# **Danielle R. Taber**

From: Jerry Worsham < JWorsham@rhlfirm.com>
Sent: Tuesday, December 02, 2014 11:33 AM

**To:** Danielle R. Taber

**Cc:** Wendy Flood; Tina LePage

Subject: Comments on the West Van Buren WQARF Site Draft Feasibility Study Report submitted

by the Roosevelt Irrigation District (RID)

Attachments: 12-1-14 ADEQ Public Meeting.pdf; RID Phase 1 Wellhead Treatment System Annual

VOC Mass Removal Eval Tech Memo 20141031.pdf

### Attn: Danielle Tabor:

On behalf of Meritor, Inc., attached are the written formal comments that I prepared for the Public Hearing of December 1, 2014, which I was not able to present due to the limited time allowed for comments by the General Public. The chart that I did present for the Public Hearing Record concerning the "RID's Operational Timeline for the ERA/MERA wells" is found under **Exhibit 3.** The attached Report by Arcadis US, Inc. is the background for the "RID's Operational Timeline for the ERA/MERA wells" chart and also should be included in Meritor, Inc.'s comments under **Exhibit 3** and is referenced in the main body of the comments.

Meritor, Inc. may have additional comments based upon the draft Feasibility Study reports as presented in the Public hearing. Call me direct at (602) 744-5763 with any questions.

Jerry

Jerry D. Worsham II Member *Ridenour Hienton, P.L.L.C.* Chase Tower 201 North Central Avenue, Suite 3300 Phoenix, Arizona 85004

E. jworsham@rhlfirm.com | O (602) 254-9900 | F (602) 254-8670 | W. www.rhlfirm.com

This electronic mail transmission contains information from the law firm of Ridenour Hienton, P.L.L.C. that may be confidential or privileged. Such information is solely for the intended recipient, and use by any other party is not authorized. If you are not the intended recipient, be aware that any disclosure, copying, distribution or use of this message, its contents or any attachments is prohibited. Any wrongful interception of this message is punishable as a Federal Crime. If you have received this message in error, please notify the sender immediately by telephone at (602) 254-9900 or by electronic mail at jworsham@rhlfirm.com

# DECEMBER 1, 2014 ADEQ PUBLIC MEETING WEST VAN BUREN WATER QUALITY ASSURANCE REVOLVING FUND (WQARF) REGISTRY SITE – COMMUNITY ADVISORY BOARD

RE: COMMENTS ON THE ROOSEVELT IRRIGATION DISTRICT'S DRAFT FEASIBILITY STUDY (July 2014)

Appendix A – "Summary of Conditional Tasks Conducted, Original Early Response Action"

My name is Jerry D. Worsham II, I am an environmental and natural resources attorney with the law firm of Ridenour Hienton, PLLC. On behalf of Meritor, Inc., I provide these comments on the Roosevelt Irrigation District's (RID) Draft Feasibility Study (FS) Report (July 2014) concerning the West Van Buren Area WQARF Registry Site concerning the RID's Appendix A – Summary of Conditional Tasks Conducted – Original Early Response Action.

I suggest that the Arizona Department of Environmental Quality ("ADEQ") reject this factually inaccurate summary from the Roosevelt Irrigation District ("RID") for the following reasons. On June 24, 2010, the ADEQ issued a conditional approval to the RID for an Early Response Action ("ERA") with four conditional tasks, which required: 1) a public health threat [assessment]; 2) RID well investigation; 3) groundwater modeling; and 4) a pump and treat system [engineering study]. (See Exhibit 1) The RID's captioned Appendix A to the Draft Feasibility Study attempts to explain how RID completed the conditional tasks or obtained data as required by ADEQ's conditional approval of the original ERA. It is apparent that RID has not satisfied the ADEQ's four conditions and ADEQ should revoke the conditional approval. In particular, ADEQ has not issued any approvals of the public health risk assessment or issued a Certification required under AAC R18-16-411(E)(1) for the RID's Operation and Maintenance Plan.

As stated by ADEQ Director Darwin, "ADEQ's June 24, 2010 approval of RID's February 3, 2010 ERA Work Plan is a final decision. The approval is conditioned upon RID's implementation of the procedures described in the June 24<sup>th</sup> approval upon RID's compliance with applicable statute and rule. ADEQ has and will continue to evaluate RID's adherence to these requirements. If ADEQ determines that RID has failed to adequately follow the conditions of approval identified in the June 24<sup>th</sup> letter or the applicable statutes and rules, ADEQ will take appropriate action to ensure RID meets the terms of the conditional approval, and if compliance is not achieved, revoke the approval under the appropriate legal procedures."

<sup>&</sup>lt;sup>1</sup> On July 12, 2012, RID submitted a "Modified Early Response Action (MERA) Proposal" and followed with the "Modified Early Response Action Work Plan" dated October 22, 2012. Again, ADEQ conditionally approved the MERA on February 1, 2013. It is presumed the four conditions identified in the ERA have been maintained by ADEQ as conditions in the MERA.

# BACKGROUND

# Original ERA

The design of the original ERA was described in detail in a document titled "Work Plan Roosevelt Irrigation District Early Response Action, West Van Buren Water Quality Assurance Revolving Fund Site" ("WP") (February 3, 2010). Generally described, it covers the following key elements: 1) a centralized groundwater treatment facility (CGTF); 2) physical improvements to existing pipeline and canals; 3) modifications to existing extraction wells; and 4) new pipelines. As a concept, the CGTF was supposed to be designed and constructed to treat 20,000 gallons per minute (gpm) of contaminated water using liquid-phase granular activated carbon (LGAC).

As detailed in the "Technical Memo" for the ERA submitted by RID dated February 2, 2010, "The primary feature of the ERA is a 20,000 gallon per minute (gpm) capacity central groundwater treatment facility ("CGTF") located along the RID Main Canal near 84<sup>th</sup> Avenue and Van Buren Street in Phoenix, Arizona." (p.1) Phase 1 wells included RID wells # 105, 106, 107, 108, 109, 110, 112, 113 and 114. Phase 2 wells included # 89, 92, 95 and 100. (WP) (pgs. 34 and 36). RID stated that separate new pipelines would be installed to the Salt Canal and then to the CGTF for treatment. (WP p. 33)

# **MERA**

On October 22, 2012, ADEQ received the **Modified Early Response Action** (MERA) Work Plan from RID.<sup>2</sup> The original ERA's proposed CGTF and associated facilities have been abandoned, modified or superseded depending on your viewpoint. The MERA is a very different proposal/concept/work plan from the ERA. "The **Modified ERA Work Plan** ("MWP") modifies this original design approach in several areas . . . The **original ERA Work Plan** included a CGTF designed to treat 20,000 gpm of water from ten of the most highly contaminated RID wells using LGAC . . . This modified ERA Work Plan will consist of wellhead LGAC treatment systems, in lieu of the CGTF, at eight of the most highly contaminated RID wells." (MWP p. 24)

"Phase 1 of the Modified ERA Work Plan consists of installation and operation of the four wellhead treatment systems included in the RID-95 Wellhead Pilot Treatment Proposal. One of these wells, RID 114, is located at the eastern end of the Salt Canal at 23<sup>rd</sup> Avenue and West Van Buren Street. The remaining three wells, the "southern-tier wells" (RID-89, RID-92 and RID-95) are all located approximately ¾ mile south of the Salt Canal." (MWP p. 28)

"Phase 2 of the Modified ERA Work Plan consists of equipping four additional RID wells with high VOC concentrations with wellhead treatment." These additional wells (anticipated as RID-100, RID-106, RID-112 and RID-113) will be equipped with wellhead treatment systems similar to those constructed at the pilot treatment systems sites . . . These installations will be designed

<sup>&</sup>lt;sup>2</sup> To date, RID has not submitted a revised or a new Technical Memorandum to support the MERA.

<sup>&</sup>lt;sup>3</sup> According to the RID's Draft Feasibility Study, the concept of implementing the Phase 2 wellhead treatment systems has been abandoned in the MERA and will instead be incorporated into the ADEQ's review of the Draft Feasibility Study (Draft Feasibility Study, pgs. 131, 138 Synergy Environmental, LLC and Montgomery & Associates (2014)).

consistent with the Phase 1 treatment systems as detailed in the RID-95 Wellhead Pilot Treatment System Proposal, dated August 18, 2011, whose implementation was agreed to by ADEQ by letter dated September 2, 2011." (MWP p. 29)

By letter dated February 1, 2013, ADEQ issued a new Administrative Determination titled "Conditional Approval of RID's Modified Early Response Action Work Plan West Van Buren (WQARF) Registry Site," and specifically stated, "The Modified ERA Work Plan serves as a modification to RID's original Early Response Action Work Plan dated February 3, 2010... This approval supersedes the ADEQ's approval of the previous ERA Work Plan dated February 3, 2010."

# COMMENTS

Individual comments follow on RID's compliance with ADEQ's conditional Tasks 1 through 4 including:

### Task No. 1

Comment and Exhibit 1 A public health threat [assessment];

Conclusion: RID's own report concludes that there is not an imminent (acute) risk to the public from the contamination being released from the RID water systems. (See Exhibit 2) To date, ADEQ has not approved or determined that the Public Health Exposure Assessment and Mitigation Summary Report (2011) has satisfied the condition required by Task No. 1.

# Task No. 2

Comment and Exhibit 1 RID well investigation;

Conclusion: To date, ADEQ has not determined that the RID's Phase 1 well investigations have satisfied the conditions required by Task 2.

# Task No. 3

Comment and Exhibit 1 Groundwater modeling; and

Conclusion: RID has failed to complete the following Task 3 steps as they identified as necessary:

- · Conduct final phase of modeling
  - o Complete model update/refinement
  - Refine modeling projections (expected to he similar to current projections)
- Prepare report
- Ohtain Task 3 approval from ADEQ
- Continue to refine model as ERA progresses

To date, RID has not submitted a Groundwater Modeling Report to satisfy ADEQ's Task No. 3 condition.

Task No. 4

Comment and Exhibit 1 A pump and treat system [engineering study] follow in specific detail below.

Conclusion: RID significantly overstated the removal capacity of Volatile Organic Components (VOC) contamination in the MERA. Instead of 3500 pounds per year [later reduced to 1900 pounds per year] it most likely has the removal capacity of 1446 pounds per year based upon a Technical Memorandum and report by Arcadis, U.S., Inc. (October 31, 2014). (See Exhibit 3) RID has submitted a response to ADEQ comments on the Operation and Maintenance (O & M) Plans deficiencies dated October 20, 2014. ADEQ has not issued a Certification required under AACR 18-16-411 (E)(1) for the O & M Plan. RID has not satisfied conditions for Task 4.

SEE MORE SPECIFIC AND DETAILED COMMENTS ON ADEQ CONDITIONAL TASKS 1 – 4 on the following pages 5 – 14.

# SPECIFIC COMMENTS

ADEQ Tasks No. 1 - 4

# Task No. 1

# Description

# Completion/Submittal Date

### Public Health Threat

The RID plan states there is a current risk to the public from exposure to VOC's (from both air and water) within the West Van Buren Area (WVBA), however, specific documentation about the risks and how the risks will be mitigated during the ERA implementation has not yet been provided.

Within 30 days of ERA approval, RID shall submit a risk analysis work plan to ADEQ documenting the risks and demonstrating to ADEQ how and when the ERA will mitigate the risks.

# RID's Submission:

Based upon the RID's Modified ERA Work Plan, "Task 1 work, detailed in the Public Health Exposure Assessment and Mitigation Work Plan (Synergy, 2011a), was completed and results were submitted to ADEQ on September 16, 2011, in a Summary Report (Synergy 2011b)." (MERA WP p. 19)

# Comments:

The RID has made many unsubstantiated statements without proof concerning the alleged risks and how the risks would be mitigated by the proposed ERA (or the MERA). In general, Baseline Risk Assessments provide an evaluation of the potential threat to human health and the environment in the absence of any remedial action. Baseline Risk Assessments provide the basis for determining whether or not remedial actions [or Early Response Actions] are necessary and the justification for performing remedial actions.

In response to ADEQ Task No. 1, RID submitted a document titled "Public Health Exposure Assessment and Mitigation Work Plan" (Synergy Environmental, LLC (undated)). On October 7, 2010, ADEQ responded with descriptions of significant discrepancies in the RID Work Plan. In the response, ADEQ noted that the RID Work Plan did not provide for the four components of a site-specific human health risk assessment [conditional Task No. 1] as required under Arizona Administrative Code (AAC) R18-16-401 among other limitations.

Going forward, RID conducted a limited-scope sampling of air and water from RID's water supply well discharges and surface conveyances to measure Volatile Organic Compounds ("VOC") contamination from groundwater entering the environment and to provide insight into the fate and transport of these contaminants. Based on air sampling data from this assessment, RID submitted a "Public Health Exposure Assessment and Mitigation Summary Report" ("Risk Report") (Synergy Environmental LLC, 2011). The alleged purpose of the Risk Report was to evaluate the potential for acute public exposure to Contaminants of Concern ("COCs") in the WVBA Site from the transfer of pollutants in groundwater to the atmosphere.

The RID Risk Report stated that the limited scope sampling event was intended to facilitate a preliminary assessment of the potential risk to the public health from inhalation of

<sup>&</sup>lt;sup>4</sup> "Guidance for Conducting Remedial Investigation and Feasibility Study under CERCLA," p. 3-20 (EPA/OSWER Directive 9355.3-01, Oct. 1998)

COCs released to the air from RID water supply system operations in the WVBA Site. As such, RID then concluded that the current air emissions from RID water supply well discharges and water supply conveyance do not pose an acute risk to public health.

The RID's own screening level determination concludes that:

Review of these data, and consideration of the reasonable likelihood for potential public exposure, result in the conclusion that there is not an imminent (acute) risk to the public from the contamination being released from the RID water systems. While air sampling results show that many points in the RID water systems exceed air inhalation screening-level guidelines for the short term exposure (acute MRLs and one-hour AAAQGs), these points are not likely to provide a reasonable public exposure pathway due to their physical nature and locations. Similarly, water sampling results show that many points in the RID water systems exceed screening-level guidelines for ingestion (EPA RSL – tap water and SWQSs – drinking water), however, the contaminated water is not expected to lead to an unacceptable public exposure based on the limited and transient potential use of this water as a source of drinking water. Water from the RID system in the WVBA Site is not currently used for municipal drinking water supply. (See Exhibit "2" RID Report pgs. 27-28)

The Report also states, "While there does not appear to be an acute exposure risk to the public from these contaminants, the long term effects from public exposure to uncontrolled air emissions cannot be determined by this limited-scope sampling event."

# Conclusion:

RID's own report concludes that there is not an imminent (acute) risk to the public from the contamination being released from the RID water systems. To date, ADEQ has not approved or determined that the Public Health Exposure Assessment and Mitigation Summary Report (2011) has satisfied the condition required by Task No. 1.

# Task No. 2

# Description

# Completion/Submittal Date

# RID Wells Investigation

Due to the proposed increased pumping rate at RID wells to be used for remediation, RID must conduct well testing and modeling to insure that changes in pumping will not adversely affect groundwater quality and levels within the WVBA beyond what would be expected with the current pumping conditions. Water levels must be maintained at or near current levels taking into account the natural variations. The investigation must determine how ERA work plan implementation will affect both the aquifer and wells in the area of the plume.

Within 45 days of ERA approval, RID shall submit a well investigation work plan for the investigation of RID wells within the plume boundary. This investigation shall include at a minimum, water levels, screen intervals, spinner log testing, depth specific analytical testing, and video logging.

Within 60 days of completion of the work required by the well investigation work plan, RID shall submit a well investigation report to ADEQ.

# RID's Submission:

Based upon the RID's Modified ERA Work Plan, "Task 2 work, detailed in the Well Investigation Work Plan (M&A, 2010b), was completed at RID-95 and reported to ADEQ in the RID-95 Well Investigation Technical Memorandum (M&A, 2012); well investigations were recently conducted at RID-111R and at RID-92." (MERA WP p. 19)

### Comments:

The RID modified or abandoned the ERA for the MERA and did not submit the ADEQ's required information on all RID wells within the [West Van Buren Water Quality Assurance Revolving Fund (WQARF) Site] plume boundary. ADEQ's purpose for the required investigation was "to determine how the ERA [or MERA] work plan implementation would affect both the aquifer and wells in the area of the plume." RID acknowledged that it owns and operates 32 large capacity water production wells within the WVBA WQARF Site.

RID submitted an initial Well Investigation Work Plam (Montgomery and Associates (November 24, 2010)) which proposed limited well investigation on three wells identified as RID-92, RID-95 and RID-114 [RID-111 was approved as a replacement] including video surveys, test pumping, fluid movement investigations and depth specific samples for all three wells was proposed. On February 9, 2011 ADEQ reviewed and approved the RID's Well Investigation Work Plan, but specifically stated that "ADEQ's approval and RID's execution of the abridged work plan does not satisfy all conditions of the overall work plan for Task 2 conditional approval of the Early Response Action (ERA)."

RID has asserted that, "Although not intended to satisfy all of the conditions set forth by the ADEQ in the ERA approval letter (ADEQ 2010a), or address all of the comments received from ADEQ on the original August 2010 Task 2 Work Plan (M&A, 2010b), a phase 1 well investigation program was approved by ADEQ to be conducted during a lower water demand period when only select RID production wells were in service (M&A, 2010c). Later phases of well investigation activities would not be available until the next low demand period or until after a replacement well at RID-111 was constructed (G&K, 2010) . . . In accordance with the conceptual outline given in Gallagher & Kennedy's November 15, 2010 letter to ADEQ, the phase 1 investigations were limited to wells RID-92, RID-95 and RID-114 . . ." RID did submit a Phase 1 well investigation report for RID-95 (July 25, 2011), a Technical Memorandum for RID-92 (June 18, 2013) and a Technical Memorandum for RID-111-R (June 18, 2013).

# Conclusion:

To date, ADEQ has not determined that the RID's Phase 1 well investigations have satisfied the conditions required by Task 2.

# Task No. 3

# Description

# Completion/Submittal Date

# Groundwater Modeling

A groundwater model must be constructed to estimate the effects of the changes RID well pumping rates. RID has indicated that the overall pumping rate will stay the same; however, the wells that will be pumped will change. This change must be modeled.

The groundwater model must also evaluate how the diverted pumpage of RID wells will affect other contaminant groundwater plumes, such as those created at Leaking Underground Storage Tank (LUST) sites and neighboring WQARF and Superfund sites.

The model must also consider differing pumping rates and locations. One of the goals of the ERA is to remediate groundwater. RID must maximize, to the extent practical, the removal of contaminants from the subsurface when the ERA is implemented. Currently the RID treatment system plan is based on treating the entire volume of groundwater that the RID wells are capable of pumping. However, this may be excessive if the wells can be pumped at a lower rate from the contaminant zone and still maintain the desired effects of groundwater recovery. Therefore, the model shall also consider impact of other pumping rates on drawdown and capture zones.

Within 60 days of ADEQ's written approval of the well investigation report, RID shall submit a groundwater model work plan. At a minimum, the groundwater model shall estimate the effects of changed pumping rates and locations on the aquifer, including but not limited to water levels and all contaminant plumes within the WVBA and neighboring WOARF and CERCLA sites.

Within 60 days of completion of the work required by the groundwater model work plan, RID shall submit a groundwater model report to ADEQ for approval.

### RID's Submission:

Based upon the RID's Modified ERA Work Plan, "Task 3 work, detailed in the Groundwater Modeling Work Plan (M&A, 2011), is currently underway." (MERA WP p.19)

# Comments:

ADEQ specified in the 2010 ERA approval letter, that the groundwater model must meet two primary objectives:

- 1. Estimate the effects on groundwater levels and capture zones in the WVBA Site due to the proposed ERA pumping regimen; and,
- Evaluate how the groundwater withdrawals diverted from the RID wells during the ERA will affect other contaminant plumes within the WVBA Site and neighboring WQARF and Superfund Sites.

RID submitted a report titled "Groundwater Modeling Work Plan for Wellhead Pilot Treatment Systems" (Synergy Environmental, LLC (October 27, 2011)) ("Phase 1 Modeling Work Plan"). This Phase 1 Modeling Work Plan was submitted to ADEQ to evaluate the hydrologic effects of prioritized pumping of wells to be equipped with wellhead treatment, pursuant to the RID-95 Wellhead Pilot Treatment System Proposal ("Pilot System Initiative"). The historic RID pumping regimen and the proposed prioritized and sustained pumping regimen at the four (4) wells equipped with wellhead treatment were to be simulated in the model to project the net hydrologic effect of the proposed pumping changes through 2014. The proposed modeling effort was to simulate groundwater flow and advective migration of contaminants using particle tracking; however, contaminant transport modeling was not proposed for modeling.

The proposed scope of work for the Phase 1 Modeling Work Plan was developed to meet the objectives for the operation of the four wells included as part of the Pilot System Initiative (RID-89, RID-92, RID-95 and RID-111-R). However, RID then changed directions, and a Modified ERA Proposal was submitted. RID indicated its belief that it made sense to defer further action for the Phase 1 Modeling Work Plan pending ADEQ review and consideration of the Modified ERA Proposal.

In a RID presentation titled "Groundwater Modeling Roosevelt Irrigation District Early Response Action" (September 27, 2011), RID indicated the following steps were necessary to satisfy Task 3:

- Submit Task 3 Modeling Work Plan to ADEQ
- Conduct final phase of modeling
  - o Complete model update/refinement
  - o Refine modeling projections (expected to be similar to current projections)
- Prepare report
- Obtain Task 3 approval from ADEQ
- Begin well head treatment
- Continue to refine model as ERA progresses
- Use model for [Feasibility Study] FS

RID submitted a modeling report titled "Feasibility Study Groundwater Modeling" (Montgomery & Associates (June 30, 2014)) as part of RID's Draft Feasibility Study Report (July 2014). However, this groundwater modeling effort was designed to assist in the evaluation of RID's proposed remedial strategies in the feasibility study. It is not determined if this modeling satisfies the ADEQ's conditional approval and ADEQ has not commented on the modeling report.

# Conclusion:

RID has failed to complete the following Task 3 steps as they identified as necessary:

- · Conduct final phase of modeling
  - o Complete model update/refinement
  - o Refine modeling projections (expected to be similar to current projections)
- Prepare report
- · Obtain Task 3 approval from ADEQ
- Continue to refine model as ERA progresses

To date, RID has not submitted a Groundwater Modeling Report to satisfy ADEQ's Task No. 3 condition.

# Task No. 4

# Description

# Pump and Treat System

RID must complete an engineering design study which describes all technical requirements for a pump and treat remediation system, including a description of the influent and effluent contaminant levels.

All applicable permits must be in place, prior to construction and/or operation of the pump and treat system, as required under the relevant statue and rules.

RID must also submit a construction, operation and maintenance work plan for the pump and treat system. The work plan must contain a plan for monitoring groundwater quality and groundwater elevations, including what wells will be sampled and monitored, the frequency that they will be sampled and monitored, and the parameters that will be analyzed. As part of the work plan, RID must also submit [proposed sampling frequency, locations, and analytical methods, at the pump and treat system.

# Completion/Submittal Date

Within 60 days of ADEQ's written approval of the groundwater model report, RID shall submit an engineering design study for the pump and treat remediation system sealed by an Arizona Registered Professional Engineer. At a minimum, the [engineering design study shall include all of the technical design requirements of the pump and treat remediation system, including a description of the influent and effluent contamination levels]. In addition, the engineering design study must include a list of all permits that must be obtained prior to construction and operation.

Within 60 days of ADEO's written approval of the engineering design study, RID shall submit a remediation system construction, operation and maintenance work plan. At a minimum the work plan shall include an Operation and Maintenance (O & M) plan for the remediation system, a description of the sampling of RID canals and wells (both for groundwater elevation and quality) during operation of the remediation system, and a description of sampling of remediation system influent and effluent water.

# RID's Submission:

Based upon the RID's Modified ERA Work Plan, "[Task 4 work], Engineering pilot studies, detailed in the RID-95 Wellhead Pilot Treatment System Proposal (Synergy, 2011c), with implementation agreed to by ADEQ by letter dated September 2, 2011 (ADEQ, 2011b), were completed and treatment systems installed at four (4) RID wells [RID-89, RID-95 and RID-114](all currently in operation)." (MERA WP p. 19)

### Comments:

RID submitted the Modified Early Response Action Proposal (July 17, 2012) which radically altered the RID's conceptual ERA. Since the RID has abandoned or modified the original concept of a CGTF, the implementation of an individual well head LGAC treatment system is standard technology. RID indicated that the technology change provided the following benefits:

"Significantly reduces the scope and cost of the final groundwater remedy by reducing the number of impacted RID wells that will need to be addressed by supplemental remedial actions developed during the WVBA Site FS (from 7 to 4 wells) and by providing effective mass contaminant removal and treatment by the earlier implementation of the wellhead groundwater pump, treat and blend systems that will remediate approximately 3500 pounds per year of VOC contamination in the regional groundwater."

RID significantly overstated the removal capacity of VOC contamination in the MERA. Instead of 3500 pounds per year [later reduced to 1900 pounds per year] it has most likely to be 1446 pounds per year based upon a Technical Memorandum and report by Arcadis, U.S., Inc. (October 31, 2014). (See Exhibit 3)

The RID submitted an Operation and Maintenance Plan (O & M) Plan on April 7 and April 10, 2014; however, this O & M Plan has significant deficiencies identified by ADEQ. RID has submitted a response to ADEQ comments on the O & M deficiencies. ADEQ has not issued a Certification of the O & M Plan required under AACR 18-16-411 (E)(1).

Based upon the RID's submission to ADEQ and the Monthly Progress Reports, in 2012 the MERA wells actually removed 895 lbs. of VOCs, in 2013 the MERA actually removed 767 lbs. of VOCs and in 2014 the MERA wells actually removed 89 lbs. (Arcadis pg. 2/12 and 6/12) The fact that RID has not been able to continuously operate the MERA wells and has operated in by-pass/shutdown for most of the operational history of the MERA wells certainly questions the ability of RID to accurately predict VOC removal in the future. (See Exhibit 3)

# Conclusion:

RID has not satisfied conditions for Task 4. RID has submitted a response to ADEQ comments on the O & M deficiencies dated Octoher 20, 2014. ADEQ has not issued a Certification required under AACR 18-16-411 (E)(1)

# SUMMARY

These comments with supporting documentation and exhibits confirm that RID has not satisfied Tasks 1-4 as required by ADEQ's conditional approvals dated June 24, 2010 or February 1, 2013. The RID's failure to implement and satisfy the conditions in the ERA/MERA also suggest that the RID's Draft Feasibility Study is suspect and factually inaccurate. ADEQ should revoke the conditional approvals of the ERA/MERA for failure to satisfy the conditions of approval.

As stated by ADEQ Director Darwin, "ADEQ's June 24, 2010 approval of RID's February 3, 2010 ERA Work Plan is a final decision. The approval is conditioned upon RID's implementation of the procedures described in the June 24<sup>th</sup> approval upon RID's compliance with applicable statute and rule. ADEQ has and will continue to evaluate RID's adherence to these requirements. If ADEQ determines that RID has failed to adequately follow the conditions of approval identified in the June 24<sup>th</sup> letter or the applicable statutes and rules, ADEQ will take appropriate action to ensure RID meets the terms of the conditional approval, and if compliance is not achieved, revoke the approval under the appropriate legal procedures."

# EXHIBIT "1"

Approval of the proposed RID ERA is made with the following conditions that must be met within the time periods identified below, or within another time period approved by ADEQ. All work plans required by this conditional approval must be submitted to ADEQ for approval prior to implementation, and must include a schedule for performing all tasks identified in the work plan. Once a work plan is approved by ADEQ, all tasks within the work plan must be completed in accordance with the schedule in the approved work plan, unless a deviation is agreed upon by ADEQ in writing. RID shall hegin implementation of task 1 and 2 concurrently, and 2, 3 and 4 sequentially. Conditional approval is based on the assumption that each of these areas of concern will be investigated appropriately and the results of the investigations will demonstrate that the ERA continues to meet minimum applicable statutory and rule requirements. Days are calendar days, unless specifically noted otherwise.

Task No.	Description	Completion/Submittal Date			
1. Public Health Threat	The RID work plan states there is a current risk to the public health from exposure to VOCs (from both air and water) within the West Van Buren Area (WVBA), however, specific documentation about the risks and how the risks will be mitigated during the ERA implementation has not yet been provided.	Within 30 days of ERA approval, RID shall submit a risk analysis work plan to ADEQ documenting the risks and demonstrating to ADEQ how and when the ERA will mitigate the risks.			
2. RID Wells Investigation	Due to the proposed increased pumping rate at RID wells to be used for remediation, RID must conduct well testing and modeling to insure that changes in pumping will not adversely affect groundwater quality and levels within the WVBA beyond what would be expected with the current pumping conditions. Water levels must be maintained at or near current levels taking into account natural variations. The investigation must determine how ERA workplan implementation will affect both the aquifer and wells in the area of the plume.				

Task No.	Description	Completion/Submittal Date
3. Groundwater Modeling	A groundwater model must be constructed to estimate the effects of the changed RID well pumping rates. RID has indicated that the overall pumping rate will stay the same; however, the wells that will be pumped will change. This change must be modeled.  The groundwater model must also evaluate how the diverted pumpage of RID wells will affect other contaminant groundwater plumes, such as those created at Leaking Underground Storage Tank (LUST) sites and neighboring WQARF and Superfund sites.  The model must also consider differing pumping rates and locations. One of the goals of the ERA is to remediate groundwater. RID must maximize, to the extent practical, the removal of contaminants from the subsurface when the ERA is implemented. Currently the RID treatment system plan is based on treating the entire volume of groundwater that the RID wells are capable of pumping. However, this may be excessive if the wells can be pumped at a lower rate from the contaminant zone and still maintain the desired effects of groundwater recovery. Therefore, the model shall also consider impacts of other pumping rates on drawdown and capture zones.	Within 60 days of ADEQ's written approval of the well investigation report, RID shall submit a groundwater model work plan. At a minimum, the groundwater model shall estimate the effects of changed pumping rates and locations on the aquifer, including but not limited to water levels and all contaminant plumes within the WVBA and neighboring WQARF and CERCLA sites.  Within 60 days of completion of the work require by the groundwater model work plan, RID shall submit a groundwater model report to ADEQ for approval.

Task No.	Description	Completion/Submittal Date
4. Pump and Treat System	RID must complete an engineering design study which describes all technical requirements for a pump and treat remediation system, including a description of the influent and effluent contaminant levels.	Within 60 days of ADEQ's written approval of the groundwater model report, RID shall submit an engineering design study for the pump and treat remediation system sealed by an Arizona Registered Professional Engineer. At a minimum the engineering design study shall include all of the
	All applicable permits must be in place, prior to construction and/or operation of the pump and treat system, as required under the relevant statutes and rules.	technical design requirements of the pump and treat remediation system, including a description of the influent and effluent contamination levels. In addition, the engineering design study must include a list of all permits that must be obtained prior to
	RID must also submit a construction, operation and maintenance work plan for the pump and	construction and operation.
and trea plan gro wil that the the	treat system. The work plan must contain a plan for monitoring groundwater quality and groundwater elevations, including what wells will be sampled and monitored, the frequency that they will be sampled and monitored, and the parameters that will be analyzed. As part of the work plan, RID must also submit proposed sampling frequency, locations, and analytical methods, at the pump and treat system.	Within 60 days of ADEQ's written approval of the engineering design study, RID shall submit a remediation system construction, operation, and maintenance work plan. At a minimum the work plan shall include, an Operation and Maintenance (O&M) plan for the remediation system, a description of the sampling of RID canals and wells (both for groundwater elevation and quality) during operation of the remediation system, and a description of sampling of remediation system influent and effluent water.

# EXHIBIT "2"



# **EARLY RESPONSE ACTION**

# PUBLIC HEALTH EXPOSURE ASSESSMENT AND MITIGATION SUMMARY REPORT

Prepared for:

Gallagher & Kennedy, P.A.

Prepared by:

Synergy Environmental, LLC

On Behalf of the Roosevelt Irrigation District

# WEST VAN BUREN AREA WATER QUALITY ASSURANCE REVOLVING FUND SITE

September 16, 2011





will maximize the VOC mass removal during the ERA and eliminate public access and exposure to the highest VOC concentrations.

# 5.1.3 RID Water Systems - Operational Controls

RID operational controls will consist of modification to their well pumping protocols. The anticipated approach for prioritizing pumping of RID wells will be as follows:

- impacted wells connected to treatment (i.e., wellhead or CGTF);
- un-impacted wells; and,
- impacted wells (with lowest COC concentrations) that do not have mitigation measures in place.

Maintaining the above pumping guidelines will help reduce public exposure to the highest VOC concentrations and most effectively utilize the in-place mitigation measures.

# 6.0 CONCLUSIONS

This Public Health Exposure Assessment was undertaken in order to accomplish the following objectives:

- assess the potential for public exposure to unacceptable levels of VOC contamination at the WVBA Site;
- compare the analytical results to health-based guidance levels to make a <u>screening-level determination</u> as to whether these substances pose an imminent and significant risk to public health; and,
- utilize the results to facilitate the development of detailed designs for engineering controls as mitigation measures, where warranted, to reduce the concentration of hazardous substances in the local environment.

Systematic air and water sampling, and resulting analytical data, provide the basis for addressing the first and second objectives. Numerous points of potential exposure were assessed through this sampling, and the analytical results were compared to the screening-level guidance values of Section 4.1.

Review of these data, and consideration of the reasonable likelihood for potential public exposure, result in the conclusion that there is not an imminent (acute) risk to the public from the contamination being released from the RID water systems. While air sampling results show that many points in the RID water systems exceed air inhalation screening-level guidelines for short-term exposure (acute MRLs and one-hour AAAQGs), these points are not likely to provide a reasonable public exposure pathway due to their physical nature and locations. Similarly, water sampling results show that many points in the RID water systems exceed screening-level



guidelines for ingestion (EPA RSL - tap water and SWQSs - drinking water), however, the contaminated water is not expected to lead to an unacceptable public exposure based on the limited and transient potential use of this water as a source of drinking water. Water from the RID system in the WVBA Site is not currently used for municipal drinking water supply.

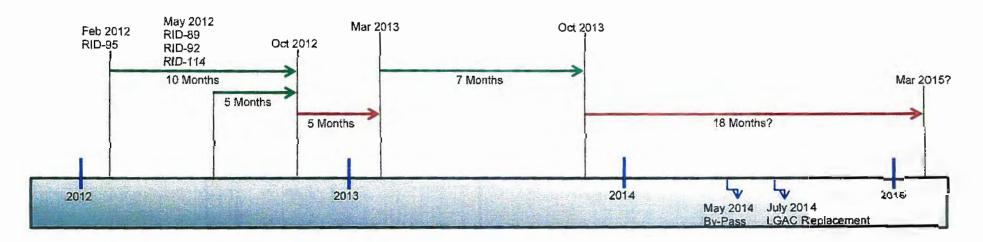
While there does not appear to be any imminent (acute) exposure risk to the public from these contaminants, the long-term effects from exposure to volatilized COCs in the air are uncertain. The results of this study confirmed the presence of WVBA Site COCs in all air samples obtained in and proximal to the RID wells and water conveyance systems. Many of the air samples, collected in representative breathing-zones, exceed screening-level guidelines for chronic exposure to TCE and PCE (annual AAAQGs and industrial/residential RSLs) in ambient air. In contrast, COCs were not detected in air samples obtained in background locations positioned away from the RID water system.

This Public Health Exposure Assessment is not intended to quantify the level of risk to the public, but rather to provide data to assess whether imminent public exposure risk is present. There are many uncertainties inherent in any such assessment, as described in Section 4.4, that limit the interpretation of data and the degree of confidence that can be placed on any inferred outcome. While this assessment cannot be used to calculate the numerical risk associated with these exposures, it is reasonable to conclude that the relative level of risk is greater in the presence of detectable COCs than it is in their absence.

The analytical results from this sampling demonstrate that significant transfer of these volatile contaminants from the water into the air is occurring, persistent and ongoing. This transfer of mass from one media to another represents uncontrolled releases to the local environment and is not consistent with ADEQ policy. Consequently, and regardless of the uncertainty of the magnitude of effects of long-term exposure to public health, RID intends to implement measures to limit these exposures. As outlined in the approved ERA, RID intends to design and construct engineering controls, such as groundwater treatment systems and physical enclosures for selected open segments of the water system, as discussed in Sections 5.1.1 and 5.1.2. RID also intends to implement operational controls to prioritize pumping as discussed in Section 5.1.3.

# EXHIBIT "3"

# ROOSEVELT IRRIGATION DISTRICT MODIFIED EARLY RESPONSE ACTION OPERATIONAL TIMELINE



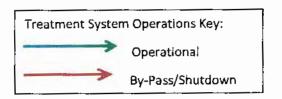
According to the RID's revised O&M Plan (October 2014 -Revision 4) at page 21:

"Based on carbon change out frequencies for each of the well head treatment systems to date, the estimated LGAC change-out schedule per vessel at each MERA site is included below:

# 4 MERA Wells have 9 Skids/18 Vessels LGAC:

RID-89: 4-5 months of operation RID-92: 2-3 months of operation RID-95: 2-3 months of operation RID-114: 5-6 months of operation"

Carbon change out costs for one vessel is at least \$16,000.00 per vessel. (Source: RID's Request for Reimbursement under ARS 49-282 (E) (11) to ADEQ including the chart titled "Reimbursement for Remedial Action Costs/Roosevelt Irrigation District")



# Groundwater CLEANUP COALITION

ROOSEVELT IRRIGATION DISTRICT

RID Early Response Action Technical
Briefing
To The

West van Buren Community Avovisory Board

Arizona Department of Environmental Quality

- \* WELLHEAD PILOT TREATMENT SYSTEMS INITIATIVE
- ♦ RID-95 TREATMENT SYSTEM STARTED UP 2/6/2012
   TECHNOLOGY/DESIGN DEMONSTRATION PERIOD —
- ♦ RID-89 TREATMENT SYSTEM STARTED UP 5/24/2012
- ♦ RID-92 TREATMENT SYSTEM STARTED UP 5/23/2012
- ♦ RID-114 TREATMENT SYSTEM STARTED UP 5/22/2012

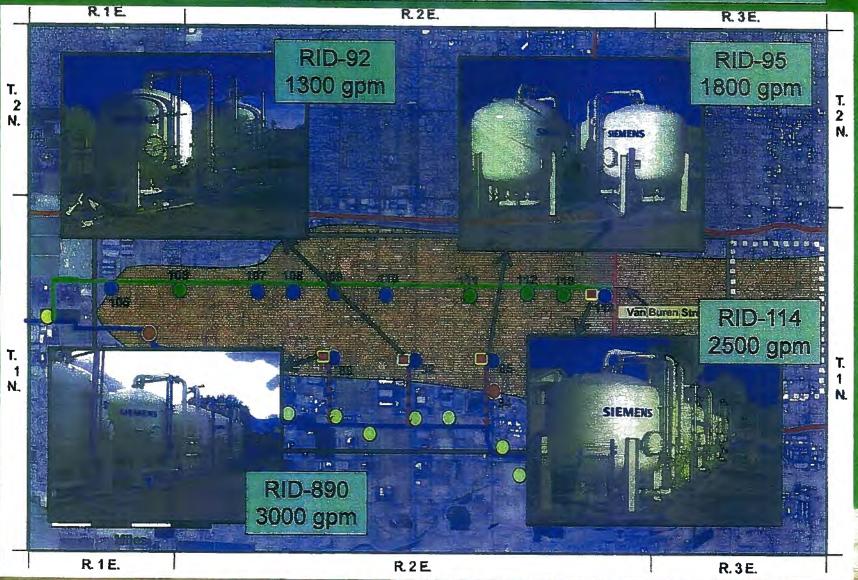
ALL TREATMENT SYSTEMS TURNED OFF 10/31/2012 AND WILL BE RESTARTED IN THE SPRING WHEN RID WATER DEMAND INCREASES

~ 2 BILLION GALLONS OF CONTAMINATED GROUNDWATER TREATED APPROXIMATELY 1000 POUNDS OF VOCS CAPTURED / DESTROYED



# RID ERA TECHNICAL BRIEFING

12/6/12



WWW.WVGROUNDWATER.ORG

Groundwater



October 7, 2013

Ms. Tina LePage Manager, Remedial Projects Unit Arizona Department of Environmental Quality 1011 West Washington Street Phoenix, AZ 85007

Re: September 2013 Monthly Progress Report - RID Wellhead Treatment Systems

Dear Ms. LePage:

This September 2013 Monthly Progress Report for the RID Wellhead Treatment Systems is provided for your review. This Monthly Progress Report, consistent with Section 8 of the RID-95 Wellhead Pilot Treatment System Proposal, dated August 18, 2011, provides information regarding wellhead treatment systems currently operating at RID-89, RID-92, RID-95, and RID-114. This will be the final monthly progress report for 2013. The next report will be completed after wells are restarted by RID in early 2014.

This Monthly Progress Report includes:

- Narrative summary of operational status including malfunctions, if any, and the actions taken to correct the malfunction.
- Operational data including: hours/percentage of operating time during the reporting period, volume of groundwater treated, approximate mass of target contaminants of concern (COCs) removed, and cumulative mass of target COCs removed since system start-up.
- Tabular summary of water quality samples collected and analytical results.
- Copies of final laboratory reports.

Please contact me by phone at 602-430-2785 or by email at andrew.machugh@synenv.com, should you have any questions or comments regarding this report.

Best Regards,

Synergy Environmental, LLC

Andrew MacHugh, PE

ANDREW J.

MacHUGH

cc: Donovan Neese, Roosevelt Irrigation District
David Kimball, Gallagher & Kennedy



# Summary of Operational Status

# RID-89 Wellhead Treatment System

The RID-89 Wellhead Treatment System (WTS) did not operate during the reporting period because the well was shut off for the first four days due to a decrease in RID's customer water demand, and after the well was restarted on September 5th, the WTS operated in bypass mode to allow for granular activated carbon (GAC) fill line maintenance. RID shut down the well for the remainder of the pumping season on September 25th. Operational data and estimated mass of target COCs removed since WTS start-up are provided in Table 1. No water quality samples were collected during the reporting period.

# RID-92 Wellhead Treatment System

The RID-92 WTS only operated in bypass mode during the reporting period to allow for GAC fill line maintenance. RID shut down the well for the remainder of the pumping season on September 25th. Operational data and estimated mass of target COCs removed since WTS start-up are provided in **Table 1**. No water quality samples were collected during the reporting period.

# RID-95 Wellhead Treatment System

The RID-95 WTS did not operate during the reporting period because the well was shut off for the first four days due to a decrease in RID's customer water demand, and after the well was restarted on September 5th, the WTS operated in bypass mode to allow for GAC fill line maintenance. RID shut down the well for the remainder of the pumping season on September 24th. Operational data and estimated mass of target COCs removed since WTS start-up are provided in **Table 1**. No water quality samples were collected during the reporting period.

# RID-114 Wellhead Treatment System

RID-114 WTS operated approximately 25% of the time during the reporting period. The well was shut off for the first four days due to a decrease in RID's customer water demand, and after the well was restarted on September 5th, the WTS processed flow from the well at an average flow rate of 2,380 gpm. WTS operation changed from treatment to bypass mode on September 14th due to GAC exhaustion. It was decided to delay replacement of the GAC until the beginning of the 2014 pumping season to prevent in-vessel fouling of new GAC during the 4 to 5 month system lay-up. RID shut down the well for the remainder of the pumping season on September 24th. Operational data and estimated mass of target COCs removed for the reporting period and since WTS start-up are provided in Table 1. A summary of water quality data is provided in Table 2.



# Attachments:

- Table 1. RID Wellhead Treatment Systems Metrics
   Table 2. RID-114 Wellhead Treatment System Data Summary
   Copy of Final Analytical Report

# TABLE 1. RID WELLHEAD TREATMENT SYSTEMS METRICS West Van Buren Area WQARF Registry Site

Reporting Period: <u>September 2013</u>

WELLHEAD TREATM	IENT SYSTEMS DATA					
RID-89	Volume of GW Treated, This Period:	0	acre-feet	Estimated Mass of Target COCs Removed, This Period:	0	pounds
	Volume of GW Treated, Since Start-up1:	3,809	acre-feet	Mass of Target COCs Removed, Since Start-up:	406	pounds
	Operational Hours:	0	0%			
RID-92	Volume of GW Treated, This Period:	0	_acre-feet	Estimated Mass of Target COCs Removed, This Period:	0	pounds
	Volume of GW Treated, Since Start-up <sup>2</sup> :	1,521	acre-feet	Mass of Target COCs Removed, Since Start-up:	361	pounds
	Operational Hours:	D	0%			
RID-95	Volume of GW Treated, This Period:	0	acre-feet	Estimated Mass of Target COCs Removed, This Period:	0	pounds
	Volume of GW Treated, Since Start-up3:	2,825	acre-feet	Mass of Target COCs Removed, Since Start-up:	477	pounds
	Operational Hours:	0	0%			
RID-114	Volume of GW Treated, This Period:	83	acre-feet	Estimated Mass of Target COCs Removed, This Period:	7	pounds
	Volume of GW Treated, Since Start-up4:	3,437	acre-feet	Mass of Target COCs Removed, Since Start-up:	419	pounds
	Operational Hours:	189	25%			
TOTALS (all sites):	Volume of GW Treated, This Period:	83	acre-feet	Estimated Mass of Target COCs Removed, This Period:	7	pounds
	Volume of GW Treated, This Period:	27	million gallons	Mass of Target COCs Removed, Since Start-up:	1,662	pounds
	Volume of GW Treated, Since Start-Up: Volume of GW Treated, Since Start-Up:		acre-feet million gallons			

Explanation: 1 May 24, 2012 start-up date.

SYNERGY BRIBONNESTAL, LLC

<sup>&</sup>lt;sup>2</sup> May 23, 2012 start-up date.

<sup>&</sup>lt;sup>3</sup> February 6, 2012 start-up date.

<sup>&</sup>lt;sup>4</sup> May 22, 2012 start-up date.

# TABLE 2. RID-114 WELLHEAD TREATMENT SYSTEM DATA SUMMARY WEST VAN BUREN AREA WOARF REGISTRY SITE

(results presented in micrograms per liter, µg/L)

				TARGET COCs						
SAMPLE LOCATION	SAMPLE ID*	DATE	LEAD VESSEL	SAMPLE TYPE	TCE	PCE	1,1-DCE	TCM	1,1-DCA	cis- 1,2-DC
	PA MAXIMUM CO	TAMINANT	LEVELS (M	CL), as µg/L:	5	5	- 7	none	none	70
INFLUENT	114-Influent	9/9/13		Primary	35.4	2.5	2.1	2.1	1.5	6.0
2007.05	114-POC	9/2/13	-		No sample collected; production well was offline.					line.
POINT OF COMPLIANCE	114-POC	9/9/13		Primary	5. <b>7</b>	<0.5	2.8	2.1	1.7	7.5
CONFLIANCE	114-POC	9/16-30/13		Primary	Not sampled because system was in bypass mode or offline					
	TF	REATMENT SKI	D#1 (NOR	TH, REACTIV	ATED CAR	BON)				-
MID-SKID (EFFLUENT OF LEAD VESSEL)	114-MID-1	9/2/13	В	-	No sample collected; production well was offline.					
	114-MID-1	9/9/13	В	Primary	23.3	<0.5	3.2	2.3	1.9	8.2
	114-MID-1	9/16-30/13	В		Not sampled because system was in bypass mode or offline					
	TR	EATMENT SKII	D #2 (MIDI	DLE, REACTIV	ATED CAR	BON)				
	114-MiD-2	9/2/13	В		No sample collected; treatment system				system offli	ne.
MID-SKID	114-MID-2	9/9/13	В	Primary	30.7	<0.5	2.8	2.1	1.6	7.2
(EFFLUENT OF LEAD VESSEL)	DUP090913	9/9/13	В	Duplicate	31.1	<0.5	2.9	2.2	1.6	7.4
	114-MID-2	9/16-30/13	В		Not sampled because system was in bypass mode or offline					
	Û	EATMENT SKI	D #3 (SOU	TH, REACTIV	ATED CAR	BON)			游	
AND CHID	114-MID-3	9/2/13	В	-	No sample collected; treatment system offline.					
MID-SKID	114-MID-3	9/9/13	В	Primary	27.8	<0.5	3.0	2.2	1.7	7.6
(EFFLUENT OF LEAD VESSEL)	114-MID-3	9/16-30/13	В		Not samp	pled becar	use system	was in by	pass mode	or offlin

# EXPLANATION:

COC = Contaminant of Concern

TCE = Trichloroethene

TCM = Chloroform 1,1-DCA = 1,1-Dichloroethane

PCE = Tetrachloroethene 1,1-DCE = 1,1-Dichloroethene

. cis-1,2-DCE = cis-1,2-Dichloroethene

\* All samples analyzed by Airtech Environmental Laboratories following EPA Test Method 82608.

<0.5 = Result is less than laboratory method reporting limit (MRL).





# **Copies of Final Analytical Reports**



# Airtech Environmental Laboratories (AEL)

4620 E.Elwood St., Suite 13, Phoenix, AZ 85040 480-968-5888 Fax 480-966-1888

Date:

September 13, 2013

Client: Company: Andrew MacHugh

Work Order #:

131007

Synergy Environmental, LLC

Project Name:

RID Pilot Treatment Systems

Address:

10645 N. Tatum Blvd, #200-437

Project Number:

802.40

Phoenix, AZ 85028

Received Date:

9/9/2013

# Dear Client:

Airtech Environmental Laboratories received seven (7) samples for analysis.

All analyses met laboratory QA/QC with any exceptions addressed in the Case Narrative.

If you have any questions or concerns regarding your samples analysis, please contact the laboratory at 480-968-5888

Sincerely,

Yu Min Shi

**Technical Director** 

Airtech Environmental Labs

Arizona ADHS License No. AZ0740



## Airtech Environmental Laboratories (AEL)

4520 E.Elwood St., Suite 13, Phoenix, AZ 85040 480-968-5888 Fax 480-966-1888

Date:

September 13, 2013

Client: Andrew MacHugh Work Order #: 131007

Company: Synergy Environmental, LLC Project Name: RID Pilot Treatment Systems

Address: 10645 N. Tatum Blvd, #200-437 Project Number: 802.40
Phoenix, AZ 85028 Received Date: 9/9/2013

### SAMPLE SUMMARY

LAB ID	CLIENT ID	METHOD	SAMPLE DATE	SAMPLE TIME
131007-01	Trip Blank	8260B	8/5/2013	
131007-02	114-Influent	8260B	9/9/2013	1158
13!007-03	114-POC	8260B	9/9/2013	1200
131007-04	114-MID-1	8260B	9/9/2013	1202
131007-05	114-MID-2	8260B	9/9/2013	1204
131007-06	114-MID-3	8260B	9/9/2013	1206
131007-07	DUP090913	8260B	9/9/2013	

## ROOSEVELT IRRIGATION DISTRICT

DIRECTORS
W. BRUCE HEIDEN, PRESIDENT
DWIGHT B. LEISTER
K.C. GINGG

103 WEST BASELINE ROAD BUCKEYE, ARIZONA 85326 TELEPHONE (623) 386-2046 FAX (623) 386-4360 SUPERINTENDENT DONOVAN L. NEESE

October 20, 2014

Ms. Tina LePage, Manager Remedial Projects Unit, Waste Programs Division Arizona Department of Environmental Quality 1110 West Washington Street Phoenix, AZ 85007

Re: RESPONSE TO COMMENTS: REVIEW OF OPERATION AND MAINTENANCE PLAN —
ROOSEVELT IRRIGATION DISTRICT WELLHEAD TREATMENT SYSTEMS

West Van Buren WQARF Registry Site Phoenix, Arizona

Dear Ms. LePage:

The Roosevelt Irrigation District (RID) has reviewed comments by the Arizona Department of Environmental Quality (ADEQ) and three (3) individuals/entities (David Iwanski, a WVBA Site CAB member; Ridenour Hienton, PLLC, counsel for Meritor, Inc., and Fennemore Craig, PC, counsel for Nucor Corporation and BNSF Railway Company) on the *Operation & Maintenance Plan, RID Wellhead Treatment Systems* (O&M Plan), dated October 2013 (Revision 3), received on September 5<sup>th</sup>, 2014. As requested, the following responses to ADEQ comments and the stakeholder comment letters are being submitted within 45 calendar days of the date of ADEQ's letter. Also, with this letter, RID is submitting a revised O&M Plan for ADEQ's review, and if appropriate, approval pursuant to Arizona Administrative Code (A.A.C.) R18-16-411(E)(1) and "certification by the Department that the elements of the operations and maintenance plan adequately protect public health against treatment system failure" in accordance with A.A.C. R18-16-411(E)(1).

#### RESPONSES TO ADEQ REQUIRED INFORMATION

Comment #1: "In accordance with A.A.C. R18-16-411(E)(4), the O&M Plan shall include 'a process for the treatment system operator to promptly notify potentially affected water providers of a failure of a key treatment system component that cauld affect the quality of a discharge of treated water.'

While RID has pravided a brief natification procedure description in Section 4.1, which includes natification to ADEQ, RID has not included potentially affected water providers such as the City

**RID's Response:** As requested, Section 4.5.5 of the revised O&M Plan has been updated to include a referral to the notification procedure outlined in Section 4.1.

RID has considered ADEQ's comment regarding automatic operation of the sump pumps. Now that the wellhead treatment systems have been operating for several pumping seasons, RID is comfortable changing the controls system so that the sump pumps operate automatically in response to a high liquid level alarm, and then automatically shut-off the well pump in response to a high-high liquid level critical alarm (in lieu of switching the systems to bypass mode).

The requested pipe route from the secondary containment sump to the discharge point are included in the new piping and instrumentation diagrams (Figures 3 through 6), and detailed in the engineering drawings included in Appendices A through D.

Comment #21: "Section 4.5.6 - SCADA System and Control Strategy, page 19: ADEQ requests that O&M Plan include screen shots from the SCADA system. The information provided in this section does not adequately document the remote system operation. ADEQ recommends that a table outlining the SCADA system alarm parameters be included in this section."

RID's Response: A new appendix (Appendix G) will include screen shots from the 5CADA system, however, since the wellhead treatment systems are not operating, the screen shots will need to be included after the treatment systems are restarted to show relevant operational data. Due to RID's historical pumping operations / customer water demand, the treatment systems may not be restarted until March 2015. RID will provide ADEQ with the requested 5CADA system screen shots as soon as they are available to include in its copy of the revised O&M Plan.

As requested, a table that outlines the SCADA system alarm parameters has been included in Section 4.5.6 of the revised O&M Plan.

Comment #22: "Section 4.5.9 — Unplanned Shutdowns/System Operation Upset Events: ADEQ advises that a referral to the notification procedure in Section 4.1 be included in this section for when a power outage, heavy rain or critical alarm occurs. ADEQ recommends that a list of the critical alarm conditions be provided in this section."

RID's Response: The requested information has been included in Section 4.5.9 of the revised O&M Plan. However, there is only one critical alarm that will automatically shut off the well pump, which is the high wellhead pressure shut-off condition. These details are included in the revised O&M Plan.

Comment #23: "Section 4.6 - Sampling and Analysis: The Field Sampling Plan and Quality Assurance Plan for the WVBA WQARF site was not developed with the sampling and QA/quality contral (QC) procedures for the operations of a groundwater treatment/remedy system. As

such, ADEQ recommends that RID develop their own sampling and QA/QC procedures for their wellhead treatment systems."

RID's Response: References to the Field Sampling Plan and Quality Assurance Plan for the WVBA WQARF site have been removed from the revised O&M Plan, which now includes RID's own sampling and QA/QC procedures for the wellhead treatment systems.

Comment #24: "Section 4.6.2 - Frequency and Locations of Sampling: ADEQ requests that any change in sampling frequency be approved by the department before implementation."

RID's Response: RID will request ADEQ's approval for any change in sampling frequency for the wellhead treatment systems. The revised O&M Plan includes this new requirement in Section 4.6.2.

Comment #25: "Section 4.6.3 – Sampling Methods: Refer to Comment 23. In addition, ADEQ suggests that RID clarify that samples to be collected ore for system operations purposes as opposed to investigative. ADEQ also recommends that RID develop their awn Health and Safety Plan (HASP) that is specific to the work being conducted by RID and its contractors."

RID's Response: As indicated in RID's response to Comment #23, references to the Field Sampling Plan and Quality Assurance Plan for the WVBA WQARF site have been removed from the revised O&M Plan, which now includes RID's own sampling and QA/QC procedures for the wellhead treatment systems. Also, Section 4.6.3 of the revised O&M Plan now specifically refers to the sampling program as the "wellhead treatment systems sampling program" to ensure that the samples collected could not be interpreted as investigative. Lastly, RID has developed its own Health & Safety Plan for the wellhead treatment systems which is included as Appendix H of the revised O&M Plan.

Camment #26: "Section 5.0 – Spent GAC Management: ADEQ suggests that RID include or reference the procedure for collecting a representative grab sample of carbon for analysis and profiling."

RID's Response: Section 5.0 has been updated to include the procedure for collecting a representative grab sample of carbon for analysis and profiling in the revised O&M Plan.

Comment #27: "Section 6.2 – Progress Reports: ADEQ noted that the example progress report included in Appendix K did not include information that covered all of the bulleted items in this section. ADEQ recommends that documentation of corban change out be included in the progress reports.

Nate that in general, RPU requests one hardcopy and one electronic copy of monthly progress reports."

RID's Response: A historical Monthly Progress Report is now included as an appendix of the revised O&M Plan (Appendix L). The example Report includes all the information described in the bulleted items in Section 6.2. As requested, the revised O&M Plan also specifies that RID will submit one hardcopy and one electronic copy of future Monthly Progress Reports to ADEQ.

Comment #28: "Figure 1 - Study Area: ADEQ requests the following changes to Figure 1:

- a. Update current plume boundaries.
- b. Update label of RID-111 to RID-111R.
- c. Label the RID wells with wellhead treatment systems differently than the wells without treatment systems.
- d. Add a boundary outline for the Phoenix Central City and Estrella urban villages that are described in Section 2.1."

RID's Response: The revised O&M Plan includes a new Figure 1, titled "Site Location Map", which presents the boundaries for the Phoenix Central City and Estrella urban villages that are described in Section 2.1. Figure 1 of the O&M Plan (Revision 3) has been revised with current plume boundaries; correct label for RID-111R; and includes different well symbols for the RID wells with wellhead treatment systems. This revised figure has been renamed Figure 2 (Site Map and Vicinity) in the revised O&M Plan.

Comment #29: "Figures 2 through 5: ADEQ requests that the figures be revised to include items mentioned in previous comments as well as:

- a. Accurate and complete piping and instrumentation diagrams (PID) for each treatment system.
- b. The title of the figures "process flow diagram" should be revised to reflect what is included in the figures since process information such as flow rates, temperatures, and pressures are not provided.
- Identification of all flow and pressure transmitters and water level switches.
- d. Show all valves, sampling ports, and air release valves on the carbon vessels."

RIC's Response: Figures 2 through 5 from Revision 3 of the O&M Plan have been revised as piping and instrumentation diagrams and include all the instrumentation requested. These new figures have been renamed as Figures 3 through 6 in the revised O&M Plan.

Comment #30: "Appendix H - Health and Safety Plan:

#### General

ADEQ recommends that RID develop their own HASP that is specific to the work being conducted by RID and its contractors.

Section 1.1 - Scape of Work

Comment #5: "Appendix J includes the 'Weekly Operation and Maintenance Inspection Form.'
This report and data should be incorporated into Appendix K and submitted to ADEQ as part of the proposed Appendix K Monthly Report."

RID's Response: The Weekly Operation and Maintenance Inspection Form has been updated to include ADEQ's recommendations (see ADEQ Comment #31). The new form is included as Appendix J in the revised O&M Plan. A historical Monthly Progress Report is now included as an appendix of the revised O&M Plan (Appendix L), as recommended by ADEQ. The example Report includes all the information described in the bulleted items in Section 6.2 as requested by ADEQ (see ADEQ Comment #27).

Comment #6: "I suggest ADEQ should demand that RID revise the Monthly Report to track and report these metrics. How do you know if they are operating? Note: Section 4.5 Instrumentation and Controls in RID's O&M Plan indicates they have instrumentation to document these porameters."

RID's Response: A historical Monthly Progress Report is now included as an appendix of the revised O&M Plan (Appendix L), as recommended by ADEQ. The example Report includes all information described in the bulleted items in Section 6.2 as requested by ADEQ (see ADEQ Comment #27).

Comment #7: "Section 4.1 – Although immediate notification of adverse control conditions are important to RID, Synergy and ADEQ, under AAC R 18-16-411(E)(4) it requires that a process for the water treatment system operator to also promptly notify 'potentially affected water providers' of a key treatment system component that could affect the quality of a discharge of treated water. This may include the City of Phoenix or the Salt River Project."

RID's Response: Treated water from the wellhead treatment systems currently is exclusively discharged to RID canals and laterals. Consequently, there are no other potentially affected water providers within the WVBA Site that would be affected by a discharge of treated water in the event of significant process control issues or failures at any of the wellhead treatment systems. However, if water provider conditions change in the future, the revised O&M Plan will be updated to include proper notifications to those other potential water providers that could be affected by a discharge of treated water. This new language is included in Section 4.1 of the revised O&M Plan.

Comment #8: "There are twenty-two (22) technical comments which are included under Exhibit 2. These identified issues reflect technical problems with the O&M Plan which must be addressed. ADEQ should review and direct RID to make the 22 identified technical revisions."

RID's Response: All specific comments identified by ARCADIS U.S., Inc. are appreciated and were considered. For those comments that were also identified by ADEQ, the recommended

changes were already included in the revised O&M Plan. For new comments that were favorably considered, the revised O&M Plan was modified to address those comments.

In response to General Comment #3, there are no permits required to operate the wellhead treatment systems.

In response to Specific Comment #3, spare parts are identified in the engineering drawings now included as Appendices A through D, and the Siemens O&M Manual included as Appendix E of the revised O&M Plan.

Other comments that were considered but not addressed in the revised O&M Plan were not regarded as "technical problems", and therefore, not necessary elements to adequately protect public health against treatment system failure.

<u>Letter #3</u> - Fennemore Craig, P.C., counsel for Nucor Corporation and BNSF Railway Company, Comments on the Roosevelt Irrigation District's ("RID") "Operation and Maintenance Plan", dated July 21, 2014.

Comment: "It is more logical to consider these four wellhead treatments os four separate treatment facilities requiring four separate O&M Plons."

RID's Response: All wellhead treatment systems pump and treat groundwater from a commingled plume, are operated from one central field office, and are comprised of identical equipment sets, control valves, RTUs, instrumentation, etc. The primary differences include the capacity of the wells feeding the treatment systems and the routing of the treatment system piping, which is not a significant aspect for O&M considerations. RID does not believe these differences merit generating four (4) separate plans, and therefore, only one (1) O&M Plan will be used for the wellhead treatment systems. Similarly, these wellhead treatment systems are part of a single effort to address regional contamination pursuant to the ADEQ-approved Modified ERA, dated February 1, 2013.

We appreciate your prompt review of the attached revised *O&M Plan, RID Wellhead Treatment Systems* (Revision 4), and are available to meet at your convenience regarding any questions you may have.

Best Regards, Roosevelt Irrigation District

Donovan L. Neese



ARCADIS U.S., Inc. 410 North 44th Street Suite 1000 Phoenix Arizona 85008 Tel 602 438 0883 Fax 602 438 0102

#### MEMO

Jerry D. Worsham II, Esq. Ridenour Hienton, P.L.L.C. Chase Tower 201 North Central Ave, Suite 3300, Phoenix, Arizona 85004

Robert A. Mongrain, RG (ARCADIS) **ARCADIS Project File** 

Quentin R. Moore, P.E. (ARCADIS)

October 31, 2014

ARCADIS Project No.: AZ001042.0005

Subject

RID Phase 1 Wellhead Treatment System Annual VOC Mass Removal Evaluation

ARCADIS has prepared this technical memorandum in response to your request to evaluate the validity of the Roosevelt Irrigation District (RID) anticipated total annual volatile organic compound (VOC) mass removal of up to 1,900 pounds through the operation of the Modified Early Response Action (MERA) Phase 1 wellhead treatment systems. The locations and general construction of the MERA Phase 1 wellhead treatment systems are detailed in the Modified Early Response Action Work Plan (MERA Work Plan) for the West Van Buren Area (WVBA) Water Quality Assurance Revolving Fund (WQARF) Site, prepared by Synergy Environmental, LLC on behalf of the RID (Synergy Environmental, LLC, 2012). The locations of the wells are shown on Figure 1. The Phase 1 wellhead treatment systems consist of groundwater extraction and wellhead treatment using liquid-phase granulated activated carbon (LGAC) at four RID production wells, including RID-89, RID-92, RID-95 and RID-114. (Figures 2-1 through 2-4 identifies RID's Process Flow Diagram and treatment system for each Phase 1 well.) Groundwater extraction and treatment operations were initiated at RID production well RID-95 in February 2012, and at all other production wells in May 2012. The plan to utilize four additional groundwater extraction wells in Phase 2 of the MERA apparently has been abandoned.

Originally, the RID asserted to the Arizona Department of Environmental Quality (ADEQ) in the MERA Proposal (July 12, 2012) that the MERA would, "...remediate approximately 3,500 pounds per year of VOC contamination in the regional groundwater..." (MERA Proposal Executive Summary p. iii and p.7, Synergy Environmental, LLC, 2012a) In the MERA Workplan (October 2012), RID changed their position and asserted that the MERA wells would remediate up to 2,300 pounds per year (MERA Work Plan

Executive Summary p. ii). "Based on current VOC concentrations in the Phase 1 RID wells, the estimated total annual VOC mass removal during Phase 1 would be up to **approximately 1,900 pounds** ....Based on current VOC concentrations in the Phase 2 wells, the estimated total annual contaminant VOC mass removal following implementation of Phase 2 would be **approximately 440 pounds**." (MERA Work Plan p. 28, 29 and Table 2, Synergy Environmental, LLC 2012b) (Attachment 1).

The purpose of this technical memorandum is to verify the RID's estimate to ADEQ of 1,900 pounds per year for the total annual VOC mass removal by the MERA Phase 1 wellhead treatment systems. In support of this estimate, ARCADIS reviewed ADEQ's website<sup>1</sup> and available operational data documented in Monthly Progress Reports obtained from the West Valley Groundwater Cleanup Coalition<sup>2</sup> website, and estimated individual production well pumping rates and total VOC concentrations (Montgomery & Associates, 2009; HDR Engineering, Inc. 2010).

#### **Report Summary**

According to the Phase 1 wellhead treatment system Monthly Progress Reports, in 2012, 2013 and 2014, the Phase 1 wellhead treatment systems actually removed only 895 pounds, 767 pounds and 89 pounds of VOCs, respectively. This is well below the RID's annual projections of 1,900 pounds. If all Phase 1 wellhead treatment systems operated continuously, without downtime, at sustained maximum observed VOC concentrations and at a removal efficiency of 100 percent, the Phase 1 wellhead treatment systems could remove up to 2,182 pounds per year of target VOCs annually. However, given that the RID historically decreases production during the late fall and winter months [November – March] when the irrigation demand is low and the mass removal efficiency is not likely to exceed 95 percent, the most-likely maximum annual VOC removal rate is 1,446 pounds per year. Therefore, it is apparent that the RID's projected total annual target VOC mass removal of 1,900 pounds per year is a significant over estimate. The most-likely maximum annual VOC removal rate is approximately 25 percent less than the RID's anticipated removal rate (1,446/1,900 lbs/year x100%). Additionally, it should be noted that during late 2013 and for nearly all of 2014 (where RID reports are available to describe operations), the RID Phase 1 MERA wells have been operated in bypass mode, such that groundwater bypassed the treatment systems and was delivered to their canal/conveyance system untreated.

<sup>&</sup>lt;sup>1</sup> http://www.azdeq.gov/environ/waste/sps/wub.html

<sup>&</sup>lt;sup>2</sup> http://www.wvgroundwater.org/project-documents

#### **Background Facts**

The WVBA WQARF Site is located in West Phoenix. The Site extends from 7<sup>th</sup> Avenue to 75<sup>th</sup> Avenue and from Buckeye Road to Interstate-10. The groundwater in the WVBA Site is impacted primarily by VOCs as a result of several historical releases as well as impacted groundwater migrating from the upgradient Motorola 52<sup>nd</sup> Street Superfund Site. The primary VOC constituents of concern (COCs) detected at concentrations exceeding the respective Arizona Aquifer Water Quality Standard (AWQS) and United States Environmental Protection Agency (USEPA) Maximum Contaminant Level (MCL) within the WVBA Site include:

Table 1: WVBA Site VOCs and Associated MCLs

voc	MCL (µg/L)
1,1-dichloroethane (1,1-DCA)	N/A
1,1-dichloroethene (1,1-DCE)*	7
cis 1,2-dichloroethene (cis, 1,2 DCE)	70
tetrachloroethene (PCE)*	5
1,1,1-trichlorethane (TCA)*	200
trichloroethene (TCE)	5
vinyl chloride (VC)	2
chloroform	80**
Benzene, toluene, ethylbenzene, xylenes (collectively, BTEX)	5; 1,000; 700; 10,000

µg/L: micrograms per liter

N/A: None Assigned

The RID operates 32 water supply wells within the WVBA Site currently for irrigation purposes. Twenty-three of these wells are located within the extent of WVBA groundwater impacts. The RID wells located within the WVBA Site are variably screened across the Upper Alluvial Unit (UAU), Middle Alluvial Unit (MAU) and Lower Alluvial Unit (LAU) of the West Salt River Valley (SRV) alluvial basin. The RID extracts approximately 75,000 acre-feet per year (ac-ft/yr) of groundwater on average from wells located within the WVBA Site; however the capacity of the RID well network within the WVBA Site exceeds 110,000 ac-ft/yr. The majority of this groundwater extraction is derived from the UAU and occurs during the peak irrigation demand season that begins in early March and extends through the end of September. The RID has

<sup>\*</sup>Target VOC

<sup>\*\*</sup>Based on the USEPA Maximum Contaminant Level Goal.

elected to pursue a voluntary early response action (ERA) (Montgomery & Associates, 2010) which has been significantly modified and is commonly referred to as the MERA. Details of the MERA are found in the MERA Proposal (July 2012) and the MERA Work Plan (October 2012).

#### **RID Wellhead Treatment Systems**

The MERA Work Plan outlines the RID's intent to install wellhead treatment systems at eight of RID's production well locations. Currently, the RID has installed wellhead treatment systems at only four locations (Phase 1), including production wells RID-89, RID-92, RID-95 and RID-114. Phase 2 of the MERA consists of installing wellhead treatment at the remaining four locations: RID-100, RID-106, RID-112 and RID-113. According to the RID's proposed Draft Feasibility Study (July 2014), the concept of implementing the Phase 2 wellhead treatment systems has been abandoned in the MERA and will instead be evaluated as part of the Arizona Department of Environmental Quality's (ADEQ's) review of the merits of the Draft Feasibility Study (see pgs 131, 138 [Synergy Environmental, LLC and Montgomery & Associates, 2014])<sup>3</sup>.

The Phase 1 wellhead treatment systems consist of Siemens HP1220 treatment skids, which include two 20,000 pound LGAC vessels per skid connected in series. Each treatment skid is capable of treating up to 1,100 gallons per minute (gpm). Several treatment skids are operated in parallel for those wellhead treatment systems requiring greater than 1,100 gpm treatment capacity. Table 2 below provides basic information for each Phase 1 wellhead treatment system. Several sources of information provide estimated treatment system flow rates (Table 2). The flow rates reported in the MERA Work Plan are obtained from actual 2012, 2013 and 2014 data. The flow rates reported by Montgomery & Associates (Groundwater Response Action Implementation Plan [Montgomery & Associates, 2009]) and HDR Engineering LLC (Early Response Action Conceptual Design Summary [HDR Engineering Inc., 2010]) were estimated before head loss associated with the treatment system components and piping was well understood. Figure 1 provides the location of each Phase 1 RID well and associated treatment system.

٠

<sup>&</sup>lt;sup>3</sup> "RID-100, RID-106, RID-109 and RID-112: Wellhead treatment at these four (4) impacted water supply wells was authorized by ADEQ in the Modified ERA Work Plan. The wellhead treatment systems were to be installed in Phase 2 of the Modified ERA Work Plan, but now have been incorporated into the FS." (Synergy Environmental, LLC, 2014 p. 131)

Table 2: Phase 1 Wellhead Treatment System - Basic Information

Wellhead	Location	ı	Number of Skids				
Treatment System	Location	MERA <sup>[1]</sup>	GWRA IP <sup>[2]</sup>	ERA CDS <sup>[3]</sup>	(Vessels)		
RID-89	51 <sup>st</sup> Ave. and Hadley St.	3,100	2,900	3,900	3 (6)		
RID-92	43rd Ave. and Hadley St.	1,300	1,200	1,200	1 (2)		
RID-95	35 <sup>th</sup> Ave. and Sherman St.	1,700	1,700	2,300	2 (4)		
RID-114	23 <sup>rd</sup> Ave. and Van Buren St.	2,500	2,500	2,500	3 (6)		

gpm: gallons per minute

Implementation of the MERA Work Plan is based on the treatment of select target VOCs. The target VOCs include: TCE, PCE and 1,1-DCE. Based on the target VOC concentrations observed at each Phase 1 production well in September 2012, the RID estimated a total annual target VOC mass removal of approximately 1,900 pounds. (See Attachment 1 RID's "MERA Work Plan", Pgs. 28-30, Table 2 [October 2012]).

#### **Phase 1 Wellhead Treatment System Mass Removal Verification**

ARCADIS reviewed available Phase 1 operational data documented in Monthly Progress Reports obtained from the West Valley Groundwater Cleanup Coalition website (Synergy Environmental, LLC, 2012c-j, 2013a-g and 2014a-e). The Phase 1 operational data obtained from the Monthly Progress Reports is summarized in Attachment 2, Table 2-1. According to the Monthly Progress Reports, the actual annual mass removal of target VOCs (TCE, PCE and 1,1-DCE) was 895 pounds, 767 pounds and 89 pounds in 2012, 2013 and 2014 respectively (Table 3).

<sup>[1]</sup> Modified Early Response Action (Synergy Environmental LLC, 2012)

<sup>[2]</sup> Roosevelt Irrigation District Groundwater Response Action Implementation Plan (Montgomery & Associates, 2009)

<sup>[3]</sup> Roosevelt Irrigation District Early Response Action Conceptual Design Summary (HDR Engineering, Inc., 2010)

Table 3: Phase 1 Wellhead Treatment System 2012, 2013 and 2014 VOC Mass Removal (Actuals)

Year	Pounds of Target VOCs
2012	895
2013	768
2014	89
Total	1,751

ARCADIS evaluated the Monthly Progress Report data to confirm the accuracy of the reported monthly and cumulative mass of target VOCs removed. Monthly Progress Reports are available for the months of February thru August and October of 2012, March thru September of 2013, and May thru September of 2014. ARCADIS confirmed the accuracy of the monthly VOC mass removed reported in each Monthly Progress Report, with the exception of the mass removed at the RID-92 wellhead treatment system for the August 2012 reporting period. According to the August 2012 Monthly Progress Report, no water samples were collected from the RID-92 wellhead treatment system influent or effluent (point of compliance) during the reporting period, because the treatment system was offline for the majority of the period (to accommodate well investigation activities) and when online, the treatment system was operated in bypass mode. However, the target VOC mass removed by the RID-92 wellhead treatment system for the month of August 2012 is reported as 7 pounds. The basis for this VOC mass is unclear considering no influent and effluent samples were collected and the system, when online, operated only in bypass mode. It appears that the previous month's (July 2012) target VOC concentration data was assumed as a reasonable estimate for the purposes of estimating the August 2012 VOC mass removed.

ARCADIS also confirmed the accuracy of the cumulative mass removed in 2012, 2013 and 2014, assuming:

- 134 pounds of target VOCs were removed during the month of September 2012 (this Monthly Progress Report is not available). This is based on the difference between the cumulative mass removed between the August 2012 and October 2012 reporting periods.
- Operations were suspended at all wellhead treatment systems for the months of November 2012 thru February 2013 and October 2013 thru April 2014 (Monthly Progress Reports for these months are also unavailable). This is a reasonable assumption considering 1) the reported cumulative target VOC mass removed through March 2013 is consistent with no treatment operations between November 2012 and February 2013; 2) the cumulative mass removed through May 2014 is consistent with no treatment operations between October 2013 and May

- 2014; and 3) that the irrigation demand season typically begins in early March and extends through the end of September.
- Use of the treatment systems was suspended in May 2014 and the wells were operated in bypass mode through the majority of the 2014 pumping season. The Phase 1 treatment systems will not likely be restarted until March 2015 (Roosevelt Irrigation District, 2014).

ARCADIS' verified the mass of each target VOC removed (TCE, PCE and 1,1-DCE), total target VOC mass removed (sum of the TCE, PCE and 1,1-DCE mass removed), and cumulative target VOC mass removed. The results of these calculates are provided in Attachment 2, Table 2-1 under the columns titled "MASS REMOVED – VERIFICATION". The difference, expressed as a percentage, between the reported VOC mass removed and ARCADIS' calculations is provided in the final column of Table 2-1. The net percent difference for 2012 and 2013 is less than 0.50 percent, which could be entirely attributed to rounding; therefore ARCADIS has determined that the actual quantity of target VOC mass removed reported by the RID is accurate.

#### Phase 1 Wellhead Treatment System Potential Maximum VOC Mass Removal

Table 4 below summarizes the potential maximum annual target VOC mass removal for the Phase 1 wellhead treatment systems. The maximum potential mass removal is based on each wellhead treatment system operating at:

- maximum flow rate, continuously 365 days per year;
- sustained target VOC concentrations, represented by the maximum of each target VOC exceeding the respective USEPA MCL observed at each respective location between 2012 and 2014; and
- 100 percent mass removal efficiency (VOCs are reduced to concentrations below the detection limit).

This annual target VOC mass removal represents the "best-case" scenario. The maximum flow rate for each wellhead treatment system is taken as the lesser of the actual maximum flow rate observed between 2012 and 2013, or the wellhead treatment system capacity (based on 1,100 gpm per treatment skid). The reported maximum flow rate is not a representative flow rate because these flow rates were estimated before head loss associated with the treatment system components and piping was well understood. The USEPA MCL is 5 µg/L for TCE and PCE and 7 µg/L for 1,1-DCE.

**Table 4: Potential Maximum Annual Target VOC Mass Removal.** 

Wellhead Treatment System	F	low Rate (gpn	1)	VOC C	VOC Mass					
	Actual Maximum	Treatment System Capacity	Reported Maximum	TCE	PCE	1,1-DCE	Removal (pounds)			
RID-89	3,129	3,300	3,900 <sup>[3]</sup>	32	9.7	2.6	572			
RID-92	1,327	1,100	1,300 <sup>[1]</sup>	77	14	5.1	442			
RID-95	1,874	2,400	2,400	2,400	2,400	2,300 [3]	65	4.4	8.2	601
RID-114	RID-114 2,634 3,300 2,500 <sup>[1,2,3]</sup>			49	3.9	3.5	566			
	Total	2,182								

gpm: gallons per minute

μg/L: micrograms per liter

Table 5 below presents a more realistic, yet still conservative scenario, which accounts for the decrease in irrigation water demand during the late fall to early winter. Similar to the "best-case" scenario (Table 4), the most-likely annual mass removal is based on each wellhead treatment system operating at:

- maximum flow rate; and
- sustained target VOC concentrations, represented by the maximum of each target VOC exceeding the respective USEPA MCL observed at each respective location between 2012 and 2014.

However, the flow rate is not assumed to be continuous. Rather, the wellhead treatment systems are assumed to be inactive for the months of January, February, November and December. In addition, the actual average mass removal efficiency of the Phase 1 wellhead treatment systems from 2012 to 2014 was 93 percent. The mass removal efficiency is better represented by 95 percent, which is more realistic than a mass removal efficiency of 100 percent.

<sup>[1]</sup> Modified Early Response Action (Synergy Environmental LLC, 2012)

<sup>[2]</sup> Roosevelt Irrigation District Groundwater Response Action Implementation Plan (Montgomery & Associates, 2009)

<sup>[3]</sup> Roosevelt Irrigation District Early Response Action Conceptual Design Summary (HDR Engineering, Inc., 2010)

Table 5: Most-Likely Maximum Annual VOC Mass Removal.

Wellhead	F	low Rate (gpn	າ)	VOC C	VOC Mass																
Treatment System	Actual Maximum	Treatment System Capacity	Reported Maximum	TCE	PCE	1,1-DCE	Removal (pounds)														
RID-89	3,129	3,300	3,900 <sup>[3]</sup>	32	9.7	2.6	384														
RID-92	1,327	1,100	1,300 [1]	77	14	5.1	358														
RID-95	1,874	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,300 [3]	65	4.4	8.2	404
RID-114	RID-114 2,634 3,300 2,500 <sup>[1,2,3]</sup>				3.9	3.5	380														

gpm: gallons per minute

μg/L: micrograms per liter

#### **Conclusions**

The RID reported in the MERA Work Plan an anticipated total annual target VOC mass removal of up to 1,900 pounds per year through the operation of the Phase 1 wellhead treatment systems. It is now apparent that the four Phase 2 wells will not receive wellhead treatment systems. In 2012 and 2013, the Phase 1 wellhead treatment systems removed **895 pounds** and **767 pounds**, respectively (Table 3). In 2014, because the wells were generally operated in temporary shutdown or bypass mode, the Phase 1 wellhead treatment systems removed a total of 89 pounds (Table 3). If all Phase 1 wellhead treatment systems operated continuously, without downtime, at sustained maximum observed VOC concentrations and at a removal efficiency of 100 percent, the Phase 1 wellhead treatment systems could remove up to 2,182 pounds per year of target VOCs annually (Table 4). However, given that the RID must decrease production during the late fall and winter months when the irrigation demand is low and the mass removal efficiency is not likely to exceed 95 percent, the most-likely maximum annual VOC removal rate is 1.446 pounds per year. Therefore, it is apparent that the anticipated total annual target VOC mass removal of 1,900 pounds is a significant over estimate. RID's Phase 1 wellhead treatment systems will remove only 76 percent of the projected VOC removal rate on an annual basis. Additionally, as the wells have been operated in temporary shutdown or bypass mode during late 2013 and nearly all of 2014 (where reports were available) minimal treatment for VOCs have occurred under the MERA Phase 1. In all, the treatment systems have been operational for approximately 16 months since 2012, and either offline or operated in bypass mode the remaining 17 months to date.

<sup>[1]</sup> Modified Early Response Action (Synergy Environmental LLC, 2012)

<sup>[2]</sup> Roosevelt Irrigation District Groundwater Response Action Implementation Plan (Montgomery & Associates, 2009)

<sup>[3]</sup> Roosevelt Irrigation District Early Response Action Conceptual Design Summary (HDR Engineering, Inc., 2010)

#### References

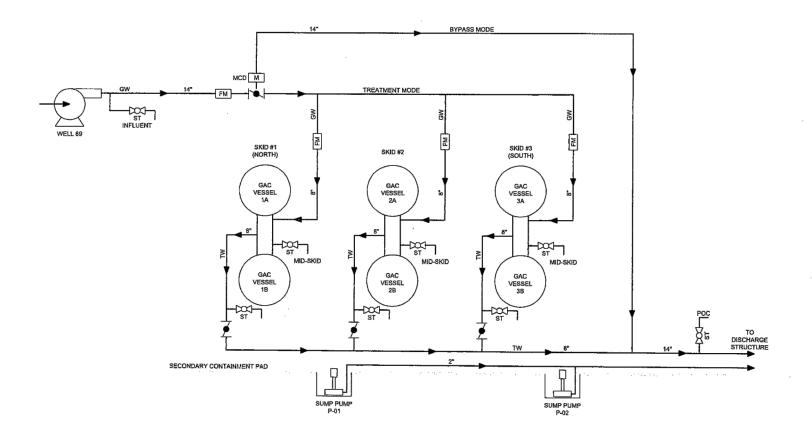
- HDR Engineering, Inc., 2010. RID Groundwater Remediation Early Response Action Conceptual Design Summary Technical Memo. Prepared for Montgomery and Associates, Inc. February 2.
- Montgomery and Associates, 2009. Draft Roosevelt Irrigation District Groundwater Response Action Implementation Plan, West Van Buren Water Quality Assurance Revolving Fund Site. September 25.
- Montgomery and Associates, 2010. Roosevelt Irrigation District Groundwater Response Action Implementation Plan, West Van Buren Water Quality Assurance Revolving Fund Site. February 3.
- Roosevelt Irrigation District, 2014. Response to Comments: Review of Operation and Maintenance Plan Roosevelt Irrigation District Wellhead Treatment Systems, West Van Buren WQARF Registry Site, Phoenix, Arizona. October 20.
- Synergy Environmental, LLC, 2012a. Modified Early Response Action Proposal, for the West Van Buren Water Quality Assurance Revolving Fund Site, Phoenix, Arizona. Submitted to the Arizona Department of Environmental Quality on behalf of Roosevelt Irrigation District. July 17.
- Synergy Environmental, LLC, 2012b. Modified Early Response Action Work Plan, West Van Buren WQARF Registry Site, Phoenix, Arizona. Prepared for Arizona Department of Environmental Quality on behalf of Roosevelt Irrigation District. October.
- Synergy Environmental, LLC, 2012c. February 2012 Monthly Progress Report RID-95 Wellhead Pilot Treatment Systems. March 19.
- Synergy Environmental, LLC, 2012d. March 2012 Monthly Progress Report RID-95 Wellhead Pilot Treatment Systems. April 10.
- Synergy Environmental, LLC, 2012e. April 2012 Monthly Progress Report RID-95 Wellhead Pilot Treatment Systems. May 14.
- Synergy Environmental, LLC, 2012f. May 2012 Monthly Progress Report RID-95 Wellhead Pilot Treatment Systems. June 14.
- Synergy Environmental, LLC, 2012g. June 2012 Monthly Progress Report RID-95 Wellhead Pilot Treatment Systems. July 14.

- Synergy Environmental, LLC, 2012h. July 2012 Monthly Progress Report RID-95 Wellhead Pilot Treatment Systems. August 14.
- Synergy Environmental, LLC, 2012i. August 2012 Monthly Progress Report RID-95 Wellhead Pilot Treatment Systems. May 14.
- Synergy Environmental, LLC, 2012j. October 2012 Monthly Progress Report RID-95 Wellhead Pilot Treatment Systems. November 13.
- Synergy Environmental, LLC, 2013a. March 2013 Monthly Progress Report RID Wellhead Treatment Systems. April 15.
- Synergy Environmental, LLC, 2013b. April 2013 Monthly Progress Report RID Wellhead Treatment Systems. May 8.
- Synergy Environmental, LLC, 2013c. May 2013 Monthly Progress Report RID Wellhead Treatment Systems. June 12.
- Synergy Environmental, LLC, 2013d. June 2013 Monthly Progress Report RID Wellhead Treatment Systems. July 11.
- Synergy Environmental, LLC, 2013e. July 2013 Monthly Progress Report RID Wellhead Treatment Systems. August 12.
- Synergy Environmental, LLC, 2013f. August 2013 Monthly Progress Report RID Wellhead Treatment Systems. September 12.
- Synergy Environmental, LLC, 2013g. September 2013 Monthly Progress Report RID Wellhead Treatment Systems. October 7.
- Synergy Environmental, LLC, 2014a. May 2014 Monthly Progress Report RID Wellhead Treatment Systems. June 17.
- Synergy Environmental, LLC, 2014b. June 2014 Monthly Progress Report RID Wellhead Treatment Systems. July 18
- Synergy Environmental, LLC, 2014c. July 2014 Monthly Progress Report RID Wellhead Treatment Systems. August 11.

- Synergy Environmental, LLC, 2014d. August 2014 Monthly Progress Report RID Wellhead Treatment Systems. September 15.
- Synergy Environmental, LLC, 2014e. September 2014 Monthly Progress Report RID Wellhead Treatment Systems. October 15.
- Synergy Environmental, LLC, and Montgomery & Associates 2014. Draft Feasibility Study Report, West Van Buren WQARF Site, Phoenix, Arizona. Prepared for Arizona Department of Environmental Quality on behalf of Roosevelt Irrigation District. July 11.



Figures



 $\odot$ 

CENTRIFUGAL PUMP

MANUAL VALVE

FM

FLOW METER

MOTOR-OPERATED VALVE, MODULATING

SAMPLE TAP

gw GROUNDWATER

w TREATED WATER

POC POINT OF COMPLIANCE

ADAPTED FROM SYNERGY ENVIRONMENTAL, LLC FIGURE 2, DATED 10/03/13



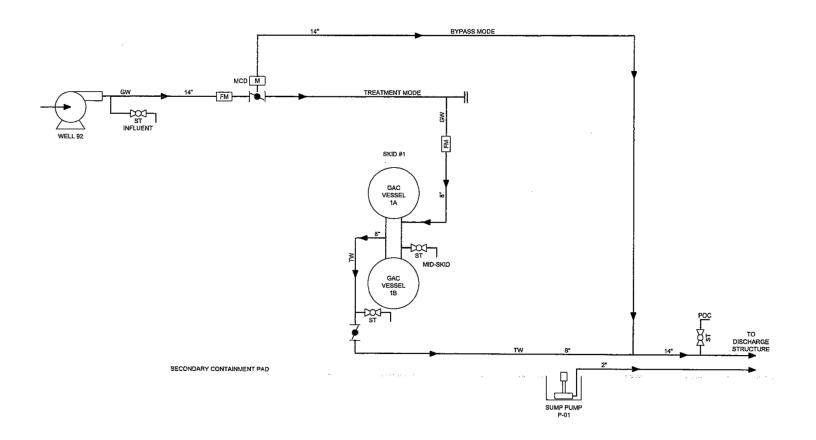
410 N. 44th Street Suite 1000 Phoenix, AZ 85008-6503 Tel: 602.438.0883 Fax: 602.438.0102

www.arcadis-us.com

PROCESS FLOW DIAGRAM
RID-89 WELL HEAD TREATMENT SYSTEM
500 South 15th Street Eggility

500 South 15th Street Facility Phoenix, Arizona

FIGURE



CENTRIFUGAL PUMP

MANUAL VALVE

FM

FLOW METER

SAMPLE TAP

MOTOR-OPERATED VALVE, MODULATING GROUNDWATER

TREATED WATER

BLIND FLANGE FOR

**FUTURE CONNECTION** 

POINT OF COMPLIANCE

410 N. 44th Street Suite 1000 Phoenix, AZ 85008-6503 Tel: 602.438.0883 Fax: 602.438.0102

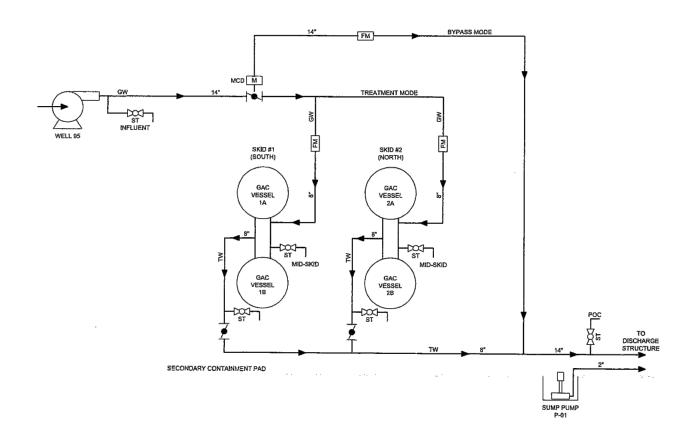
www.arcadis-us.com

## **PROCESS FLOW DIAGRAM RID-92 WELL HEAD TREATMENT SYSTEM**

ADAPTED FROM SYNERGY ENVIRONMENTAL, LLC FIGURE 3, DATED 10/03/13

500 South 15th Street Facility Phoenix, Arizona

**FIGURE** 



Q

CENTRIFUGAL PUMP

MANUAL VALVE

FM

FLOW METER

MOTOR-OPERATED VALVE, MODULATING

SAMPLE TAP

GW GROUNDWATER

w TREATED WATER

POC POINT OF COMPLIANCE

ADAPTED FROM SYNERGY ENVIRONMENTAL, LLC FIGURE 4, DATED 10/03/13



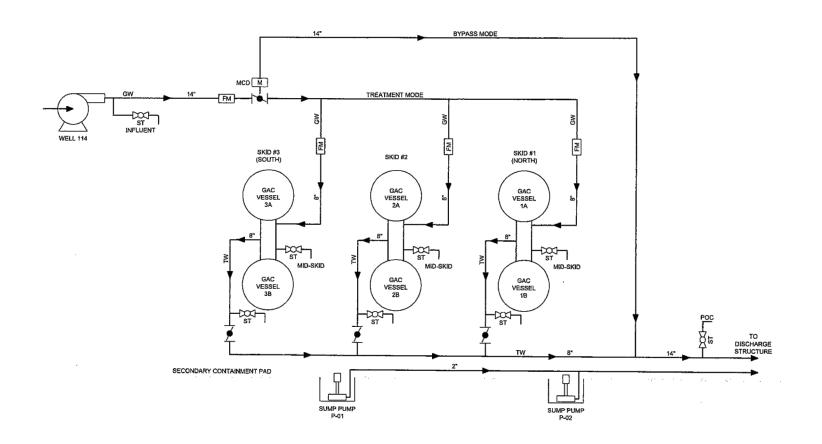
410 N. 44th Street Suite 1000 Phoenix, AZ 85008-6503 Tel: 602.438.0883 Fax: 602.438.0102

www.arcadis-us.com

PROCESS FLOW DIAGRAM
RID-95 WELL HEAD TREATMENT SYSTEM

500 South 15th Street Facility Phoenix, Arizona

FIGURE



 $\mathbb{Q}^{\neg}$ 

CENTRIFUGAL PUMP



MANUAL VALVE

FM

FLOW METER

—XXX

SAMPLE TAP

M - 6

MOTOR-OPERATED COLUMN VALVE, MODULATING

gw GROUNDWATER

TW TREATED WATER

POC POINT OF COMPLIANCE

ADAPTED FROM SYNERGY ENVIRONMENTAL, LLC FIGURE 5, DATED 10/03/13



410 N. 44th Street Suite 1000 Phoenix, AZ 85008-6503 Tel: 602.438.0883 Fax: 602.438.0102

www.arcadis-us.com

# PROCESS FLOW DIAGRAM RID-114 WELL HEAD TREATMENT SYSTEM

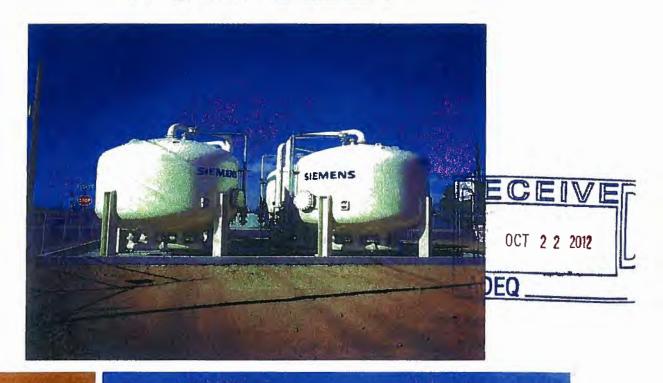
500 South 15th Street Facility Phoenix, Arizona

FIGURE



**Attachment 1** 

## MODIFIED EARLY RESPONSE ACTION WORK PLAN



OCTOBER 2012

WEST VAN BUREN WOARF REGISTRY SITE PHOENIX, ARIZONA

Prepared by:

Synergy Environmental, LLC

On Behalf of:

**Roosevelt Irrigation District** 

Prepared for:

**Arizona Department of Environmental Quality** 







already present at concentrations below MCLs, to pass through the LGAC vessels will result in a significant reduction in OBM costs while achieving MCLs for all VOCs. This approach will enable much longer LGAC bed life compared to GAC replacement at the first detection of these deminimis VOCs in the treatment system effluent.

Table 2 has been revised to include mass removal estimates that include only target VOCs. The VOC concentrations in Table 2 have also been updated to include the latest ADEQ sampling results and the reduced flow rates due to treatment system head losses.

The Modified ERA Work Plan will be implemented in a two-phase approach as described in the following sections.

#### 4.3.1 Phase 1

Phase 1 of the Modified ERA Work Plan consists of installation and operation of the four wellhead treatment systems included in the RID-95 Wellhead Pilot Treatment System Proposal (Synergy, 2011c). These four wells are among the most highly contaminated wells, and treatment of these wells has resulted in restoring the quality of the water supply from these wells to concentrations protective of all RID current and reasonably foreseeable end uses. One of these wells, RID-114, is located at the eastern end of the Salt Canal at 23<sup>rd</sup> Avenue and West Van Buren Street (Figure 14). The remaining three wells, the "southerntier wells" (RID-89, RID-92 and RID-95), are all located approximately ¾ mile south of the Salt Canal that runs parallel to West Van Buren Street along the southern alignment. RID-89, -92 and -95 are located on 51<sup>st</sup>, 43<sup>rd</sup> and 35<sup>th</sup> Avenues, respectively.

Phase 1 design and construction has been completed and wellhead treatment at all four wells is currently underway. The most recent information regarding volumes of water treated and VOC mass removed from these Phase 1 wells is available in the August 2012 Monthly Progress Report - RID-95 Wellhead Pilot Treatment Systems (Synergy, 2012a).

Based on current VOC concentrations in the Phase 1 RID wells, the estimated total annual VOC mass removal during Phase 1 would be up to approximately 1,900 pounds, which would be more than the total pounds of VOCs removed in FY2011 at all other WQARF sites. (Table 2). System performance monitoring is being conducted to assess well operations and treatment effectiveness. The treated water from Phase 1 will be used for its highest beneficial use, which in addition to irrigation could include industrial supply and/or potable supply, in the reasonably foreseeable future.

Production capacity of these four wells decreased as a result of the additional head losses through the treatment systems. Reductions in pump output have been observed in each well with average losses of approximately 10%. Well RID-92 has the highest production



)

capacity loss of approximately 18%. RID intends to recover this lost capacity at each of these wells as part of this ERA through well equipment replacement and installation of an additional treatment skid at RID-92. Additional engineering assessment is needed to determine the most appropriate means of restoring the lost water production capacity that resulted from the wellhead treatment, and this assessment will occur as part of the Modified ERA Work Plan.

#### 4.3.2 Phase 2

Phase 2 of the Modified ERA Work Plan consists of equipping four additional RID wells with high VOC concentrations with wellhead treatment. These additional wells (anticipated as RID-100, RID-106, RID-112, and RID-113) will be equipped with wellhead treatment systems similar to those constructed at the pilot treatment system sites, as illustrated in Figure 14. The objective is the restoration of the quality of the water supply from these additional contaminated RID wells to concentrations protective of all RID current and reasonably foreseeable end uses. Three of the Phase 2 wells are located along the Salt Canal that runs parallel to West Van Buren Street along the southern alignment. RID-106, -112 and -113 are located just east of 67<sup>th</sup>, at 32<sup>nd</sup> and just east of 28<sup>th</sup> Avenues, respectively. The remaining Phase 2 well, RID-100, is an additional southern-tier well located at 27<sup>th</sup> Avenue approximately ¾ mile south of Van Buren Street.

Phase 2 wellhead treatment systems installation is anticipated to begin in late 2013, upon availability of project funds. These installations will be designed consistent with the Phase 1 treatment systems as detailed in the RID-95 Wellhead Pilot Treatment System Proposal, dated August 18, 2011, whose implementation was agreed to by ADEQ by letter dated September 2, 2011.

Phase 2 implementation may require access to, or acquisition of, additional land for siting of wellhead treatment units at the targeted RID well sites. Information obtained during Phase 2 planning and design concerning land availability, site access, and well and water quality conditions will dictate final decisions concerning treatment system installation and/or may necessitate alternative siting for wellhead treatment, particularly associated with RID wells on the Salt Canal.

Based on current VOC concentrations in the Phase 2 wells, the estimated total annual contaminant VOC mass removal following implementation of Phase 2 would be approximately 440 pounds (Table 2). The treated water from Phase 2 would be used for its highest beneficial use, which in addition to irrigation could include industrial supply and/or potable supply in the reasonably foreseeable future.



The total annual volume of water pumped during the ERA would be nominally equivalent to the current annual volume pumped by RID from this area and future groundwater levels will be unaffected by the ERA.

As discussed in Phase 1, the production capacity of these Phase 2 wells will also be reduced due to head losses through the treatment systems. RID intends to recover this lost capacity at each well as part of this ERA and installation of an additional treatment skid at RID-106.

TABLE 2
MODIFIED ERA WELL FLOW RATES AND CONTAMINANT DATA
WEST VAN BUREN AREA WATER QUALITY ASSURANCE REVOLVING FUND SITE

PHASE DESCRIPTION	WELL NAME	PUMPING RATE (gpm) <sup>1</sup>	TOTAL VOCs (ug/l) <sup>2</sup>	TOTAL TARGET VOCs (ug/l) <sup>3</sup>	ESTIMATED MASS OF TOTAL TARGET VOCS CAPTURED (pounds per year) <sup>4</sup>
	RID-89	3,100	44	34	468
PHASE 1 -	RID-92	1,300	93	76	436
PILOT WELLHEAD	RID-95	1,700	88	68	504
TREATMENT SYSTEMS INITIATIVE	RID-114	2,500	60	44	484
	TOTAL:	8,600	Section 1	-	1,892
	RID-100	2,100	30	16	146
PHASE 2 -	RID-106	1,500	35	29	189
ADDITIONAL WELLHEAD	RID-112	1,700	12	6.3	47
TREATMENT SYSTEMS	RID-113	2,300	11	5.3	54
	TOTAL	7,600	436		
	COMBINED P	HASE 1 AND	PHASE 2 MA	SS CAPTURED:	2,328

#### EXPLANATION:

RID = Roosevelt Irrigation District

gpm = gallons per minute

VOCs = Volatile Organic Compounds

ug/l = micrograms per liter

MCL = Maximum Contaminant Level

TCE = Trichloroethene

PCE = Tetrachloroethene

1,1-DCE = 1,1-Dichloroethene



<sup>&</sup>lt;sup>1</sup>Phase 1 pumping rates are based on actual data obtained from wells in treatment mode. Phase 2 pumping rates are based on RID production data with an estimated 10% derating for future treatment system head losses. Pumping rate loss based on empirical data obtained during Phase 1 work.

<sup>&</sup>lt;sup>2</sup> Sum of concentrations for all VOCs, including those VOCs currently below MCLs (see Table 1).

<sup>&</sup>lt;sup>3</sup> Sum of concentrations for TCE, PCE and 1,1-DCE (where 1,1-DCE exceeds the MCL) (see Table 1).

<sup>&</sup>lt;sup>4</sup> Mass removal assumes 100% duty for Phase 1 and Phase 2 wells.



**Attachment 2** 

## Attachment 2 Table 2-1: Summary of Available Monthly Progress Report Data

Wellhead Treatment System	Year	Monthly Report Date	Volume of Groundwater Treated	Cumulative Volume of Groundwater Treated	Opearting Hours	Flow Rate (Period Average)	TCE	PCE	1,1-DCE	TCE	PCE	1,1-DCE	Target VOC Mass Removed	Target VOC Mass Removed (Cumulative)	TCE	PCE	1,1,DCE	Target VOC Mass Removed	Target VOC Mass Removed (Cumulative)	Percent Difference
		Jan-12 Feb-12	(acre-ft) - -	(acre-ft) - -	(hours) - -	(gpm) - -	(μg/L) - -	(µg/L) - -	(µg/L) - -	(μg/L) - -	(μg/L) - -	(µg/L) - -	(pounds)	(pounds)	(pounds)	(pounds)	(pounds)	(pounds)	(pounds)	(%) - -
		Mar-12 Apr-12 May-12	- 106	- 106	- - 184	- - 3,129	- 32	9.4	2.6	- 0.50	- 0.50	- 0.50	- - 12	- 12	9.2	2.7	- 0.8	- - 12.7	12.7	-5.9%
	2012	Jun-12 Jul-12 Aug-12	408 385 397	514 899 1,296	720 696 739	3,077 3,004 2,918	31 29 30	8.6 8.3 9.0	2.1 2.0 2.2	0.50 0.50 0.50	0.50 0.50 0.50	0.50 0.50 0.50	46 41 44	59 100 144	34.4 30.2 32.0	9.5 8.7 9.7	2.4 2.1 2.3	46.3 41.0 44.0	59 100 144	0.1% 0.1% 0.0%
		Sep-12 Oct-12	382 359 NA	1,678 2,037 NA	NA 734 NA	NA 2,656 NA	NA 28 NA	NA 8.6 NA	NA 1.9 NA	NA 0.50 NA	NA 0.50 NA	NA 1.7 NA	41 36	185 221	NA 27.7 NA	NA 8.4 NA	NA 0.2 NA	41.0 36.3 NA	185 221 NA	0.0% -0.1% NA
		Nov-12 Dec-12 Jan-13	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA NA	NA NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA
		Feb-13 Mar-13 Apr-13	NA 338 390	NA 2,375 2,766	NA 621 720	NA 2,956 2,942	NA 32 31	9.1 9.5	NA 2.3 2.3	NA 0.80 4.5	0.50 0.50	NA 2.2 2.2	NA 37 39	NA 258 296	NA 28.2 28.3	NA 8.4 10.1	0.1 0.1	NA 36.7 38.5	NA 258 296	0.0% -0.1%
RID-89	2013	May-13 Jun-13	387 354 288	3,153 3,507 3,795	744 720 648	2,825 2,670 2,414	30 31 32	9.6 9.6 9.7	1.9 2.4 2.3	2.7 4.4 1.0	0.50 0.50 0.50	1.2 1.5 1.3	40 36 32	336 372 404	29.0 25.7 24.0	10.1 9.2 7.6	0.7 0.8 0.8	39.8 35.7 32.5	336 372 404	-0.1% 0.0%
		Jul-13 Aug-13 Sep-13	14 0	3,809 3,809	33 0	2,304 0	30 OFFLIINE	8.8 OFFLINE	2.1 OFFLINE	NS OFFLINE	NS OFFLINE	NS OFFLINE	1 0	406 406	NS OFFLINE	NS OFFLINE	NS OFFLINE	NS OFFLINE	NS OFFLINE	-0.1% NS OFFLINE
		Oct-13 Nov-13 Dec-13	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA
		Jan-14 Feb-14 Mar-14	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA
	2014	Apr-14 May-14	NA 263	NA 4,072	NA 575	NA 2,484	NA 27.9	NA 8.3	NA 2.4	NA 7.3	NA 0.50	NA 2.5	NA 26	NA 432	NA 16.1	NA 5.9	NA 0.8	NA 22.9	NA 427	NA 1.08%
		Jun-14 Jul-14 Aug-14	0 0	4,072 4,072 4,072	0 0	0 0	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS
		Sep-14 Jan-12	0 -	4,072	0 - -	0 -	NS -	NS -	NS -	NS -	NS -	NS -	NS -	NS -	NS -	NS -	NS -	NS -	NS -	NS -
		Feb-12 Mar-12 Apr-12	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
	2012	May-12 Jun-12 Jul-12	50 162 168	50 211 379	208 698 744	1,305 1,260 1,226	71 71	14 13 12	3.6 3.5 3.8	0.50 0.50 0.50	0.50 0.50 0.50	0.50 0.50 0.54	12 38 39	12 50 89	9.4 31.1 32.3	1.9 5.5 5.7	0.5 1.5 1.5	11.8 38.1 39.4	12 50 89	1.5% 0.2% -0.3%
		Aug-12 Sep-12	29 60 139	408 468 607	126 NA 709	1,250 NA 1,065	NS NA 72	NS NA 13	NS NA 4.0	NS NA 0.65	NS NA 0.50	NS NA 0.50	7 16 33	96 112 145	NS NA 26.8	NS NA 4.8	NS NA 1.5	7.0 16.0 33.2	96 112 145	-0.3% -0.3%
		Oct-12 Nov-12 Dec-12	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	-0.3% NA NA
		Jan-13 Feb-13 Mar-13	NA NA 141	NA NA 748	NA NA 577	NA NA 1,327	NA NA 72	NA NA 14	NA NA 4.2	NA NA 6.4	NA NA 0.50	NA NA 2.2	NA NA 31	NA NA 176	NA NA 25.1	NA NA 5.5	NA NA 0.8	NA NA 31.4	NA NA 177	NA NA -0.5%
RID-92		Apr-13 May-13 Jun-13	161 161 157	910 1,071 1,228	718 735 714	1,218 1,190 1,194	73 73 74	14 14 13	4.7 3.8 4.4	0.50 0.50 0.83	0.50 0.50 0.50	0.94 2.9 6.0	40 38 37	216 254 291	31.9 31.8 31.3	5.9 6.0 5.7	1.6 0.4 -0.7	39.5 38.3 36.4	216 255 291	-0.2% -0.2% 0.0%
	2013	Jul-13 Aug-13	159 134	1,387 1,521	725 613	1,191 1,187	75 77	14 12	5.1 4.8	3.7 0.54	0.50 0.50	4.8 3.6	37 33	328 361	30.8 28.0	6.0 4.5	0.1	36.8 32.9	328 361	0.1% 0.1%
		Sep-13 Oct-13 Nov-13	NA NA	1,521 NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA
_		Dec-13 Jan-14 Feb-14	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA
	2014	Mar-14 Apr-14	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA
		May-14 Jun-14 Jul-14	124 0 0	1,645 1,645 1,645	564 0 0	1,194 0 0	69.4 NS NS	NS NS	4.6 NS NS	2.2 NS NS	0.5 NS NS	7.00 NS NS	25 NS NS	386 NS NS	22.66 NS NS	3.47 NS NS	-0.81 NS NS	25.3 NS NS	386 NS NS	-0.02% NS NS
		Aug-14 Sep-14 Jan-12	0	1,645 1,645	0	0	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS
		Feb-12 Mar-12	195 240	195 435	565 744	1,874 1,752	41 50	3.0	6.1 7.4	0.50	0.50	0.50	26 40	26 65	21.7 32.6	1.6	3.2 4.8	26.6 39.9	27 66	-4.3% -1.6%
	2012	Apr-12 May-12 Jun-12	220 186 220	655 841 1,061	702 602 720	1,702 1,678 1,659	52 54 58	3.8 4.2 4.0	8.0 8.2 6.5	0.50 0.50 0.50	0.50 0.50 0.50	0.50 0.50 0.68	38 33 41	104 137 178	31.2 27.1 34.4	2.3 2.1 2.4	4.8 4.1 3.5	38.3 33.3 40.3	105 138 178	-0.7% -0.8% -0.2%
		Jul-12 Aug-12 Sep-12	224 218 202	1,284 1,503 1,705	742 743 NA	1,639 1,593 NA	59 63 NA	4.1 4.4 NA	6.7 7.7 NA	0.50 0.50 NA	0.50 0.50 NA	0.98 2.1 NA	41 43 38	220 262 300	36.0 37.3 NA	2.5 2.6 NA	3.5 3.3 NA	42.0 43.2 38.0	220 264 302	-0.2% -0.6% -0.5%
		Oct-12 Nov-12	91 NA NA	1,796 NA NA	346 NA NA	1,428 NA NA	65 NA NA	4.2 NA NA	7.4 NA NA	0.50 NA NA	0.50 NA NA	5.4 NA NA	18 NA NA	318 NA NA	16.1 NA NA	1.0 NA NA	0.5 NA NA	17.6 NA NA	319 NA NA	-0.4% NA NA
_		Jan-13 Feb-13	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA
RID-95		Mar-13 Apr-13 May-13	175 218 223	1,971 2,189 2,412	553 713 744	1,719 1,660 1,628	35 54 55	2.6 4.0 4.2	5.1 7.6 7.5	0.50 0.50 0.95	0.50 0.50 0.50	2.9 2.0 6.8	19 38 36	336 374 410	16.6 31.8 33.0	1.2 2.3 2.5	1.0 3.3 0.4	18.9 37.5 36.0	338 376 412	-0.6% -0.4% -0.4%
	2013	Jun-13 Jul-13	204 200 10	2,615 2,816 2,825	696 686 33	1,592 1,583 1,646	56 58 57	4.1 4.1 3.5	6.6 7.2 7.2	2.5 2.9 NS	0.50 0.50 NS	5.8 5.2 NS	32 33 1	442 475 477	29.8 30.0 NS	2.3 2.2 NS	0.5 1.1 NS	32.6 33.3 NS	444 477 NS	-0.5% -0.5% NS
		Aug-13 Sep-13 Oct-13	0 NA	2,825 NA	0 NA	0 NA	OFFLINE NA	OFFLINE NA	OFFLINE NA	OFFLINE NA	OFFLINE NA	OFFLINE NA	0 NA	477 NA	OFFLINE NA	OFFLINE NA	OFFLINE NA	OFFLINE NA	OFFLINE NA	OFFLINE NA
-		Nov-13 Dec-13 Jan-14	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA
		Feb-14 Mar-14	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA
	2014	Apr-14 May-14 Jun-14	169 0	2,994 2,994	577 0	1,591 0	48.5 NS	3.2 NS	7.7 NS	8.7 NS	0.5 NS	8.2 NS	20 NS	496 NS	18.3 NS	2.2 NS	-0.2 NS	20.3 NS	498 NS	-0.35% NS
		Jul-14 Aug-14 Sep-14	0 0 0	2,994 2,994 2,994	0 0	0 0	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS	NS NS NS
		Jan-12 Feb-12 Mar-12	- - -	<del>-</del> -			-	-	-	-	-	-	-		-	-		-		-
		Apr-12 May-12	97 232	97 329	- 200 510	- 2,634 2,471	- 49 47	3.0 2.6	3.5 2.6	0.50 0.50	0.50 0.50	- 0.50 0.50	- 15 33	- 15 48	- 12.9 29.9	- 0.8 1.7	0.9	- 14.7 33.1	- 15 48	2.3%
	2012	Jun-12 Jul-12 Aug-12	337 326	666 992	744 743	2,460 2,383	43 44	2.5 2.8	2.5 2.6	0.50 0.50	0.50 0.50	0.50 0.50	44 44	91 135	39.2 39.0	2.3 2.5	2.3 2.3	43.8 43.8	92 135	0.4% -0.6% -0.3%
		Sep-12 Oct-12 Nov-12	315 320 NA	1,307 1,627 NA	NA 729 NA	NA 2,384 NA	NA 40 NA	NA 2.7 NA	NA 2.4 NA	NA 0.50 NA	0.50 NA	NA 1.9 NA	39 37 NA	174 211 NA	NA 34.5 NA	NA 2.3 NA	NA 0.4 NA	39 37.2 NA	174 212 NA	-0.2% -0.3% NA
		Dec-12 Jan-13	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA
		Feb-13 Mar-13 Apr-13	171 317	1,798 2,115	379 711	2,450 2,421	47 47	2.7 2.9	3.0 3.1	0.87 1.9	0.50 0.50	2.2 2.3	23 42	234 276	21.7 38.8	1.3 2.5	0.4 0.7	23.3 42.0	235 277	-0.4% -0.4%
RID-114	2013	May-13 Jun-13 Jul-13	318 315 321	2,432 2,747 3,069	725 719 744	2,382 2,379 2,343	43 43 38	3.9 2.8 2.7	2.7 3.0 2.5	3.8 4.1 1.1	0.50 0.50 0.50	2.7 2.5 2.2	37 36 35	314 350 384	34.1 33.2 32.2	3.4 2.4 2.4	0.0 0.4 0.2	37.4 36.1 34.8	314 350 385	-0.1% -0.1% -0.3%
		Aug-13 Sep-13	286 83 NA	3,354 3,437 NA	689 189 NA	2,254 2,385 NA	37 35 NA	2.4 2.5 NA	2.3 2.1 NA	4.2 5.7 NA	0.50 0.50 NA	2.2 2.8 NA	27 7 NA	412 419 NA	25.5 6.7 NA	1.9 0.6 NA	0.1 -0.2 NA	27.4 7.1 NA	413 420 NA	-0.2% -0.2% NA
		Oct-13 Nov-13 Dec-13	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA
		Jan-14 Feb-14 Mar-14	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA
	2014	Apr-14 May-14 Jun-14	NA 230 0	NA 3,668 3,668	NA 574 0	NA 2,176 0	NA 33.7 NS	NA 2.3 NS	NA 2.2 NS	NA 7.3 NS	NA 0.5 NS	NA 2.5 NS	NA 18 NS	NA 437 NS	NA 16.5 NS	NA 1.44 NS	-0.16 NS	NA 7.1 NS	NA 427 NS	NA 2.3% NS
		Jul-14 Aug-14	0	3,668 3,668	0	0	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS
		Sep-14	0	3,668	0	0	NS	NS	NS	NS	NS	NS	NS 2012 Subtotal 2013 Subtotal	NS 895 768	NS	NS	NS	NS 2012 Subtotal 2013 Subtotal	NS 898 765	-0.30% 0.40%
		Notes:	d from Monthly Da	ta Reports - http://v	www.wvgroundwat	er.org/project-docu	uments						2014 Subtotal Total	89 1,751				2014 Subtotal Total	68 1,731	22.60% 1.16%

NS ... NA OFFLINE

No data. Date preceds wellhead treatment system start-up.

Not Sampled. Treatment system operated in bypass mode.

Not Available. Monthly Progress Report is not available.

Not Sampled. Treatment system operated in bypass mode.

Not Sampled. Treatment system operated in bypass mode.

Not Sampled. Treatment system offline for the reporting period.

Value derived using available data from August 2012 and October 2012 Monthly Progress Reports

System was not sampled during reporting period. It is unclear what concentration data the reported removed mass is based on. The estimate could be based on the previous month's data.