MONTGOMERY
& ASSOCIATES
Water Resource Consultants

Well Investigation Work Plan

November 24, 2010

Prepared for:
Gallagher & Kennedy, P.A. and
Roosevelt Irrigation District

Roosevelt Irrigation District Early Response Action

West Van Buren Area
Water Quality Assurance Revolving Fund Site

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& ASSOCIATES

November 24, 2010

PHASE 1 WELL INVESTIGATION WORK PLAN

ROOSEVELT IRRIGATION DISTRICT
EARLY RESPONSE ACTION
WEST VAN BUREN AREA
WATER QUALITY ASSURANCE REVOLVING FUND SITE

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EARLY RESPONSE ACTION
WEST VAN BUREN AREA
WATER QUALITY ASSURANCE REVOLVING FUND SITE

1.0 INTRODUCTION

This Phase 1 Investigation Work Plan describes a subset of the scope of work and tasks associated with the comprehensive well investigations, outlined in the Well Investigation Work Plan dated August 9, 2010, for the Early Response Action (ERA) at the West Van Buren Area Water Quality Assurance Revolving Fund Site (the WVBA Site). This Phase 1 well investigation work is intended to enable Roosevelt Irrigation District (RID) to begin field work this December (2010) and provide insight and lessons learned that would be integrated into the comprehensive Phase 2 Well Investigation Work Plan that will follow this first phase of investigation.

This Phase 1 Well Investigation Work Plan is not intended to satisfy all of the conditions set forth by the Arizona Department of Environmental Quality (ADEQ) in the ERA approval letter or address all of the comments received from ADEQ on the original August 2010 Task 2 Work Plan. Rather, it is intended to facilitate immediate commencement of a Phase 1 well investigation program that can be conducted while the RID wells are not in full service. It is anticipated that the RID wells will return to full service in February 2011 and will be unavailable for further well investigation work until the next low

demand period or after a replacement well at RID-111 is constructed (see November 2010 letter from Gallagher & Kennedy to ADEQ).

In accordance with the conceptual outline given in Gallagher & Kennedy's November 15, 2010, letter to ADEQ, this Work Plan comprises Phase 1 of Well Investigations and is limited to wells RID-92, RID-95, and RID-114. RID will prepare a Phase 2 Work Plan for additional well investigations after the Phase 1 well investigation is completed. RID will address all of ADEQ's comments in the Phase 2 Work Plan. RID will resubmit the comprehensive Task 2 Work Plan for ADEQ review and approval before commencing with Phase 2 well investigation work.

Locations for RID wells in the WVBA are shown on **Figure 1**. This Phase 1 Well Investigation Work Plan was prepared to accomplish the following objectives:

- Demonstrate that the proposed well investigation work can be conducted at minimal risk to RID and provides meaningful information for the ERA.
- Document the existing construction and structural integrity of three RID wells that will be integrated into the ERA, and
- Characterize vertical distribution of groundwater flow and contaminants of concern (COC) in one deep ERA well that penetrates the Lower Alluvial Unit (LAU).

The WVBA Site is located within the West Salt River Valley (SRV) hydrologic sub-basin. In general, the basin-fill alluvial deposits in the SRV are subdivided into three hydrogeologic units from shallowest to deepest: 1) Upper Alluvial Unit (UAU), 2) Middle Alluvial Unit (MAU), and 3) Lower Alluvial Unit (LAU). The UAU within the WVBA Site was further divided into two subunits designated as the UAU1 and UAU2. **Figure 1** depicts the approximate boundaries of, relevant features within, and the extent of groundwater contamination in the WVBA Site. The extent of groundwater contamination associated with the WVBA Site is generally bounded on the north by Interstate 10, on the east by 7th Avenue,

on the south by Lower Buckeye Road, and on the west beyond 75th Avenue. RID owns and operates 32 large capacity water production wells within the WVBA Site; 21 of these wells are currently impacted by the groundwater contamination. Based on the reported hydrogeologic conditions in the WVBA Site in the Draft Remedial Investigation Report, the RID wells probably derive most of their water from the UAU. Groundwater pumping by RID represents the primary discharge from the WVBA Site (Terranext, 2008).

2.0 WELL INVESTIGATIONS

Well investigations will be conducted in a phased approach. The phased approach will allow critical tasks to be conducted in a timely manner and minimize impact on RID operations. The phased approach will also provide timely results that might be useful for groundwater modeling that will be conducted concurrently with the comprehensive well investigations conducted after RID-111 is redrilled and operational. This Work Plan addresses well investigations in wells RID-92, RID-95, and RID-114. These wells were selected for the following reasons: 1) to provide information for shallow and deep wells {two wells completed in the UAU and upper MAU (RID-92 and RID-114), and one well completed in the UAU, MAU, and LAU (RID-95)}; 2) to provide information for wells with the highest concentrations of volatile organic compounds (VOCs); 3) to minimize the risk to existing RID infrastructure; 4) to minimize the potential impact on RID operations; and 5) to complete the investigations before the increase in seasonal demand, which is expected to occur in February 2011.

The proposed Phase 1 scope of work includes the following tasks:

TASK 1: VIDEO SURVEYS
TASK 2: FLUID-MOVEMENT INVESTIGATIONS
TASK 3: ANALYSIS AND REPORTING

The scope of work for Phase 1 of well investigations will include video surveys as specified in Task 1 at ERA extraction wells RID-92, RID-95, and RID-114, and detailed well investigations as specified in Task 2 at well RID-95. Well RID-95 was selected for fluid-movement investigations because it is the deepest RID well proposed for use in the ERA and is perforated over an extensive interval that penetrates the UAU from 180 feet below land surface (bls), through the MAU, and to 1,775 feet bls in the LAU. Additionally, the risk of well testing to RID operations is reduced because the well has 24-inch well casing in the interval where the pump is set. A 1-page summary of available lithologic information for well RID-95 is given in **Attachment A**.

The detailed well investigations will include the following activities: remove existing pumping equipment; obtain video surveys of the wells; install test equipment that will allow access to zones below the pumps; purge the wells as needed to ensure future samples will be representative of normal pumping conditions; conduct geophysical logging to obtain caliper, temperature, and fluid conductivity data; conduct dynamic spinner logging operations to identify zones where water enters the wells; obtain groundwater samples at selected depths, including depths where the flow regime changes noticeably, during pumping operations to identify zones where contaminants enter the wells; and obtain wellhead samples and flow rate information for evaluation of the depth-specific data obtained.

2.1 TASK 1 – VIDEO SURVEYS

Video surveys will be conducted at wells RID-92, RID-95, and RID-114. These video surveys will be conducted to document the integrity and construction details of the well. Each video survey will include color images in both horizontal and vertical downhole views. Each video survey shall include a continuous downhole scan to total depth of the well and side view scans as appropriate.

The following information will be documented for each well: depth to water level; depth to top of fill material; description of water clarity and amount of suspended solids; depths to top and bottom of each major section of casing perforations; description of the type and number of perforations per foot; notes regarding integrity of well casing and degree of plugging of perforations; and notes regarding anomalous conditions in the casing and indications of vertical flow of water in the casing.

Following video logging at RID-92 and RID-114, RID will equip these wells with a sounding tube and pressure transducers, where feasible, and reinstall the existing or replacement permanent pumping equipment. The water level data obtained through pressure transducers will be used to evaluate measured water level changes that occur when RID wells resume pumping in the spring and refine aquifer parameters for subsequent groundwater modeling.

RID will evaluate whether any additional actions at the wells are prudent based on results of these well video surveys. RID will coordinate with ADEQ regarding any additional actions recommended.

2.2 TASK 2 – FLUID-MOVEMENT INVESTIGATIONS

Preliminary data available for well construction and depths to non-pumping water level for RID-95 are summarized in **Table 1**. These data will be confirmed and augmented, where possible, with data obtained during the video survey. The procedures summarized below for preparation and conduct of fluid-movement investigations will be completed at well RID-95.

2.2.1 Preparations for Testing

Following the video survey as described in Task 1, test pumping equipment will be installed in the well. Flow rate for testing operations will be designed to be as close to the normal operational pumping rate as feasible, within the constraints posed by the dimensions of the wells and testing equipment. All equipment installed in the well or used for testing operations, including the column and access pipes, will be properly decontaminated using hot water and a high-pressure sprayer at an off-site location prior to mobilization to the site. The testing equipment will include: a submersible pump set to the minimum depth required for testing operations; a 3-inch diameter access pipe set below the bottom of the pump assembly to allow the wire line tools to pass the pump and access the bottom of the well; a separate 1½-inch diameter access pipe set to the top of the pump bowls for measurement of water levels during testing operations; and other piping appurtenances such as a flow meter, pressure gage, flow control valve, and sampling port. The upper section of the 3-inch access pipe must not have perforations to allow calibration of the spinner logging tool. A small section of the access pipe will be perforated above the pump.

Prior to conducting the fluid-movement investigations at each well, the test pumping equipment will be operated at the design flow rate for a minimum cumulative period of 3 days to minimize the potential impact of vertical flow in the wells during the preceding period when the wells were idle. A duration of 3 days of pumping was selected to provide a reasonable and cost-effective amount of time to purge the well prior to conduct of fluid-movement investigations. Aquifer testing will be conducted during purging and pumping operations for the fluid-movement investigation. In combination with results of fluid-movement investigations, these test data will enable estimates of aquifer properties that can be used in modeling during the Feasibility Study process. Water produced from the wells during testing operations will be discharged to existing RID canal and lateral system.

A 24-hour constant-rate aquifer test will be conducted at the well. The flow rate will be monitored and adjusted as needed to maintain a constant value. Following the aquifer

test, the pump will be shut off and the water level in the well will be allowed to recover for 24 hours. Immediately after the recovery period, the pump will be re-started for an additional 2 days of purging at the same pumping rate as was used for the 24-hour test; however, the rate will only be monitored and adjusted periodically. During the 24-hour test, field measurements for pH, electrical conductivity, and temperature will be recorded. During this entire period, including the testing, recovery, and purging phases, water level will be monitored using pressure transducers; an electrical water level sounder will be used to confirm transducer data. Water levels measured during the drawdown and recovery periods will be analyzed to obtain aquifer transmissivity.

To maximize the interval below the pump during testing operations, the test pump will be set to provide a minimum submergence below the normal pumping water level; this will maximize the portion of the well where fluid movement investigations can be conducted below the pump. The minimum submergence required is generally determined by the net positive suction head required to prevent cavitation of the pump.

2.2.2 Testing Operations

Fluid-movement investigations and depth-specific sampling will be conducted at well RID-95 under non-pumping conditions with no equipment installed and under pumping conditions following the cumulative 3-day purging period. Fluid-movement investigations include geophysical logging to measure the flow rate of water at successive depth intervals within the cased borehole. When evaluated in conjunction with depth-specific samples obtained at appropriate depths, these data allow determination of differences in water quality and flow rate associated with specific zones where water and/or contaminants enter or exit the well.

The following geophysical logging and groundwater sampling will be conducted in the order listed:

1) Temperature / Fluid Conductivity Probe – This combination probe provides continuous measurements for fluid temperature and conductivity. Results of the conductivity log shall be compensated for temperature in the field.

2) Spinner Flow Meter - The spinner flow meter shall be used to measure flow rates in the well. For non-pumping conditions, the spinner flow meter shall be used in the following three modes: 1) during downward travel at a constant speed (logs will be obtained at up to three separate constant speeds); 2) during upward travel at a constant speed (logs will be obtained at up to three separate constant speeds); and 3) and at stationary depths selected based on results of the geophysical logs obtained previously. For pumping conditions, the spinner flow meter shall be used in the following two modes: 1) during downward travel at a constant speed (logs will be obtained at three separate constant speeds); and 2) at stationary depths selected based on results of the geophysical logs obtained previously.

3) Depth-Specific Water Sampling – Depths for sampling will be selected in the field based on results of geophysical logs obtained previously. Depth-specific water samples will be obtained using vacuum-actuated sampling tools lowered into the well via the geophysical contractor's wire line. Water samples will be analyzed for VOCs and selected general chemical constituents and parameters (such as total dissolved solids content, electrical conductivity, and pH). Analyses of general chemical constituents will be conducted to evaluate changes in general groundwater chemistry between aquifer zones. In addition, field measurements for pH, electrical conductivity, and temperature will be recorded for the water samples obtained.

4) Caliper – The caliper tool will be used to document the diameter of the well casing and to calculate volume flow rates based on linear flow velocities measured with the spinner flow meter tool.

The tests proposed will be conducted for all depths below the pump. All tests proposed can also and will be conducted above the pump, but some tests rarely provide useful results within this depth interval. Groundwater quality in the access pipe above the pump may be representative for the respective depths; therefore, depth-specific samples, fluid conductivity logs, and temperature logs will be obtained and analyzed. Groundwater flow conditions inside the access pipe above the pump are generally not representative of average flow conditions in that interval; therefore, spinner logging is generally not useful above the pump. The logging tools must pass through the interval above the pump to access the interval below the pump; therefore, spinner logging data will be conducted above the pump, but these data will likely not be analyzed quantitatively.

Locations for depth-specific samples will be selected based on lithology, well construction, and results of geophysical logging and spinner flow meter logging. All currently available lithologic data (**Attachment A**) and well construction data (**Table 1**) will be used to determine target sampling depths. Multiple depths will be selected and will include, at a minimum: major lithologic changes, including location of the projected UAU/MAU and MAU/LAU contacts; and locations where substantial changes in fluid conductivity, temperature, or flow rate are identified. In the field, additional samples will be obtained at depths where substantial flow into or out of the well are inferred based on results of the temperature, fluid conductivity, and spinner logging data. The logging will be conducted when ADEQ technical staff are available to observe the testing operations, and RID will confer with ADEQ regarding interpretation of the field data obtained from fluid flow and geophysical logs for final determination of depth-specific sample target depths and selection of any additional depth-specific samples, to the extent that this does not unduly delay the execution of the sampling operations.

Following completion of all tasks, the testing equipment will be removed and the existing or replacement permanent pumping equipment will be reinstalled. As feasible, the well will be equipped with a sounding tube and pressure transducer for continuous water level measurements.

2.3 TASK 3 – ANALYSIS AND REPORTING

Data obtained in Tasks 1 and 2 will be analyzed to assess well construction details, well casing integrity, and water levels for all three RID wells. For well RID-95, the data will also be analyzed to assess the vertical profile for both flow rate and water quality. A hydrogeologic report summarizing results of work completed will be submitted to ADEQ within 60 days of completion of the work. Data obtained and interpretations made based on the data will also be used to plan Phase 2 of the Well Investigation, improve the conceptual

hydrogeologic model of the groundwater flow regime in the WVBA and refine assumptions incorporated into the groundwater flow model for the Site.

2.4 METHODS AND PROTOCOLS

To the extent possible, the field activities, sampling methods, laboratory analyses and quality assurance procedures will adhere to protocols developed by ADEQ in the WVBA Field Sampling and Analysis Plan (FSAP), Quality Assurance Project Plan (QAPP) and Site-Specific Health and Safety Plan (HASP) (BE&K/Terranext, 2000a, b and c). As follows are notable exceptions and deviations from methods and procedures presented in the ADEQ documents include:

- Video logs will be conducted as described in Section 2.1 of this Work Plan.
- Depth-specific samples will be collected from well RID-95 during the detailed well investigation as described in Section 2.2.2. Samples from the wellhead shall be collected at proposed new, well-specific sample port installed at an access plug located on the discharge piping of each well. If necessary, sampling activities require more than one day.
- Purge water collected during water quality sampling at well RID-95 will be transferred to discharge collection box within the well site.
- During previous RID wellhead sampling activities conducted by ADEQ & M&A, one sample port was used and transferred between wells. Consequently, decontamination procedures described in the FSAP were required to prevent well cross-contamination. With the proposed installation of sample ports at the well, decontamination will not be necessary for this activity.

- Wellhead and depth-specific water quality samples will be analyzed for VOCs following EPA Test Method 524.2 (drinking water method), rather than EPA Test Method 624 (waste water method).
- Additional analyses may be requested for depth-specific water quality sampling including: total dissolved solids content (by Standard Method 2540 C), electrical conductivity (by Standard Method 2510 B), and pH (by Standard Method 4500-H+).
- Following review and acceptance of final laboratory reports, RID will prepare chemical data summary tables and attach to final laboratory reports for inclusion in the hydrogeologic report.
- Water level measurements will be obtained as described in Section 2.2.1 using a pressure transducer during and following well purging conducted for the proposed well testing of RID-95 to obtain drawdown and recovery data associated with short-term aquifer testing.

If any additional, unanticipated exceptions or other modifications to these Plans are determined prior to or after initiation of field work, RID will coordinate with ADEQ to identify and resolve.

3.0 SCHEDULE

The time available for conducting the Phase 1 scope of work described in this Work Plan is short. All work must be completed by February 1, 2011, to ensure access to RID wells during periods of lower water demand and well usage. Therefore, RID is prepared to work closely with ADEQ to expedite approval, bidding, contracting, scheduling, and completion of the work to meet the RID time constraint. RID will provide ADEQ with as

much notice as possible regarding scheduling all field activities to allow ADEQ technical staff to be available for oversight and sampling operations.

4.0 REFERENCES CITED

Arizona Department of Environmental Quality, 2010, **Conditional Approval of a Water Quality Assurance Revolving Fund (WQARF) Early Response Action (ERA) Work Plan for the West Van Buren Registry Site.** June 24, 2010.

BE&K/Terranext, 2000a, **Field Sampling and Analysis Plan, West Van Buren WQARF Registry Site, Phoenix, Arizona**: prepared for the Arizona Department of Environmental Quality, January 10, 2000.

_____, 2000b, **Quality Assurance Project Plan, West Van Buren WQARF Registry Site, Phoenix, Arizona**, prepared for the Arizona Department of Environmental Quality, 2000.

_____, 2000c, **Site-Specific Health and Safety Plan, West Van Buren WQARF Registry Site, Phoenix, Arizona**, prepared for the Arizona Department of Environmental Quality, 2000.

Terranext, 2008, **Draft Remedial Investigation Report, West Van Buren Area WQARF Registry Site, Phoenix, Arizona:** prepared for the Arizona Department of Environmental Quality, October 2008.

TABLES

TABLE 1.
SUMMARY OF CONSTRUCTION DETAILS FOR ROOSEVELT IRRIGATION DISTRICT WELLS IN WVBA SITE

Well Name	Canal Site	RID Location	ADWR Number	UTM Y NORTHING[a] (meters)	UTM X EASTING[a] (meters)	Land Surface Altitude (feet, msl)	Hole Depth (feet, bls)	Screened Interval(s) (feet, bls)	Unit(s) Screened[b]	Year Constructed	Casing Total Depth (feet, bls)	Casing Material	Casing Diameter (inches)	Drilling Method	Reported Depth to Water[c] (feet, bls)	Reported Pump Capacity (gpm)	Estimated Pumping Rate (gpm)	Pump Setting Depth (feet, bls)
RID-83	CC1SS	4-1/2E 4-3/4N	55-607227	3,701,539	385,814	1,027.61	790	170-790	UAU, MAU, LAU	1/12/72	790	Steel - 0.375-inch wall	18 16	Rotary	107	1,940	2,300	260
RID-84	CC1SS	5-3/4E 4-1/2N	55-607226	3,701,110	387,420	1,036.27	600	130-518	UAU, MAU	2/4/52	532	Steel - 10 gauge	20	---	106[d]	2,419	2,400	220
RID-85	CC1SS	6E 4N	55-607225	3,700,499	388,212	1,029.57	700	135-682	UAU, MAU, LAU	4/11/52	700	Steel	20	---	98[d]	3,495	2,600	180
RID-86	CC1SS	6-1/2E 3-3/4N	55-607224	3,699,885	388,798	1,030.55	300	55-288	UAU	10/22/40; redrill	300	Steel - 8 gauge	24	---	97	5,286	3,600	200
RID-87	CC1SS	7-1/2E 3-1/2N	55-607223	3,699,441	390,397	1,034.69	500	75-480	UAU, MAU	8/7/47; redrill	496	Steel - 8 gauge	20	---	98	4,570	2,000	200
RID-88	CC1SS	8E 3-1/2N	55-607222	3,699,621	391,203	1,033.63	1,800	165-820 835-1,485 1,500-1,785	UAU, MAU, LAU	11/29/64	1785	Steel - 8 gauge	24 20 16	Cable Tool	92[d]	3,718	2,000	290
RID-89	CC1SS	8E 4-1/4N	55-607221	3,700,825	391,427	1,043.47	1,800	180-805 860-1,434 1,465-1,770	UAU, MAU, LAU	4/29/65; redrill	1785	Steel - 8 gauge	20 16 12	Cable Tool	102[d]	3,853	3,900	200
RID-90	CC1SS	8-1/2E 3-1/2N	55-607220	3,699,620	392,011	1,032.64	460	110-446	UAU, MAU	5/13/52	446	Steel	20	---	88[d]	3,494	2,500	290
RID-91	CC1SS	9E 3-1/2N	55-607219	3,699,621	393,019	1,039.56	449	80-448	UAU, MAU	3/12/99	449	Steel	20	---	92[d]	5,510	3,200	280
RID-92	CC1SS	9E 4-1/4N	55-607218	3,700,619	393,032	1,048.82	500	180-488	UAU, MAU	2/9/59; redrill	488	Steel - 8 gauge	20	Cable Tool	104[d]	1,971	1,200	270
RID-93	CC1SS	9-1/2E 3-1/2N	55-607217	3,699,612	393,827	1,038.83	540	110-431	UAU, MAU	3/9/57	445	Steel - 8 gauge	24	Cable Tool	86	6,944	4,000	180
RID-94	CC1SS	10E 3-3/4N	55-607216	3,700,003	394,638	1,044.76	425	85-412	UAU, MAU	6/29/52	425	Steel	24	Cable Tool	91	6,138	3,300	180
RID-95	CC1SS	10E 4-1/4N	55-607215	3,700,801	394,647	1,054.05	1,800	180-815 836-1,470 1,497-1,775	UAU, MAU, LAU	12/29/64; redrill	1775	Steel - 6 & 8 gauge	24 20 16	Cable Tool	98	3,875	2,300	180
RID-96	CC1SS	10-1/8E 3-1/4N	55-607214	3,699,002	394,631	1,041.87	800	123-788	UAU, MAU, LAU	5/7/68	788	Steel	24	---	82[d]	4,480	3,000	180
RID-97	CC1SS	10-1/2E 3-1/8N	55-607213	3,698,788	395,240	1,042.	1,800	200-824 836-1,490 1,500-1,788	UAU, MAU, LAU	10/26/65	1788	Steel	24 20 16	Cable Tool	78	5,958	3,200	200
RID-98	CC1SS	11E 3N	55-607212	3,698,560	396,258	1,048.42	1,675	200-785 800-1,480 1,500-1,665	UAU, MAU, LAU	8/28/65; redrill	1675	Steel	24 20 16	Cable Tool	78	5,286	3,800	200
RID-99	CC1SS	11E 3-3/4N	55-607211	3,699,977	396,058	1,050.55	420	70-400	UAU, MAU	6/24/52	420	Steel - 8 gauge	24	Cable Tool	89	2,778	2,400	180
RID-100	CC1SS	11E 4-1/4N	55-607210	3,700,572	396,257	1,061.17	302	55-290	UAU	10/10/40	302	Steel - 8 gauge	24	---	102	3,136	2,100	230
RID-101	CC1SS	11-1/2E 3N	55-607209	3,698,758	396,860	1,050.	400	110-390	UAU, MAU	2/28/69; redrill	400	Steel - 8 gauge	24	---	81	6,720	4,500	180
RID-102	CC1SS	11-3/4E 3-3/4N	55-607196	3,699,960	397,262	1,055.12	440	85-414	UAU, MAU	8/4/52	428	Steel - 8 gauge	24	Cable Tool	86	5,958	3,900	170
RID-103	CC1SS	12E 3-1/4N	55-607208	3,698,948	397,663	1,058.01	440	80-420	UAU, MAU	8/1/52	440	Steel - 8 gauge	24	Cable Tool	86	4,614	2,200	220

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TABLE 1.
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Well Name	Canal Site	RID Location	ADWR Number	UTM Y NORTHING[a] (meters)	UTM X EASTING[a] (meters)	Land Surface Altitude (feet, msl)	Hole Depth (feet, bls)	Screened Interval(s) (feet, bls)	Unit(s) Screened[b]	Year Constructed	Casing Total Depth (feet, bls)	Casing Material	Casing Diameter (inches)	Drilling Method	Reported Depth to Water[c] (feet, bls)	Reported Pump Capacity (gpm)	Estimated Pumping Rate (gpm)	Pump Setting Depth (feet, bls)
RID-104	CC1SS	12-1/8E 3-3/4N	55-607207	3,699,953	397,864	1,058.	410	100-370	UAU, MAU	6/14/57; redrill (new location)	390	Steel - 8 gauge	24	Cable Tool	88	5,510	3,600	200
RID-105	Salt Canal	5E 5N	55-607206	3,701,924	386,623	1,033.61	622	80-508	UAU, MAU	7/16/42; redrill	622	Steel - 8 gauge	20	---	117	2,374	1,900	260
RID-106	Salt Canal	6E 5N	55-607205	3,701,890	388,246	1,041.62	790	80-776	UAU, MAU, LAU	5/30/42; redrill	790	Steel - 8 gauge	20	---	118	3,000	1,500	200
RID-107	Salt Canal	7E 5N	55-607204	3,701,867	389,824	1,049.69	414	200-404	UAU, MAU	5/27/43; redrill	414	Steel - 10 gauge	24 16	---	121	2,195	2,100	220
RID-108	Salt Canal	7-1/2E 5N	55-607203	3,701,846	390,432	1,054.6	284	62-270	UAU	11/22/40; redrill	276	Steel - 8 gauge	24	---	123	1,711	1,900	210
RID-109	Salt Canal	8E 5N	55-607202	3,701,830	391,446	1,058.01	500	140-394	UAU, MAU	5/18/57; redrill	406	Steel - 8 gauge	20	Cable Tool	125	2,845	2,400	200
RID-110	Salt Canal	9E 5N	55-607201	3,701,820	392,849	1,060.3	500	140-465	UAU, MAU	4/18/57; redrill	480	Steel - 8 gauge	20	---	112[d]	3,069	2,900	240
RID-111	Salt Canal	9-3/4E 5N	55-607200	3,701,802	394,459	1,062.45	454	55-192 206-442	UAU, MAU	3/30/43; redrill	454	Steel - 8 & 10 gauge	24 16	---	---	2,016	2,000	---
RID-112	Salt Canal	10-1/2E 5N	55-607199	3,701,571	395,856	1,064.44	650	300-635	UAU, MAU, LAU	9/15/43	650	Steel - 10 gauge	16	---	107[d]	3,136	1,700	210
RID-113	Salt Canal	11E 5N	55-607198	3,701,765	396,055	1,070.71	415	228-398	UAU, MAU	1/24/53	398	Steel - 10 gauge	20	---	n/a	3,136	2,300	220
RID-114	Salt Canal	11-1/2E 5N	55-607197	3,701,759	396,862	1,070.38	395	205-380	UAU, MAU	2/11/53	395	Steel - 10 gauge	20	---	108	2,240	2,500	220

Notes:

[a] Universal Transverse Mercator Zone 12, North American Datum 1927.

[b] Average depth to aquifer units: UAU from land surface to 310 feet bls, MAU from 310 to 500 feet bls, and LAU 500 feet bls and below (February 2010 ERA Work Plan).
Unit depths also determined based on Draft RI geologic cross sections prepared by Terranext.

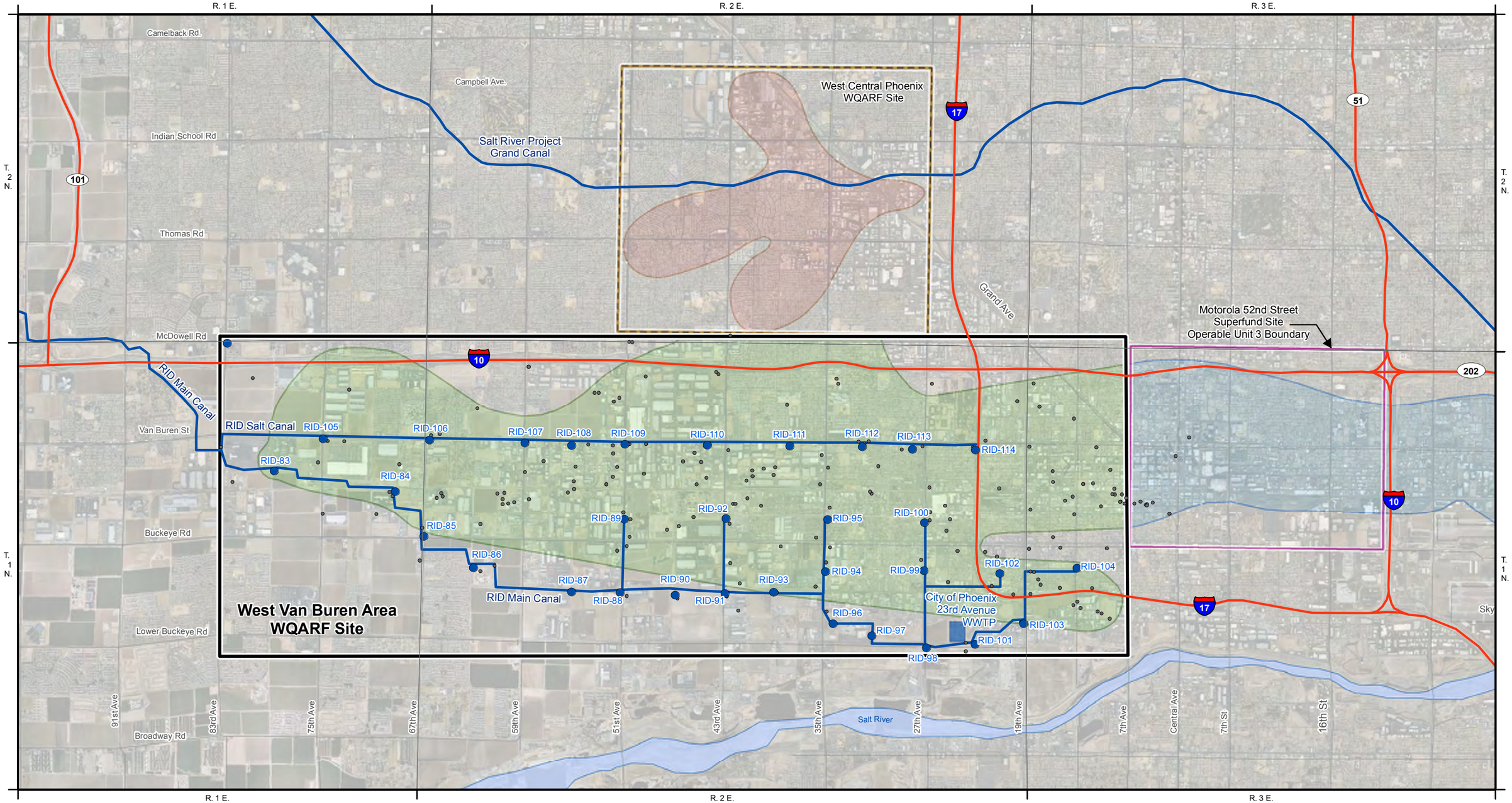
[c] RID reported 2008 non-pumping water levels.

[d] RID reported potential obstruction in well, or oil on water surface caused problem with sounder measurement.

RID-XX Yellow highlighted wells produce groundwater impacted by volatile organic compounds.

Abbreviations:
msl = above mean sea level
bls = below land surface
WVBA = West Van Buren Area

ILLUSTRATIONS



EXPLANATION

- Roosevelt Irrigation District Well
- Monitor Well
- Existing Canal or Pipeline
- Interstates
- Local Streets
- Estimated Extent of Impacted Groundwater in WVBA WQARF Site Based on 1st Quarter 2008 Data (Terranext, 2008a)
- Estimated Extent of Impacted Groundwater in West Central Phoenix WQARF Site
- Estimated Extent of Impacted Groundwater in Motorola 52nd Street Superfund Site

Abbreviations

WVBA - West Van Buren Area
WQARF - Water Quality Assurance Revolving Fund
WWTP - Waste Water Treatment Plant
RID - Roosevelt Irrigation District

N

0 5,000
Feet

Roosevelt Irrigation District
Early Response Action
Well Evaluation Work Plan

STUDY AREA

MONTGOMERY & ASSOCIATES
Water Resource Consultants

2010

FIGURE 1

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ATTACHMENTS

ATTACHMENT A

ROOSEVELT IRRIGATION DISTRICT (Redrill)

RID-92
WELL LOG

REPORT ON WELL 9E-4½N

Work started---------December 19, 1958
Work completed------February 9, 1959
Total depth----------500'
500' of 20" - 8 Ga. casing used
and left in the well.

LOG OF WELL

0' - 4'---------Brown Clay
4' - 9'---------Brown Clay and gravel
9' - 29'--------Sandy Clay
29' - 107'-------Gravel and boulders
107' - 218'-------Sand, Gravel and boulders
218' - 222'-------Caliche
222' - 238'-------Sandy clay, gravel and boulders
238' - 253'-------Soft brown clay
253' - 293'-------Sand and gravel ½"
293' - 319'-------Soft brown clay
319' - 343'-------Sandy clay and gravel
343' - 346'-------Coarse sand
346' - 500'-------Sandy clay and gravel

PERFORATIONS

COMPLETED IN MAIL

Moss Hydraulic perforator used
180' to 488' - 16 holes per 10 inches
Diameter - 3/16" - Length - 2½"
Depth at which water was first found - 113'
Standing level before perforating - 175'
Standing level after perforating - 112'

Well is straight from top to bottom

REMARKS

Drilled by Roscoe Moss Company-Cable Tool #39
Bill Hulsey, Driller

COST

For Drilling - Casing - Perforation
to a depth of 500'----------$ 12,765.00

Cost per foot----------$ 25.53

ATTACHMENT A

ROOSEVELT IRRIGATION DISTRICT

Redrill

RID-95
(1 of 2)
WELL LOG

REPORT ON WELL 10E-4¼N

Work started - July 7, 1964
Work Completed - December 29, 1964
Total Depth - 1800 feet
Depth of Casing - 1800 feet

LOG OF WELL

0 - 12 Top soil
12 - 114 sand and boulders
114 - 253 Loose sand and gravel
253 - 280 clay and gravel
280 - 350 caliche, clay and gravel
350 - 360 sand and gravel
360 - 385 sticky clay with hard streaks
385 - 410 sandy clay, coarse gravel
410 - 485 sticky clay, hard streaks
485 - 760 sticky gray clay
760 - 775 sand and gravel
775 - 795 sticky clay
795 - 807 sand and gravel
807 - 915 sticky clay, sandy streaks
915 - 1185 sand and gravel, some clay
1185- 1240 tight gravel, some clay
1240- 1530 granite, rock embedded in clay
1530- 1800 conglomerate, or hill formation.

PERFORATION

COMPLETED IN LAU

24" - 180' to 815' 12 holes per 5 inches
20" - 836' to 1470' 10 holes per 5 inches
16" - 1497' to 1775' 8 holes per 4 inches
Moss Hydraulic perforator used
Diameter of Perforations 5/16"
Length of Perforations 2¼"
Depth at which water first found 135'
Standing level before perforating 71'
Standing level after perforating 89'

836' of 24" 6 & 8 ga. casing used and left in well
678' of 20" 8 ga. casing used and left in well
317' of 16" 8 ga. casing used and left in well

REMARKS

Drilled by Roscoe Moss Company
Drillers - H.C. Cope, J.E. Garner, & M.G. Cope
Cable Tool Rig No. 47

Cost $65,273.88

ATTACHMENT A

ROOSEVELT IRRIGATION DISTRICT

RID-114

WELL DATA

Report on Well 11½ - 5N Deepening Job

Work Started	-	January 26, 1953
Completed Work	-	February 11, 1953
Total Depth	-	395'
Depth of Casing	-	202' - 20"

Log of Well

200'	-	206'	Caliche
206'	-	250'	Sand and gravel
250'	-	270'	Soft sandy clay
270'	-	290'	Clay
290'	-	350'	Sandy clay
350'	-	395'	Hard Clay

Perforations

Perforated from 205' to 380'
Perforations 5/8" x 5", 10 Holes per 12"

Standing level after perforating 85'

Type of perforator used - Mills

Remarks

Drilled by: Roscoe Moss Company
Driller: J. N. Olson

Cost

Drilling and casing 202' of 20" 10 gauge well 395' -$ 2,004.35

Roosevelt Irrigation District furnished 164'20" used Pipe. Roscoe Moss Company furnished starter and drive section