FINAL SAMPLING AND ANALYSIS PLAN

Contract No. W91278-06-D-0026
Task Order DY-02

Prepared for:

Camp Stanley Storage Activity
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1.0 INTRODUCTION

This document is an amendment to the existing Sampling and Analysis Plan (SAP) for quarterly groundwater monitoring **(Volume 1-4: Sampling and Analysis Plan and Quality Assurance Project Plan)** in the CSSA Environmental Encyclopedia. The purpose of this addendum is to identify and address specific sampling and analysis plan items for the Task Order DY02 field activities and confirm that the activities will be conducted as set out in the original SAP or subsequent addenda.

This addendum to the SAP is prepared in accordance with applicable state regulations. The guidance for sampling techniques was adapted from the Air Force Center for Environmental Excellence (AFCEE) Model Field Sampling Plan (MFSP). Input and recommendations from the United States Environmental Protection Agency (USEPA), Region 6 and the Texas Commission on Environmental Quality (TCEQ) were also considered and incorporated into the planning documents.

1.1 GROUNDWATER MONITORING SCOPE OF WORK

1. Perform six rounds of groundwater monitoring from selected off-post wells and perform monthly operation and maintenance (O&M) at granular activated carbon (GAC) systems located off-post. The estimated number of wells to be sampled is 76, 56, 62, 47, 66, and 46 in September 2007, December 2007, March 2008, June 2008, September 2008, and December 2008, respectively. These sample counts do not include quality assurance/quality control (QA/QC) samples.
2. Perform six rounds of groundwater monitoring from selected on-post wells.
3. Perform three rounds of semi-annual sampling at the four Westbay®-equipped wells (CS-WB01, CS-WB02, CS-WB03, and CS-WB04) located both on- and off-post. The Westbay-equipped wells located at solid waste management unit B-3 (CS-WB04, CS-WB05, CS-WB07, and CS-WB08) are sampled under a separate CSSA TO and are not covered in this sampling plan.
4. Collect, dispose, treat, and discharge of liquid investigation derived waste (IDW) at the CSSA GAC (Outfall 002).
5. Operate and perform basic O&M tasks at the Texas Pollution Discharge Elimination System (TPDES)-permitted GAC treatment system located at Outfall 002 for 12 months. Operate and perform basic O&M tasks and sampling at Outfall 004 for 12 months.

2.0 GROUNDWATER WELL SAMPLING

On-post wells will be sampled according to the **Three-Tiered Long-Term Monitoring Network Optimization Evaluation (Parsons 2005)** as set out for drinking water, monitoring or agricultural/livestock wells and the **Data Quality Objectives for the Groundwater Monitoring Program (Parsons, 2006)**. Additionally, up to 40 off-post private and public drinking water wells may be sampled in accordance with the Data Quality Objectives (DQO).

A well network optimization study was conducted in accordance with the **AFCEE Long-Term Monitoring Optimization (LTMO) Guide (AFCEE 1997)**, which includes the evaluation of cumulative historical analytical results, GIS data, statistical trends, project and assess redundancy and sampling frequency. The study provided a qualitative evaluation based on hydrogeologic factors to provide specific reasons for retaining each monitoring well in the sampling network. Results of the study were presented and revisions to the number of wells sampled and their frequency changed accordingly. **Table 1** indicates the current number of wells and sampling parameters that are funded under DY02. **Table 2** indicates the tentative list of wells expected to be sampled on-post based on the LTMO sampling frequency. **Table 3** indicates the analytes to be sampled under DY02.

Sampling of the wells will be based on AFCEE Handbook procedures with exceptions as appropriate for the hydrogeology at the site. The wells will be purged in accordance with low-flow sampling techniques. QA/QC sampling and analysis will be performed to meet requirements in the CSSA Quality Assurance Program Plan (QAPP). Purged water will be containerized and transported to the GAC treatment system prior to discharge at CSSA's Outfall 002.

Table 1 Sample Quantities and Analytical Parameters

		Analyses & Method					
		VOCs	Metals	Trip Blank	MS	MSD	Field Duplicates
Well Type/Total No. Wells		**8260**	**6010**	**8260**	**8260**	**8260**	**8260**
September 2007							
Total Wells	76						
CSSA Wells		36	36	3	1	1	2
Off-Post Supply Wells*		40	-	3	2	2	4
December 2007							
Total Wells	56						
CSSA Wells		16	16	3	1	1	1
Off-Post Supply Wells		40	-	3	2	2	4
March 2008							
Total Wells	62						
CSSA Wells		22	22	3	2	2	3
Off-Post Supply Wells		40	-	3	2	2	4
June 2008							
Total Wells	47						
CSSA Wells		7	7	3	1	1	1
Off-Post Supply Wells		40	-	3	2	2	4

Table 1 Sample Quantities and Analytical Parameters (cont'd)

		Analyses & Method					
		VOCs	**Metals**	**Trip Blank**	**MS**	**MSD**	**Field Duplicates**
Well Type/Total No. Wells		**8260**	**6010**	**8260**	**8260**	**8260**	**8260**
September 2008							
Total Wells	66						
CSSA Wells		26	26	3	2	2	3
Off-Post Supply Wells		40	--	3	2	2	4
December 2008							
Total Wells	46						
CSSA Wells		6	6	3	1	1	1
Off-Post Supply Wells		40	--	3	2	2	4

Table 2
Tentative List of Wells to be Sampled

Count	Well ID	*Analytes*	*Sep-07*	*Dec-07*	*Mar-08*	*Jun-08*	*Sep-08*	*Dec-08*	*Sampling Frequency*
1	CS-MW1-LGR	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
2	CS-MW1-BS	VOCs & metals (Pb, Cd, Ni)	S	NS	NS	NS	NS	NS	Biennial
3	CS-MW1-CC	VOCs & metals (Pb, Cd, Ni)	S	NS	NS	NS	NS	NS	Biennial
4	CS-MW2-LGR	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
5	CS-MW2-CC	VOCs & metals (Pb, Cd, Ni)	S	NS	NS	NS	NS	NS	Biennial
6	CS-MW3-LGR	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
7	CS-MW4-LGR	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
8	CS-MW5-LGR	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
9	CS-MW6-LGR	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
10	CS-MW6-BS	VOCs & metals (Pb, Cd, Ni)	S	NS	NS	NS	NS	NS	Biennial
11	CS-MW6-CC	VOCs & metals (Pb, Cd, Ni)	S	NS	NS	NS	NS	NS	Biennial
12	CS-MW7-LGR	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
13	CS-MW7-CC	VOCs & metals (Pb, Cd, Ni)	S	NS	NS	NS	NS	NS	Biennial
14	CS-MW8-LGR	VOCs & metals (Pb, Cd, Ni)	NS	S	NS	NS	S	NS	Every 9 months*
15	CS-MW8-CC	VOCs & metals (Pb, Cd, Ni)	S	NS	NS	NS	NS	NS	Biennial
16	CS-MW9-LGR	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
17	CS-MW9-BS	VOCs & metals (Pb, Cd, Ni)	S	NS	NS	NS	NS	NS	Biennial
18	CS-MW9-CC	VOCs & metals (Pb, Cd, Ni)	S	NS	NS	NS	NS	NS	Biennial
19	CS-MW10-LGR	VOCs & metals (Pb, Cd, Ni)	NS	S	NS	NS	S	NS	Every 9 months*
20	CS-MW10-CC	VOCs & metals (Pb, Cd, Ni)	S	NS	NS	NS	NS	NS	Biennial
21	CS-MW11A-LGR	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
22	CS-MW11B-LGR	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
23	CS-MW12-LGR	VOCs & metals (Pb, Cd, Ni)	NS	S	NS	NS	S	NS	Every 9 months*
24	CS-MW12-BS	VOCs & metals (Pb, Cd, Ni)	S	NS	NS	NS	NS	NS	Biennial
25	CS-MW12-CC	VOCs & metals (Pb, Cd, Ni)	S	NS	NS	NS	NS	NS	Biennial
26	CS-MW16-LGR	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
27	CS-MW16-CC	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
28	CW-MW17-LGR	VOCs & metals (Pb, Cd, Ni)	NS	S	NS	NS	S	NS	Every 9 months*
29	CS-MW18-LGR	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
30	CS-MW19-LGR	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
31	CS-1	VOCs & metals (Pb, Cd, Ni)	NS	S	NS	NS	S	NS	Every 9 months*
32	CS-2	VOCs & metals (Pb, Cd, Ni)	NS	S	NS	NS	S	NS	Every 9 months*
33	CS-4	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
34	CS-9	VOCs & metals (Pb, Cd, Ni)	S	NS	NS	S	NS	NS	Every 9 months*
35	CS-10	VOCs & metals (Pb, Cd, Ni)	NS	S	NS	NS	S	NS	Every 9 months*
36	CS-11	VOCs & metals (Pb, Cd, Ni)	NS	S	NS	NS	S	NS	Every 9 months*
37	CS-D	VOCs & metals (Pb, Cd, Ni)	S	NS	S	NS	S	NS	Semi-annual
38	CS-MWG-LGR	VOCs & metals (Pb, Cd, Ni)	NS	S	NS	NS	S	NS	Every 9 months*
39	CS-MWH-LGR	VOCs & metals (Pb, Cd, Ni)	S	NS	NS	NS	NS	NS	Biennial
40	CS-I	VOCs & metals (Pb, Cd, Ni)	NS	S	NS	NS	S	NS	Every 9 months*
41	CS-MW20-LGR	VOCs & metals (Pb, Cd, Ni)	S	S	S	S	NS	S	Quarterly**
42	CS-MW21-LGR	VOCs & metals (Pb, Cd, Ni)	S	S	S	S	NS	S	Quarterly**
43	CS-MW22-LGR	VOCs & metals (Pb, Cd, Ni)	S	S	S	S	NS	S	Quarterly**
44	CS-MW23-LGR	VOCs & metals (Pb, Cd, Ni)	S	S	S	S	NS	S	Quarterly**
45	CS-MW24-LGR	VOCs & metals (Pb, Cd, Ni)	S	S	S	S	NS	S	Quarterly**
46	CS-MW25-LGR	VOCs & metals (Pb, Cd, Ni)	S	S	S	S	NS	S	Quarterly**

	Sep-07	*Dec-07*	*Mar-08*	*Jun-08*	*Sep-08*	*Dec-08*
Subtotal	36	16	22	7	26	6
Add off-post	40	40	40	40	40	40
Totals	**76**	**56**	**62**	**47**	**66**	**46**

*Wells recommended for annual sampling frequency in the LTMO are scheduled every nine months (every third quarter) to gather seasonal data.
**Quarterly until LTMO Update study can recommend a frequency.

Table 3 Analytes to be Sampled

On-post Analyses	
VOCs	**Metals**
1,1 – dichlorethene cis – 1,2 – dichloroethene trans – 1,2 – dichloroethene tetrachloroethene trichloroethene vinyl chloride	cadmium lead nickel
Off-post Analyses	
VOCs	
1,1 – dichlorethene cis – 1,2 – dichloroethene trans – 1,2 – dichloroethene tetrachloroethene trichloroethene vinyl chloride	

2.1 WATER LEVEL MEASUREMENTS

Water level measurements will be obtained from on-post monitoring, agricultural and drinking water wells that provide good access for an electric measuring device. The depth to water will be measured to the nearest 0.01-foot with respect to the surveyed reference point on the top of the casing. If no clear reference point exists, the reading will be obtained from the north side of the well casing as a reference point. Drinking water wells are equipped with gauging tubes for obtaining water levels.

In the past, drinking water supply wells were shut down before a quarterly event (no more than 48 hours) to allow the aquifer to equilibrate. Due to the addition of wells installed in specified zones the drinking water supply wells are no longer needed to produce the potentiometric maps, therefore shutting down these wells is no longer necessary. A water level measurement will still be collected during quarterly water level measurements. The recently installed solar powered pump at CS-I will require shut-off prior to collecting a water level measurement.

A portion of on-post wells contain transducers and two weather stations have been installed. The weather stations are located near CS-MW16-LGR along the northern fenceline of the inner cantonment, and near the southeast corner of the inner cantonment, west of Building 90. The transducers are currently being relocated to provide the best range of water level data in coordination with the newly installed SCADA network. Data from all well transducers and weather stations will be downloaded as part of each quarterly event for creation of a potentiometric surface figure. Water levels may also be collected from select off-post wells to assist in preparation of potentiometric surface maps.

2.2 GROUNDWATER SAMPLING METHODS

In general, the overall goal of any groundwater sampling program is to collect representative water samples with little or no alteration in water chemistry. Analytical data obtained in this manner may be used for a variety of purposes depending on regulatory requirements. CSSA has initiated a low-flow sampling program for all the installation's monitoring wells, while drinking water and livestock wells are equipped with either high capacity or solar powered downhole pumps. Other wells include low-yielding perched aquifer wells (AOC-65), Westbay® multi-port equipped wells, on- and off-post public drinking water wells, and off-post domestic drinking water wells. There are five types of well sampling that will be routinely carried out over the course of this task order. Each type of well and the appropriate sampling technique is discussed below:

2.2.1 On-post Wells with Dedicated Low-Flow Bladder Pumps

A goal of the CSSA groundwater monitoring program is collection of data that is most representative of conditions at the site. It is generally accepted that static water in the well casing is not representative of the formation water and needs to be purged prior to collection of groundwater samples. However, water in the screened interval may indeed be representative of the formation, depending on well construction and site hydrogeology. CSSA uses a low-flow sampling strategy in many of the on-post monitoring wells. The use of low-flow purging and sampling techniques mitigates sampling-induced turbidity problems. The following discussion and procedures are excerpted from the USEPA guidance entitled *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures* (USEPA 1995).

Low-flow refers to the velocity with which water enters the pump intake and is imparted to the formation pore water in the immediate vicinity of the well screen. The objective is to pump in a manner that minimizes stress (drawdown) to the system to the extent practical, taking into account established site sampling objectives. Typically flow rates on the order of 0.1-0.5 liters per minute (L/min) are used; however, some extremely porous formations can be successfully sampled at flow rates to one (1) L/min. Isolation of the screened interval water from the overlying stagnant casing water may be accomplished using low-flow minimal drawdown techniques. When the pump intake is located within the screened interval most of the water pumped will be drawn in directly from the formation with little mixing of casing water or disturbance to the sampling zone.

CSSA utilizes a QED Well Wizard™ system for collecting low-flow samples. The sampling device consists of a pressurized nitrogen gas canister, pneumatic controller, gas injection tubing, a bladder pump, a drop pipe with inlet (deeper wells only), and discharge tubing. Prior knowledge of the well construction is necessary to assist in purging. At a minimum, any stagnant water remaining in the pump tubing needs to be purged so that formation-representative groundwater is being collected at the sampling port. A minimum purge volume is defined as the amount of water held in storage within the 3/8-inch discharge tubing. Water may stagnate within the discharge tubing between sampling events since it is held by a check valve located at the pump. **Table 4** lists the current and anticipated low-flow pump systems to be sampled at CSSA. An estimated minimum purge volume to evacuate stagnant water is also included in this table. As additional wells are completed and actual construction information becomes available, the table will be updated.

Well purging is necessary to obtain samples of water from a formation in the screened interval. Rather than using the arbitrary guideline of purging three casing volumes prior to sampling, water quality measurements will be used to establish stabilization time for several parameters (*e.g.*, temperature, pH, and specific conductance) on a well-specific basis. Data on pumping rate, drawdown, and volume required for parameter stabilization can be used as a guide for conducting subsequent sampling activities. The following recommendations should be considered:

- Use low-flow rates (<0.5 L/min) during both purging and sampling to maintain minimal drawdown in the well;
- Make proper adjustments to stabilize the flow rate as soon as possible;
- Remove a sufficient volume to purge stagnant water from the discharge tubing; and
- Monitor water quality indicators during purging.

Table 4
Low-Flow Pump Installation Data and Minimum Tubing Purge Volumes

Well Name	Screen Interval	Pump Depth	Inlet Depth[1]	Minimum Tubing Purge[2]
	(feet bgs)			(gallons)
CS-MW1-LGR	288-313	300	303.5	0.87
CS-MW1-BS	340.5-365.5	302	353	2.1
CS-MW1-CC	395-420	302	407	2.5
CS-MW2-LGR	318-343	330	333.5	0.95
CS-MW2-CC	425-450	302	438	1.27
CS-MW3-LGR	402-427	374	417	1.17
CS-MW4-LGR	299-324	203	315	0.91
CS-MW5-LGR	420-445	404	435	1.21
CS-MW6-LGR	340-365	311	355	1.01
CS-MW6-BS	397-422	311	412	1.15
CS-MW6-CC	451-476	311	466	1.29
CS-MW7-LGR	322-347	290	337	0.96
CS-MW7-CC	430-455	290	445	1.24
CS-MW8-LGR	332-357	299	347	0.99
CS-MW8-CC	440-465	299	455	1.26
CS-MW9-LGR	296-321	283	311	0.90
CS-MW9-BS	352-377	303	367	1.04
CS-MW9-CC	425-450	303	440	1.23
CS-MW10-LGR	370-395	294	379	1.07
CS-MW10-CC	470-495	293	478	1.32
CS-MW11A-LGR	420-445	342	432	1.21
CS-MW11B-LGR	182-207	194	197	0.61
CS-MW12-LGR	333-358	302	345	2.0
CS-MW12-BS	382-407	302	384	2.4
CS-MW12-CC	440-465	302	452	2.8
CS-2	205-350	339	339	0.97
CS-MW16-LGR	199-310	290	293	1.7
CS-MW16-CC	406-431	TBD	TBD	2.5
CS-MW17-LGR	367-392	307	380	1.1
CS-MW18-LGR	385-410	325	397.5	1.1
CS-MW19-LGR	340-365	305	352.5	1.0
CS-D	205-263	253	253	0.75
CS-MWG-LGR	155-339	315	318	1.8

- **bgs** – Below Ground Surface
- **TBD** – To Be Determined. Pump depth will be determined after installation.
- [1] In deeper wells, the Inlet depth varies from pump depth when a drop tube is installed below the pump.
- [2] Minimum purge volume indicates the approximate volume of stagnant groundwater that may be retained within a 3/8" discharge tubing of a typical QED system at CSSA. At least this much water requires purging to ensure that fresh groundwater samples are being obtained.

Prior to sampling, all sampling devices and monitoring equipment will be calibrated in accordance with manufacturer's recommendations and the SAP **(Volume 1-4: Sampling and Analysis Plan)**. Calibration of the pH meter should be performed with at least two known pH solutions that bracket the expected range.

The USEPA recommends that the water level be checked periodically to monitor drawdown in the well as a guide to flow rate adjustment. The goal is minimal drawdown (<0.1 meter) during purging. At CSSA, it is unlikely that the dedicated bladder pumps can create such a drawdown in the main karst aquifers (*e.g.*, LGR and CC). In lower yielding intervals (perched aquifer or BS wells) this goal may be difficult to achieve under some circumstances due to geologic heterogeneity within the screened interval, and may require adjustment based on site-specific conditions and experience of the Parsons field team.

Water quality indicator parameters will be continuously monitored during purging. The water quality indicator parameters monitored can include temperature, pH, and conductivity. The last two parameters are often most sensitive. Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well. Measurements should be taken every 3-5 minutes. Stabilization is achieved after all parameters have stabilized for three successive readings at some volume beyond the minimum purge requirements. Three successive readings should be within ± 1° F (± 0.5° C) for temperature, ± 0.1 for pH, ± 5% for conductivity, and ± 10% for turbidity.

Samples will be collected upon stabilization of water quality parameters. If an in-line device is used to monitor water quality parameters, it should be disconnected or bypassed during sample collection. Sampling flow rate may remain at established purge rate or may be adjusted slightly to minimize aeration, bubble formation, turbulent filling of sample bottles, or loss of volatiles due to extended residence time in tubing. Typically, flow rates less than 0.5 L/min are appropriate. The flow rate for volatile sampling should approach 0.1 L/min. Generally, volatile (*e.g.*, solvents and fuel constituents) and gas sensitive (*e.g.*, Fe^{2+}, CH_4, H_2S/HS^-, and/or alkalinity) parameters should be sampled first. If filtered (dissolved) samples are needed, filtering will be performed last, and in-line filters should be used. Groundwater samples should be collected directly into this container from the pump tubing.

2.2.2 Westbay® Multi-Port Samplers

Westbay®-equipped monitoring wells will be monitored and sampled three times from September 2007 until December 2008. Samples from these wells will be obtained on a semi-annual frequency. Parsons will supply two field technicians per groundwater sampling event. Groundwater samples will be collected from discrete intervals using the Westbay® device for three semi-annual events. Pressure readings will be recorded at selected depth intervals in the Westbay®-equipped wells prior to sampling activities.

The sampling and use of the multi-port monitoring devices require specialized training provided by Westbay®. Several people from CSSA and Parsons were trained on the correct usage and procedures for obtaining meaningful data. Requirements for measurement, purging, and sampling were provided by Westbay® at that time.

2.2.3 Deep Wells Sampled by the Bailer Method

Some quarterly groundwater events include deeper, larger diameter wells that may be routinely sampled but are not equipped with any sampling device. Currently, there are no wells scoped for sampling with this design, but the need may eventually arise periodically (*e.g.*, CS-3 is not equipped with a pump). The diameter and depth preclude bailing as a feasible purging alternative. Samples collected from such wells will be obtained by bailer grab samples. The same field methodology for shallow wells will be implemented for collecting deeper samples utilizing a bailer. A single measurement for pH, temperature, and conductivity will be recorded to document the water quality.

2.2.4 On-post Drinking and Wildlife Water Supply Wells

Drinking and wildlife water wells available for groundwater monitoring are purged to remove water from the pump column. Currently, these include CS-1, CS-9, CS-10, CS-11, and CS-I. Purged groundwater is typically pumped into the distribution system at CS-1, CS-9, and CS-10. CS-11 is currently off-line, therefore the well is purged directly onto the ground surface. Wells with pumps are purged 10 to 15 minutes prior to sampling. Since CS-1 pumps continuously, it is sampled as soon as monitoring parameters stabilize. Temperature, pH, and conductivity will be taken prior to and during purging. Well purging will be performed until temperature, pH, and conductivity values stabilize. Stabilization is defined for pH as ± 0.1 unit, temperature ± 1°F (±0.5°C), turbidity as ± 10 %, and conductivity as ± 5 %. Successive measurements will be taken at 5-minute intervals. All water quality parameters recorded while purging will be noted in the field logbook. Samples are collected from the water faucet tap located at or near the top of the wellhead.

2.2.5 Off-post Domestic and Public Supply Wells

Off-post groundwater samples will be collected from select off-post public drinking water and domestic drinking water wells. Nearly all these wells are equipped with a submersible water pump, a bladder-type pressure chamber or booster pump, and possibly a large storage capacity cistern. These wells are purged and sampled with the same criteria as the on-post drinking water wells. Most off-post well locations require a signed access agreement and a minimum of 72-hours notification to the well owner before accessing the site.

Most wells with pressure tanks can be operated by opening a faucet to create a pressure drop, thereby engaging the well pump. Cisterns and booster pumps often operate the well pump with some type of level switch (float or pressure), and therefore may require some manipulation to engage the pump. This can be accomplished either by draining water from the cistern to activate the switch, or manually engaging the switch at its location if the well is so equipped. The field sampling team will bring an extra garden hose to directly purge water to an unobtrusive location, if necessary. When possible, public drinking water supply wells will be operated by the owners of the system or their designated representative only. The City of Fair Oaks has instructed Parsons' personnel in proper procedures for sampling FO-J1, as set out below.

The field sampling team must ensure that the pump is running when the groundwater sample is collected. CSSA has already retrofitted several off-post domestic wells with wellhead sampling ports. All samples must originate at or as near to the wellhead as possible prior to other system influences, which include pressure tanks, booster pumps, water softeners, and/or cisterns.

Because of the variability in privately owned drinking water systems, multiple procedures are required to assure that the well pump is running and that a representative groundwater sample is obtained. Instructions for the individual off-post wells sampled to date are included to ensure sample integrity and proper entrance and exit from the well owner's property without disrupting the well owner. Future off-post drinking water wells added to the monitoring program should follow similar procedures, as applicable.

2.2.5.1 DOM-2

1. The well is located in a gated community; in order to enter have the address and contact information for the guard.
2. Well is located to the left of the driveway in a doghouse enclosure. Remove enclosure by lifting doghouse off pad. (Note: recommend wearing gloves to avoid cutting hands on sharp edges of well house enclosure. Beware of mice and spiders.)
3. Engage well pump with pump key **(Figure Pump Key-1)**, box located near electrical box **(Appendix B, Figure DOM-2).**
4. Purge at wellhead tap. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
5. Collect sample from wellhead tap.
6. Disengage pump and retrieve key **(Figure Pump Switch-1)**.
7. Return well housing back to original configuration.

2.2.5.2 FO-8

1. The well is located in a fenced in enclosure, key is kept in CSSA key box, labeled Fair Oaks. Address is on telephone pole next to the well.
2. On the electrical box next to the well make sure the power is on and pump switch is set to "Hand", then push the start button. *Note: Make sure all settings are put back as they were when you arrived, after sample is collected.*
3. Purge at wellhead tap **(Appendix B, Figure FO-8)**. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample and return all settings back to original configuration as when the operator arrived.
5. Close and lock all gates.
6. For changes to this accepted procedure or any other questions regarding the Fair Oaks Ranch Utilities public drinking water wells, contact Mr. John B. Moring, Jr., Fair Oaks Ranch Utilities, 7286 Dietz Elkhorn Rd, Fair Oaks Ranch, TX 78015, (210) 652-7929.

2.2.5.3 FO-J1 (Owned and operated by Fair Oaks Ranch Utilities, City of Fair Oaks)

1. The well is located behind JW-14's residence. Enter through the gate at south end of property. The key is kept in the CSSA key box. Go through three gates, closing each gate behind you so the dog does not escape. The well is located in a fenced in area, see photo **Appendix B, Figure FO-J1**.
2. On the telephone pole next to the well make sure the power is on and pump switch is set to "Hand", then push the start button. *Note: Make sure all settings are put back as they were when you arrived, after sample is collected.*
3. Purge at wellhead tap. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample and return all settings back to original configuration as when the operator arrived.
5. Close and lock all gates.
6. For changes to this accepted procedure or any other questions regarding the Fair Oaks Ranch Utilities public drinking water wells, contact Mr. John B. Moring, Jr., Fair Oaks Ranch Utilities, 7286 Dietz Elkhorn Rd, Fair Oaks Ranch, TX 78015, (210) 652-7929.

2.2.5.4 FO-17

1. The well is located in a fenced in enclosure, key is kept in CSSA key box, labeled Fair Oaks.
2. This particular well has no access to manually engage the pump.
3. Purge at wellhead tap. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample and make sure wellhead tap is turned off.
5. Close and lock the gate.
6. For changes to this accepted procedure or any other questions regarding the Fair Oaks Ranch Utilities public drinking water wells, contact Mr. John B. Moring, Jr., Fair Oaks Ranch Utilities, 7286 Dietz Elkhorn Rd, Fair Oaks Ranch, TX 78015, (210) 652-7929

2.2.5.5 FO-22

1. The well is located in a fenced in enclosure, key is kept in CSSA key box, labeled Fair Oaks. Address is on telephone pole next to the well.
2. On the electrical box next to the well make sure the power is on and pump switch is set to "Hand", then push the start button. *Note: Make sure all settings are put back as they were when you arrived, after sample is collected.*
3. Purge at wellhead tap. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample and return all settings back to original configuration as when the operator arrived.
5. Close and lock all gates.
6. For changes to this accepted procedure or any other questions regarding the Fair Oaks Ranch Utilities public drinking water wells, contact Mr. John B. Moring, Jr., Fair Oaks Ranch Utilities, 7286 Dietz Elkhorn Rd, Fair Oaks Ranch, TX 78015, (210) 652-7929.

2.2.5.6 I10-5

1. Well is located in fenced in area to the right of the shopping center. Well owner must be contacted to open the gate.
2. Open drain valve at the bottom of the cistern to engage well pump.
3. After well pump engages purge at wellhead. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample from wellhead tap.
5. Make sure drain valve is closed and wellhead tap is turned off before leaving.

2.2.5.7 I10-7

1. Well is located at back of property, follow driveway back and well is to the left, in a building resembling an outhouse, see **Appendix B, Figure I10-7**.
2. Purge pressure tank from faucet facing back of well house, which will engage the well pump.
3. Purge at wellhead. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample from wellhead tap.
5. Make sure all water is turned off before leaving.

2.2.5.8 I10-8

1. Well is located on the right, next to the building, as you pull into the driveway, see **Figure I10-8**.
2. Purge pressure tank from any faucet in the vicinity, which will engage the well pump.
6. Purge at wellhead. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
7. Collect sample from wellhead tap.
8. Make sure all water is turned off before leaving.

2.2.5.9 JW-5

1. Well is located to the left as you pull in the driveway in front of the main house, see **Figure JW-5**.
2. Purge pressure tank from the faucet on the wellhouse, which will engage the well pump.
3. When the pump engages record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample from faucet on the side of the wellhouse.
5. Make sure all water is turned off before leaving.

2.2.5.10 JW-6

1. Must have gate code to enter (contact well owner for current code).
2. Well is located straight ahead when entering the driveway, behind trees.
3. Turn on water faucet at pressure tank to engage well pump, see **Appendix B, Figure JW-6**.

4. Purge at wellhead. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
5. Collect sample from wellhead tap.
6. Make sure all water is turned off before leaving.

2.2.5.11 JW-7

1. Well is located behind house, following path to right of house, well is in a well house.
2. Turn on water faucet on the outside of the well house to purge pressure tank, see **Appendix B, Figure JW-7**.
3. Listen for well pump to engage. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample from tap on outside of well house.
5. Make sure all water is turned off before leaving.

2.2.5.12 JW-8

1. Well is located at end of driveway, look for the cistern **(Appendix B, Figure JW-8.1 and JW-8.2)**.
2. Watch out for bees and scorpions at wellhead. Remove barrel to gain access to wellhead.
3. Open valve at the base of the cistern to purge enough water to engage the well pump.
4. Purge at wellhead. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
5. Collect sample from wellhead tap.
6. Turn wellhead faucet off, replace barrel over well, and close cistern valve before leaving.

2.2.5.13 JW-9

1. Arrive at gate, reach through and push black button in gray box to open gate, stand guard to make sure dog does not escape, close gate behind you during sampling.
2. Well is located on the right hand side of driveway, before you reach the residence **(Appendix B, Figure JW-9.1)**.
3. Open valve on far side of the cistern to engage well pump, see **Appendix B, Figure JW-9.2**.
4. Purge at wellhead. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
5. Collect sample from wellhead tap.
6. Make sure all water is turned off and cistern valve is closed before leaving.
7. When leaving stand guard at gate while it closes to make sure dog does not escape.

2.2.5.14 JW-12

1. Well is located to the right of the driveway across from house in a well house **(Appendix B, Figure JW-12)**.
2. Turn on faucet outside the main house and/or nearby garage.

3. When pump engages record pH, temperature, and conductivity readings at the wellhead until parameters stabilize, record approximate gallons purged.
4. Collect sample from wellhead tap.
5. Turn all water faucets off and leave everything as it was upon arrival.

2.2.5.15 JW-13

1. Well is located to the left of the driveway across from house **(Appendix B, Figure JW-13)**.
2. Turn on faucet at pressure tank to purge well and engage well pump. Follow the water hose away from well and unhook the first connection encountered. This hose leads to the dog's water and will flood the dog pen if not disconnected.
3. Purge at wellhead. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample from wellhead tap; make sure well pump has not turned off when collecting readings and sample.
5. Turn all water faucets off, reconnect hose to dog pen, close gate behind you when leaving.

2.2.5.16 JW-14

1. Contact well owner to schedule a time to sample, well owner will usually leave the gate open that day.
2. Well is located to the right of house when facing it, in small stucco building by the garage **(Appendix B, Figure JW-14)**.
3. Turn on water faucet in front of house in flowerbed to purge pressure tank.
4. Hook up water hose to faucet at wellhead and divert water out of well house while purging.
5. Listen for well pump to engage and record parameters (pH, temperature, conductivity, gallons purged).
6. When parameters stabilize, remove hose from wellhead faucet and collect sample directly from wellhead tap. Use a collection container to minimize the amount of water that spills inside the well house. (Note: if pump disengages during sampling wellhead faucet will shut off.)
7. Make sure the water is turned off to flowerbed in front of house before leaving.

2.2.5.17 JW-15

1. Well is located behind the house.
2. Turn on water by the garden to purge until pump engages, will have to listen and/or feel the water line to detect whether the well pump is running.
3. Purge at wellhead tap. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample from wellhead tap.
5. Make sure all water is turned off before leaving.

2.2.5.18 JW-26

1. Well is located through the second gate to the left in a well house. Contact well owner to open main gate **(Appendix B, Figure JW-26)**.
2. Use water hose to purge water until pump engages, will have to listen and/or feel the water line to detect whether the well pump is running.
3. Purge at wellhead tap. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Disconnect water hose and collect sample from wellhead tap.

2.2.5.19 JW-27

1. Well is located to the right of the house when facing it, to gain access enter through gate on Fawn Mountain Road **(Appendix B, Figure JW-27)**.
2. Connect the water hose to avoid flooding the well house. Use well pump key **(Figure Pump Key-1)** to engage well pump.
3. Purge at wellhead tap. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Remove water hose and collect sample from wellhead, using a container to minimize water running onto the floor of the well house.
5. Disengage pump and retrieve pump key. Make sure water faucet is turned off. Be sure that all items are left in the condition they were found upon arrival.

2.2.5.20 JW-28

1. Contact well owner for current gate code.
2. The well is located in the shed to the left of the driveway, see **Figure JW-28.1 and 28.2**.
3. Turn on water faucet by the house to purge pressure tank.
4. When pump engages use a water hose to purge at wellhead tap to avoid flooding well house. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
5. Remove water hose and collect sample from wellhead, use a container to catch any overflow.
6. Turn all faucets off and leave everything in the same condition as it was found upon arrival.

2.2.5.21 JW-29

1. The well is located to the right of house.
2. Turn on water faucet on the way to the well, by the dog bowl, to purge pressure tank, **(Appendix B, Figure JW-29).**
3. Purge at wellhead tap. Listen and feel the ground to ensure well pump has engaged. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample from wellhead.
5. Turn all faucets off and leave everything in the same condition as it was found upon arrival.

2.2.5.22 JW-30

1. The well is located behind the house.
2. Locate small gray box attached to electrical box **(Figure Pump Switch-1)**, use pump key **(Figure Pump Key-1)** to engage well pump **(Appendix B, Figure JW-30)**.
3. Purge at wellhead tap. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample from wellhead tap.
5. Turn off pump switch and retrieve key, turn all water off. Leave everything in the condition it was found upon arrival.

2.2.5.23 LS-1

1. CSSA has a key to the LS-1 gate. A low flow pump will be installed in this well bore. Sampling should follow low flow protocols.
2. Well is located in gated area **(Appendix B, Figure LS-1)**.
3. Purge at wellhead tap. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample from wellhead.

2.2.5.24 LS-4

1. CSSA has a key to the LS-1 gate. A low flow pump will be installed in this well bore. Sampling should follow low flow protocols. Well is located in gated area **(Appendix B, Figure LS-4)**.
2. Purge at wellhead tap. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
3. Collect sample from wellhead.

2.2.5.25 LS-5

1. Engage well pump with switch on telephone pole by well **(Figure Pump Switch-1)**, use pump key **(Figure Pump Key-1)** to turn switch on **(Appendix B, Figure LS-5)**.
2. Purge at wellhead tap. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
3. Collect sample from wellhead.
4. Turn off well pump and retrieve key, make sure wellhead faucet is turned off.

2.2.5.26 LS-6

1. Well is located next to cistern, look for gray GAC house.
2. In well house locate small gray pump switch box under the electrical box **(Figure Pump Switch-1)**. Use pump key to engage well pump **(Figure Pump Key-1)**. Purge at wellhead to the left of GAC house **(Appendix B, Figure LS-6.1)**. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
3. Collect pre-GAC sample directly from wellhead.

4. Collect post-GAC sample from the sample port in bottom of GAC house between the two canisters **(Appendix B, Figure LS-6.2)**.
5. Turn off well pump and retrieve pump key.
6. Record gallons used from flowmeter at top inside the GAC unit.
7. Temporarily cut off water into GAC unit to change the prefilters:
   a. Turn red valve in the upper left corner of unit to the off position.
   b. Unscrew both blue prefilter canisters and change filters if dirty.
   c. Screw filters back on, turn valve back on and check for leaks.
   d. Make sure unit is functioning properly before leaving; check sample ports to make sure water is running through the system.
8. Leave everything as it was upon arrival, except if the GAC system was bypassed or disconnected. Report any tampering with the system or apparent leaks to CSSA Environmental Office and/or Carbonair for repair.

2.2.5.27 LS-7

1. Well is located on south side of Curres Rd., look for the GAC unit, just behind the residence **(Appendix B, Figure LS-7)**.
2. Purge at the tap closest to pressure tank and at the wellhead tap located behind GAC unit. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged. Take pre-GAC sample from wellhead tap.
3. Post-GAC sample is collected from sample port at bottom of GAC unit between canisters as in LS-6 **(Appendix B, Figure LS-7)**.
4. Record gallons used from flowmeter at top inside the GAC unit.
5. Temporarily cut off water to change prefilters:
   a. Turn red valve in the upper left corner of unit to the off position.
   b. Unscrew both blue prefilter canisters and change filters if dirty.
   c. Screw filters back on, turn valve back on and check for leaks.
   d. Make sure unit it functioning properly before leaving; check sample ports to make sure water is running through the system.
6. Leave everything as it was upon arrival, except if the GAC system was bypassed or disconnected. Report any tampering with the system or apparent leaks to CSSA Environmental Office and/or Carbonair for repair.

2.2.5.28 OFR-1

1. Well is located behind house, follow road to right at first fork, then to left at second fork, look for pressure tank **(Appendix B, Figure OFR-1)**.
2. Unhook water hose at wellhead.
3. Purge at wellhead tap. Listen for pump to engage and/or feel the water line to ensure pump is running. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample at wellhead tap.
5. Reconnect water hose and leave everything as it was upon arrival. Sometimes the water is already running; the hose leads to a watering tub for cattle in the pasture.

2.2.5.29 OFR-3

1. Contact the well owner or his employees to arrange access to the area of the wellhead, it is normally locked, see **Figure PFR-3.1 and 3.2**.
2. Well is located to the left of the building and GAC unit is located to the right of the building when facing the building from the parking lot.
3. Purge at wellhead (to the left of the building), listen and feel for pump to engage and record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample from wellhead tap (left of building).
5. Post-GAC sample is collected from inside the GAC unit (right of the building) from the bottom sample port between the canisters as in LS-6 **(Appendix B, Figure OFR-3)**.
6. Record gallons used from flowmeter at top inside the GAC unit.
7. Temporarily cut off water to change prefilters:
   a. Turn red valve in the upper left corner of unit to the off position.
   b. Unscrew both blue prefilter canisters and change filters if dirty.
   c. Screw filter back on, turn valve back on and check for leaks.
   d. Make sure unit it functioning properly before leaving; check sample ports to make sure water is running through the system.
8. Leave everything as it was upon arrival, except if the GAC system was bypassed or disconnected. Report any tampering with the system or apparent leaks to CSSA Environmental Office and/or Carbonair for repair.

2.2.5.30 OFR-4

1. Well is located behind the house, straight ahead when coming up the driveway **(Appendix B, Figure OFR-4)**.
2. Open valve on right side of black holding tank to drain the pressure tank.
3. Purge at the wellhead tap. When pump engages wellhead tap will produce water. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample from wellhead tap.
5. Close valve on black holding tank and leave everything as it was before leaving.

2.2.5.31 RFR-3

1. Well is located in storage shed behind the main house.
2. Purge pressure tank from a faucet on the back of the house and use a water hose to purge at faucet by pressure tank. Listen for pump to engage.
3. When pump engages record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample from wellhead tap.
5. Turn off all water and leave well house as it was upon arrival.

2.2.5.32 RFR-4

1. Well is located near the cow pen, when entering main gate, pass the main house on the left, a second house will come up on the left, turn right at the dead end, follow road until you see an old barn and cow pen, well is located to the left.
2. Locate wellhead next to the cistern, a small gray box is attached to the electrical box **(Figure Pump Switch-1)**, use pump key **(Figure Pump Key-1)** to engage pump **(Appendix B, Figure RFR-4)**.
3. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
4. Collect sample from wellhead tap.
5. Turn off well pump and retrieve pump key.
6. Turn off all water and leave everything as it was upon arrival.

2.2.5.33 RFR-5

1. After sampling RFR-4, continue on same road in same direction. Another house is located on the left side of the road. The well is to the right of the house when facing it, in a doghouse type enclosure **(Appendix B, Figure RFR-5)**.
2. Lift well housing off well. Purge at faucet near the greenhouse to engage well pump.
3. Run a water hose off the wellhead tap to avoid getting insulation wet.
4. When pump engages record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
5. Remove water hose and collect sample from wellhead tap.
6. Turn off all water and replace well housing as it was upon arrival.

2.2.5.34 RFR-8

1. Well is located to the far left side of property, when facing the residence **(Appendix B, Figure RFR-8)**.
2. Turn on water at any outside faucet to purge the pressure tank, well owner will usually assist with this.
3. Make sure well pump is engaged, can feel the ground vibrating under the concrete well pad when the pump is running.
4. Purge at wellhead tap. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
5. Collect sample from wellhead.
6. Turn everything off and replace flower arrangement over wellhead. Watch for scorpions, wasps, or other insects.

2.2.5.35 RFR-9

1. Well is located on the left side of the driveway, by the house **(Appendix B, Figure RFR-9)**.
2. Turn on the water outside of the house to purge pressure tank so well pump will engage.
3. Purge at wellhead tap. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.

4. Collect sample from wellhead.
5. Turn water faucet off at house before leaving.

2.2.5.36 RFR-10

1. Well is located near the antenna tower, follow drive way to the right at first fork, to the right at second fork, up the hill toward the trailer, pass trailer on right side, well is located straight ahead, look for black holding tank and 2 GAC units.
2. The well has two GAC units running in parallel.
3. A switch to engage the well pump has been installed in GAC unit A between the carbon canisters **(Appendix B, Figure RFR-10.1)**. Note: Pump key not needed to engage well pump.
4. The pre-GAC sample will be collected from the wellhead located behind the GAC units.
5. Engage pump by flipping switch on and purge at wellhead tap. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
6. Collect pre-GAC sample from wellhead.
7. Two post-GAC samples are collected from sample ports at the bottom of each GAC unit between canisters, in the appropriate GAC unit A or unit B. **(Appendix B, Figure LS-6.2)**.
8. Turn pump switch off before turning faucet off.
9. Record gallons used from flowmeter at top inside each GAC unit.
10. Temporarily cut off water to change prefilters:
    a. Verify well pump is not running, if it is, make sure switch in GAC A is in off position then cut power at the telephone pole to the left of the GAC units.
    b. Turn red valve in the upper left corner of each unit to the off position.
    c. Unscrew both blue and clear prefilter canisters and change filters if dirty.
    d. Also check back-up filters attached to the back of GAC unit A **(Appendix B, Figure RFR-10.2)**.
    e. Screw filters back on, turn power and red valves back on and check for leaks.
    f. Make sure unit is functioning properly before leaving; check sample ports to make sure water is running through the system.
11. Leave everything as it was upon arrival, except if the GAC system was bypassed or disconnected. Report any tampering with the system or apparent leaks to CSSA Environmental Office and/or Carbonair for repair.

2.2.5.37 RFR-11

1. Well is located in a well house behind the main business office. Note: the door is not attached, but is leaning up against the doorframe opening. Move the door aside and watch your head, this is a low doorframe.
2. Purge at faucet immediately outside of well house. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged.
3. Take pre-GAC sample from wellhead.
4. Post-GAC sample is collected from sample port in the corner after it has run through both canisters.
5. Record gallons used from flowmeter at top inside the GAC unit.

6. Temporarily cut off water to change prefilters as in LS-6: **(Appendix B, Figure LS-6.2)**
   a. Turn red valve off located just before first prefilter.
   a. Unscrew both blue prefilter canisters and change filters if dirty.
   b. Screw filters back on, turn valve back on and check for leaks.
   c. Make sure unit is functioning properly before leaving; check sample ports to make sure water is running through the system.
7. Leave everything as it was upon arrival, except if the GAC system was bypassed or disconnected. Report any tampering with the system or apparent leaks to CSSA Environmental Office and/or Carbonair for repair.

2.2.5.38 RFR-12

1. This well should be sampled in conjunction with I10-2 to avoid bothering the well owner more than once.
2. Contact Steve from AAA Stowaway to accompany you to RFR-12, which is located to the left of the Pico Diamond Shamrock gas station when facing the station.
3. Enter the gated area, then well house.
4. Pull the existing water hose out of the well house and turn on water to engage the well pump. If pump does not come on, climb on top of cistern and push down float switch to engage the well pump **(Appendix B, Figure RFR-12.1)**.
5. Record pH, temperature, and conductivity readings until parameters stabilize, record approximate gallons purged. Readings are taken from water hose purge water and the sample is collected from the faucet in the corner closest to the well head **(Appendix B, Figure RFR-12.2)**.
6. Turn off all water and return the well house to the condition it was in upon arrival.

2.2.5.39 RFR-13

1. Contact well owner for gate code. Well is located on the right side of the driveway in well house.
2. Locate black holding tank, climb up the side, remove the cover and pull the float switch up until well pump engages.
3. Record pH, temperature, and conductivity readings at the faucet in front of the pressure tank until parameters stabilize, record approximate gallons purged. Collect sample **(Appendix B, Figure RFR-13)**.
4. Turn off all water and return the well house to the condition it was in upon arrival.

2.2.5.40 RFR-14

5. Well is located to the left of the house down the hill near the garage.
6. Currently while the house in under construction the well is powered by a generator. Make sure generator exhaust is facing downwind, start generator.
7. Record pH, temperature, and conductivity readings at the faucet at the wellhead until parameters stabilize, record approximate gallons purged. Collect sample (Appendix B, Figure RFR-13).
8. Turn off water and generator and leave well as it was upon arrival.

2.3 GROUNDWATER SAMPLE IDENTIFICATION

To keep groundwater sampling information consistent, a naming convention was established as part of the DQOs. Consistent use of a standardized naming convention allows for better database management and ease of use. Nomenclature has been established to distinguish the following data types:

- Wellhead Samples, including on post monitoring wells and those samples collected as pre-GAC monitoring points (*e.g.,* RFR-10, CS-1, *etc*.);
- Multiple GAC systems serving a single wellhead (*e.g.,* A, B, C, *etc*.);
- GAC system performance monitoring (canisters #1 or #2); and
- Qualifiers to describe special sampling points *(e.g.,* entry point, point-of-use tap)

Table 5 lists valid sample identification codes for wells currently sampled, in addition to the new wells described in this work plan. All sampling locations have a geographic prefix followed by an alphanumeric designator. The following are examples of geographic coding:

- CS: Camp Stanley
- FO: Fair Oaks Ranch
- HS: Hidden Springs
- I10: Interstate Highway 10
- JW: Jackson Woods
- LS: Leon Springs Villa
- OFR: Old Fredericksburg Road
- RFR: Ralph Fair Road
- DOM: Dominion

Some off-post well locations are treated with one or more GAC units. The GAC units are designated as unit "A" or unit "B." There is currently only one location with multiple GAC systems (RFR-10). Except for the system at RFR-10, the GAC units consist of two canisters (#1 and #2) that are operated in series, with sampling ports following each canister. Occasionally, samples are collected after individual canisters to evaluate their condition and monitor for COC breakthrough. Other infrequently collected samples include entry point (EP) samples collected at public supply wells, and water samples collected from a point-of-use faucet (tap) such as in a kitchen or washroom.

It is imperative that sampling conventions be applied consistently. For those occasions when a new sampling point does not fit one of the valid sample identifications (*e.g.,* a new GAC system or a newly added well), the field sampling team will contact the project or task manager to assign a new unique sample identifier.

Table 5
Valid Groundwater Sample Identifications
On-post Wells

Well Type	Well Location	Valid Sample Identification
On-Post Quarterly Monitoring Wells	CS-MW1 LGR	CS-MW1-LGR
	CS-MW1 BS	CS-MW1-BS
	CS-MW1 CC	CS-MW1-CC
	CS-MW2 LGR	CS-MW2-LGR
	CS-MW2 CC	CS-MW2-CC
	CS-MW3 LGR	CS-MW3-LGR
	CS-MW4 LGR	CS-MW4-LGR
	CS-MW5 LGR	CS-MW5-LGR
	CS-MW6 LGR	CS-MW6-LGR
	CS-MW6 BS	CS-MW6-BS
	CS-MW6 CC	CS-MW6-CC
	CS-MW7 LGR	CS-MW7-LGR
	CS-MW7 CC	CS-MW7-CC
	CS-MW8 LGR	CS-MW8-LGR
	CS-MW8 CC	CS-MW8-CC
	CS-MW9 LGR	CS-MW9-LGR
	CS-MW10 LGR	CS-MW10-LGR
	CS-MW10 CC	CS-MW10-CC
	CS-MW11A LGR	CS-MW11A-LGR
	CS-MW11B LGR	CS-MW11B-LGR
	CS-MW12 LGR	CS-MW12-LGR
	CS-MW12 CC	CS-MW12-CC
	CS-MW16-LGR	CS-MW16-LGR
	CS-MW16-CC	CS-MW16-CC

Well Type	Well Location	Valid Sample Identification
On-Post Quarterly Monitoring Wells (cont.)	CS-MW17-LGR	CS-MW17-LGR
	CS-MW18-LGR	CS-MW18-LGR
	CS-MW19-LGR	CS-MW19-LGR
	CS-2	CS-2
	Well D	CS-D
	CS-G-LGR	CS-MWG-LGR
	CS-H	CS-MWH-LGR
	CS-I	CS-I
	AOC-65 CS-MW1	AOC-65 MW1
	AOC-65 MW2A	AOC-65 MW2A
	AOC-65 MW2B	AOC-65-MW2B
	AOC-65 MW3	AOC-65-MW3
	AOC-65 MW4	AOC-65-MW4
Westbay®-equipped wells	CS-WB01 LGR	CS-WB01.LGR
	CS-WB02-LGR	CS-WB02-LGR
	CS-WB03-LGR	CS-WB03-LGR
	CS-WB04-LGR	CS-WB04-LGR
	Note: Differentiate Multi-port Zones by indicating depth of packer zones with SBD and SED ERPIMS qualifiers	
On-post Drinking Water Wells	Well 1	CS-1
	Well 9	CS-9
	Well 10	CS-10
	Well 11	CS-11

Valid Groundwater Sample Identifications for Off-post Wells

Well Location	Valid Sample Identification	Remarks
DOM-2	DOM-2	Wellhead sample port
FO-8	FO-8	Wellhead sample port
FO-17	FO-17	Wellhead sample port
FO-22	FO-22	Wellhead sample port
FO-J1	FO-J1 FO-J1 EP	Wellhead sample port FO-J1 Entry Point to Distribution System
I10-5	I10-5	Wellhead sample port
I10-7	I10-7 I10-7 NP	Wellhead sample port Non-purged sample
I10-8	I10-8	Wellhead sample port

Well Location	Valid Sample Identification	Remarks
JW-5	JW-5	Wellhead sample port
JW-6	JW-6	Wellhead sample port
JW-7	JW-7	Wellhead sample port
JW-8	JW-8	Wellhead sample port
JW-9	JW-9 JW-9 A2	Wellhead sample port Post filtration system
JW-12	JW-12	Wellhead sample port
JW-13	JW-13	Wellhead sample port
JW-14	JW-14 JW-14 NP	Wellhead sample port Non purged sample
JW-15	JW-15	Wellhead sample port
JW-26	JW-26	Wellhead sample port
JW-27	JW-27	Wellhead sample port
JW-28	JW-28	Wellhead sample port

Table 5 (cont'd)
Valid Sample Identifications
Off-post Wells

Well Location	Valid Sample Identification	Remarks		Well Location	Valid Sample Identification	Remarks
JW-29	*JW-29*	*Wellhead sample port*		*OFR-4*	*OFR-4*	*Wellhead sample port*
JW-30	*JW-30*	*Wellhead sample port*		*RFR-3*	*RFR-3*	*Wellhead sample port*
LS-1	*LS-1*	*Wellhead sample port*		*RFR-4*	*RFR-4*	*Wellhead sample port*
				RFR-5	*RFR-5*	*Wellhead sample port*
LS-4	*LS-4*	*Wellhead sample port*		*RFR-8*	*RFR-8*	*Wellhead sample port*
LS-5	*LS-5*	*Wellhead sample port*		*RFR-9*	*RFR-9*	*Wellhead sample port*
LS-6	*LS-6* *LS-6-A1* *LS-6-A2* *LS-6-A2-Tap*	*Wellhead sample port* *GAC canister #1 sample port* *GAC canister #2 sample port* *Sample after GAC canister #2 at a point-of-use faucet*		*RFR-10*	*RFR-10* *RFR-10-A1* *RFR-10-A2* *RFR-10-A2-Tap* *RFR-10-B1* *RFR-10-B2* *RFR-10-B2-Tap*	*Wellhead sample port* *House: GAC #1 sample port* *House: GAC #2 sample port* *House: Sample after GAC #2 at a point-of-use faucet* *Trailer: GAC #1 sample port* *Trailer: GAC #2 sample port* *Trailer: Sample after GAC canister #2 at a point-of-use faucet*
LS-7	*LS-7* *LS-7-A1* *LS-7-A2* *LS-7-A2-Tap*	*Wellhead sample port* *GAC canister #1 sample port* *GAC canister #2 sample port* *Sample after GAC canister #2 at a point-of-use faucet*		*RFR-11*	*RFR-11* *RFR-11-A1* *RFR-11-A2* *RFR-11-A2-Tap*	*Wellhead sample port* *GAC canister #1 sample port* *GAC canister #2 sample port* *Sample after GAC canister #2 at a point-of-use faucet*
OFR-1	*OFR-1*	*Wellhead sample port*		*RFR-12*	*RFR-12*	*Wellhead sample port*
OFR-2	*OFR-2*	*Wellhead sample port*		*RFR-13*	*RFR-13*	*Wellhead sample port*
OFR-3	*OFR-3* *OFR-3-A1* *OFR-3-A2* *OFR-3-A2-Tap*	*Wellhead sample port* *GAC canister #1 sample port* *GAC canister #2 sample port* *Sample after GAC canister #2 at a point-of-use faucet*		*RFR-14*	*RFR-14*	*Wellhead sample port*

2.4 GROUNDWATER SAMPLING PARAMETERS

Sampling frequencies are determined for each well based on the LTMO and the DQOs and is either semiannual, biennial, every nine months or quarterly. Depending on the location and historical results, all wells are sampled for either the CSSA QAPP list of VOC analytes (Full List VOCs), or the reduced list of analytes (Short List VOCs) of compounds historically detected at CSSA. Metals analyses include lead, cadmium and nickel. In addition, newly installed wells will be sampled for additional metals (nine total) and natural water quality parameters during the first quarterly monitoring event following their installation. All groundwater samples will be analyzed for those parameters and methods listed in **Table 2**.

Currently, all off-post drinking water wells are sampled for the Short List VOCs. The project manager or task manager will prepare a list of sampling parameters for each well prior to each quarterly event. No analyses for inorganics or natural water quality parameters are submitted for laboratory analyses from off-post sampling locations.

2.5 SAMPLE COLLECTION PROCEDURE

Sample labels with well ID, sample data, analysis, sample team initials, and preservatives are generated in chERPs prior to sample collection each day. All label information can be printed prior to sampling with the exception of sample time, which will be handwritten in the appropriate space before applying the labels to the containers. As field parameters stabilize during well purging, sampling containers are labeled when the sample is collected. The sample time will be completed on the pre-printed chERPs label and the label attached to the container. After sample collection samples will be stored in a cooler on ice for shipment to the laboratory.

3.0 DECONTAMINATION PROCEDURES

All equipment that may directly or indirectly come into contact with samples will be decontaminated in a designated decontamination area. These include any sampling instruments used in the collection of groundwater samples. In addition, the contractor will take care to prevent the sample from coming into contact with potentially contaminating substances such as tape, oil, engine exhaust, corroded surfaces, and dirt.

The following procedure will be used to decontaminate sampling devices such as bailers that can be hand-manipulated and tubing that is not dedicated to the specific well. For sampling, the equipment will be scrubbed with a solution of potable water and Alconox, or equivalent laboratory-grade detergent. Then the equipment will be rinsed with copious quantities of potable water followed by ASTM Type II reagent water. (If equipment has come into contact with oil or grease, rinse the equipment with pesticide-grade methanol followed with pesticide-grade hexane.) The equipment will be air dried on a clean surface or rack, such as Teflon®, stainless steel, or oil-free aluminum elevated at least 2 feet above ground.

Reagent-Grade II water, methanol, and hexane will be purchased, stored, and dispensed only in glass, stainless steel, or Teflon containers. These containers will have Teflon caps or cap liners. If any question of purity exists, new materials will be used. Methanol and hexane are to be stored in the firehouse flammable liquids storage or other designated area, when not in use.

Sampling equipment includes bailers, pH meters, and conductivity meters that directly contact samples. The following steps must be followed when decontaminating this equipment:

1. Set up a decontamination area at the site. The decontamination area should progress from "dirty" to "clean" and end with an area for drying decontaminated equipment. At a minimum, clean plastic sheeting must be used to cover the ground, tables, or other surfaces on which decontaminated equipment is to be placed. However, sampling equipment to be used for organic sample collection will not come into contact with plastic after the final rinse, and oil-free aluminum foil must be used. Plastic sheeting must also be placed to capture reagent Grade II water, hexane, and methanol used for rinsing equipment.
2. Wash the item thoroughly with soapy, laboratory-grade detergent solution. Do not submerge pH meters or conductivity meters. Use a stiff-bristle brush to dislodge any clinging dirt. Disassemble any items that might trap contaminants internally before washing. Do not reassemble until decontamination is complete, and items are dry.
3. Rinse the item in clear potable water. Rinse water should be replaced as needed, generally when cloudy.
4. Rinse the item with ASTM Type II reagent water.
5. Rinse equipment with pesticide grade methanol.
6. Rinse equipment with pesticide grade hexane.
7. After drying, wrap the cleaned item in oil-free aluminum foil for storage at least two feet above the ground.
8. After decontamination activities are completed, collect disposable gloves, boots, and clothing. Place contaminated items in proper containers for disposal.

4.0 INVESTIGATION-DERIVED WASTE HANDLING

IDW may include purged groundwater and decontamination fluids (water and other fluids). The field sampling team will be responsible for containing and managing produced fluids.

4.1 OUTFALL 002 AND OUTFALL 004

During this project, Parsons will maintain and operate the CSSA GAC unit located at Outfall 002 and the Outfall 004. The operation and discharge limits are governed by the CSSA TPDES permit ***(*Volume 6-2, NPDES*)***. The purpose of the GAC unit is to treat small quantities of contaminated groundwater generated during investigative activities, and properly discharge it to the permitted outfall. The average outfall flow rate is permitted at 30,000 gallons per day, which is approximately 20.8 gallons per minute (gpm) over a 24-hour period.

In general, the GAC unit is comprised of a small centrifugal pump, cartridge-type pre-filters, two 200-pound GAC canisters, and meters that monitor the discharge. Water to be treated may be introduced into the system via a 500-gallon tank located within the building, or be pumped in from external rental tanks (or roll-off boxes) outside the building. The system can be operated in either a series or parallel configuration. The system is sized to match the daily average flow of 30,000 gallons per day. Each carbon canister is rated for a flow rate of 10 gpm, meaning the system can effectively treat contaminated groundwater at 20 gpm in a parallel configuration, or 10 gpm in a series configuration. Appendix C provides a general schematic view and other operational information for the GAC.

Parsons will be responsible for daily operation and maintenance of the GAC unit. It is imperative that the GAC unit be operated and monitored by those requirements set forth in the TPDES permit. Those operating the unit should familiarize themselves with its requirements. In general, the logsheet must be completed for each treatment operation. The TPDES permit requires that the discharge volume, average flow, instantaneous flow, and pH be monitored for each discharge event. The discharge volume and instantaneous flow can be recorded from the integral flowmeter. Likewise, the instantaneous pH measurement can be recorded from its dedicated meter. Total discharge is measured by recording the flow totalizer measurements before and after treatment. The instantaneous flow readout should be used to control the flow so the discharge rate does not exceed the engineered capacity (10 gpm in series or 20 gpm in parallel). In its current configuration, Valve No. 7 should be used to regulate the discharge rate. Series operation is the preferred configuration because it allows the groundwater greater contact time with the activated carbon.

Filters will be checked regularly, and the pressure gauge monitored often for indications that the filters are becoming fouled. Both 1 micron and 5 micron filters are used to prevent suspended sediments from fouling the carbon canisters. In series, a 5 micron filter in filter chamber “A” should be followed by a 1 micron filter in chamber “B”. In parallel operation, both filter chambers “A” and “B” should be fitted with 1 micron filters. Suspended sediments will dramatically reduce the life of the GAC unit, and any means necessary should be employed to reduce the amount of solids entering the system.

In accordance with the TPDES permit, samples from the outfall operations will be collected twice during each week the GAC at Outfall 002 is operated and as needed during operations at Outfall 004. A monitoring week is defined as starting on midnight Sunday, and ending at midnight on the following Saturday. To ensure that the sampling requirements are attained, the following sampling schedule will be employed.

During the first treatment of the week, three samples will be obtained. At start-up, one sample will be obtained from sample port “A.” At the end of the treatment, one additional sample will be collected from sampling port “A” and one sample will be collected from sampling port “B.” The second pair of samples will be submitted for PCE and TCE analysis, while the first sample is retained on ice in the sample refrigerator. If the GAC unit will be operated one or more times before the end of the week, one additional sample will be obtained at sample port “A” before the end of the treatment cycle, and the stored sample will be discarded. However, if the GAC unit is not operated at any other time that week, the first sample collected will be submitted for analysis. All samples will be analyzed with a 7-day turn-around-time.

The GAC unit log will be maintained at all times. In addition, maintenance records will be kept updated on the GAC log as well as the dry-erase board located within the GAC building. Filters also need to be inventoried on a bi-weekly basis. A copy of the GAC unit log will be provided to the CSSA Environmental Office and faxed to the project manager every Friday so the monthly reports can be generated. Parsons will provide the completed TPDES discharge monitoring reports (DMR) for Outfalls 002 and 004 to CSSA on a monthly basis and assist in submittal of the DMRs to TCEQ. Outfall samples are collected dependent upon the gallons of groundwater treated. An estimated volume of sampling based on the previous two years of Outfall 002 operation has been used.

APPENDIX A

OFF-POST WELL PHOTOGRAPHS

Figure DOM-2

Figure FO-8

Figure FO-J1

Figure I10-7

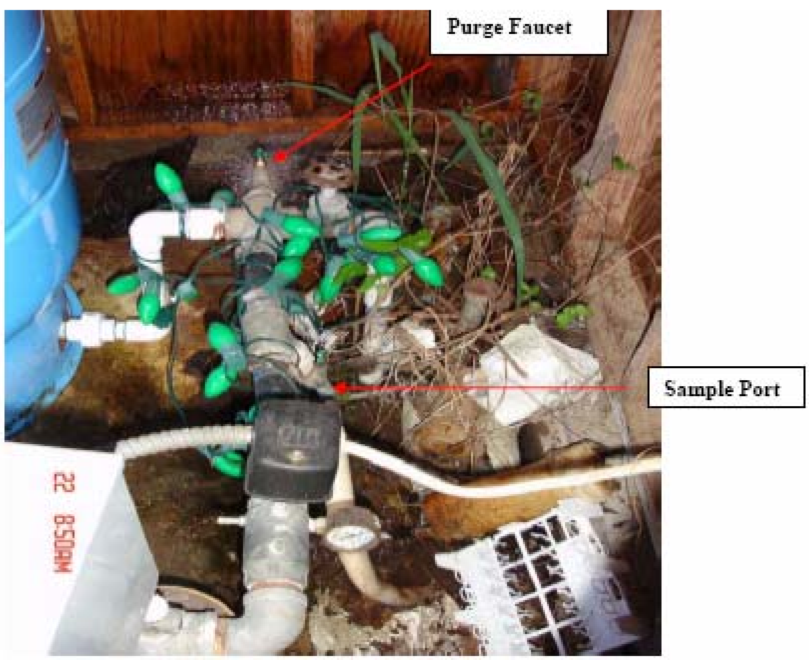


Figure I10-8

Figure JW-5

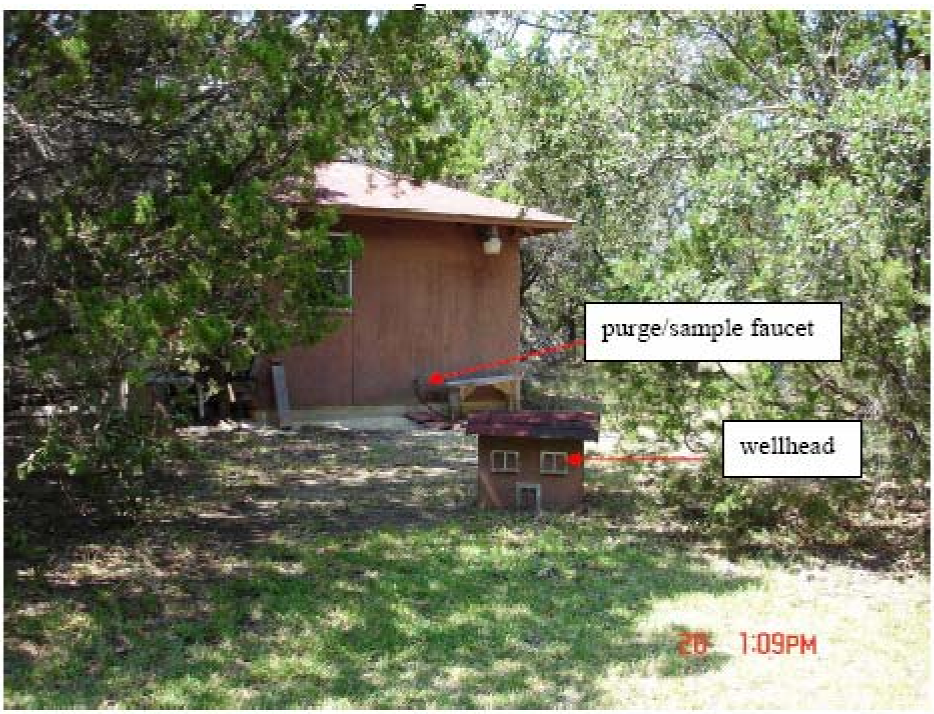


Figure JW-6

Figure JW-7

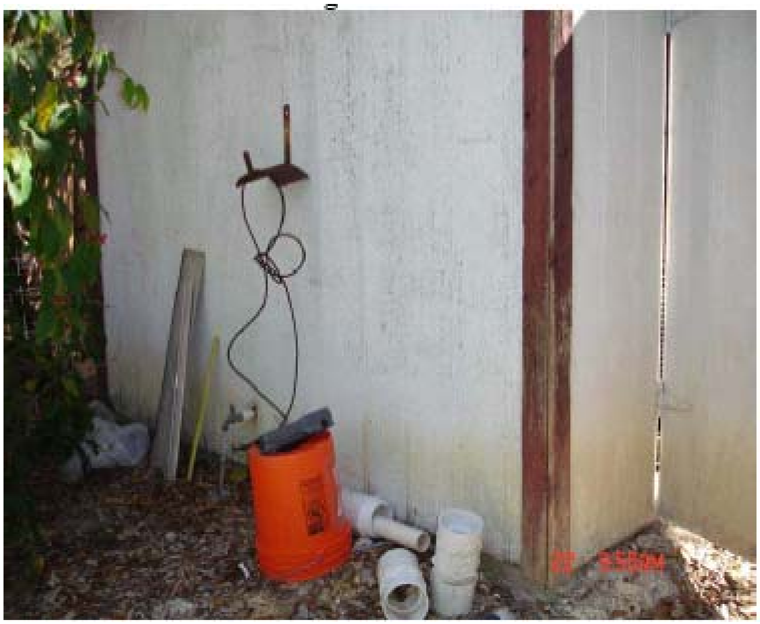


Figure JW-8.1

Figure JW-8.2

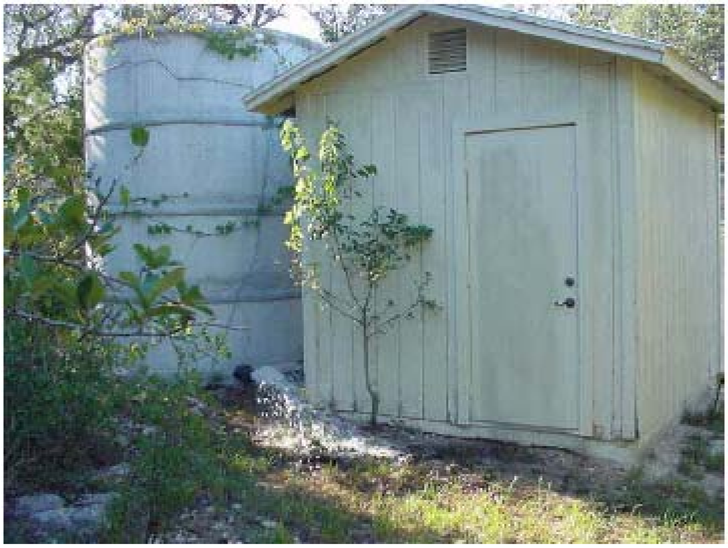


Figure JW-9.1

Figure JW-9.2

Figure JW-12

Figure JW-13

Figure JW-14

Figure JW-26

Figure JW-27

Figure JW-28.1

Figure JW-28.2

Figure JW-29

Figure JW-30

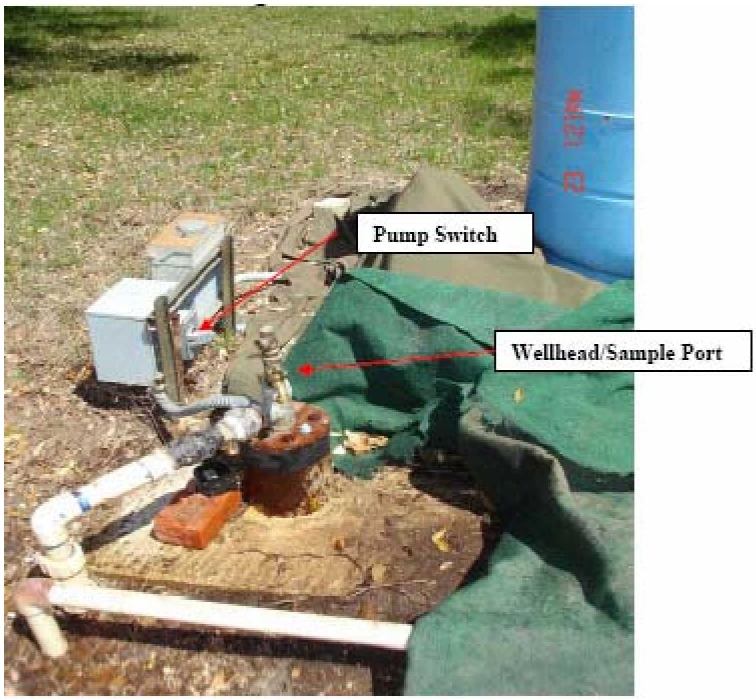


Figure LS-1

Figure LS-4

Figure LS-5

Figure LS-6.1

Figure LS-6.2

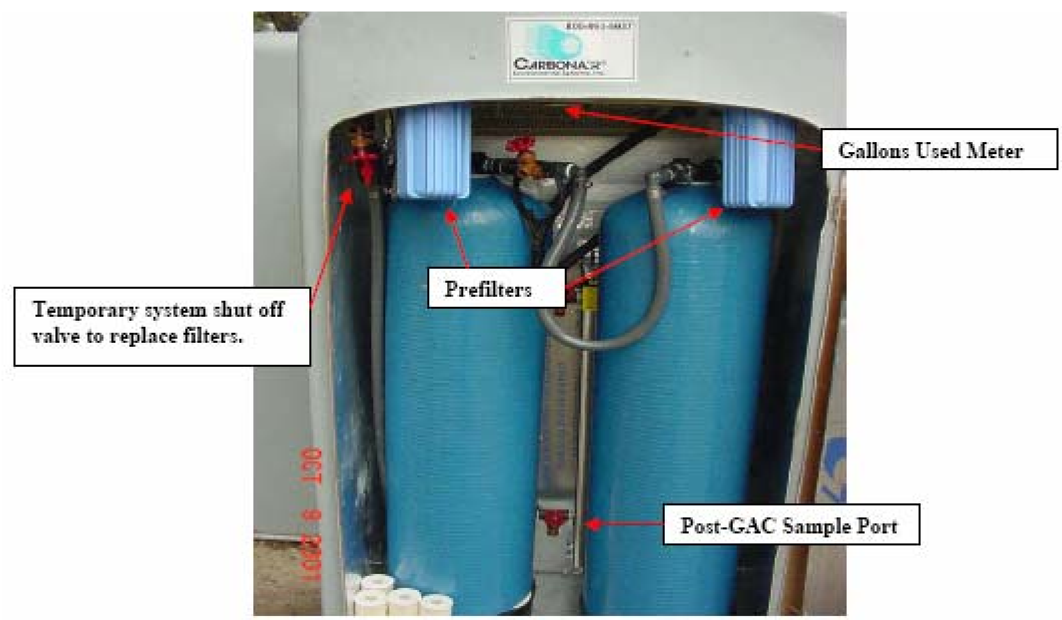


Figure LS-7

Figure OFR-1

Figure OFR-3.1

Figure OFR-3.2

Figure OFR-4

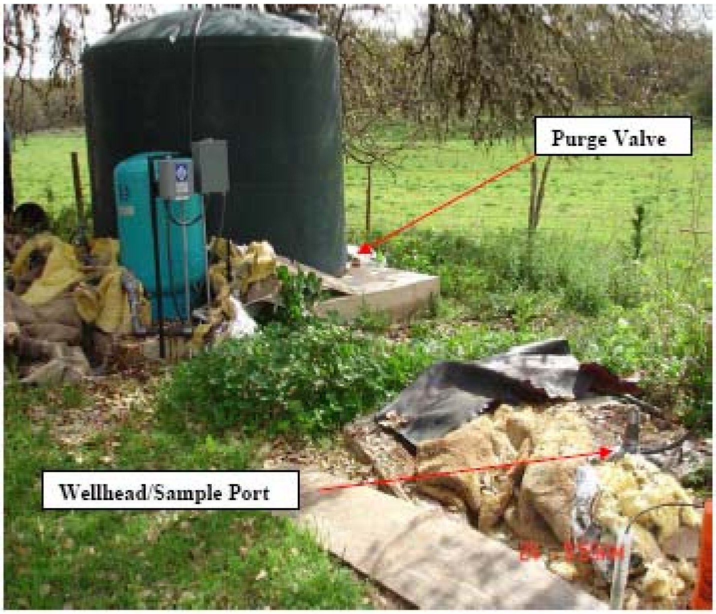


Figure Pump Key-1

Figure Pump Switch-1

Figure RFR-4

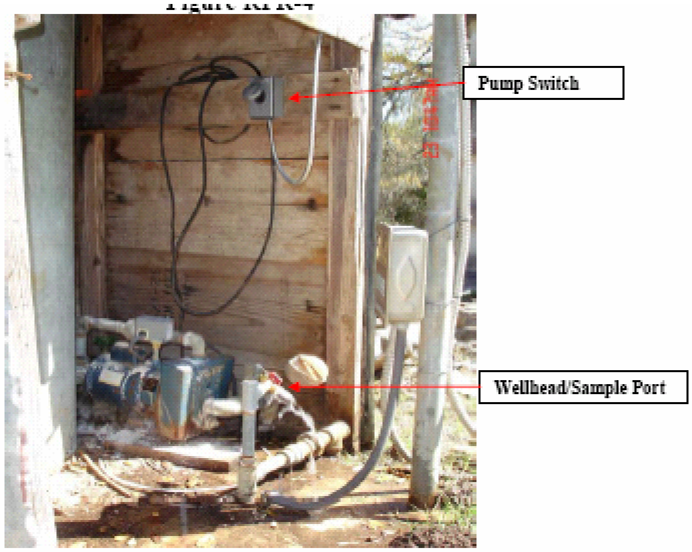


Figure RFR-5

Figure RFR-8

Figure RFR-9

Figure RFR-10.1

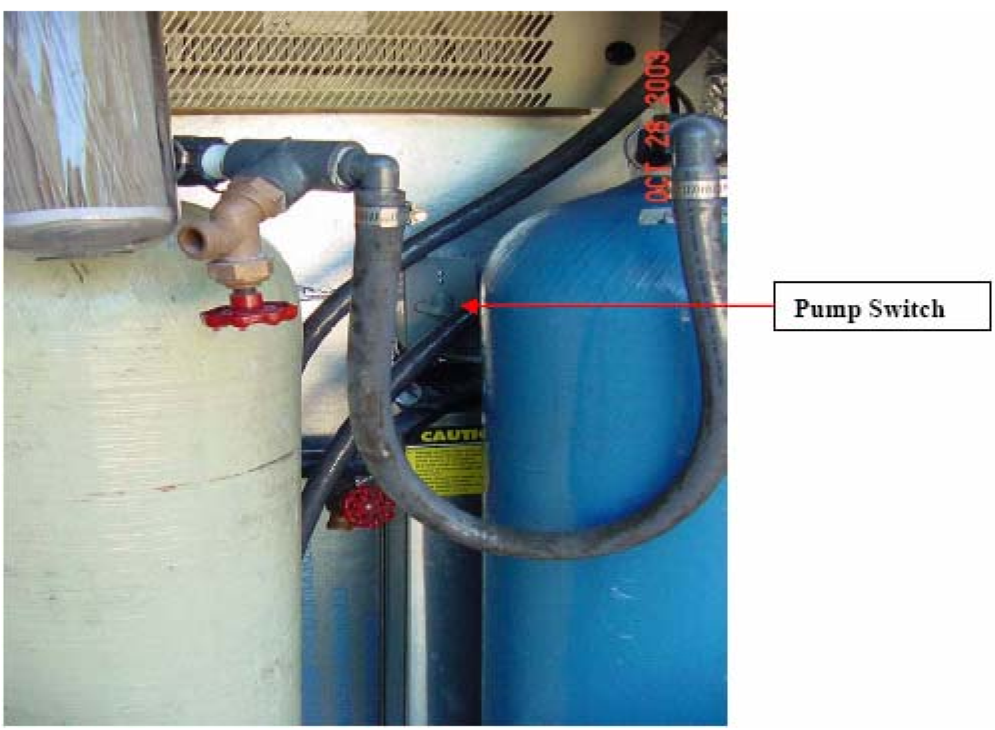


Figure RFR-10-2

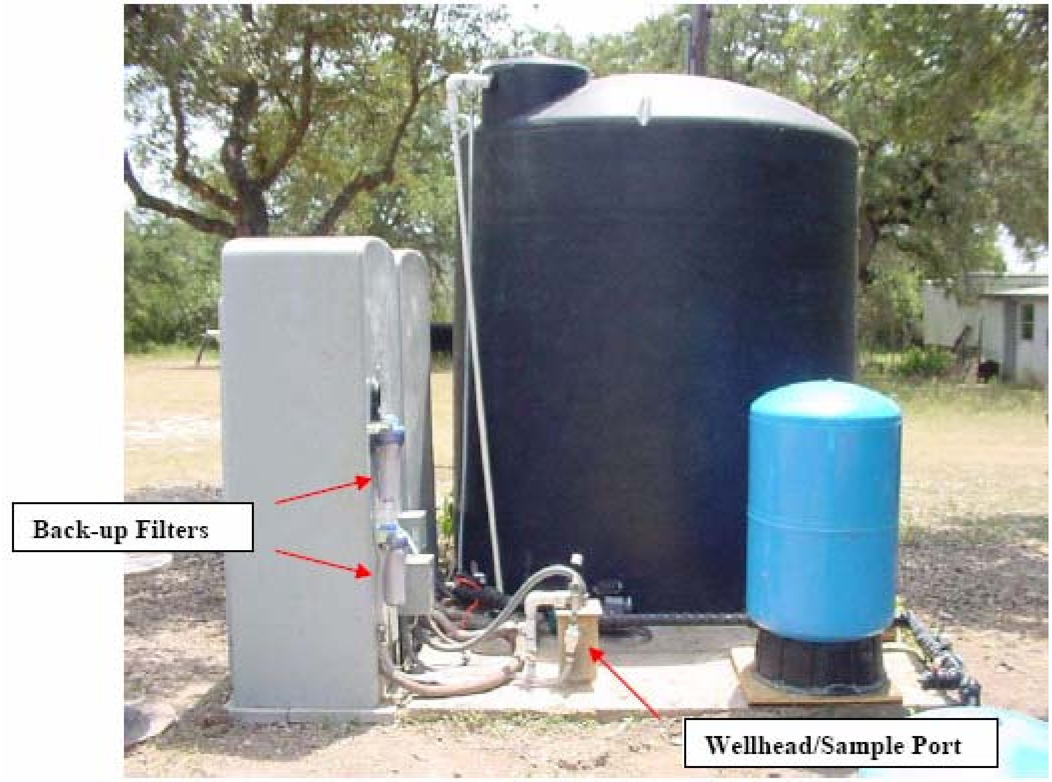


Figure RFR-12.1

Figure RFR-12.2

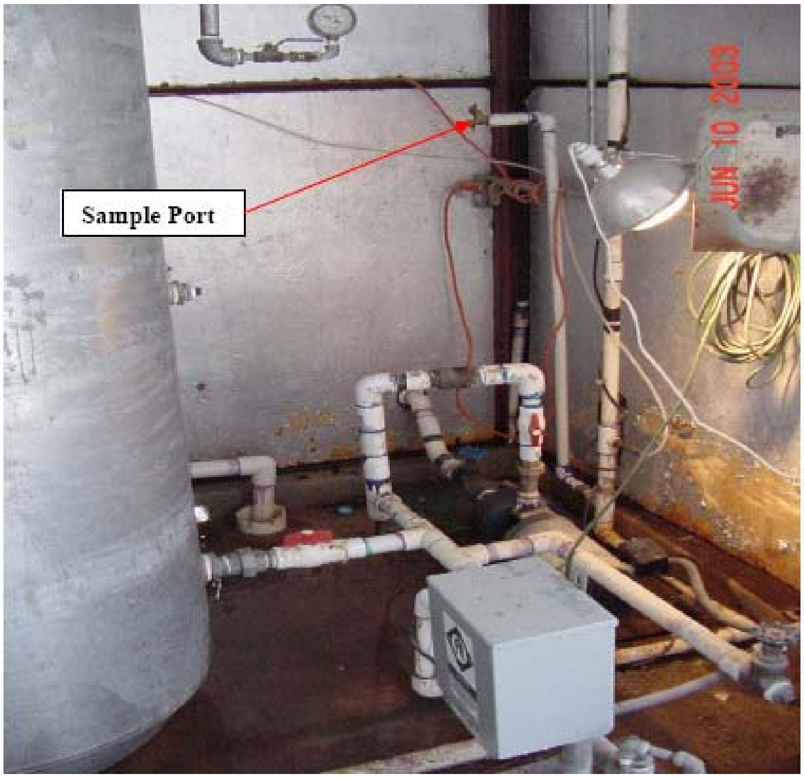
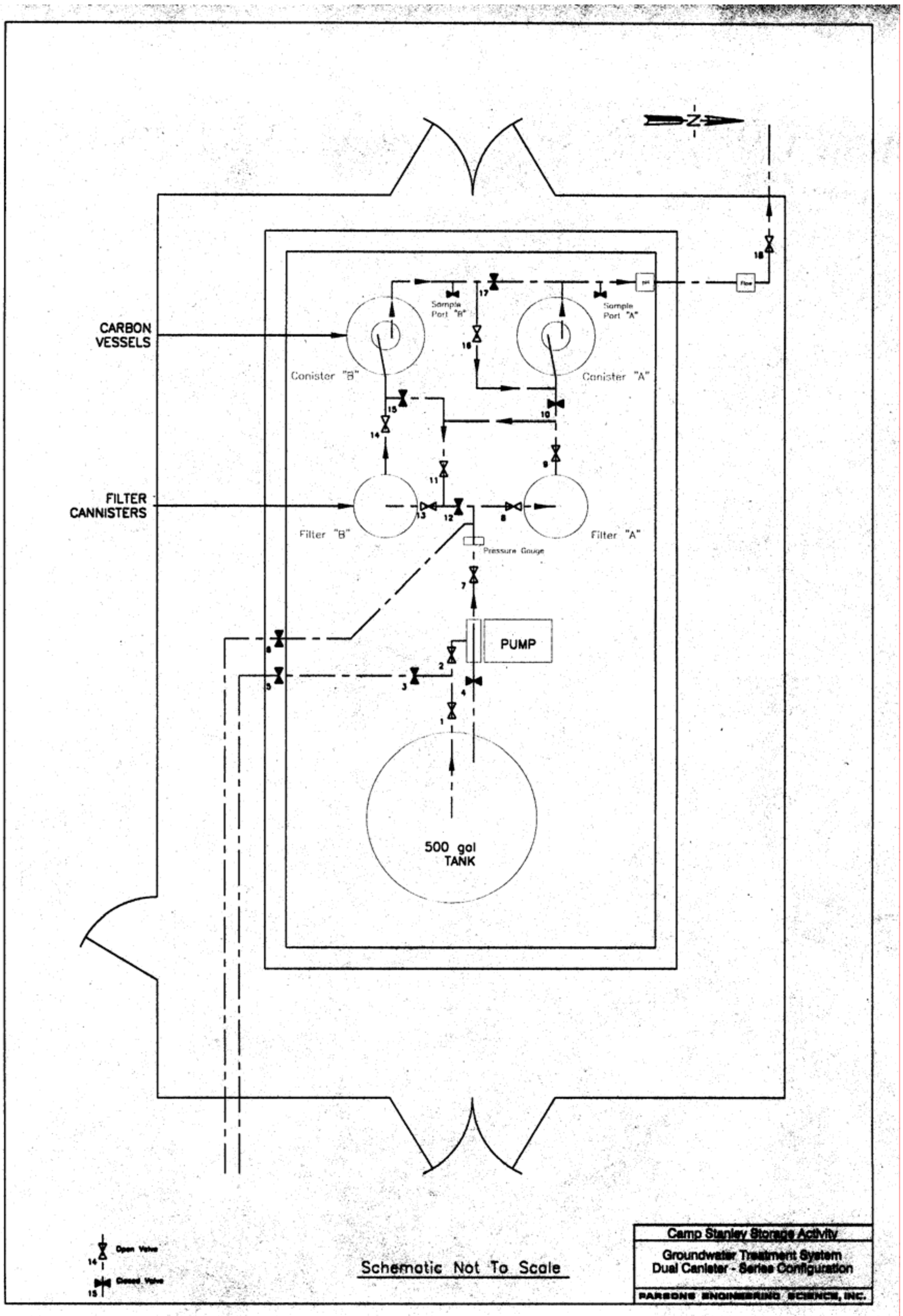
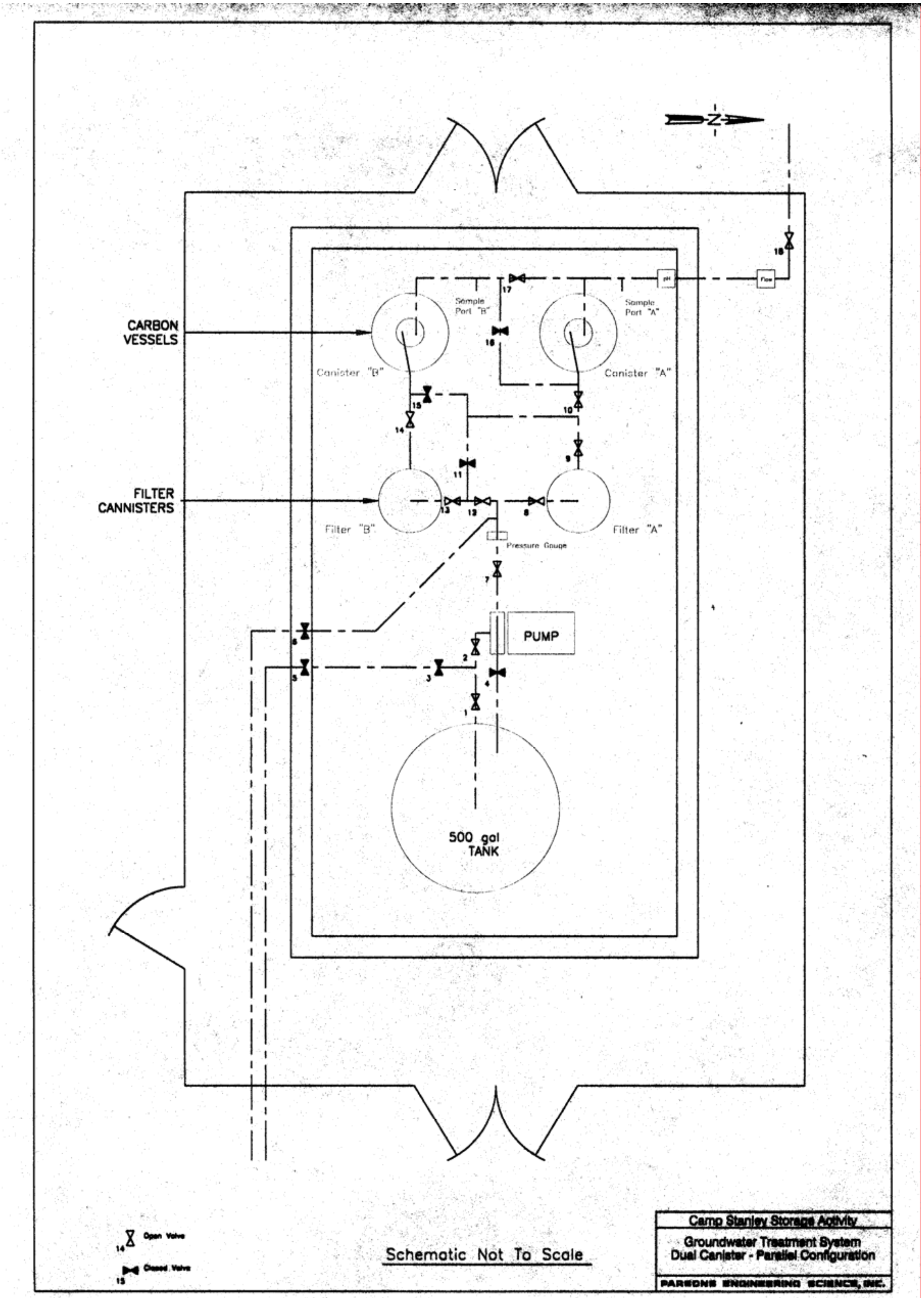


Figure RFR-13

Figure RFR-14

APPENDIX B
GAC UNIT OPERATIONAL DATA


CARBON VESSELS
FILTER CANNISTERS
Sample Port "B"
Sample Port "A"
Canister "B"
Canister "A"
Filter "B"
Filter "A"
Pressure Gauge
PUMP
500 gal TANK
Open Valve
Closed Valve
Schematic Not To Scale
Camp Stanley Storage Activity
Groundwater Treatment System
Dual Canister - Series Configuration
PARSONS ENGINEERING SCIENCE, INC.


CARBON VESSELS
FILTER CANNISTERS
Sample Port "B"
Sample Port "A"
Canister "B"
Canister "A"
Filter "B"
Filter "A"
Pressure Gauge
PUMP
500 gal TANK
Open Valve
Closed Valve
Schematic Not To Scale
Camp Stanley Storage Activity
Groundwater Treatment System
Dual Canister - Parallel Configuration
PARSONS ENGINEERING SCIENCE, INC.

Month/Year:__________________

Page:______

Outfall 002 Field Log

Camp Stanley Storage Activity
Boerne, Texas

TPDES Permit No. 03849 (TX0064505)

		Monitoring Data							Sampling Data			Process Data			Operation
Date	Treatment Fluid Source	Time		pH	Temp.	Flow Totalizer	Treatment Discharge	Instantaneous Flow	Sample Collected	Sample ID	Laboratory ID	Treatment Configuration	Filter Size	Filter Change	Operator's Signature
(mm-dd-yy)	*(Well ID)*	*(24 hour)*			*(Celsius)*	*(gallons)*	*(gallons)*	*(gpm)*	*(Yes / No)*	*(002-A or 002-B)*	*(DHL, STL, APPL)*	*(Parallel / Series)*	*(1 um / 5 um)*	*(Yes / No)*	
		Start													
		Stop													
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