

February 8, 2013

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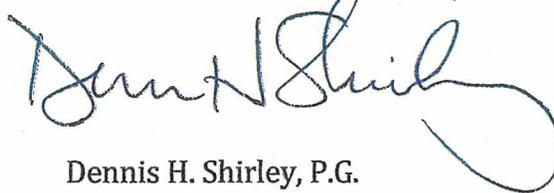


**RE: FINAL FEASIBILITY STUDY WORK PLAN, WEST VAN BUREN AREA (WVBA)
WATER QUALITY ASSURANCE REVOLVING FUND (WQARF) SITE**

Mr. Chiaradia:

On behalf of the Roosevelt Irrigation District, Synergy Environmental LLC is submitting a Final Feasibility Study Work Plan (FSWP) for the West Van Buren Area WQARF Registry Site incorporating minor revisions to the Draft FSWP to address comments identified in your letter dated February 1, 2013. We look forward to discussing the implementation of the Feasibility Study as part of our meeting planned next Wednesday.

Best Regards,
SYNERGY ENVIRONMENTAL, LLC

A handwritten signature in black ink that reads "Dennis H. Shirley".

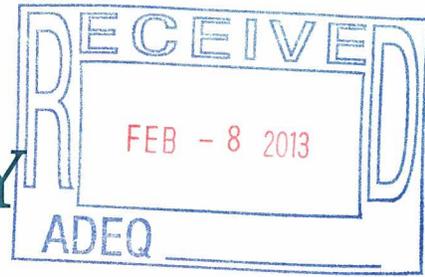
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FEASIBILITY STUDY WORK PLAN

REGIONAL GROUNDWATER REMEDY EVALUATION



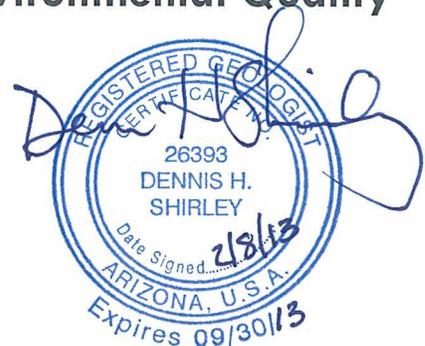
FEBRUARY 2013

WEST VAN BUREN WQARF REGISTRY SITE
PHOENIX, ARIZONA

Prepared by: **Synergy Environmental, LLC**

On Behalf of: **Roosevelt Irrigation District**

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



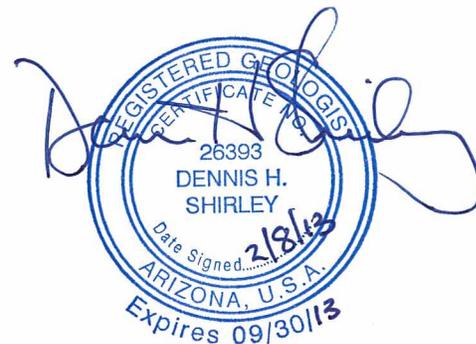


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- 1 FEASIBILITY STUDY VICINITY MAP**

LIST OF ACRONYMS

1,1-DCE	1,1- dichloroethene
1,1,1-TCA	1,1,1-trichloroethane
AAC	Arizona Administrative Code
AAR	Arizona Administrative Register
ADEQ	Arizona Department of Environmental Quality
ARS	Arizona Revised Statutes
AWQS	aquifer water quality standard
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
COC	contaminant of concern
COP	City of Phoenix
COT	City of Tolleson
CPPM	Central Phoenix Plume Model
CSM	conceptual site model
DNAPL	dense non-aqueous phase liquid
EPA	Environmental Protection Agency
ERA	early response action
FS	feasibility study
GAC	granular activated carbon
LAU	lower alluvial unit
M52	Motorola 52 nd Street Superfund Site
MAU	middle alluvial unit
MCL	maximum contaminant level
MTBE	methyl tertiary-butyl ether
OU	Operable Unit
PCE	tetrachloroethene
PRP	potentially responsible party
RI	remedial investigation
RID	Roosevelt Irrigation District
ROD	Record of Decision
SRP	Salt River Project
TCE	trichloroethene
UAU	upper alluvial unit
VOC	volatile organic compound
WCP	West Central Phoenix
WOC	West Osborn Complex
WQARF	Water Quality Assurance Revolving Fund
WVBA	West Van Buren Area
µg/l	microgram per liter

1.0 INTRODUCTION

Synergy Environmental, LLC has prepared this Feasibility Study (FS) Work Plan for the regional groundwater remedy evaluation of the West Van Buren Area (WVBA) Water Quality Assurance Revolving Fund (WQARF) Site (hereafter the WVBA Site). This FS Work Plan is submitted on behalf of Roosevelt Irrigation District (RID) to the Arizona Department of Environmental Quality (ADEQ) and pursuant to Arizona Revised Statutes (ARS) §§ 49-282.05 and 49-287.03 and to the terms of the *Agreement to Conduct Work* between ADEQ and RID dated October 8, 2009 (ADEQ, 2009).

1.1 Purpose of the Feasibility Study

As reflected in ADEQ's rulemaking preamble (Arizona Administrative Register, 2002), a FS is conducted to identify proposed remedies that may be capable of achieving remedial objectives (ROs) and to select a preferred remedy which:

- assures protection of public health, welfare, and the environment;
- provides for the control, management, or cleanup of hazardous substances so as to allow for the maximum beneficial use of waters of the state, to the extent practicable;
- is reasonable, necessary, cost-effective, and technically feasible; and
- addresses any well that either supplies water for municipal, domestic, industrial, irrigation or agricultural uses or is part of a public water system, if the well would now or in the reasonably foreseeable future produce water that would not be fit for its current or reasonably foreseeable end use without treatment.

1.2 Scope of the Feasibility Study Work Plan

This FS Work Plan is intended to specify the process that will identify the proposed groundwater remedy for the WVBA Site pursuant to regulatory requirements and community involvement. This Work Plan has been prepared in accordance with the requirements of Arizona Administrative Code (AAC) R18-16-407.

The FS will build on information incorporated in the *Remedial Investigation Report, West Van Buren Area WQARF Registry Site, Phoenix, Arizona* (hereafter, the *Final RI Report*), prepared by Terranext (2012), including the Final Remedial Objectives Report prepared by ADEQ. The FS will be fully integrated with the results of the WVBA Site remedial

investigation and, as such, much of the material on background understanding, observed soil and groundwater contamination, and characterization of the WVBA will be derived from and/or be referenced to the *Final RI Report* (Terranext, 2012).

The RI was conducted to identify sources where releases of hazardous substances may have impacted groundwater and evaluate the nature and extent of the comingled contamination in groundwater. The *Final RI Report* (Terranext, 2012) provides a comprehensive summary of site-specific investigations and source control remedial actions that have been conducted throughout the past 25 years. Consequently, this FS Work Plan assumes that actions taken to date under ADEQ oversight have adequately characterized and addressed the known sources of hazardous substances impacting the surface and subsurface soils and any further source control actions that are required to eliminate or mitigate a continuing source of contamination will be under ADEQ's lead. The scope of this FS will, therefore, not include source control actions for surface and subsurface soils in consideration of remedial alternatives for the groundwater remedy. Should any further information arise that identifies the need to address a presently unknown source of hazardous substances or loss or impairment of land use caused by contamination of surface and subsurface soils, it is further assumed that ADEQ will, independent of the groundwater remedy, assure the necessary actions are taken to remediate or control the hazardous substances causing the impairment or restriction to the land and/or groundwater use.

The primary issue of concern at the WVBA Site is groundwater contamination by chlorinated volatile organic compounds (VOCs). Three principal VOCs consisting of trichloroethene (TCE), tetrachloroethene (PCE), and to a lesser extent, 1,1-dichloroethene (1,1-DCE), are detected in groundwater at concentrations in excess of Arizona aquifer water quality standards (AWQS) throughout large parts of the WVBA Site. According to the *Final RI Report* (Terranext, 2012), the extent and concentrations of these VOCs detected in the groundwater plume suggest that multiple sources have contributed to the comingled plume over time.

There are other contaminants in the groundwater within the WVBA Site, such as chromium and organic constituents of petroleum products, including methyl tertiary-butyl ether (MTBE), benzene, toluene, ethyl benzene, and xylene isomers. These compounds will not be directly addressed in this FS. Although chromium is a hazardous substance and a designated WVBA Site contaminant of concern (COC), its occurrence is limited to localized areas in the groundwater that can only be clearly attributed to one known source area in the southeast portion of the WVBA Site (Terranext, 2012).

Although the federal Superfund Program, as indicated in 42 U.S.C. 9601(14), does not address releases of petroleum products, the WQARF Program can address petroleum releases, pursuant to ARS § 49-283.02, that are not currently subject to corrective action under the Arizona Underground Storage Tank Program and that have migrated in groundwater beyond the boundary of the property on which the petroleum release occurred. Nonetheless, the FS will not focus on petroleum releases directly, rather the FS will address the new VOCs generated and released by the disposal and release of petroleum products in groundwater contaminated with VOCs in the WVBA Site. Therefore, the scope of this FS is to develop a regional groundwater remedy to address widespread VOC contamination in groundwater attributed to WVBA COCs.

The WVBA Site is also part of a larger region of VOC groundwater contamination that encompasses the adjacent Motorola 52nd Street federal Superfund site (M52 Site) to the east and the West Central Phoenix WQARF Site (WCP Site) to the north as shown in **Figure 1**. Information provided in the *Final RI Report* (Terranext, 2012) indicates that groundwater contamination from Operable Unit 3 (OU3) at the M52 Site and sub-sites within the WCP Site migrates into and impacts the WVBA Site. Although the WVBA, WCP, and M52 sites are contiguous, they have been subdivided for the purpose of assisting administration and implementation of groundwater remedial actions. The United States Environmental Protection Agency (EPA) directs M52 Site remedial actions pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), or federal Superfund Program, whereas ADEQ is responsible for the WVBA Site and WCP sites under WQARF Program authority. The WVBA Site FS will integrate available information from the M52 and WCP sites, where appropriate, to provide regional context for the evaluation of groundwater.

Finally, as required by WQARF Program rules, the FS process will adhere to community involvement requirements of AAC R18-16-404 and rely upon ADEQ to coordinate public communication and comments. The FS Work Plan will be made available to the public, consistent with the *Community Involvement Plan for West Van Buren WQARF Site, Phoenix, Arizona* (ADEQ, 2011).

1.3 Feasibility Study Organization

The FS Report prepared for the regional groundwater remedy evaluation for the WVBA Site will include the following sections:

- Section 1 – Introduction
- Section 2 – Background
- Section 3 – Site Characterization
- Section 4 – Feasibility Study Scoping
- Section 5 – Identification and Screening of Remedial Alternatives
- Section 6 – Evaluation of Reference Remedy and Alternative Remedies
- Section 7 – Proposed Remedy
- Section 8 – Community Involvement

The following sections of this FS Work Plan coincide with the structure of the FS Report and describe the main elements to be included and technical approach that will be followed in conducting the FS.

1.4 Feasibility Study Schedule

A proposed schedule for the FS will be developed in consultation with ADEQ following the public comment period and in consideration of relevant Community Advisory Board and external Stakeholders input on the FS scope of work and development process. The proposed FS schedule will be submitted within 30 days following ADEQ's notice to proceed with conduct of the FS.

2. SITE BACKGROUND

This section of the FS Report will provide a summary of:

- Site Description and Physical Setting
- Contaminants of Concern
- Remedial Investigation Activities
- Early Response Actions
- Public Participation Activities

The following sections describe the main elements to be included and technical approach that will be followed in addressing these points in the FS.

2.1 Site Description and Physical Setting

Background information regarding the WVBA Site and its physical setting are available in the *Final RI Report* (Terranext, 2012). This information, which is based on Site remedial investigations and characterization that have been conducted since 1988, provides extensive background information to convey historical context and conceptual understanding of the WVBA Site. The FS will be fully integrated with the results of the WVBA Site remedial investigation and, as such, much of the Site background materials in the FS Report will derive from the *Final RI Report* (Terranext, 2012).

2.2 Contaminants of Concern

COCs in the groundwater at the WVBA Site principally consist of TCE, PCE, and 1,1-DCE. Concentrations of other VOCs observed in WVBA groundwater include 1,1,1-trichloroethane (TCA), 1,1-dichloroethane, cis-1,2-dichloroethene, 1,1-dichloroethene, and 1,4-dioxane. The occurrence and extent of VOCs in soil and groundwater throughout the WVBA Site suggest that multiple sources have contributed to regional groundwater contamination. The FS Report will provide a profile of each VOC and summarize the current understanding of the hazardous properties, environmental fate, and potential routes of exposure to public health and aquatic and terrestrial biota.

2.3 Remedial Investigation Activities

The *Final RI Report* (Terranext, 2012) contains the most complete and up to date summary of facility-specific and area-wide remedial investigations conducted at the WVBA Site. A chronology of Site activities and a summary of area-wide remedial investigations and source area remediation will be developed and listed in the FS Report.

The FS for the WVBA Site will provide an overview of relevant background information for the M52 and WCP sites to provide appropriate regional context for the WVBA Site remedy selection. Relevant documents to be reviewed and summarized in this overview of WVBA Site background may include, but are not limited to:

West Central Phoenix WQARF Registry Site:

- *Final Remedial Investigation Report, West Osborn Complex WQARF Site, West Osborn Road, Phoenix, Arizona* (GeoTrans, 2004).
- *Remedial Objective Report, West Central Phoenix-West Osborn Complex, Phoenix, Arizona* (ADEQ, 2005).
- *Final Feasibility Study Report for the Shallow Groundwater System, West Osborn Complex WQARF Site, Phoenix, Arizona* (GeoTrans, 2012a).
- *Final Feasibility Study Report for the Lower Sand and Gravel Subunit, West Osborn Complex WQARF Site, Phoenix, Arizona* (GeoTrans, 2012b).

Motorola 52nd Street CERCLA Site:

- *Second Five Year Review Addendum Report, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit No. 2 Area, Phoenix, Arizona* (EPA, 2007).
- *OU3 Administrative Settlement Agreement and Order on Consent for Remedial Investigation and Feasibility Study and Statement of Work* (EPA, 2010).
- *Final OU3 Phase III Groundwater Remedial Investigation and Feasibility Study Work Plan* (Environmental Resources Management, 2010).
- *Final Evaluation Report, End Use Alternatives for Remediated Groundwater, Operable Unit 1 (OU1), Motorola 52nd Street Superfund Site* (Clear Creek Associates, 2010).
- *Effectiveness Report – 2010, 20th Street Groundwater Treatment Facility, 52nd Street Superfund Site, Operable Unit No. 2 Area, Phoenix, Arizona* (Conestoga-Rovers & Associates, 2010).

- *2011 Sitewide Five-Year Review Report, Motorola 52nd Street Superfund Site, Phoenix, Arizona* (URS Corporation, 2011).

2.4 Early Response Actions

Two Early Response Actions (ERAs) have been conducted or are underway at the WVBA Site. Pursuant to AAC R18-16-405, an ERA is conducted to address current risks to public health, welfare, and the environment; protect or provide a supply of water; address sources of contamination; or control or contain contamination where such actions are expected to reduce the scope or cost of the remedy needed at the site.

ADEQ conducted an ERA at the American Linen Supply Company Facility to address a known source of VOC contamination. The ERA was initiated to reduce VOC concentrations in soils at the facility and control the migration of VOCs to and in groundwater. Extraction and treatment of VOCs in soil and groundwater were employed from 2000 to 2003 to complete the ERA. Over 118 million gallons of groundwater were pumped and treated removing an estimated 24 pounds of VOCs (Terranext, 2012).

A second ERA is underway to protect and provide a water supply from the most highly contaminated RID wells in the WVBA Site that is protective of all RID current and reasonably foreseeable municipal, agricultural and industrial end uses and to address current and future risks to public health, welfare and the environment from exposures to contaminants in the groundwater that are known to volatilize into the air when pumped from the most highly contaminated RID wells. Further information describing the RID ERA is documented in the February 3, 2010 *Work Plan, Roosevelt Irrigation District Early Response Action, West Van Buren Water Quality Assurance Revolving Fund Site* prepared for RID by Montgomery & Associates (2010) and the October 19, 2012 *Modified Early Response Action Work Plan* prepared by Synergy Environmental (2012) and summarized in Section 4 (Overview of Early Response Action) of this later document.

The FS Report will provide a summary of the ERAs conducted and underway at the WVBA Site. The summary will include an assessment of the effectiveness of both actions in addressing WQARF program goals of an ERA as well as their significance to the regional groundwater remedy evaluation.

2.5 Public Participation

The FS Report will summarize and include a chronology of community involvement and public participation in the WVBA Site remedial investigation/feasibility study process, including public input received on this FS Work Plan and development of the proposed regional groundwater remedy.

3. SITE CHARACTERIZATION

This section of the FS Report will provide a summary of:

- Geology and Hydrogeology
- Identification of Contaminant Sources
- Impacts from the M52 and WCP Sites
- Nature and Extent of Contamination
- Groundwater Model Development

The FS will integrate existing information available for the WVBA Site, and adjacent WCP and M52 sites, to document Site characteristics and groundwater conditions as part of the WVBA Site regional groundwater remedy evaluation. The *Final RI Report* (Terranext, 2012) provides the most comprehensive source of information pertaining to the WVBA Site but only provides limited reference to site conditions and sources from the WCP and M52 sites, sites that are potentially contributing to WVBA Site contamination. Any additional information available concerning site conditions, contributing VOC sources, and contaminant occurrence and transport from the M52 and WCP sites will be obtained from ADEQ, EPA, and other site documents such as those cited in the previous section.

The following sections describe the main elements to be included and technical approach that will be followed in addressing these points in the FS.

3.1 Geology and Hydrogeology

Remedial investigations of the WVBA, WCP, and M52 sites were initiated in the 1980s and extensive facility-specific and regional evaluations have been conducted to characterize area-wide geology and groundwater hydrology. The study area of these investigations covers a portion of the West Salt River Valley where the subsurface consists of alluvial sediments deposited in a structural basin. The thickness of the basin fill deposits ranges from less than 100 feet toward the east part of the M52 Site to greater than 1,000 feet underlying the WVBA and WCP sites. The sediments are divided into three hydrogeologic units that include the Upper Alluvial Unit (UAU), the Middle Alluvial Unit (MAU), and the Lower Alluvial Unit (LAU). Groundwater is present in all units but aquifer characteristics vary considerably among the units. The UAU is the most productive hydrogeologic unit and is known to produce large groundwater yields to wells throughout much of this region. In

terms of observed groundwater flow and contaminant transport, the principal hydrogeologic units of concern are the UAU, and to a lesser extent, the MAU. The basin sediments are underlain by a complex suite of older igneous, metamorphic, and well-lithified sedimentary rocks.

Existing information concerning geologic and hydrogeologic conditions at the WVBA, WCP, and M52 sites will be considered as part of the FS to provide regional context of hydrogeologic conditions. This review and analysis may include:

- lithologic logs from select monitoring and production wells distributed throughout all sites and analysis of physical properties of subsurface materials;
- alluvial unit sedimentological properties and heterogeneities in sediment composition and lateral and vertical variation of hydrogeologic unit thickness;
- groundwater elevations observed in unit-specific monitor wells at all sites to identify the direction of groundwater flow, hydraulic gradients, and seasonal change in hydrologic conditions;
- hydrologic data (e.g. hydraulic conductivity, storage coefficient, effective porosity, etc.) to characterize aquifer properties and potential spatial variability;
- location and magnitude of groundwater recharge and discharge areas, including groundwater pumping; and
- geologic cross-sections to depict and correlate the regional hydrogeologic framework of basin-fill alluvial deposits between sites and, where significant, underlying bedrock complex.

This information will be included, as appropriate, in the Conceptual Site Model (CSM) and presented in the FS Report.

3.2 Identification of Contaminant Sources

The *Final RI Report* (Terranext, 2012) provides results of approximately 50 soil and/or groundwater investigations conducted by facility owners and operators at suspected source areas within the WVBA Site. Among the facility-specific investigations, detailed descriptions of site investigations, remedial activities, and regulatory histories are given in the *Final RI Report* (Terranext, 2012) for nine facilities within the WVBA Site facilities owned and/or operated by:

- Air Liquide America Specialty Gases, LP;
- American Linen Supply Company;

- ChemResearch Company, Inc.;
- U.S. Department of Energy;
- Dolphin Industries, Inc.;
- Maricopa County Materials Management;
- Prudential Overall Supply;
- Reynolds Metals Company; and
- Van Waters & Rogers (now Univar USA Inc.).

Data and information from facility-specific investigation at these and all other WVBA facilities where COCs are known to be present in environmental media will be considered as part of the FS. In consultation with ADEQ, this evaluation will include any new information documenting contaminant source contribution at the WVBA Site that is obtained or available since publication of the *Final RI Report* (Terranext, 2012). The information and analyses developed in the identification and assessment of contaminant sources will be included in the regional CSM and presented in the FS Report.

3.3 Impacts from the M52 and WCP Sites

Groundwater contaminated with the same COCs found in the WVBA Site groundwater has been identified at the M52 Site east of the WVBA and at the WCP Site to the north. Data and interpretation provided in the *Final RI Report* (Terranext, 2012) indicate that contaminated groundwater from both sites enters the WVBA Site. Information from these adjacent sites will be evaluated as part of the FS, as appropriate, to ensure the CSM and remedy selection process consider regional groundwater contamination impacts and influences and incorporate consistent approaches to formulation of remedial alternatives and ultimately the groundwater remedy selected. A summary of each site follows.

3.3.1 Motorola 52nd Street CERCLA Site

The M52 site encompasses the regional groundwater contamination plume to the east of the WVBA Site as shown in **Figure 1**. Groundwater monitoring data indicate groundwater flow and contaminant transport in the plume is east to west. The M52 Site is subdivided into three operable units: OU1, OU2, and OU3. As previously mentioned, the M52 Site is a federal-lead site under CERCLA authority. Although the M52 Site is a federal CERCLA site, EPA designated ADEQ as the lead agency for oversight of OU1 and OU2 on the basis that groundwater remedies have been developed and implemented at these operable units. Interim groundwater pump and treat systems are currently operating in OU1 and OU2 to

address impacted groundwater within these OUs. According to the ADEQ's Narrative Site Information for the M52 site, on September 3, 2003, EPA issued General Notice letter to the following companies in OU2:

- D-Velco Manufacturing of Arizona
- Honeywell International, Inc.
- City of Phoenix
- U.S. Air Force
- ITT Industries
- Kachina Technical Services and Processes, Inc.
- Phoenix Industrial Properties, Ltd.
- Joray Corporation
- Laundry and Cleaners Supply, Inc.
- Papago Plating Company, Inc.
- B and G Investments
- Thomas and Nancy Stonebraker

EPA is now focused on the OU3 area and has directed Potentially Responsible Parties (PRPs) to conduct facility-specific work and an area-wide remedial investigation (EPA, 2010). The OU3 area is directly east of the WVBA Site and shares a common border along 7th Avenue and is bordered on the north by McDowell Road, on the east by 20th Street, and on the south by Buckeye Road. To date, no groundwater remedy has been implemented in OU3; therefore, impacted groundwater continues to migrate from OU3 to the WVBA Site. The following parties have been identified as PRPs at OU3 (Terranext, 2012):

- Arizona Public Service/Pinnacle West Capital Corporation
- Arvin Meritor/Adobe Air/Cooper Industries
- Baker Metal Products
- Capitol Engineering
- Fruehauf Trailer Sales/Wabash National Trailer Centers
- McCoy's Laundry and Dry Cleaners
- Milum Textile Services Company
- Phoenix Newspapers
- Salt River Project
- Walter Power Systems/Tierney Turbines
- Union Pacific Railroad
- Westinghouse

3.3.2 West Central Phoenix WQARF Site

Impacted groundwater north of the WVBA Site at McDowell Road between 27th and 51st Avenues is associated with the WCP Site and is being managed by ADEQ. Groundwater monitoring data indicate groundwater flow and contaminant transport, at least in shallow groundwater in the WCP Site, is to the southwest and into the WVBA Site (Terranext, 2012; GeoTrans, 2012).

The WCP Site is subdivided into 5 sub-sites: 1) East Grand Avenue, 2) West Grand Avenue, 3) North Plume, 4) North Canal Plume, and 5) West Osborn Complex, of which the West Osborn Complex (WOC) is the southernmost site and hence most closely associated with the WVBA Site. Three facilities have been identified as likely sources of groundwater contamination in the WOC (Terranext, 2012):

- United Industrial Corporation
- Corning Inc./Components Inc.
- NUCOR Corporation

A number of other industrial facilities have operated within the WOC in the past, as well as within the nearby North Canal Plume and East and West Grand Avenue sub-sites, where historical and current releases are suspected to have comingled with groundwater contamination in the WOC plume (GeoTrans, 2012).

ADEQ is currently in the process of finalizing a Proposed Remedial Action Plan for the WOC sub-site, having completed an FS pertaining to the shallow groundwater system (GeoTrans, 2012) and lower sand and gravel subunit (GeoTrans, 2009). The proposed remedy for shallow groundwater consists of 30 gallons per minute of groundwater extraction and treatment at the WOC source area with monitored natural attenuation of the bulk of the VOC plume extending to the WVBA Site. As such, impacted groundwater continues to migrate from the WOC to the WVBA Site.

3.4 Nature and Extent of Contamination

As summarized in the previous section, site investigations have been conducted at numerous industrial and commercial facilities over the past 25 years. These investigations have identified many and widespread sources of VOC contamination in soil and groundwater throughout the WVBA and adjacent sites. The impact of these source areas

on area-wide groundwater has been documented by remedial investigations that include data from a network of over 100 monitoring wells. This section describes the approach that will be taken to summarize the nature and extent of contamination impacting groundwater at the WVBA Site for the FS. This existing information will be included in the CSM and presented in the FS Report.

3.4.1 Soil/Unsaturated Zone

As a result of over 20 years of ADEQ investigations, the *Final RI Report* (Terranext, 2012), provides and references considerable data that document the types of contaminants, observed concentrations, and source area remediation that has been conducted at WVBA facilities. ADEQ has conducted or directed numerous facility investigations that are summarized in Section 2.0 (Previous Investigations) and Section 4.2 (Source Investigations) of the *Final RI Report* (Terranext, 2012). Given this historical focus on source areas and extensive work to characterize and remediate soil and vadose zone contamination, this FS Work Plan will not reconsider these source areas but rather will focus on critical factors potentially affecting the regional groundwater remedy (e.g. see Section 3.4.3).

3.4.2 Groundwater

Information from the *Final RI Report* (Terranext, 2012) indicates that VOCs are prevalent in groundwater throughout a large portion of the WVBA Site. The data indicate widespread VOC contamination within the UAU and, to a significant lesser degree, the MAU by TCE, PCE, 1,1-DCE, TCA, and other compounds that may be breakdown products. Further, the *Final RI Report* indicates that these same VOC contaminants are entering the WVBA Site from upgradient areas to the east (OU3 area of M52 Site) and north (WOC sub-site of WCP Site).

Concentrations of individual VOCs detected at WVBA Site groundwater monitoring wells are not uniform in groundwater, and there are notable lateral variations that suggest multiples sources have contributed, and may still be contributing, to the plume. Review of historical data generally indicates similar or higher concentrations of the VOC compounds existed at the time when area-wide monitoring was initiated at the WVBA Site in 1988. Similar temporal and spatial trends are evident in RID production wells throughout the WVBA Site.

The *Final RI Report* (Terranext, 2012) adequately characterizes the nature and extent of groundwater contamination for the FS. The data from water quality monitoring of WVBA

Site monitor wells and RID production wells will be compiled to further analyze spatial and temporal trends. Information from this assessment will also be used to define, to the extent possible, the estimated mass of dissolved groundwater contaminant mass and attenuation of contaminant mass over time and identify where data indicate the potential for continuing sources of dissolved groundwater contamination.

3.4.3 Potential Occurrence of DNAPLs

Groundwater within the WVBA Site is primarily impacted by VOCs that are chlorinated solvents, which are denser than water. The potential presence of liquid-phase VOCs from releases of these chlorinated solvents (commonly referred to as dense nonaqueous phase liquids [DNAPLs]) can serve as a long-term source of dissolved contaminant plumes and persist in groundwater over a long time, making it much more difficult to restore the aquifer. As such, the potential occurrence of DNAPLs at source areas within the WVBA Site will be evaluated as part of the FS.

DNAPLs are difficult to detect directly in the subsurface, which lends credence to the conclusion drawn in the *Final RI Report* (Terranext, 2012) that the presence of DNAPLs in the WVBA has not been identified. However, the presence of a DNAPL can sometimes be inferred based on site characterization data. Other indicators may include spatial patterns in groundwater or temporal trends in concentrations that may indicate a subsurface DNAPL source.

The data compiled in the preceding two sections that document the magnitude and spatial and temporal trends of contamination concentration in soil and groundwater at the WVBA Site will be utilized to evaluate the likelihood of DNAPLs. This analysis will follow methodology in EPA guidance documents (EPA, 1992; Cohen and Mercer, 1993) for analyzing potential DNAPL occurrence. In instances where site characterization data is not definitive, more detailed assessment may be conducted to include review of site history, solvent use, and facility operations to assist in the assessment of potential DNAPL occurrence.

3.4.4 Canal/Surface Water

There has been limited characterization of the nature and extent of contamination in surface water, including water conveyance canals, at the WVBA Site. Information regarding canal/surface water contamination at the WVBA Site is provided in the *Roosevelt Irrigation*

District Canal Characterization Report (BE&K/Terranext, 2001) and the *Public Health Exposure Assessment and Mitigation Summary Report* (Synergy Environmental, 2011). In addition to these studies, ADEQ has collected water quality samples from the RID Main and Salt Canals at various times throughout the course of Site remedial investigations.

While this FS Work Plan is focused on the development of a groundwater remedy, the process of selecting that groundwater remedy will address the relative effects that proposed remedial alternatives have on contaminant transfer to surface water in RID canals and its fate in the environment.

3.4.5 Air

There has also been limited characterization of the nature and extent of contamination in air at the WVBA Site. Information regarding the occurrence of COCs in air at the WVBA Site is provided in the following documents:

- *Roosevelt Irrigation District Canal Characterization Report* (BE&K/Terranext, 2001),
- *Analysis of Air Toxics Collected as Part of the Joint Air Toxics Assessment Project* (Hafner and O-Brien, 2006),
- *RID Early Response Action Public Health Exposure Assessment and Mitigation Summary Report* (Synergy Environmental, 2011).

While this FS Work Plan is focused on the development of a groundwater remedy, the process of selecting that groundwater remedy will address the relative effects that proposed remedial alternatives have on contaminant transfer to air and its fate in the environment. In addition, the ERA Work Plan (Montgomery & Associates, 2010) and recent modifications proposed to the ERA (Synergy Environmental, 2012) that are currently being implemented by RID includes specific provisions for implementing mitigation measures to control releases of COCs to air.

3.5 Groundwater Model Development

The *Final RI Report* (Terranext, 2012) describes efforts by ADEQ and its former contractor, Roy F. Weston Inc., to develop, calibrate, and validate a groundwater flow model for the WVBA Site (Weston, 2000 and 2001) as well as other models previously developed that encompassed the domain of the Weston model. This model is known as the Central Phoenix Plume Model (CPPM) and includes a model grid extending from 99th Avenue on the

west to 56th Street on the east and from Dobbins Road to the south to Camelback Road on the north. The final CPPM developed by Weston was a 5-layer transient groundwater model that simulated seasonal pumping in the model study area during the period from 1972 through 1998. The CPPM utilized the model code MODFLOW-SURFACT (HydroGeologic, 1996) to simulate groundwater flow.

The CPPM was designed to model aquifer conditions and groundwater movement and assist in the evaluation of remedial strategies and their effects on groundwater movement and the contaminant plume. Contaminant transport modeling was not conducted because the scale of the model was too large and the data requirements too extensive. Based on Terranext's review of model development, calibration, and validation, the *Final RI Report* (Terranext, 2012) concludes that the CPPM is capable of serving its intended purpose to evaluate remedial alternatives and contaminant movement in the study area.

The CPPM will be updated and recalibrated with relevant data through 2012 to serve as the basis for proposed modeling to simulate effects on groundwater from remedial alternatives that involve groundwater extraction. A task-specific work plan will be developed to guide the work to update, calibrate, and validate the model's use in the FS process. The model code MODFLOW-SURFACT will be used to simulate groundwater flow and the particle tracking code MODPATH (Pollock, 1994) will simulate hydraulic capture and advective contaminant migration. The Groundwater Vistas graphical user interface will be used to facilitate the modeling (Rumbaugh and Rumbaugh, 2007).

4. FEASIBILITY STUDY SCOPING

This section of the FS Report will provide a summary of key institutional requirements and implementation issues for consideration in development of response strategies and scenarios that include:

- Regulatory Requirements
- Response Actions/Remedial Goals at M52 and WCP Sites
- Current and Reasonably Foreseeable Land Use
- Current and Reasonably Foreseeable Water Use
- Remedial Objectives
- Conceptual Site Model

The following sections describe the main elements to be included and technical approach that will be followed in addressing these points in the FS.

4.1 Regulatory Requirements

ADEQ has established specific remedial action criteria pursuant to ARS §49-282.06 that must be met in consideration and selection of remedial action(s) for the WVBA Site.

Among other requirements, the designated remedial actions shall:

- Assure the protection of public health and welfare and the environment;
- Provide for the control, management or cleanup of the hazardous substances in order to allow the maximum beneficial uses of waters of the state, to the extent practicable; and
- Be reasonable, necessary, cost-effective, and technically sound.

For remediation of waters of the state that will be considered by this regional groundwater remedy evaluation, the selected remedy must address, at a minimum, any well that at the time of the remedial action either supplies water for municipal, domestic, irrigation or agricultural uses or is part of a public water system if the well would now or in the reasonably foreseeable future produce water that would not be fit for its current or reasonably foreseeable end uses without treatment due to the release of hazardous substances.

4.2 Response Actions/Remedial Goals at M52 and WCP Sites

The adjacent M52 and WCP sites are further advanced in the RI/FS process than the WVBA Site and have selected or initiated groundwater remedial actions at certain sub-sites to address contamination within their site boundaries. Relevant information pertinent to remedy selection at the M52 and WCP sites, such as ROs, regulatory requirements, development and selection of remediation technologies, and groundwater end use, will be compiled, reviewed, and documented as part of this FS. This evaluation will be summarized in the FS Report to provide benchmarks of requirements that are applicable or relevant and appropriate to WVBA groundwater remedy selection to ensure consistency and protectiveness of adopted remedial actions.

As follows is a brief summary of the groundwater remediation approach at these adjacent sites.

4.2.1 Motorola 52nd Street CERCLA Site

Interim groundwater remedies are currently operating at the OU1 and OU2 sub-sites of the M52 CERCLA Site. The primary remedial action objectives are to establish a capture zone across the entire width and depth of the contaminant plume in this region and reduce contaminant concentrations in the alluvial aquifer upgradient of the extraction wells. OU1 is intended to contain groundwater contamination from the source area at the Freescale Semiconductor Facility to approximately 40th Street, and OU2 addresses contamination west of the OU1 containment zone to approximately 20th Street. The extracted water is treated for VOCs to meet drinking water standards and discharges to the sanitary sewer at OU1 and to the Salt River Project (SRP) Grand Canal for agricultural irrigation purposes at OU2. The treatment technology employs air stripping and liquid-phase granular activated carbon (GAC) at OU1 and liquid-phase GAC and ultraviolet oxidation at OU2.

4.2.2 West Central Phoenix WQARF Site

The groundwater remedy for the WOC portion of the WCP WQARF Site was selected based on two separate feasibility studies conducted to address the shallow groundwater system (GeoTrans, 2012) and lower sand and gravel aquifer (GeoTrans, 2009). In both cases, the FS concluded that the remedial actions must protect and preserve the groundwater supply that has been lost to VOC contamination for use by all groundwater providers and applied treatment technologies must achieve drinking water standards for COCs. Liquid-phase GAC

was selected as the most cost effective treatment technology capable of reliably treating VOC contaminated groundwater while assuring a high degree of public protection against potential exposure to VOCs in air.

4.3 Current and Reasonably Foreseeable Land Use

As noted in the *Remedial Objectives Report* that is included as Appendix AA to the *Final RI Report* (Terranext, 2012), the entire WVBA Site is located within the City of Phoenix (COP) but the western margin of the Site abuts the City of Tolleson (COT) along 75th Avenue. The WVBA Site is located within two of the 15 “urban villages” that comprise the COP, Central City Village and Estrella Village.

Within the WVBA Site there are no village cores (a central focus with a pedestrian-oriented mix of land uses) or special planning districts. There are, however, large acreages of agricultural land available to be developed, especially in the western Estrella Village. Consequently, Estrella Village has been identified as a COP targeted growth area and is expected to experience significant increases in both employment and residential growth.

Land use in eastern COT, adjacent to the WVBA Site, is primarily agricultural/vacant and industrial. This area, similar to the COP Estrella Village area, is also expected to experience significant increase in growth.

Relevant information pertinent to zoning regulations and institution controls that may concern land use within the WVBA Site will be compiled, reviewed, and documented as part of this FS. This evaluation will be summarized in the FS Report to ensure that all remedial measures that may be contemplated as part of the groundwater remedy evaluation conform to current and reasonably foreseeable land use of all local governments with land jurisdiction.

ROs for land use are provided in Section 4.6.1.

4.4 Current and Reasonably Foreseeable Groundwater Water Use

The *Final RI Report* (Terranext, 2012) describes groundwater use in the WVBA under three general categories; municipal, agricultural and commercial/industrial/domestic use. Each of these general use categories is briefly introduced in the following sections.

4.4.1 Municipal Groundwater Use

The *Final RI Report* (Terranext, 2012) lists several entities that have expressed intent to or have reserved the option to pump groundwater from the WVBA for municipal use, including COP, RID, SRP, and COT. The COP has indicated that this impacted groundwater constitutes a vast reserve of water for use in meeting the COP's future municipal water needs. RID, SRP, and COT have indicated in planning documents and/or their respective Land and Water Use Study Questionnaires that impacted or threatened wells in the WVBA may be used as a drinking water supply for residential and commercial development in the foreseeable future.

In addition, the Town of Buckeye and the City of Goodyear have both submitted letters indicating interest in future utilization of remediated groundwater from the WVBA through agreement with RID.

Relevant information pertinent to COP, RID, SRP, and COT water resource planning and policies and any future development plans will be compiled, reviewed, and documented as part of this FS. This evaluation will be summarized in the FS Report to ensure that all remedial measures that may be contemplated as part of the groundwater remedy evaluation are consistent with the water management plans of affected water providers in the WVBA Site and vicinity.

ROs established for municipal groundwater use are provided in Section 4.6.2

4.4.2 Agricultural Groundwater Use

The majority of groundwater pumped within the WVBA Site for agricultural use is pumped by RID and transported via canal to District lands in the west valley. SRP has wells near the WVBA, which are used to pump groundwater for agricultural purposes, but none of these wells are located within the WVBA Site boundaries.

Relevant information pertinent to RID and SRP water resource planning and policies and any future development plans will be compiled, reviewed, and documented as part of this FS. This evaluation will be summarized in the FS Report to ensure that remedial measures that may be contemplated as part of the groundwater remedy evaluation are consistent with the water management plans of affected water providers in the WVBA Site and vicinity.

The RO established for agricultural groundwater use is provided in Section 4.6.2

4.4.3 Commercial/Industrial/Domestic Groundwater Use

ADEQ has been working with local stakeholders for many years to assess and quantify commercial/industrial/domestic groundwater use in the WVBA Site. While it has been concluded that these uses of groundwater within the WVBA Site are minimal, ADEQ concluded that private groundwater use within the WVBA does include commercial, industrial and domestic uses.

Relevant information pertinent to potential commercial/industrial/domestic groundwater use in the WVBA Site will be compiled, reviewed, and documented as part of this FS. The impact, if any, of WVBA Site contamination on private well owners that use groundwater for commercial/industrial/domestic purposes will be summarized in the FS Report.

ROs established for commercial/industrial/domestic groundwater use are provided in Section 4.6.2

4.5 Current and Reasonably Foreseeable Canal/Surface Water Use

Groundwater pumped from RID wells within the contaminated region of the WVBA Site discharges to a network of canals and laterals that convey water by surface flow for RID use. The RID Main Canal originates at 19th Avenue south of Interstate 17 and carries treated wastewater from the COP 23rd Avenue Wastewater Treatment Plant as well as water from groundwater extraction wells that discharge directly into the Main Canal or through lateral feeder canals.

SRP owns and operates a canal, the Grand Canal, that trends east-west to the north of the WVBA Site, transporting both surface water and groundwater. Oriented north-south from the Grand Canal, at approximately 0.5 mile intervals, are open and piped lateral canals that transport water by gravity southward. These lateral canals are also fed by a number of local SRP production wells; however, no SRP wells are located within the WVBA Site.

Relevant information pertinent to RID and SRP water resource planning and policies and any future development plans will be compiled, reviewed, and documented as part of this FS. This evaluation will be summarized in the FS Report to ensure that remedial measures that may contemplate use of RID and SRP surface water delivery systems as part of the groundwater remedy evaluation are consistent with the water management plans of affected water providers in the WVBA Site and vicinity.

Municipal Groundwater Use

Based upon review of public comments, which identified water quality degradation and the potential establishment of more stringent maximum containment levels, ADEQ's ROs for Municipal Groundwater Use are as follows:

- To protect, restore, replace or otherwise provide a water supply for municipal use by currently and reasonably foreseeable future municipal well owners within the WVBA WQARF Site if the current and reasonably foreseeable future uses are impaired or lost due to contamination from the Site. Remedial actions will be in place for as long as need for the water exists, the resource remains available and the contamination associated with the WVBA WQARF Site prohibits or limits groundwater use. Remedial actions to meet ROs will be implemented upon issuance of the ROD. If there is an imminent risk to human health or the environment, then an ERA may be initiated prior to implementation of the ROD.
- To protect, restore, replace or otherwise provide a water supply for municipal use by currently and reasonably foreseeable future municipal well owners within the WVBA WQARF Site if the current and reasonably foreseeable future uses are impaired or lost due to contamination from the Site. Remedial actions will be in place for as long as need for the water exists, the resource remains available and the contamination associated with the WVBA WQARF Site prohibits or limits groundwater use. Remedial actions to meet ROs will be implemented upon issuance of the ROD. If there is an imminent risk to human health or the environment, then an ERA may be initiated prior to implementation of the ROD.

Agricultural Groundwater Use

Based upon review of public comments, ADEQ's ROs for Agricultural Groundwater Use are as follows:

- To protect, restore, replace or otherwise provide for the current and reasonably foreseeable future supply of groundwater for agricultural/irrigation use and for the associated recharge capacity that is threatened by or lost due to contamination associated with the WVBA WQARF Site. Remedial actions will be in place for as long as need for the water exists, the resource remains available and the contamination associated with the WVBA WQARF Site prohibits or limits groundwater use. Remedial actions to meet ROs will be implemented upon issuance of the ROD. If there is an imminent risk to human health or the environment, then an ERA may be initiated prior to implementation of the ROD.

there is an imminent risk to human health or the environment, then an ERA may be initiated prior to implementation of the ROD.

- To protect, restore, replace or otherwise provide a water supply for potable or non-potable use by RID wells outside the current plume boundaries of the WVBA WQARF Site if the current and reasonably foreseeable future uses are impaired or lost due to contamination from the Site. Remedial actions will be in place for as long as need for the water exists, the resource remains available and the contamination associated with the WVBA WQARF Site prohibits or limits groundwater use. Remedial actions to meet ROs will be implemented upon issuance of the ROD. If there is an imminent risk to human health or the environment, then an ERA may be initiated prior to implementation of the ROD.

SRP Canal Water Use

Based upon review of public comments, ADEQ's single RO for SRP Canal Water Use is as follows:

- To protect, restore, replace or otherwise provide a water supply for potable or non-potable use by SRP wells outside the current plume boundaries of the WVBA WQARF Site if the current and foreseeable future uses are impaired or lost due to contamination from the Site. Remedial actions will be in place for as long as need for the water exists, the resource remains available and the contamination associated with the WVBA WQARF Site prohibits or limits groundwater use. Remedial actions to meet ROs will be implemented upon issuance of the ROD. If there is an imminent risk to human health or the environment, then an ERA may be initiated prior to implementation of the ROD.

4.7 Conceptual Site Model

An important and fundamental requirement for the WVBA Site regional groundwater remediation evaluation is a well-defined CSM. Information obtained as part of the FS process will be used to prepare a representative CSM for the WVBA Site. The goal of the CSM is to understand the relationship between sources of contamination, migration pathways, and receptors associated with the Site and identified COCs. The CSM synthesizes what is known regarding the Site physical setting and relevant Site features and main processes that control contaminant fate and transport and actual or potential impacts of the contamination on public health and the environment.

be applied to different portions of the aquifer. As previously noted, however, it is presumed that actions taken to date under ADEQ oversight have adequately characterized and addressed the known sources of hazardous substances impacting the surface and subsurface soils. Therefore, source control actions to eliminate or mitigate a continuing source of soil contamination will not be considered as an element of the groundwater remedy evaluation and any further source control actions that are required will be conducted independent of the groundwater remedy under ADEQ lead.

As set forth in AAC R18-16-407(G), remedial measures necessary to achieve ROs will be identified for each remedial alternative in consultation with and/or considering the needs of the water providers or known well owners in the WVBA Site whose water supplies are affected by the release or threatened release of hazardous substances. Within the WVBA, RID is the major impacted groundwater provider. There are 32 RID wells in the WVBA vicinity that are impacted by or threatened to be impacted by VOCs that are COCs in area-wide groundwater. In fact, recent monitoring conducted in September 2012, identified detectable concentrations of VOCs in 23 of the 26 RID wells that were sampled and found that 14 RID wells were impacted by at least one VOC at a concentration exceeding EPA maximum contaminated levels (MCLs).

In identifying remedial measures, the needs of the well owners and water providers and their customers, including the quantity and quality of water, water rights and other legal constraints on water supplies, and the reliability of water supplies and any operational implications will be considered. Remedial measures may include, but are not limited to, well replacement, well modification, water treatment, provision of replacement of alternative supplies, or engineering controls. Consistent with ARS § 49-282.06(B)(4)(b), remedial measures will address any well that at the time of selection of the remedy, either supplies water for municipal, domestic, industrial, irrigation or agricultural uses or is part of a public water system if the well would now or in the reasonably foreseeable future produce water that would not be fit for its current or reasonably foreseeable end uses without treatment due to the release of hazardous substances. The specific measures to address any such well shall not reduce the supply of water available to the well owner.

5.2 Screening of Remediation Technologies

Applied remediation technologies are required to implement remedial strategies that utilize remedial measures to address source control, controlled migration, physical containment, and plume remediation. Remedial technologies consist of the actual equipment, materials,

and/or processes used to implement the remedial strategy and measures. Appropriate remedial technologies to address VOC contamination impacting WVBA Site groundwater and capable of meeting ROs for land and water use will be identified and screened according to the following criteria:

- Applicable or relevant and appropriate regulatory requirements;
- Consistency with regional remedial actions sites;
- Contaminant treatment effectiveness and reliability;
- Implementability;
- Operation and maintenance requirements;
- Generation and management of residual waste products; and
- Cost effectiveness.

As previously stated, this FS Work Plan assumes that actions taken to date under ADEQ oversight have adequately characterized and addressed the known source areas of hazardous substance releases to surface and subsurface soils. Consequently, the scope of this FS is limited to consideration of remediation technologies for the groundwater remedy.

Based on similar work at other sites and consideration of presumptive technology selection for remedies addressing VOCs in extracted groundwater (EPA, 1996), technologies that have been identified for treatment as a remedial measure to address VOC contamination in groundwater at the WVBA Site will include, but may not be limited to:

- Groundwater extraction and treatment by air stripping
- Groundwater extraction and treatment by GAC
- Groundwater extraction and treatment by chemical/UV oxidation

In accordance with AAC R18-16-407(G), other remedial measures including, but not limited to, well replacement, well modification, and engineering controls will also be evaluated in terms of achieving remedial objectives or satisfying water provider requirements to address wells impacted or threatened by WVBA Site groundwater contamination.

All remedial actions considered shall, consistent with ARS § 49-282.06(A), assure protection of public health and welfare and the environment; to the extent practicable, provide for the control, management, or cleanup of the hazardous substances in order to allow the maximum beneficial use of the waters of the state; and be reasonable, necessary, cost-effective, and technically feasible.

Following screening, the treatment technologies that have been retained for further consideration as groundwater response actions will be evaluated for their consistency with general land use plans of local governments with land use jurisdiction and their consistency with the water management plans of affected water providers. Selected technologies that rank the highest and conform to the threshold requirements for land and water use will be retained and combined with selected strategies and measures to develop the reference remedy and alternative remedies.

5.3 Development of the Reference Remedy and Alternative Remedies

As set forth in AAC R18-16-407(E) and based on the formulation of remedial strategies and measures and screening of remedial technologies described in previous sections, at least three remedial alternatives will be developed for detailed evaluation in the FS. Remedial alternatives will consist of a reference remedy and two or more alternative remedies. Each remedial alternative will consist of the specific remedial strategy and all remedial measures determined to be capable of meeting ROs for land and water use. Where appropriate, the remedial alternatives may incorporate different remedial strategies for different aquifers or portions of aquifers and include contingent remedial strategies or remedial measures to address reasonable uncertainties regarding the achievement of ROs or uncertain time frames in which ROs will be achieved. As previously noted, source control will not be considered as an element of the proposed remedial alternatives.

The RID ERA (Montgomery & Associates, 2010) presents a remedial strategy to address certain contaminated RID wells within the WVBA Site and will be included as a component of one or more of the remedial alternatives to be evaluated as part of this FS process.

5.3.1 Reference Remedy

As set forth in AAC R18-16-407(E)(2), the reference remedy will be developed based on best professional judgment following engineering, geological, or hydrogeological standards of practice, considering the following and provided that it meets ROs for land and water use.

- Information in the *Final RI Report*;
- Best available scientific information concerning available remedial technologies; and
- Analysis of comparison criteria and the ability of the reference remedy to comply with ARS § 49-282.06.

5.3.2 Alternative Remedies

Two or more remedial alternatives will be developed for comparison with the reference remedy. WQARF Program rules set forth in AAC R18-16-407(E)(3) require that at least one of the alternative remedies will employ a remedial strategy or combination of strategies that is more aggressive than the reference remedy and at least one of the alternative remedies will employ a remedial strategy or combination of strategies that is less aggressive than the reference remedy. A more aggressive strategy is one that requires fewer remedial measures to achieve ROs, a strategy that permanently achieves ROs in a shorter period of time, or a strategy that is more certain in the long term and requires fewer contingencies. A less aggressive remedial strategy will still be capable of achieving site ROs, but may use different viable technologies or less intensive application of remedial measures.

6. EVALUATION OF REFERENCE AND ALTERNATIVE REMEDIES

This section of the FS Report will provide a summary of the comparative evaluation of remedial alternatives and the results obtained with respect to:

- Achievement of ROs
- Consistency with General Land Use and Water Management Plans
- Analysis of Comparison Criteria
- Detailed Comparison of Alternative Remedies

The following describes the main elements to be included and technical approach that will be followed in addressing these points in the FS.

6.1 Achievement of ROs

As set forth in AAC R18-16-407(H)(1), each of the remedial alternatives will be evaluated to demonstrate how the remedial strategies and measures combined in the reference remedy and alternative remedies achieve ROs for land and water use.

6.2 Consistency with General Land Use and Water Management Plans

As set forth in AAC R18-16-407(H)(2), each of the remedial alternatives will be evaluated to substantiate how the remedial strategies and measures employed for the reference remedy and alternative remedies are consistent with the general land use plans of local governments with land jurisdiction and the water management plans of affected water providers in the WVBA Site.

6.3 Analysis of Comparison Criteria

As set forth in AAC R18-16-407(H)(3), each of the remedial alternatives will be evaluated with respect to the comparison criteria of practicability, risk, cost, and benefit in accordance with the following analysis. As appropriate, the standard units of measure set forth in Appendix A of the WQARF Program remedy selection rules will be used for comparison of remedial alternatives.

6.3.1 Practicability

The practicability of each remedial alternative will be evaluated for comparative analysis in terms of its feasibility, short- and long-term effectiveness, and reliability. The evaluation of practicability will consider site-specific conditions, characteristics of the contamination resulting from the release, performance capabilities of available technologies to permanently and significantly reduce toxicity, mobility, or volume of hazardous substances, and institutional considerations which may affect the ease of undertaking remedial actions, such as the ability and time to obtain necessary approvals and permits, negotiate agreements, as well as access or acquire property for rights-of-way and construction.

6.3.2 Risk

Risk associated with each remedial alternative will be evaluated based on their overall protectiveness of public health and aquatic and terrestrial biota under reasonably foreseeable end uses of water. The risk evaluation will address and provide a screening-level comparative analysis of:

1. fate and transport of contaminants and contaminant concentrations and toxicity over the life of the remediation;
2. current and future land and resource use;
3. exposure pathways, duration of exposure, and changes in risk over the lifetime of the remediation;
4. protection of public health and aquatic and terrestrial biota while implementing the remedial action; and
5. residual risk in the aquifer at the end of remediation.

6.3.3 Cost

An estimate of the cost of each remedial alternative, including the expenses and losses associated with capital, operating, maintenance, and life cycle costs, will be developed for comparative analysis. The cost analysis will include: analysis of all projected water uses and costs associated with use-based treatment, other use impairment costs of water not remediated to water quality standards, and the cost of alternative water supply or treatment. Transactional costs necessary to implement the remedial alternatives, including the transactional costs of establishing long-term financial mechanisms, such as trust funds for funding of an alternative remedy, will be included in the cost evaluation. This evaluation will specify the specific sources of information and major assumptions used to derive cost

estimates and describe sources of uncertainty in the overall estimate and the impact of these uncertainties on the cost of the remedial alternatives.

Estimates of life-cycle costs will follow EPA guidance (EPA, 2000) for documenting FS cost estimates and present long-term cost projections in terms of a 30- and 50-year present value analysis. The discount rate used in the present value analysis will be developed in coordination with ADEQ and financial analysts.

6.3.4 Benefit or Value

The benefit, or value, attributed to each remedial alternative will be evaluated and provide a comparative assessment of factors such as:

1. lowered risk to human, aquatic and terrestrial species;
2. reduced concentration and reduced volume of contaminated water;
3. decreased liability and acceptance by the public;
4. aesthetics and preservation of existing uses;
5. enhancement of future uses; and
6. improvements to local economies.

6.4 Comparison of Alternative Remedies

A comparison of the reference remedy and alternative remedies will be made in order to evaluate and distinguish the findings from evaluation of the comparison criteria of practicability, risk, cost, and benefit. This comparative analysis will clarify the relative performance of each remedial alternative in relation to each specific evaluation criterion. The purpose of this analysis is to identify the advantages and disadvantages of each remedial alternative relative to one another. To the extent feasible, this comparison will be summarized in matrix form to provide a side-by-side comparison of the composite analysis of comparison criteria. Any uncertainties associated with the comparative analysis of remedial alternatives will be presented and the potential impact on the defined comparison criteria will be discussed.

7. PROPOSED REMEDY

The results of the detailed analysis provide the basis for identifying a preferred alternative for the regional groundwater remedy. Based on detailed evaluation and comparison of the reference remedy and other defined alternative remedies, a proposed remedy will be identified along with the rationale for selection of the proposed remedy in a draft FS Report submitted to ADEQ. The proposed remedy may be the reference remedy, any of the other alternative remedies evaluated in the FS, or a different combination of remedial strategies and remedial measures that were included in the alternative remedies evaluated in the FS. The FS will clearly define how the proposed remedy will achieve ROs, how the comparison criteria were considered, and how the proposed remedy meets the requirements of ARS §49-282.06.

8. COMMUNITY INVOLVEMENT

Public participation and community relations activities during the FS will adhere to community involvement requirements of AAC R18-16-404 and the *Community Involvement Plan for West Van Buren WQARF Site, Phoenix, Arizona* (ADEQ, 2011). Consistent with this Community Involvement Plan, ADEQ will lead the public outreach and coordinate public communication and comments. Specific community involvement activities may include the preparation and distribution of public notices describing the availability of the FS Work Plan and the Draft FS Report for public review and participation in public meetings to discuss each document. In order to broaden communication outreach and enhance transparency, RID, in coordination with ADEQ, will continue to deliver messages and information through the various communications channels and platforms developed for the Early Response Action. These channels and platforms may include one-on-one briefings, group presentations, electronic and print media, and web-based communications.

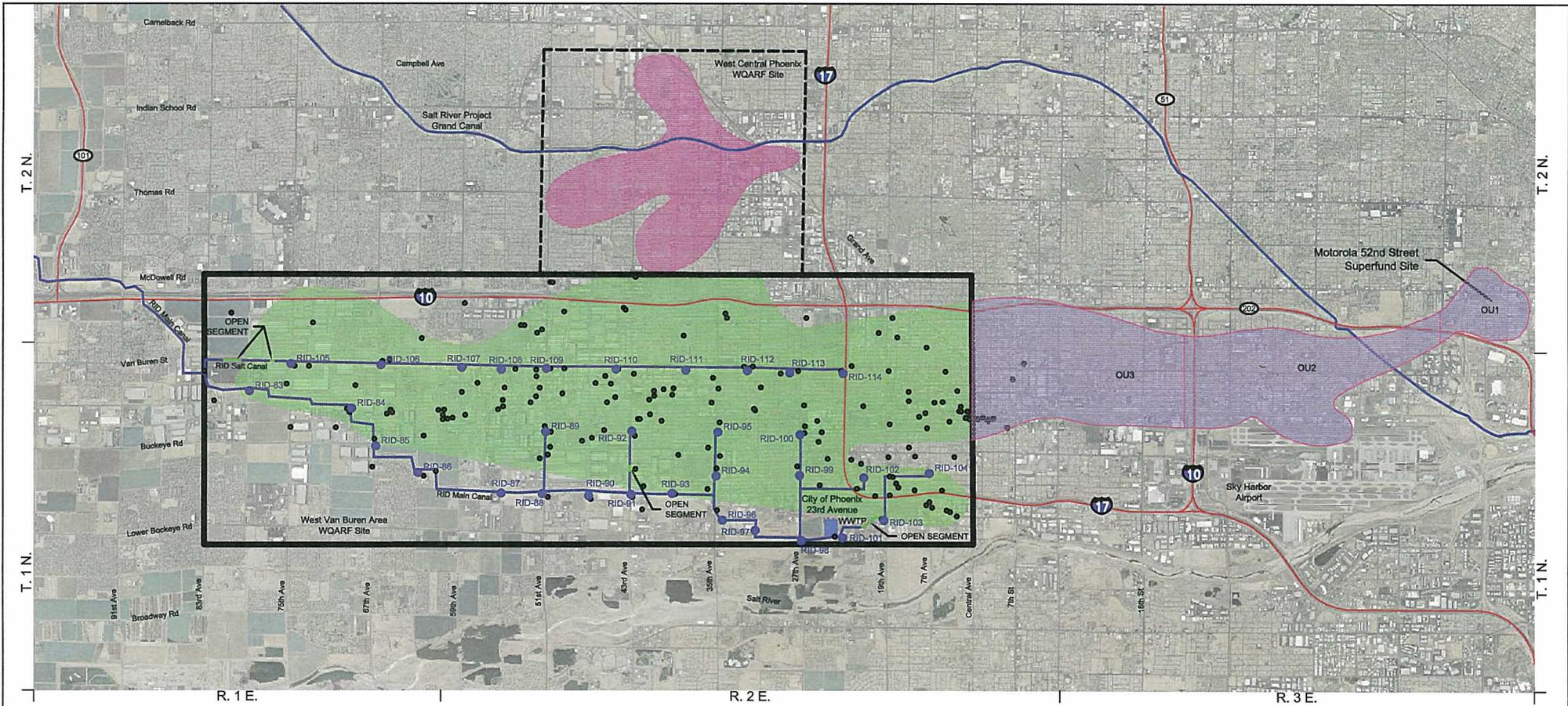
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VICINITY MAP



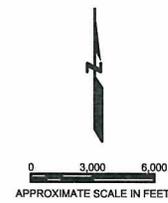
EXPLANATION

- Roosevelt Irrigation District Well
- Monitor Well
- Existing Canal or Pipeline
- Existing Canal Open Segment
- Interstates

- Estimated Extent of Impacted Groundwater in WVBA WQARF Site Base 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
- OU - Operable Unit



FEASIBILITY STUDY AREA

Roosevelt Irrigation District
West Van Buren Area
WQARF Site

By: LD Date: 09/27/12 Project No. 804.10

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Figure 1