCO treatability study show that solvent contamination was mobilized/oxidized as a result of the study. Baseline samples in the WB03-UGR zone were less than 6 µg/L in July 2012. Thirty days after the initial injection, PCE concentrations were above 6,000 µg/L, and persisted through December 2015. In September 2015 this zone spiked at 23,737 µg/L after reporting PCE at 7,632 µg/L in December 2014.

CS-WB02 was installed nearly 300 feet south of CS-WB03 and the Building 90 source area. In general most zones in 2015 showed a slight decrease in PCE and TCE (**Appendix D.2**). The exception was the –LGR-09 zone that showed an increase in PCE from 7.63 µg/L (December 2014) to 14.18 µg/L (December 2015). Zone –LGR-05 reported its first detection of *cis*-1,2-DCE in September 2015. The changes over the last couple of years do not follow the historic pattern seen after the ISCO injections in August 2012 and May-June 2013 which showed a significant increase in PCE approximately 3-4 months after the ISCO injections. The result is interesting because it initially implicated that there is a vertical conduit between the shallower ISCO injection zones (trench gallery and injection wells) and the deeper strata of CS-WB02-LGR-09. In 2015 this theory could be complicated by above average rainfall following a severe drought in the area.

Multi-port well CS-WB01 is located approximately 500 ft south of CS-WB03 and the Building 90 source area. Once again, for the zones that are normally saturated, historical PCE and TCE are present at concentrations less than 32 µg/L. Since mid-2005, there has been a general trend of increasing contaminant concentrations in zones CS-WB01-LGR-02 and -LGR-07. Initially, the –LGR-09 zone was following the same increasing trend beginning in 2005. In late 2009 the overall concentrations began decreasing until 2015 where they began an upward trend. These noted increases seem to correspond with increases observed in several upgradient CS-WB02 zones, and may be associated with a "flushing" event in which a slug of contaminated groundwater is moving downgradient away from the source zone (**Appendix D.1**). At CS-WB01, the trend has been that TCE concentrations generally exceed PCE for most zones. The zone with the relatively highest concentration is typically –LGR-09. Zones -04, -06, -07, and -08 reported their highest detection of *cis*-1,2-DCE to date. Also, zone -05 reported its first contraction of *cis*-1,2-DCE. The results of CS-WB01 indicate that the contamination becomes preferentially stratified such that greater contamination is found above and below zones LGR-04, -05, and -06, to the south and west. No discernible effect from the ISCO treatability study has been ascertained at CS-WB01.

Off-post at CS-WB04, trace detections of less than 1 µg/L PCE are generally reported in the LGR-02, LGR-03, LGR-04, and LGR-08 zones. WB04-LGR-05 has never been sampled due to an erroneous sample port installation. Since September 2006, TCE has been reported above the MCL in zones LGR-06 and LGR-07 at concentrations less than 21 µg/L and PCE has been above the MCL since 2008. PCE in zone LGR-07 did fall back below the MCL in September 2015 and remained below the MCL in December 2015. In 2009, the concentration of PCE in both LGR-06 and LGR-07 more than doubled compared to September 2008 (**Appendix D.4**). In 2010, PCE in LGR-06 decreased from 33 µg/L to 11 µg/L while the LGR-07 PCE concentration decreased from 19 µg/L to 1.7 µg/L. But in 2011, the PCE concentration in LGR-06 increased to 28.76 µg/L PCE, and zone LGR-07 also increased its PCE concentration to 24.41 µg/L. In June 2013, the increasing trend continued with PCE reaching a historical high of 39.18 µg/L in LGR-06. The levels in LGR-07 dropped slightly in 2013 and the levels remained similar in June and September 2013. In 2014, the increasing PCE trend reappeared in LGR-06 reaching another historic high in December 2014 (44.92 µg/L). Zone LGR-07 mimicked the LGR-06 zone but reaching its PCE historic high in June 2014 (32.86 µg/L). In March 2015, both of these zones reached another historic high concentration (55.08 µg/L in the -06 zone and 35.6 µg/L in the -07 zone) for PCE. These trends in LGR-06 and -07 are evident on the graphs presented in **Appendix D.4**. These two zones have been the most dynamic in change of all the multiport zones monitored in this program, and are an indication that contaminant mass is migrating westward in these intervals.

Historically, the off-post zone with the most persistent contamination is CS-WB04-LGR-09. Nearly equivalent levels of PCE and TCE are found at concentrations that generally range above the MCL between 8 µg/L and 16 µg/L. In March 2015, LGR-09 was at the high end of this range. Zones LGR-10 (PCE = 7.47 µg/L) and LGR-11 (PCE = 444.82 µg/L) reported their first detection above the MCL in March 2015. Below this depth, any solvent contamination in the remainder of the BS and CC are at concentrations less than 2.0 µg/L. The only exception to this is zone CC-03 which reported PCE at 6.66 µg/L in September 2015. Prior to September 2006, essentially no chlorinated solvents were detected in the CS-WB04-LGR-11 zone.

The BS and CC zones are sampled on an 18-month schedule and were not sampled in 2013 but were sampled in June 2014 and September 2015. Historically, the BS zones have essentially been contaminant-free, except for occurrences of *cis*-1,2-DCE (0.25 µg/L) in October 2007 and PCE (0.18 µg/L) in March 2009. Later, trace detections of PCE and *cis*-1,2-DCE were reported in both BS zones in September 2012 and September 2015. *Cis*-1,2-DCE is consistently reported in interval CC-01, with PCE also being reported in September 2015 at a historic high of 0.84 µg/L. Zone CC-02 also had a detection of PCE at the high end of its historic range (0.47 to 1.3 µg/L). In 2014 *cis*-1,2-DCE remained at trace levels in CC-01 and no other COC were detected in the CC zones. In 2015 zone CC-03 spiked with PCE at concentrations of 6.66 µg/L up from the 2012 concentration of 2.71 µg/L.

2.2.2 Off-Post Analytical Results

The frequencies for sampling off-post wells in 2015 were determined by the updated *Three-Tiered Long Term Monitoring Network Optimization Evaluation* (Parsons 2010), in compliance with *The Plan*, and *DQOs for the Groundwater Monitoring Program* (Parsons 2010). An overview of sampling frequencies for off-post wells is given in **Table 2.8**. Fifty-three off-post wells were sampled during the 2015 quarterly monitoring events, and their locations are illustrated on **Figure 1.1**. In June 2011 the LTMO study was implemented to sample frequencies off-post. The TCEQ and EPA approval for implementing the LTMO off-post was received in February 2011 (see **Appendix J)**.

Off-post wells sampled during the quarterly monitoring events were selected based on previous sampling results and proximity to both the CSSA boundary and wells with detections of PCE and TCE. Public and private supply wells located west and south of CSSA were selected for these events. Samples were also collected from the off-post well granular activated carbon (GAC) filtration systems after treatment during the March and September events.

Off-post wells sampled in 2015 included (see **Figure 1.1** for well locations):

- Four public supply wells in the Fair Oaks area (FO-J1, FO-8, FO-17, and FO-22);
- Three public wells in the Hidden Springs Estates subdivision (HS-1, HS-2, and HS-3);
- Four wells used by the general public along Interstate Highway 10 (I10-2, I10-5, I10-7, and I10-8);
- Sixteen privately-owned wells in the Jackson Woods subdivision (JW-5, JW-6, JW-7, JW-8, JW-9, JW-12, JW-13, JW-14, JW-15, JW-20, JW-26, JW-27, JW-28, JW-29, JW-30, and JW-31);

Table 2.8
2015 Off-Post Groundwater Sampling Rationale

Well ID	2015				Sampling Frequency
	Mar	June	Sept	Dec	
BSR-03		NS	NS		9-month (snapshot)
BSR-04		NS	NS		9-month (snapshot)
FO-8		NS	NS		9-month (snapshot)
FO-17		NS	NS		9-month (snapshot)
FO-22		NS	NS		9-month (snapshot)
FO-J1		NS	NS		9-month (snapshot)
HS-1		NS	NS		9-month (snapshot)
HS-2		NS	NS		9-month (snapshot)
HS-3		NS	NS		9-month (snapshot)
I10-2		NS	NS		9-month (snapshot)
I10-4	NA	NA	NA	NA	P&A
I10-5		NS	NS	NS	9-month (snapshot)
I10-7		NS	NS		9-month (snapshot)
I10-8		NS	NS		9-month (snapshot)
I10-10	NS	NS	NS	NS	One time sample
JW-5		NS	NS		9-month (snapshot)
JW-6		NS	NS		9-month (snapshot)
JW-7		NS	NS		9-month (snapshot)
JW-8		NS	NS		9-month (snapshot)
JW-9		NS	NS		9-month (snapshot)
JW-12	NA		NS		9-month (snapshot)
JW-13		NS	NS		9-month (snapshot)
JW-14		NS	NS		9-month (snapshot)
JW-15		NS	NS	NS	9-month (snapshot)
JW-20		NS	NS		9-month (snapshot)
JW-26		NS	NS	NS	9-month (snapshot)
JW-27		NS	NS		9-month (snapshot)
JW-28		NS	NS	NS	9-month (snapshot)
JW-29		NS	NS		9-month (snapshot)
JW-30		NS	NS		9-month (snapshot)
JW-31		NS	NS		9-month (snapshot)
LS-1		NS	NS		9-month (snapshot)
LS-4		NS	NS	NS	9-month (snapshot)
LS-5					Quarterly
LS-5-A2		NS		NS	Biannually (Mar & Sept)
LS-6					Quarterly
LS-6-A2		NS		NS	Biannually (Mar & Sept)
LS-7					Quarterly
LS-7-A2		NS		NS	Biannually (Mar & Sept)
OFR-1	NA	NA	NA	NA	P&A
OFR-3					Quarterly
OFR-3-A2		NS		NS	Biannually (Mar & Sept)
OFR-4	NA	NA	NA	NA	P&A
OW-HH1		NS	NS		9-month (snapshot)
OW-HH2			NS		9-month (snapshot)
OW-CE1		NS	NS		9-month (snapshot)
OW-CE2		NS	NS		9-month (snapshot)
OW-MT2		NS	NS		9-month (snapshot)
OW-BARNOWL			NS		9-month (snapshot)
OW-DAIRYWELL		NS	NS		9-month (snapshot)
OW-HH3		NS	NS		9-month (snapshot)
RFR-3		NS	NS		9-month (snapshot)
RFR-4	NS	NS	NS	NS	9-month (snapshot)
RFR-5		NS	NS		9-month (snapshot)
RFR-8		NS	NS		9-month (snapshot)
RFR-9		NS	NS		9-month (snapshot)
RFR-10					Quarterly
RFR-10-A2		NS		NS	Biannually (Mar & Sept)
RFR-10-B2		NS		NS	Biannually (Mar & Sept)
RFR-11					Quarterly
RFR-11-A2		NS		NS	Biannually (Mar & Sept)
RFR-12		NS	NS		9-month (snapshot)
RFR-13	NS	NS	NS	NS	electricity off
RFR-14		NS	NS		9-month (snapshot)
SLD-01					9-month (snapshot)
SLD-02		NS	NS		9-month (snapshot)

	VOCs detected are greater than 90% of the MCL. Sample monthly; quarterly after GAC installation.
	VOCs detected are greater than 80% of the MCL. The well will be placed on a monthly sampling schedule until GAC installation then quarterly sampling after GAC installation.
	VOCs detected are less than 80% of the MCL (<4.0 ppb and >0.06 ppb for PCE & <4.0 ppb >0.05 ppb for TCE). After four quarters of stable results the well can be removed from quarterly sampling.
	This well has a GAC filtration unit installed by CSSA. Post GAC samples are collected every six months. A1 - after GAC canister #1 A2 - after GAC canister #2
NS	Not sampled for that event.

- Five wells in the Leon Springs Villa area (two public supply wells removed from service: LS-1, and LS-4; and three privately-owned wells: LS-5, LS-6, and LS-7);
- One privately-owned well on Old Fredericksburg Road (OFR-3);
- Eight privately-owned wells in the Ralph Fair Road area (RFR-3, RFR-5, RFR-8, RFR-9, RFR-10, RFR-11, RFR-12, and RFR-14);
- Eight public supply wells from The Oaks Water Supply System (OW-HH1, OW-HH2, OW-HH3, OW-CE1, OW-CE2, OW-MT2, OW-BARNOWL, and OW-DAIRYWELL);
- Two public supply wells in the Scenic Loop Drive area, SLD-01 and SLD-02; and
- One privately owned well along Boerne Stage Road (BSR-03) and one public supply well (BSR-04).
- All wells were sampled from a tap located as close to the wellhead as possible. Most taps were installed by CSSA to obtain a representative groundwater sample before pressurization, storage, or the water supply distribution system. Water was purged to engage the well pump prior to sample collection. Conductivity, pH, and temperature readings were recorded to confirm adequate purging while the well was pumping. Purging measurements were recorded in the field logbook for each sampling event.
- All groundwater samples were submitted to APPL for analysis. Groundwater samples were analyzed for the short list of VOCs (*cis*-1,2-DCE, *trans*-1,2-DCE, 1,1-DCE, PCE, TCE, and vinyl chloride) using SW-846 Method 8260B. Off-post wells are not analyzed for metals as part of the groundwater monitoring program.
- The data packages containing the analytical results for the 2015 sampling events were reviewed and verified according to the guidelines outlined in the CSSA QAPP. After the data packages were received by Parsons, quarterly data verification reports were submitted to CSSA as an attachment in the Quarterly Groundwater Reports.
- Based on historical detections, the lateral extent of VOC contamination above the MDL extends approximately 2.7 miles beyond the west boundary of CSSA (well SLD-01) and 0.4 miles to the south of CSSA (well LS-4). Information such as well depth, pump depth, and other pertinent data necessary to characterize the vertical extent of migration is not readily available for most off-post wells. However, the typical well construction for the area is open borehole completions that penetrate the full thickness of the Middle Trinity aquifer (LGR, BS, and CC).
- Concentrations of VOCs detected in 2015 are presented in **Table 2.9**. Full analytical results from the 2015 sampling events are presented in **Appendix G**. Concentration trends are illustrated on **Figures 2.7 and 2.8** for wells LS-5, LS-6, LS-7, OFR-3, RFR-10, and RFR-11 for PCE and TCE. These wells were selected because they have had detections of PCE and TCE that approach and/or exceed MCLs. **Figure 2.7** includes precipitation data from the weather stations located at CSSA, AOC-65 WS and B-3 WS. This figure suggests VOC concentrations in OFR-3 and RFR-10 are very sensitive to significant rain events and that VOC concentrations in LS-5, LS-6, and LS-7 are less sensitive to rainfall.

Table 2.9
2015 Off-Post Groundwater COCs Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
Laboratory Detection Limits & Maximum Contaminant Level							
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**
BSR-03	3/3/2015	--	--	--	--	--	--
	12/15/2015	--	--	--	--	--	--
BSR-04	3/2/2015	--	--	--	--	--	--
	12/4/2015	--	--	--	--	--	--
FO-8	3/4/2015	--	--	--	--	--	--
Duplicate	3/4/2015	--	--	--	--	--	--
	12/2/2015	--	--	--	--	--	--
FO-17	3/4/2015	--	--	--	--	--	--
	12/3/2015	--	--	--	--	--	--
FO-22	3/4/2015	--	--	--	--	--	--
	12/3/2015	--	--	--	--	--	--
FO-J1	3/5/2015	--	--	--	--	--	--
	12/1/2015	--	--	--	--	--	--
HS-1	3/11/2015	--	--	--	--	--	--
	12/3/2015	--	--	--	--	--	--
Duplicate	12/3/2015	--	--	--	--	--	--
HS-2	3/11/2015	--	--	--	--	--	--
	12/3/2015	--	--	--	--	--	--
HS-3	3/11/2015	--	--	--	--	--	--
	12/3/2015	--	--	--	--	--	--
I10-2	3/2/2015	--	--	--	--	--	--
	12/2/2015	--	--	--	--	--	--
I10-5	3/3/2015	--	--	--	--	--	--
I10-7	3/2/2015	--	--	--	--	--	--
	12/2/2015	--	--	--	--	--	--
I10-8	3/3/2015	--	--	--	--	--	--
	12/2/2015	--	--	--	--	--	--
Duplicate	12/2/2015	--	--	--	--	--	--
JW-5	3/3/2015	--	--	--	--	--	--
	12/9/2015	--	--	--	--	--	--
Duplicate	12/9/2015	--	--	--	--	--	--
JW-6	3/3/2015	--	--	--	--	--	--
	12/1/2015	--	--	--	--	--	--
JW-7	3/3/2015	--	--	--	--	--	--
	12/1/2015	--	--	--	**0.28F**	--	--
JW-8	3/3/2015	--	--	--	--	--	--
	12/2/2015	--	--	--	--	--	--
Duplicate	12/2/2015	--	--	--	--	--	--
JW-9	3/18/2015	--	--	--	--	--	--
Duplicate	3/18/2015	--	--	--	--	--	--
	12/10/2015	--	--	--	--	--	--
JW-12	6/3/2015	--	--	--	--	--	--
	12/7/2015	--	--	--	--	--	--
JW-13	3/20/2015	--	--	--	--	--	--
	12/18/2015	--	--	--	--	--	--
JW-14	3/5/2015	--	--	--	--	--	--
	12/1/2015	--	--	--	--	--	--

Table 2.9
2015 Off-Post Groundwater COCs Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
Laboratory Detection Limits & Maximum Contaminant Level							
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
JW-15	3/5/2015	--	--	--	--	--	--
JW-20	3/5/2015	--	--	--	--	--	--
	12/2/2015	--	--	--	--	--	--
JW-26	3/3/2015	--	--	--	--	--	--
JW-27	3/4/2015	--	--	--	--	--	--
Duplicate	3/4/2015	--	--	--	--	--	--
	12/2/2015	--	--	--	--	--	--
JW-28	3/6/2015	--	--	--	--	--	--
JW-29	3/3/2015	--	--	--	--	--	--
Duplicate	3/3/2015	--	--	--	--	--	--
	12/3/2015	--	--	--	--	--	--
JW-30	3/5/2015	--	--	--	--	--	--
	12/1/2015	--	--	--	--	--	--
JW-31	3/18/2015	--	--	--	--	--	--
	12/1/2015	--	--	--	--	--	--
LS-1	3/11/2015	--	--	--	**0.49F**	--	--
	12/3/2015	--	--	--	--	--	--
LS-4	3/11/2015	--	--	--	--	--	--
LS-5	3/2/2015	--	--	--	**0.98F**	**3.36**	--
	6/1/2015	--	--	--	**1.22F**	**2.72**	--
	9/8/2015	--	--	--	**0.83F**	**2.43**	--
	11/30/2015	--	--	--	**1.02F**	**2.15**	--
LS-5-A2	3/2/2015	--	--	--	--	--	--
	9/8/2015	--	--	--	--	--	--
LS-6	3/2/2015	--	--	--	**0.81F**	**3.48**	--
	6/1/2015	--	--	--	**0.29F**	--	--
	9/8/2015	--	--	--	**0.62F**	**2.04**	--
	11/30/2015	--	--	--	--	--	--
LS-6-A2	3/2/2015	--	--	--	--	--	--
	9/8/2015	--	--	--	--	--	--
LS-7	3/2/2015	--	--	--	**1.92**	**0.44F**	--
	6/1/2015	--	--	--	--	--	--
	9/8/2015	--	--	--	**1.26F**	--	--
	11/30/2015	--	--	--	**0.24F**	--	--
LS-7-A2	3/2/2015	--	--	--	--	--	--
	9/8/2015	--	--	--	--	--	--
OFR-3	4/3/2015	--	--	--	**6.25**	**3.3**	--
	6/1/2015	--	--	--	**4.19**	**2.59**	--
	9/8/2015	--	--	--	**6.88**	**3.64**	--
	11/30/2015	--	--	--	**3.51**	**1.86**	--
OFR-3-A2	4/3/2015	--	--	--	--	--	--
	9/8/2015	--	--	--	--	--	--
OW-BARNOWL	3/4/2015	--	--	--	--	--	--
	6/3/2015	--	--	--	--	--	--
	12/1/2015	--	--	--	--	--	--

Table 2.9
2015 Off-Post Groundwater COCs Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
Laboratory Detection Limits & Maximum Contaminant Level							
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**
OW-CE1	3/4/2015	--	--	--	--	--	--
	12/1/2015	--	--	--	--	--	--
OW-CE2	3/4/2015	--	--	--	--	--	--
	12/1/2015	--	--	--	--	--	--
OW-DAIRYWELL	3/4/2015	--	--	--	--	--	--
	12/1/2015	--	**0.20F**	--	--	--	--
Duplicate	12/1/2015	--	--	--	--	--	--
OW-HH1	3/4/2015	--	--	--	--	--	--
	12/1/2015	--	--	--	--	--	--
OW-HH2	3/4/2015	--	--	--	--	--	--
Duplicate	3/4/2015	--	--	--	--	--	--
	6/3/2015	--	--	--	--	--	--
	12/1/2015	--	--	--	--	--	--
OW-HH3	3/4/2015	--	--	--	--	--	--
	12/1/2015	--	--	--	--	--	--
OW-MT2	3/4/2015	--	--	--	--	--	--
	12/1/2015	--	--	--	--	--	--
RFR-3	3/3/2015	--	--	--	--	--	--
	12/2/2015	--	--	--	--	--	--
RFR-5	3/3/2015	--	--	--	--	--	--
	12/2/2015	--	--	--	--	--	--
RFR-8	3/4/2015	--	--	--	--	--	--
	12/4/2015	--	--	--	--	--	--
RFR-9	3/6/2015	--	--	--	--	--	--
	12/7/2015	--	--	--	--	--	--
RFR-10	3/2/2015	--	**0.35F**	--	**21.58**	**14.42**	--
	6/1/2015	--	**0.13F**	--	**9.19**	**5.53**	--
	9/8/2015	--	--	--	**19.71**	**7.93**	--
	11/30/2015	--	--	--	**6.27**	**3.5**	--
RFR-10-A2	3/2/2015	--	--	--	--	--	--
	9/8/2015	--	--	--	--	--	--
RFR-10-B2	3/2/2015	--	--	--	--	--	--
	9/8/2015	--	--	--	--	--	--
RFR-11	3/2/2015	--	--	--	**0.77F**	**2.61**	--
	6/1/2015	--	--	--	**0.93F**	--	--
	9/8/2015	--	--	--	**0.84F**	**1.71**	--
Duplicate	9/8/2015	--	--	--	**0.71F**	**1.58**	--
	11/30/2015	--	--	--	**1.22F**	--	--
RFR-11-A2	3/2/2015	--	--	--	--	--	--
	9/8/2015	--	--	--	--	--	--
RFR-12	3/2/2015	--	--	--	**0.24F**	**0.89F**	--
Duplicate	3/2/2015	--	--	--	**0.26F**	**0.82F**	--
	12/2/2015	--	--	--	**0.29F**	**0.80F**	--
RFR-14	3/4/2015	--	--	--	--	--	--
	12/4/2015	--	--	--	--	--	--

Table 2.9
2015 Off-Post Groundwater COCs Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
Laboratory Detection Limits & Maximum Contaminant Level							
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**
SLD-01	3/3/2015	--	--	--	--	--	--
	6/3/2015	--	--	--	--	--	--
Duplicate	6/3/2015	--	--	--	--	--	--
	9/14/2015	--	--	--	--	--	--
	12/2/2015	--	--	--	--	--	--
SLD-02	3/3/2015	--	--	--	--	--	--
	12/2/2015	--	--	--	--	--	--

BOLD	≥ MDL
BOLD	≥ RL
BOLD	≥ MCL

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

Abbreviations/Notes:

Duplicate	Field Duplicate
TCE	Trichloroethene
PCE	Tetrachloroethene
DCE	Dichloroethene
--	non detect

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.

Figure 2.7
PCE and TCE Concentration Trends and Precipitation

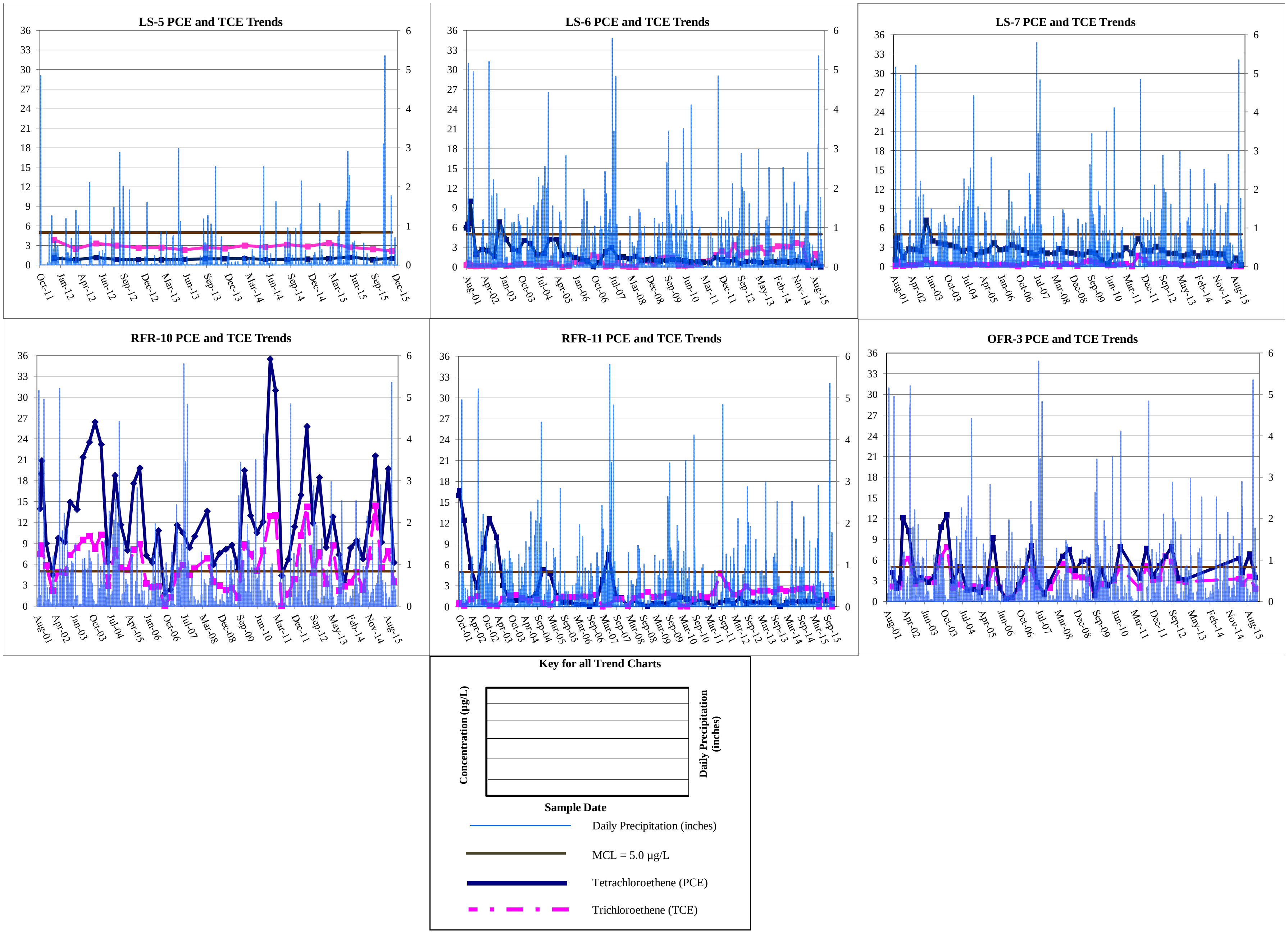
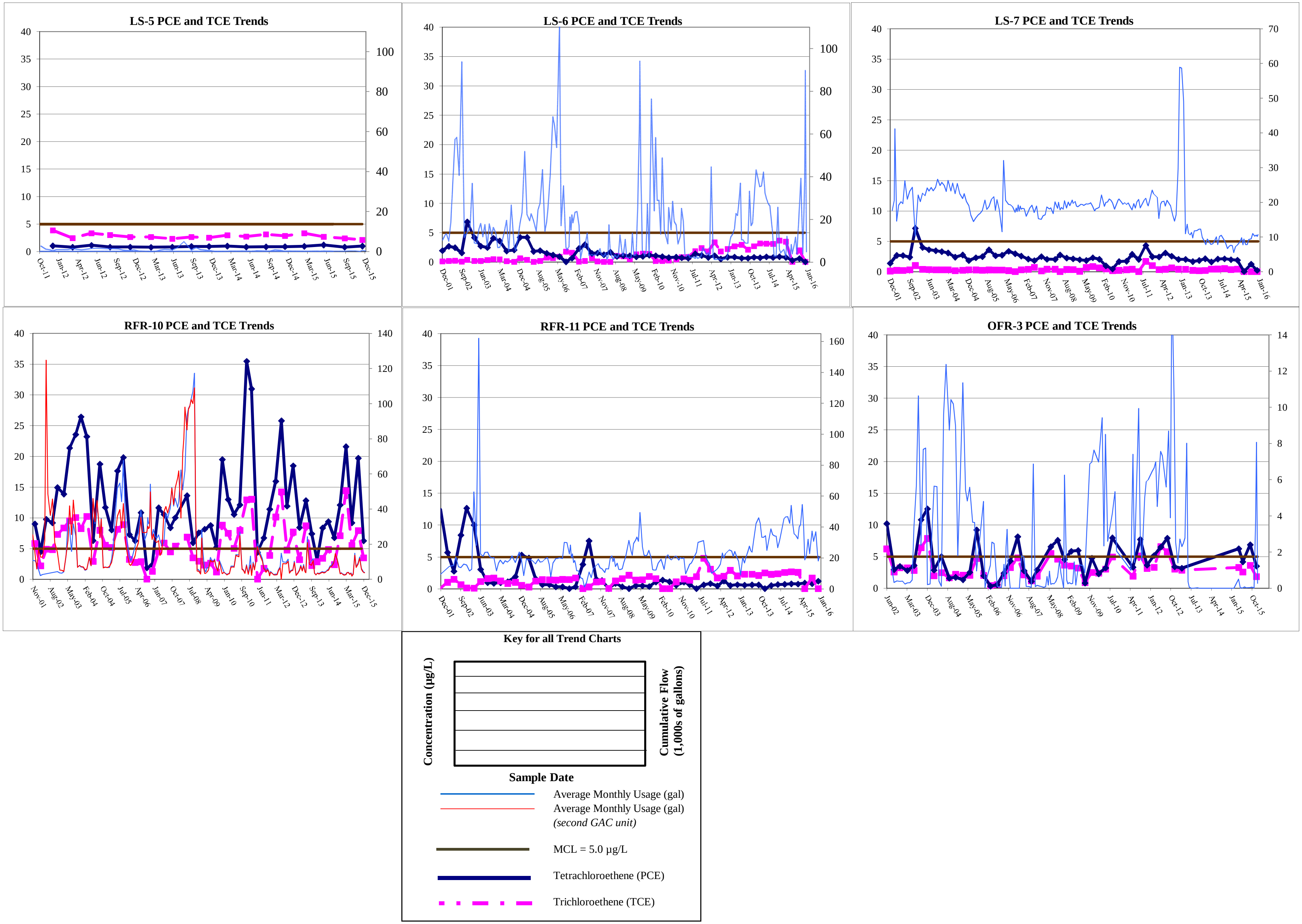


Figure 2.8
PCE and TCE Concentration Trends and Monthly Water Usage



J:\CSSA Program\Restoration\Groundwater\GW Monitoring Reports\2015\Annual Report

Data from RFR-11 presents a mixed picture. From October 2001 through December 2007, RFR-11 VOC concentration peaks showed a good correlation to significant rainfall events, but after 2007, this correlation is less pronounced. It may be coincidental, but the changes in rainfall/VOC concentration correlations in RFR-11 happened when the San Antonio Water System (SAWS) abandoned pumping of the Bexar Met public supply wells in Leon Springs Villas (LS-1, LS-2, LS-3, LS-4). **Figure 2.8** shows PCE and TCE concentrations with monthly water usage at each off-post well. The off-post GAC systems are equipped with flowmeters that track the gallons of water treated by the units. Data in this figure suggests little correlation between VOC concentrations and well pumping volumes.

2.2.2.1 Off-Post Wells with COC Detections above the MCL

During 2015, off-post wells RFR-10 and OFR-3 had raw water (pre-GAC) concentrations exceeding the MCL. Well RFR-10 concentrations exceeded the MCL for PCE during all four quarterly events and TCE also exceeded the MCL during the March, June, and September events. Well OFR-3 also exceeded the MCL for PCE when it was brought back on line in April and during the September event. An evaluation of concentration trends through 2015 are included in **Figures 2.7 and 2.8**.

2.2.2.2 GAC Filtration Systems

All off-post drinking water wells that historically exceeded or approached MCLs have already been equipped with GAC filtration systems. These wells, and the date the filtration system was installed, are listed in **Table 2.10**. CSSA maintains and operates these GAC filtration systems at no cost or inconvenience to the well owners.

Table 2.10 GAC Filtration Systems Installed

Well	Date Installed
LS-6	August 2001
LS-7	August 2001
OFR-3	April 2002
RFR-10	October 2001
RFR-11	October 2001
LS-5	October 2011

Semi-annual post-GAC confirmation samples are collected from all wells equipped with GAC filtration systems (**Appendix H**). The samples confirm that the GAC filtration systems are working effectively and that VOCs are reduced to concentrations below the applicable drinking water MCLs.

To date, no COCs have been detected above RLs in the GAC-filtered samples. These samples were collected during the March and September 2015 events in accordance with project DQOs. See **Appendix H** for pre- and post-GAC sample comparisons.

Regular GAC maintenance/inspection occurs every 3 weeks. This task includes changing pre-filters and troubleshooting problems occurring with the systems. On February 2, 2015 and August 26, 2015 the carbon in the GAC filtration systems (LS-5, LS-6, LS-7, RFR-10, OFR-3, and RFR-11) was changed out.

2.2.2.3 Off-Post Wells with COC Detections below the MCL

Detections from all wells sampled off-post are presented in **Table 2.9** and complete 2015 results are included in **Appendix G**. The groundwater monitoring results include wells where COCs were detected at levels below applicable MCLs. These detections occurred in wells LS-5, LS-6, LS-7, and RFR-11. The detections below the MCL and above the RL are summarized as follows:

- **LS-5 –** Concentration of TCE exceeded the RL in March, June, September, and December 2015. PCE was also detected below the RL during these sampling events. This well is equipped with a GAC filtration system.
- **LS-6 –** Concentrations of TCE exceeded the RL in March and September 2015. PCE was detected in March, June, and September as well but below the RL. This well is equipped with a GAC filtration system.
- **LS-7 –** Concentrations of PCE exceeded the RL in March 2015 but fell below the RL during the September and December sampling events. Concentrations of TCE were also present in March but below the RL. This well is equipped with a GAC filtration system.
- **RFR-11** - Concentration of TCE exceeded the RL in the March and September quarterly sampling events. PCE was also detected below the RL in all four sampling events. This well is equipped with a GAC filtration system.

2.2.2.4 Off-Post Wells with COC Detections below the Reporting Limits

The off-post results include detections in wells for which the analyte is identified, but at a concentration below the RL. These results are assigned an "F" flag under the CSSA QAPP. In 2015, this included wells JW-7, LS-1, OW-DAIRYWELL, and RFR-12. The detections below the reporting limit are summarized as follows:

- **JW-7 –** Concentrations of PCE detected below the RL in December 2015.
- **LS-1 –** Concentrations of PCE detected below the RL in March 2015.
- **OW-DAIRYWELL** - Concentrations of *cis*-1,2-DCE detected below the RL in December 2015.
- **RFR-12 –** Concentrations of PCE and TCE detected below the RL in March and December 2015.

2.2.3 Isoconcentration Mapping

2.2.3.1 PCE, TCE, and cis-1,2-DCE

In annual reports prior to 2010, the maximum concentration detected during any quarterly event in the LGR wells (on-post and off-post) were contoured into isoconcentration contour maps for PCE, TCE, and *cis*-1,2-DCE. The reason for creating these "composite" maps resulted from the LTMO sampling frequency enacted in 2005. No single quarterly event included all of the wells in the sampling program. The LTMO program was updated in 2010 to include a "snapshot" sampling event in which all on- and off-post wells were sampled during the same event. These snapshot events began in September 2010, and now occur every 9 months. Annual reports now only include isoconcentration maps of contaminants collected during a single sampling event.

Another development in the representation of contamination in groundwater came in March 2012. At the direction of the USEPA (**Appendix K**), isoconcentration maps depicting groundwater contamination will no longer present isoconcentration contour lines below the laboratory RL, which is considered quantifiable data. Trace detections of contamination (F-flagged data) reported by the lab are considered qualitative results and therefore are not suitable for demonstrating the extent of contaminant plumes. Results below the RL are still presented on the maps, but are not contained within an isoconcentration contour line. For the compounds reported, the RL (and lowest isoconcentration line) are as follows: *cis*-1,2-DCE (1.2 µg/L), PCE (1.4 µg/L), and TCE (1.0 µg/L).

To better represent the plume source areas, data from deepest LGR zone of the Westbay wells were also composited into the isoconcentration maps. The LGR-09 zone from Westbay wells CS-WB01 through CS-WB04 were sampled in March and December 2015 and are included in the maps to help delineate Plume 2. The LGR-04 zone of Westbay wells CS-WB05 through CS-WB08 were sampled in April and October 2015 as part of the SWMU B-3 Bioreactor operations, and assist in delineating the central portion of Plume 1. These isoconcentration maps are provided for March (**Figures 2.9, 2.10, and 2.11)** and December 2015 (**Figures 2.12, 2.13, and 2.14)** to illustrate the extent of contamination as measured and inferred from analytical results.

The 2015 extent of COCs above the RL (approximately 1 µg/L) for each of PCE, TCE and *cis*-1,2-DCE can be determined by reviewing the two sets of figures generated for March and December 2015. March 2015 PCE concentrations above 1.4 µg/L are detected on-post in wells CS-MW1-LGR, CS-MW8-LGR, CS-MW10-LGR, CS-MW16-LGR, CS-MW36-LGR, B3-EXW01 through B3-EXW05. Additionally, the LGR-09 zone from CS-WB01 and CS-WB02 and the LGR-04 zones from CS-WB05 through CS-WB07 are all above the PCE RL of 1.4 µg/L (**Figure 2.9**). Off-post detections of PCE above 1.4 µg/L include LS-7, OFR-3, RFR-10, and CS-WB04-LGR-09.

TCE follows a similar pattern in March 2015, and has been detected above 1.0 µg/L in Plume 1 wells CS-MW1-LGR, CS-MW5-LGR, CS-MW16-LGR, CS-MW36-LGR, and B3-EXW01 through B3-EXW05. Additionally, the LGR-04 zones from CS-WB05 through CS-WB08 are all above 1.0 µg/L TCE (**Figure 2.10**). The LGR-09 zone for the on-post Westbay wells CS-WB01 through CS-WB03 within Plume 2 were all above 1.0 µg/L TCE during 2014. Off-post wells with a TCE concentration reported above 1.0 µg/L include wells LS-5, LS-6, OFR-3, RFR-10, RFR-11, and CS-WB04-LGR-09.

In March 2015, *cis*-1,2-DCE was reported at levels above 1.2 µg/L in on-post wells CS-MW1-LGR, CS-MW5-LGR, CS-MW16-LGR, the LGR-09 zone of CS-WB03 and CS-WB04, CS-EXW01 through CS-EXW05 and the LGR-04 zones of CS-WB05 through CS-WB08. Off-post wells with a *cis*-1,2-DCE concentration reported above 1.2 µg/L only included Westbay well CS-WB04 (**Figure 2.11**).

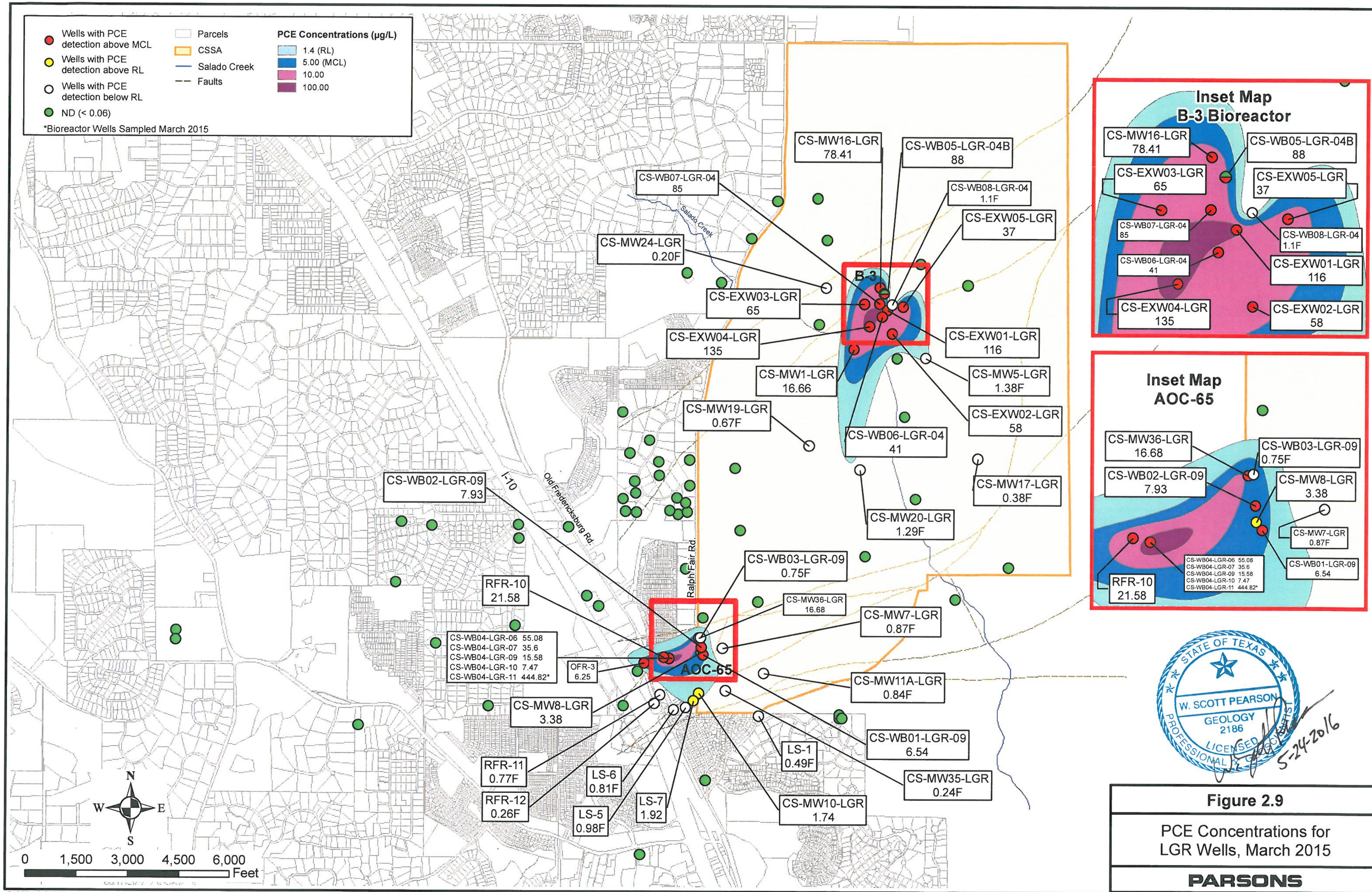


Figure 2.9

PCE Concentrations for LGR Wells, March 2015

PARSONS

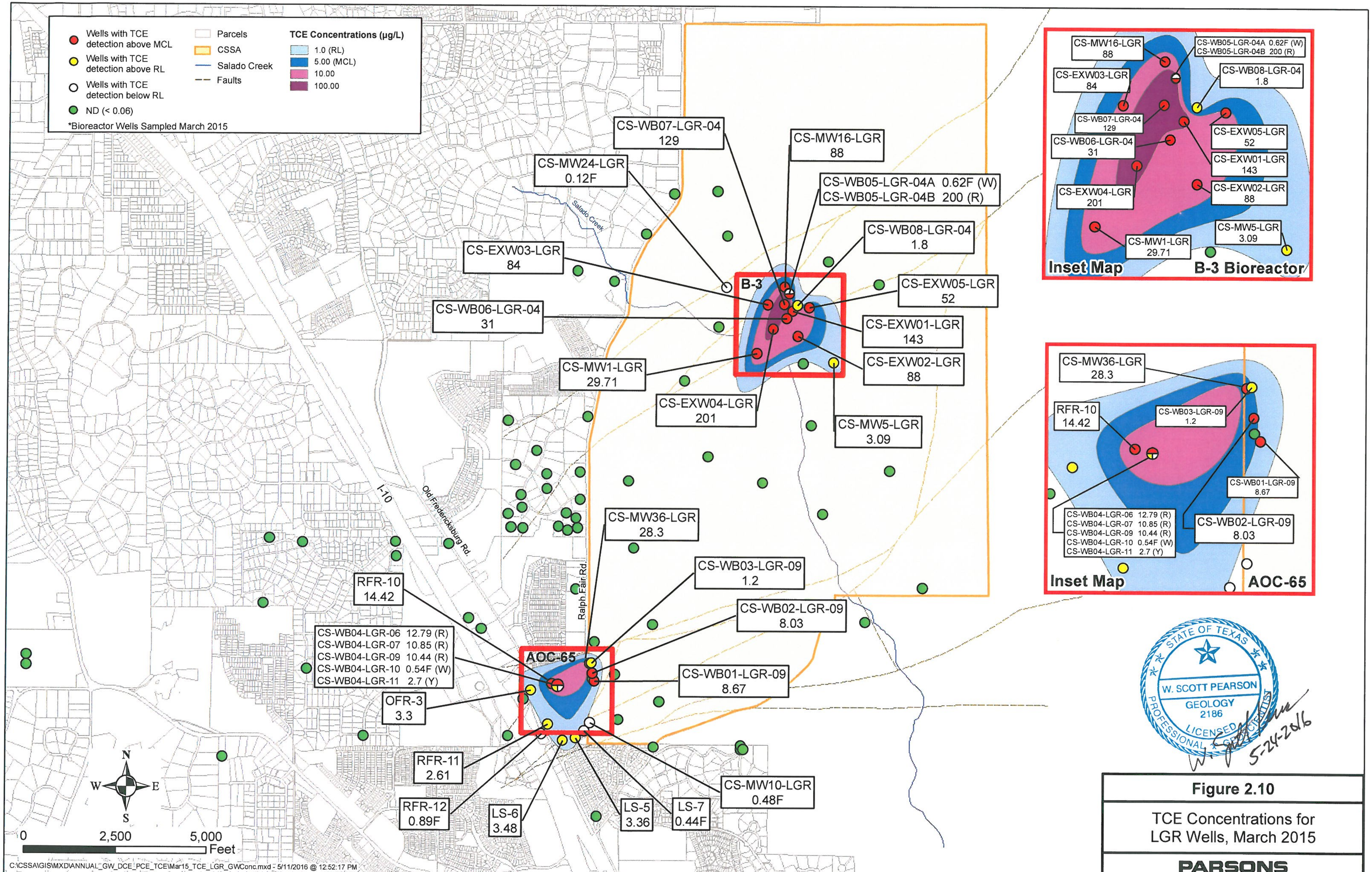


Figure 2.10

TCE Concentrations for LGR Wells, March 2015

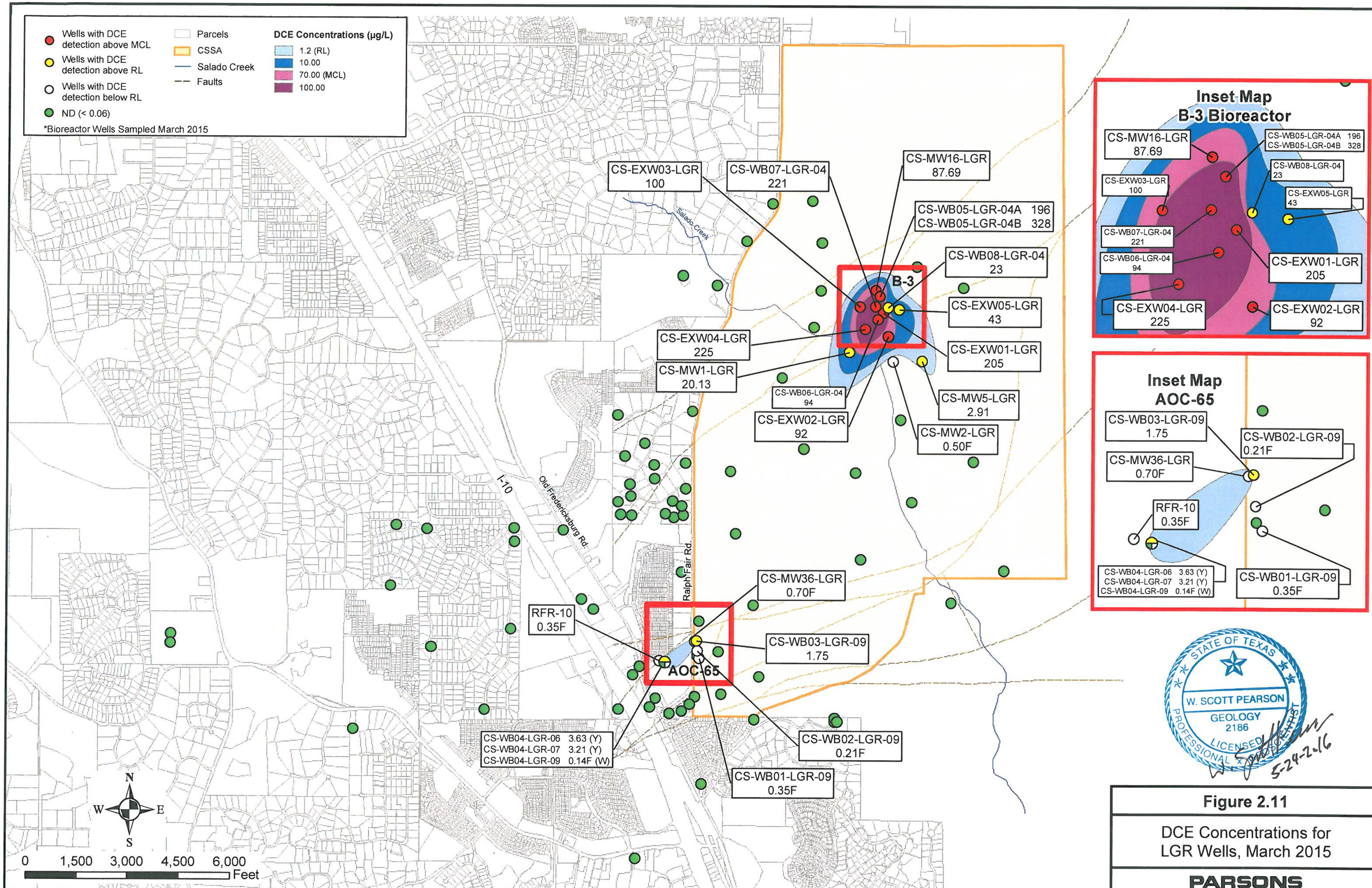


Figure 2.11

DCE Concentrations for LGR Wells, March 2015

PARSONS

C:\CSSA\GIS\MXD\ANNUAL_GW_DCE_PCE_TCE\Mar15_DCE_LGR_GWConc.mxd - 5/11/2016 @ 10:46:43 AM

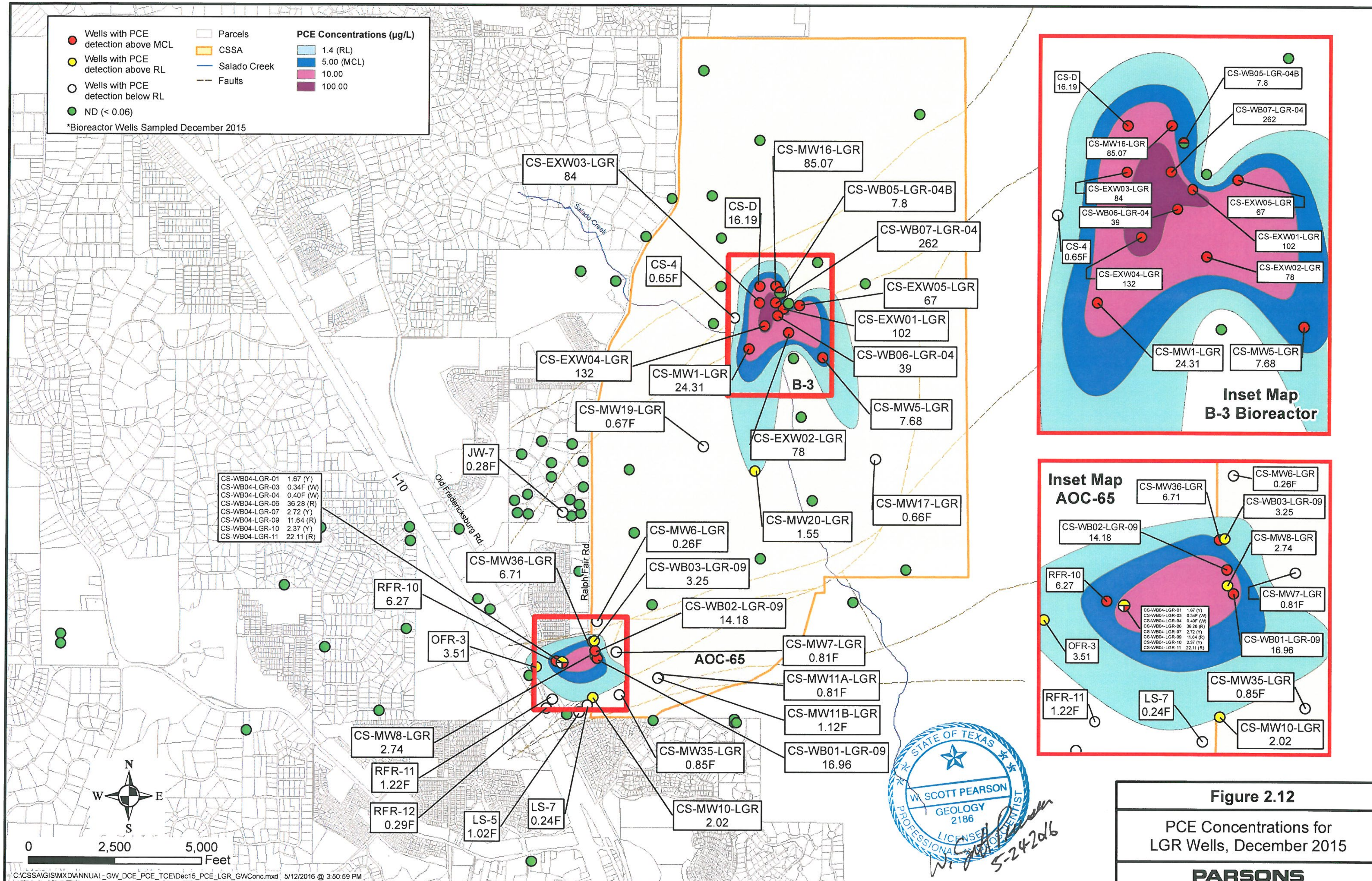


Figure 2.12

PCE Concentrations for LGR Wells, December 2015

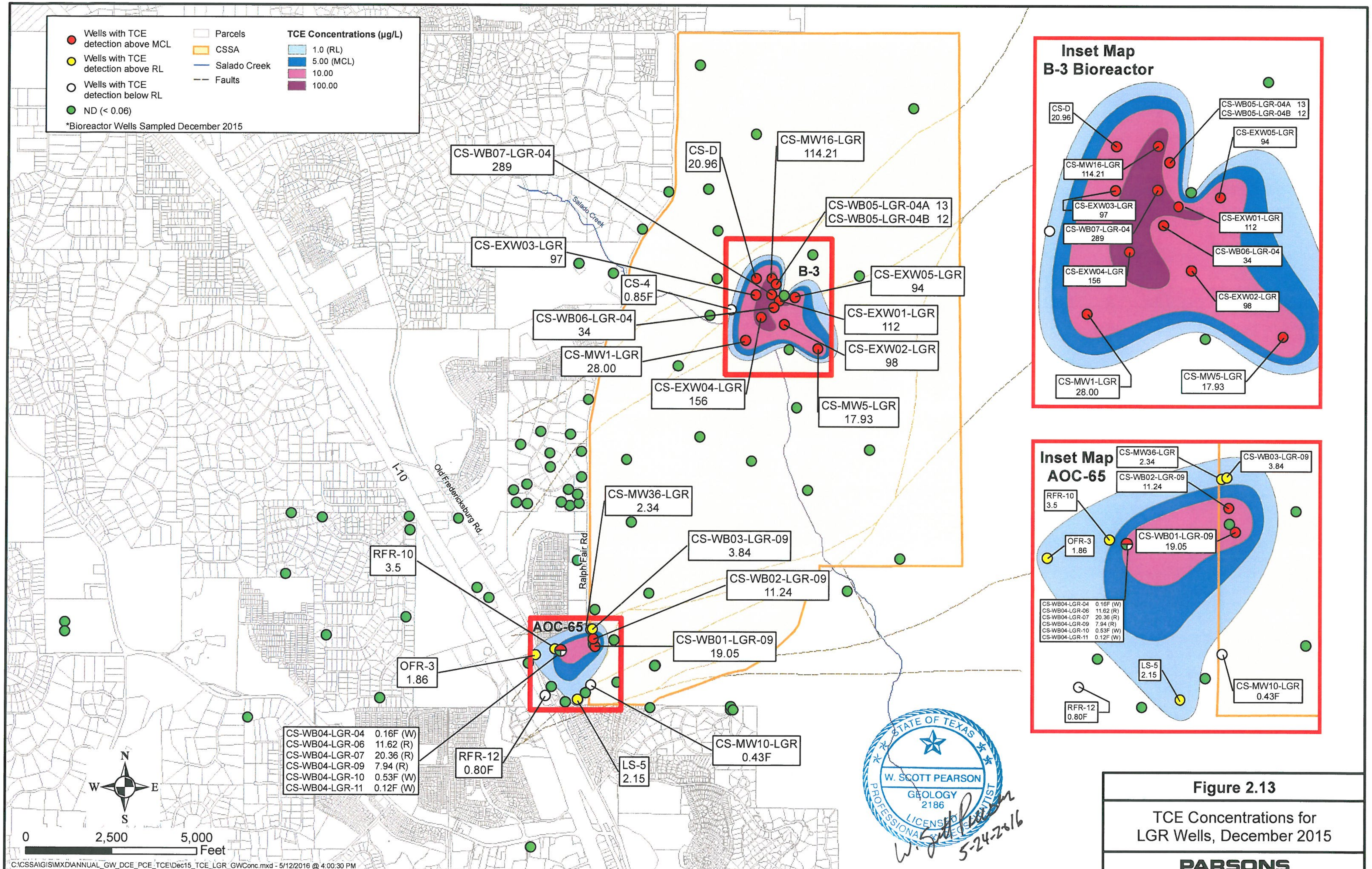
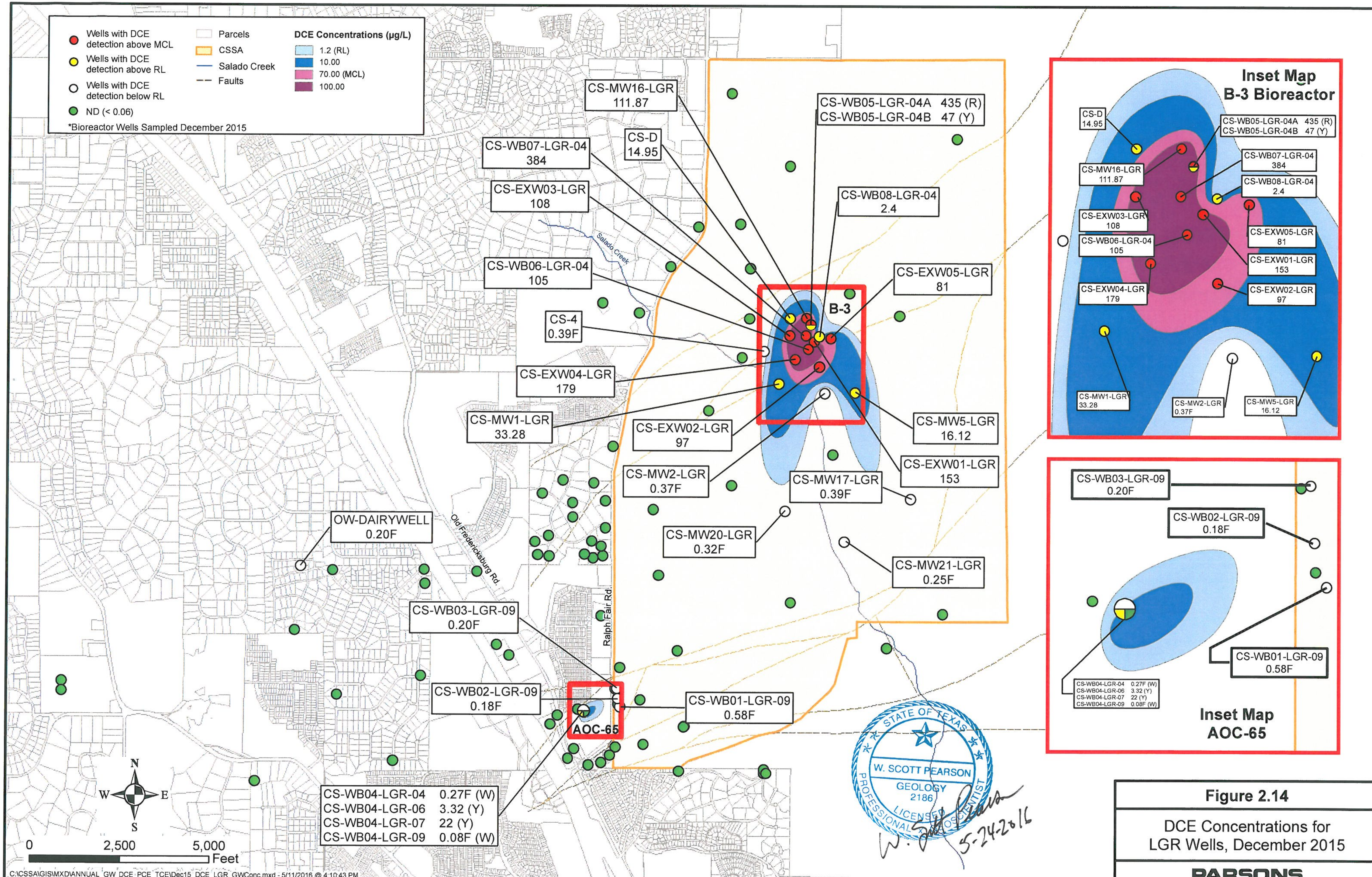


Figure 2.13
TCE Concentrations for LGR Wells, December 2015



Wells with DCE detection above MCL
Wells with DCE detection above RL
Wells with DCE detection below RL
ND (< 0.06)
*Bioreactor Wells Sampled December 2015
Parcels
CSSA
Salado Creek
Faults
DCE Concentrations (µg/L)
1.2 (RL)
10.00
70.00 (MCL)
100.00
CS-MW16-LGR 111.87
CS-D 14.95
CS-WB07-LGR-04 384
CS-EXW03-LGR 108
CS-WB06-LGR-04 105
CS-4 0.39F
CS-EXW04-LGR 179
CS-MW1-LGR 33.28
CS-EXW02-LGR 97
CS-MW2-LGR 0.37F
CS-WB05-LGR-04A 435 (R)
CS-WB05-LGR-04B 47 (Y)
CS-WB08-LGR-04 2.4
CS-EXW05-LGR 81
CS-MW5-LGR 16.12
CS-EXW01-LGR 153
CS-MW17-LGR 0.39F
CS-MW20-LGR 0.32F
CS-MW21-LGR 0.25F
B-3
Salado Creek
OW-DAIRYWELL 0.20F
Old Fredericksburg Rd.
Ralph Fair Rd.
CS-WB03-LGR-09 0.20F
CS-WB02-LGR-09 0.18F
CS-WB01-LGR-09 0.58F
AOC-65
CS-WB04-LGR-04 0.27F (W)
CS-WB04-LGR-06 3.32 (Y)
CS-WB04-LGR-07 22 (Y)
CS-WB04-LGR-09 0.08F (W)
N
W
E
S
0
2,500
5,000
Feet
Inset Map B-3 Bioreactor
CS-D 14.95
CS-WB05-LGR-04A 435 (R)
CS-WB05-LGR-04B 47 (Y)
CS-WB07-LGR-04 384
CS-MW16-LGR 111.87
CS-WB08-LGR-04 2.4
CS-EXW03-LGR 108
CS-EXW05-LGR 81
CS-WB06-LGR-04 105
CS-EXW01-LGR 153
CS-EXW04-LGR 179
CS-EXW02-LGR 97
CS-MW1-LGR 33.28
CS-MW2-LGR 0.37F
CS-MW5-LGR 16.12
CS-WB03-LGR-09 0.20F
CS-WB02-LGR-09 0.18F
CS-WB01-LGR-09 0.58F
CS-WB04-LGR-04 0.27F (W)
CS-WB04-LGR-06 3.32 (Y)
CS-WB04-LGR-07 22 (Y)
CS-WB04-LGR-09 0.08F (W)
Inset Map AOC-65
STATE OF TEXAS
W. SCOTT PEARSON
GEOLOGY
2186
LICENSED
PROFESSIONAL GEOSCIENTIST
5-24-2016
Figure 2.14
DCE Concentrations for LGR Wells, December 2015
PARSONS
C:\CSSA\GIS\MXD\ANNUAL_GW_DCE_PCE_TCE\Dec15_DCE_LGR_GWConc.mxd - 5/11/2016 @ 4:10:43 PM

December 2015 PCE concentrations above 1.4 µg/L are detected on-post in wells CS-MW1-LGR, CS-MW5-LGR, CS-MW8-LGR, CS-MW10-LGR, CS-MW16-LGR, CS-MW20-LGR, CS-MW36-LGR, CS-D, and B3-EXW01 through B3-EXW05. Additionally, the LGR-09 zone from CS-WB01 through CS-WB03, and the LGR-04 zones from CS-WB05 through CS-WB07 are all above the PCE RL of 1.4 µg/L (**Figure 2.12**). Off-post detections of PCE above 1.4 µg/L include OFR-3, RFR-10, and CS-WB04-LGR-09.

TCE has been detected in December 2015 above 1.0 µg/L in Plume 1 wells CS-MW1-LGR, CS-MW5-LGR, CS-MW16-LGR, CS-MW36-LGR, and B3-EXW01 through B3-EXW05. Additionally, the LGR-04 zones from CS-WB05 through CS-WB08 are all above 1.0 µg/L TCE (**Figure 2.13**). The LGR-09 zone for the on-post Westbay wells CS-WB01 through CS-WB03 within Plume 2 were all above 1.0 µg/L TCE during 2014. Off-post wells with a TCE concentration reported above 1.0 µg/L include wells LS-5, OFR-3, RFR-10, and CS-WB04-LGR-09.

In December 2015, *cis*-1,2-DCE was reported at levels above 1.2 µg/L in on-post wells CS-MW1-LGR, CS-MW5-LGR, CS-MW16-LGR, CS-D, CS-EXW01 through CS-EXW05 and the LGR-04 zones of CS-WB05 through CS-WB08. Off-post wells with a *cis*-1,2-DCE concentration reported above 1.2 µg/L only included Westbay well CS-WB04 LGR zones -06 and -07 (**Figure 2.14**).

Isoconcentration maps have also been prepared based on analytical data collected in 2006 through 2013. Those isoconcentration maps are available for review in the ***CSSA Environmental Encyclopedia, Volume 5 Groundwater***, in the *2006 through 2014 Annual Groundwater Reports*. In general, the 2015 plume extent and geometry is consistent with 2014 data.

Finally, the maximum annual concentrations detected near the LGR plume centers are generally stable in comparison to 2014. At Plume 1, VOC concentrations have slightly increased upgradient at CS-MW16-LGR, and remained stable or slightly increased downgradient at CS-MW1-LGR. Within Plume 2, the VOC concentrations have slightly increased in well RFR-10 (downgradient off-post) and decreased in CS-MW36-LGR (source area). Shallower source area monitoring points have noted increases in VOC concentrations at CS-WB03 and decreases in VOC concentrations at CS-WB02, presumably in response to the remedial efforts associated with the ISCO treatability study or other hydrogeologic conditions. See **Table 2.11** for comparison of the 2014 and 2015 data near the plume centers.

Table 2.11 Comparison of 2014 & 2015 PCE, TCE, and cis-1,2-DCE Max. Levels

	PCE		TCE		*cis*-1,2-DCE	
	2014	*2015*	*2014*	*2015*	*2014*	*2015*
B-3 Plume 1						
CS-MW16-LGR	70.97	85.07	86.11	114.21	76.51	111.87
CS-MW1-LGR	28.46	35.77	37.28	36.16	45.90	46.36
CS-4	NS	0.65	NS	0.85	NS	0.39
AOC-65 Plume 2						
RFR-10	12.1	21.58	7.1	14.42	0.19	0.35
CS-MW36-LGR	18.27	16.68	32.77	28.3	0.79	0.70
CS-WB02-LGR-09	430.41	14.18	11.37	11.24	0.28	0.21
CS-WB03-UGR-01	19,818	23,737	111.4	216	2.89	21.7

2.3 Public Meeting

On April 23, 2015, a public meeting hosted by the U.S. Environmental Protection Agency (USEPA) presented the Statement of Basis and proposed remedy for groundwater contamination at Camp Stanley Storage Activity. USEPA solicited feedback from the community and addressed public comments on the proposed remedy. Presentations were made by CSSA, Parsons, and Mr. Greg Lyssy of USEPA. Sixteen people attended this meeting.

3.0 GROUNDWATER MONITORING PROGRAM CHANGES

3.1 Access Agreements Obtained in 2015

Access agreements are signed by off-post well owners to grant permission to CSSA to collect groundwater samples from each well. Well JW-12 a former participant in the groundwater monitoring program was reinstated when the access agreement was returned May 31, 2015. Well OFR-3 is back on the sampling schedule after the property was sold numerous times, the new well owner signed an access agreement on March 30, 2015.

3.2 Wells Added to or Removed From Program

Well JW-12 was added back into the program in June 2015. JW-12 was initially sampled in September 2001 and remained on the sampling schedule until June 2009. At this time the owner did not renew their access agreement and would not return phone calls. On May 31, 2015 the access agreement was signed and returned and well JW-12 was added back to the sampling schedule. A trace detection of PCE in September 2007 has been the only detection in the history of sampling this well.

The property at well OFR-3 was purchased in March 2015. The landowner was contacted and an access agreement was signed on March 30, 2015. The well was sampled on April 3, 2015, the post-GAC sample was non-detect indicating the GAC filtration system is functioning properly. Well OFR-3 will remain on the quarterly sampling schedule and routine scheduled GAC maintenance will resume.

Well AR-1 was added to the program in April 2015 as a one-time sample. Interest by a local homeowner that attended the March 23rd public meeting initiated sampling of this well. Although this well is nowhere near the plume and well north of CSSA, this sample was collected at the request of the landowner. No VOCs related to CSSA's groundwater investigation were identified in the water sample from this well.

In December 2015 well I10-5 opted to not return their access agreement and to be removed from the sampling program. This well has been sampled since December 2002 and has never reported a detection related to CSSA's groundwater investigation.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the evaluation of the on- and off-post groundwater monitoring program data collected in 2015, the following conclusions and recommendations can be made:

- On-post wells CS-D, CS-MW16-LGR, CS-MW16-CC, CS-MW1-LGR, CS-MW5-LGR, and CS-MW36-LGR all exceeded VOC MCLs in 2015 and should remain on the sampling schedule in the future.
- Well CS-MW5-LGR reported its highest concentrations of PCE and TCE (first time above the applicable MCLs) since sampling began in 2001. This well is currently on a 9 month sampling schedule. Due to its proximity to future drinking water well CS-13 and the recent increase in contaminant concentrations, it is recommended that CS-MW5-LGR be moved to the quarterly monitoring schedule.
- No on-post wells had metals detected above the MCL, SS, or AL in 2015.
- Continue with the initiative to collect a “snapshot” event from all on- and off-post wells as well as selected Westbay zones. The current recommendation is to collect a snapshot event every 9 months so that the changes in the plume can be monitored seasonally.
- Nineteen Westbay intervals had detections above the MCL in 2015. These intervals should remain on the 9-month sampling schedule in the future as recommended in the LTMO study.
- The Westbay wells at AOC-65 continue to indicate the strong presence of contamination near the source area (CS-WB03). Significant contamination above the MCLs continues to exist near-surface and in the lower-yielding upper strata of aquifer. The concentrations in the upper WB03-UGR-01 zone increased significantly in September 2012, likely due to the ISCO injection into the AOC-65 trench performed in August 2012. In May-June 2013, a larger scale ISCO injection was performed and the levels in this upper zone remained elevated. In September-October 2014, an even larger ISCO injection was performed and the VOC concentrations showed a steep decline in some intervals of the aquifer by December 2014. From August-September 2015 a smaller injection was performed using permanganate and injecting into newly installed infiltration cells in the road west of Building 90. This in turn significantly increased concentration in the upper WB03-UGR-01 zone. In most cases throughout the post, VOC contamination in the main portion of aquifer remains at concentrations below the MCLs.
- Off-post wells OFR-3 and RFR-10 exceeded the MCL for PCE and/or TCE in 2015. Wells OFR-3, RFR-10, LS-5, LS-6, LS-7, and RFR-11, are equipped with a GAC filtration system and should remain on the quarterly sampling schedule in the future. The GAC filtration systems will continue to be maintained by CSSA.
- Former drinking water wells CS-9 and CS-11 were plugged and abandoned in August – September 2015. These wells were removed from the water system due to inorganic and microbial contamination problems addressed in previous reports.

- For future sampling events, off-post wells where no VOCs were detected will be sampled as needed, depending on historical detections, or during the 9-month 'snapshot' event.
- Analytical data indicates CS-MW16-CC remains at the low end of historical VOC contamination levels for this well. This data suggests nearly continuous pumping of CS-MW16-CC to the SWMU B-3 Bioreactor is having a positive impact on Cow Creek aquifer restoration and that BS aquitard between LGR and CC zones in the CS-MW16 vicinity is effective in mitigating further downward migration of contamination.
- **Figure 2.7** shows VOC concentrations in RFR-10 and OFR-3 are very sensitive to rainfall events while VOC concentrations in LS-5, LS-6, LS-7; and RFR-11 show less fluctuations after significant precipitation. This observation suggests RFR-10 and OFR-3 may be located along a fracture pattern that ties into the AOC-65 source area.

5.0 REFERENCES

CSSA 2002. *CSSA Quality Assurance Program Plan.*

CSSA 2002a. *Off-Post Monitoring Program and Response Plan.*

CSSA 2008. *CSSA Environmental Encyclopedia*, www.stanley.army.mil

Parsons 2001. *Offsite Well Survey Report*.

Parsons 2005. *Final Three-Tiered Long Term Monitoring Network Optimization Evaluation.*

Parsons 2006. *Final Data Quality Objectives for the Groundwater Monitoring Program.*

Parsons 2010. *2010 Update: Final Three-Tiered Long Term Monitoring Network Optimization Evaluation.*

Parsons 2010a. *Final Data Quality Objectives for the Groundwater Monitoring Program. Revised November 2010.*

Parsons 2010b. *Off-Post Well Survey Report*.

NOAA, National Weather Service Forecast, Monthly/Annual/Average Precipitation Boerne and San Antonio (KSAT), Texas (1986 - 2015), http://nowdata.rcc-acis.org/ewx/

APPENDIX A

ON- AND OFF-POST EVALUATION OF DATA QUALITY OBJECTIVES ATTAINMENT

Appendix A. On-Post 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, and HSP.	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 in 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 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 months with additional samples collected during the "snapshot" event. Selected zones from these wells were sampled in 2015.	Yes.	Continue sampling.

Activity	Objectives	Action	Objective Attained?	Recommendations
	Identify any temporal changes in hydraulic gradients due to seasonal influences (2.1.5).	Downloaded data from continuous-reading transducer in wells: CS-1, CS-10, CS-12, CS-MW1-LGR, CS-MW1-BS, CS-MW4-LGR, CS-MW16-LGR, CS-MW16-CC and CS-MW24-LGR. Data was also downloaded from the northern and southern continuous-reading weather stations B-3 WS and AOC-65 WS. Water levels will be graphed from selected wells against precipitation through 2015 and will be included in this annual groundwater report.	Yes.	Continue collection of transducer data and possibly install transducers in other cluster wells.
Contamination Characterization (Groundwater 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 44 of 48 CSSA wells. Of the 96 samples scheduled to be collected in 2015 93 samples were actually collected. Three samples were not collected due to the water levels falling below the dedicated pumps.	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 (COCs) 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.	Samples were analyzed for the selected VOCs using USEPA method SW8260B and metals (Cd, Cr, Pb, Hg). Drinking water wells were also sampled for additional metals (As, Ba, Cu, Zn). Analyses were conducted in accordance with the AFCEE QAPP and approved variances. All RLs were below MCLs, as listed below: **ANALYTE** / **RL (µg/L)** / **MCL (µg/L)** 1,1-DCE / 1.2 / 7 *cis*-1,2-DCE / 1.2 / 70 *trans*-1,2-DCE / 0.6 / 100 Vinyl Chloride / 1.1 / 2 PCE / 1.4 / 5 TCE / 1.0 / 5	Yes.	Continue sampling.

Activity	Objectives	Action	Objective Attained?	Recommendations
Contamination Characterization (Groundwater Contamination) (Continued)		**ANALYTE** **RL (µg/L)** **MCL (µg/L)** Arsenic 5 10 Barium 5 2000 Chromium 10 100 Copper 10 1300 Zinc 50 5000 (SS) Cadmium 1 5 Lead 5 15 (AL) Mercury 1 2		
	Meet AFCEE QAPP quality assurance requirements.	Samples were analyzed in accordance with the CSSA QAPP and approved variances. Parsons chemists verified all data and performed data validation according to the CSSA QAPP and approved variances.	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
		An 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.

Activity	Objectives	Action	Objective Attained?	Recommendations
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 A Off-Post 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, and HSP.	All sampling was conducted in accordance with the procedures described in the project plans.	Yes	NA
Contamination Characterization (Groundwater Contamination)	Determine the potential extent of off-post contamination (§2.3.1 of the DQOs for the Groundwater Contamination Investigation, revised November 2010).	Samples for laboratory analysis were collected from selected off-post public and private wells, which are located within a ½ mile radius of CSSA. Also, selected wells outside the ½ mile radius were sampled at the request of the EPA.	Partially	Replace wells where no VOCs were detected with wells that may be identified in the future, located to the west and southwest of AOC-65 to provide better definition of plume 2. Continue sampling of wells to the west of plume 1 (Fair Oaks and Jackson Woods) to confirm any detections possibly related to plume 1.
	Meet CSSA QAPP quality assurance requirements.	Samples were analyzed in accordance with the CSSA QAPP and approved variances. Parsons chemists verified all data and performed data validation according to the CSSA QAPP and approved variances.	Yes	NA
		All data flagged with a "U", "M", and "J" are usable for characterizing contamination.	Yes	NA

Activity	Objectives	Action	Objective Attained?	Recommendations
	Evaluate CSSA monitoring program and expand as necessary (§2.3.1 of the DQOs for the Groundwater Contamination Investigation, revised November 2010). Determine locations of future monitoring locations.	Evaluation of data collected is ongoing and is reported in this annual groundwater report and will be reported in future quarterly groundwater reports. Additional information covering the CSSA monitoring program is available in Volume 5, CSSA Environmental Encyclopedia.	Yes	Continue data evaluation and quarterly teleconferences for evaluation of the monitoring program. Each teleconference/planning session covers expansion of the quarterly monitoring program, if necessary.
Project schedule/ Reporting	The quarterly monitoring project schedule shall provide a schedule for sampling, analysis, validation, verification, reviews, and reports for monitoring events off-post.	A schedule for sampling, analysis, validation, verification, data review and reports is provided in this annual groundwater report and will be reported in future quarterly groundwater reports. Additional information covering the CSSA monitoring program is available in Volume 5, CSSA Environmental Encyclopedia.	Yes	Continue quarterly and annual reporting to include a schedule for sampling, analysis, validation, verification, data review and data reports.

Activity	Objectives	Action	Objective Attained?	Recommendations
Remediation	Evaluate the effectiveness of GACs (§3.2.3) and install as needed (§3.2.5 both of the DQOs for the Groundwater Contamination Investigation, revised November 2010).	Perform maintenance as needed. Install new GACs as needed.	Yes	Maintenance to the off-post GAC systems to be continued by Parsons' personnel approximately every 3 weeks. Semi annual (or as needed) maintenance to the off-post GAC systems by additional subcontractors to continue. Evaluations of future sampling results for installation of new GAC systems will occur as needed.

APPENDIX B

2015 QUARTERLY ON-POST GROUNDWATER ANALYTICAL RESULTS

Appendix B
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
	6/8/2015	0.12U	**46.36**	**0.81**	**35.77**	**36.16**	0.08U
	12/7/2015	0.12U	**33.28**	**0.69**	**24.31**	**28.00**	0.08U
CS-MW1-CC	12/7/2015	0.12U	0.07U	0.08U	**0.10F**	0.05U	0.08U
CS-MW2-LGR	3/10/2015	0.12U	**0.50F**	0.08U	0.06U	0.05U	0.08U
	6/8/2015	0.12U	**0.54F**	0.08U	0.06U	0.05U	0.08U
	12/8/2015	0.12U	**0.37F**	0.08U	0.06U	0.05U	0.08U
CS-MW2-CC	12/8/2015	0.12U	0.07U	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
	12/8/2015	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
	12/8/2015	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
	2/3/2016	0.12U	**16.12**	**0.43F**	**7.68**	**17.93**	0.08U
CS-MW6-LGR	3/10/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/9/2015	0.12U	0.07U	0.08U	**0.26F**	0.05U	0.08U
CS-MW6-CC	12/9/2015	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
	12/9/2015	0.12U	0.07U	0.08U	**0.81F**	0.05U	0.08U
CS-MW7-CC	12/9/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
CS-MW8-LGR	3/10/2015	0.12U	0.07U	0.08U	**3.38**	0.05U	0.08U
	6/10/2015	0.12U	0.07U	0.08U	**2.44**	0.05U	0.08U
	12/9/2015	0.12U	0.07U	0.08U	**2.74**	0.05U	0.08U
CS-MW8-CC	12/9/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	12/9/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
CS-MW9-LGR	3/13/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/15/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
CS-MW9-CC	12/15/2015	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
	6/9/2015	0.12U	0.07U	0.08U	**1.86**	**0.44F**	0.08U
	12/10/2015	0.12U	0.07U	0.08U	**2.02**	**0.43F**	0.08U
CS-MW10-CC	12/9/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
CS-MW11A-LGR	3/11/2015	0.12U	0.07U	0.08U	**0.84F**	0.05U	0.08U
	6/9/2015	0.12U	0.07U	0.08U	**0.96F**	0.05U	0.08U
	12/10/2015	0.12U	0.07U	0.08U	**0.81F**	0.05U	0.08U
CS-MW11B-LGR	12/14/2015	0.12U	0.07U	0.08U	**1.12F**	0.05U	0.08U
CS-MW12-LGR	3/12/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/14/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
CS-MW12-CC	12/14/2015	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
	12/16/2015	0.12U	**110.97**	**0.62**	**83.2**	**114.21**	0.08U
Duplicate	12/16/2015	0.12U	**111.87**	**0.48F**	**85.07**	**113.04**	0.08U
CS-MW16-CC	3/13/2015	0.12U	**14.77**	**6.57**	**0.15F**	**5.16**	0.08U
	12/16/2015	0.12U	**15.9**	**6.68**	0.06U	**4.27**	0.08U
CS-MW17-LGR	3/18/2015	0.12U	0.07U	0.08U	**0.30F**	0.05U	0.08U
Duplicate	3/18/2015	0.12U	0.07U	0.08U	**0.38F**	0.05U	0.08U
	12/16/2015	0.12U	**0.39F**	0.08U	**0.66F**	0.05U	0.08U
CS-MW18-LGR	3/18/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/14/2015	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
	12/14/2015	0.12U	0.07U	0.08U	**0.67F**	0.05U	0.08U
Duplicate	12/14/2015	0.12U	0.07U	0.08U	**0.65F**	0.05U	0.08U
CS-MW20-LGR	3/17/2015	0.12U	0.07U	0.08U	**1.29F**	0.05U	0.08U
	12/17/2015	0.12U	**0.32F**	0.08U	**1.55**	0.05U	0.08U
CS-MW21-LGR	3/13/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/17/2015	0.12U	**0.25F**	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

Appendix B
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
	12/18/2015	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
	12/14/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U

Appendix B
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
	6/8/2015	NA	NA	0.0005U	**0.0012F**	NA	0.0019U	NA	0.0001U
	12/7/2015	NA	NA	0.0005U	**0.0014F**	NA	0.0019U	NA	0.0001U
CS-MW1-CC	12/7/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	0.0001U
CS-MW2-LGR	3/10/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	0.0001U
	6/8/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	0.0001U
	12/8/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	0.0001U
CS-MW2-CC	12/8/2015	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
	12/8/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	0.0001U
CS-MW4-LGR	3/10/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	0.0001U
	12/8/2015	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
	12/17/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	0.0001U
CS-MW6-LGR	3/10/2015	NA	NA	0.0005U	**0.0016F**	NA	0.0019U	NA	0.0001U
	12/9/2015	NA	NA	0.0005U	**0.0011F**	NA	0.0019U	NA	0.0001U
CS-MW6-CC	12/9/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	0.0001U
CS-MW7-LGR	3/10/2015	NA	NA	0.0005U	**0.0024F**	NA	0.0019U	NA	0.0001U
	12/9/2015	NA	NA	0.0005U	**0.0014F**	NA	0.0019U	NA	0.0001U
CS-MW7-CC	12/9/2015	NA	NA	0.0005U	0.001U	NA	0.0019U	NA	0.0001U
CS-MW8-LGR	3/10/2015	NA	NA	0.0005U	**0.0021F**	NA	0.0019U	NA	0.0001U
	6/10/2015	NA	NA	0.0005U	0.001U	NA	0.0019U	NA	0.0001U
	12/9/2015	NA	NA	0.0005U	**0.0011F**	NA	0.0019U	NA	0.0001U
CS-MW8-CC	12/9/2015	NA	NA	0.0005U	**0.0015F**	NA	0.0019U	NA	0.0001U
Duplicate	12/9/2015	NA	NA	0.0005U	**0.0012F**	NA	0.0019U	NA	0.0001U
CS-MW9-LGR	3/13/2015	NA	NA	0.0005U	**0.0042F**	NA	0.0019U	NA	0.0001U
	12/15/2015	NA	NA	0.0005U	0.0010U	NA	**0.0021F**	NA	0.0001U
CS-MW9-CC	12/15/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	0.0001U
CS-MW10-LGR	3/11/2015	NA	NA	0.0005U	**0.0035F**	NA	0.0019U	NA	0.0001U
	6/9/2015	NA	NA	0.0005U	**0.0013F**	NA	0.0019U	NA	0.0001U
	12/10/2015	NA	NA	0.0005U	**0.0018F**	NA	0.0019U	NA	0.0001U
CS-MW10-CC	12/9/2015	NA	NA	0.0005U	0.001U	NA	0.0019U	NA	0.0001U
CS-MW11A-LGR	3/11/2015	NA	NA	0.0005U	**0.0020F**	NA	0.0019U	NA	0.0001U
	6/9/2015	NA	NA	0.0005U	0.001U	NA	0.0019U	NA	0.0001U
	12/10/2015	NA	NA	0.0005U	0.001U	NA	0.0019U	NA	0.0001U
CS-MW11B-LGR	12/14/2015	NA	NA	0.0005U	**0.0166**	NA	**0.0025F**	NA	0.0001U
CS-MW12-LGR	3/12/2015	NA	NA	0.0005U	**0.0018F**	NA	0.0019U	NA	0.0001U
	12/14/2015	NA	NA	0.0005U	**0.0011F**	NA	**0.0025F**	NA	0.0001U
CS-MW12-CC	12/14/2015	NA	NA	0.0005U	0.0010U	NA	**0.0035F**	NA	0.0001U
CS-MW16-LGR	3/13/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	**0.0002F**
	12/16/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	0.0001U
Duplicate	12/16/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	0.0001U
CS-MW16-CC	3/13/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	0.0001U
	12/16/2015	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
Duplicate	3/18/2015	NA	NA	0.0005U	**0.0084F**	NA	0.0019U	NA	0.0001U
	12/16/2015	NA	NA	0.0005U	**0.0014F**	NA	0.0019U	NA	0.0001U
CS-MW18-LGR	3/18/2015	NA	NA	0.0005U	**0.0017F**	NA	0.0019U	NA	0.0001U
	12/14/2015	NA	NA	0.0005U	0.0010U	NA	**0.0042F**	NA	0.0001U
CS-MW19-LGR	3/12/2015	NA	NA	0.0005U	**0.0023F**	NA	0.0019U	NA	0.0001U
	12/14/2015	NA	NA	0.0005U	**0.0014F**	NA	**0.0024F**	NA	0.0001U
Duplicate	12/14/2015	NA	NA	0.0005U	**0.0014F**	NA	0.0019U	NA	0.0001U
CS-MW20-LGR	3/17/2015	NA	NA	0.0005U	**0.0021F**	NA	0.0019U	NA	0.0001U
	12/17/2015	NA	NA	0.0005U	**0.0018F**	NA	0.0019U	NA	0.0001U
CS-MW21-LGR	3/13/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	**0.0002F**
	12/17/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	0.0001U
CS-MW22-LGR	3/17/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	0.0001U
	12/18/2015	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
	12/14/2015	NA	NA	0.0005U	0.0010U	NA	**0.0022F**	NA	0.0001U
CS-MW24-LGR	3/13/2015	NA	NA	0.0005U	**0.0043F**	NA	0.0019U	NA	0.0001U
	6/8/2015	NA	NA	0.0005U	0.001U	NA	0.0019U	NA	0.0001U
	12/14/2015	NA	NA	0.0005U	0.001U	NA	**0.0033F**	NA	0.0001U

Appendix B
2015 Quarterly On-Post Groundwater Monitoring Analytical Results

CS-MW25-LGR	3/13/2015	NA	NA	0.0005U	**0.0012F**	NA	0.0019U	NA	0.0001U
Duplicate	3/13/2015	NA	NA	0.0005U	**0.0012F**	NA	0.0019U	NA	0.0001U
	12/16/2015	NA	NA	0.0005U	**0.0015F**	NA	0.0019U	NA	0.0001U
CS-MW35-LGR	3/18/2015	NA	NA	0.0005U	0.0010U	NA	0.0019U	NA	0.0001U
	6/9/2015	NA	NA	0.0005U	0.001U	NA	0.0019U	NA	0.0001U
	12/14/2015	NA	NA	0.0005U	**0.0011F**	NA	0.0019U	NA	0.0001U
CS-MW36-LGR	3/10/2015	NA	NA	0.0005U	**0.0016F**	NA	0.0019U	NA	0.0001U
	6/10/2015	NA	NA	0.0005U	0.001U	NA	0.0019U	NA	0.0001U
	9/11/2015	NA	NA	0.0005U	**0.0126**	NA	0.0019U	NA	0.0001U
	12/9/2015	NA	NA	0.0005U	**0.0043F**	NA	0.0019U	NA	0.0001U
CS-D	6/8/2015	NA	NA	0.0005U	0.001U	NA	0.0019U	NA	0.0001U
	12/17/2015	NA	NA	0.0005U	0.001U	NA	0.0019U	NA	0.0001U
CS-2	3/17/2015	NA	NA	0.0005U	**0.0019F**	NA	0.0019U	NA	0.0001U
	12/14/2015	NA	NA	0.0005U	0.001U	NA	0.0019U	NA	0.0001U
CS-4	6/10/2015	NA	NA	0.0005U	0.001U	NA	0.0019U	NA	0.0001U
	12/14/2015	NA	NA	0.0005U	0.001U	NA	**0.0023F**	NA	0.0001U
CS-MWG-LGR	12/16/2015	NA	NA	0.0005U	0.001U	NA	0.0019U	NA	0.0001U
CS-MWH-LGR	12/16/2015	NA	NA	0.0005U	0.001U	NA	0.0019U	NA	0.0001U
CS-I	12/16/2015	NA	NA	0.0005U	0.001U	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
Duplicate	3/9/2015	0.0002U	**0.0358**	0.0005U	**0.0012F**	**0.008F**	0.0019U	**0.218**	0.0001U
	6/11/2015	**0.00167F**	**0.038**	0.0005U	0.001U	**0.009F**	0.0019U	**0.235**	0.001U
	9/15/2015	**0.0008F**	**0.0324**	0.0005U	0.0010U	0.003U	0.0019U	**0.148**	0.0001U
	12/18/2015	**0.00260F**	**0.0334**	0.0005U	0.0010U	0.003U	0.0019U	**0.197**	0.0001U
CS-10	3/9/2015	**0.0016F**	**0.0392**	0.0005U	0.0010U	**0.014**	0.0019U	**0.051**	0.0001U
	6/15/2015	**0.00172F**	**0.0396**	0.0005U	**0.0014F**	**0.008F**	0.0019U	**0.063**	0.001U
Duplicate	6/16/2015	**0.00135F**	**0.0379**	0.0005U	0.001U	**0.008F**	0.0019U	**0.056**	0.001U
	9/15/2015	**0.0008F**	**0.037**	0.0005U	0.0010U	**0.005F**	0.0019U	**0.062**	0.0001U
	12/18/2015	**0.00203F**	**0.035**	0.0005U	0.0010U	**0.005F**	0.0019U	**0.032F**	0.0001U
Duplicate	12/18/2015	**0.00218F**	**0.0365**	0.0005U	0.0010U	**0.004F**	0.0019U	**0.034F**	0.0001U
CS-12	3/9/2015	0.0002U	**0.0312**	0.0005U	**0.0012F**	0.003U	0.0019U	**0.072**	0.0001U
	6/15/2015	**0.00199F**	**0.0298**	0.0005U	0.001U	**0.006F**	0.0019U	**0.077**	0.001U
	9/15/2015	0.0002U	**0.0282**	0.0005U	0.0010U	**0.096**	0.0019U	**0.126**	0.0001U
	12/18/2015	**0.0026F**	**0.0292**	0.0005U	0.0010U	**0.007F**	0.0019U	**0.090**	0.0001U
CS-13	3/9/2015	**0.0029F**	**0.0294**	0.0005U	0.0010U	0.003U	0.0019U	**0.252**	0.0001U
	6/15/2015	**0.0029F**	**0.0304**	0.0005U	0.001U	**0.004F**	0.0019U	**0.522**	0.001U
	9/14/2015	**0.0058F**	**0.0272**	0.0005U	**0.0011F**	**0.013**	0.0019U	**0.232**	0.0001U
Duplicate	9/14/2015	**0.0044F**	**0.0274**	0.0005U	**0.0011F**	**0.009F**	0.0019U	**0.242**	0.0001U
	12/18/2015	**0.0028F**	**0.0282**	0.0005U	**0.0011F**	**0.007F**	0.0019U	**0.300**	0.0001U

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

All samples were analyzed by APPL, Inc. using laboratory method SW8260B.
VOC data reported in µg/L & metals data reported in mg/L.

Abbreviations/Notes:

mS	millisiemans
µg/L	micrograms per liter
mg/L	milligrams per liter
deg. C	degrees Celsius
Duplicate	Field Duplicate
AL	Action Level
SS	Secondary Standard

Data Qualifiers:

F-The analyte was positively identified but the associated numerical value is below the RL.
M = There was possible interference from the sample itself, the M flagged result is usable and defensible.
U-The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.

APPENDIX C

2015 WESTBAY® ANALYTICAL RESULTS

Appendix C
2015 Westbay® Analytical Results

Well ID	Date Sampled	(1,1-dichloroethene)	cis-1,2-DCE (cis-1,2-dichloroethene)	TCE (trichloroethene)	PCE (tetrachloroethene)	trans-1,2-DCE (trans-1,2-dichloroethene)	Vinyl Chloride
CS-WB01-LGR-01	9/16/2015	<0.12	<0.07	**0.26F**	**1.30F**	<0.08	<0.08
CS-WB01-LGR-02	9/16/2015	<0.12	<0.07	**2.26**	**11.09**	<0.08	<0.08
CS-WB01-LGR-03	9/16/2015	<0.12	<0.07	**8.37**	**2.87**	<0.08	<0.08
CS-WB01-LGR-04	9/16/2015	<0.12	**0.61F**	<0.05	<0.06	<0.08	<0.08
CS-WB01-LGR-05	9/16/2015	<0.12	**0.24F**	**0.88F**	<0.06	<0.08	<0.08
CS-WB01-LGR-06	9/16/2015	<0.12	**0.92F**	**1.58**	<0.06	<0.08	<0.08
CS-WB01-LGR-07	9/16/2015	<0.12	**5.23**	**13.68**	**14.83**	<0.08	<0.08
CS-WB01-LGR-08	9/16/2015	<0.12	**8.57**	**7.86**	**0.68F**	**0.31F**	<0.08
CS-WB01-LGR-09	3/23/2015	<0.12	**0.35F**	**8.67**	**6.54**	<0.08	**0.28F**
	9/16/2015	<0.12	**0.60F**	**14.37**	**12.41**	<0.08	<0.08
	12/2/2015	<0.12	**0.58F**	**19.05**	**16.96**	<0.08	<0.08
CS-WB02-LGR-03	9/23/2015	<0.12	<0.07	**0.26F**	**2.47**	<0.08	<0.08
CS-WB02-LGR-04	9/23/2015	<0.12	<0.07	**5.74**	**3.38**	<0.08	<0.08
CS-WB02-LGR-05	9/23/2015	<0.12	**0.17F**	**1.84**	**0.79F**	<0.08	<0.08
CS-WB02-LGR-06	9/23/2015	<0.12	**0.43F**	**2.39**	**4.61**	**0.23F**	<0.08
CS-WB02-LGR-07	9/23/2015	<0.12	**0.29F**	**1.22**	**0.34F**	<0.08	<0.08
CS-WB02-LGR-08	9/23/2015	<0.12	**2.45**	**0.54F**	<0.06	**0.39F**	<0.08
CS-WB02-LGR-09	3/23/2015	<0.12	**0.21F**	**8.03**	**7.93**	<0.08	<0.08
	9/23/2015	<0.12	**0.20F**	**7.31**	**9.43**	<0.08	<0.08
	12/2/2015	<0.12	**0.18F**	**11.24**	**14.18**	<0.08	<0.08
CS-WB03-UGR-01	9/21/2015	<12.0**	**21.70F****	**216.25****	**23737.01*****	<8.0**	<8.0**
CS-WB03-LGR-01	9/21/2015	<0.12	**0.85F**	**26.33**	**621.09***	<0.08	<0.08
CS-WB03-LGR-03	9/21/2015	<0.12	<0.07	**1.96**	**7.28**	<0.08	<0.08
CS-WB03-LGR-04	9/21/2015	<0.12	<0.07	**5.67**	**18.61**	<0.08	<0.08
CS-WB03-LGR-05	9/21/2015	<0.12	<0.07	**2.44**	**16.74**	<0.08	<0.08
CS-WB03-LGR-06	9/21/2015	<0.12	**5.53**	<0.05	<0.06	<0.08	<0.08
CS-WB03-LGR-07	9/21/2015	<0.12	**2.6**	**5.43**	**1.71**	<0.08	<0.08
CS-WB03-LGR-08	9/21/2015	<0.12	**2.4**	**0.39F**	<0.06	<0.08	<0.08
CS-WB03-LGR-09	3/24/2015	<0.12	**1.75**	**1.2**	**0.75F**	<0.08	<0.08
	9/17/2015	<0.12	**0.49F**	**4.39**	**4.61**	<0.08	<0.08
	12/2/2015	<0.12	**0.20F**	**3.84**	**3.25**	<0.08	<0.08
CS-WB04-LGR-01	9/22/2015	<0.12	<0.07	<0.05	**1.67**	<0.08	<0.08
CS-WB04-LGR-03	9/22/2015	<0.12	<0.07	<0.05	**0.34F**	<0.08	<0.08
CS-WB04-LGR-04	9/22/2015	<0.12	**0.27F**	**0.16F**	**0.40F**	<0.08	<0.08
CS-WB04-LGR-06	3/24/2015	<0.12	**3.63**	**12.79**	**55.08**	**0.40F**	<0.08
	9/22/2015	<0.12	**5.1**	**12.09**	**16.68**	**0.25F**	<0.08
	12/3/2015	<0.12	**3.32**	**11.62**	**36.28**	**0.30F**	<0.08
CS-WB04-LGR-07	3/24/2015	<0.12	**3.21**	**10.85**	**35.6**	**0.26F**	<0.08
	9/22/2015	<0.12	**35.47**	**13.03**	**2.01**	**0.25F**	<0.08
	12/3/2015	<0.12	**22**	**20.36**	**2.72**	**0.29F**	<0.08
CS-WB04-LGR-08	9/22/2015	<0.12	**0.47F**	**0.75F**	**0.82F**	<0.08	<0.08
CS-WB04-LGR-09	3/24/2015	<0.12	**0.14F**	**10.44**	**15.58**	<0.08	<0.08
	9/22/2015	<0.12	<0.07	**6.33**	**10.03**	<0.08	<0.08
	12/3/2015	<0.12	**0.08F**	**7.94**	**11.64**	<0.08	<0.08
CS-WB04-LGR-10	3/24/2015	<0.12	<0.07	**0.54F**	**7.47**	<0.08	<0.08
	9/22/2015	<0.12	<0.07	**0.59F**	**2.2**	<0.08	<0.08
	12/3/2015	<0.12	<0.07	**0.53F**	**2.37**	<0.08	<0.08
CS-WB04-LGR-11	3/24/2015	<0.12	<0.07	**2.7**	**444.82***	<0.08	<0.08
	9/22/2015	<0.12	<0.07	<0.05	**1.5**	<0.08	<0.08
	12/3/2015	<0.12	<0.07	**0.12F**	**22.11**	<0.08	<0.08
CS-WB04-BS-01	9/22/2015	<0.12	<0.07	<0.05	**0.46F**	<0.08	<0.08
CS-WB04-BS-02	9/22/2015	<0.12	<0.07	<0.05	**0.94F**	<0.08	<0.08
CS-WB04-CC-01	9/22/2015	<0.12	**1.02F**	<0.05	**0.84F**	<0.08	<0.08
CS-WB04-CC-02	9/22/2015	<0.12	**0.21F**	<0.05	**1.29F**	<0.08	<0.08
CS-WB04-CC-03	9/22/2015	<0.12	**0.17F**	<0.05	**6.66**	<0.08	<0.08

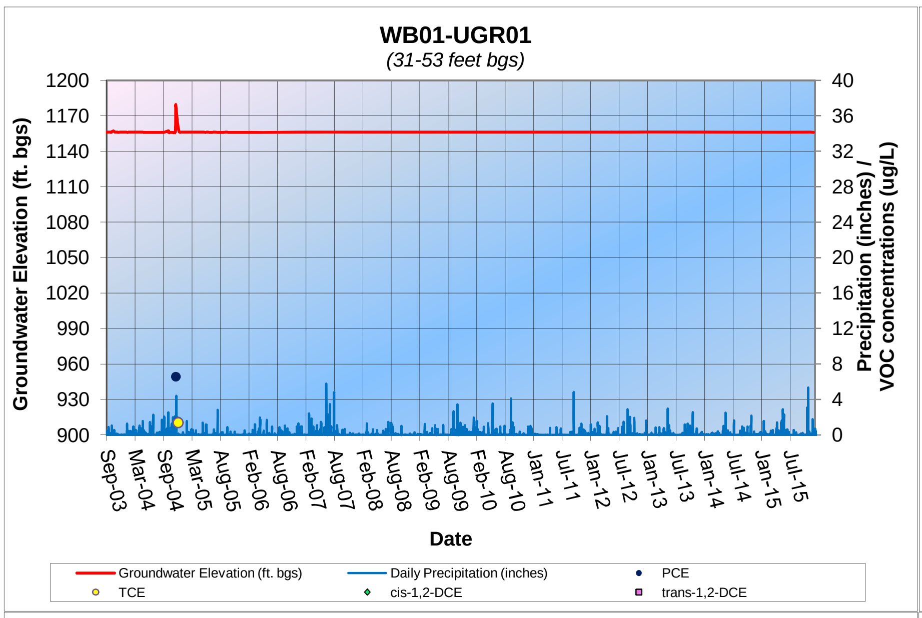
Data Qualifiers
F-The analyte was positively identified but the associated numerical value is below the RL.
* The analyte was run at a dilution of 10.
** The analyte was run at a dilution of 100.
*** The analyte was run at a dilution of 500.
All values are reported in µg/L.

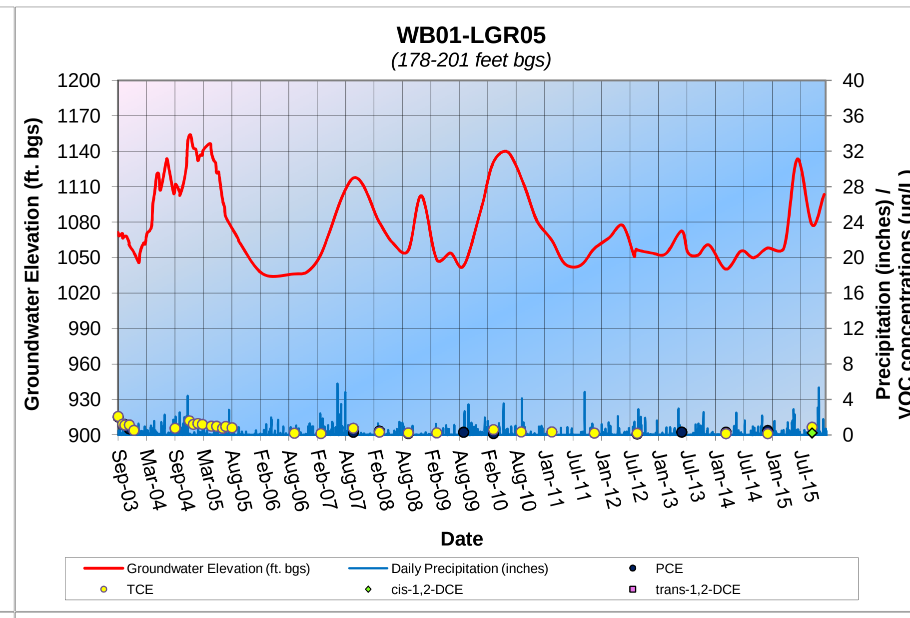
BOLD (white)	≥ MDL
BOLD (blue)	≥ RL
BOLD (red)	≥ MCL

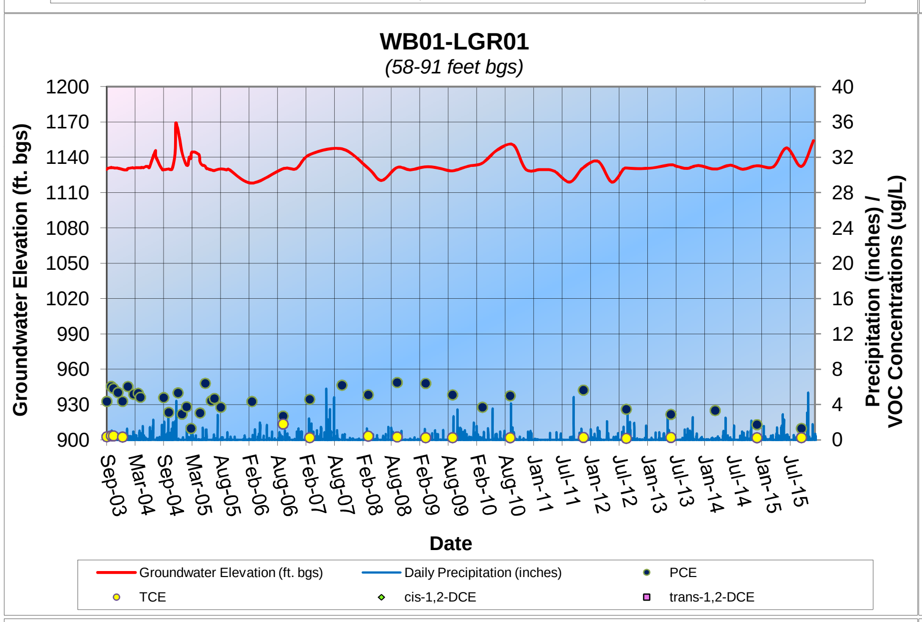
APPENDIX D

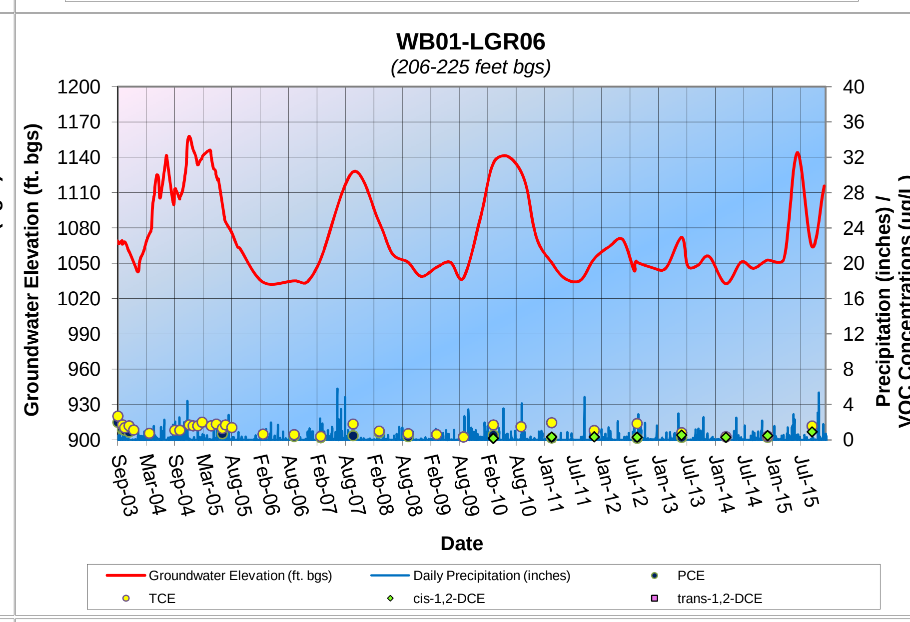
CUMULATIVE WESTBAY® ANALYTICAL GRAPHS

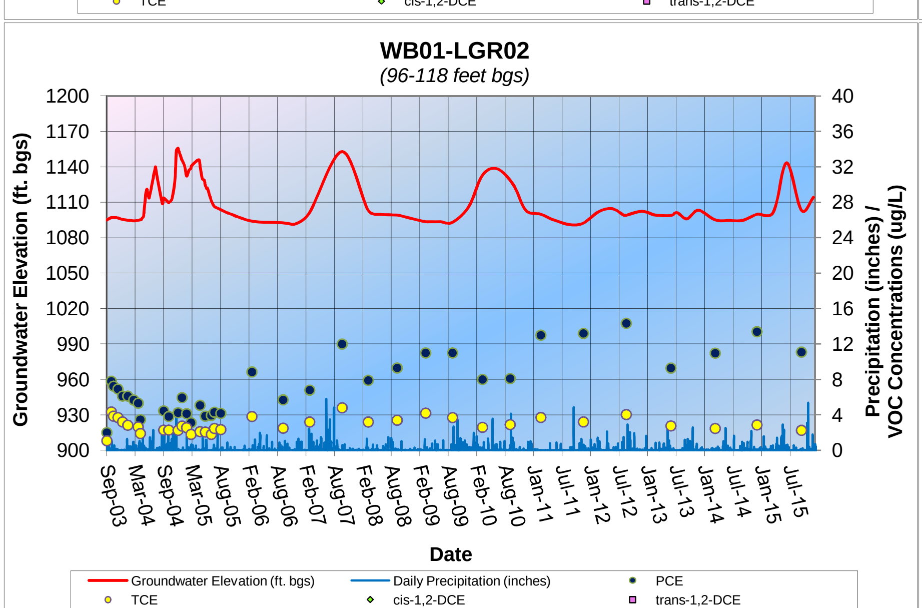
Appendix D.1 - CS-WB01 Culmulative VOC Concentrations, Groundwater Level, and Precipitation

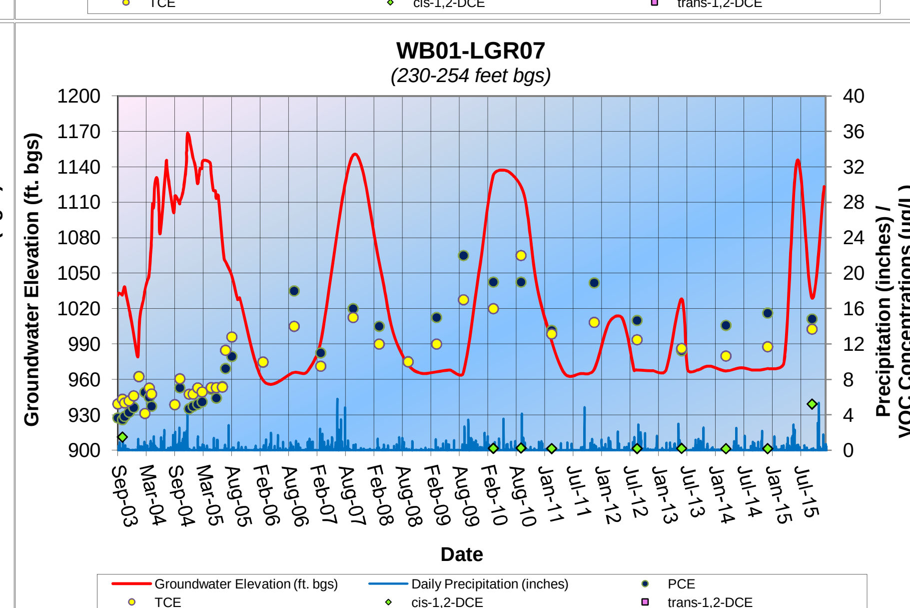


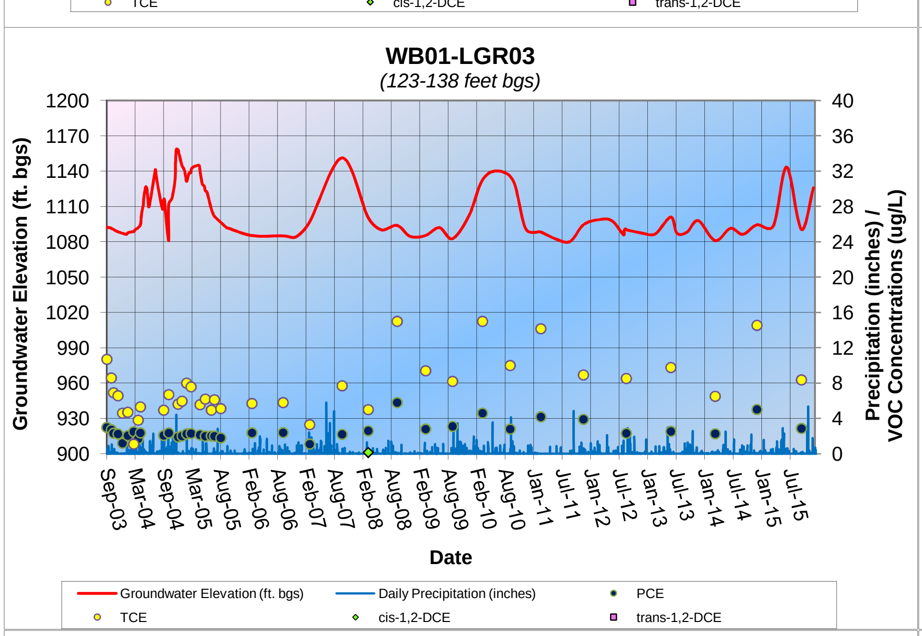


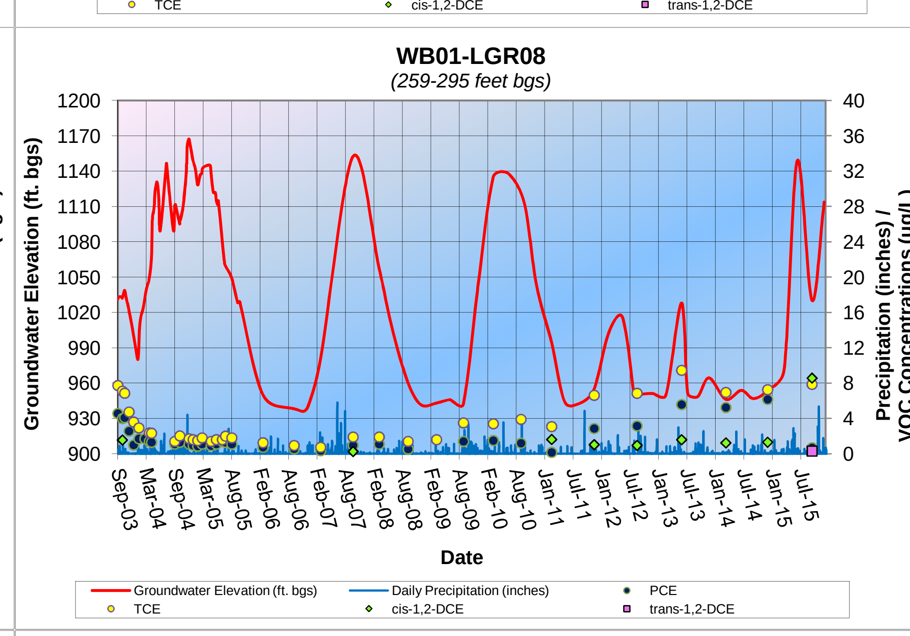


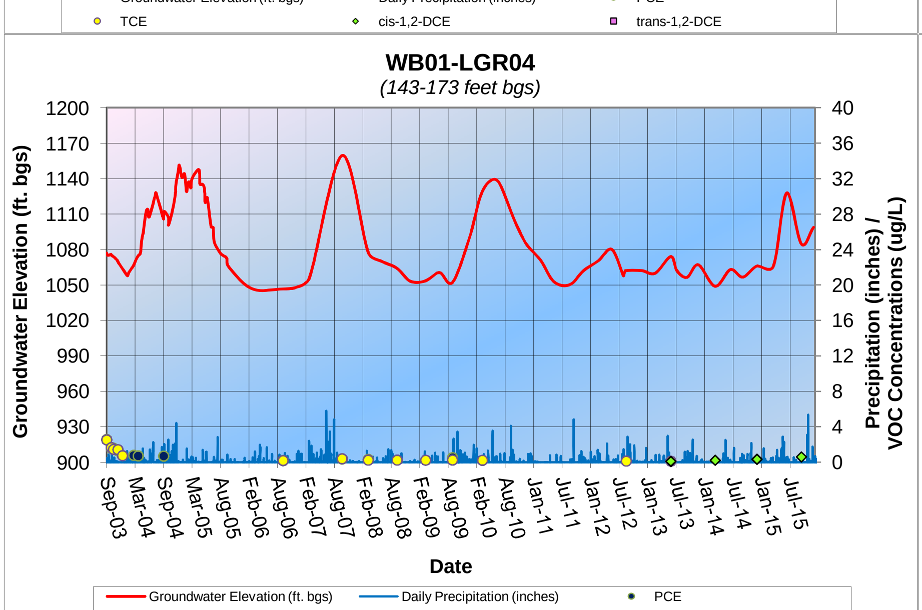


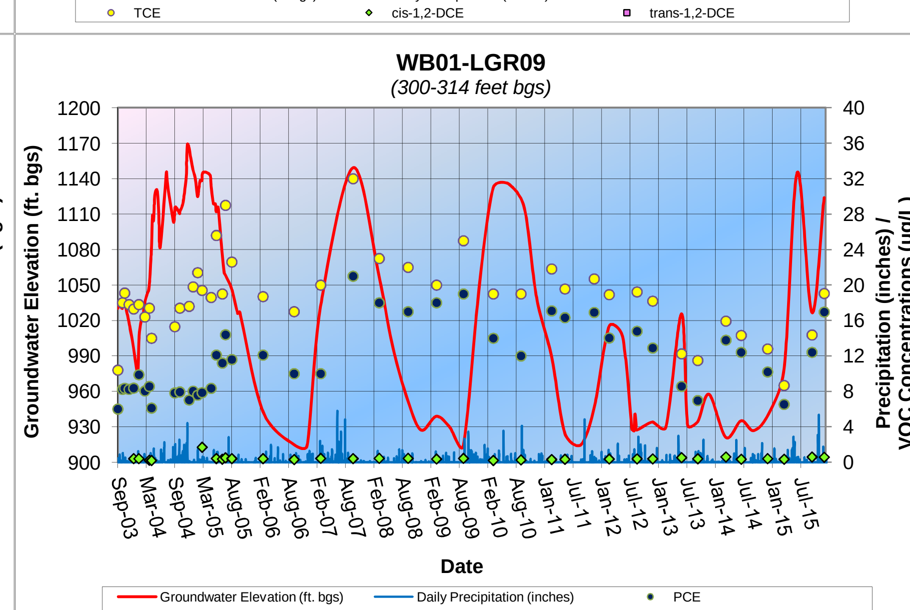




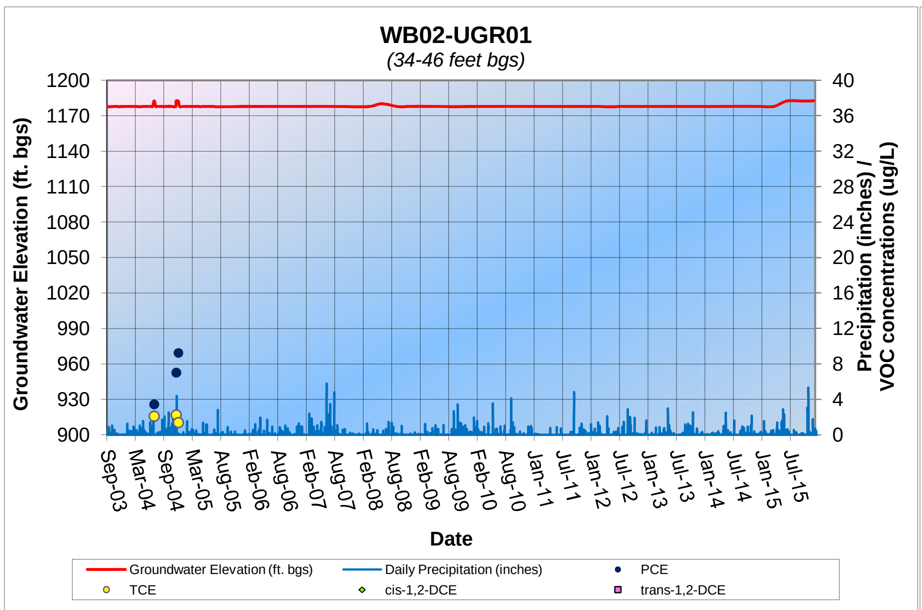


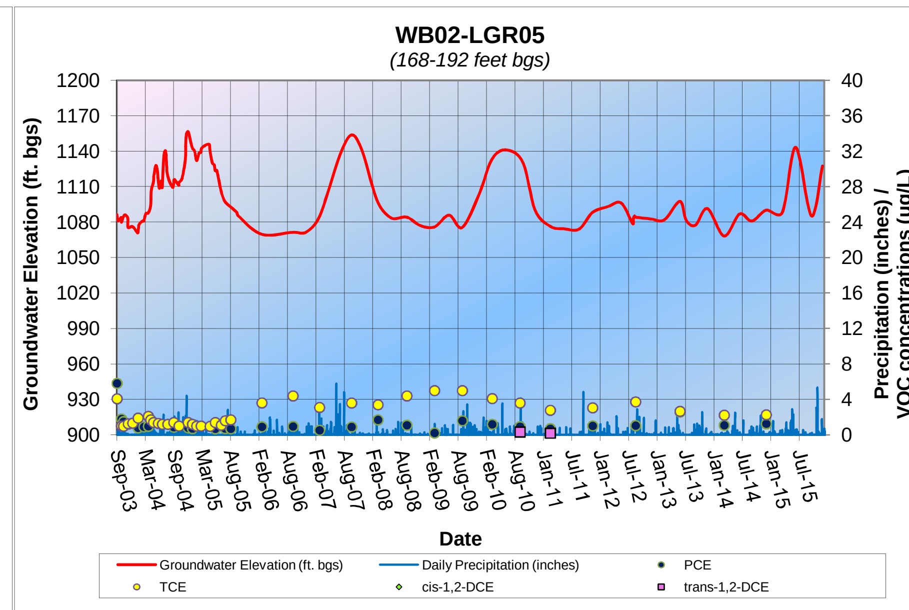


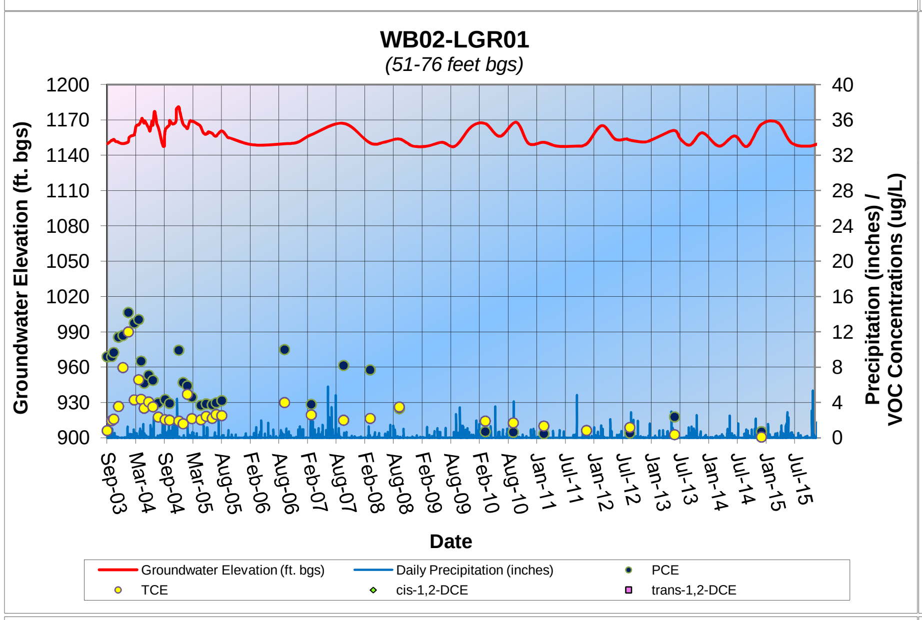


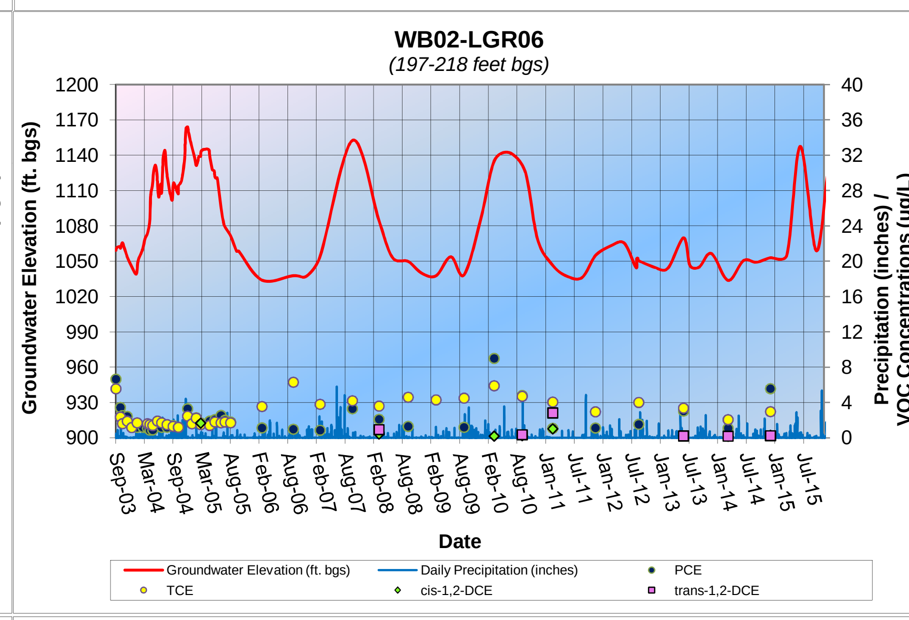


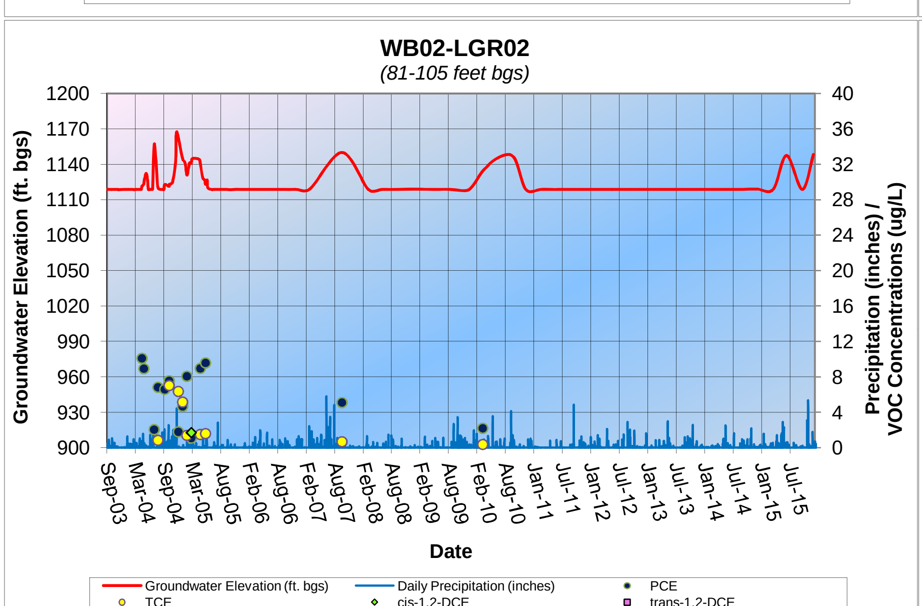
Appendix D.2 - CS-WB02 Culmulative VOC Concentrations, Groundwater Level, and Precipitation

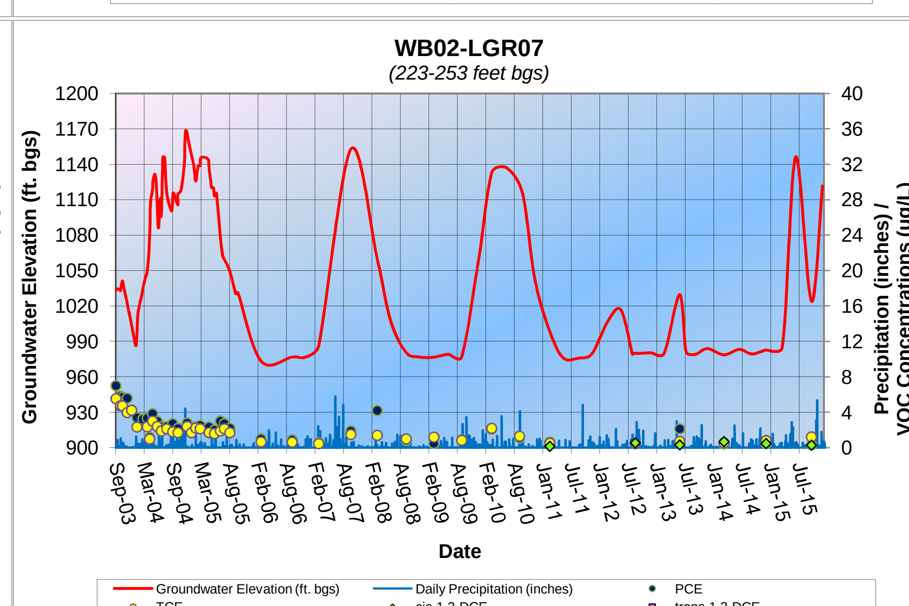


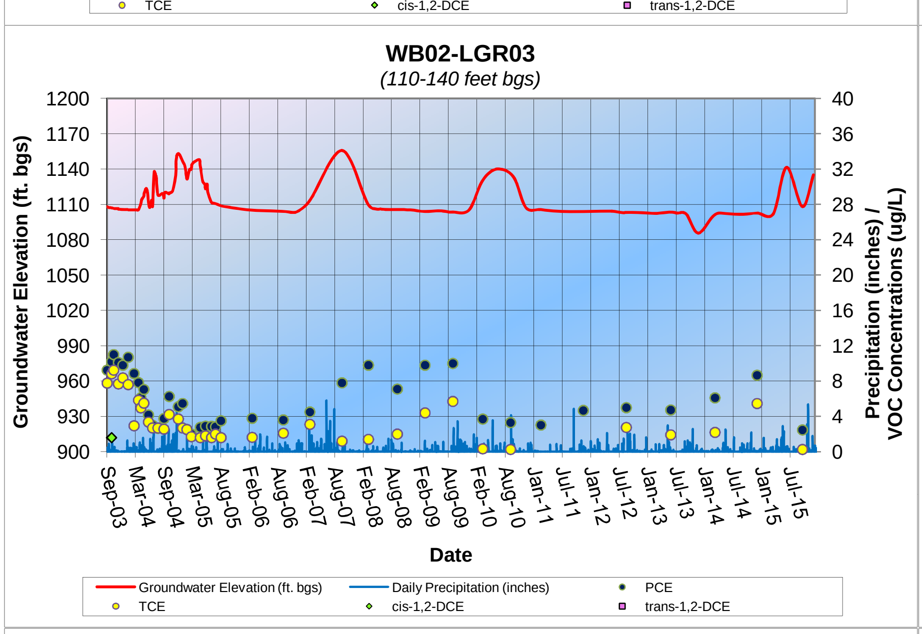


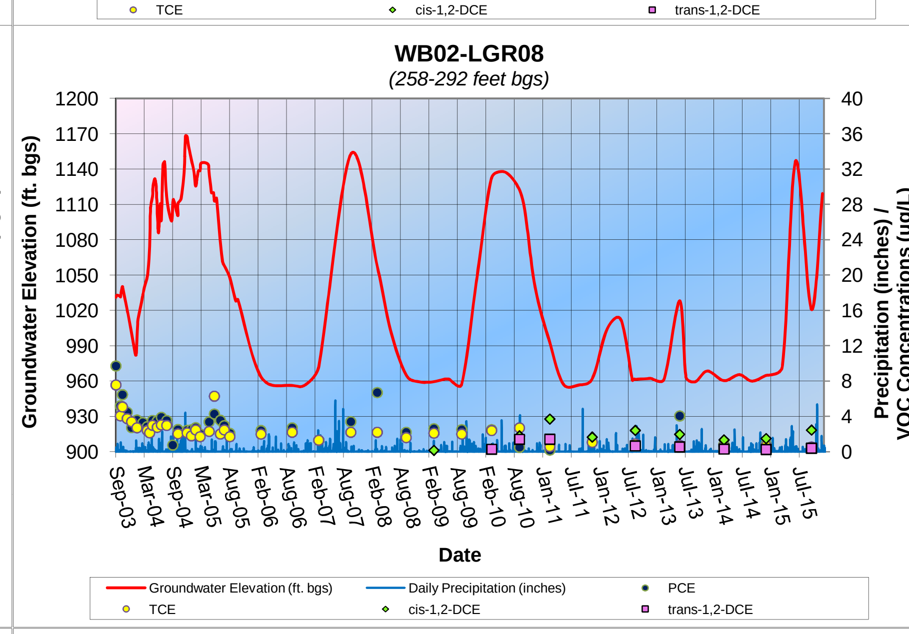


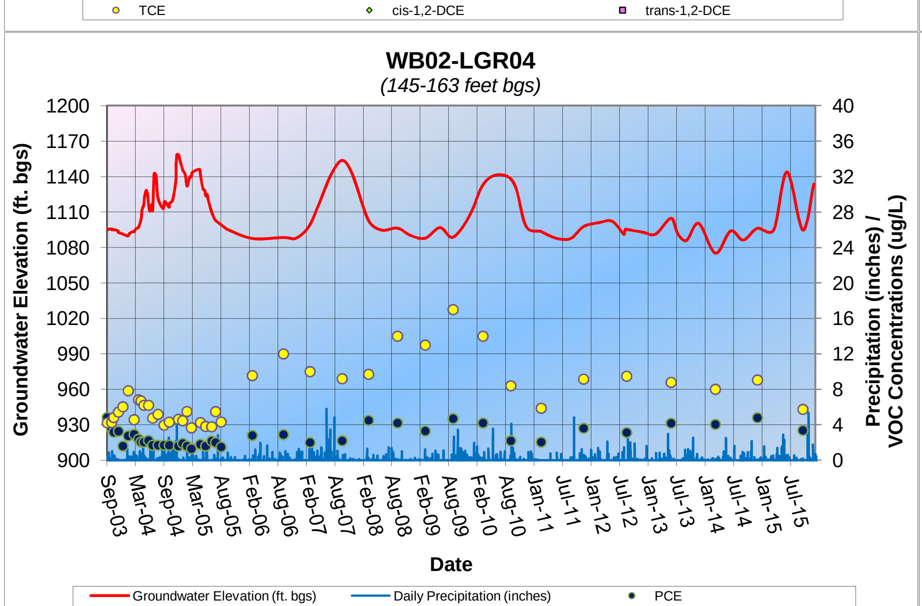


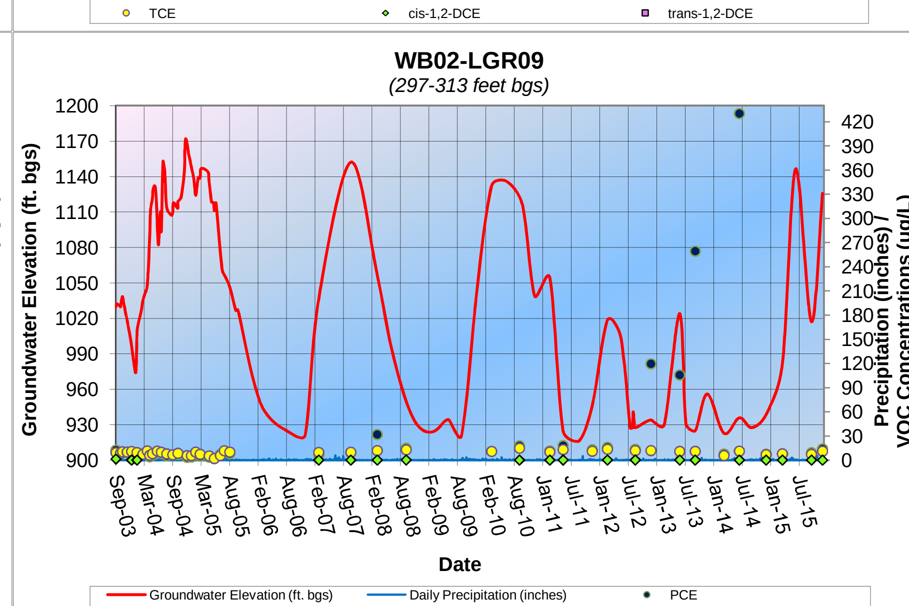




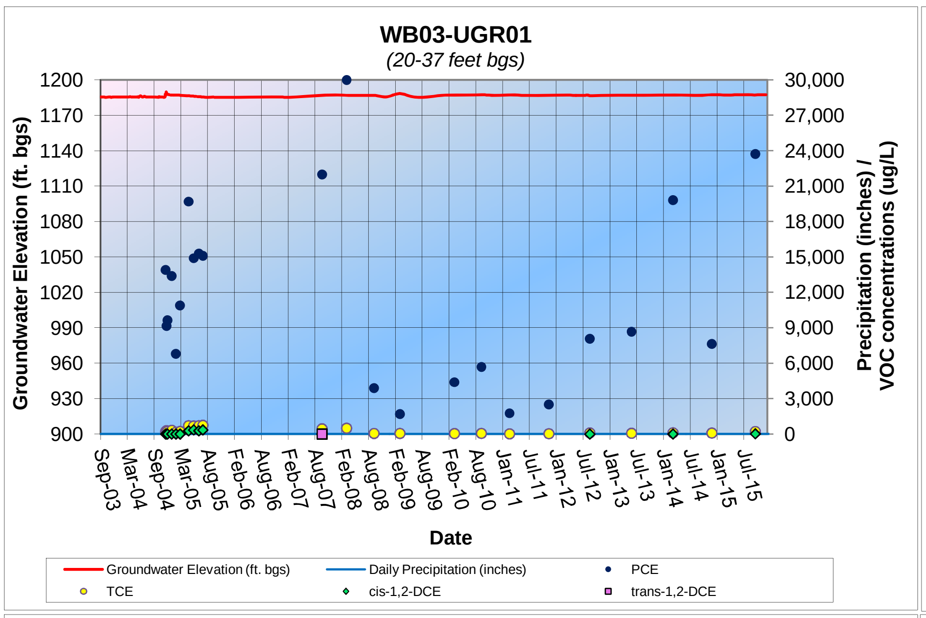


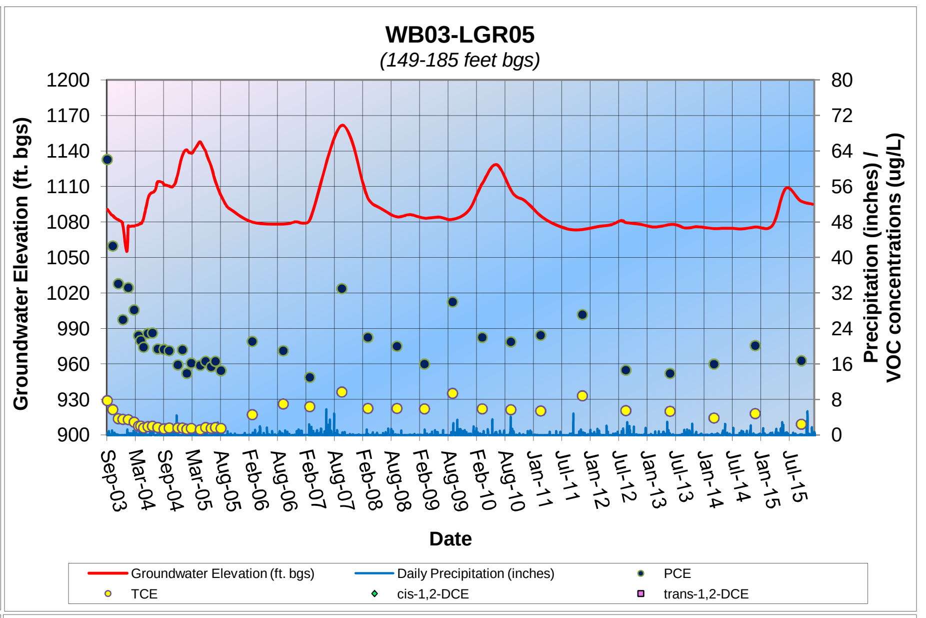


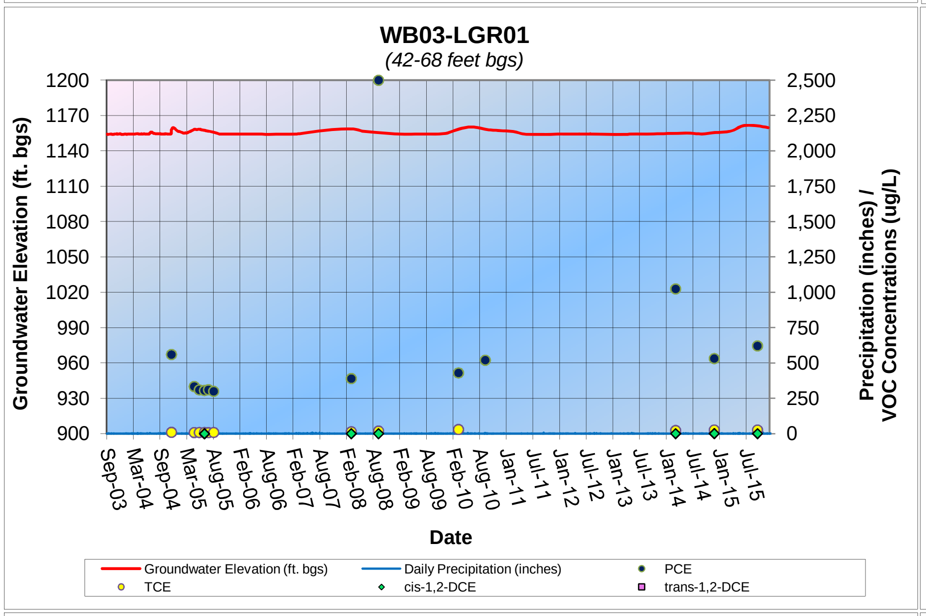


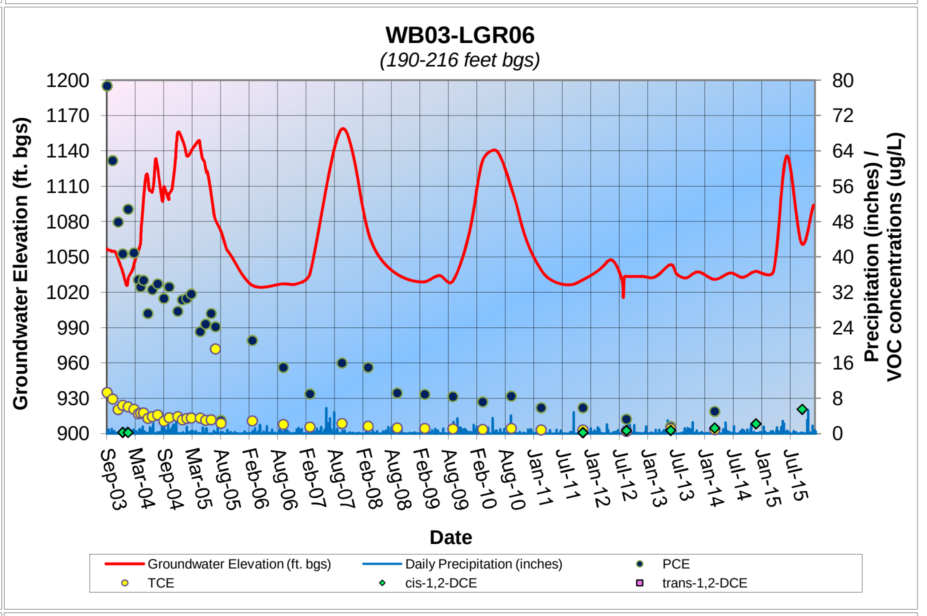


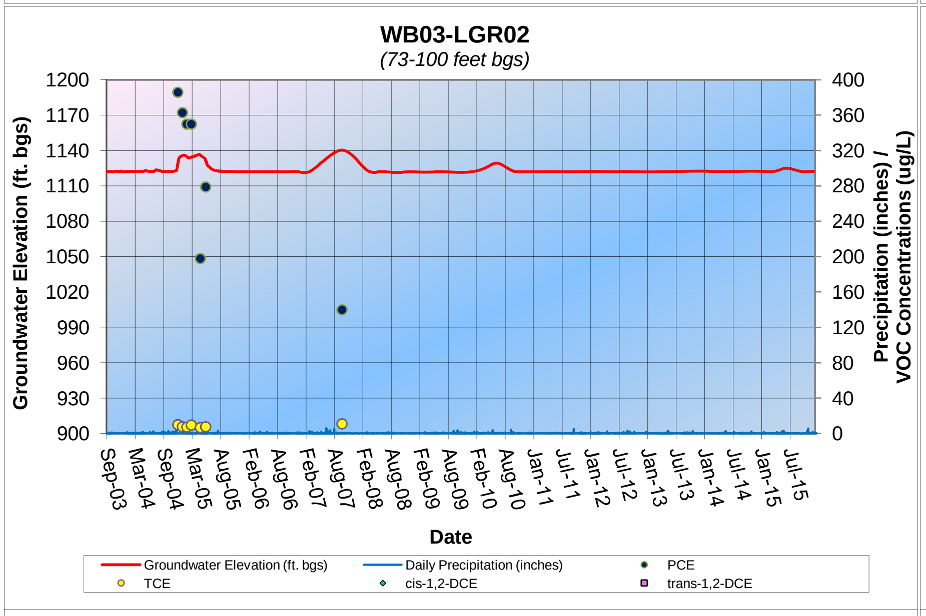
Appendix D.3 - CS-WB03 Culmulative VOC Concentrations, Groundwater Level, and Precipitation

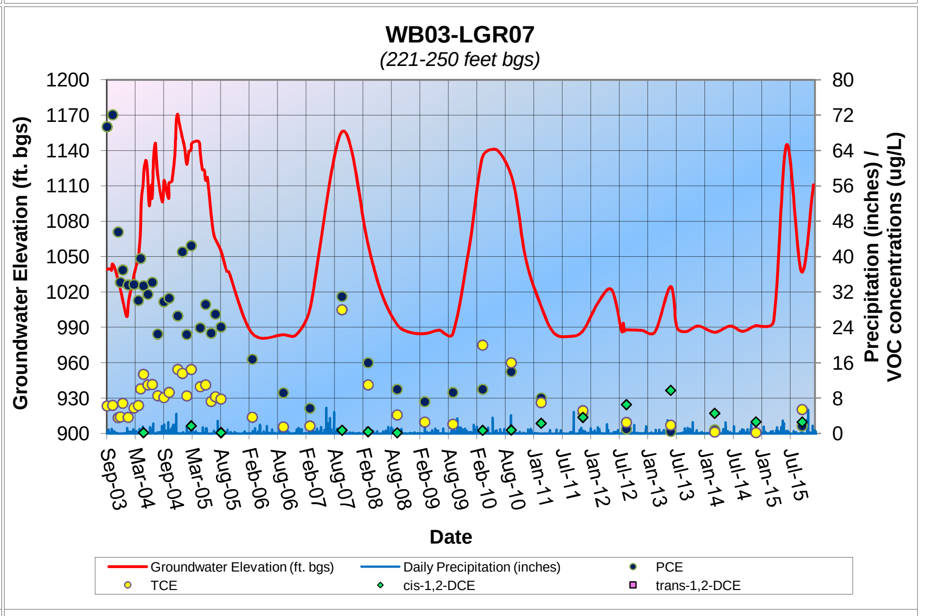


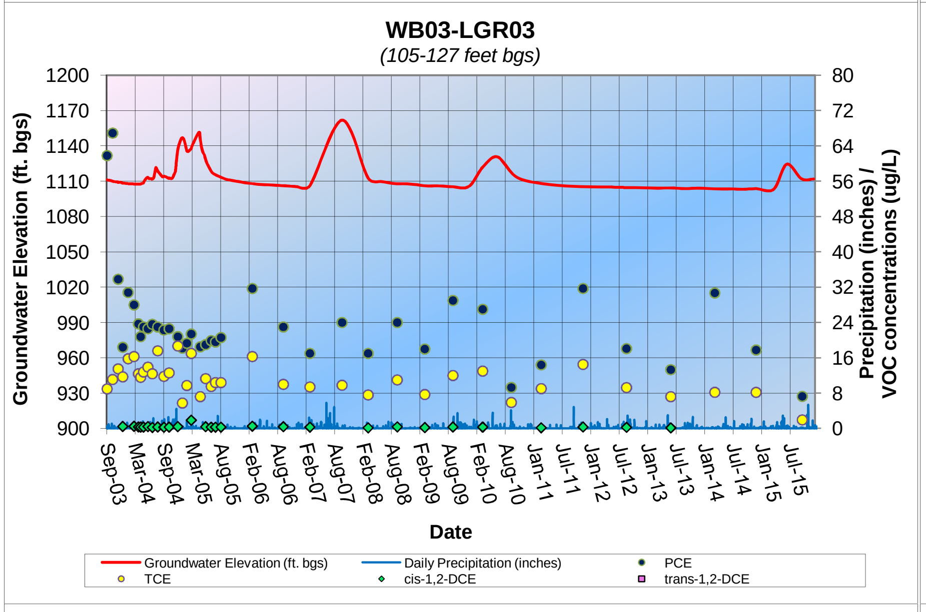


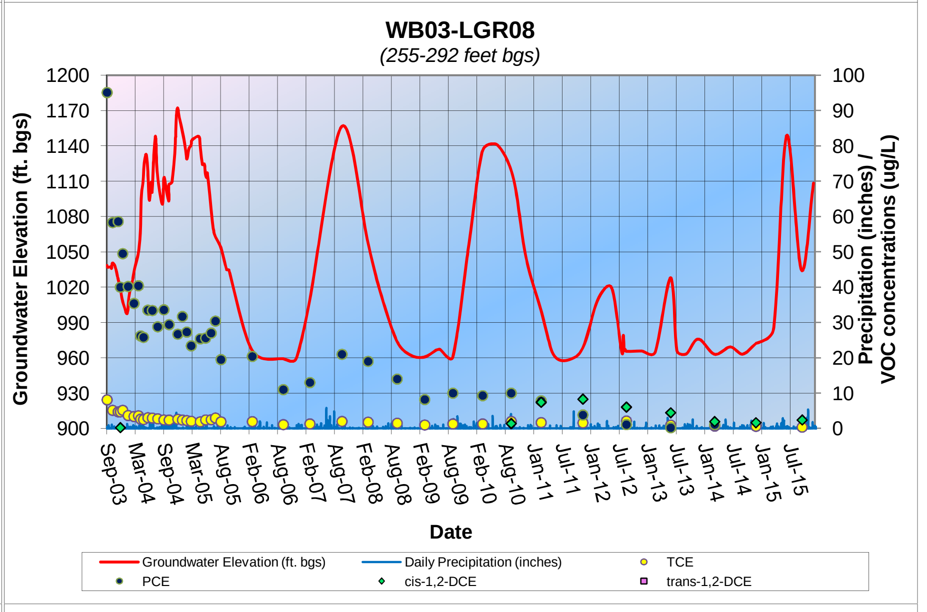


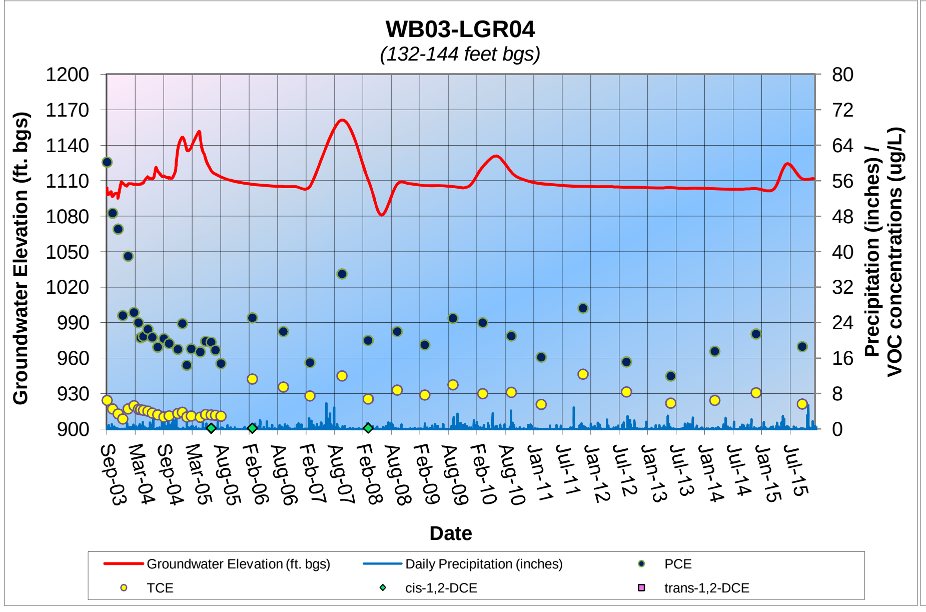


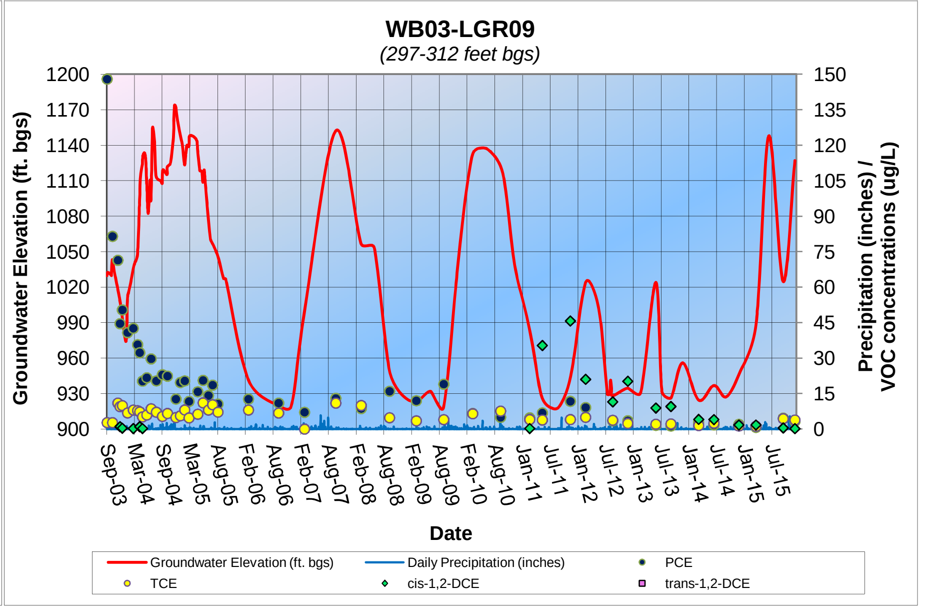




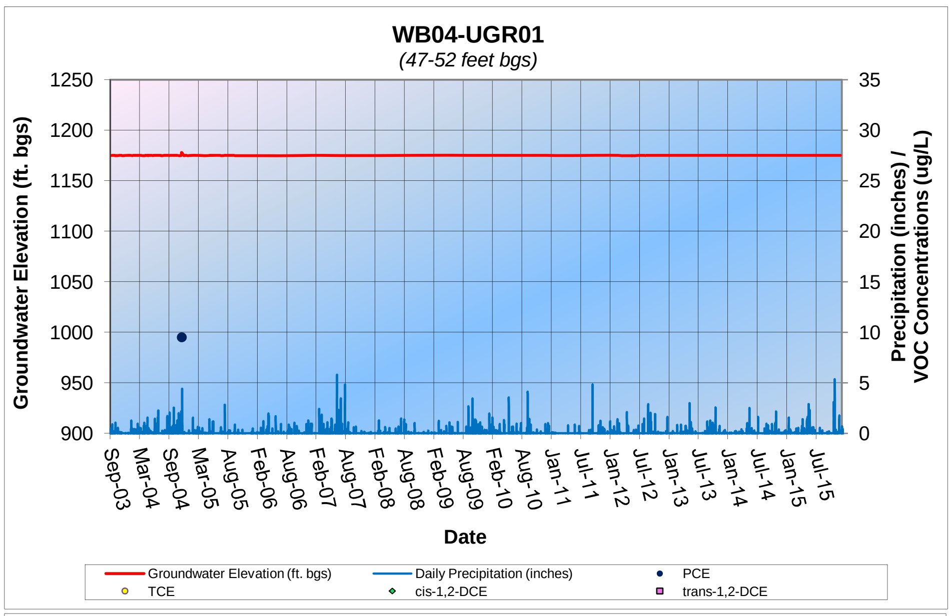


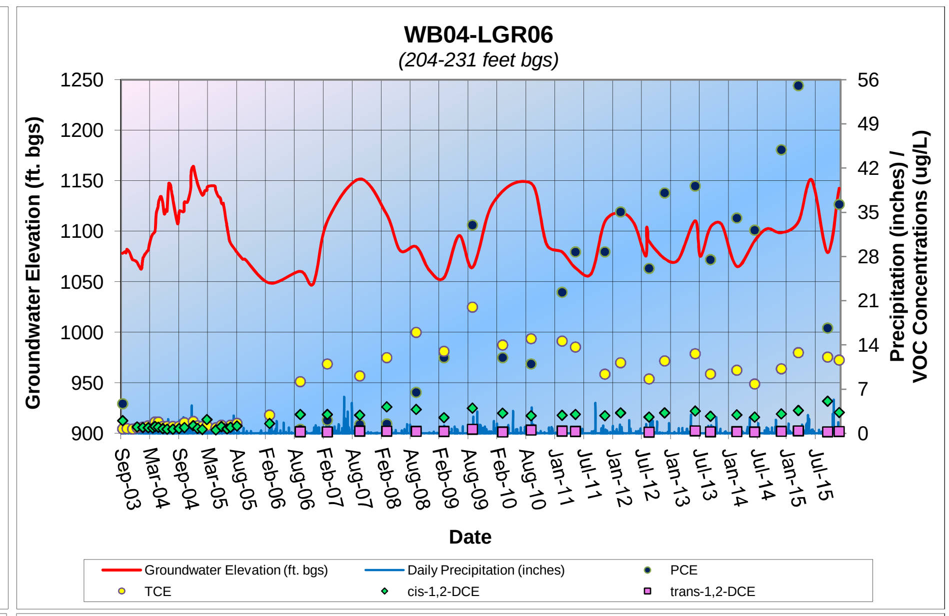


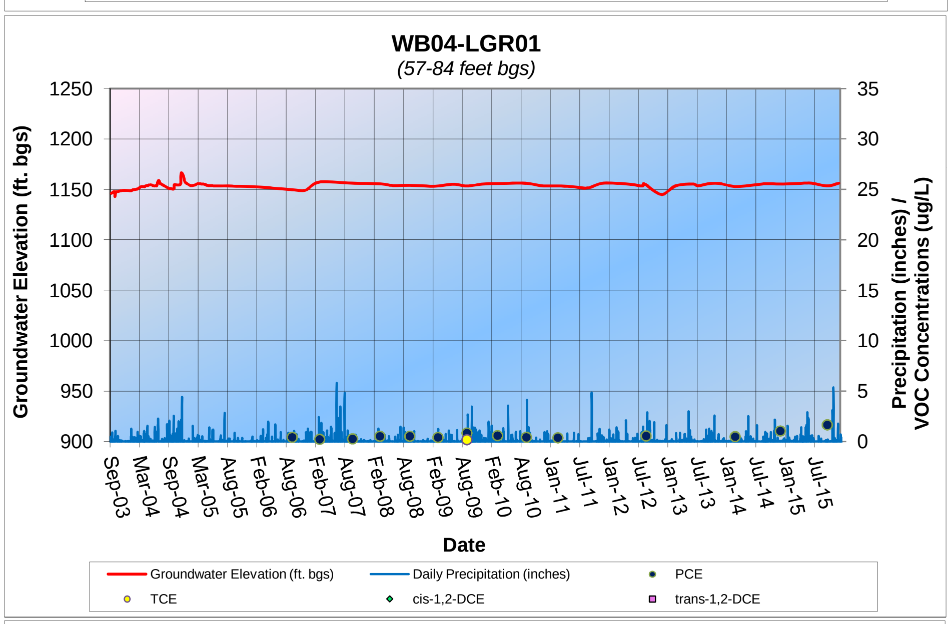


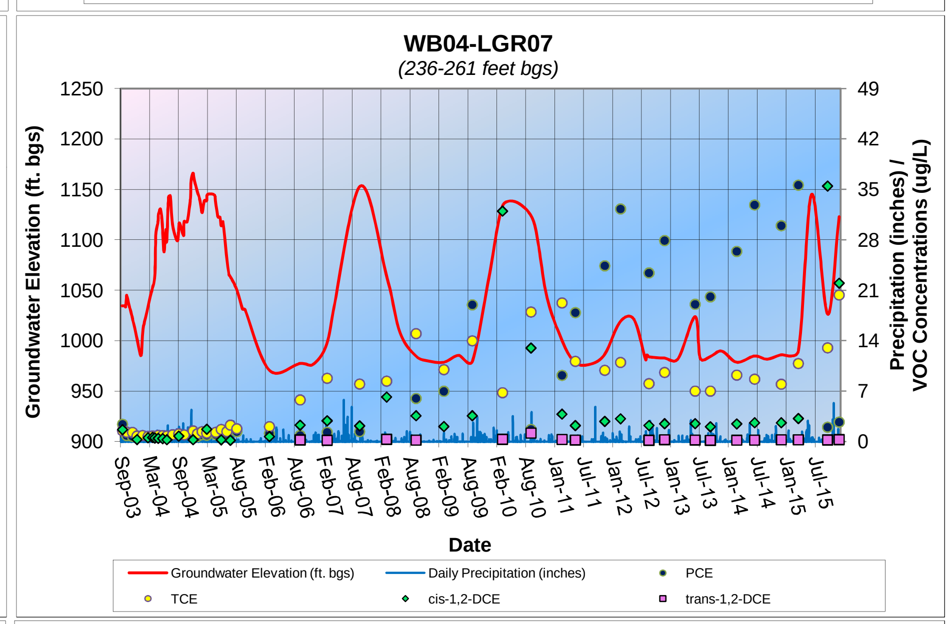


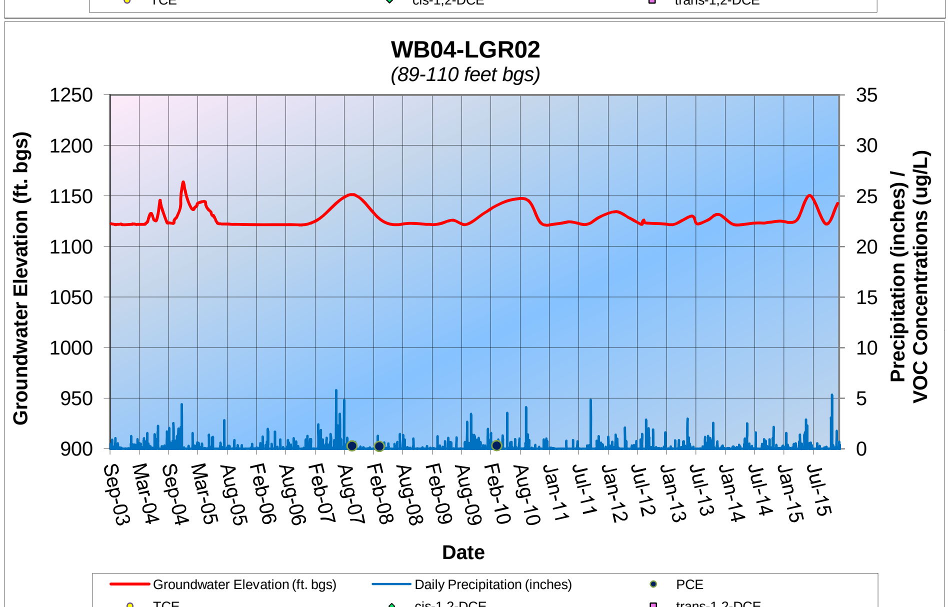
Appendix D.4 - CS-WB04 Culmulative VOC Concentrations, Groundwater Level, and Precipitation

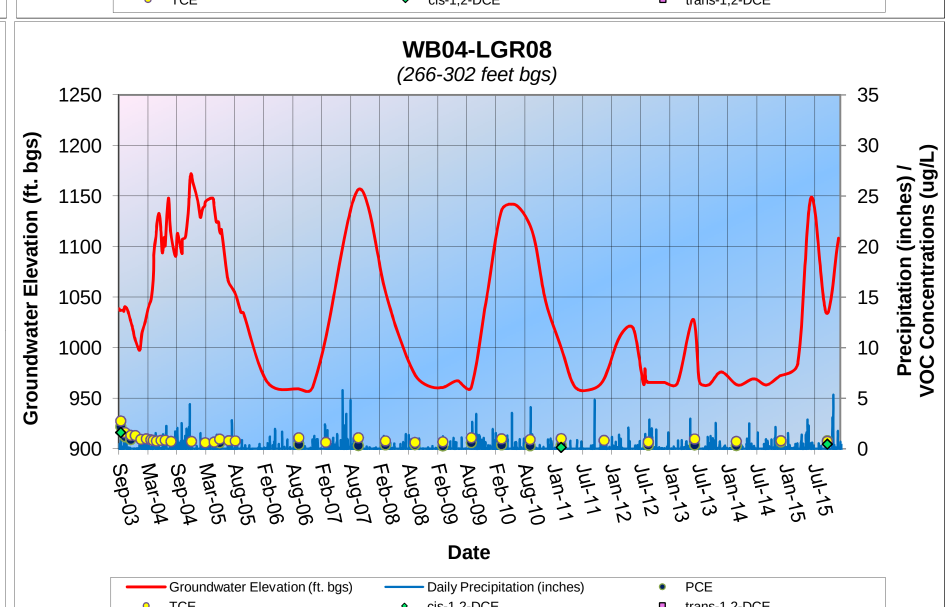


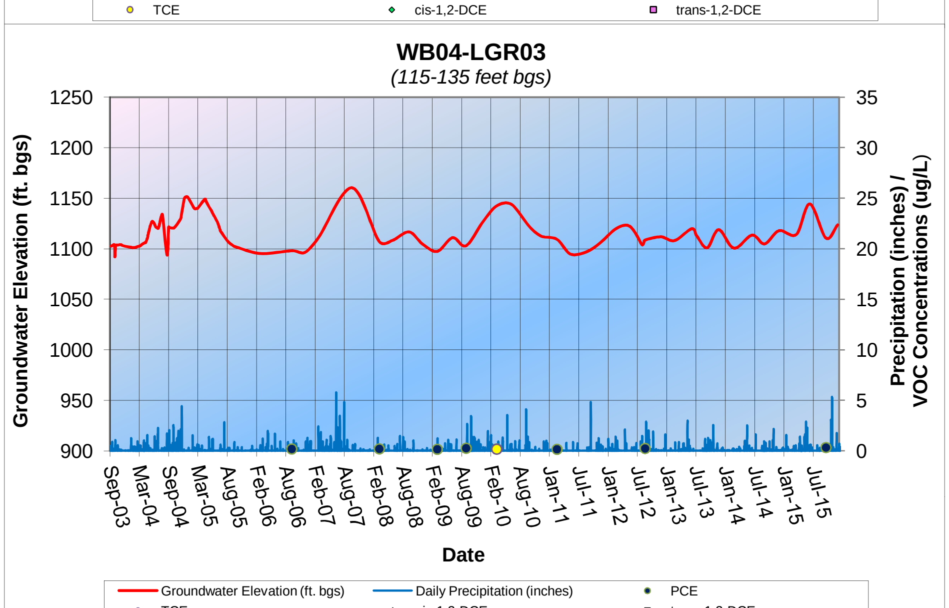


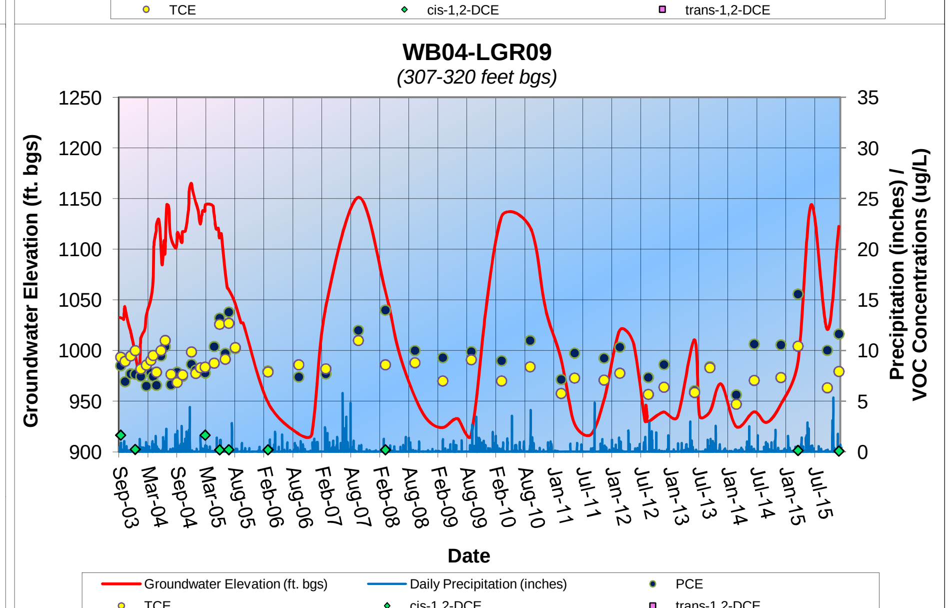


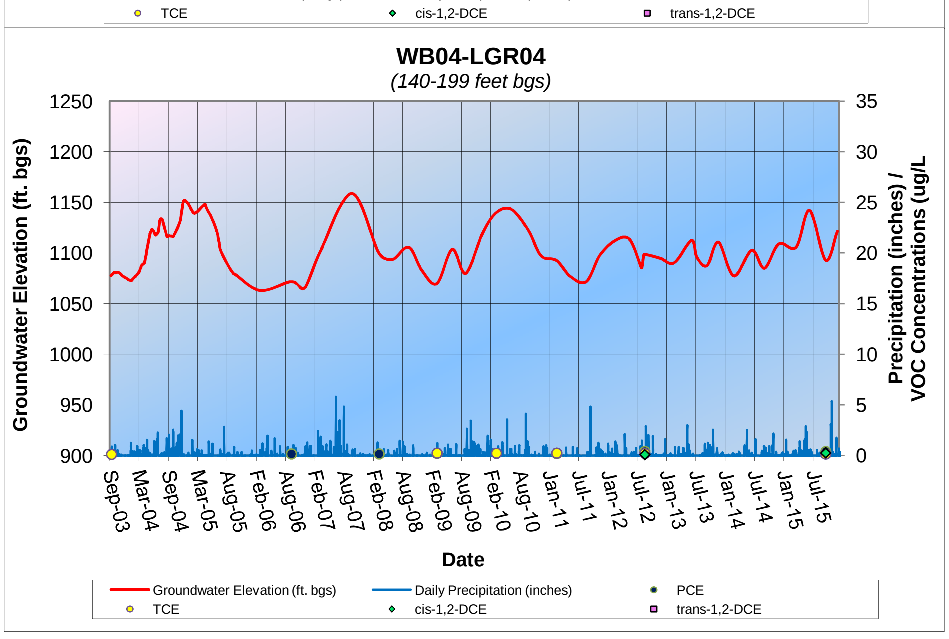


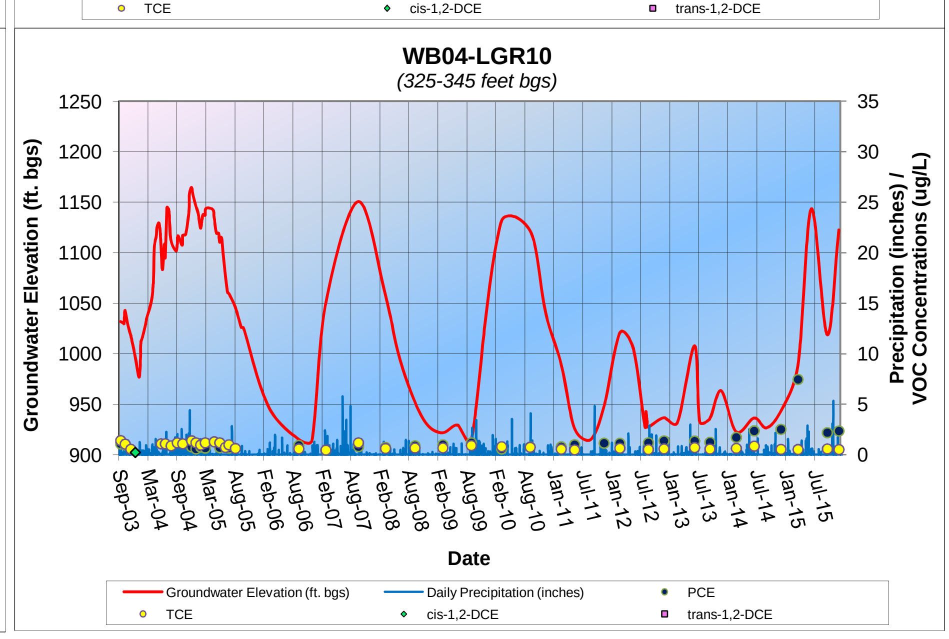




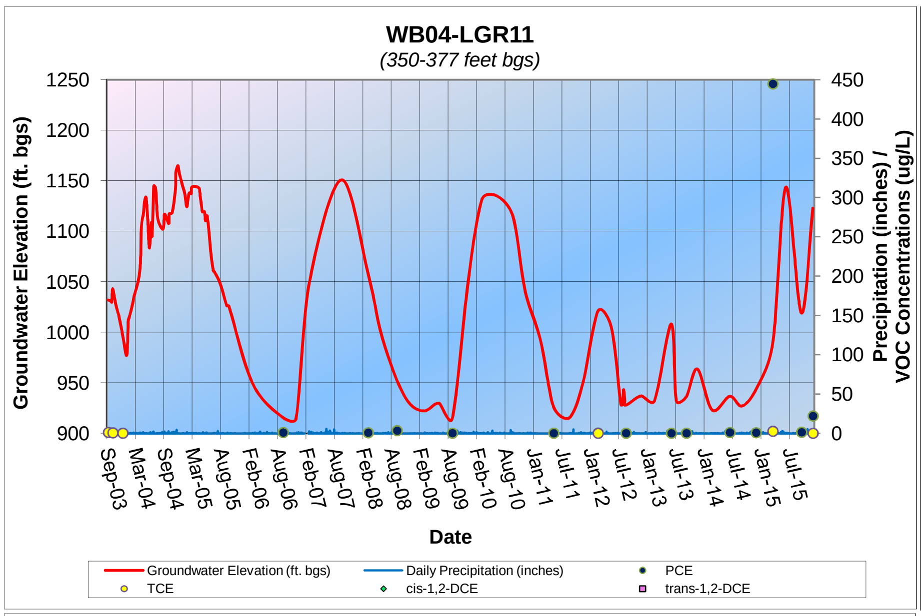


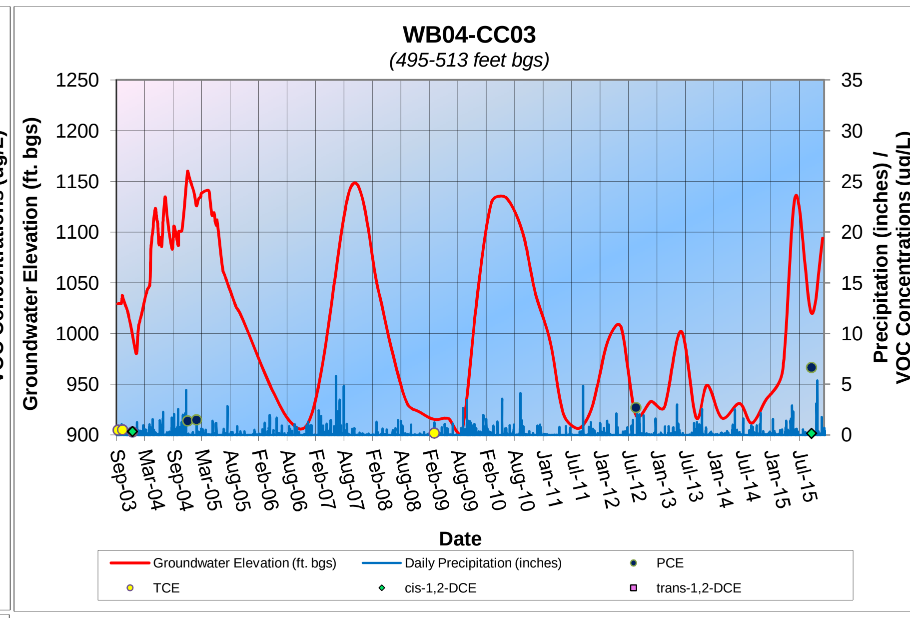


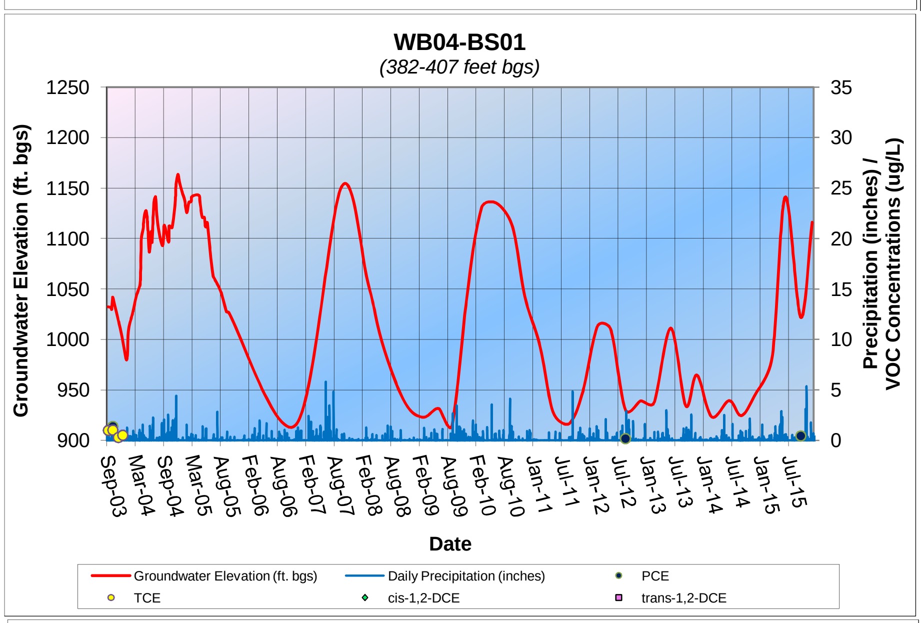


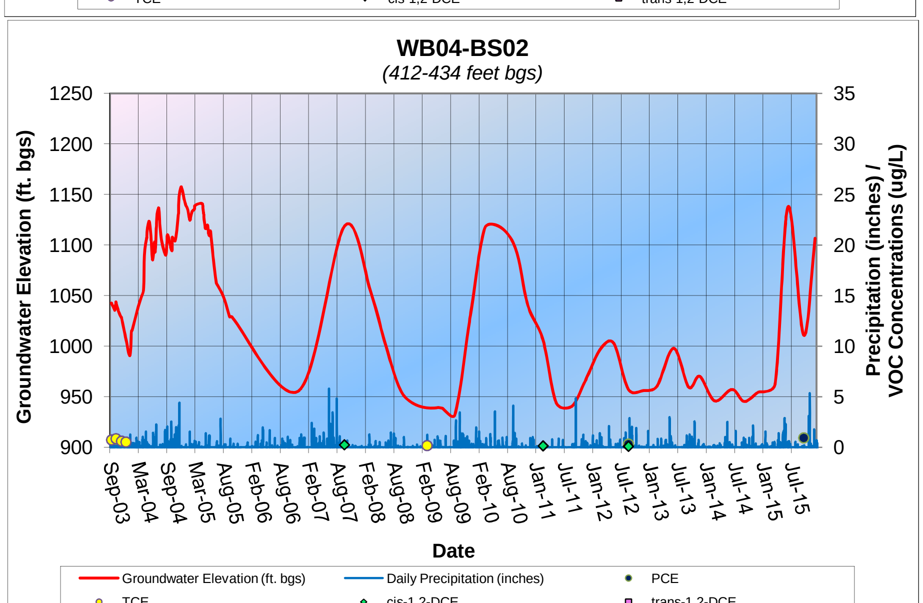


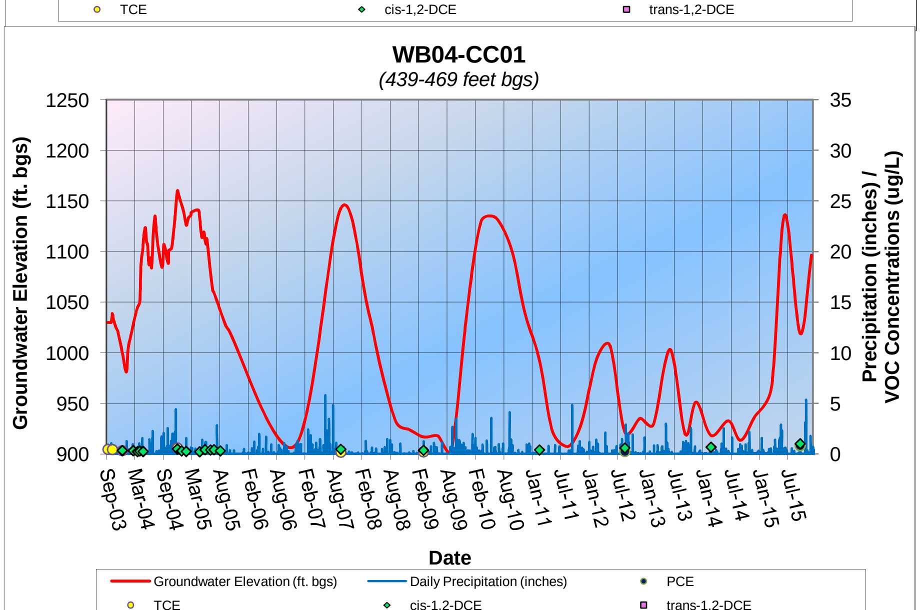
Appendix D.4 - CS-WB04 Culmulative VOC Concentrations, Groundwater Level, and Precipitation

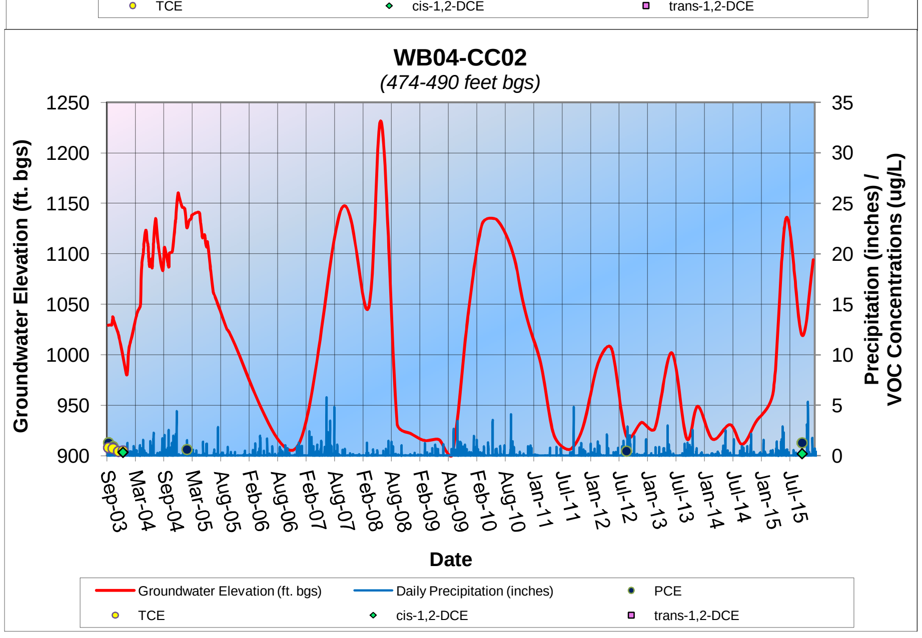












APPENDIX E

DECEMBER 2015 DROUGHT CONTINGENCY PLAN TRIGGERS

Voluntary CSSA Site-Specific Trigger Levels

At a minimum, CSSA will adopt the current drought stage declared by the TGWCD and abide by the actions set forth in this drought management plan. At the discretion of CSSA management, the next severity of drought stage may be declared when two or more wells meet the stage condition requirements for three (3) consecutive days.

Drought Stages Based on CS-MW18-LGR		
Stage 0	Static groundwater level <250’ as measured from top of the well	**<250’**
Stage I	Static groundwater level at or below 250’ as measured from top of well	**250’**
Stage II	Static groundwater level at or below 345’ as measured from top of well	**345’**
Stage III	Static groundwater level at or below 355’ as measured from top of well	**355’**
Stage IV	Not a potable water well – Stage IV not established	**N/A**

Drought Stages Based on Well 1 Static Groundwater Level		
Stage 0	Static groundwater level <165’ as measured from top of the well	**<165’**
Stage I	Static groundwater level at or below 165’ as measured from top of well	**165’**
Stage II	Static groundwater level at or below 186’ as measured from top of well	**186’**
Stage III	Static groundwater level at or below 270’ as measured from top of well	**270’**
Stage IV	Pumping water level is less than 30’ above the pump – **Critical Water Level**	**370’**
Pump		**400’**

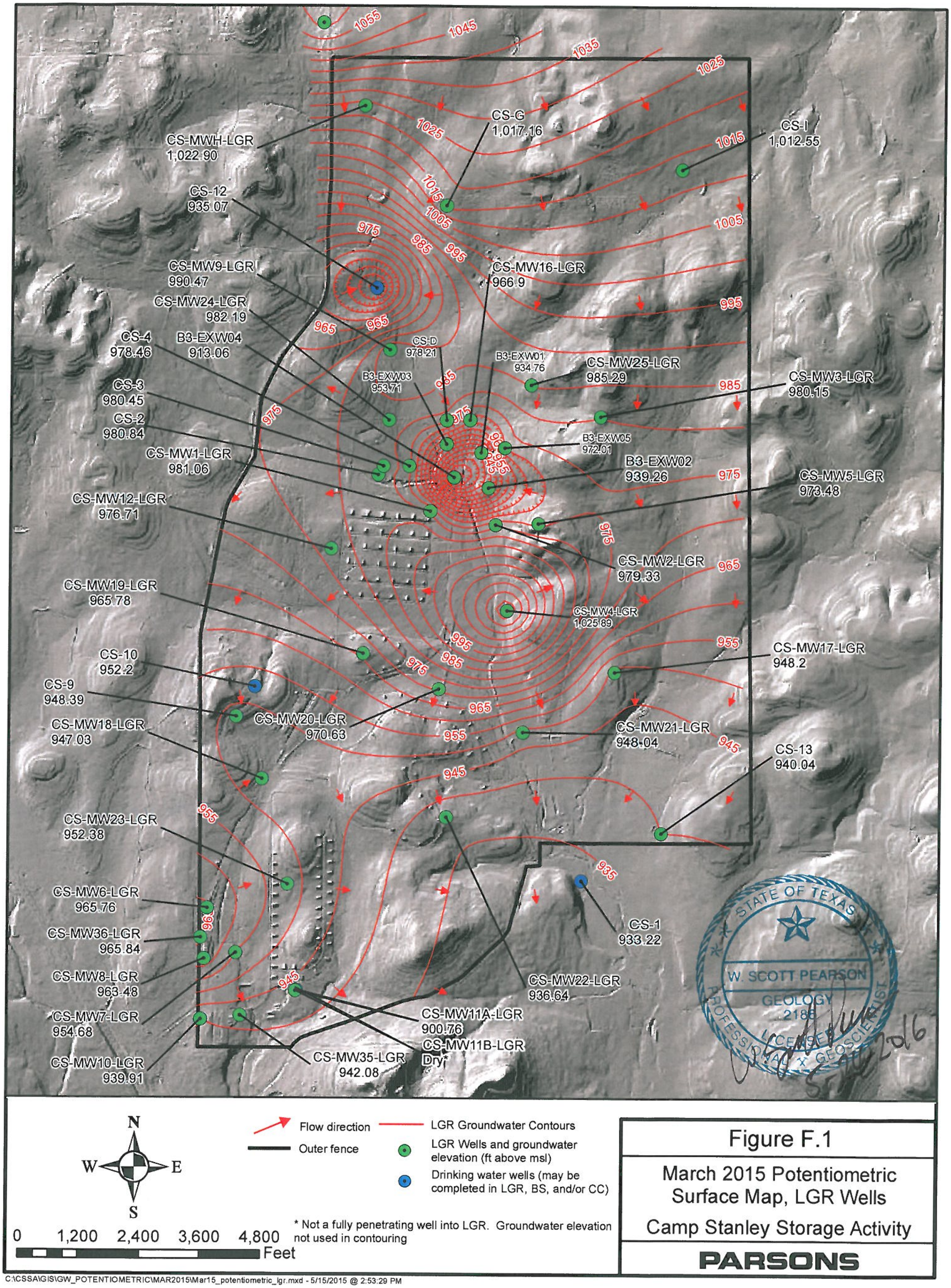
Drought Stages Based on Well 10 Static Groundwater Level		
Stage 0	Static groundwater level <322’ as measured from top of the well	**<322’**
Stage I	Static groundwater level at or below 322’ as measured from top of well	**322’**
Stage II	Static groundwater level at or below 357’ as measured from top of well	**357’**
Stage III	Static groundwater level at or below 397’ as measured from top of well	**397’**
Stage IV	Pumping water level is less than 30’ above the pump – **Critical Water Level**	**524’**
Pump		**554’**

Drought Stages Based on Well 12 Static Groundwater Level		
Stage 0	Static groundwater level <230’ as measured from top of the well	**<230’**
Stage I	Static groundwater level at or below 230’ as measured from top of well	**230’**
Stage II	Static groundwater level at or below 251’ as measured from top of well	**251’**
Stage III	Static groundwater level at or below 290’ as measured from top of well	**290’**
Stage IV	Pumping water level is less than 30’ above the pump – **Critical Water Level**	**415’**
Pump		**445’**

Drought Stages Based on Distribution System		
Stage IV	Storage Capacity of Reservoir Drops below 80% – **Critical Water Level**	**<80% of Full**
Stage IV	Runtime of two or more wells exceeds 18 hours per day	**>18 Hours**
Stage IV	System-wide outage (e.g., water main break, supply contamination, or loss of pumping capability or power)	

APPENDIX F

POTENTIOMETRIC MAPS FOR MARCH, JUNE, SEPTEMBER, DECEMBER 2015



C:\CSSA\GIS\GW_POTENTIOMETRIC\MAR2015\Mar15_potentiometric_lgr.mxd - 5/15/2015 @ 2:53:29 PM

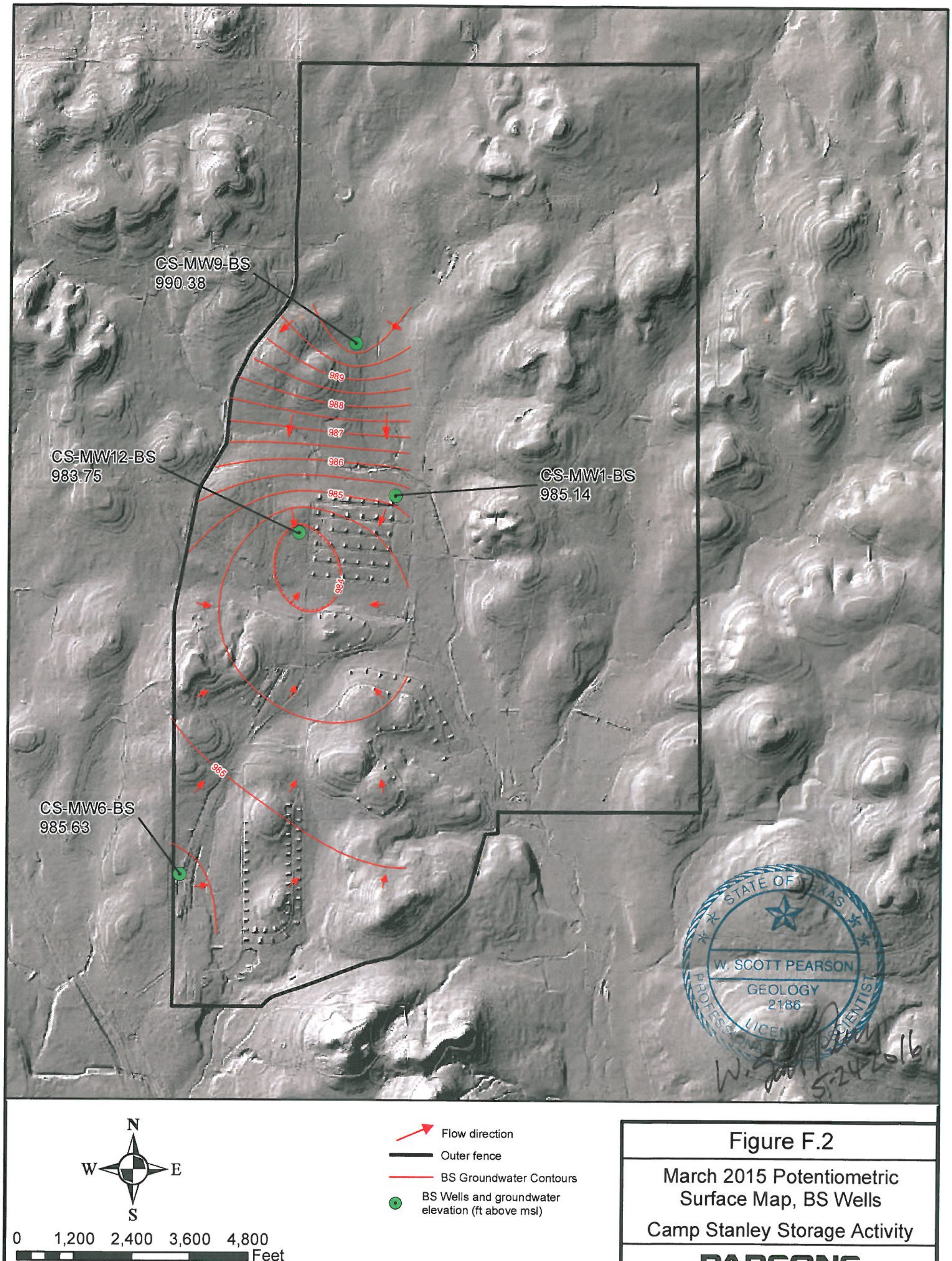


Figure F.2

March 2015 Potentiometric Surface Map, BS Wells

Camp Stanley Storage Activity

PARSONS

C:\CSSA\GIS\GW_POTENTIOMETRIC\MAR2015\Mar15_potentiometric_bs.mxd - 5/15/2015 @ 3:02:21 PM

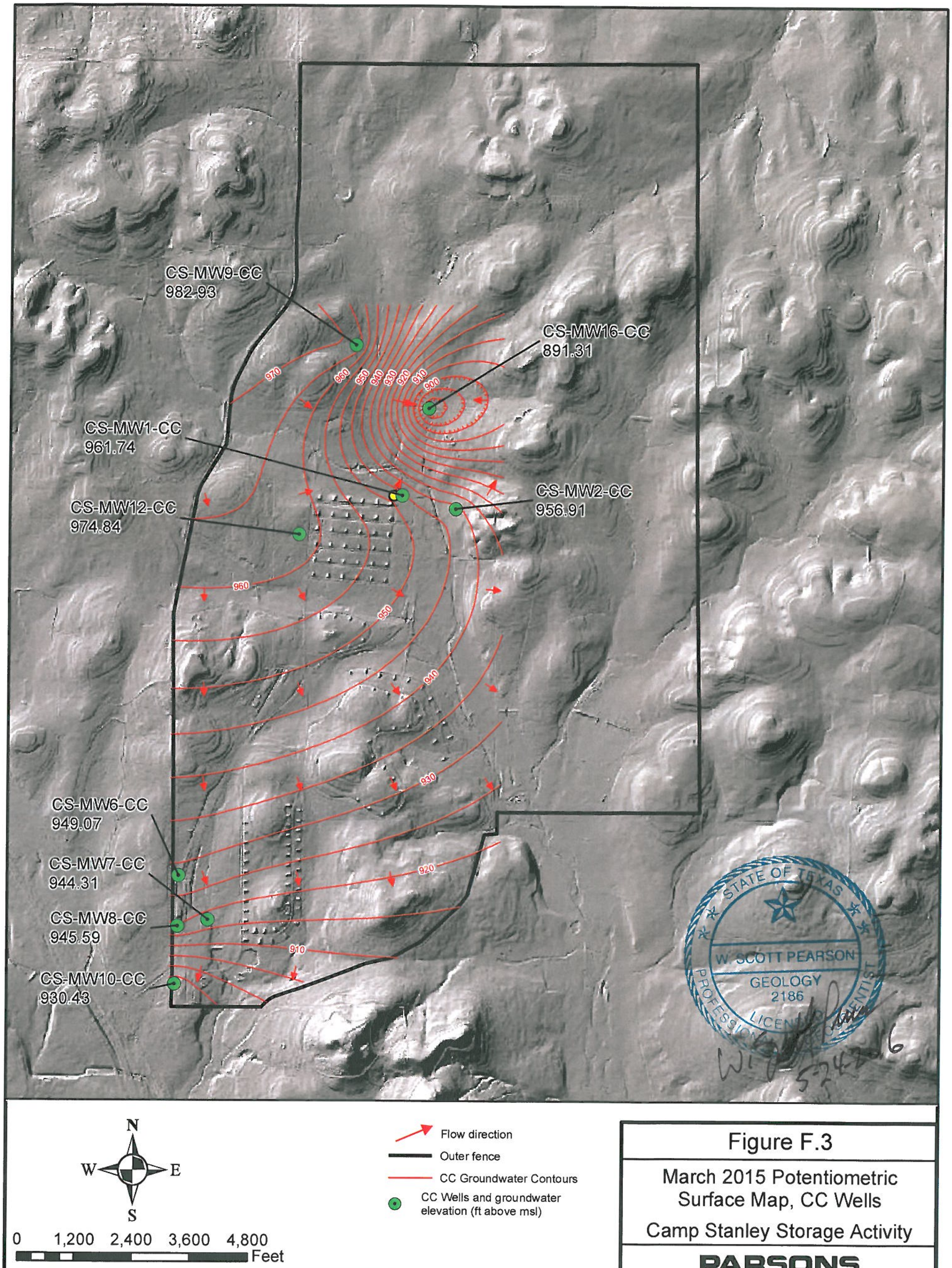


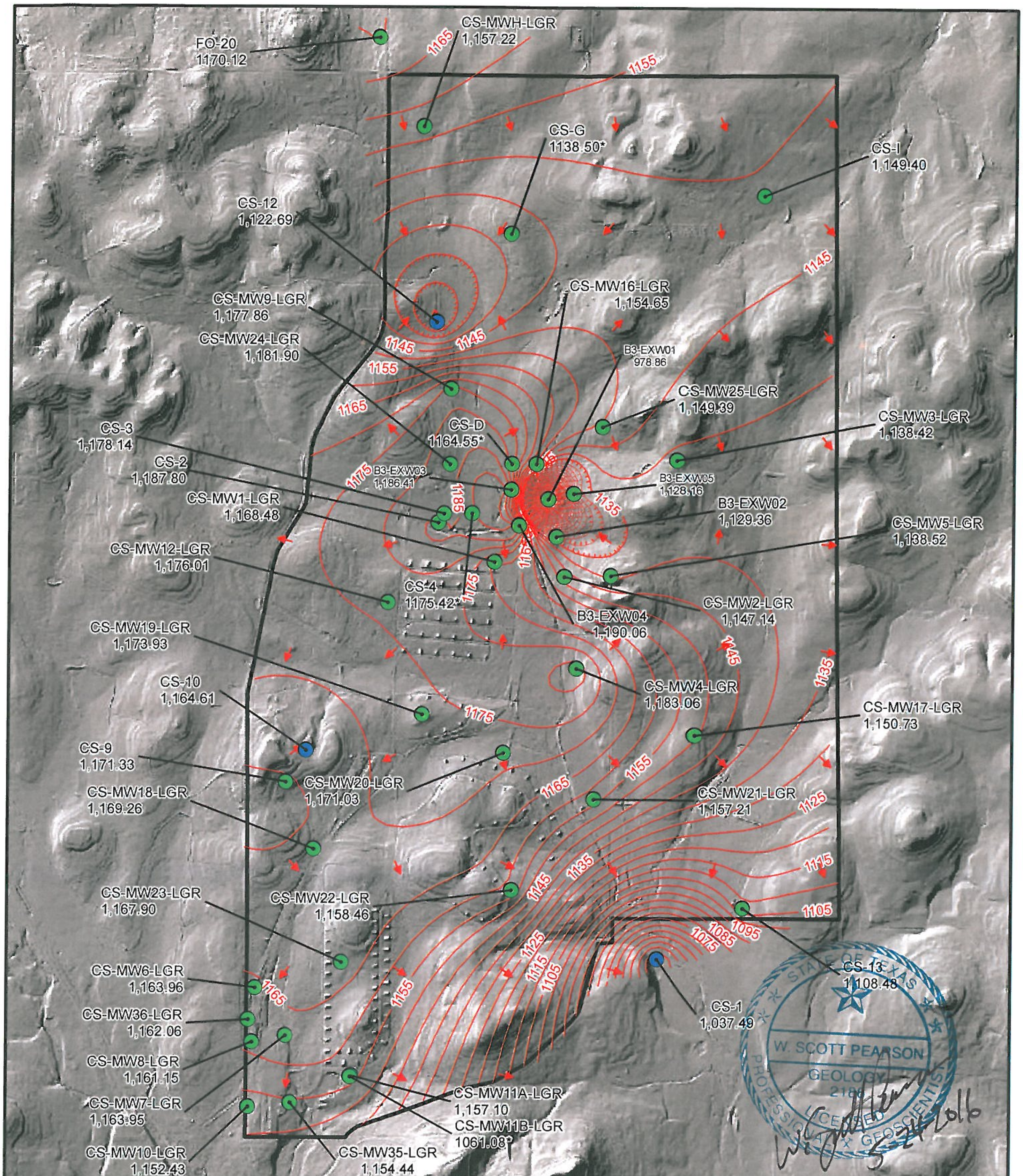
Figure F.3

March 2015 Potentiometric Surface Map, CC Wells

Camp Stanley Storage Activity

PARSONS

C:\CSSA\GIS\GW_POTENTIOMETRIC\MAR2015\Mar15_potentiometric_cc.mxd - 5/15/2015 @ 3:14:23 PM



N
W E
S

0 1,200 2,400 3,600 4,800 Feet

Flow direction

Outer fence

LGR Groundwater Contours

LGR Wells and groundwater elevation (ft above msl)

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

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

Figure F.4

June 2015 Potentiometric Surface Map, LGR Wells

Camp Stanley Storage Activity

PARSONS

C:\CSSA\GIS\GW_POTENTIOMETRIC\JUN2015\Jun15_potentiometric_lgr.mxd - 7/27/2015 @ 3:02:08 PM

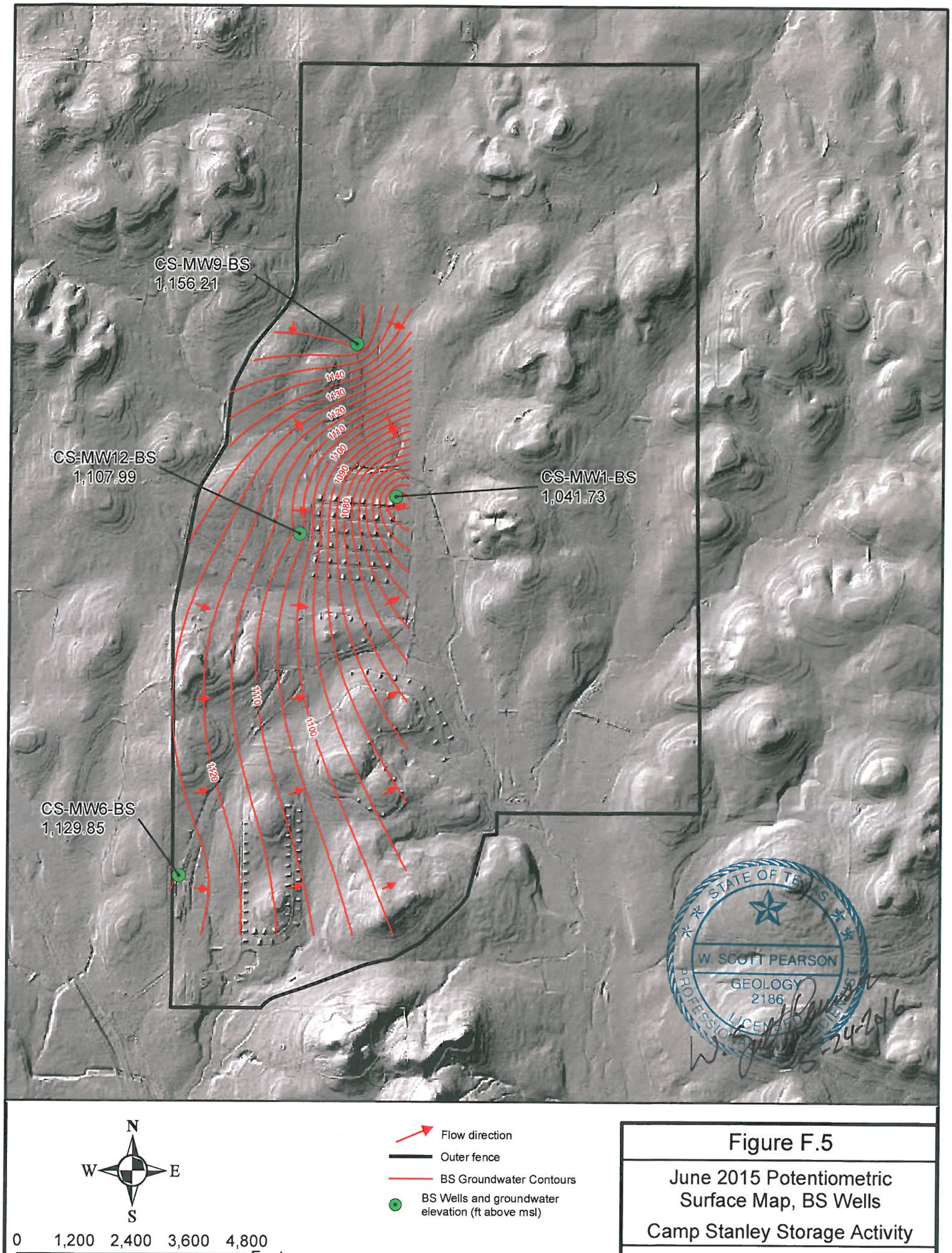


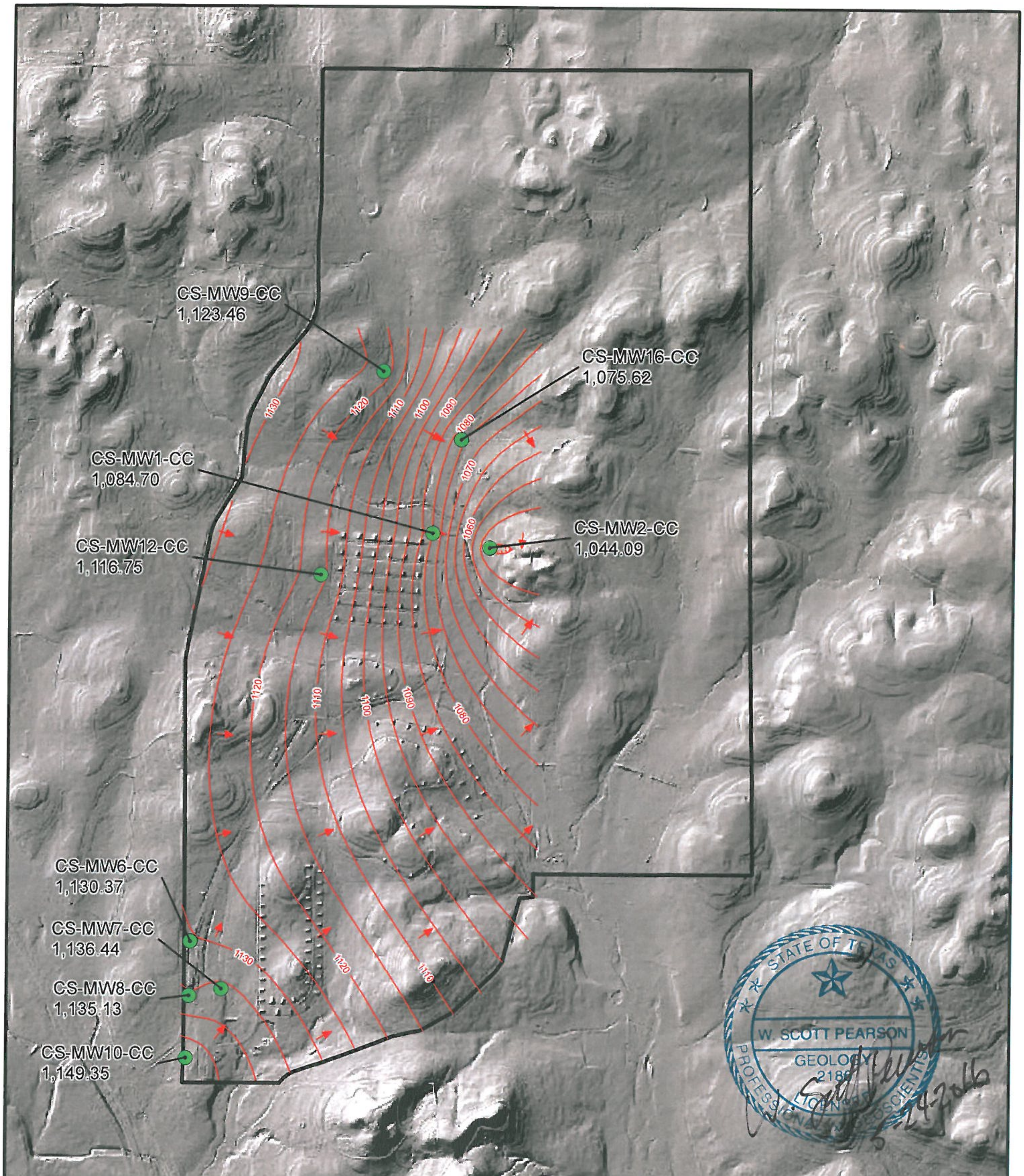
Figure F.5

June 2015 Potentiometric Surface Map, BS Wells

Camp Stanley Storage Activity

PARSONS

C:\CSSA\GIS\GW_POTENTIOMETRIC\JUN2015\Jun15_potentiometric_bs.mxd - 7/23/2015 @ 5:25:52 PM



N
W E
S

0 1,200 2,400 3,600 4,800
Feet

- Flow direction
- Outer fence
- CC Groundwater Contours
- CC Wells and groundwater elevation (ft above msl)

Figure F.6

June 2015 Potentiometric Surface Map, CC Wells

Camp Stanley Storage Activity

PARSONS

C:\CSSA\GIS\GW_POTENTIOMETRIC\JUN2015\Jun15_potentiometric_cc.mxd - 7/23/2015 @ 5:16:02 PM

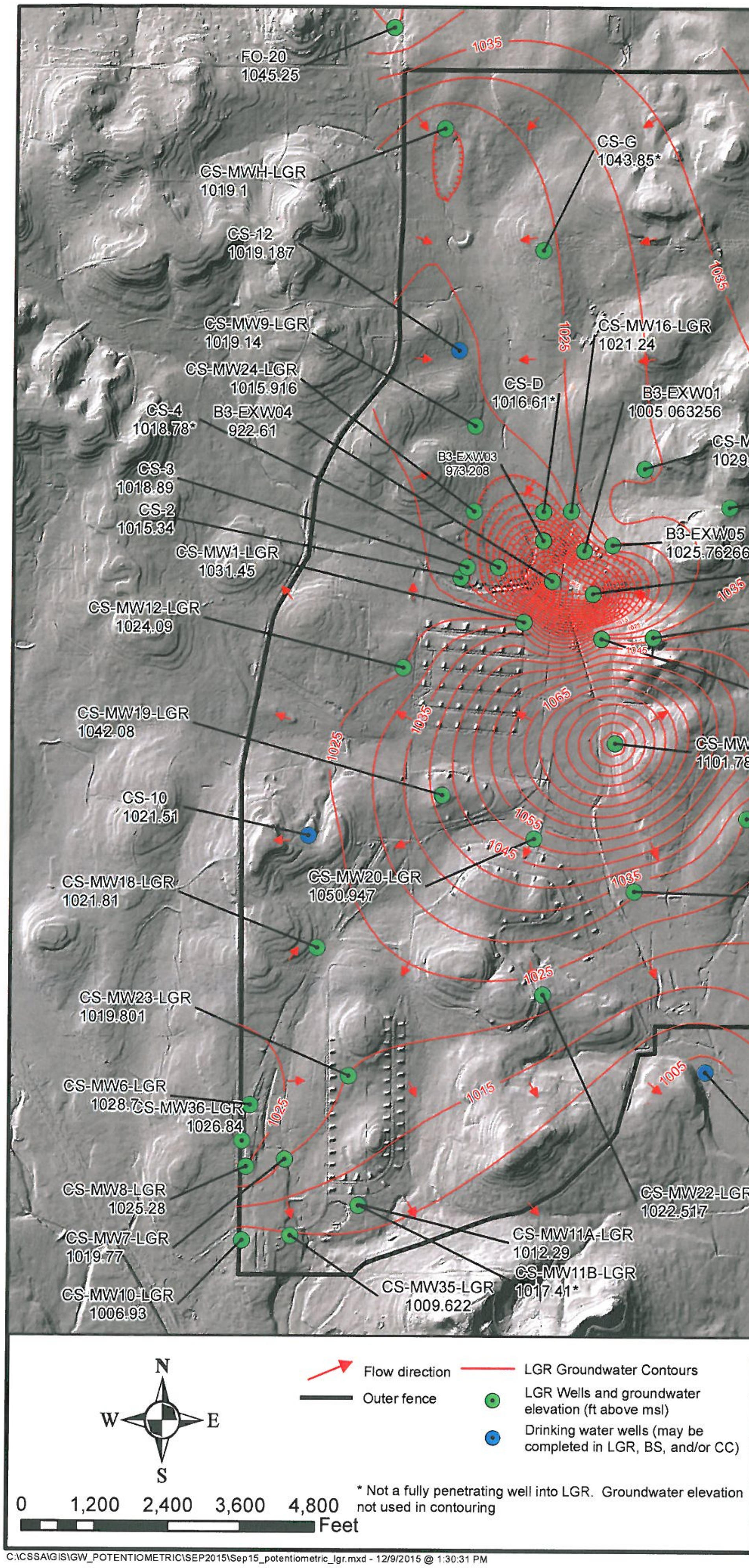


Figure F.7

September 2015 Potentiometric Surface Map, LGR Wells

Camp Stanley Storage Activity

C:\CSSA\GIS\GW_POTENTIOMETRIC\SEP2015\Sep15_potentiometric_lgr.mxd - 12/9/2015 @ 1:30:31 PM

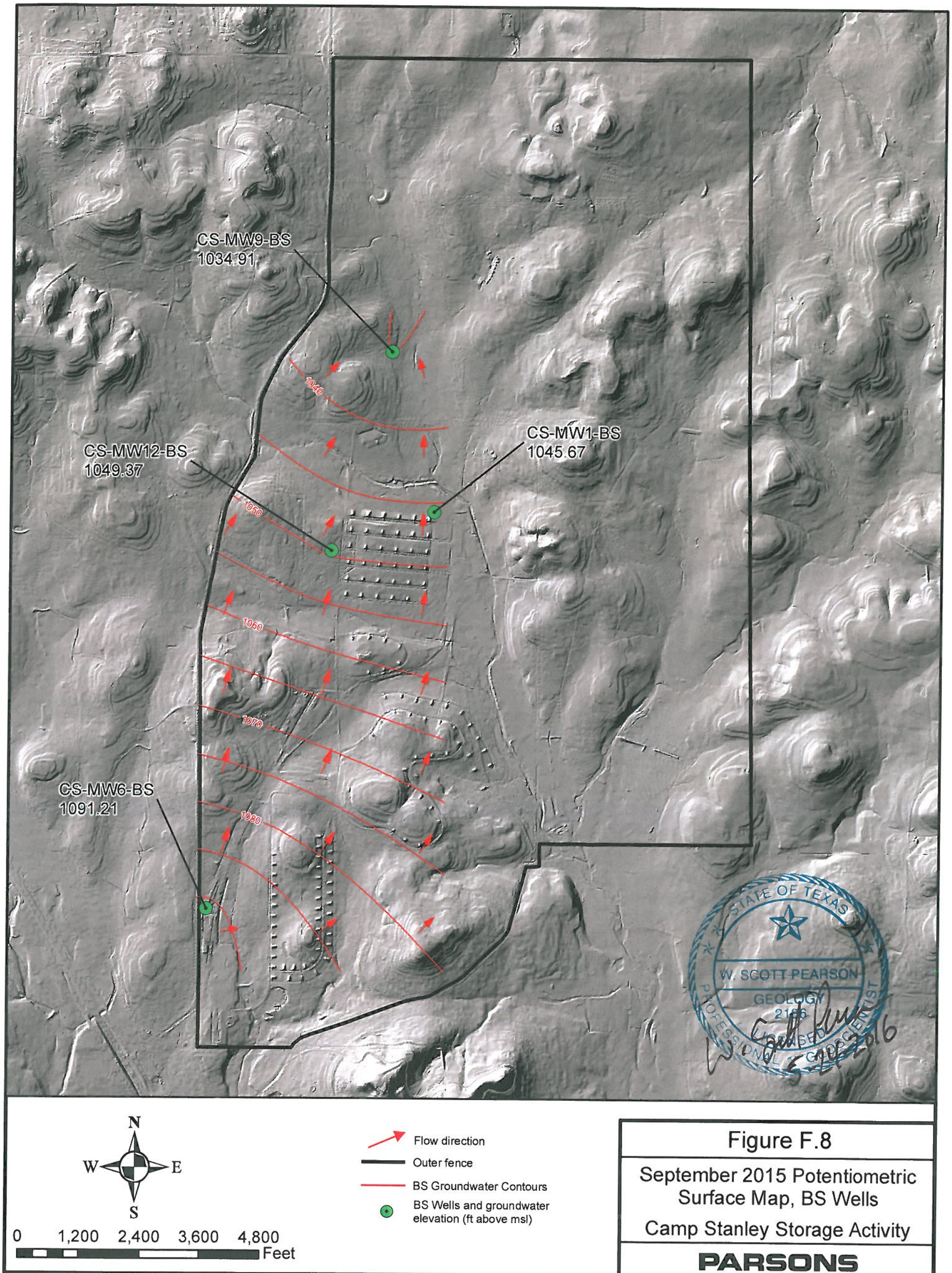


Figure F.8

September 2015 Potentiometric Surface Map, BS Wells

Camp Stanley Storage Activity

PARSONS

C:\CSSA\GIS\GW_POTENTIOMETRIC\SEP2015\Sep15_potentiometric_bs.mxd - 12/9/2015 @ 3:00:58 PM

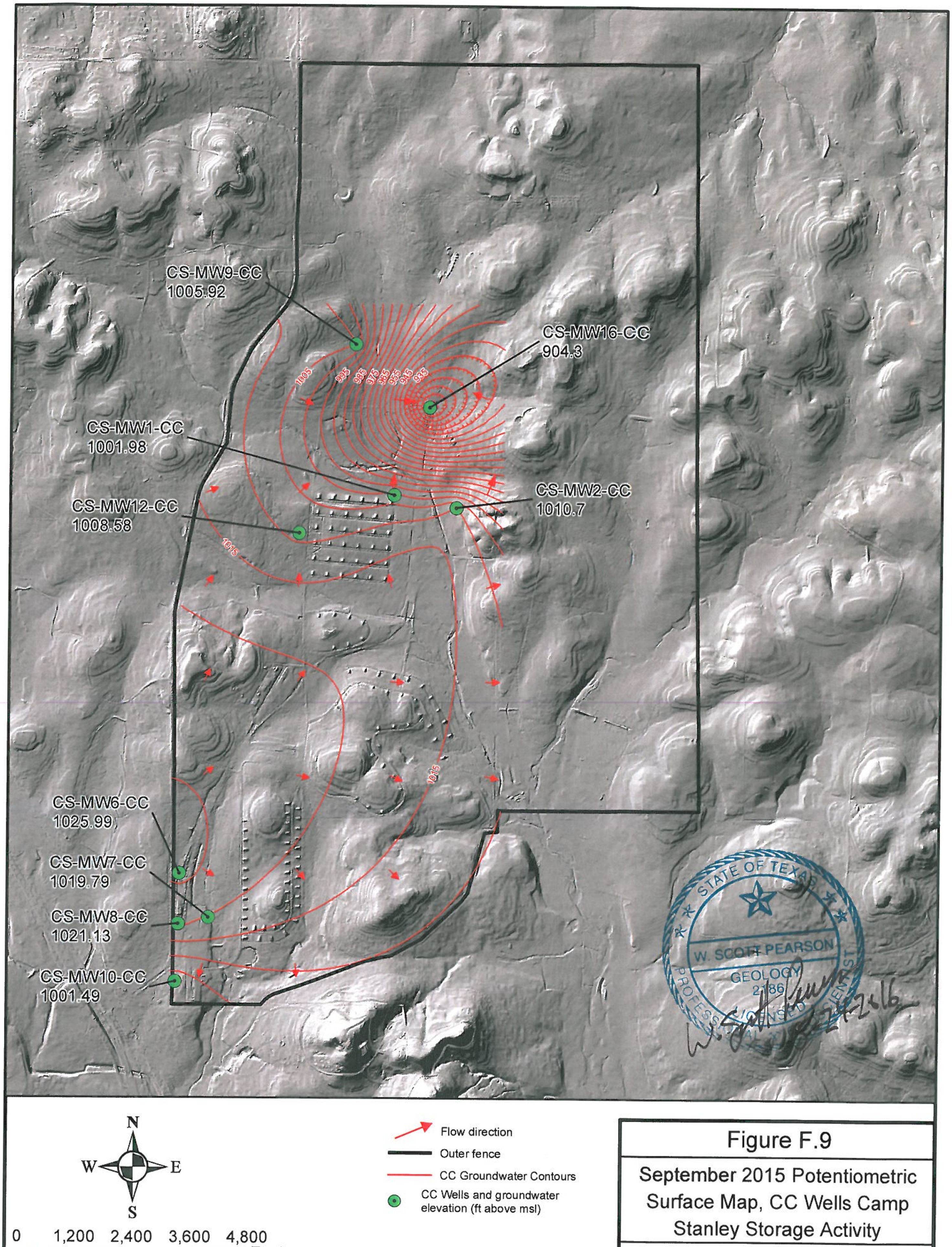
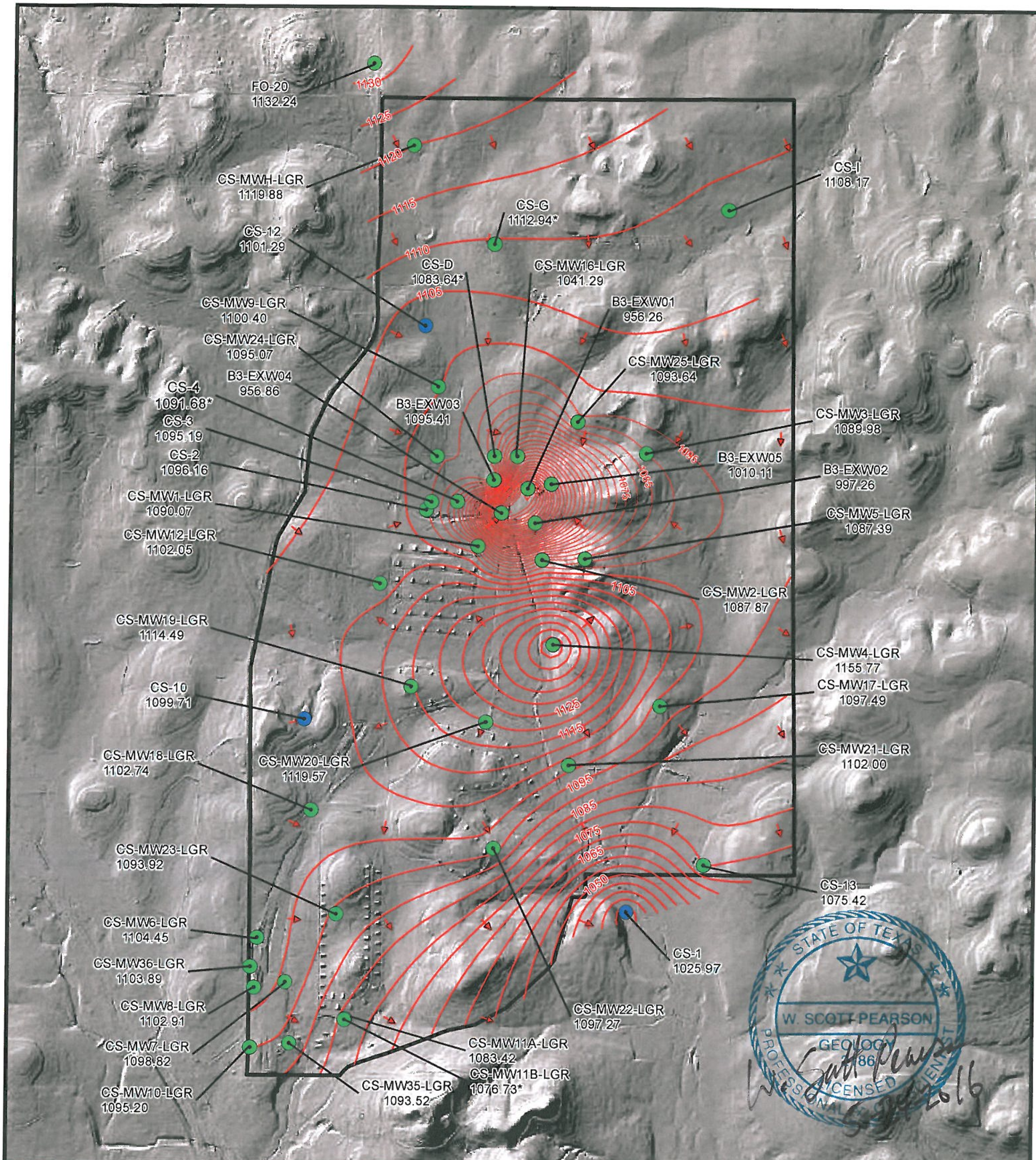


Figure F.9

September 2015 Potentiometric Surface Map, CC Wells Camp Stanley Storage Activity

PARSONS

C:\CSSA\GIS\GW_POTENTIOMETRIC\SEP2015\Sep15_potentiometric_cc.mxd - 12/9/2015 @ 3:23:09 PM



N

0 0.5 Miles

Flow direction

LGR Groundwater Contours

Outer fence

LGR Wells and groundwater elevation (ft above msl)

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

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

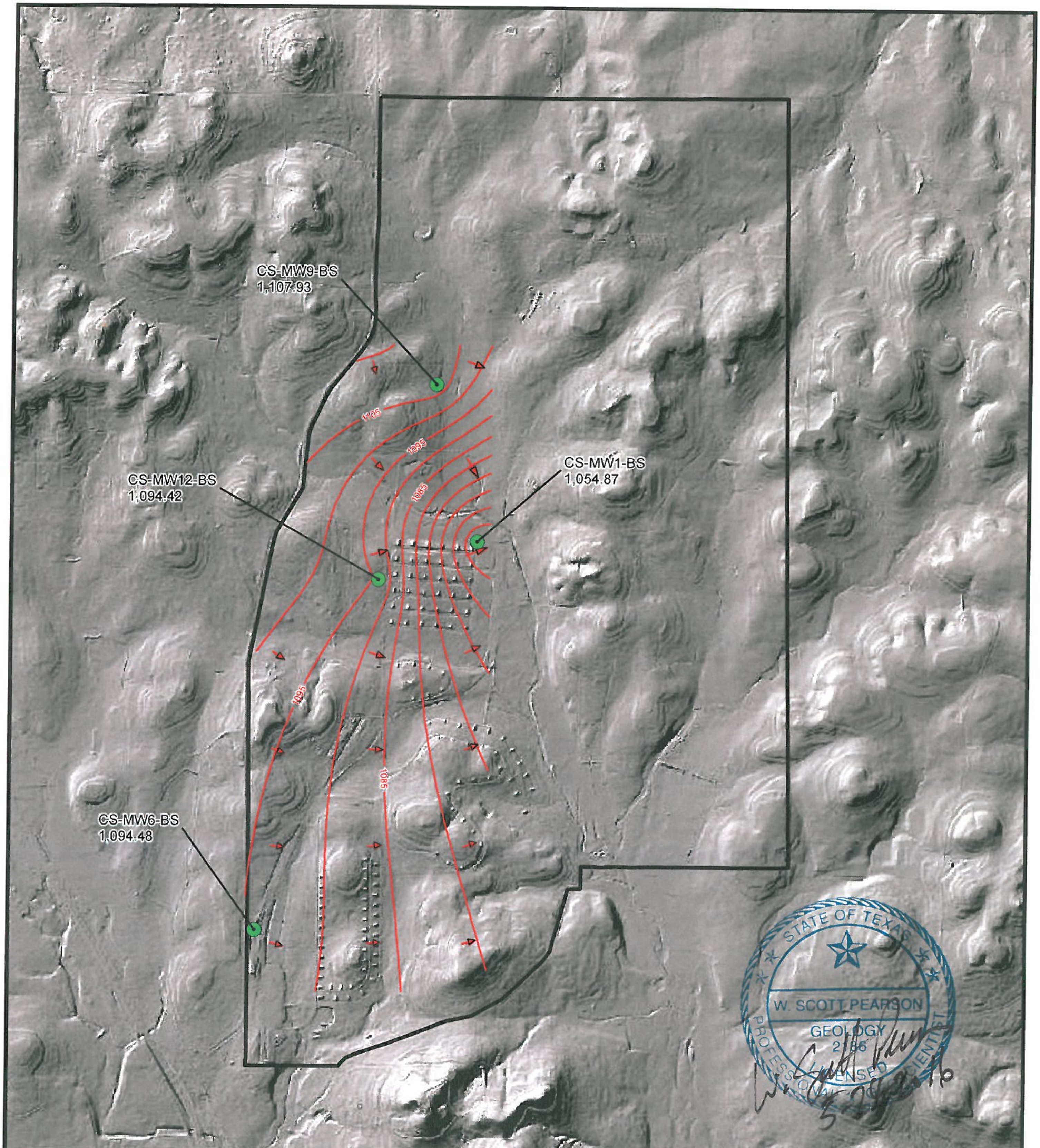
C:\CSSA\GIS\GW_POTENTIOMETRIC\DEC2015\Dec15_potentiometric_lgr.mxd - 3/17/2016 @ 7:27:42 PM

Figure F.10

December 2015 Potentiometric Surface Map, LGR Wells

Camp Stanley Storage Activity

PARSONS



N

0 0.5 Miles

Flow direction

Outer fence

BS Groundwater Contours

BS Wells and groundwater elevation (ft above msl)

C:\CSSA\GIS\GW_POTENTIOMETRIC\DEC2015\Dec15_potentiometric_bs.mxd - 3/18/2016 @ 11:08:47 AM

Figure F.11

December 2015 Potentiometric Surface Map, BS Wells

Camp Stanley Storage Activity

PARSONS

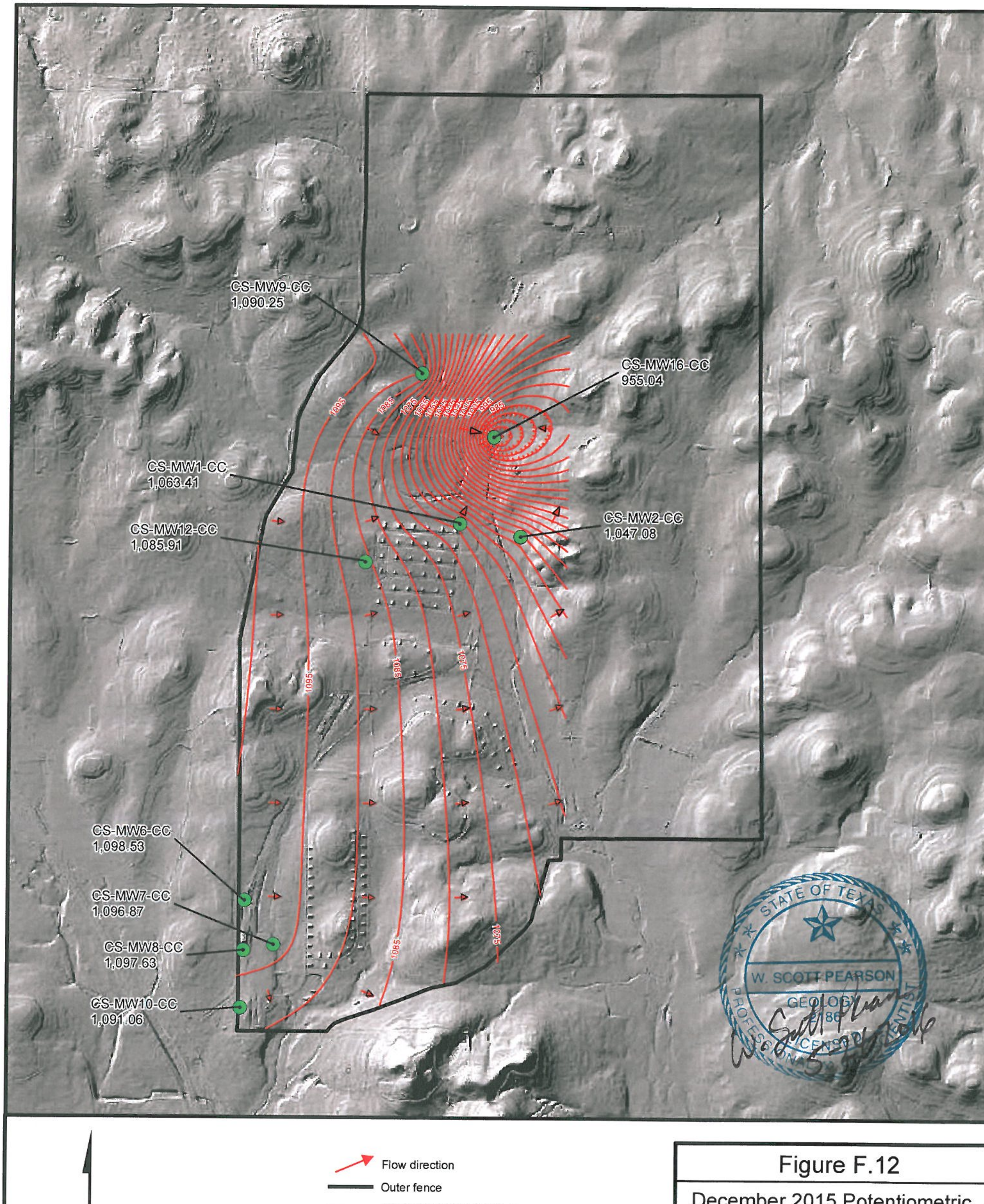


Figure F.12

December 2015 Potentiometric Surface Map, CC Wells

Camp Stanley Storage Activity

PARSONS

APPENDIX G

2015 QUARTERLY OFF-POST GROUNDWATER ANALYTICAL RESULTS

Appendix G
2015 Quarterly Off-Post Groundwater Monitoring Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
BSR-03	3/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/15/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
BSR-04	3/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
FO-8	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
FO-17	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
FO-22	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
FO-J1	3/5/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/1/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
HS-1	3/11/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	12/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
HS-2	3/11/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
HS-3	3/11/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
I10-2	3/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
I10-5	3/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
I10-7	3/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
I10-8	3/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	12/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-5	3/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/9/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	12/9/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-6	3/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/1/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-7	3/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/1/2015	0.12U	0.07U	0.08U	**0.28F**	0.05U	0.08U
JW-8	3/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	12/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-9	3/18/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	3/18/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/10/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-12	6/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/7/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-13	3/20/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/18/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-14	3/5/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/1/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-15	3/5/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-20	3/5/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-26	3/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U

Appendix G
2015 Quarterly Off-Post Groundwater Monitoring Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
JW-27	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-28	3/6/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-29	3/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	3/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-30	3/5/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/1/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-31	3/18/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/1/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
LS-1	3/11/2015	0.12U	0.07U	0.08U	**0.49F**	0.05U	0.08U
	12/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
LS-4	3/11/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
LS-5	3/2/2015	0.12U	0.07U	0.08U	**0.98F**	**3.36**	0.08U
	6/1/2015	0.12U	0.07U	0.08U	**1.22F**	**2.72**	0.08U
	9/8/2015	0.12U	0.07U	0.08U	**0.83F**	**2.43**	0.08U
	11/30/2015	0.12U	0.07U	0.08U	**1.02F**	**2.15**	0.08U
LS-5-A2	3/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/8/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
LS-6	3/2/2015	0.12U	0.07U	0.08U	**0.81F**	**3.48**	0.08U
	6/1/2015	0.12U	0.07U	0.08U	**0.29F**	0.05U	0.08U
	9/8/2015	0.12U	0.07U	0.08U	**0.62F**	**2.04**	0.08U
	11/30/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
LS-6-A2	3/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/8/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
LS-7	3/2/2015	0.12U	0.07U	0.08U	**1.92**	**0.44F**	0.08U
	6/1/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/8/2015	0.12U	0.07U	0.08U	**1.26F**	0.05U	0.08U
	11/30/2015	0.12U	0.07U	0.08U	**0.24F**	0.05U	0.08U
LS-7-A2	3/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/8/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OFR-3	4/3/2015	0.12U	0.07U	0.08U	**6.25**	**3.3**	0.08U
	6/1/2015	0.12U	0.07U	0.08U	**4.19**	**2.59**	0.08U
	9/8/2015	0.12U	0.07U	0.08U	**6.88**	**3.64**	0.08U
	11/30/2015	0.12U	0.07U	0.08U	**3.51**	**1.86**	0.08U
OFR-3-A2	4/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/8/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OW-BARNOWL	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	6/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/1/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OW-CE1	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/1/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OW-CE2	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/1/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OW-DAIRYWELL	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/1/2015	0.12U	**0.20F**	0.08U	0.06U	0.05U	0.08U
Duplicate	12/1/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OW-HH1	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/1/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U

Appendix G
2015 Quarterly Off-Post Groundwater Monitoring Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
OW-HH2	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	6/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/1/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OW-HH3	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/1/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OW-MT2	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/1/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-3	3/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-5	3/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-8	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-9	3/6/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/7/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-10	3/2/2015	0.12U	**0.35F**	0.08U	**21.58**	**14.42**	0.08U
	6/1/2015	0.12U	**0.13F**	0.08U	**9.19**	**5.53**	0.08U
	9/8/2015	0.12U	0.07U	0.08U	**19.71**	**7.93**	0.08U
	11/30/2015	0.12U	0.07U	0.08U	**6.27**	**3.5**	0.08U
RFR-10-A2	3/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/8/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-10-B2	3/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/8/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-11	3/2/2015	0.12U	0.07U	0.08U	**0.77F**	**2.61**	0.08U
	6/1/2015	0.12U	0.07U	0.08U	**0.93F**	0.05U	0.08U
	9/8/2015	0.12U	0.07U	0.08U	**0.84F**	**1.71**	0.08U
Duplicate	9/8/2015	0.12U	0.07U	0.08U	**0.71F**	**1.58**	0.08U
	11/30/2015	0.12U	0.07U	0.08U	0.06U	**1.22F**	0.08U
RFR-11-A2	3/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/8/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-12	3/2/2015	0.12U	0.07U	0.08U	**0.24F**	**0.89F**	0.08U
Duplicate	3/2/2015	0.12U	0.07U	0.08U	**0.26F**	**0.82F**	0.08U
	12/2/2015	0.12U	0.07U	0.08U	**0.29F**	**0.80F**	0.08U
RFR-14	3/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/4/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
SLD-01	3/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	6/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	6/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/14/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
SLD-02	3/3/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	12/2/2015	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U

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

Appendix G
2015 Quarterly Off-Post Groundwater Monitoring Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride

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

Abbreviations/Notes:

Duplicate	Field Duplicate
TCE	Trichloroethene
PCE	Tetrachloroethene
DCE	Dichloroethene

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 H

PRE- AND POST-GAC SAMPLE COMPARISONS FOR WELLS LS-5, LS-6, LS-7, OFR-3, RFR-10, AND RFR-11

APPENDIX H

PRE- AND POST-GAC SAMPLE COMPARISONS FOR WELLS LS-5, LS-6, LS-7, RFR-10, RFR-11, AND OFR-3

LS-5					LS-6				
	PCE (µg/L)		TCE (µg/L)			PCE (µg/L)		TCE (µg/L)	
Date	**Pre**	**Post**	**Pre**	**Post**	**Date**	**Pre**	**Post**	**Pre**	**Post**
3/2/2015	0.98F	ND	3.36	ND	3/2/2015	0.81F	ND	3.48	ND
6/1/2015	1.22F	NA	2.72	NA	6/1/2015	0.29F	NA	ND	NA
9/8/2015	0.83F	ND	2.43	ND	9/8/2015	0.62F	ND	2.04	ND
11/30/2015	1.02F	NA	2.15	NA	11/30/2015	ND	NA	ND	NA

LS-7					RFR-10				
	PCE (µg/L)		TCE (µg/L)			PCE (µg/L)		TCE (µg/L)	
Date	**Pre**	**Post**	**Pre**	**Post**	**Date**	**Pre**	**Post**	**Pre**	**Post**
3/2/2015	1.92	ND	0.44F	ND	3/2/2015	21.58	ND/ND	14.42	ND/ND
6/1/2015	ND	NA	ND	NA	6/1/2015	9.19	NA	5.53	NA
9/8/2015	1.26F	ND	ND	ND	9/8/2015	19.71	ND/ND	7.93	ND/ND
11/30/2015	0.24F	NA	ND	NA	11/30/2015	6.27	NA	3.5	NA

RFR-11					OFR-3				
	PCE (µg/L)		TCE (µg/L)			PCE (µg/L)		TCE (µg/L)	
Date	**Pre**	**Post**	**Pre**	**Post**	**Date**	**Pre**	**Post**	**Pre**	**Post**
3/2/2015	0.77F	ND	2.61	ND	4/3/2015	6.25	ND	3.3	ND
6/1/2015	0.93F	NA	ND	NA	6/1/2015	4.19	NA	2.59	NA
9/8/2015	0.84F	ND	1.71	ND	9/8/2015	6.88	ND	3.64	ND
9/8/2015 FD	0.71F	NA	1.58	NA	11/30/2015	3.51	NA	1.86	NA
11/30/2015	1.22F	NA	ND	NA					

NA – not applicable (post-GAC not sampled during this event) ND – indicates analyte was not detected at or above the MDL. FD – field duplicate.

APPENDIX I

DECEMBER 2015
DATA VERIFICATION REPORTS

SDG 78048
SDG 78072
SDG 78093
SDG 78122
SDG 78172
SDG 78213
SDG 78256
SDG 78278

DATA VERIFICATION SUMMARY REPORT

for 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 off-post Camp Stanley Storage Activity (CSSA) on 30th of November 2015. The samples were assigned to the following Sample Delivery Group (SDG). All off-post groundwater samples were analyzed for VOCs only.

78048

The field QC samples associated with this SDG was a trip blank (TB). 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 2.0ºC, 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 seven (7) water samples, including six (6) off-post groundwater samples and one (1) TB. All samples were collected on 30th of November 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 three analytical batches (#203305, 203306, and 203307) 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 three laboratory control spike (LCS) samples and the surrogate spikes.

All LCSs and surrogate spike recoveries were within acceptance criteria.

Precision

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

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.
- The three LCSs were 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 three method blanks and one TB associated with the VOC analyses in this SDG. All blanks were non-detect for all target VOCs at method detection limits.

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%.

DATA VERIFICATION SUMMARY REPORT

for 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) samples collected from off-post Camp Stanley Storage Activity (CSSA) on 1st and 2nd of December 2015. The samples were assigned to the following Sample Delivery Group (SDG). All off-post groundwater samples were analyzed for VOCs only.

78072

The field QC samples associated with this SDG were three sets of parent/field duplicate (FD), one set of matrix spike/matrix spike duplicate (MS/MSD), and a trip blank (TB). 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 3.0ºC, 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) groundwater samples, including twenty-six (26) off-post groundwater samples, three (3) FD, one (1) set of MS/MSD, and one (1) TB. All samples were collected on 1st and 2nd of December 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 two analytical batches (#203134 and #203135) 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 two laboratory control spike (LCS) samples, MS/MSD, and the surrogate spikes. Sample JW-6 was designated as the parent sample for the MS/MSD analyses on the COC.

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

Precision

Precision was evaluated based on the relative percent difference (%RPD) of parent/FD results and MS/MSD. Samples OW-DAIRYWELL, JW-8, and I10-8 were collected in duplicate.

For all three sets of parent and FD samples, all results were non-detect at or above the reporting limits; therefore, the %RPD calculation was not applicable.

All %RPDs of 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.
- Both LCSs were 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 two method blanks and one TB associated with the VOC analyses in this SDG. All blanks were non-detect for all target VOCs. No target VOC was detected at or above the associated MDL in the two method 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%.

DATA VERIFICATION SUMMARY REPORT

for 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) samples collected from off-post Camp Stanley Storage Activity (CSSA) on 3rd of December 2015. The samples were assigned to the following Sample Delivery Group (SDG). All off-post groundwater samples were analyzed for VOCs only.

78093

The field QC samples associated with this SDG were one set of parent/field duplicate (FD), one set of matrix spike/matrix spike duplicate (MS/MSD), and a trip blank (TB). 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 3.0ºC, 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) groundwater samples, including seven (7) off-post groundwater samples, one (1) FD, one (1) set of MS/MSD, and one (1) TB. All samples were collected on 3rd of December 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 analytical batch, #202995, 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 laboratory control spike (LCS) sample, MS/MSD, and the surrogate spikes. Sample FO-22 was designated as the parent sample for the MS/MSD analyses on the COC.

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

Precision

Precision was evaluated based on the relative percent difference (%RPD) of parent/FD results and MS/MSD. Sample HS-1 was collected in duplicate.

For the parent and FD samples, all results were non-detect at the reporting limits; therefore, the %RPD calculation was not applicable.

All %RPDs of 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.
- Both LCSs were 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 two method blanks and one TB associated with the VOC analyses in this SDG. All blanks were non-detect for all target VOCs. No target VOC was detected at or above the associated MDL in the two method 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%.

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 both on-post and off-post Camp Stanley Storage Activity (CSSA) on 4 and 7 of December 2015. The samples were assigned to the following Sample Delivery Group (SDG). All off-post groundwater samples were analyzed for VOCs only. The two on-post samples were also analyzed for selected metals, cadmium, chromium, lead, and mercury.

78122

The field QC sample associated with this SDG was a trip blank (TB). 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 3.0ºC, 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 eight (8) groundwater samples, including five (5) off-post groundwater samples, two (2) on-post groundwater samples, and one (1) TB. All samples were collected on 4 and 7 of December 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 analytical batch, #203442, 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 laboratory control spike (LCS) sample and the surrogate spikes.

All LCS and surrogate spike recoveries were within acceptance criteria.

Precision

Precision could not be evaluated due to the lack of duplicate analysis involved in this SDG.

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.
- 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. Trip blank was non-detect for all target VOCs. No target VOC was detected at or above the associated MDL in the two method 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 two (2) on-post groundwater samples collected on 4 and 7 December, 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 #203499. 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.

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.

Both 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 two 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 two (2) on-post groundwater samples collected on 4 and 7 of December, 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 #203418. 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 SDG.

Representativeness

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

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

Both 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 two 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) samples collected from both on-post and off-post Camp Stanley Storage Activity (CSSA) on 8, 9, and 10 of December 2015. The samples were assigned to the following Sample Delivery Group (SDG). All off-post groundwater samples were analyzed for VOCs only. All of the on-post samples were also analyzed for selected metals including cadmium, chromium, lead, and mercury.

78172

The field QC samples associated with this SDG were two trip blanks (TBs) and two field duplicates (FDs). 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. Both coolers were received by the laboratory at a temperature of 3.0ºC, 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 twenty (20) groundwater samples, including two (2) off-post groundwater samples, fourteen (14) on-post groundwater samples, and two (2) TB. All samples were collected from 8 to 10 of December 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 two analytical batches, #203589 and #203590, 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 two laboratory control spike (LCS) samples and the surrogate spikes.

All LCSs and surrogate spike recoveries were within acceptance criteria.

Precision

Precision was evaluated using the relative percent difference (%RPD) of the two sets of parent and FD samples. Samples JW-5 and CS-MW8-CC were collected in duplicate.

None of the target VOCs was detected at or above reporting limits in both sets of parent/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 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.

- Both LCSs were 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 two method blanks and two TBs associated with the VOC analyses in this SDG. Trip blanks was non-detect for all target VOCs. No target VOC was detected at or above the associated MDL in the two method 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 fifteen (15) on-post groundwater samples including one (1) FD collected on 8, 9 and 10 of December 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 #203551. 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 measured by the %RPD of the parent/FD result. On-post well CS-MW8-CC was collected in duplicate for metal analysis.

All three target metals were reported with value less than the reporting limits; 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 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 fifteen (15) on-post groundwater samples including one (1) FD collected on 8, 9 and 10 of December 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 #2033581. 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 measured based on the %RPD of the parent/FD sample results. Sample CS-MW8-CC was collected in duplicate for the mercury analysis.

Both parent and FD samples had no detection of mercury; 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 blank 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 December 14 and 15, 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 water samples were also analyzed for metals including cadmium, chromium, lead, and mercury.

78213

The field QC samples associated with this SDG were one set of parent/field duplicate (FD), one pair of matrix spike/matrix spike duplicate (MS/MSD), 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. 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 seventeen (17) samples, including twelve (12) on-post groundwater samples, one (1) off-post groundwater samples, one (1) FD, one (1) set of MS/MSD, and one (1) TB. All samples were collected from December 14 and, 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 analytical batch #203338 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. In addition, accuracy was evaluated based on then %R of MS and MSD results. Sample CS-MW23-LGR was designated as the parent sample for the MS/MSD analyses.

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

Precision

Precision was evaluated based on the relative percent difference (%RPD) of parent/FD results and MS/MSD analyses. Sample CS-MW19-LGR was collected in duplicate.

None of the target compounds were detected at or above the reporting limit in the parent/FD samples.

All %RPDs of 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 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 one method blank and one TB associated with the VOC analyses in this SDG. Both blanks were non-detect at method detection limits for all target VOCs.

Completeness

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

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

ICP-AES METALS

General

The ICP-AES portion of this SDG consisted of thirteen (13) groundwater samples including twelve (12) on-post water samples and one (1) FD. All samples were collected on December 14 or 15, 2015 and analyzed for cadmium, chromium, and lead.

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

The samples for ICP-AES metals were digested in batch #203621. All analyses were performed undiluted.

Accuracy

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

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

Precision

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

None of the target metals were detected above the reporting limits, therefore, the %RPD calculation was not applicable.

All %RPDs of MS/MSD 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 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 thirteen (13) groundwater samples including twelve (12) on-post water samples and one (1) FD. All samples were collected on December 14 or 15, 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 #203703. The analyses were performed undiluted.

Accuracy

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

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

Precision

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

Mercury was not detected in the parent and FD samples.

%RPD was compliant for the MS/MSD results.

Representativeness

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

- Comparing the COC procedures to those described in the CSSA QAPP;
- Comparing actual analytical procedures to those described in the CSSA QAPP;
- Evaluating 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 off-post Camp Stanley Storage Activity (CSSA) on December 16 and 17, 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 water samples were also analyzed for metals including cadmium, chromium, lead, and mercury.

78256

The field QC samples associated with this SDG were one set 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. 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 thirteen (13) samples, including eleven (11) on-post groundwater samples, one (1) FD, and one (1) TB. All samples were collected from December 14 and, 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 two analytical batches #203749 and 203752 under two sets 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 except cis-1,2-DCE and TCE were analyzed with two fold dilution for samples CS-MW16-LGR and its FD.

Accuracy

Accuracy was evaluated using the percent recovery (%R) obtained from the two laboratory control spike (LCS) samples 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/FD results. Sample CS-MW16-LGR was collected in duplicate.

Cis-1,2-DCE, PCE, and TCE were detected above the reporting limits in the parent and its FD. All %RPDs were <30%.

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 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 two method blanks and one TB associated with the VOC analyses in this SDG. All blanks were non-detect at method detection limits for all target VOCs.

Completeness

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

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

ICP-AES METALS

General

The ICP-AES portion of this SDG consisted of twelve (12) groundwater samples including eleven (11) on-post water samples and one (1) FD. All samples were collected on December 16 or 17, 2015 and analyzed for cadmium, chromium, and lead.

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

The samples for ICP-AES metals were digested in batch #203844. All analyses were performed undiluted.

Accuracy

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

The LCS recoveries were within acceptance criteria.

Precision

Precision was measured based on the %RPD of parent/FD sample results.

None of the target metals were detected above the reporting limits, 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 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 twelve (12) groundwater samples including eleven (11) on-post water samples and one (1) FD. All samples were collected on December 16 or 17, 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 #203818. 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 measured based on the %RPD of parent/FD sample results.

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-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) samples collected from Camp Stanley Storage Activity (CSSA) on December 18, 2015. The samples were assigned to the following Sample Delivery Group (SDG). All on-post samples were analyzed for volatile organic compounds (VOCs) and metals including arsenic, barium, cadmium, chromium, copper, lead, zinc, and mercury. One monitoring well, CS-MW22-LGR, was analyzed for a shorter list of metals which included cadmium, chromium, lead, and mercury.

78278

The field QC samples associated with this SDG were one set of parent/field duplicate (FD), one set of matrix spike/matrix spike duplicate (MS/MSD), 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 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 ten (10) samples, including six (6) on-post groundwater samples, one (1) FD, one (1) set of MS/MSD, and one (1) TB. All samples were collected on December 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 two batches, all field samples were run in batch #203688, but the MS/MSD were analyzed in a different batch. These two batches had two sets 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. Sample CS-13 was designated for MS/MSD analysis on the chain of custody (CoC).

All LCS, MS, MSD, 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 and MS/MSD results. Sample CS-10 was collected in duplicate.

None of the target VOCs were detected in the parent and FD samples, therefore, the %RPD calculation was not applicable.

All %RPDs of MS/MSD 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 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 eight (8) on-post groundwater samples including five (5) on-post well samples, one set of MS/MSD, and one (1) FD which were collected on December 18, 2015 and analyzed for arsenic, barium, cadmium, chromium, copper, lead, and zinc. CS-MW22-LGR was analyzed for cadmium, chromium, and lead only.

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 #203845. All analyses were performed undiluted.

Accuracy

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

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

Precision

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

All %RPDs were compliant for the MS/MSD analyses.

Only barium was detected above the reporting limit in the parent and FD samples. The %RPD was 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 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 eight (8) on-post groundwater samples including five (5) on-post well samples, one set of MS/MSD, and one (1) FD which were collected on December 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 #198427. The analyses were performed undiluted.

Accuracy

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

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

Precision

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

The %RPD of MS/MSD was compliant.

Mercury was not detected in the parent and 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%.