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Additional Remedial Investigation Work Plan

14 October 2005

Prepared for:



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12 October 2005

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LIST OF ACRONYMS
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APE-West	American Promotional Events – West
bgs	below ground surface
COC	constituent of concern
EDD	electronic data deliverable
°F	degrees Fahrenheit
ft	feet
GeoSyntec	GeoSyntec Consultants
GIS	geographic information system
GLA	GeoLogic Associates
Goodrich	Goodrich Corporation
HSP	Health and Safety Plan
IDW	investigation-derived waste
MCL	Maximum Contaminant Level
MS	matrix spike
MSD	matrix spike duplicate
MSL	Mean Sea Level
MVSL	Mid-Valley Sanitary Landfill
NTU	Nephelometric Turbidity Units
Order	14 July 2003 USEPA Administrative Order for Remedial Investigation
ORP	oxidation-reduction potential
PDF	portable data format
PID	photoionization detector
PRP	potentially responsible party
PVC	polyvinyl chloride
QA	Quality Assurance
QC	Quality Control
RCP	Rialto Concrete Products
RI	Remedial Investigation
RWQCB	Regional Water Quality Control Board, Santa Ana Region
Site	160-Acre Parcel, Rialto, California
TICs	tentatively identified compounds
TCE	trichloroethene
USA	Underground Service Alert

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USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOCs	volatile organic compounds
WCLC	West Coast Loading Corporation

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1 INTRODUCTION

1.1 Terms of Reference

This Draft *Additional Remedial Investigation Work Plan* (Work Plan) was prepared by GeoSyntec Consultants, Inc. (GeoSyntec), on behalf of Goodrich Corporation (Goodrich), as a follow-up to meetings between Goodrich and the Regional Water Quality Control Board, Santa Ana Region (RWQCB). This Work Plan continues the remedial investigation of an area in Rialto, California, referred to by the RWQCB as the “160-acre parcel” (the Site) and incorporates comments made by the RWQCB on the draft Work Plan submitted on 8 September 2005. From the 1940s to the present, a number of entities are known or suspected to have handled and/or managed perchlorate or perchlorate-containing materials on the Site and on other parcels in the Rialto area. This Work Plan is intended to characterize the impacts to the groundwater downgradient of the Site.

This Work Plan was prepared by GeoSyntec professional staff under the direction of Karen Arteaga, P.E., of GeoSyntec, and reviewed by Ms. Arteaga in accordance with the peer review policy of the firm.

1.2 Purpose of the Work Plan

Consistent with the requirements of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, *et seq.*, established by the United States Environmental Protection Agency (USEPA), and in compliance with directives of the RWQCB, the Additional Remedial Investigation will collect data necessary (i) to assess the nature and extent of contamination and the threat, if any, to the public health, welfare, or the environment caused by the release or threatened release of hazardous substances, pollutants or contaminants at or from the Site and (ii) to adequately characterize the Site conditions for the purpose of developing and evaluating effective remedial alternatives.

An Administrative Order (the Order) dated 14 July 2003 was issued to Goodrich and Emhart Industries Inc., by the USEPA, Region 9 [USEPA, 2003] to conduct a Remedial Investigation (RI) of the Site. In compliance with the Order,

Goodrich conducted an RI from May 2004 through January 2005 [GeoSyntec, 2005a]. The RI consisted of a soil gas survey, a soil investigation, and the installation of four groundwater monitoring wells (PW-1 through PW-4) and three piezometers (PW-2A through PW-4A) at one upgradient and three crossgradient / downgradient locations relative to the Site. Groundwater level gauging of these wells and piezometers has been conducted on a monthly basis from October 2004 to present, and groundwater sampling of the monitoring wells has been conducted in October, November, and December 2004 and January, April, and July 2005. On 24 March 2005, on behalf of Goodrich, GeoSyntec submitted a draft Remedial Investigation Report to the USEPA and the RWQCB.

At the request of the RWQCB, this Work Plan was prepared to further investigate hydrogeological conditions in the vicinity and downgradient of the Site and to evaluate the areal and vertical extent of potential constituents of concern (COCs) detected in groundwater. As identified from the RI, COCs in groundwater beneath the Site include volatile organic compounds (VOCs), including trichloroethene (TCE), perchlorate and chlorate (which is a natural degradation product of perchlorate). These chemicals will be the target analytes for this investigation.

1.3 Scope of Work

The scope of work proposed in this Work Plan includes the following activities:

- Drilling of five boreholes downgradient (i.e., southeast) of the Site;
- Installing five multi-screened permanent Westbay[®] groundwater monitoring wells (PW-5 through PW-9) in the boreholes;
- Conducting groundwater level gauging and sampling of select wells in the Site vicinity, including wells associated with the 160-acre parcel (wells PW-1 through PW-9 and piezometers PW-2A through PW-4A), the monitoring well located on the Target Property (well TW-1), monitoring wells associated with the Mid-Valley Sanitary Landfill (wells N-1, N-6, and N-11), monitoring wells installed by the United States

Geological Survey (wells 1N/5W-27D2-4 and 1N/5W-28J2,3), and water production wells #22, Rialto Wells Nos. 1, 2, 3, 4, 5 and 6 (refer to Table 1 for available well construction details);

- Evaluating and summarizing the analytical data collected; and
- Preparing an *Additional Remedial Investigation Report* to describe the field activities and the results of this investigation.

1.4 Work Plan Organization

This Work Plan is organized as follows, with exhibits and attachments supporting the text:

- Section 2, *Background*, in which a brief Site description and history are presented and the physical aspects of the Site and vicinity are discussed;
- Section 3, *Groundwater Investigation*, in which the rationale and general procedures for implementing the investigation are described;
- Section 4, *Data Management and Reporting*, in which the procedures for recording, managing, and reporting the data collected during the groundwater investigation are presented and the expectations for the project schedule are described;
- Section 5, *References*, in which a list of the materials referenced in this Work Plan is provided;
- Appendix A, *Health and Safety Plan (HSP)*, which describes procedures for control of site access, mitigation of potential hazards, use of personal protective equipment and other topics related to worker health and safety during performance of the field activities;

- Appendix B, *Relevant Boring Logs*, which contains available boring logs for wells that are in the vicinity of the Site and relevant to this proposed investigation (see list in Table 1); and
- Appendix C, *Relevant Well Construction Diagrams*, which contains available well construction diagrams for wells that are in the Site vicinity and relevant to this proposed investigation (see list in Table 1).

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2 BACKGROUND

2.1 Site Description

The 160-acre parcel is located in the southwest quadrant of Section 21, Township 1 North, and Range 5 West, of the United States Geological Survey (USGS), 7.5 minute series “Devore, California” quadrangle map (1956, photo revised 1980). The Site is bounded by West Casa Grande Drive on the north, Locust Avenue on the east, the extension of Alder Avenue on the west, and the extension of Summit Avenue on the south in the City of Rialto, San Bernardino County, California (Figure 1). Various buildings and other structures are located throughout the Site, and several roadways run through the Site, including West Lowell Street and other unimproved roads. The Site is subdivided into smaller parcels, and there currently are at least 12 property owners within the 160 acres. Portions of the Site currently are used for commercial and / or industrial purposes, while other areas are open space or vacant. Current on-site activities include the following:

- American Promotional Events – West (APE-West), 3196 North Locust Avenue: Occupying the northern portion of the Site, APE-West imports, stores, and distributes fireworks and pyrotechnic materials [Locus Technologies, 2004].
- Pyro Spectaculars, 3196 North Locust Avenue: Occupying the northern portion of the Site, Pyro Spectaculars is a pyrotechnics company that develops and produces fireworks displays for large, public events [Locus Technologies, 2004].
- Rialto Concrete Products (RCP), 2250 West Lowell Street: Occupying the central and southwestern portion of the Site, RCP manufactures concrete pipes, including sewer pipes, storm drain pipes, and other large-diameter pipes [Marsh, 2001].
- B & B Plastic Recycling Inc., 3040 North Locust Avenue: Occupying the eastern-central portion of the Site, B & B Plastic Recycling Inc., is a facility that appears to warehouse plastic materials for recycling.

2.2 Site History

The Site originally was part of the approximately 2,000-acre Rialto Ammunition Storage Point, which was used by the United States military during World War II for the storage and transport of ordnance and explosives. After the military's tenure, the Site was owned and occupied by West Coast Loading Corporation (WCLC) from approximately 1952 through 1957. As reported in the Order, WCLC's activities at the Site included the loading, assembly, and testing of munitions with perchlorate for the United States Army and United States Navy (Paragraph 12 of the Order). On 1 July 1957, WCLC merged into Kwikset Locks, Inc., and sold the Site to Goodrich on or about 19 July 1957 (Paragraph 13 of the Order). From approximately 1957 to 1963, Goodrich operated on portions of the Site and these operations included research and development and limited production of missiles. Goodrich sold the Site in 1966.

After Goodrich's departure from the Site, various defense contractors, fireworks and pyrotechnic companies have operated on portions of the Site, including but not limited to Ensign-Bickford Company, Ordnance Associates, Pyrotronics Corporation, Pyro Spectaculars, Inc., and APE-West. These operations are known to have involved or are suspected to have involved the use of perchlorate and / or perchlorate-containing materials.

Over the past 60 years since the United States military's departure, other nearby parcels in the Site's vicinity also are known or suspected to have operations involving perchlorate or perchlorate-containing materials, including but not limited to Atlas Fireworks, Celebrity Fireworks, Broco, Inc., Broco Environmental, Inc., Denova Environmental, Whittaker Corporation, American Explosives Company, AMEX Products, Inc., Tasker Industries, General Dynamics, Zambelli Fireworks Manufacturing (also known as Zambelli Fireworks Internationale), The Marquardt Corporation, Trojan Fireworks, and Astro Pyrotechnics. Additionally, immediately southwest of the 160-acre parcel is the Mid-Valley Sanitary Landfill (MVSL), which is a 487-acre Class III municipal solid waste management facility owned and operated by the County of San Bernardino since 1958. The MVSL has expanded over the former location of explosive storage bunkers used by the United States military and subsequently by private entities and over areas where some of the above-referenced operations formerly occurred (e.g., Broco, Inc., Celebrity Fireworks, Atlas Fireworks).

Other entities in the area, such as the MVSL, are also known sources of other non-perchlorate constituents, including TCE [GeoLogic Associates (GLA), 2004].

2.3 Regional Geology and Hydrogeology

The Site is located within the northwest portion of the Rialto-Colton groundwater basin (Figures 2 and 3). Groundwater flow in the Basin is controlled by several barriers and faults, some of which delineate the boundaries of the basin. The Rialto-Colton Basin extends from Barrier J, which is located on the northwest, to the Santa Ana River on the southeast. On the northeast, the basin is bounded by the San Jacinto Fault, which separates the Lytle and Bunker Hill groundwater basins. To the southwest is the Rialto-Colton Fault, which separates the Rialto-Colton Basin from the Chino groundwater basin [GLA, 2003].

There is evidence that groundwater recharge in the northwest portion of the Rialto-Colton Basin is almost exclusively by leakage through Barrier J with a minor contribution from infiltration [Dutcher and Garrett, 1963]. Recent work by USGS indicates that significant underflow may occur across the northern portions of the San Jacinto Fault where it is coincident with Lytle Creek [Woolfenden and Kadhim, 1997; Woolfenden and Koczot, 2000]. Southwest of this area, underflow across the San Jacinto Fault (Barrier E) appears to be relatively limited. On the west side of the Rialto-Colton Basin, the northern portion of the Rialto-Colton Fault impedes groundwater flow. Leakage appears to occur in the southeastern portion of Rialto-Colton Basin into the adjacent Chino Basin where the Rialto-Colton Fault crosses the Santa Ana River. Groundwater in the Rialto-Colton Basin occurs within alluvial sediments. Groundwater flow in the northern central portion of the Basin flows to the south and southeast [GLA, 2003].

The USGS identified four hydrostatic units in the Rialto-Colton Basin: river-channel deposits, and the upper, middle, and lower water-bearing units [Woolfenden and Kadhim, 1997; Woolfenden and Koczot, 2000]. The river-channel deposits and upper water-bearing unit are saturated only in areas adjacent to water courses (e.g., Lytle Creek and the Santa Ana River). As reported by Woolfenden and Kadhim, the upper water-bearing unit is highly permeable and freely allows infiltration of precipitation, streamflow, and artificially recharged imported water, which percolates

into the water table [Woolfenden and Kadhim, 1997]. The middle water-bearing unit, which comprises the uppermost aquifer system beneath the site, is areally extensive throughout the Rialto-Colton basin and primarily consists of coarse to medium sand and interbedded silt and clay. “The middle water-bearing unit ranges in thickness from about 240 to 600 feet (ft) and is thickest in the northwestern part of the basin south of Barrier J” [Woolfenden and Kadhim, 1997]. The lower-water bearing unit also is areally extensive throughout the basin, consisting mainly of interbedded sand and clay, and ranges in thickness from 100 ft (southeastern portion of the basin) to 400 ft in other parts of the basin [Woolfenden and Kadhim, 1997]. The middle water-bearing unit yields abundant groundwater, while the lower water-bearing unit yields smaller volumes of groundwater.

An unnamed fault is located adjacent to the eastern boundary of the Site. “The unnamed fault is a partial barrier to groundwater movement in the middle water-bearing unit and an effective barrier in the lower water-bearing unit” [Woolfenden and Kadhim, 1997].

2.4 Local Geology and Hydrogeology

GLA, the consultant on behalf of the County of San Bernardino (owner of MVSL), reports the presence of three laterally continuous aquifers within what USGS identifies as the middle water-bearing unit [GLA, 1997 and 2003]. GLA identifies these laterally continuous aquifers as an upper, unconfined aquifer (A Zone), an intermediate, partially confined aquifer (B Zone), and a deep regional aquifer (C Zone). The C Zone reportedly provides much of the groundwater that is pumped in the area by municipal supply wells. The three aquifers are separated by aquitards that generally range in thickness from only a few feet to more than 30 feet [GLA, 1997 and 2003].

While the A Zone had a saturated thickness of approximately 15 to 35 ft between 1996 and 1998, regional drought conditions have resulted in dewatering of this Zone [GLA, 1997 and 2003]. GLA reported that the saturated thickness of the B Zone is approximately 40 to 140 ft in the vicinity of the MVSL. The B Zone consists of interbedded lenses of gravel, sand, silt and clay. The C Zone is estimated to be up to 150 ft thick in the vicinity of the MVSL. GLA reports that the B and C Zones are separated in the vicinity of the MVSL by a thick clay aquitard [GLA, 1997 and 2003].

The groundwater elevations between the B and C Zones differ by greater than 100 ft, which indicates that this aquitard is a competent barrier to vertical flow between these two zones in the vicinity of the MVSL [GLA, 1997 and 2003].

2.5 Site-Related Geologic and Hydrogeologic Conditions

2.5.1 Physical Geology

During the previous RI [GeoSyntec, 2005a], dual induction and / or gamma ray geophysical logs were collected from boreholes PW-1 through PW-4. Based on soil cuttings from each of the boreholes, physical properties of soil samples collected between depths of 486 and 601.5 ft bgs, and the interpretation of the geophysical logs, fine-grained materials are present at depths between 540 and 600 ft bgs in the vicinity of the Site [GeoSyntec, 2005a]. With the additional information from the temporary wells installed during the RI, including water levels (refer to Section 2.5.2) and water chemistry, it appears that temporary wells screened below 600 ft bgs generally were installed within the lower portion of the middle water bearing unit [GeoSyntec, 2005a]. Piezometers PW-2A, PW-3A, and PW-4A also appear to be installed and screened within the lower portion of the middle water-bearing unit, which may correspond to the C Zone as defined by GLA.

Based on the general chemistry data (i.e., alkalinity as carbonate (CaCO_3), sulfate, chloride, magnesium, calcium, sodium, potassium, total dissolved solids, and pH) collected from monitoring wells PW-1 through PW-4, these wells appear to be screened in the aquifer that correlates to GLA's B Zone [GeoSyntec, 2005a]. The general chemistry results of groundwater samples collected from monitoring wells PW-1 through PW-3 are similar to those reported in the nearby USGS monitoring wells screened within the middle water-bearing unit (i.e., 1N/5W-21K3, 1N/5W-21K4 and 1N/5W-28J2) [GeoSyntec, 2005a].

2.5.2 Groundwater Elevations and Flow Direction

GLA reports that the A Zone appears to be dewatered in the vicinity of the MVSL; therefore, it is assumed that the first water-bearing unit in the vicinity of the

160-acre parcel occurs within what GLA defines as the B Zone. The mid-point elevations of the monitoring wells screened in this Zone (wells PW-1 through PW-4) ranges from 1,591.81 to 1,684.48 ft MSL [GeoSyntec, 2005a]. Groundwater elevations measured in monitoring wells PW-1 through PW-4 indicate that groundwater in the first water-bearing unit is flowing to the southeast [GeoSyntec, 2005a]. With the exception of monitoring well PW-1, groundwater elevations have increased by approximately 5 ft in what GLA defines as the B Zone over the period between October 2004 and August 2005 [GeoSyntec, 2005b]. The increase in elevation in monitoring well PW-1 has been approximately 45 ft over that same time period.

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3 GROUNDWATER INVESTIGATION

3.1 Proposed Groundwater Monitoring Well Locations

Five multi-screened Westbay[®] groundwater monitoring wells (PW-5 through PW-9) are proposed for installation between 1 and 1.7 miles southeast (i.e., downgradient) of the Site (Figures 2 and 3). Groundwater monitoring well locations may be adjusted in the field based on access constraints and field considerations. Changes in the monitoring well locations will be discussed with RWQCB prior to drilling. As set forth in the Administrative Settlement Agreement between the RWQCB and Goodrich, up to four additional Westbay[®] groundwater monitoring wells may be installed consistent with the methodology and procedures outlined in this Work Plan.

3.2 Access and Permits

Goodrich will be responsible for obtaining access agreements from the appropriate owners and tenants for clearance of proposed borehole locations and for existing wells in the Site vicinity identified by the RWQCB for groundwater monitoring. The RWQCB may be contacted to assist in obtaining access at particular parcels where borehole drilling has been proposed or where groundwater monitoring is proposed.

A qualified California-licensed drilling contractor will conduct the subsurface drilling and sample collection. Prior to field mobilization, the necessary drilling permits (e.g., County of San Bernardino) will be obtained. Encroachment permits, if necessary, will be obtained from the City of Rialto prior to the commencement of field activities, for access to public right-of-ways for borehole drilling. For well locations that are in the public right-of-way, traffic control plans will be drafted by a licensed contractor and implemented as necessary.

3.3 Borehole Drilling

Field activities will be conducted in accordance with the project-specific Health and Safety Plan (HSP) (Appendix A). During drilling and sampling, a photo-ionization detector (PID) will be used to monitor the ambient breathing space (Appendix A).

Prior to drilling each borehole, USA will be contacted to help identify underground utility lines that may be located in the vicinity of the borehole. Additionally, a geophysical survey will be conducted at each of the boreholes to evaluate the potential existence of subsurface utility lines or other underground obstructions. Prior to drilling, each borehole will be air-knifed to a maximum depth of 10 ft bgs as a further precaution to avoid drilling through potential underground utility lines.

At each proposed location, boreholes will be drilled to approximately 650 ft bgs. The boreholes will be drilled using a 12.25-inch mud-rotary drilling bit. Mud rotary drilling uses a rotating drill pipe with a hard-tooled drill bit attached at the bottom to force fluid down through the drill pipe and then back up the borehole for discharge at the surface into a mud shaker. The cuttings are separated from the fluids in the shaker, and then the remaining fluid is recirculated back through the drill rods via a pump. The drilling fluid stabilizes the borehole wall and limits the inflow of formation fluids, which is intended to limit cross contamination of aquifers. The bentonite drilling mud will be monitored for weight, viscosity, and sand content with a mud scale, marsh funnel and cup, and a sand content kit, respectively. The excess drill cuttings will be transferred into on-site roll-off bins for temporary storage pending disposal offsite (Section 3.12).

The total depth of the borehole will be decided in the field based on the observations of the field geologist and in consultation with the RWQCB. The borehole will be terminated when the field geologist collects adequate information to assess that the borehole has reached what has been termed previously as the C Zone. Information used to reach this conclusion will include the field observations of drill cuttings and occurrence of water-producing zones, information gained from the previous drilling of wells for the 160-acre parcel, static groundwater levels and other available information from existing nearby groundwater wells. Field observations will be recorded in field

notebooks. Observations may include including drilling progress, properties of the drilling mud, occurrence of groundwater, and unusual conditions encountered during the drilling.

The drilling equipment (i.e., bits, pipes, mud shaker, and backfill equipment) either were new or cleaned in the field using a high-pressure steam cleaner.

Water used during drilling generally will be supplied from a nearby municipal hydrant that will be sampled prior to usage (Section 3.8.2).

3.4 Borehole Geophysics

Due to the difficulty of accurately logging boreholes when mud drilling techniques are employed, downhole geophysics will be the tool used to assess the lithology of the borehole, rather than detailed logs kept by a geologist. After completion of the borehole drilling and prior to the well installation, each borehole will be cleaned out and the mud in the hole will be thinned to facilitate installation of the well casing yet maintain stability of the borehole. Each borehole will be logged using geophysical methods to assist with the identification of discrete water-bearing units for the placement of well screens. The following geophysical techniques will be used:

- Laterolog (LL3)/Gamma Ray Log. The laterolog is a focused resistivity logging technique designed to achieve greater penetration into the formation than conventional resistivity (normal) logs. The result is a greater radius of investigation and more detailed resolution of lithologic changes in the formation. The gamma ray log records the amount of natural gamma radiation emitted by the rocks surrounding the borehole. The most common sources of this radiation are the unstable isotopes of potassium (K40), thorium (TH232), and uranium (U235 and U238). K40 is by far the most abundant of these elements because it is present in the most common rock-forming minerals such as potassium feldspars, biotite, and the clay minerals that form from the weathering of feldspars. Clay and shale-bearing zones often emit relatively high gamma radiation; thus, the gamma ray log will be used to identify these potential barriers to groundwater flow.

- Electric Logs. The electric log consists of the spontaneous potential (SP) curve, two resistivity curves of varying depths of investigation (the short and long normal resistivity curves), and the single point resistance curve. The electric log can be used to correlate the types of formation materials (e.g., sand, clay, hard rock).
 - Spontaneous-Potential Log. This method records potentials or voltages developed between the borehole fluid and the surrounding rock and fluids. Spontaneous potential logs can be used in the evaluation of lithology and water quality.
 - Short and Long Normal Resistivity. There are two types of resistivity curves typically used in electric logging; those of shallow penetration and those of deep penetration. The depth of penetration is related to the distance between the current electrode and the potential electrode on the resistivity sonde. The short normal or 16-inch resistivity curve may be influenced by invasion of the drilling fluid into the formation. The long normal or 64-inch resistivity curve shows the resistivity of the same zone further away from the borehole, beyond the invaded zone. In permeable soil or rock, the porosity affects the depth of invasion and the dissolved ion content of water in the pores determines the resistivity of the material. The two curves are plotted side by side for comparison.
- Sonic/Variable Density Log (VDL). The sonic tool is designed to measure the time it takes for a compressional sound wave (P wave) to travel laterally from the tool's transmitter through the drilling fluid to the borehole wall, through the formation and back across the drilling fluid to the tool's receivers. The sonic tool has one transmitter that emits sound pulses at a frequency of approximately 23 mega-Hertz and two receivers spaced at 3 ft and 5 ft above the transmitter to record the difference in time from transmission to reception. The travel time is related to the porosity of the formation and is recorded in micro seconds. The soniclog

will be used to investigate changes in porosity and to distinguish between air-filled and water-filled porosity.

The presentation of the typical open hole sonic log includes a variable density log or display of the full wave train recorded by the 5-ft receiver on the sonic log tool.

- Caliper Log. The caliper log may be used as a tool for recording borehole diameter. Changes in the borehole diameter can be related to the type and size of the drill bit, the drilling technique, the physical properties and consistency of the formation, the degree of fracturing or caving along the borehole wall and the location of groundwater-producing zones. Borehole diameter can be useful in interpreting and correlating the other geophysical logs because it can affect the log response of the other methods.

The results of the geophysical techniques noted above will be submitted to the RWQCB along with proposed well construction diagrams containing recommendations for the locations of Westbay[®] screens. The number and locations of screen intervals will be dependent upon the lithology and will range from two to a maximum of seven per well. Following RWQCB concurrence with the well construction diagram, the well casings will be installed (Section 3.5).

3.5 Well Casing Installation and Development

An outer well casing will be installed in the borehole following the completion of the downhole geophysics. The casing will be constructed of 4-inch diameter low carbon steel riser pipe and 5- to 30-ft stainless steel wire-wrap screens with 0.010- inch horizontal slots in the areas slated for Westbay[®] ports. In addition, the 10 ft of blank casing above and below each screen will be of stainless steel construction as well, transitioning to the low carbon steel. Each section of screen and blank casing will be measured before being lowered into the boring to define depths of screen placement. Screen and well casings will be flush-threaded, and a bottom cap will be installed at the base of each well. A 20-ft or 25-ft sump also may be installed at the bottom of the well. The length of the well screens will be dependent on the number and locations of the zones targeted for Westbay[®] ports, and will be approximately 5- to 30-ft

long, depending on specific hydrogeologic conditions and the downhole geophysics. As noted in Section 3.4, the proposed well construction diagrams will be submitted to the RWQCB for review and approval prior to well construction.

Well construction materials will be new, factory-decontaminated materials. Centralizers will be used to promote proper positioning of the well screen in the borehole. Sand packs (#3 sand) will be installed from approximately 1 ft below to 3 ft above each well screen using tremie placement techniques. Each sand pack will be surged and settled and additional sand will be placed to the desired depth. Approximately 2 ft of fine-grained transition sand layer (#2/16 sand) will be placed above each sand pack. Above each fine-grained transition sand layer, a 1:1 mixture of bentonite chips and coarse sand is installed using positive displacement tremie techniques, up to approximately 5 ft below the bottom of the next highest well screen. The monitoring wells will be completed with a protective surface casing complete with lockable cap or with a flush-mounted lockable cap and concrete collar. Final locations and elevations of the monitoring wells will be recorded by a State-licensed land surveyor.

During the well construction and development, to the extent possible, the drilling mud will be removed from the well to allow the groundwater to flow into the well, filter pack and casing for future sampling.

No more than 24 hours after installation, the 4-inch diameter well will be developed to remove residual drilling mud from the borehole and remove fine-grained sediments from the screen intervals. Limiting the time between well completion and the beginning of development will be critical, as much of the drilling mud will have been removed from the borehole by that time (i.e., during well construction). Thus, there will be a potential for cross contamination between the screened intervals, which will not be isolated from one another at that time. A straddle packer (K-packer) apparatus will be used to separate each screened interval. The screened intervals will be developed one at a time, first by bailing the residual drilling mud from the casing and then surging with a swab tool to draw fine-grained materials into the filter pack and well casing. Then the fine-grained material in the well casing and sump will be removed using a stainless steel bailer. Then, each screened zone will be developed in sequence via air lifting. Air lifting will continue until the driller deems it possible to safely and efficiently use an electronic submersible pump for the continuation of

development. At that point, the well screens will be scrubbed and development will continue via submersible pump, one screen at a time. Field measurements of water quality parameters (i.e., temperature, pH, specific conductance, and turbidity) will be recorded periodically during development using a water quality meter, such as a Horiba U-10 or equivalent. The wells will be judged satisfactorily developed when water quality parameters have stabilized in three consecutive readings to within 10%. Due to the use of mud drilling techniques, it may not be possible to achieve stabilization of the turbidity parameter. The progress of development will be recorded in the field logbook.

Water generated during development of the 4-inch diameter well will be stored in roll-off bins pending disposal (Section 3.12).

3.6 Westbay® Well Installation and Polishing

After development of the 4-inch diameter well, multi-port Westbay® wells will be installed within the 4-inch steel casing. The Westbay® system consists of the following components, which will be new and will arrive at the site wrapped in plastic:

- 1.5-inch-diameter Schedule 80 PVC blank casing;
- PVC couplings used to connect various casing components;
- PVC measurement-port couplings that allow access to the aquifer for pressure measurements and water sampling;
- PVC pumping-port couplings that allow access to the aquifer for well purging and hydraulic conductivity testing; and
- Nitrile rubber inflatable packers that seal the annulus between the measurement and pumping ports at each screened interval.

Specific technicians trained and certified by Westbay® of Vancouver, Canada, for installation of the wells will be in the field to perform the installation. Prior to the initiation of Westbay® installation activities, the Westbay® components will be organized in sequence at the ground surface on racks and partly assembled in

accordance with the proposed well construction diagram approved by the RWQCB. The Westbay[®] casing “string” will be assembled by lowering the casing segments into the 4-inch diameter steel casing by hand and attaching each successive segment to the adjacent coupling one at a time. Each coupling will be pressure tested before it is lowered downhole. After the Westbay[®] casing is placed in the well, nitrile rubber packers will be placed in the well between screen intervals and inflated with water, one at a time, beginning with the lowest packer, using Westbay’s[®] downhole tool. The Westbay[®] technician will perform several quality assurance and quality control (QA/QC) checks on the ports, the seals and the packers both during and following installation of the string.

After the Westbay[®] string is installed, a polishing step will be conducted to remove stagnant water and residual suspended materials remaining in the well casing from the initial well development. The polishing will be completed using a low-flow gas displacement submersible pump capable of fitting inside the 1.5-inch diameter Westbay[®] casing. The pump will be lowered into the well one screened interval at a time. The port on the Westbay[®] will be opened to expose the Westbay[®] screen, and the low-flow pump will purge approximately three casing volumes of groundwater from the zone. The process will be repeated for each screened zone until the polishing step is completed.

In addition to the installation, the Westbay[®] technician will provide approximately 2 days of training to the field staff in techniques for pressure profiling and fluid sampling. The training will include bench tests and operation of the equipment and selected well operation tasks to demonstrate procedures and give trainees the opportunity to gain experience under Westbay[®]’s supervision.

3.7 Groundwater Monitoring Activities

3.7.1 General

Groundwater monitoring events conducted in accordance with this Additional RI will include the following:

- Sampling of the individual screen intervals at boreholes PW-5 through PW-9, after installation and development of the 4-inch diameter steel casing but before installation of the Westbay® string;
- Sampling from the individual Westbay® ports at boreholes PW-5 through PW-9, after installation and development of the Westbay® system;
- Sampling of the 160-acre parcel monitoring wells, select USGS monitoring wells, and select water supply wells approximately one month after the last of Westbay® wells PW-5 through PW-9 is installed and polished. The following wells will be included (Figure 3; Table 1):
 - Monitoring wells PW-1 through PW-4;
 - Each port of Westbay® wells PW-5 through PW-9;
 - Monitoring wells 1N/5W-27D2, 1N/5W-27D3, 1N/5W-28J2 and 1N/5W-28J3 installed by the USGS (select screens); and
 - Water production wells West Valley Water District (WVWD) #22 and Rialto Wells Nos. 1, 2, 3, 4, 5 and 6 (select screens).

The groundwater samples will be analyzed for the COCs, i.e. VOCs, perchlorate, and chlorate. In addition, samples from select monitoring wells and piezometers and some individual screen intervals will be analyzed for general chemistry parameters (Tables 1 and 2, Section 3.10).

- Water-level gauging to be conducted approximately one month after the last of Westbay® wells PW-5 through PW-9 is installed and polished, contemporaneous with the sampling event noted above. In addition to the wells noted above for sampling, the following wells will be included:
 - Piezometers PW-2A through PW-4A;
 - Monitoring well TW-1 located on the Target property; and

- Monitoring well 1N/5W-27D4 installed by the USGS.

The monitoring of wells other than those associated with the 160-acre parcel will be contingent upon well access agreements (Section 3.2). Furthermore, gauging and sampling activities will be coordinated, to the extent possible, with activities conducted at the MVSL, so that data can be collected at similar time periods to facilitate interpretation. The cooperation of the County and its consultant in this effort is critical to obtaining these data.

3.7.2 Groundwater Monitoring Procedures

There are three different types of groundwater monitoring events to be conducted for this Additional RI:

- Monitoring of screen intervals in the steel casing prior to Westbay® installation;
- Monitoring of the Westbay® well screens; and
- Monitoring of conventional wells.

The first monitoring event will occur in the new wells PW-5 through PW-9 after the 4-inch diameter steel casing is installed and developed but before the Westbay® string is installed. Before the samples are collected, each screened interval will be purged using a submersible pump. The sampling interval will be isolated from the remainder of the well and other screen by use of a rubber K-packer above and below the targeted screen interval. The pump will be connected to and between the packers and connected to the surface using 2-inch galvanized steel discharge pipe. Field measurements of water quality parameters (i.e., temperature, pH, specific conductance, dissolved oxygen, oxidation-reduction potential [ORP] and turbidity) will be recorded periodically during purging using a water quality meter, such as a Horiba U-22 or equivalent. Each zone will be judged satisfactorily purged when water quality parameters have stabilized in three consecutive readings to within 10%. After purging, the sample will be collected from the individual screened zone and the process will be repeated at the next zone. Sampling equipment will be decontaminated prior to use at each well.

For subsequent monitoring events at PW-5 through PW-9, after the Westbay[®] wells have been installed, Westbay[®]'s proprietary MOSDAX sampler probe will be used. Because the samples from the Westbay[®] ports are collected directly from the aquifer, purging prior to sampling is not necessary. Trained personnel will lower the MOSDAX probe into the Westbay[®] casing and locate the desired port using magnetic sensors. The sampling probe will be "docked" at the desired measurement-port and the sample will be collected. After collection, the sample will be brought to the surface and transferred to the appropriate sample containers. The sampling probe will be decontaminated prior to use at each well.

For sampling at other conventional wells (i.e., PW-1 through PW-4, USGS wells, production wells) the wells first will be purged using electric submersible pumps or bailers. Groundwater samples will be collected after a minimum of three well volumes are removed and water quality readings (i.e., temperature, specific conductance, dissolved oxygen, ORP, turbidity, and pH) have stabilized in three consecutive readings to within 10%. Water quality measurements will be collected periodically during purging using a water quality meter, such as a Horiba U-22 or equivalent. Groundwater samples then will be collected using a factory-sealed, double-check valve, disposable, polyethylene bailer. Sampling equipment will be decontaminated prior to use at each well.

For each of the events described above, static water levels will be measured and recorded to the nearest 0.01 ft prior to groundwater sampling. For traditional monitoring wells and piezometers, an electronic sounding device will be used. For the Westbay[®] wells, groundwater elevation will be measured indirectly at each screened interval by recording pressure with the MOSDAX probe and converting that to a groundwater elevation.

Unfiltered groundwater samples will be transferred into laboratory-supplied containers (Table 2), labeled, and transported to the California-certified laboratory for analysis (Sections 3.9 and 3.10). Samples will be analyzed using standard laboratory turnaround times and results will be reported to the RWQCB consistent with the procedures outlined in Section 4.

3.8 Field Quality Assurance / Quality Control (QA/QC)

3.8.1 General

Field QA / QC samples that will be collected during this proposed investigation include duplicate groundwater samples, hydrant water samples, equipment blanks, and trip blanks. A description of each field QA / QC sample is discussed below, and sample nomenclature, storage, and transport is presented in Section 3.9. Refer to the Quality Assurance Project Plan provided as Appendix D of the Final *Remedial Investigation Work Plan* [GeoSyntec, 2004] for data quality objectives and a description of the laboratory QA / QC program. Table 3 presents a summary of the laboratory QA / QC program.

3.8.2 Hydrant Water Samples

Prior to drilling each borehole, a water sample will be collected from the nearby municipal hydrant planned as the water source for drilling of the borehole. The hydrant water sample will be collected directly from the hydrant into appropriate laboratory-supplied containers and analyzed for VOCs, perchlorate, and chlorate.

3.8.3 Field Duplicate Samples

Field duplicate samples will be collected and analyzed to evaluate sampling and analytical precision. Field duplicates will be collected and analyzed in the same manner as the primary groundwater samples collected from the monitoring wells (Section 3.10). Field duplicate samples will be collected at a minimum frequency of 1 duplicate per 10 primary samples, or 10% of the total number of primary samples. Agreement between duplicate sample results and primary sample results will reflect sampling and analytical precision.

3.8.4 Equipment Blank Samples

Equipment blank samples are obtained by filling or rinsing decontaminated sampling equipment with laboratory-supplied water or distilled water free of VOCs, sampling this water, and submitting the sample for analysis. One equipment blank sample will be collected each day that primary groundwater samples are collected. The equipment blank samples will be analyzed in the same manner as the primary groundwater samples collected from the monitoring wells (Section 3.10).

3.8.5 Trip Blank Samples

The primary purpose of trip blanks is to detect potential additional sources that may influence chemical values reported in field samples. Trip blanks serve as a mechanism of control for sample bottle preparation, blank water quality, and sample handling. Trip blank samples are prepared by the laboratory by filling a clean sampling container with reagent-grade, de-ionized water that is certified by the laboratory as COC-free. The sample then is taken to the Site and handled with the other project samples and submitted for analysis of VOCs only, including Tentatively Identified Compounds (TICs) by USEPA Method 8260B. One trip blank sample will be included in each shipping container used to transport field samples for VOC analysis.

3.9 Sample Labeling, Storage, and Transport

A label will be attached firmly to each sample container side (i.e., not lid). The following information will be written legibly with indelible ink on the label:

- Sample ID:
 - For groundwater samples collected from a permanent monitoring well, the sample ID will be the existing monitoring well location ID. For Westbay[®] wells, each screen interval will be designated with a letter, starting with “A” for the uppermost screen and continuing alphabetically;

- For duplicate groundwater samples collected from permanent wells PW-1 through PW-9, the sample ID will be PW-*xx*, where *xx* is 25 through 28 corresponding to primary groundwater samples collected from wells PW-1 through PW-4, respectively; *xx* can also be 35 through 39 corresponding to primary groundwater samples collected from wells PW-5 through PW-9, respectively; for example, a duplicate sample collected from the permanent well PW-6 will be labeled as PW-36;
 - For hydrant water samples, the sample ID will be Hydrant-PW*x-yy*, where *xx* is the borehole ID (i.e., 5, 6, 7, 8, or 9) and *yy* is the number of the sample in sequence (starting from 01);
 - For equipment blank samples, the sample ID will be PW-29-*mm-dd*, where *mm* and *dd* will indicate the month and day the sample was collected, respectively; for example, if an equipment blank was collected on 5 December 2005, the equipment blank sample ID will be PW-29-12-05; and
 - For trip blank samples, the sample ID will be PW-30-*mm-dd-xx*, where *mm* and *dd* will indicate the month and day the sample was collected, respectively, and *xx* will reflect the number of ice chests containing samples for each day of sampling (starting with 01); for example, if one ice chest containing samples was used on 14 January 2006, the trip blank sample ID will be PW-30-01-14-01;
- Sampling date and time; and
 - Sampler's initials.

After labeling, the sample containers will be placed in separate sealable plastic bags and stored inside an ice chest pre-cooled to 4 degrees Centigrade or below with Blue Ice® packages or double-bagged ice packets. Breakable or otherwise fragile sample containers will be wrapped in plastic bubble-wrap or equivalent packaging materials, as necessary. The completed chain-of-custody record will be placed in a

sealed plastic bag and accompany the samples in the ice chest to the laboratory. After receipt of the samples, the laboratory will notify the GeoSyntec Project Manager if conditions or problems are identified that require immediate resolution. Such conditions may include container breakage, missing or improper chain-of-custody, exceeded holding times, missing or improper sample labeling, or frozen water samples. The samples in question will not be analyzed until the problem has been resolved. If the holding times have been exceeded, the data may be excluded and re-sampling may be requested, or the data may be used but qualified in the reporting.

Ice chests containing samples will be delivered to a California-certified laboratory within 24 hours of collection either by courier or an overnight shipping service. The tracking number of the shipping firm will serve as additional chain-of-custody information in the event that samples need to be shipped via overnight shipping service.

3.10 Analytical Program

At the RWQCB's request, the wells associated with the 160-acre parcel (PW-1 through PW-9) and selected wells owned by others (Section 3.7.1) will be monitored contemporaneously to further evaluate the distribution of COCs in the Rialto-Colton Basin. The groundwater samples collected from these wells (Table 1) will be analyzed for the following parameters:

- VOCs by USEPA Method 5030B/8260B;
- Perchlorate by USEPA Method 314.0; and
- Chlorate by USEPA Method 300.1.

In addition, to assist in differentiating water types in the aquifers, groundwater samples will be collected from select wells and within various zones within the Basin and analyzed for general chemistry parameters. This sampling will include the following analytes (Table 1):

- Calcium, magnesium, sodium, and potassium by USEPA Method 6010B Dissolved;
- Manganese by USEPA Method 6020 Dissolved;
- Methane, ethane, and ethene by RSK 175 Dissolved;
- Biochemical oxygen demand by USEPA Method 405.1;
- Chemical oxygen demand by USEPA Method 410.1;
- Sulfide by USEPA Method 376.2;
- Sulfate, nitrate, phosphate, chloride by USEPA Method 300.0;
- Ammonia by SM 4500-NH₃, F;
- Total dissolved solids (TDS) by USEPA Method 160.1;
- pH by USEPA Method 150.1;
- Hardness by USEPA Method 2340B; and
- Alkalinity by USEPA Method 2320B.

Appropriate sample containers required for the parameters are summarized in Table 2. Project reporting limits are presented in Table 3. Target analytes for field QA / QC samples are discussed in Section 3.8.

3.11 Equipment Decontamination

Drilling equipment will be decontaminated prior to and between drilling at each borehole location by steam cleaning or high-pressure hot water cleaning. The drilling equipment may be decontaminated at any time during field activities, if the field

engineer or geologist believes the integrity of the data collection may be compromised by contaminated equipment.

Vehicles and other heavy equipment operated during the field investigation also may require decontamination to reduce the risk for unnecessary contamination of personnel and to keep equipment in good working order. Frequency of decontamination will be assessed by the field engineer or geologist, based on a visual inspection of the degree of soiling or on knowledge of the type and area of work.

Non-dedicated conventional sampling equipment will be decontaminated both before and after samples are collected. Equipment will be decontaminated using first a solution of decontamination detergent (e.g., Alconox) and water, then a potable water rinse, and finally a distilled water rinse. Equipment will be immersed in decontamination liquid and scrubbed by brushing. As an alternative method, non-dedicated sampling equipment also may be decontaminated by steam cleaning or high-pressure hot water cleaning.

Westbay[®] sampling equipment will be decontaminated first by washing the stainless-steel sample-collection bottles in a solution of non-phosphate detergent (e.g., Liquinox[®]) and rinsing the bottle with distilled water. The interior surfaces of the MOSDAX sampling probe, and the hoses and valves associated with Westbay[®] sampling bottles will be decontaminated by forcing several volumes of Liquinox[®] and distilled water through them and conducting a final rinse with distilled water. The rinsing is accomplished by forcing several volumes of distilled water through the part using a clean plastic squeeze bottle used only for this purpose.

The decontamination procedures for personal protective equipment (PPE) are addressed in the project-specific HSP (Appendix A). Disposal of decontamination wastes is further discussed in Section 3.12 below.

3.12 Waste Handling

Investigation-derived waste (IDW) (e.g., drill cuttings, well development and purge water) will be stored in containers approved by the United States Department of Transportation (D.O.T). Samples of IDW may be collected and analyzed for total

petroleum hydrocarbons (TPH) – full carbon chain (USEPA Method 8015M), VOCs (USEPA Method 8260B), perchlorate (USEPA 314.0), and Title 22 Metals (USEPA Method 6000/7000) to evaluate the appropriate method for disposal. Hazardous materials, if any, will be manifested by a Goodrich representative and delivered to an appropriate licensed facility for disposal. Non-hazardous materials, including soil or water that is contaminated but not classified as hazardous, also will be disposed at an appropriate facility.

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4 DATA MANAGEMENT AND REPORTING

4.1 Field Records

Field activities will be documented in daily field reports and on required field forms (e.g., well development log, chains-of-custody). Entries will include sufficient detail to potentially reproduce sampling activities. Entries will be made in indelible ink, with each page initialed and dated by the field personnel. Changes or corrections to entries will consist of line-out deletions (e.g., no “white-out” correction fluid) which are initialed and dated by the author of the change or correction.

Field reports will be stored in the project file when not in use. The field reports will be reviewed by the GeoSyntec Project Manager to evaluate completeness of the field records and appropriateness of the field methods employed. Entries in the field report may include, at a minimum, the following information:

- Names of field personnel and visitors;
- Changes in field personnel or responsibilities;
- Date and time of each entry;
- Ambient weather conditions at the beginning of each work day and any significant changes throughout the work day;
- Site observations and sketches;
- Details regarding sampling activities, such as borehole ID, sample ID, field measurements, etc.;
- Significant physical/environmental conditions encountered during the field activity;
- Deviations from the Work Plan or HSP;
- Level of safety protection and any changes in the level of protection;

- Types of field instruments used and daily calibration data;
- Health and safety monitoring records; and
- Other significant events that may occur during field activities.

4.2 **Analytical Data**

Analytical data packages or reports will be obtained from the laboratory and will be consistent with USEPA Level II documentation, which will include the following:

- Analytical results of field samples and field QA / QC samples;
- Date of sample arrival at the laboratory and
- Date of extraction (if any) and analysis;
- Method of analysis;
- Narrative;
- Cross reference;
- Chain-of-custody;
- Method references;
- Surrogate recoveries;
- Internal standard recoveries;
- Laboratory control sample and duplicate recoveries; and
- Matrix spike and matrix spike duplicate (MS/MSD) recoveries.

To facilitate the integration of laboratory data into a database or geographic information system (GIS) platform, the laboratory also will be required to deliver data on electronic media (electronic data deliverables, or EDDs). Data from the EDDs will be entered into a GIS platform that contains historical data for the project (e.g., data collected from the previous RI). The GIS platform will assist in evaluating and visualizing the data. Analytical results will be compared to project-specific reporting limits, as presented in Table 3. Upon request, the laboratory will make associated raw data available.

4.3 **Reporting**

Various submittals will be made during and after field activities. During field activities, monthly progress will be provided to the RWQCB. Information to be included with the monthly progress reports will include borehole logs, temporary and permanent well construction details, raw analytical data, and other relevant data.

After the fieldwork and data evaluation have been completed, the draft *Additional Remedial Investigation Report* will be prepared and submitted to the RWQCB for review. The report will include discussions of the field activities, results of analytical testing, and an interpretation of the extent (areal and vertical) of the chemicals detected in groundwater, based on the available data. An environmental professional licensed in the State of California will prepare, sign and stamp the draft *Additional Remedial Investigation Report* in general accordance with locally-accepted standards of practice and professional care.

In accordance with RWQCB reporting requirements, analytical data will be transmitted electronically to the RWQCB in a portable data format (PDF) for GeoTracker.

4.4 **Estimated Project Schedule**

The field work will commence within 45 days of the RWQCB's written approval of this Work Plan, in general accordance with the tentative project schedule (Figure 4), and contingent upon the availability of the necessary subcontractors. The installation, development and polishing of the Westbay[®] wells is estimated to last six months, based on an average of seven screen intervals per well. The development of the steel casing and the polishing of the Westbay[®] ports is critical to the success of the Westbay[®] system and is a time-intensive event that can take one week per screen interval. The schedule can be expected to be extended if additional screen intervals (i.e., more than five per well) are installed.

The comprehensive gauging and sampling event for the new wells and other select wells (Table 1) will take place approximately one month after installation,

development and polishing of the new Westbay® wells is completed. After the fieldwork and data evaluation have been completed, the draft *Additional Remedial Investigation Report* will be prepared and submitted to the RWQCB for review. Conditions outside the control of GeoSyntec may impact the project schedule.

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FIGURES

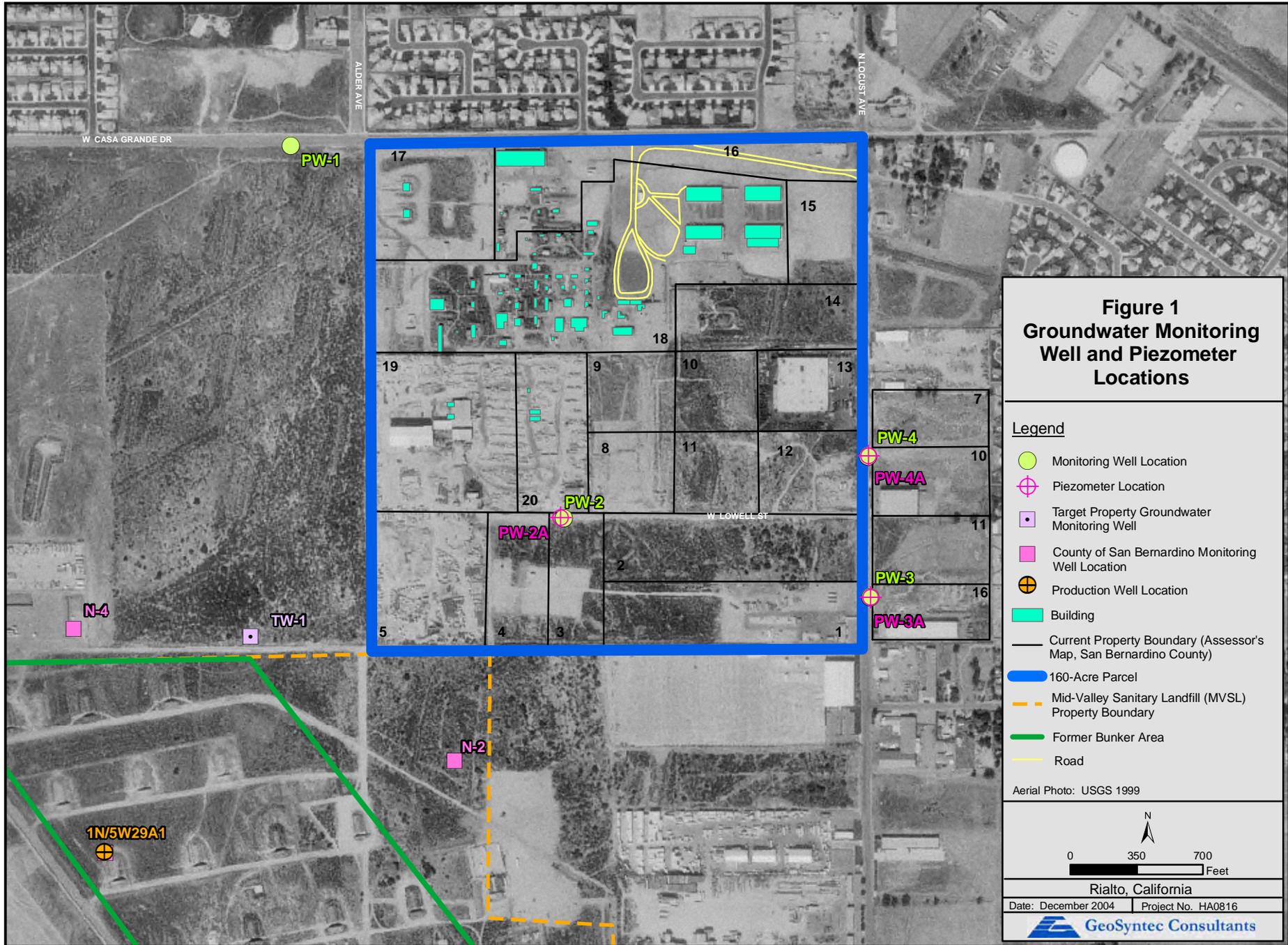


Figure 1 Groundwater Monitoring Well and Piezometer Locations

Legend

- Monitoring Well Location
- ⊕ Piezometer Location
- Target Property Groundwater Monitoring Well
- County of San Bernardino Monitoring Well Location
- ⊕ Production Well Location
- Building
- Current Property Boundary (Assessor's Map, San Bernardino County)
- 160-Acre Parcel
- Mid-Valley Sanitary Landfill (MVSL) Property Boundary
- Former Bunker Area
- Road

Aerial Photo: USGS 1999



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Feet

Rialto, California

Date: December 2004	Project No. HA0816
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 **GeoSyntec Consultants**

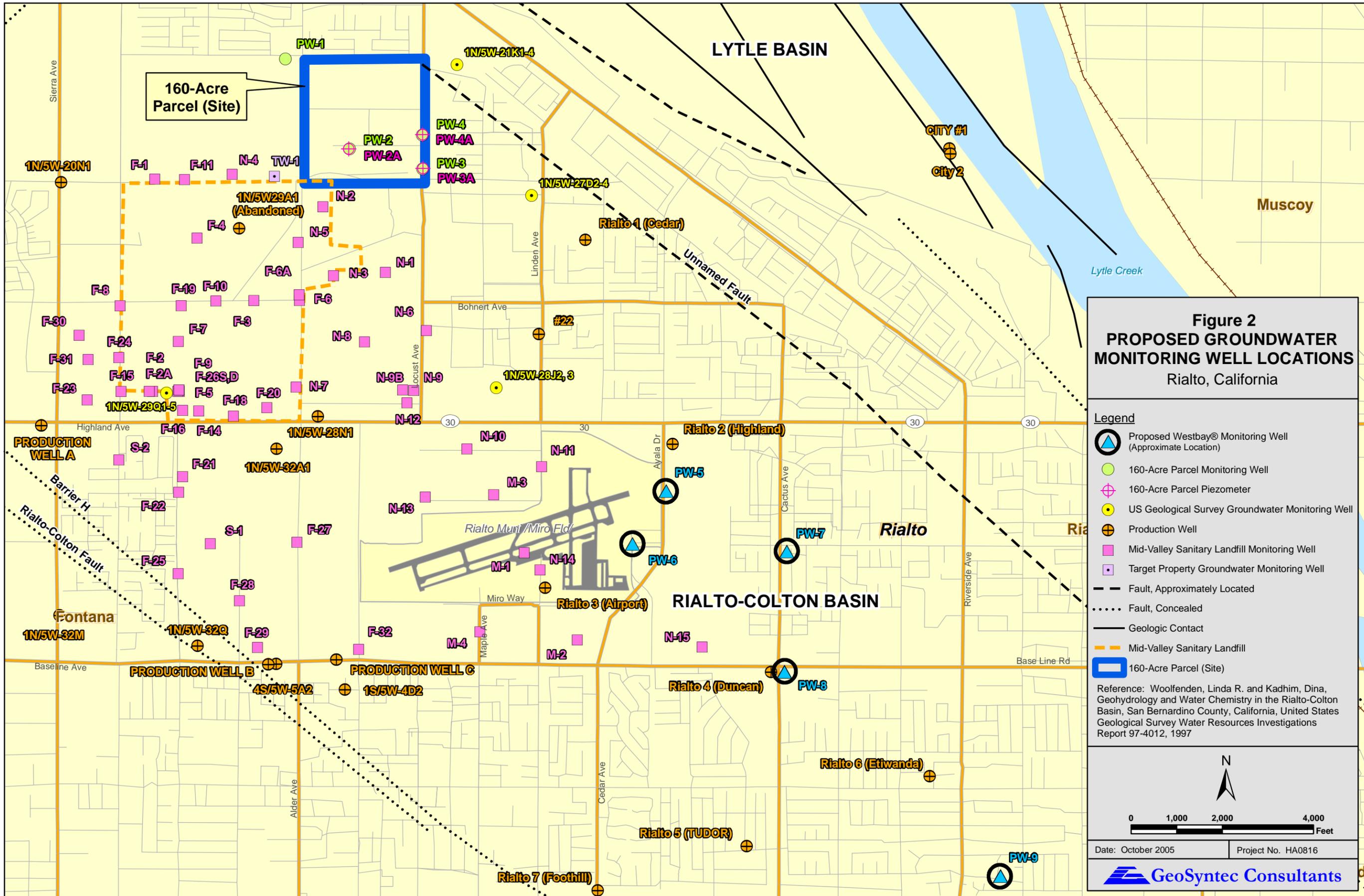


Figure 2
PROPOSED GROUNDWATER
MONITORING WELL LOCATIONS
 Rialto, California

Legend

- Proposed Westbay® Monitoring Well (Approximate Location)
- 160-Acre Parcel Monitoring Well
- 160-Acre Parcel Piezometer
- US Geological Survey Groundwater Monitoring Well
- Production Well
- Mid-Valley Sanitary Landfill Monitoring Well
- Target Property Groundwater Monitoring Well
- Fault, Approximately Located
- Fault, Concealed
- Geologic Contact
- Mid-Valley Sanitary Landfill
- 160-Acre Parcel (Site)

Reference: Woolfenden, Linda R. and Kadhim, Dina, Geohydrology and Water Chemistry in the Rialto-Colton Basin, San Bernardino County, California, United States Geological Survey Water Resources Investigations Report 97-4012, 1997

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Date: October 2005 Project No. HA0816

GeoSyntec Consultants

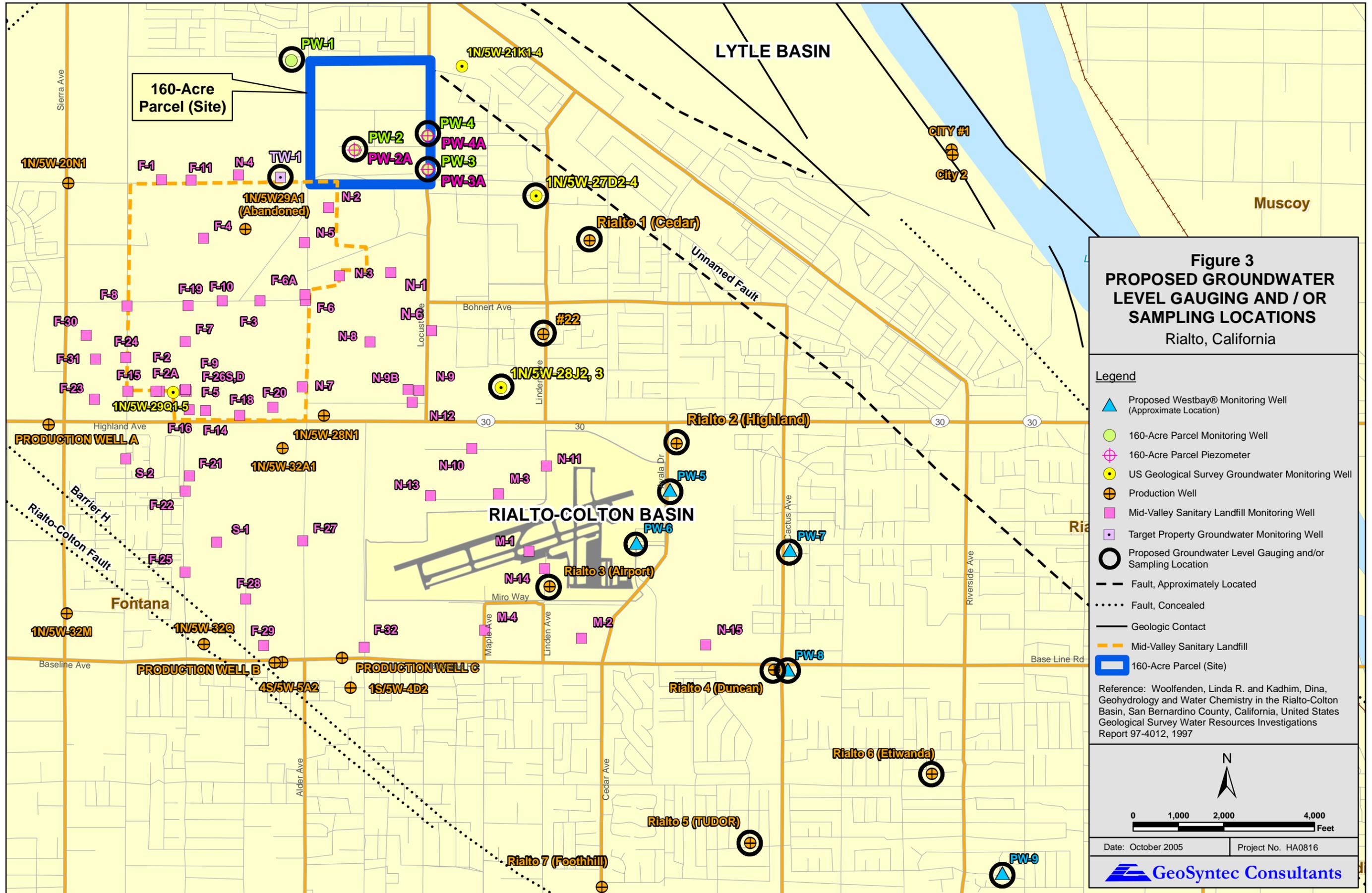


Figure 3
PROPOSED GROUNDWATER
LEVEL GAUGING AND / OR
SAMPLING LOCATIONS
 Rialto, California

- Legend**
- Proposed Westbay® Monitoring Well (Approximate Location)
 - 160-Acre Parcel Monitoring Well
 - 160-Acre Parcel Piezometer
 - US Geological Survey Groundwater Monitoring Well
 - Production Well
 - Mid-Valley Sanitary Landfill Monitoring Well
 - Target Property Groundwater Monitoring Well
 - Proposed Groundwater Level Gauging and/or Sampling Location
 - Fault, Approximately Located
 - Fault, Concealed
 - Geologic Contact
 - Mid-Valley Sanitary Landfill
 - 160-Acre Parcel (Site)

Reference: Woolfenden, Linda R. and Kadhim, Dina, Geohydrology and Water Chemistry in the Rialto-Colton Basin, San Bernardino County, California, United States Geological Survey Water Resources Investigations Report 97-4012, 1997

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Date: October 2005 Project No. HA0816



TABLES

TABLE 1
WELL CONSTRUCTION AND MONITORING DETAILS
Additional Remedial Investigation
160-Acre Parcel, Rialto, California

Page 1 of 2

Well ID	Installation Date	Total Well Depth (ft bgs)	Top of Casing (TOC) Elevation (ft MSL)	Screened Interval (ft bgs)	Diameter (inches)	Well Type	Proposed for Groundwater Monitoring			Owner
							Gauging	COCs ⁽¹⁾	General Chemistry ⁽²⁾	
PW-1	8-Jun-04	480	1,704.48	440 - 480	4	monitoring	✓	✓	✓	Goodrich
PW-2	9-Jul-04	500	1,639.36	455 - 495	4	monitoring	✓	✓	✓	Goodrich
PW-2A	16-Oct-04	642	1,639.58	622 - 642	4	piezometer	✓		✓	Goodrich
PW-3	2-Aug-04	501	1,611.81	456 - 496	4	monitoring	✓	✓	✓	Goodrich
PW-3A	2-Aug-04	626	1,611.81	606 - 626	2	piezometer	✓			Goodrich
PW-4	18-Sep-04	515	1,626.56	470 - 510	4	monitoring	✓	✓		Goodrich
PW-4A	18-Sep-04	648	1,626.56	638 - 648	2	piezometer	✓			Goodrich
PW-5 (multiple screens)	TBD	TBD	TBD	TBD (multiple)	4	monitoring	✓	✓	✓ screens TBD	Goodrich
PW-6 (multiple screens)	TBD	TBD	TBD	TBD (multiple)	4	monitoring	✓	✓	✓ screens TBD	Goodrich
PW-7 (multiple screens)	TBD	TBD	TBD	TBD (multiple)	4	monitoring	✓	✓	✓ screens TBD	Goodrich
PW-8 (multiple screens)	TBD	TBD	TBD	TBD (multiple)	4	monitoring	✓	✓	✓ screens TBD	Goodrich
PW-9 (multiple screens)	TBD	TBD	TBD	TBD (multiple)	4	monitoring	✓	✓	✓ screens TBD	Goodrich
TW-1	Aug 2004	474	1,644.13	444 - 474	4	monitoring	✓			Target Corp.

TABLE 1
WELL CONSTRUCTION AND MONITORING DETAILS
Additional Remedial Investigation
160-Acre Parcel, Rialto, California
Page 2 of 2

Well ID	Installation Date	Total Well Depth (ft bgs)	Top of Casing (TOC) Elevation (ft MSL)	Screened Interval (ft bgs)	Diameter (inches)	Well Type	Proposed for Groundwater Monitoring			Owner
							Gauging	COCs ⁽¹⁾	General Chemistry ⁽²⁾	
1N/5W-27D4	1992 - 1994	250	1,543 ⁽³⁾	225 - 245	2	monitoring	✓			United States Geological Survey
1N/5W-27D3	1992 - 1994	367		342 - 362	2	monitoring	✓	✓	✓	United States Geological Survey
1N/5W-27D2	1992 - 1994	478		450 - 470	2	monitoring	✓	✓		United States Geological Survey
1N/5W-28J3	1992 - 1994	355	1,512 (3)	330 - 350	2	monitoring	✓	✓	✓	United States Geological Survey
1N/5W-28J2	1992 - 1994	455		430 - 450	2	monitoring	✓	✓		United States Geological Survey
Rialto Well #1	TBP	TBP	TBP	TBP	TBP	production	✓	✓	✓	City of Rialto
Rialto Well #2	TBP	TBP	TBP	TBP	TBP	production	✓	✓	✓	City of Rialto
Rialto Well #3	TBP	TBP	TBP	TBP	TBP	production	✓			City of Rialto
Rialto Well #4	TBP	TBP	TBP	TBP	TBP	production	✓			City of Rialto
Rialto Well #5	TBP	TBP	TBP	TBP	TBP	production	✓			City of Rialto
Rialto Well #6	TBP	TBP	TBP	TBP	TBP	production	✓			City of Rialto
West Valley Well No. 22	TBP	TBP	TBP	530 - 570	TBP	production	✓	✓	✓	West Valley Water District
	TBP	TBP	TBP	610 - 630	TBP	production	✓	✓	✓	

NOTES:

⁽¹⁾ COCs = Constituents of Concern, i.e. perchlorate, volatile organic compounds, and chlorate

⁽²⁾ Refer to analytes listed in Table 2 for General Chemistry.

⁽³⁾ Ground surface elevation

TBD = To be determined

TBP = To be provided

ft bgs = feet below ground surface

ft MSL = feet above Mean Sea Level

TABLE 2
SUMMARY OF GROUNDWATER ANALYSES AND SAMPLE CONTAINERS
Additional Remedial Investigation
160-Acre Parcel, Rialto, California
Page 1 of 1

ANALYTES	METHOD	CONTAINER TYPE	TOTAL NUMBER OF CONTAINERS REQUIRED	PRESERVATION	HOLDING TIME (DAYS)
Volatile Organic Compounds	USEPA 8260B	40 mL VOA vials	3 x 40 mL VOA vials	4°C, HCl pH<2	14
Perchlorate	USEPA 314.0	500 mL poly bottle	1 x 500 mL poly bottle	4°C	28
Chlorate	USEPA 300.1	500 mL poly bottle	1 x 500 mL poly bottle	4°C	28
General Chemistry Parameters					
Calcium, Iron, Magnesium, Potassium, & Sodium	USEPA 6010B Diss	500 mL poly bottle	1 x 1 L poly bottle	4°C	1
Manganese	USEPA 6020 Diss	500 mL poly bottle		4°C	1
Methane, Ethane, & Ethene	RSK 175 Diss	40 mL VOA vials with a rubber septa	3 x 40 mL VOA vials with a rubber septa	4°C, HCl pH<2	14
Biochemical Oxygen Demand	USEPA 405.1	1 L poly bottle	1 x 1 L poly bottle	4°C	2
Chemical Oxygen Demand	USEPA 410.1	500 mL poly bottle	1 x 500 mL poly bottle	4°C, H ₂ SO ₄ pH<2	28
Ammonia-N	SM 4500-NH ₃ , F	500 mL poly bottle		4°C, H ₂ SO ₄ pH<2	28
Sulfide	USEPA 376.2	500 mL poly bottle	1 x 500 mL poly bottle	4°C, Zn Acetate + NaOH pH>9	7
Total Dissolved Solids (TDS)	USEPA 160.1	500 mL poly bottle	1 x 500 mL poly bottle	4°C	7
Nitrate	USEPA 300.0	500 mL poly bottle	1 x 500 mL poly bottle	4°C	2
Phosphate		500 mL poly bottle		4°C	2
Sulfate		500 mL poly bottle		4°C	28
Chloride		500 mL poly bottle		4°C	28
Alkalinity and Hardness as CaCO ₃	SM 2320B/2340B	500 mL poly bottle	1 x 500 mL poly bottle	4°C	14
pH	USEPA 150.1	500 mL poly bottle	1 x 500 mL poly bottle	4°C	Immediate

Notes:

VOA = volatile organic analysis

L = liter

mL = milliliter

°C = degrees Celsius

TABLE 3
LABORATORY QUALITY ASSURANCE / QUALITY CONTROL (QA/QC) PROGRAM
Additional Remedial Investigation
160-Acre Parcel, Rialto, California
Page 1 of 5

Method	Analyte	CAS #	MDL	PRL	Units	Surrogate %R	Duplicate RPD	Matrix Spike		Blank Spike	
								%R	RPD	%r	RPD
VOLATILE ORGANIC COMPOUNDS (VOCs)											
EPA 8260B	Acetone	67-64-1	4.5	10	ug/l	-	-	10-150	35	25-120	30
EPA 8260B	Benzene	71-43-2	0.28	0.50	ug/l	-	-	70-120	20	70-120	20
EPA 8260B	Bromobenzene	108-86-1	0.27	1.0	ug/l	-	-	60-135	25	80-120	20
EPA 8260B	Bromochloromethane	74-97-5	0.32	1.0	ug/l	-	-	60-140	25	65-135	20
EPA 8260B	Bromodichloromethane	75-27-4	0.30	1.0	ug/l	-	-	70-140	20	70-140	20
EPA 8260B	Bromoform	75-25-2	0.32	1.0	ug/l	-	-	50-135	25	50-135	25
EPA 8260B	Bromomethane	74-83-9	0.34	1.0	ug/l	-	-	50-140	25	60-140	20
EPA 8260B	2-Butanone (MEK)	78-93-3	3.8	10	ug/l	-	-	30-140	30	40-135	30
EPA 8260B	n-Butylbenzene	104-51-8	0.37	1.0	ug/l	-	-	70-135	20	75-130	20
EPA 8260B	sec-Butylbenzene	135-98-8	0.25	1.0	ug/l	-	-	70-130	20	75-125	20
EPA 8260B	tert-Butylbenzene	98-06-6	0.22	1.0	ug/l	-	-	70-130	20	75-125	20
EPA 8260B	Carbon tetrachloride	56-23-5	0.28	0.50	ug/l	-	-	70-140	25	70-140	25
EPA 8260B	Chlorobenzene	108-90-7	0.36	1.0	ug/l	-	-	80-125	20	80-125	20
EPA 8260B	Chloroethane	75-00-3	0.33	1.0	ug/l	-	-	50-145	25	60-145	20
EPA 8260B	Chloroform	67-66-3	0.33	1.0	ug/l	-	-	70-130	20	70-130	20
EPA 8260B	Chloromethane	74-87-3	0.30	1.0	ug/l	-	-	30-145	30	40-145	25
EPA 8260B	2-Chlorotoluene	95-49-8	0.28	1.0	ug/l	-	-	65-145	25	75-125	20
EPA 8260B	4-Chlorotoluene	106-43-4	0.29	1.0	ug/l	-	-	70-145	20	75-125	20
EPA 8260B	Dibromochloromethane	124-48-1	0.28	1.0	ug/l	-	-	65-145	20	65-145	20
EPA 8260B	1,2-Dibromo-3-chloropropane	96-12-8	0.92	5.0	ug/l	-	-	50-150	25	50-130	25
EPA 8260B	1,2-Dibromoethane (EDB)	106-93-4	0.32	1.0	ug/l	-	-	70-125	20	70-125	20
EPA 8260B	Dibromomethane	74-95-3	0.36	1.0	ug/l	-	-	65-135	20	70-130	20
EPA 8260B	1,2-Dichlorobenzene	95-50-1	0.32	1.0	ug/l	-	-	70-130	20	75-120	20

TABLE 3
LABORATORY QUALITY ASSURANCE / QUALITY CONTROL (QA/QC) PROGRAM
Additional Remedial Investigation
160-Acre Parcel, Rialto, California
Page 2 of 5

Method	Analyte	CAS #	MDL	PRL	Units	Surrogate %R	Duplicate RPD	Matrix Spike		Blank Spike	
								%R	RPD	%r	RPD
VOLATILE ORGANIC COMPOUNDS (VOCs)											
EPA 8260B	1,3-Dichlorobenzene	541-73-1	0.35	1.0	ug/l	-	-	70-130	20	75-120	20
EPA 8260B	1,4-Dichlorobenzene	106-46-7	0.37	1.0	ug/l	-	-	75-120	20	80-120	20
EPA 8260B	Dichlorodifluoromethane	75-71-8	0.79	5.0	ug/l	-	-	10-160	30	10-160	30
EPA 8260B	1,1-Dichloroethane	75-34-3	0.27	1.0	ug/l	-	-	65-135	20	70-135	20
EPA 8260B	1,2-Dichloroethane	107-06-2	0.28	0.50	ug/l	-	-	60-150	25	60-150	20
EPA 8260B	1,1-Dichloroethene	75-35-4	0.32	1.0	ug/l	-	-	65-145	25	75-140	20
EPA 8260B	cis-1,2-Dichloroethene	156-59-2	0.32	1.0	ug/l	-	-	60-130	20	65-125	20
EPA 8260B	trans-1,2-Dichloroethene	156-60-5	0.27	1.0	ug/l	-	-	60-135	20	65-130	20
EPA 8260B	1,2-Dichloropropane	78-87-5	0.35	1.0	ug/l	-	-	60-130	20	65-120	20
EPA 8260B	1,3-Dichloropropane	142-28-9	0.30	1.0	ug/l	-	-	65-140	25	70-130	20
EPA 8260B	2,2-Dichloropropane	594-20-7	0.29	1.0	ug/l	-	-	60-150	20	70-150	20
EPA 8260B	1,1-Dichloropropene	563-58-6	0.28	1.0	ug/l	-	-	60-145	20	75-130	20
EPA 8260B	cis-1,3-Dichloropropene	10061-01-5	0.22	0.50	ug/l	-	-	70-140	20	70-130	20
EPA 8260B	trans-1,3-Dichloropropene	10061-02-6	0.24	0.50	ug/l	-	-	70-140	20	75-135	20
EPA 8260B	Ethylbenzene	100-41-4	0.25	1.0	ug/l	-	-	70-125	20	80-120	20
EPA 8260B	Hexachlorobutadiene	87-68-3	0.38	1.0	ug/l	-	-	65-140	25	65-140	20
EPA 8260B	2-Hexanone	591-78-6	2.6	10	ug/l	-	-	15-140	35	40-135	30
EPA 8260B	Isopropylbenzene	98-82-8	0.25	1.0	ug/l	-	-	65-130	25	70-125	20
EPA 8260B	p-Isopropyltoluene	99-87-6	0.28	1.0	ug/l	-	-	70-130	20	75-125	20
EPA 8260B	Methylene chloride	75-09-2	0.48	5.0	ug/l	-	-	60-135	20	60-135	20
EPA 8260B	4-Methyl-2-pentanone (MIBK)	108-10-1	2.5	10	ug/l	-	-	40-140	30	40-135	30
EPA 8260B	Naphthalene	91-20-3	0.41	1.0	ug/l	-	-	50-145	25	50-145	25
EPA 8260B	n-Propylbenzene	103-65-1	0.27	1.0	ug/l	-	-	70-135	20	75-130	20

TABLE 3
LABORATORY QUALITY ASSURANCE / QUALITY CONTROL (QA/QC) PROGRAM
Additional Remedial Investigation
160-Acre Parcel, Rialto, California
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Method	Analyte	CAS #	MDL	PRL	Units	Surrogate %R	Duplicate RPD	Matrix Spike		Blank Spike	
								%R	RPD	%r	RPD
VOLATILE ORGANIC COMPOUNDS (VOCs)											
EPA 8260B	Styrene	100-42-5	0.16	1.0	ug/l	-	-	60-145	25	80-135	20
EPA 8260B	1,1,1,2-Tetrachloroethane	630-20-6	0.27	1.0	ug/l	-	-	65-145	20	70-145	20
EPA 8260B	1,1,2,2-Tetrachloroethane	79-34-5	0.24	1.0	ug/l	-	-	60-140	25	60-135	25
EPA 8260B	Tetrachloroethene	127-18-4	0.32	1.0	ug/l	-	-	70-130	20	75-125	20
EPA 8260B	Toluene	108-88-3	0.36	1.0	ug/l	-	-	65-120	20	70-120	20
EPA 8260B	1,2,3-Trichlorobenzene	87-61-6	0.45	1.0	ug/l	-	-	60-135	20	65-135	20
EPA 8260B	1,2,4-Trichlorobenzene	120-82-1	0.48	1.0	ug/l	-	-	55-140	25	70-140	20
EPA 8260B	1,1,1-Trichloroethane	71-55-6	0.30	1.0	ug/l	-	-	75-140	20	75-140	20
EPA 8260B	1,1,2-Trichloroethane	79-00-5	0.30	1.0	ug/l	-	-	60-135	20	65-125	20
EPA 8260B	Trichloroethene	79-01-6	0.26	1.0	ug/l	-	-	70-125	20	75-120	20
EPA 8260B	Trichlorofluoromethane	75-69-4	0.34	1.0	ug/l	-	-	50-150	25	60-145	25
EPA 8260B	1,2,3-Trichloropropane	96-18-4	0.85	1.0	ug/l	-	-	60-140	25	60-130	20
EPA 8260B	1,2,4-Trimethylbenzene	95-63-6	0.23	1.0	ug/l	-	-	60-125	20	75-125	20
EPA 8260B	1,3,5-Trimethylbenzene	108-67-8	0.26	1.0	ug/l	-	-	70-130	20	75-125	25
EPA 8260B	Vinyl chloride	75-01-4	0.26	0.50	ug/l	-	-	40-130	25	50-125	20
EPA 8260B	o-Xylene	95-47-6	0.24	1.0	ug/l	-	-	65-125	20	75-125	20
EPA 8260B	m,p-Xylenes	GIS-130-312	0.52	1.0	ug/l	-	-	60-125	25	70-120	20
EPA 8260B	Xylenes, Total	1330-20-7	0.52	1.0	ug/l	-	-	60-135	20	70-120	20
EPA 8260B	Methyl-tert-butyl Ether (MTBE)	1634-04-4	0.32	1.0	ug/l	-	-	50-150	25	55-145	25
EPA 8260B	Dibromofluoromethane	1868-53-7			Surrogate	80-120	-	-	-	-	-
EPA 8260B	Toluene-d8	2037-26-5			Surrogate	80-120	-	-	-	-	-
EPA 8260B	4-Bromofluorobenzene	460-00-4			Surrogate	80-120	-	-	-	-	-

TABLE 3
LABORATORY QUALITY ASSURANCE / QUALITY CONTROL (QA/QC) PROGRAM
Additional Remedial Investigation
160-Acre Parcel, Rialto, California
Page 4 of 5

Method	Analyte	CAS #	MDL	PRL	Units	Surrogate %R	Duplicate RPD	Matrix Spike		Blank Spike	
								%R	RPD	%r	RPD
METALS											
EPA 6010B Diss	Calcium	7440-70-2	0.015	0.10	mg/l	-	-	75-125	20	80-120	20
EPA 6020 Diss	Manganese	7439-96-5	0.25	1.0	ug/l	-	-	75-125	20	80-120	20
EPA 6010B Diss	Magnesium	7439-95-4	0.0030	0.020	mg/l	-	-	75-125	20	80-120	20
EPA 6010B Diss	Potassium	7440-09-7	0.066	0.50	mg/l	-	-	75-125	20	80-120	20
EPA 6010B Diss	Sodium	7440-23-5	0.095	0.50	mg/l	-	-	75-125	20	80-120	20
INORGANICS											
SM 4500-NH3, F	Ammonia-N	NA	0.11	0.5	mg/l	-	-	75-125	15	85-115	15
EPA 300.1	Chlorate	7664-41-7	0.0039	0.01	mg/l	-	-	75-125	20	85-115	20
EPA 300.0	Chloride	16887-00-6	0.26	0.5	mg/l	-	-	80-120	20	90-110	20
EPA 300.0	Nitrate-N	14797-55-8	0.072	0.11	mg/l	-	-	80-120	20	90-110	20
EPA 314.0	Perchlorate	14797-73-0	0.80	1.0	ug/l	-	-	80-120	20	85-115	15
EPA 300.0	Phosphate	PO4	0.35	0.50 mg/l	mg/l	-	-	80 - 120	20	90 - 110	20
EPA 300.0	Sulfate	14808-79-8	0.18	0.5	mg/l	-	-	80-120	20	90-110	20
EPA 376.2	Sulfide	18496-25-8	0.017	0.1	mg/l	-	-	70-130	30	80-120	20

TABLE 3
LABORATORY QUALITY ASSURANCE / QUALITY CONTROL (QA/QC) PROGRAM
Additional Remedial Investigation
160-Acre Parcel, Rialto, California
Page 5 of 5

Method	Analyte	CAS #	MDL	PRL	Units	Surrogate %R	Duplicate RPD	Matrix Spike		Blank Spike	
								%R	RPD	%r	RPD
OTHER COMPOUNDS AND PARAMETERS											
SM2320B	Alkalinity as CaCO3	471-34-1	2.0	2.0	mg/l	-	20	-	-	-	-
SM2340B	Hardness (as CaCO3)	NA	1.0	1.0	mg/l	-	-	-	-	-	-
RSK 175 Diss	Methane	74-82-8	0.0091	0.05	mg/l	-	-	80 - 120	25	80 - 120	25
RSK 175 Diss	Ethane	74-84-0	0.00092	0.05	mg/l	-	-	80 - 120	25	80 - 120	25
RSK 175 Diss	Ethene	74-85-1	0.0011	0.01	mg/l	-	-	80 - 120	25	80 - 120	25
EPA 405.1	Biochemical Oxygen Demand	BOD	0.59	2.0	mg/l	-	-	NA	NA	85 - 115	20
EPA 410.1-.2	Chemical Oxygen Demand	NA	15	20	mg/l	-	-	70 - 120	15	90 - 110	15
EPA 150.1	pH	12408-02-5	NA	NA	pH Units	-	5	-	-	-	-
EPA 160.1	Total Dissolved Solids	NA	10	10	mg/l	-	10	-	-	90-110	20

NOTES:

CAS # = Chemical Abstract System Number

MDL = Method Detection Limit

PRL = Project Reporting Limit (also referred to as the Method Reporting Limit)

NA = Not Applicable

%R = Percent recovery

RPD = Relative Percent Difference

Blank Spike = Laboratory Control Sample

ug/l = micrograms per liter

mg/l = milligrams per liter



**DRAFT Additional Remedial Investigation Work Plan
Rialto, California**



**DRAFT Additional Remedial Investigation Work Plan
Rialto, California**



**DRAFT Additional Remedial Investigation Work Plan
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