EARLY RESPONSE ACTION

RID-95 Wellhead Pilot Treatment System Proposal

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On Behalf of the

Roosevelt Irrigation District

WEST VAN BUREN AREA
WATER QUALITY ASSURANCE REVOLVING FUND SITE

August 18, 2011

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SYNERGY ENVIRONMENTAL, LLC

August 18, 2011

ROOSEVELT IRRIGATION DISTRICT
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WATER QUALITY ASSURANCE REVOLVING FUND SITE

1. INTRODUCTION

The RID-95 Wellhead Pilot Treatment System (Pilot System) is proposed in order to accomplish the following:

- Evaluate the effectiveness of liquid-phase granular activated carbon (*l*GAC) technology in removing the mixture of volatile organic compounds (VOCs) present in the West Van Buren Area (WVBA) groundwater plume, and contaminating Roosevelt Irrigation District (RID) wells;
- Evaluate two different types of *l*GAC for removal efficiency, bed life and other operational performance factors;
- Evaluate the feasibility and constraints of wellhead treatment for consideration at other potential locations in the impacted RID well field;
- Refine capital and operations and maintenance (O&M) cost estimates to support subsequent response actions; and,
- Provide near-term capture and control of a substantial amount of the contaminants impacting RID's water supply.

Consistent with the Task 4 - Engineering Design Study, required by the Arizona Department of Environmental Quality (ADEQ) in the Early Response Action (ERA) approval letter of June 24, 2010, RID is proposing to conduct this Pilot System as a means of evaluating the *l*GAC treatment technology specified in the ERA Work Plan (ADEQ, 2010).

The RID-95 well, located on the northeast corner of Sherman St. and 35th Ave., was selected for this Pilot System for a number of reasons:

- ERA Task 2 Well Investigations - investigations, rehabilitation and repairs were recently completed at RID-95 and the well is thoroughly characterized, both mechanically (well casing integrity) and hydrogeologically, and is known to be in good condition;
- The RID-95 well site is relatively large compared to other impacted RID well sites in the WVBA, approximately 6,900 square feet (ft^2) total area, and is located in an industrialized part of the WVBA;
- RID-95 is one of the highest total VOC concentration wells (3rd highest) among the impacted RID production wells in the WVBA (78.5 micrograms per liter (μg/L) total VOCs, approximately 575 pounds per year at 100% duty); and,
- RID-95 pumps at relatively low flow rate compared to most of the RID wells in the WVBA (approximately 2,000 gallons per minute (gpm)).

RID proposes that a commercially available, pre-engineered and pre-fabricated *l*GAC system be designed, installed and operated to treat the discharge from well RID-95. The technical basis for implementing this Pilot System is described in the following sections along with information on the system design, proposed sampling and analysis plan, proposed operation and maintenance (O&M), and anticipated schedule for implementation.

2. TECHNICAL BASIS

The Pilot System will consist of two *l*GAC modules treating the entire flow from impacted well RID-95. At 2,000 gpm this system will represent a 1/10th - scale version of the full build-out detailed in the approved ERA Work Plan. The Pilot System is intended to provide the information discussed in the following sections in support of the Task 4 - Engineering Design Study required by ADEQ.

The most recent data for the concentration of target contaminants in well RID-95 are as follows:

TCE - 58 μg/L PCE - 9.8 μg/L 1,1-DCE - 7.9 μg/L

The Pilot System will provide demonstration of the effectiveness and reliability of the technology, allow for the evaluation of different types of GAC, enable refinement of performance estimates/assumptions, enable evaluation of physical Site constraints, and provide refinement of capital and O&M cost estimates.

2.1 DEMONSTRATION OF TECHNOLOGY EFFECTIVENESS/RELIABILITY

The Pilot System will provide operating information that will allow evaluation of the capability of the *l*GAC technology to effectively and reliably remove VOC contaminants from the extracted groundwater. The Pilot System will also provide demonstration of the operational safeguards provided by the series (lead-lag) configuration and the resulting level of reliability in consistent and predictable removal of the contaminants.

2.2 EVALUATION OF DIFFERENT GAC MATERIALS

The Pilot System will allow for side-by-side comparison of different *l*GAC base materials. GAC can be manufactured from many different types of carbonaceous materials including coal, peat, wood and coconut-shells. Two different types of commonly used GAC, one derived from coconut-shell and one from coal feed stock, will be evaluated to determine the relative performance of each. Performance will be measured in terms of adsorption capacity (bed life), losses through reactivation, associated cost and operational indicators such as head loss, resistance to fouling, and operational issues (such as frequency of backwashing and resistance to short-circuiting).

2.3 REFINEMENT OF PERFORMANCE ESTIMATES

The Pilot System will enable RID to refine the preliminary estimates and assumptions for O&M of the *l*GAC technology, specific to the mixture of contaminants found in the WVBA groundwater plume and impacted well water. Isotherms, showing the relative adsorption capacity of selected GAC to a given contaminant, are available from GAC manufacturers and have been relied upon for developing the existing preliminary operational estimates. However, isotherms are typically generated for single compounds (not mixtures) and are derived through laboratory batch testing under static, equilibrium conditions in a pure medium (such as deionized water). Actual working adsorption capacity may be much less than equilibrium batch capacity because other constituents may be present in the water, such as naturally occurring organics, and because of the difference in adsorption kinetics between the static and dynamic systems.

Pilot testing will allow for determination of the characteristics of the breakthrough curve under dynamic and controlled operating conditions such as surface loading rate and empty bed contact time. Pilot testing will enable assessment of the effects of competition between compounds for adsorption sites as well as potential effects from variations in water chemistry (e.g., pH and hardness) and physical properties such as the presence of suspended solids (e.g., sand, silt, and clay).

Results of the pilot testing will provide refined estimates for bed life, the time it takes for the GAC to become fully saturated, and enable creation of breakthrough curves for each of the target contaminants to assist in predicting future operating requirements and frequency of GAC replacement/reactivation.

2.4 EVALUATION OF PHYSICAL SITE CONSTRAINTS

The Pilot System will provide information regarding the physical and logistical constraints encountered in the design, construction, and O&M of wellhead treatment. Information such as Site area needs, accessibility for GAC transfers and well maintenance activities, utility clearances and safety/security considerations will be collected during the pilot program. This information will be used to assess the viability and practicality of considering similar wellhead treatment systems on other impacted RID wells. This information will also be useful in completing the Task 4 - Engineering Design Study.

2.5 REFINEMENT OF CAPITAL AND O&M COST ESTIMATES

The Pilot System will generate capital and O&M cost data that can be used as scale-up factors for more accurate estimation of subsequent implementation of the full-scale Early Response Action (ERA) implementation. The ERA Work Plan included conceptual design of treatment systems that are essentially identical to the equipment set at the Pilot System and, therefore, these cost data will be directly relevant and applicable (RID, 2010).

3. SYSTEM DESIGN

The Pilot System will consist of two (2) Siemens or equivalent *l*GAC package treatment skids each capable of treating up to 1,000 gallons per minute (gpm) of water in a series (lead-lag) configuration. The basic configuration of the proposed Pilot System is consistent with similar treatment systems in use at other VOC-contaminated groundwater remediation sites in the valley, including the Phoenix Goodyear Airport - North site where several of the *l*GAC wellhead treatment systems discharge directly into the RID Main Canal, consistent with the proposed Pilot System. The equipment set of the Pilot System is equivalent to the equipment included in the approved ERA Work Plan.

The sections that follow will provide general design information regarding the *l*GAC equipment skids, well interconnections/piping, instrumentation and controls and associated general Site improvements. Detailed engineering design will be completed and submitted to ADEQ for review and approval. The project team will coordinate with ADEQ during this process to ensure that the Pilot System design incorporates safeguards necessary to assure protection of public health in the event of a failure.

In light of the fact that the Pilot System will primarily be comprised of pre-engineered modules (the *l*GAC skids), and considering the relative simplicity and standardized controls approach of this treatment process, the detailed design is expected to proceed quickly. While ADEQ will be advising as the detailed design develops, formal design documentation submittal will be provided at the 90% completion stage. RID will conduct the detailed design in accordance with the general concepts and conditions that follow.

The conceptual Site plan is included herein as Figure 1. The final Site plan and equipment layout may be significantly different.

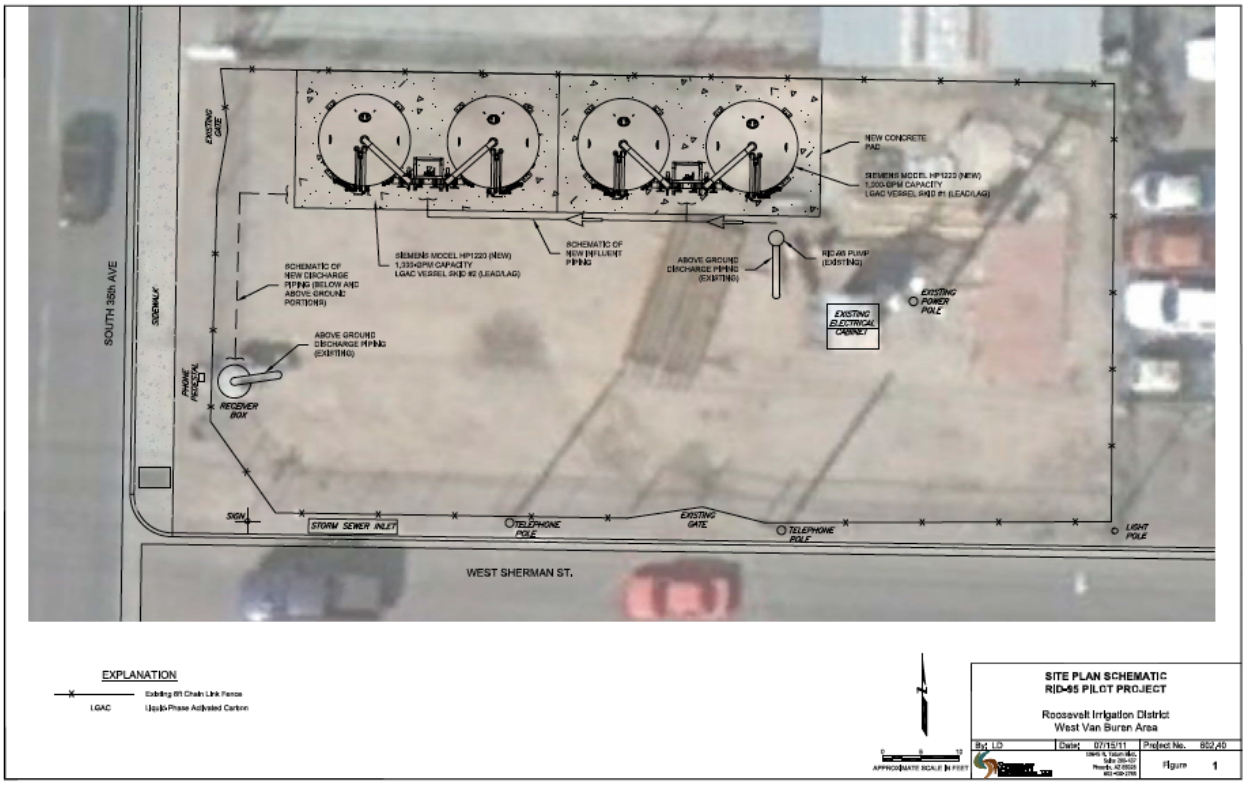


FIGURE 1. CONCEPTUAL SITE PLAN

3.1 lGAC EQUIPMENT SKIDS

The *l*GAC treatment system equipment skids will consist of Siemens Model HP1220 systems (or similar) with the following design features:

- Down-flow configuration to facilitate backwash, if needed;

- 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 will operate utilizing existing well equipment to pump the impacted groundwater through the *l*GAC vessels for treatment and periodic backwash;
- Equipped with sample ports at 25%, 50% and 75% of bed depth 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; and,
- Integrated GAC transfer piping (4-inch Schedule 10 304L stainless steel)

Siemens Model HP1220 general equipment specifications and additional summary information is provided in **Appendix A** as a reference for proposed equipment sets.

3.2 INTERCONNECTIONS/PIPING

The existing discharge pipe from the well will be interconnected to the treatment skids through new piping and valved to enable splitting of the flow evenly between the two skids. The new piping will allow treatment of full- or partial-flow and provide a means of bypassing treatment for all or a portion of the well discharge. Piping is provided on each of the two treatment modules to facilitate isolation and backwashing of individual vessels and to redirect flow to switch vessels between lead and lag service.

3.3 INSTRUMENTATION AND CONTROLS

The Pilot System will be equipped with instrumentation and controls (I&C) that will enable remote operation and monitoring of key performance parameters of the system operation. This I&C approach is intended to be consistent with the approach to be employed in the full ERA implementation. Instrumentation will include, but not be limited to:

- Well pump run status;
- Well discharge flow rate, instantaneous and totalized;
- Flow rates into each individual skid, instantaneous and totalized; and,
- Feed and differential pressure across each vessel.

Controls will include, but not be limited to:

- Pump start/stop;
- By-pass flow valve(s); and,
- Flow splitting/trimming valves.

These I&C nodes will be integrated into a supervisory control and data acquisition (SCADA) system that will provide for remote control of the system as well as continuous monitoring capabilities and data storage to document all aspects of treated system operations and reliability required to assure the successful remediation of the groundwater supply to Arizona state standards and permit requirements. The SCADA system will include local instrumentation, controls and telemetry, and interface with a new control center as well as through remote Internet-accessible linkage. The SCADA system will be capable of expansion to incorporate additional treatment systems in the future.

3.4 SITE IMPROVEMENTS

Site improvements will consist of the following:

- Site clearing and grading with nominal 3-inch decomposed granite or gravel surfacing;
- Construction of a security fence to enclose the entire well Site;
- Installation of access gates to support GAC transfers and maintenance;
- Construction of reinforced concrete equipment pads;
- Construction of secondary containment wall around equipment skids with integrated sump pump and water level detection;
- Construction of reinforced concrete driveway and skirts, as necessary;
- Relocation of existing utilities (if necessary); and,
- Implementation of security measures, including lighting.

4. SAMPLING AND ANALYSIS

This section provides the Sampling and Analysis Plan (SAP) that describes methods and procedures to collect and analyze treatment system samples in conjunction with the Pilot System. 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 SAP provides additional details specific to the planned sampling and analysis described in this Proposal.

4.1 PURPOSE OF SAMPLING AND ANALYSIS PROGRAM

The goal of the Pilot System SAP is to collect data to:

- Evaluate the effectiveness of *l*GAC technology in removing the mixture of VOCs contaminating RID wells;
- Evaluate different types of *l*GAC (i.e., coal-based and coconut carbon) for removal efficiency, bed life and other operational performance factors; and,
- Evaluate the feasibility and constraints of wellhead treatment for consideration at other potential locations in the VOC-impacted RID well field.

4.2 FREQUENCY AND LOCATIONS OF SAMPLING

The proposed data collection/sampling program is presented in the table below. The location and frequency of each sample will be conducted for each of the individual *l*GAC vessel skids. Sampling frequency and locations refer only to the "lead" vessel except where noted.

LOCATION	FREQUENCY	COMMENT
Influent Sample Port	Commissioning	Sample at System Commissioning
	Weekly	Until First Vessel GAC Change-Out
	Monthly	After First Vessel GAC Change-Out
25% Bed Depth Sample Port	Weekly	From Start-Up
	Monthly	After First Vessel GAC Change-Out
50% Bed Depth Sample Port	Weekly	Upon Detection of Target VOCs in 25% Bed Depth Sample
	Monthly	After First Vessel GAC Change-Out and Detection in 25% Bed Depth Sample
75% Bed Depth Sample Port	Weekly	Upon Detection of Target VOCs in 50% Bed Depth Sample
	Monthly	After First Vessel GAC Change-Out and Detection in 50% Bed Depth Sample
Mid-Vessel Sample Port	Commissioning	Sample at System Commissioning to Confirm No Short-Circuiting
	Weekly	Upon Detection of Target VOCs in 75% Bed Depth Sample
	Monthly	After First Vessel GAC Change-Out and Detection in 75% Bed Depth Sample
Effluent Sample Port	Monthly	Continuous during operation of the Pilot System

Water sampling at 25%, 50% and 75% bed depths may be discontinued once the preceding sample indicates that one of the target VOCs is within 10% of the influent concentration for those target VOCs (indicating saturation of the GAC at that point in the bed).

The effluent sample port will constitute the compliance point for demonstrating that the Pilot System achieves the water quality standards for the target VOCs. Applicable water quality standards consist of the Environmental Protection Agency maximum contaminant levels. Field quality control (QC) samples will be collected as described in Section 4.4.3.

4.3 SAMPLING METHODS

The following section provides details regarding the methods that will be utilized for the sampling described in this Proposal. To the extent practical, water quality samples will be collected and analyzed following protocols developed by ADEQ in the WVBA Field Sampling and Analysis Plan (FSAP) (BE&K/Terranext, 2000a). Sampling will be conducted consistent with the provisions of the site-specific Health and Safety Plan (HASP) (RID, 2011).

4.3.1 Sampling Equipment & Procedure

Prior to sampling, each sample location (i.e., influent, the various bed depths, mid-vessel and effluent for each *l*GAC system skid) will be purged using dedicated sample ports. Electrical conductivity (EC), pH and temperature of the purged groundwater will be measured utilizing a Hanna Probe meter (or equivalent). Field measurements will be recorded on field data sheets (see **Appendix B**) and will continue until stabilization is observed. Stabilization will be defined as that point at which the EC and temperature of two consecutive measurements are within 10 percent and pH values are within 0.2 standard units. Once stabilization is observed, a sample will be collected. All purge water will be collected in a five (5) gallon bucket (or additional, if necessary), and will be disposed at the receiver/collection box at the Site.

Each water quality sample will be collected in a set of three (3) 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 flow rate of approximately 1,000 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 meniscus is formed. The vial will then be capped, turned upside down, and tapped to verify no headspace. Small air bubbles will be accepted, however, if an air bubble (or accumulation of air bubbles) larger than pea size is observed, the sample will be discarded and the location re-sampled. Samples will be stored in a cooler with wet ice at 4° Celsius (C), ± 2°C, and hand delivered to the analytical laboratory.

4.4 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.

4.4.1 Sample Analyses

Water samples will be analyzed for VOCs following EPA Method 8260B and submitted to TestAmerica, Inc. (TestAmerica) of Phoenix, Arizona or an alternate approved laboratory. TestAmerica is an environmental testing laboratory certified by ADHS under license number AZ0728. The laboratory MRLs for the primary contaminants (i.e., TCE, PCE and 1,1-DCE) are all 0.50 μg/L. TestAmerica's QA manual was provided to ADEQ under separate cover.

Data quality control practices will be in accordance with the TestAmerica standard operating procedure 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 TestAmerica 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 reporting results.

4.4.2 Quality Control

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 10 percent of the primary samples, with minimum of one per day of sampling. 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 logbook.

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 "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.

4.4.3 Sample Documentation and Management

Comprehensive notes will be taken to document conditions and details of each sampling event. Detailed notes will be written in a project field logbook or on preprinted project log forms/field data sheets. Note keeping will be sufficiently complete and accurate to provide a factual and objective reconstruction of all pertinent field activities. Field logbooks or project log forms will be on consecutively numbered pages signed by the individual making the entries. At a minimum, the following information will be recorded for each sample collected:

- Sample location/description
- Sample identification
- Sampler's name(s) and affiliation
- Date and time of sample collection

All documentation will be made in indelible ink. Corrections made to any document 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.

Chain-of-custody records are completed for groups of samples collected each day. The chain-of-custody record will be completed as samples are collected. An example chain-of-custody record for TestAmerica is provided as **Appendix C** 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(s) and signature(s)
- 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 TestAmerica with requested turnaround time of five (5) days and VOC analyses following EPA Method 8260B, which has a hold time of 14 days.

5. OPERATION AND MAINTENANCE

O&M of the Pilot System will be conducted according to an O&M Plan to be developed and approved by ADEQ prior to system start-up. General provisions for Pilot System O&M are proposed as follows:

- Pilot System will be operated in near-continuous mode as required by RID operations with cessation of treatment only during backwash cycles, well maintenance activities, Pilot System maintenance activities (requiring system shut-down) or unanticipated failures such as power outages or equipment malfunctions;
- Pilot System will be operated as two separate lead-lag treatment trains to provide for side-by-side comparison of coconut-shell GAC and coal-derived GAC;
- Each train will treat approximately one-half of the discharged water from well RID-95 (nominal flow of 1,000 gpm through each train) with the feed water split through trimming valves;
- Should it become necessary to shut off one or both of the treatment trains, and RID requires the flow from RID-95, the untreated flow will be temporarily bypassed around the Pilot System and discharged directly into the existing receiver box until treatment can be re-established;

- Pilot System operational performance data will be continuously monitored and this data collected (at an agreed upon data acquisition frequency) using the instrumentation and SCADA system described in Section 3.3;
- Operational data will be stored indefinitely and provided to the ADEQ periodically, as specified in the O&M Plan;
- GAC bed life will be assessed in both vessels of each treatment train by sampling and analysis for target VOCs as described in Section 4.0;
- The lead vessel in each treatment train will be operated in lead position until maximum utilization of the GAC is achieved (influent concentration of any of the target VOCs equals effluent concentration), or until one of the target VOCs is detected at the 25% bed depth in the lag vessel, whichever comes first;
- When the lead vessel achieves maximum GAC utilization (or VOCs are detected at the 25% bed depth in the lag vessel) the lag vessel will be reconfigured as lead and the spent GAC removed from the exhausted vessel and replaced with 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 (single pass) provided GAC removal/replacement can be accomplished within 48 hours (single pass treatment will not be allowed for more than 48 hours);
- Following recharge of the exhausted vessel with reactivated GAC, the recharged vessel will be backwashed to remove fines and put back into service as the lag vessel and remain in that configuration until the lead vessel is exhausted or the lag vessel sees detection of target VOCs at the 50% bed depth;
- Backwash, if needed, will be conducted at a nominal flow of 1,000 gpm and backwash water will be diverted from the backwashed vessel directly to the discharge receiver box (Note: it is anticipated that the backwash water will meet treated water VOC limits since it still passes through the GAC bed);
- The two treatment trains will remain in operation at least until two complete GAC replacement cycles are completed in order to evaluate the performance of the GAC materials through reactivation (i.e., percent losses and amount of virgin GAC makeup);

6. IMPLEMENTATION SCHEDULE

The following implementation schedule is provided for planning purposes. Acceleration of this schedule will be pursued, if feasible. However, based on the Request for Qualifications (RFQ) responses, Statements of Qualifications (SOQs) and selection of Design/Build/Finance/Operate (DBFO) entity, the Pilot System commissioning/start-up is anticipated to be prior to January 23, 2012.

Pilot System RFQ SOQs Due:	August 5, 2011 (Complete)
Award of Contract to DBFO Entity:	August 19, 2011 (Selection Made 8/8/11)
Procurement of Long-Lead Equipment:	Upon Contract Award
Detailed Design:	Upon Contract Award
ADEQ Review/Approval of Design:	To Be Determined
O&M Plan Submittal to ADEQ:	October 15, 2011
ADEQ Approval of O&M Plan:	To Be Determined
Complete System Installation:	December 15, 2011
Project Commissioning/Start-up:	December 31, 2011

7. PERFORMANCE EVALUATION

Evaluation of the performance of the Pilot System will be conducted in two phases, as follows:

- Near-term evaluation: determination of the adequacy of the technology, system design and Site-specific engineering and operation controls to assure that the Pilot System is reliable and provides safeguards to assure protection of public health.
- Long-term assessment of the O&M performance and metrics, and to refine cost estimates for scale-up of full ERA implementation.

7.1 TECHNOLOGY AND DESIGN

Near-term assessment will consider the technology, system design and Site-specific engineering and operation controls to determine the effectiveness of *l*GAC and the reliability of the systems as designed/operated to provide safeguards to protect public health in the event of system failures in accordance with ARS R18-16-411. While the detailed design will have been approved by ADEQ prior to system start-up, a brief demonstration period (i.e., 2-3 weeks) is proposed so that ADEQ can evaluate the Pilot System performance to confirm that it provides sufficient safeguards to be reliable and protective.

7.2 LONG-TERM OPERATIONAL ASSESSMENT

Operating data will be collected through a minimum of two GAC change-outs and provided to ADEQ on a monthly basis as described in Section 9. These data will be compiled, evaluated and provided to ADEQ in a long-term operational assessment technical memorandum for submittal to ADEQ. In addition to a summary of the normal O&M data, provided monthly, this technical memorandum will also include the following:

- Results of the comparison between coal and coconut shell GAC;
- O&M cost data and projections for sustained operations;
- Summary of operational issues and/or Pilot System upsets; and
- Recommendations regarding continued operation.

It is anticipated that this long-term operational assessment technical memorandum will be finalized approximately one (1) year following Pilot System start-up and may be included in the Task 4 Engineering Design Study stipulated in the ERA approval letter.

8. PILOT SYSTEM PERFORMANCE REPORTING

RID will provide the ADEQ with an electronic Pilot System progress report on a monthly basis. Each report will include the following, at a minimum:

- Approximate mass of target VOCs removed and groundwater volume treated by the Pilot System during the reporting period, and cumulative total of target VOCs removed since system start-up;
- Tabular summary of water quality samples collected and analytical results;
- Copies of final laboratory reports for the reporting period;
- Pilot System operational hours/percentage during the reporting period;
- Summary of any malfunctions which caused the system to be offline; and,
- Summary of the maintenance activities performed to correct those malfunctions.

Other reporting, such as the results of the GAC evaluation, will be included in the long-term assessment technical memorandum as described in Section 7.2.

9. ADDITIONAL WELLHEAD TREATMENT SYSTEMS

Many *l*GAC treatment systems, with substantially similar designs and controls, have been implemented and successfully operated for many years at groundwater remediation sites across the country as well as in the Phoenix area. Consequently, RID has a very high degree of confidence in the reliability and effectiveness of the technology, the equipment set and the engineering and operational controls approach proposed for the Pilot System. RID therefore proposes to implement similar wellhead treatment systems at up to three (3) additional impacted RID wells in order to expedite the removal, capture and control of VOC contaminants and to minimize the ongoing uncontrolled releases.

Following is a list of four (4) candidate wells that RID may select for additional wellhead treatment systems:

1. **RID-114**: Located at the southwest corner of 23rd Ave. and Van Buren St., the Site area is approximately 7,000 square feet. Based on nominal flow rate of 2,500 gpm, RID may install 3 x 1,000 gpm skids, which would remove up to 1,050 lbs per year of target VOCs (@ full duty).

2. **RID-100**: Located on the east side of 27th Ave., approximately ¼ mile north of Buckeye Rd., the Site area is approximately 1,960 square feet. Based on nominal flow rate of 2,125 gpm, RID may install 2 x 1,000 gpm skids, which would remove up to 475 lbs per year of target VOCs (@ full duty).

3. **RID-89**: Located on the east side of 51st Ave., approximately ¼ mile north of Buckeye Rd., the Site area is approximately 4,500 square feet. Based on nominal flow rate of 3,400 gpm, RID may install 3 x 1,000 gpm skids, which would remove up to 700 lbs per year of target VOCs (@ full duty).

4. **RID-92**: Located on the east side of 43rd Ave., approximately ¼ mile north of Buckeye Rd., the Site area is approximately 2,400 square feet. Based on nominal flow rate of 1,200 gpm, RID may install 1 x 1,000 gpm skid, which would remove up to 640 lbs per year of target VOCs (@ full duty).

Wells RID-89, RID-92 and RID-100 are all located approximately three-quarters of a mile south of the Salt Canal alignment, the principal conveyance to the central treatment facility as described in the approved ERA. These wells are fourth (4th), fifth (5th) and first (1st) (respectively) in terms of concentration of total VOC contamination. Design and installation of the interconnecting pipelines needed to move the contaminated water from these wells north to the Salt Canal, as well as the pipelines to shunt less contaminated wells south (to free up conveyance capacity), will take substantial time and effort. Consequently, these wells represent excellent candidates to apply wellhead treatment to achieve early capture and control of contaminants while the detailed ERA design is finalized and the pipelines constructed.

Well RID-114 has the second (2nd) highest contaminant concentration of all the impacted RID wells (with RID-95 being third (3rd) highest). This well is located at the eastern end of the Salt Canal and discharges directly into that conveyance. The relatively large Site, and the high contaminant concentrations, makes this well a good candidate for additional and early treatment.

The capacity of the Siemens HP1220 (or equivalent) system is 1,000-gpm nominal flow with a stated maximum of 1,100 gpm. Depending on individual Site constraints, all or a portion of the flow from these wells may be treated. It is understood that these wells, and any associated wellhead treatment, will be operated in a manner consistent with RID historical pumping until such time that the Task 3 Groundwater Modeling has been completed and ADEQ authorizes modifications to this pumping schedule and priorities.

It is proposed that, following successful performance during the assessment period discussed in Section 7.1, ADEQ approval would extend to the remaining wellhead treatment systems. These additional treatment systems would then be authorized for immediate commissioning and operation until the ERA is implemented. Due to the modular configuration of these systems, these systems could be readily moved and incorporated into the central treatment facility or remain as a permanent remediation treatment solution. Approval of this Pilot System proposal will provide authorization to proceed with these additional wellhead systems according to the stipulations set forth herein.

10. REFERENCES CITED

Arizona Department of Environmental Quality, 2010. Conditional Approval of a Water Quality Assurance Fund (WQARF) Early Response Action (ERA) Work Plan for the West Van Buren Registry Site.

BE&K/Terranext. 2000a. Field Sampling and Analysis Plan, West Van Buren WQARF Registry Site, Phoenix, AZ, prepared for ADEQ.

_____. 2000b. Quality Assurance Project Plan, West Van Buren WQARF Registry Site, Phoenix, AZ, prepared for ADEQ.

Roosevelt Irrigation District (RID). 2010. Early Response Action Work Plan, West Van Buren WQARF Site.

_____. 2011. Addendum to the BE&K/Terranext Site-Specific Health and Safety Plan, West Van Buren Area WQARF Registry Site, Phoenix, Arizona.

APPENDIX A

EXAMPLE
HP® SERIES LIQUID PHASE ADSORPTION SYSTEMS

SYNERGY ENVIRONMENTAL, LLC

Water Technologies

HP® Series Liquid Phase Adsorption Systems (ASME code)

SIEMENS

APPLICATIONS

The HP® Series Adsorption Systems are designed to remove dissolved organic contaminants from water. These systems are cost effectively used in applications including:

- Groundwater remediation
- Wastewater filtration
- Tank rinse water treatment
- Pilot testing
- Underground storage tank clean up
- Leachate treatment
- Dechlorination
- Spill cleanup
- Food grade
- Drinking water

INSTALLATION, STARTUP AND OPERATION

The HP® 810, HP® 1020 and HP® 1220 systems are shipped as separate components—two adsorbers and a piping skid module. The piping module allows the adsorbers to operate in series or parallel configurations. The systems require minimal field assembly and site connections.

Siemens can provide a total service package that includes utilizing OSHA trained personnel providing on-site carbon changeouts, packaging and transportation of spent carbon for recycling at our RCRA permitted reactivation facilities, where the contaminants are thermally destroyed.

We can provide instructions on sampling the spent carbon and completion of our spent carbon profile form. Spent carbon acceptance testing can be performed at our certified laboratory.

When requested, a certificate of reactivation will be issued.

BENEFITS AND DESIGN FEATURES:

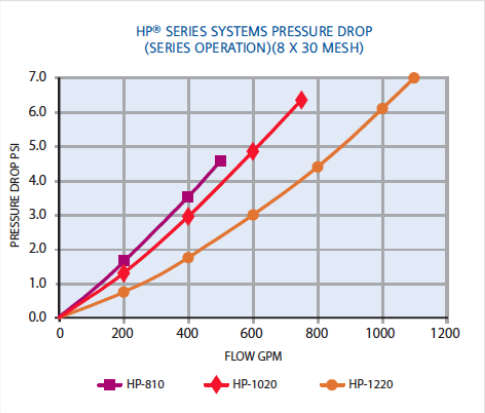
- ASME code section VIII (stamped), carbon steel vessel.
- SSPC-SP5 surface preparation, NSF 6-approved Plasite vinyl ester lining; rust preventative epoxy/urethane exterior.
- Uniform, continuous internal lining flange to flange (HP® 1020/1220 Systems).
- Proprietary vertical 316 stainless steel externally removable septa nozzles (HP® 1020/1220 Systems) allows maintenance of underdrain without vessel entry.
- Modular design for easy handling and installation.
- Internal spray nozzle ensures complete removal of all spent carbon.
- Schedule 40 carbon steel pipe, supplied with cast iron gear/wheel operated butterfly valves with EPDM seats.
- Carbon slurry piping made from schedule 10 304 stainless steel.
- In-bed water sample collection ports —25-50-75% bed depths.
- Top and side manway allows for easy internal inspection.

SPECIFICATIONS/TYPICAL PROPERTIES			
	HP® 810SYS	HP® 1020SYS	HP® 1220SYS
Dimensions (each adsorber)	96″ x 84″	120″ x 96″	144″ x 60″
Overall Height	15′ 5″	17′ 10″	15′ 4″
System Length	22′ 8″	22′ 2″	27′ 10″
System Width	10′	12′	13′ 8″
Process Piping	6″	8″	8″
Flanged Inlet/Outlet (150# ANSI)	6″	8″	8″
Carbon Fill/Discharge	4″	4″	4″
Flanged Backwash/Vent	6″	8″	8″
Manway (dia., side shell location)	20″	20″	20″
Manway (top)	14″ x 18″	14″ x 18″	14″ x 18″
Utility Water/Air (hose connection)1	2″	2″	2″
Interior Coating	Vinyl Ester	Vinyl Ester	Vinyl Ester
Exterior Coating	Urethane	Urethane	Urethane
Empty Vessel Weight (lbs.)	15,500	38,500	45,000
Carbon Weight/Vessel (lbs.)	10,000	20,000	20,000
Operating Weight (lbs.)	85,000	170,000	185,000
Design Pressure (PSIG) @ 150°F	125	125	125
Max. Flow (GPM) Series/Parallel	500/1,000	750/1,500	1,100/2,200
Backwash Rate (GPM) (8 x 30 mesh @ 55°F)	450	710	1,000

(1) Kamlock type
For detailed specifications or dimensional information or drawings, contact your local Siemens sales representative.

Safety Note: Wet activated carbon readily adsorbs atmospheric oxygen. Dangerously low oxygen levels may exist in closed vessels or poorly ventilated storage areas. Workers should follow all applicable state and federal safety guidelines for entering oxygen depleted areas.

Siemens makes no warranties as to completeness of information. Users are responsible for evaluating individual product suitability for specific applications. Siemens assumes no liability whatsoever for any special, indirect or consequential damages arising from the sale, resale or misuse of its products. All information presented herein is believed reliable and in accordance with accepted engineering practice.



The information provided in this literature contains merely general descriptions or characteristics of performance which in actual case of use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of the contract.

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WS-HP-DS-1206
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APPENDIX B

EXAMPLE FIELD DATA SHEET

SYNERGY ENVIRONMENTAL, LLC

FIELD DATA SHEET FOR TREATMENT SYSTEM SAMPLING

Project: _____ RID Well/Canal Site: _____ On-Site:_____ Off-Site:_____ Page ____ of ____

SAMPLE ID	SAMPLE DATE	TIME	TEMP (°C)	pH (S.U.)	E.C. (uS)	FIELD METER	ANALYSIS	COMMENTS/NOTES

APPENDIX C

EXAMPLE CHAIN-OF-CUSTODY RECORD

Phoenix
4625 E Cotton Center Blvd
Suite 189
Phoenix, AZ 85040
phone 602.437.3340 fax 602.454.9303

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact	Project Manager:	Site Contact:	Date:	COC No:
Synergy Environmental, LLC	Tel/Fax:	Lab Contact:	Carrier:	____ of ____ COCs
10685 N. Tatum Blvd, Suite 200-437	Analysis Turnaround Time			Job No.
Phoenix, AZ 85028	Calendar (C) or Work Days (W)			
(602) 430-2785	TAT if different from Below			SDG No.
N/A	☐ 2 weeks			
Project Name:	☐ 1 week			
Site:	☐ 2 days			
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample																	Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☐

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* *Months*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time: