SYNERGY ENVIRONMENTAL, LLC

OPERATION & MAINTENANCE PLAN

RID WELLHEAD TREATMENT SYSTEMS

OCTOBER 2013
Revision 3

WEST VAN BUREN AREA WQARF SITE
PHOENIX, ARIZONA

Prepared for: **Arizona Department of Environmental Quality**

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On Behalf of: **Roosevelt Irrigation District**

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O&M PLAN REVISION SUMMARY

#	Description
0	Original draft.
1	Refined draft incorporating updates to operational details based on initial pilot system performance.
2	Original final version; includes full record drawing sets and all available technical information.
3	Incorporates revisions following completion of pilot system performance assessment/evaluation.

October 2013, Revision 3

Operation and Maintenance Plan – RID Wellhead Treatment Systems

WEST VAN BUREN AREA
WATER QUALITY ASSURANCE REVOLVING FUND SITE

1.0 INTRODUCTION

Groundwater in the West Van Buren Area (WVBA) Water Quality Assurance Revolving Fund (WQARF) Site contains hazardous substances, principally volatile organic compounds (VOCs) that have impacted Roosevelt Irrigation District (RID) production wells. Arizona Department of Environmental Quality (ADEQ) acknowledged that the RID wells that extract and discharge VOC-contaminated groundwater to surface water are the major outflow of contamination from the Site (Terranext, 2012). It was further noted that the RID canals provide a potential route of surface water contaminant migration within and downstream of the WVBA.

RID relies on the wells within the WVBA WQARF Site to meet critical water supply needs and, consequently, submitted a Work Plan for conducting an Early Response Action (ERA) to restore a portion of these impacted wells for current and reasonably foreseeable beneficial uses, including future use as a drinking water source (Montgomery & Associates, 2010), as provided in the Arizona WQARF Program [A.R.S. § 49-282.06.B.4.b; A.A.C. R18-16-405). Although the ERA was designed to capture and treat hazardous substances primarily as a well protection and water supply initiative, the action was also proposed to mitigate public exposure associated with the uncontrolled release of VOCs in groundwater pumped by RID from the WVBA Site. Air and water sampling was conducted in accordance with the *Public Health Exposure Assessment and Mitigation Work Plan*. The resulting data enables review of the potential insight into the fate and transport of these contaminants (Synergy, 2011a). The assessment compared the sampling results to health-based guidelines to make a screening-level determination as to whether these substances pose a significant risk to public health and provide data to assist in developing detailed designs for engineering controls to limit uncontrolled VOC emissions.

Consistent with the Task 4-Engineering Design Study required by the ADEQ in the ERA approval letter of June 24, 2010 (ADEQ, 2010), RID submitted a proposal to construct and operate a pilot wellhead treatment system at RID well 95 and additional wellhead treatment at select sites

(Synergy Environmental, 2011b). In a letter dated September 2, 2011, ADEQ authorized implementation of RID's proposed pilot system initiative (ADEQ, 2011).

Before initiating treatment at the additional well sites (i.e., RID-89, RID-92 and RID-114), RID agreed to prepare and submit a near-term assessment, following one month of system operation, to consider the technology, system design and site-specific engineering and operation controls to determine the effectiveness of *l*GAC and the reliability of the system as designed/operated to provide safeguards to protect public health in the event of system failures (in accordance with Arizona Revised Statute R18-16-411). The *1-Month Technology/Design Demonstration Report: RID-95 Pilot System*, describes the successful completion of the assessment period, which demonstrated the reliable operation of the treatment system without identification of any design or operational issue that could reasonably endanger public health (Synergy, 2012a).

On July 17, 2012, a Modified ERA Proposal was submitted to ADEQ as an addendum to the original ERA Work Plan, dated February 3, 2010 and approved by ADEQ on June 24, 2010 (Synergy, 2012b). The addendum was proposed in order to provide a more cost effective approach to accomplish the goals of the ERA remedial action. The Modified ERA Proposal provided an optimized design approach to address the highest contaminated RID wells located in the WVBA and incorporated information and insights gained from the investigations prescribed by ADEQ in the original ERA Work Plan approval letter (Tasks 1 through 4) and from the Pilot System initiative. Based on the detailed consideration and analysis of this new information, RID proposed substantive modifications to the original ERA Work Plan, which included utilizing a combination of treatment and blending to effectively reduce the concentration of VOCs from several additional, lower concentration wells resulting in lower volume of water being directly treated while providing a higher total volume of groundwater that is remediated to meet applicable MCLs. On October 19, 2012, Synergy submitted the Modified ERA Work Plan to ADEQ, which incorporated applicable content from the original ERA Work Plan and from the Modified ERA Proposal (Synergy, 2012c). ADEQ approved the Modified ERA Work Plan with conditions on February 1, 2013 (ADEQ, 2013).

Consistent with the ADEQ letter dated September 2, 2011, agreeing to the implementation of the Pilot System initiative, the *Long-Term Operational Assessment Report, RID-95 Wellhead Pilot Treatment Systems* documented the long-term performance of the wellhead treatment systems in order "*…to determine whether well head treatment can be an effective treatment technology*…(that results in)…*reducing the cost of the final remedy*…*and/or mitigating contaminant exposure*" (Synergy, 2012d). The Assessment Report indicated that the RID Pilot System initiative conclusively demonstrated the cost effectiveness of the technology, and therefore the reasonableness of the selected remedy for the Modified ERA (which could be incorporated into the final remedy after the Feasibility Study analysis) in order to effectively

treat the contaminated groundwater impacting RID's wells and the successful mitigation of public health exposures to these contaminants.

As part of the scope of work described in its proposed Pilot System initiative, RID was to prepare and submit an Operation and Maintenance (O&M) Plan to ADEQ. This O&M Plan, Revision 3, provides equipment and construction details, sampling and analysis program, and specific O&M and reporting procedures for the RID wellhead treatment systems, and shall replace all previous editions. Updates and/or revisions will continue to be made to this O&M Plan, as necessary. At a minimum, this O&M Plan will be reviewed on an annual basis to confirm accuracy and completeness.

2.0 BACKGROUND

A summary of the physical setting, hydrogeologic and groundwater conditions, sources of contamination and impacts on RID wells and operations was provided in the Remedial Investigation (RI) Report (Terranext, 2012). The RI Report was published by ADEQ in August 2012, and included a discussion of the nature and extent of contamination in the WVBA Site. Brief descriptions of the Site location and physical characteristics, the contaminants of concern present at the Site and the impact of this contamination on the RID water systems are provided in the following sections.

2.1 SITE LOCATION AND PHYSICAL CHARACTERISTICS

Figure 1 depicts the approximate boundaries of the groundwater contamination, as well as relevant features within the WVBA Site. The extent of groundwater contamination associated with the WVBA Site is generally bounded on the north by McDowell Road, on the east by 7th Avenue, on the south by Lower Buckeye Road, and on the west beyond 79th Avenue.

Land use within the WVBA is predominantly zoned industrial with smaller tracts of residential (with elementary schools and churches) and commercial. The WVBA is located within the City of Phoenix Central City and Estrella urban villages. With the significant acreage of agricultural land available to be developed in the future, the Estrella Village (41 square miles) is identified as a Phoenix targeted growth area, and is expected to experience significant increases in both employment and residential growth (Synergy Environmental, 2011b).

2.2 CONTAMINANTS OF CONCERN

The contaminants of concern (COCs) in the WVBA Site have been identified based on historical and present data obtained from samples collected by ADEQ and RID from the impacted RID groundwater extraction wells over the past 20 years. These COCs comprise the commingled

WVBA Site plume and are listed as follows (including the chemical name and the Chemical Abstract Service (CAS) number:

- 1,1-Dichloroethene (1,1-DCE) CAS number 75-53-4
- Tetrachloroethene (PCE) CAS number 127-18-4
- Trichloroethene (TCE) CAS number 79-01-6
- 1,1,1-Trichloroethane (TCA) CAS number 71-55-6
- cis 1,2-Dichloroethene (cis 1,2-DCE) CAS number 156-59-2
- 1,1-Dichloroethane (1,1-DCA) CAS number 75-34-3
- Methyl *tert*-butyl ether (MTBE) CAS number 1634-04-4

Chromium is also a COC that occurs locally within the WVBA Site boundaries. The chromium concentrations in the impacted RID groundwater are well below the United States Environmental Protection Agency (EPA) maximum contaminant level (MCL) for drinking water and have only been detected in two (2) wells: RID-102 and RID-104; neither of which was selected for wellhead treatment. Consequently, chromium is not included in the sampling and analysis program as part of this O&M Plan.

Only three (3) of the listed COCs (i.e., TCE, PCE and 1,1-DCE) are present in the impacted groundwater within the WVBA Site at concentrations that exceed the EPA MCLs. Consequently, these COCs are referred to as the "target COCs" in this O&M Plan. The target COCs will be used to determine when GAC replacement is necessary.

2.3 WATER QUALITY – TREATMENT SYSTEM WELLS

Table 1 (below) presents a summary of historical analytical data showing target COC concentrations for samples collected by ADEQ from RID treatment system wells. All results that are equal to or exceed MCLs are indicated in red text.

Table 1. Summary of Recent Water Quality – Treatment System Wells

TCE, presented as micrograms per liter (µg/L)

Sample Date	Well			
	89	92	95	114
Jun-10	32	84	57	87
Apr-11	NS	NS	NS	74
Sep-12	26.4	63.9	60.2	44.1
Apr-13	34.1	73.5	54.4	48.6
Sep-13	37.5	86.4	59.6	39.0

PCE, presented as µg/L:

Sample Date	Well			
	89	92	95	114
Jun-10	8.7	17	5.0	4.3
Apr-11	NS	NS	NS	3.9
Sep-12	8.03	12.5	4.12	2.61
Apr-13	11.0	14.7	3.44	2.20
Sep-13	11.7	14.5	3.71	2.63

1,1-DCE, presented as µg/L:

Sample Date	Well			
	89	92	95	114
Jun-10	2.7	4.4	8.4	5.5
Apr-11	NS	NS	NS	4.7
Sep-12	2.39	4.68	7.33	1.71
Apr-13	2.39	5.17	9.23	3.33
Sep-13	3.14	6.22	7.52	2.50

2.4 TREATMENT GOALS

The minimum standard for treated water quality at the wellhead treatment systems is the MCL for each of the target COCs, which is consistent with the final Remedial Objectives set forth in the Final RI Report, Appendix AA (Terranext, 2012).

Target COC	MCL (µg/L)
Trichloroethene (TCE)	5.0
Tetrachloroethene (PCE)	5.0
1,1-Dichloroethene (1,1-DCE)	7.0

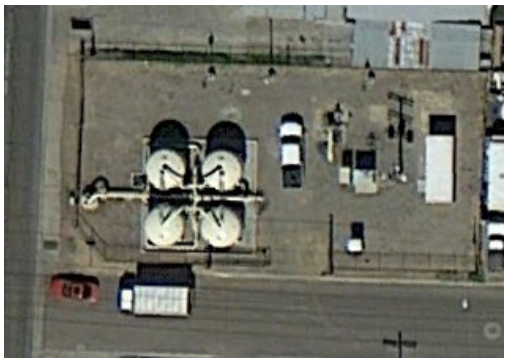
3.0 SYSTEM DESCRIPTION

RID selected a pre-engineered liquid-phase granular activated carbon (*l*GAC) system, manufactured by Siemens, to treat the discharge from the highest impacted RID production wells. The selected *l*GAC systems, described in more detail in Section 4.3, are modular and consist of two (2) GAC pressure vessels, a "skid", with a capacity of 1,000 gallons per minute (gpm, nominal) with stated maximum of 1,100 gpm. The skids are installed on and anchored to concrete containment pads with 6-inch curbing and liquid collection sumps. Wellhead treatment will be conducted in a manner consistent with RID historical pumping.

1. RID-89: Located on the east side of 51st Ave, approximately ¼ mile north of Buckeye Rd.; the site area is ~4,500 square feet (ft^2). Based on nominal flow rate of 3,400 gpm, RID installed three skids.

2. RID-92: Located on the east side of 43rde Ave, approximately ¼ mile north of Buckeye Rd.; the site area is ~2,400 ft^2. Based on nominal flow rate of 1,200 gpm, RID installed a single skid.

3. RID-95: Located on the northeast corner of Sherman Street and 35th Ave, approximately ¼ mile north of Buckeye Rd; the site area is ~6,900 ft^2. Based on nominal flow rate of 1,800 gpm, RID installed two skids.



4. RID-114: Located at the southwest corner of 23rd Ave and Van Buren St; the site area is ~7,000 ft^2. Based on nominal flow rate of 2,500 gpm, RID installed three skids.

4.0 OPERATION AND MAINTENANCE

The following sections describe the specific details for operating and maintaining the wellhead treatment systems, including a procedure for notifications during system operation upset events; and details for RID's well pumps, the selected /GAC treatment skids, wellhead treatment system operations, instrumentation and controls, and the sampling and analysis program.

4.1 SYSTEM OPERATION UPSET EVENT NOTFICATIONS

Operator receives automated notifications to alert in the event of certain control conditions described in detail in Section 4.5. The operator (Spinnaker Holdings, LLC) will notify RID and Synergy in the event of significant process control issue(s) or failure(s). As soon as the issue(s) of the event are reviewed and fully understood, Synergy will notify ADEQ by telephone if the quality of the treated water could be affected or if releases to the environment have occurred.

4.2 WELL PUMP DETAILS

Table 2 provides details for the submersible pumps currently installed and operating at the treatment system well sites. Section 4.5.1 provides the control strategy for each well pump.

4.3 /GAC TREATMENT SKIDS

The wellhead treatment systems consist of Siemens HP1220 /GAC treatment skids, each capable of treating up to 1,100 gpm of water in series (lead-lag) configuration. The numbers of skids at each well site include: RID-89 (3), RID-92 (1), RID-95 (2) and RID-114 (3), for a total of 9 skids.

The /GAC treatment skids include the following standard design features:

- Down-flow configuration to facilitate backwash;
- Integrated piping (8-inch schedule 40 carbon steel) with cast iron gear/wheel butterfly valves with EPDM seats, configured to allow series, parallel or vessel-isolation flow;
- Systems operate utilizing existing well equipment to pump the impacted groundwater through the /GAC vessels for treatment and periodic backwash;
- Equipped with sample ports at the skid influent, 25%, 50% and 75% of bed depth, and vessel effluent to enable monitoring of mass transfer zone and breakthrough;
- 20,000 pound carbon capacity in each carbon steel vessel (7,520 gallon volume);

- Maximum operating flow rate of 1,100/2,200 gpm (series/parallel) per skid and 1,000 gpm backwash flow rate (higher flow rates can be achieved but empty bed contact time would decrease proportionally);
- Integrated GAC transfer piping (4-inch Schedule 10 304L stainless steel); and,
- Vessels and piping are rated to 125 pounds per square inch (psi) and burst discs are integral to the piping to safely release and divert water in the event of over-pressure.

Vessel identifications (as labeled at each site) include:

- RID-89: 89-1A and 89-1B (treatment skid #1, north skid), 89-2A and 89-2B (treatment skid #2), and 89-3A and 89-3B (treatment skid #3, south skid).
- RID-92: 92-1A and 92-1B.
- RID-95: 95-1A and 95-1B (treatment skid #1, south skid), and 95-2A and 95-2B (treatment skid #2, north skid).
- RID-114: 114-1A and 114-1B (treatment skid #1, north skid), 114-2A and 114-2B (treatment skid #2), and 114-3A and 114-3B (treatment skid #3, south skid).

4.4 SYSTEM OPERATION

General system operation for each *l*GAC skid includes operation in treatment mode, bypass mode, and a modified treatment mode to facilitate *l*GAC change-outs and/or backwash. Each skid is configured for series (or lead-lag) operation for normal treatment mode, but are capable of parallel or single vessel operation, as necessary, to facilitate maintenance activities.

Operational performance data will be continuously monitored and collected on a monthly basis using the instrumentation and supervisory control and data acquisition (SCADA) system described in Section 4.5.6.

An O&M Manual (prepared by Siemens) for the pre-engineered *l*GAC skids is included as **Appendix A**, and provides equipment details/specifications including: standard procedures to operate the treatment skids (i.e., start-up, carbon changes, backwashing), troubleshooting, system monitoring, shutdown and emergency procedures, maintenance, a spare parts list, and specifications for the vessels (i.e., drain system, valves, burst disks, spray nozzles, pressure gauges, and interior/exterior coatings).

A flow diagram and valve sequence chart are also included in the Siemens O&M Manual. Each valve associated with the HP-1220 systems has been clearly labeled in the field to help the operator when making changes to the operation of the treatment systems.

4.4.1 Treatment Mode

Each *l*GAC skid is operated in conjunction with RID's pumping schedule with cessation of treatment during well maintenance activities, treatment system maintenance activities (requiring system shut-down) or unanticipated failures (including but not limited to: power outages, critical alarms, or equipment malfunctions).

4.4.2 Bypass Mode

Should it become necessary to shut off any of the treatment trains, and RID requires the flow from that well, the untreated flow may be temporarily bypassed (in part or in whole) around the treatment system and discharged directly into the existing receiver box until treatment can resume (utilizing 3-way valve).

4.4.3 lGAC Change-Outs and Backwash

*l*GAC bed life will be assessed/monitored in each treatment train by sampling and analysis for target COCs as described in Section 4.6. Carbon change-outs with reactivated GAC will be scheduled when any of the target COCs reach ½ of the Treatment Goals (see Section 2.4) in the Point of Compliance (POC) samples. When this condition is observed, the lead vessel of the skid with the highest target COC concentration in the Mid-Skid sample will be scheduled for the change-out[1].

During each carbon change-out, the lag vessel will be reconfigured as lead and the spent GAC removed from the exhausted vessel and replaced with fresh reactivated GAC. During removal and replacement of the spent GAC from the exhausted vessel, the remaining vessel will continue to treat the flow on a stand-alone basis (i.e., single pass). In some instances, it may be necessary to isolate an entire skid and/or switch to partial or full bypass to facilitate maintenance activities.

Following recharging of the exhausted vessel with reactivated GAC, the recharged vessel will be backwashed to remove fines, soaked for approximately 24 hours to remove entrained air and put back into service as the lag vessel and remain in that configuration until the lead vessel requires a carbon change-out. Backwash will be conducted at a flow of approximately 1,000-1,100 gpm (using treated water conveyed from the new lead vessel while operating in stand-alone basis) and backwash water will be diverted from the backwashed vessel directly to the discharge receiver box.

[1] Currently, the RID-92 wellhead treatment system only has a single skid.

4.5 INSTRUMENTATION AND CONTROLS

The wellhead treatment systems are equipped with instrumentation and controls (I&C), designed and integrated by Vertech, that provide real-time monitoring of key performance parameters of system operation. The I&C also enables remote operation and monitoring of system operations and provides alarm notification for key process and control parameters.

Instrumentation is included to monitor:

- Well pump run status;
- Well discharge and bypass flow rates (instantaneous and totalized);
- Flow to each treatment skid (instantaneous and totalized);
- Wellhead pressure; and,
- Differential pressure across each treatment skid.

Controls are included for:

- Pump start/stop;
- Bypass flow;
- Low flow at wellhead;
- High pressure at wellhead; and,
- Fluid/water level at sumps.

These I&C nodes are integrated into a SCADA system that allows for remote control of the system as well as continuous monitoring capabilities and data storage to document key aspects of treatment system operations and demonstrate the level of reliability required to ensure the successful remediation of the groundwater supply (i.e., to achieve Treatment Goals) and the protection of public health. The following sections describe the various I&C components, including O&M requirements for each.

4.5.1 Well Pumps

The well pumps for the wellhead treatment systems can be controlled manually from the local Operator Interface Terminal (OIT), mounted to the front of the Remote Terminal Unit (RTU) control panel, or operated remotely from the OIT in the control room at RID-95.

- The well pumps are started manually by pressing the Main Pump Start push button on the local OIT or the OIT located in the control room (or remotely via a web-based interface).

- The well pumps will run continuously until manually stopped by pressing the Main Pump Stop push button on the local OIT or at the OIT located in the control room.
- The pump will stop automatically in the event of a motor overload condition or other conditions such as low flow or high pressure. The well pump will need to be restarted manually after the overload relay for the main pump motor starter is reset.
- In the event of a power failure/outage while the pump is running (see Section 4.5.9), the pump will attempt to restart one time. If the attempt fails, the pump will need to be restarted manually at the local OIT or remotely at the control room after the computer is restarted.
- In the event of an overload condition with the pump motor starter, an alarm will be displayed on the OIT at the local control panel and at the OIT in the control room, and the operator will be notified.
- A high-pressure alarm will be displayed on the OIT (and operator notified), if pressure exceeds the high alarm value (30 psi). This is not a critical alarm, and therefore, will not automatically shut off the well pump.
- The well pumps will stop automatically and the operator notified if a high-pressure shut-off condition exists (i.e., at 40 psi). Restarting the well pump after a high-pressure condition will require the alarm to be reset from an OIT and the pump to be restarted manually at an OIT.

4.5.2 Flow Meters

Manufacturer/Model	Size	Sensor/Transmitter Type
Siemens, Sitrans F M Magflo®	8”& 14”	MAG 5100W/MAG 5000

- 8-inch flow meters installed one per treatment skid to measure instantaneous and totalized flow of raw groundwater (i.e., influent).
- 14-inch flow meters installed one per well site on the bypass piping. At RID-89, RID-92 and RID-114, the flow meter measures well discharge flow in both treatment and bypass modes (instantaneous and totalized values). At RID-95, the 14-inch flow meter only measures bypass flow (instantaneous and totalized) due to operational/mechanical constraints within the treatment system concrete pad. Treatment flow at RID-95 is measured by the two 8-inch flow meters, which are combined to derive the total well discharge flow rate.
- If the well flow rate at a site falls below the low flow rate alarm value (i.e., approximately 25% of nominal flow rate at each well site), an alarm will be displayed on the OIT and the operator will be notified. This is not a critical alarm, and therefore, will not automatically shut off the well pump.

Technical information, including operation and servicing details for the flow meters, is included in **Appendix B**.

4.5.3 Pressure Transmitters

Manufacturer/Model	Range	Order No.
Siemens, Sitrans P200	0-200 psig	7MF1565-4CB

- At each site, one pressure transmitter is located upstream of the 3-way valve to monitor pressure in the header piping. If the value measured by the pressure transmitter exceeds the critical (or shut-off) alarm set point (i.e., 40 psi), the operator will be notified of the alarm and the well pump will automatically shut off (see Section 4.5.1 for additional details).
- At each site, one pressure transmitter is located on the effluent piping of each treatment skid to monitor effluent water pressure and differential pressure across the vessels. If the differential pressure (calculated from the values measured at the transmitter upstream of the 3-way valve and the transmitter at the effluent piping) increases to the high differential pressure value (25 psi, which could indicate solid deposits accumulating in the carbon bed, for example), an alarm will be displayed on the OIT and the operator will be notified. This is a not critical alarm, and therefore, will not automatically shut off the well pump.

Technical information for the pressure transmitters is included in **Appendix C**.

4.5.4 3-Way Valves

Manufacturer/Model	# of Positions	Power
VSI, Series 1000 Electric Actuator [1200]	2 (on/off)	AC 120V/240V AC24

- Each wellhead treatment system includes one (1) 3-way valve that can be controlled manually at the valve, or using the electric actuator through the local OIT mounted to the front of the RTU control panel at each site, or remotely from the OIT in the central control room or via web interface. In normal operation, the valve will be closed on the bypass piping and open on the influent piping to each treatment skid.
- To prevent water hammer, power-assisted closing/opening of valve is paced to occur over a 120-second period when changing from normal operation to bypass mode, or from bypass mode to normal operation.

- For temporary changes in flow between treatment and bypass, the operator may manually open/close the bypass valve until the desired flow rates are obtained. The manual opening/closing of the bypass valve is conducted at a controlled rate to prevent water hammer.

Technical information for the 3-way valves is included in **Appendix D**.

4.5.5 Sump Level Switches

Manufacturer/Model	# of Floats	Order No. / Switch Type
Dwyer, Mercoid Series FSW2 Free-Floating Level Switch	2 (high/high-high)	FSW2-ONPN-20 / SPST NO FSW2-CNPN-20 / SPST NC

- The concrete pads at each site are constructed with approximate 6-inch berms along the pad perimeter to contain and prevent release of water and the pads slope slightly towards the collection sump(s) to facilitate collection and detection of any incidental rainfall or system leakage.
- The wellhead treatment systems at RID-92 and RID-95 each have one sump equipped with two (2) level sensors/switches.
- The RID-89 and RID-114 wellhead treatment systems each have two sumps, both equipped with two (2) level sensors/switches that operate independently.
- Each sump is covered by a grate conforming to Maricopa Association of Governments (MAG) detail 539.
- As rain water or process water accumulates in the sump, a level switch high alarm will result when fluids reach the first float (operator will be notified). If the accumulation of fluids reaches the second float, a high-high critical alarm will result in another notification to the operator and the well pump will continue operating, but the three-way valve will automatically switch the system into bypass to prevent containment overflow in the event that the accumulated water is from a treatment system breach. The operator will visually inspect the system to determine the cause of the critical alarm and take corrective action(s), as appropriate.
- The fluids contained in the sump will be conveyed (following visual inspection to confirm that no hazardous materials are present) via 1 ½" piping utilizing a manually operated sump pump (¾ horsepower, rated for 50 gpm) to the discharge structure/receiver box at the well site.

Technical information for the level switches is included in **Appendix E**.

4.5.6 SCADA System and Control Strategy

Each wellhead treatment system site is equipped with a wireless transceiver that allows communication with the control room at RID-95, which serves as the central hub for the SCADA system.

4.5.7 Temperature Sensors

Manufacturer/Model	Product No.
Siemens, 4-20 mA Room Temperature Sensor	536-753 (20 to 120°F)

- Temperature sensors are installed at all the wellhead treatment systems.
- The sensors monitor the cabinet temperature containing the control hardware and the temperature inside of the RID-95 control room. If the alarm value 120 degrees Farenheit (°F) is exceeded, the operator will be notified but no change in the operational status of the system will occur.

Technical information for the temperature sensors is included in **Appendix F**.

4.5.8 Site Security

Site security at each wellhead treatment system site includes:

- New lighting fixtures that comply with local night sky ordinance.
- New wrought-iron fencing and access gates set-up with electronic sensing alarms (except at RID-92).
- Keys for the locks at each well site access gate will be provided to approved/authorized personnel only (Note: locks are daisy-chained to allow access by Salt River Project personnel to read the electrical meters).
- Secure access to electrical equipment.
- Cameras for 24-hour site surveillance. Cameras can be remotely operated (including pan/zoom capability) to assist the operator in rapid assessment of system conditions.

Technical information related to site security is included in **Appendix G**.

4.5.9 Unplanned Shutdowns / System Operation Upset Events

An unplanned/unscheduled shutdown of the wellhead treatment systems may occur due to various reasons, which include (but are not limited to) the following:

- Power Outage – power supply outages may occur as a result of lightning storms, downed power lines, down transformer, etc. If any of the treatment systems have a loss of power, the system will automatically restart the well pump one time, in bypass mode. In the event of a power outage, a back-up power supply will allow for the SCADA system to remain operational, and the operator will be notified of the alarm. The operator will need to physically visit the treatment system to inspect the cause of the alarm, coordinate restoration of power supply at the site, and restart the treatment system.

- Heavy Rain – as indicated in Section 4.5.5, each sump is equipped with a two level sensors/switches. In the event that a heavy rainstorm causes accumulation of rain water in a sump to reach the second float (triggering a high-high critical alarm), the operator will be notified and the three-way valve will automatically switch the system to bypass mode.

- Critical Alarms – there are a number of critical alarms (identified in Section 4.5 above), that when triggered, will result in an automatic notification to the operator and the well pump will automatically shut off.

4.6 SAMPLING AND ANALYSIS

This section provides the methods and procedures to collect and analyze treatment system samples. This section provides additional guidance to the existing Field Sampling and Analysis Plan (FSAP) for the WVBA (BE&K/Terranext, 2000a). A site-specific Quality Assurance Project Plan (QAPP) (BE&K/Terranext, 2000b) has been prepared and will be complied with; however, this section provides additional details specific to the wellhead treatment systems sampling and analysis program.

4.6.1 Purpose of Sampling and Analysis Program

The goal of the sampling and analysis program is to collect data to:

- Determine when /GAC bed breakthrough/exhaustion occurs and /GAC change-out is needed;
- Determine compliance with the water quality Treatment Goals for the target COCs; and,

- Determine the approximate mass of target COCs being removed at each wellhead treatment system.

4.6.2 Frequency and Locations of Sampling

The proposed data collection/sampling programs are presented in the matrix below. The location and frequency of each sample will be conducted for each of the individual /GAC treatment skids. Sampling frequency and locations refer only to the "lead" vessel except where noted.

Sampling Program Matrix

LOCATION	**FREQUENCY**
Influent Sample Port @ Wellhead	Weekly
	Monthly*
Mid-Skid Sample Port	Weekly
	Monthly*
Point of Compliance (POC)	Weekly

The asterisk next to each "Monthly" indicates that a change to this frequency will be based on an evaluation of "Weekly" data and may be changed after the treatment system reaches steady-state. Sampling will revert to "Weekly" should significant variation or unanticipated results be observed.

The POC sample ports (installed at the 14-inch discharge piping, immediately upstream of each receiver box) will be the location for demonstrating that the treatment system achieves the water quality standards for the target COCs. Applicable water quality standards consist of the MCLs. Field quality control (QC) samples will be collected as described in Section 4.6.4.

4.6.3 Sampling Methods

The following section provides details regarding the methods that will be used for the sampling program. To the extent practical, water quality samples will be collected and analyzed following protocols developed by ADEQ in the WVBA FSAP (BE&K/Terranext, 2000a). Sampling will be

conducted consistent with the provisions of the site-specific Health and Safety Plan (Synergy, 2011a), included as **Appendix H**.

Sampling Equipment & Procedure

Prior to sample collection, each sampling port will be purged for approximately 15-30 seconds to remove any stagnant water (i.e., non-representative water). Purge water from the influent and effluent sample ports will be collected in a two (2) gallon bucket, and will be disposed within the treatment system concrete containment structure.

Each water quality sample will be collected in a set of one (1) or two (2) 40-milliliter volatile organic analysis (VOA) vials preserved with 1:1 hydrochloric acid (HCl). Samples will be collected with zero headspace. Each VOA vial will be tilted to approximately 45 degrees of vertical, and filled using a low flow rate (i.e., approximately 250 milliliters per minute of sample). The vial will be filled to the brim and then, using the cap, a small amount of water shall be added until a convex meniscus is formed. The vial will then be capped, turned upside down, and tapped to verify no headspace. Samples will be stored in a cooler with wet ice at 4° Celsius (C), ± 2°C, and hand delivered to the analytical laboratory.

4.6.4 Analytical Methods and Procedures

Samples will be analyzed following protocols developed by ADEQ in the WVBA FSAP, to the extent practical. These protocols include quality control provisions and sample documentation and management practices as described in the following sections.

Sample Analyses

Water samples will be analyzed for VOCs following EPA Method 8260B and submitted to Airtech Environmental Laboratories (AEL) of Phoenix, Arizona. AEL is an environmental testing laboratory certified by ADHS under license number AZ0740.

Data quality control practices will be in accordance with the AEL standard operating procedure (SOP) for analysis of VOCs by EPA Method 8260B. Standard quality control requires analysis of a Laboratory Control Sample (LCS), LCS duplicate, internal standard, and surrogate analytes with each sample set. The 8260B method requires analytical accuracy to fall within a series of ranges of percent recoveries for internal standards and surrogates (available in AEL QA manual). Laboratory duplicates must be less than or equal to 25 relative percent difference (RPD). Data quality control outside of these limits will be re-run if possible, or appropriately flagged with the reported results.

Quality Control

QC measures will be employed to evaluate both the field sampling procedures and techniques as well as the laboratory procedures and performance of instrumentation.

Field QC samples (including trip blanks and field duplicates) will be collected to help evaluate conditions resulting from field conditions and activities. Field QC samples may be used to evaluate variability in environmental sampling and analysis of organic contaminants.

Field duplicate samples will be collected and treated independently of its counterpart in order to assess field sampling procedures and laboratory precision and accuracy, through comparison of the results, and collected at frequency of one (1) per sampling event. Duplicate samples will be preserved, packaged, and sealed in the same manner as the primary samples. A separate sample number and identification will be assigned to the duplicate, and it will be submitted blind to the laboratory. Identity of the duplicate sample will be recorded in the field data sheets.

Trip blank samples are used to determine if VOC water samples have been contaminated during transport from the field to the lab. The trip blanks are prepared by the laboratory by filling a VOA vial head-space free with organic free water, preserved with 1:1 HCl, labeled as "Trip Blank" or "TB" with the preparation date included on the custody seal. Trip blanks will be included in each cooler used to transport water samples to the laboratory. The results of the trip blanks are a key aspect of the overall QC system for the sampling program, and will be included in the analytical results report.

Laboratory quality control samples are certified standards analyzed by the laboratory (including matrix spike samples and duplicates) to demonstrate accuracy on a daily basis. Since samples to be used as matrix spikes are randomly selected by the laboratory analyst after receipt of samples, it is understood that such analyses may or may not include samples from any given sampling event or location.

Laboratory procedures will be evaluated using field duplicate samples, matrix spikes and other internal procedures defined by the analytical method and analytical laboratory.

Sample Documentation and Management

Chain-of-custody records are completed for each sampling event. The chain-of-custody record will be completed as samples are collected. An example chain-of-custody record for AEL is provided as **Appendix I** and will accompany the samples to the laboratory. Information to be entered on each chain-of-custody record includes:

- Project name
- Project manager/contact person
- Printed name of sampler and signature
- Date and time of collection
- Sample matrix identification
- Number of containers collected for each sample
- Sample identification
- Analyses requested
- Turn-around-time requested
- Dates of possession
- Name and signature of person relinquishing samples
- Date of sample receipt
- Time of sample receipt
- Name and signature of person receiving the samples
- Remarks pertinent to sample collection, preparation, preservation, and analyses

Samples will be submitted as soon as possible (i.e., on the date of sampling) to AEL with requested turnaround time of five (5) days and VOC analyses following EPA Method 8260B, which has a hold time of 14 days.

All documentation will be made in indelible ink. Corrections will be made by drawing a line through the error and entering the correct information. Both the error and the correct information must be legible. The person making the correction will initial the document where changes are made.

5.0 SPENT GAC MANAGEMENT

For each wellhead treatment system site, spent GAC must currently be profiled every two years by the carbon vendor. Synergy will coordinate the profiling process, contacting the carbon vendor a minimum of six weeks prior to an anticipated carbon change-out so that a grab sample of spent GAC can be collected and analyzed. Following satisfactory completion of the profiling process, spent GAC can be removed and transported off-site to a reactivation facility provided the profile indicates the GAC as non-hazardous.

6.0 DOCUMENTATION AND REPORTING

This section includes the ongoing, periodic documentation and reporting necessary for effective monitoring of the wellhead treatment systems.

6.1 WEEKLY INSPECTION FORMS

Inspections will be conducted once per week to monitor the operational and physical conditions at each wellhead treatment system. A sample inspection form is included as **Appendix J**, and provides for collecting data related to water flow rates; differential pressures at the wellhead and across the treatment vessels, alarms, and equipment maintenance/repairs. The operator will complete the form during each inspection and upload all information to an inspections information database. The inspection form will be reviewed annually (at a minimum) and updated as appropriate.

6.2 PROGRESS REPORTS

For each month that the wellhead treatment systems are in operation, a Monthly Progress Report will be prepared to document remedy progress. RID will notify ADEQ of the availability of each Progress Report by approximately the 15th of the following month. A Progress Report example is provided as **Appendix K**. Each Progress Report will include the following, at a minimum:

- Approximate mass of target COCs removed and groundwater volume treated during the reporting period, and cumulative total of target COCs removed and groundwater volume treated since system start-up for each treatment system and total for all sites;
- Tabular summary of water quality samples collected and analytical results;
- Copies of final laboratory reports for the reporting period;
- Operational hours/percentage for each wellhead treatment system during the reporting period;
- Summary of any malfunctions which caused the wellhead treatment systems to be offline;
- Summary of the maintenance activities performed to correct those malfunctions; and,
- Summary of system operation upset events (see Section 4.1) reported to ADEQ by Synergy.

The most recent Monthly Progress Reports (without voluminous analytical laboratory results) are available on the West Valley Groundwater Cleanup Coalition website (http://www.wvgroundwater.org), under the "Project Documents" tab.

7.0 KEY CONTACTS LIST

Key contacts for the wellhead treatment systems include:

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