AVALON AT SOUTH BAY PROJECT

# Addendum to Final Landfill Groundwater Investigation Work Plan (ARCADIS BBL, May 14, 2007)

For

## Carson Marketplace
## (Former Cal Compact Landfill)
## Carson, California

May 1, 2008


Prepared by:

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Prepared for:

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# Addendum to
# Final Landfill Groundwater Investigation Work Plan
# (ARCADIS BBL, May 14, 2007)

**FOR**

**AVALON AT SOUTH BAY**
**(FORMER CAL COMPACT LANDFILL)**
**20300 MAIN STREET**
**CARSON, CA**

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May 1, 2008

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## APPENDIX

# 1.0 INTRODUCTION

Carson Marketplace, LLC (Carson Marketplace) is the developer of the former Cal Compact landfill property (the "Property") located at 20300 Main Street in Carson, California (Figure 1) for redevelopment into a mixed commercial and residential development to be called Avalon at South Bay. The Property and surrounding area have undergone several investigations since the early 1990s.

In an effort to identify appropriate locations for additional permanent monitoring wells and to enhance the existing groundwater remedial design, which was based on the 1995 Remedial Action Plan (RAP) (Brown & Root Environmental [B&RE] 1995), a cone penetrometer testing/Hydropunch® (CPT/HP) investigation was conducted within and around the Property in 2007 to obtain more current, as well as additional, data from the Upper Operable Unit (UOU) than was available in the RAP. The HP samples were "point-in-time" or "grab" samples which are generally used as screening data to help identify hot spots or plume boundaries to aid in remedial design and/or selection of appropriate locations for permanent monitoring wells. Additional information on the uses and typical data quality objectives of HP sampling can be found in studies conducted by the Environmental Protection Agency (EPA) and Ohio EPA (EPA 2005 and Ohio EPA 2005).

ARCADIS BBL submitted the Final Landfill Groundwater Investigation Work Plan (ARCADIS Work Plan, ARCADIS 2007a) on May 14, 2007, and conducted the CPT/HP investigation in July 2007. Results from the investigation are presented in the Groundwater Investigation Technical Memorandum (Tech Memo) dated December 12, 2007 (ARCADIS 2007b).

During this CPT/HP investigation, vinyl chloride (VC) was detected in an off-site downgradient HP location (CPT-43) at up to 100 micrograms per liter (µg/l). Because this result is of concern and was obtained from a HP location and not from a properly screened and completed groundwater monitoring well, the California EPA, Department of Toxic Substances Control (DTSC) has requested that a groundwater monitoring well be installed in order to determine the representative vinyl chloride concentration in groundwater in this area.

Tetra Tech has been retained by Carson Marketplace to conduct all environmental activities during property redevelopment, including the additional groundwater characterization around CPT-43. Because the work described herein is an extension of the July 2007 investigation, this work plan is being submitted as an Addendum to the ARCADIS Work Plan (ARCADIS 2007a), including incorporation of the corresponding Final Sampling and Analysis Plan (ARCADIS SAP, ARCADIS 2007c) that describes sampling protocols and quality assurance (QA) requirements.

Throughout this Addendum, the term "Property" will refer to the legally defined boundary of the former Cal Compact landfill property itself, while the term "Site" will refer to the area that includes the Property plus any impacted groundwater that originated from the Property out to its leading edge, which may be located off-Property.

## 1.1 Scope/Objectives

The objective of the focused characterization proposed in this Addendum is to provide additional groundwater characterization in the vicinity of CPT-43 to evaluate if further action may be required in this area.

The specific objectives of the scope of work included in this Addendum are:

- To confirm the concentrations of volatile organic compounds (VOCs) from the CPT-43 HP screening results and establish a long-term groundwater monitoring point adjacent to this location;

- To determine representative concentrations of VOCs, specifically VC, in groundwater in the vicinity of CPT-43; and

- To collect representative soil column geotechnical data above the groundwater to support location-specific vapor intrusion modeling for evaluation of potential health risk if necessary.

This Addendum presents the rationale and details for the proposed sampling program. Detailed QA and sampling protocols are contained in the incorporated ARCADIS SAP (ARCADIS 2007c), and health and safety requirements are included in the Site Health and Safety Plan (HASP) dated February 15, 2008 (Tetra Tech 2008).

# 2.0 SAMPLING RATIONALE

## 2.1 Site Background

As stated in Section 1.1, ARCADIS BBL conducted a CPT/HP investigation in July 2007 to obtain additional data to: 1) aid in the refinement of the existing groundwater remedial design, which was based on the 1995 RAP (B&RE 1995), and 2) aid in the selection of permanent groundwater monitoring well locations. This investigation included many samples along the upgradient and downgradient Property boundaries to help ascertain the likelihood of contaminants migrating onto or off of the Property. Results are presented in the Tech Memo (ARCADIS 2007b) and are generally as expected, with the exception of one sampling location, CPT-43, located approximately 575 feet southwest (downgradient) of the Property.

VOC results from the HP groundwater sampling are shown on Figures 2 through 4, respectively, for three different depth intervals: the shallow zone, or approximately 42-69 feet below ground surface (bgs); the intermediate zone or 70-89 feet bgs; and the deep zone or 90-115 feet bgs. Although complete results are not summarized herein, the figures show all VOCs that were detected in groundwater at these three depth intervals at concentrations exceeding either the maximum contaminant levels (MCLs) or the drinking water notification levels (DWNLs). These are not Site clean-up criteria, but rather, a means of presenting investigation data for evaluation purposes.

As can be seen from Figure 2, VC was detected at 100 µg/l in CPT-43 at a depth of 35 feet bgs, attenuating to just 5.8 µg/l at 48 feet bgs, and finally to 0.89 µg/l at 65 feet bgs. At this same location, cis-1,2-dichloroethene (DCE) behaves similarly, while no other VOC was detected at elevated concentrations.

Figure 2 also illustrates that no sampling location upgradient or crossgradient of CPT-43 that was sampled between 35 and 69 feet bgs contained VC above MCLs or DWNLs, except for CPT-34 located almost 1300 feet upgradient (12 µg/l VC). In fact, except for CPT-43 and CPT-34, VC was not detected above laboratory detection limits at these depths in any of the locations in the vicinity of CPT-43.

## 2.2 Data Gaps

The existing data gaps are:

- The only groundwater data collected at and in the vicinity of CPT-43 were from HP samples, which are one-time grab samples generally used for screening purposes, and may not be representative of groundwater conditions measured using a properly constructed groundwater monitoring well.

- VC in groundwater in CPT-43 has not been delineated in the downgradient direction.

- Additional data would be necessary between the southwest corner of the Property and CPT-43 to adequately demonstrate that the source of the VC in CPT-43 is not the Property.

- Additional data would be necessary between the former Martin Adams dump south of the Property and CPT-43 to adequately demonstrate that the source of the VC in CPT-43 is the former dump.

## 2.3 Sampling Strategy

Because the elevated concentrations of VC in CPT-43 can not be traced at this time to any specific on-Property source, and due to the presence of the former Martin Adams just south of the Property's southwest corner (and still upgradient of CPT-43), tracing the source and fully delineating the VC in the CPT-43 area may require substantial effort and disruption to a residential neighborhood. Also, due to limitations of HP sampling, the HP sample collected at CPT-43 may not be representative of the upper groundwater interval.

Therefore, the first step is to obtain a representative groundwater sample from a groundwater monitoring well properly constructed and completed within the upper zone to better ascertain the concentration of VC in this groundwater interval in the vicinity of CPT-43. Then, depending on this concentration and the likelihood that it would present a concern, a decision can be made with DTSC whether or not to proceed with further delineation of the VC.

The sampling strategy includes:

- Install one groundwater monitoring well, GW-9, in the immediate vicinity of CPT-43 as shown on Figure 5.

- Collect and analyze a representative groundwater sample from new well GW-9 for VC and other VOCs. The well will continue to be monitored quarterly for one year, after which an evaluation will be made as to its potential inclusion into the regular semi-annual Site monitoring program.

- Collect and analyze select soil samples above groundwater for geotechnical properties to support vapor intrusion risk calculations.

- Meet with DTSC to discuss sampling results.

Sampling locations, rationale, and details are summarized in Table 1.

# 3.0 SAMPLING PLAN

Based on the sampling rationale presented in Section 2.0, the scope of work covered by this Addendum is described below.

## 3.1 Scope of Work

One groundwater monitoring well, GW-9, will be installed within approximately 20 feet of CPT-43, within Javelin Street, a public residential roadway, as shown on Figure 5. The well will be installed to approximately 40-45 feet bgs and screened from approximately 22-42 feet, based on the CPT log from CPT-43 (Appendix A), the anticipated depth to first groundwater, and the depth-specific VC results shown on Figure 2. These measurements may change slightly based on field observations at the time of drilling but should be approximate.

During installation, the well will be continuously cored for lithology identification and geotechnical sample collection. Following well drilling and installation, the well will be developed, purged, and sampled. One representative groundwater sample will be collected for analysis of VOCs, and the vapor intrusion risk will be calculated using the groundwater and geotechnical results from the new well. All results will be discussed with DTSC to determine the path forward.

## 3.2 Permits and Approvals

All pertinent installation and encroachment permits will be obtained for the groundwater monitoring well, as described in the ARACDIS Work Plan.

## 3.3 Site Health and Safety

As required under Occupational Safety and Health Administration Standards Code of Federal Regulations Title 29, Labor, Part 1910.120, a Site-specific HASP, addressing well installation and other activities to be performed by Tetra Tech, was recently prepared and submitted to DTSC for review. Following receipt of comments from several DTSC personnel in January 2008, the HASP was finalized on February 15, 2008 (Tetra Tech 2008). All Tetra Tech personnel and its subcontractors will be required to review and sign the HASP prior to commencement of field work.

## 3.4 Field Methodology

All field methodology for the scope of work described herein is contained in the ARCADIS Work Plan, unless noted differently in this Addendum.

### 3.4.1 Drilling, Soil Sampling, Well Installation, and Development

#### 3.4.1.1 Drilling

Drilling will be performed by a California-licensed drilling company, under the supervision of a California Registered Geologist. The drilling program will consist of drilling and installing one well, GW-9, to a depth of approximately 10 feet below first occurrence of groundwater. Based on nearby monitoring wells, first groundwater is at approximately 31-32 feet bgs; therefore, the

well depth is anticipated to be approximately 43 feet bgs and will be adjusted as needed based on field observations during drilling. Underground Services Alert (USA) will be notified at least 48 hours prior to drilling for utility and pipeline location. In addition, the borehole will be hand augered to a minimum depth of five feet to clear the location for unmarked lines or utilities.

The borehole will be drilled using a hollow-stem auger (HSA) drilling rig with approximately 11-inch outside diameter (OD) hollow auger flights. To accommodate continuous core sampling, a modified California split-spoon soil sampler is attached to the drive hammer and lowered through the augers to the sampling depth. The drive hammer is used to drive the sampler, which contains three 6-inch-long vertical brass sample rings placed end-to-end, into the soil ahead of the augers to retrieve relatively undisturbed soil samples. The more common 5-foot-long barrel sampler with acetate sleeves is not planned for this location, as the presence of dense, tightly packed fine sand/silt may prevent the longer sampler from being pushed through the entire sampling interval.

#### 3.4.1.2 Soil Sampling

After the soil samples are collected in the brass rings, the sampler is removed from the borehole, and the rings are removed from the sampler. Several of the rings will be prepared for shipment to a geotechnical laboratory for analysis of the following parameters: dry bulk density, total porosity, water-filled porosity, vapor permeability, organic carbon fraction, and grain size distribution. Analytical methods and sample containers are summarized in Table 2.

Soil from the other rings will be used for observing soil properties such as lithology (using the Unified Soil Classification System), moisture, color, malleability, grain size, etc. Soil boring logs will be generated from this information.

#### 3.4.1.3 Groundwater Well Installation

After the borehole is advanced to the total depth, the well will be constructed of 4-inch ID, schedule 40 polyvinyl chloride (PVC) blank and slotted well casing. It is anticipated that the slotted well casing will have 0.020-inch slots and will be installed from approximately 10 feet above to 10 feet below first occurrence of groundwater, or approximately 22 to 42 feet bgs, depending on field observations. It will be equipped with a threaded cap on the bottom. The PVC blank well casing is then connected to the slotted casing and will extend upward to approximately 6 inches bgs. All casing and screen will be threaded; no glues or adhesives will be used. Once all casing is placed in the wellbore, the annular material will be installed.

Based on other well completions in the area and the fine-grained nature of soil encountered in CPT-43, it is anticipated that #2/16 sand will be used for annular filter pack material and will be placed from the bottom of the well to approximately 1-2 feet above the well screen. The augers will be pulled out as the annular materials are added to the well. After the sand is installed, the well will be surged to settle the filter pack and additional sand will be added to approximately 1-2 feet above the well screen. Bentonite chips or pellets will be placed above the sand and hydrated to form a 2-foot thick annular seal, topped with a bentonite/cement grout to approximately 1 foot bgs.

A locking well cap will then be installed on the well, and the entire wellhead assembly enclosed in a 12-inch diameter, steel, traffic-rated wellbox. The wellbox will be set slightly above the road surface, if allowed by the City of Carson, to minimize the chance for water entry into the wellbox and well, and cemented in place. A well completion diagram is included as Figure 6.

Waste generated will be managed as described in Section 3.4.4.

Following well installation, the well location and elevation will be surveyed to the nearest 0.01 foot by a California-licensed surveyor relative to the State Plane Coordinate System.

#### 3.4.1.4 Well Development

After the well has set for a minimum of 72 hours following installation, the well will be developed using a development rig. During development turbidity, temperature, pH, and conductivity will be measured and recorded. Well development will be considered complete when the turbidity is less than 5 Nephalometric turbidiy units (NTUs) and all parameters have stabilized to within 10 percent of their previous two readings. Water generated from development activities will be containerized in 55-gallon drums and managed as in Section 3.4.4.

### 3.4.2 Well Gauging and Groundwater Sample Collection

Procedures are as described in the ARCADIS Work Plan for VOC sample collection only; no other samples will be collected. Analytical methods and sample containers are summarized in Table 2.

### 3.4.3 Equipment Decontamination

Procedures are as described in the ARCADIS Work Plan.

### 3.4.4 Investigation-derived Waste Management

Procedures are as described in the ARCADIS Work Plan. All IDW drums will be transported back to the Property for temporary storage pending receipt of waste characterization analysis and subsequent off-site disposal.

## 3.5 Analytical Methodology

For the scope of work covered by this Addendum, chemical analysis will consist only of groundwater VOC analysis by EPA Method 8260B. Geotechnical analysis will consist of methods summarized in Table 2. Collection methods, holding times, and collection bottles are described in more detail in the ARCADIS Work Plan and SAP.

## 3.6 Quality Assurance/Quality Control

All QA/QC requirements and procedures are as described in the ARCADIS Work Plan and SAP.

## 3.7 Reporting

Following completion of field activities and receipt of all analytical results, laboratory results will be validated, data will be compiled and evaluated, and technical memoranda will be

prepared summarizing results of this data collection effort and recommending any follow-up actions. These tasks are further discussed below.

### 3.7.1 Data Valiadation

Procedures are as described in the ARCADIS Work Plan.

### 3.7.2 Data Management/Evaluation

Procedures are as described in the ARCADIS Work Plan.

### 3.7.3 Investigation Report

Following completion of all field work and evaluation of the final data, a technical memorandum summarizing field activities, results, and decisions will be prepared. The memorandum will contain a summary of the work completed, field procedures used, results, and conclusions. Tables summarizing physical and analytical sample results, a map showing final well/sampling locations, a map showing VOC results, well boring log, chain-of-custody forms, laboratory analytical reports, well purging and sampling forms, field notes, and waste disposal manifests will also be included. The memorandum will also contain vapor intrusion risk calculations for VC based on Johnson & Ettinger modeling using groundwater and soil geotechnical data from the new well.

### 3.7.4 Follow-up Technical Memoranda

If calculated vapor intrusion risks calculated above exceed allowable levels, further delineation of VC in groundwater and/or shallow soil gas sampling may be warranted to confirm the amount of VC migrating upward from the underlying groundwater. If so, proposed sampling locations and procedures will be presented in a subsequent memorandum following discussions with DTSC.

Also, following a more in-depth review of the July 2007 CPT/HP investigation results, Tetra Tech will evaluate the need for, and optimal number and locations of, additional groundwater monitoring wells for the Site. In addition, the most appropriate location(s) for performing aquifer testing and collecting samples for potential remediation bench-scale testing will be determined. Technical memoranda will be submitted to DTSC proposing the permanent monitoring well locations and potential remediation testing programs.

## 4.0 REFERENCES

ARCADIS BBL 2007a. Final Landfill Groundwater Investigation Work Plan, Former Cal Compact Landfill. May 14, 2007.

ARCADIS BBL 2007b. Groundwater Investigation Technical Memorandum, Former Cal Compact Landfill. December 12, 2007.

ARCADIS BBL 2007c. Final Sampling and Analysis Plan, Former Cal Compact Landfill. September 10, 2007.

Brown & Root Environmental 1995. Final Remedial Action Plan, Cal Compact Landfill (Upper Operable Unit) Carson, California. October 1995.

Ohio Environmental Protection Agency 2005. Technical Guidance for Groundwater Investigations. Chapter 15, Use of Direct Push Technologies for Soil and Groundwater Sampling. February 2005.

SCS Engineers 2007. First Semi-Annual 2007 Groundwater Monitoring Report, Former Cal Compact Landfill. August 2007.

Tetra Tech 2008. Site Health and Safety Plan for Avalon at South Bay (formerly Carson Marketplace). February 15, 2008.

USEPA 2005. Groundwater Sampling and Monitoring with Direct Push Technologies. OSWER No. 9200.1-51. August 2005.

# TABLES

## Table 1. Sampling Locations and Rationale Matrix

| Sample No. | Location | Purpose/Rationale | Sample Matrix | Sample Depths (feet bgs) | Sample Analytes |
|---|---|---|---|---|---|
| GW-9 | O/P; within 50 feet of CPT-43, within Javelin St. | Obtain representative groundwater sample from upper saturated zone in vicinity of CPT-43 to verify vinyl chloride concentration in this area. | Water | 22-42* | VOCs |
| GW-9 | O/P; within 50 feet of CPT-43, within Javelin St. | Obtain soil column data to use in Johnson & Ettinger vapor intrusion modeling. | Soil | 5, 7, 13, 25** | Geotech |

Notes:

O/P Off-Property

VOCs Volatile organic compounds by EPA Method 8260B

Geotech Includes: total porosity, vapor permeability, dry bulk density, water-filled porosity, organic carbon fraction, and gain size distribution

* Preliminary depths based on first occurrence of groundwater in area monitoring wells and CPT-43.

** Preliminary depths based on CPT-43 HP boring log (Appendix A). Zones of interest are capillary fringe, immediately above and below the “fat clay” layer at 8-12 feet bgs, and approximately 5 feet bgs.

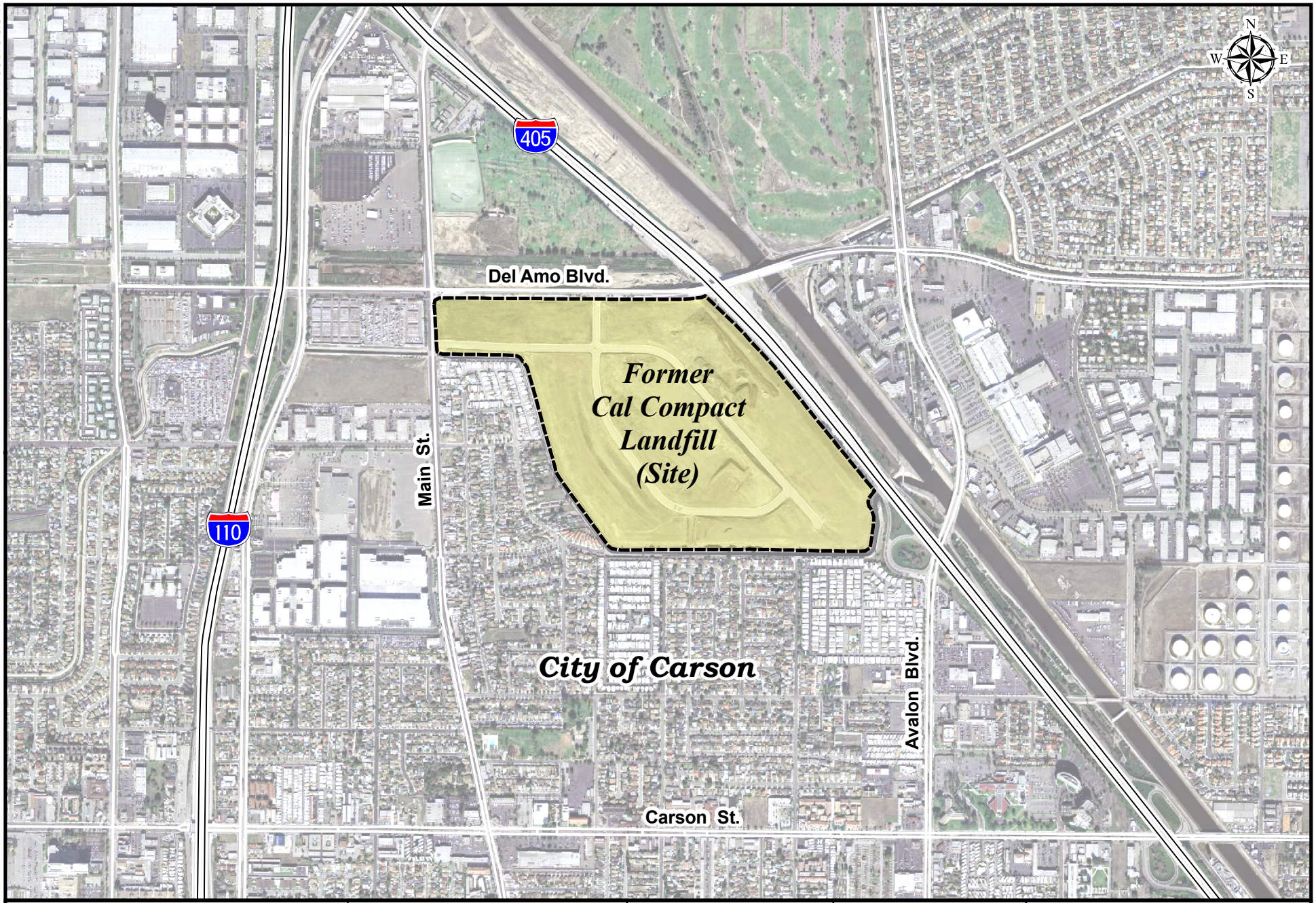
## Table 2. Analytical Methodology Matrix

| Analytes | Analytical Methods | | Minimum Required Sample Containers and Preservatives | |
|---|---|---|---|---|
| | | | Groundwater | Soil |
| VOCs | 8260B | 8260B | Two 40-ml VOA vials (preserved with HCl) | N/A |
| Geotechnical | Total Porosity | API RP40 | N/A | 1-2 1”x6” or 2”x6” rings |
| | Vapor Permeability | API RP40 | | |
| | Bulk density | API RP40 | | |
| | Water-filled Porosity | API RP40 | | |
| | Grain size distribution | ASTM D422/D4464 | | |
| | Total organic carbon | Walkley-Black | | |

N/A Matrix is not anticipated to be analyzed for particular analyte.

# FIGURES

X:\GIS\CARSON AVALON\VICINITY2.MXD




**LEGEND**

Project Location

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| TC # 21868.1.1.01 | | |
|---|---|---|
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| CHECKED BY: | | |
| APPROVED BY: | | |

AVALON AT SOUTH BAY

**Figure 1**
**Vicinity Map**

X:\GIS\CARSON AVALON\ANALYTE_SW_SHALLOW.MXD

| Sample Location | Screen | Analyte | Concentration | Units |
|---|---|---|---|---|
| GW-8 | 47-57 | 1,2-Dichloroethane | 17 | µg/L |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-23 | 53 | 1,3,5-Trimethylbenzene | 1700 | ug/L |
| | 53 | Benzene | 35000 | ug/L |
| | 53 | Ethylbenzene | 3300 | ug/L |
| | 53 | m,p-Xylene | 13000 | ug/L |
| | 53 | Naphthalene | 15000 | ug/L |
| | 53 | Naphthalene | 29000 | ug/L |
| | 53 | o-Xylene | 5600 | ug/L |
| | 53 | Toluene | 40000 | ug/L |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-26 | 58 | 1,2-Dichloroethane | 1000 | ug/L |
| | 58 | Benzene | 17000 | ug/L |
| | 58 | Ethylbenzene | 710 | ug/L |
| | 58 | Naphthalene | 560 | ug/L |
| | 58 | Naphthalene | 390 | ug/L |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-25 | 63 | 1,2-Dichloroethane | 200 | ug/L |
| | 63 | Benzene | 2200 | ug/L |
| | 63 | Naphthalene | 30 | ug/L |
| | 63 | Naphthalene | 25 | ug/L |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-24 | 54 | 1,2-Dichloroethane | 17 | ug/L |
| | 54 | Benzene | 330 | ug/L |
| | 54 | cis-1,2-Dichloroethene | 6.8 | ug/L |

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-22 | 44 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Screen | Analyte | Concentration | Units |
|---|---|---|---|---|
| GW-7B | 39-49 | 1,2-Dichloroethane | 2.1 | µg/L |
| | 39-49 | Benzene | 14 | µg/L |
| | 39-49 | cis-1,2-Dichloroethene | 17 | µg/L |

| Sample Location | Screen | Analyte | Concentration | Units |
|---|---|---|---|---|
| GW-7C | 54-64 | 1,2-Dichloroethane (EDC) | 6.88 | ug/L |
| | | Benzene | 9.96 | ug/L |

| Sample Location | Screen | Analyte |
|---|---|---|
| MWB-4 | 25-50 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-20 | 44 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-21 | 58 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Screen | Analyte |
|---|---|---|
| GW-7.1R | 56-66 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-43 | 48 | 1,2-Dichloroethane | 1.8 | ug/L |
| | 65 | 1,2-Dichloroethane | 3.9 | ug/L |
| | 35 | Benzene | 1.7 | ug/L |
| | 35 | cis-1,2-Dichloroethene | 980 | ug/L |
| | 48 | cis-1,2-Dichloroethene | 100 | ug/L |
| | 65 | cis-1,2-Dichloroethene | 27 | ug/L |
| | 35 | trans-1,2-Dichloroethene | 11 | ug/L |
| | 35 | Trichloroethene | 8.1 | ug/L |
| | 35 | Vinyl Chloride | 100 | ug/L |
| | 48 | Vinyl Chloride | 5.8 | ug/L |
| | 65 | Vinyl Chloride | 0.89 | ug/L |

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-42 | 60 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-41 | 42 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-19 | 61 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-17 | 65 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-18 | 62 | Benzene | 1 | ug/L |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-15 | 60 | 1,2-Dichloroethane | 0.85 | ug/L |
| | 60 | 1,4-Dioxane | 3.5 | ug/L |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-34 | 69 | 1,4-Dichlorobenzene | 5.3 | ug/L |
| | 69 | 1,4-Dioxane | 49 | ug/L |
| | 69 | Benzene | 2.3 | ug/L |
| | 69 | Chlorobenzene | 82 | ug/L |
| | 69 | Vinyl Chloride | 12 | ug/L |

| Sample Location | Analyte |
|---|---|
| CPT-33 | Not Sampled |

| Sample Location | Analyte |
|---|---|
| CPT-16 | Not Sampled |

| Sample Location | Screen | Analyte |
|---|---|---|
| GW-6 | 48-58 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Screen | Analyte |
|---|---|---|
| MWB-3 | 35-60 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Screen | Analyte | Concentration | Units |
|---|---|---|---|---|
| GW-7A | 52-82 | Benzene | 7190 | µg/L |

GW-8
CPT-33
A3
CPT-23
CPT-26
CPT-25
GW-7A
CPT-34
CPT-24
GW-7B
GW-7C
CPT-22
CPT-19
CPT-18
CPT-17
CPT-15
GW-6
CPT-20
CPT-21
MWB-4
GW-7.1R
CPT-16
MWB-3
CPT-43
CPT-42
CPT-41

**LEGEND**

Cone Penetrometer Test (CPT) Location
- On Site Sampling Location
- Off-Site Sampling Location

Groundwater Monitoring Well Location
- On Site Sampling Location
- Off-Site Sampling Location

Approximate Slope Area

MCL = Maximum Contaminant Level
DWNL = Drinking Water Notification Level
µg/L = Micrograms per liter
mg/L = Milligrams per liter

Note:
CPT locations and groundwater results taken from ARCADIS BBL July 2007 groundwater/hydropunch sampling event.

Monitoring well GW-7.1R sampled by SCS Engineers, May 2007.

N

0 100 200
SCALE IN FEET

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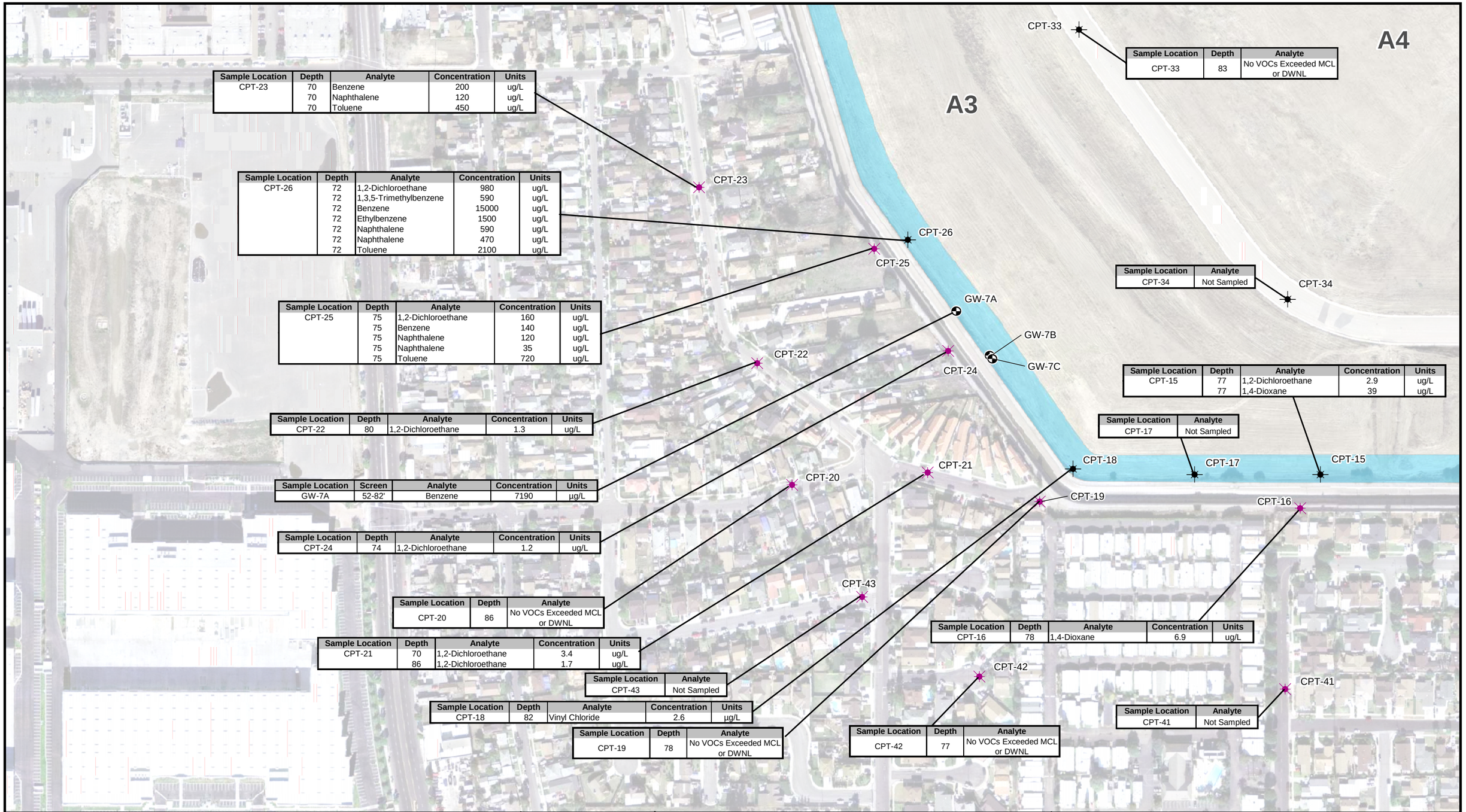
| | | |
|---|---|---|
| DRAWN BY: | SH | 02/21/08 |
| CHECKED BY: | | |
| APPROVED BY: | | |

AVALON AT SOUTH BAY

**Figure 2**
**Groundwater Investigation Sampling Locations and Analyte Results Exceeding MCLs and DWNLs - SW Corner and Off-site Locations - Shallow (42-69 feet bgs)**

X:\GIS\CARSON\AVALON\ANALYTE_SW_INTER.MXD




| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-23 | 70 | Benzene | 200 | ug/L |
| | 70 | Naphthalene | 120 | ug/L |
| | 70 | Toluene | 450 | ug/L |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-26 | 72 | 1,2-Dichloroethane | 980 | ug/L |
| | 72 | 1,3,5-Trimethylbenzene | 590 | ug/L |
| | 72 | Benzene | 15000 | ug/L |
| | 72 | Ethylbenzene | 1500 | ug/L |
| | 72 | Naphthalene | 590 | ug/L |
| | 72 | Naphthalene | 470 | ug/L |
| | 72 | Toluene | 2100 | ug/L |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-25 | 75 | 1,2-Dichloroethane | 160 | ug/L |
| | 75 | Benzene | 140 | ug/L |
| | 75 | Naphthalene | 120 | ug/L |
| | 75 | Naphthalene | 35 | ug/L |
| | 75 | Toluene | 720 | ug/L |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-22 | 80 | 1,2-Dichloroethane | 1.3 | ug/L |

| Sample Location | Screen | Analyte | Concentration | Units |
|---|---|---|---|---|
| GW-7A | 52-82' | Benzene | 7190 | µg/L |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-24 | 74 | 1,2-Dichloroethane | 1.2 | ug/L |

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-20 | 86 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-21 | 70 | 1,2-Dichloroethane | 3.4 | ug/L |
| | 86 | 1,2-Dichloroethane | 1.7 | ug/L |

| Sample Location | Analyte |
|---|---|
| CPT-43 | Not Sampled |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-18 | 82 | Vinyl Chloride | 2.6 | µg/L |

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-19 | 78 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-33 | 83 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Analyte |
|---|---|
| CPT-34 | Not Sampled |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-15 | 77 | 1,2-Dichloroethane | 2.9 | ug/L |
| | 77 | 1,4-Dioxane | 39 | ug/L |

| Sample Location | Analyte |
|---|---|
| CPT-17 | Not Sampled |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-16 | 78 | 1,4-Dioxane | 6.9 | ug/L |

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-42 | 77 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Analyte |
|---|---|
| CPT-41 | Not Sampled |

**LEGEND**

Cone Penetrometer Test (CPT) Location
- On Site Sampling Location
- Off-Site Sampling Location

Groundwater Monitoring Well Location
- On Site Sampling Location
- Off-Site Sampling Location

Approximate Slope Area

MCL = Maximum Contaminant Level
DWNL = Drinking Water Notification Level
µg/L = Micrograms per liter
mg/L = Milligrams per liter

Note:
CPT locations and groundwater results taken from ARCADIS BBL July 2007 groundwater/hydropunch sampling event.

0 100 200
SCALE IN FEET


TETRA TECH
348 W. HOSPITALITY LN. SUITE 100
SAN BERNARDINO, CALIFORNIA 92408
(909) 381-1674


TC # 21868.1.1.01

| | | |
|---|---|---|
| DRAWN BY: | SH | 02/21/08 |
| CHECKED BY: | | |
| APPROVED BY: | | |

AVALON AT SOUTH BAY

**Figure 3**
**Groundwater Investigation Sampling Locations and Analyte Results Exceeding MCLs and DWNLs - SW Corner and Off-site Locations - Intermediate (70-89 feet bgs)**

X:\GIS\CARSON AVALON\ANALYTE_SW_DEEP.MXD

A3

A4

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-23 | 95 | 1,3,5-Trimethylbenzene | 370 | ug/L |
| | 95 | Benzene | 300 | ug/L |
| | 95 | Ethylbenzene | 400 | ug/L |
| | 95 | Naphthalene | 510 | ug/L |
| | 95 | Naphthalene | 530 | ug/L |
| | 95 | Toluene | 1300 | ug/L |

CPT-23

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-26 | 95 | 1,2-Dichloroethane | 280 | ug/L |

CPT-26

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-25 | 92 | 1,2-Dichloroethane | 17 | ug/L |
| | 92 | Benzene | 33 | ug/L |
| | 92 | Naphthalene | 42 | ug/L |

CPT-25

| Sample Location | Screen | Analyte |
|---|---|---|
| GW-7 | 100-115 | No VOCs Exceeded MCL or DWNL |

GW-7

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-22 | 94 | No VOCs Exceeded MCL or DWNL |

CPT-22

CPT-24

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-24 | 96 | No VOCs Exceeded MCL or DWNL |

CPT-20

| Sample Location | Analyte |
|---|---|
| CPT-20 | Not Sampled |

CPT-21

| Sample Location | Analyte |
|---|---|
| CPT-21 | Not Sampled |

| Sample Location | Analyte |
|---|---|
| CPT-43 | Not Sampled |

CPT-43

| Sample Location | Screen | Analyte |
|---|---|---|
| MWG-3 | 85-105 | No VOCs Exceeded MCL or DWNL |

MWG-3

CPT-42

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-42 | 90 | No VOCs Exceeded MCL or DWNL |

CPT-33

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-33 | 95<br>100 | No VOCs Exceeded MCL or DWNL |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-34 | 97 | 1,2-Dichloroethane | 5 | ug/L |
| | 97 | 1,4-Dioxane | 67 | ug/L |
| | 97 | Vinyl Chloride | 3.3 | ug/L |
| | 111 | No VOCs Exceeded MCL or DWNL | | |

CPT-34

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-18 | 96 | No VOCs Exceeded MCL or DWNL |

CPT-18

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-17 | 96 | 1,2-Dichloroethane | 3.8 | ug/L |

CPT-17

| Sample Location | Depth | Analyte |
|---|---|---|
| CPT-15 | 92 | No VOCs Exceeded MCL or DWNL |

CPT-15

CPT-19

CPT-16

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-16 | 92 | 1,4-Dioxane | 5.4 | ug/L |

| Sample Location | Depth | Analyte | Concentration | Units |
|---|---|---|---|---|
| CPT-19 | 98 | 1,2-Dichloroethane | 0.6 | ug/L |

CPT-41

| Sample Location | Analyte |
|---|---|
| CPT-41 | Not Sampled |

**LEGEND**

Cone Penetrometer Test (CPT) Location
- On Site Sampling Location
- Off-Site Sampling Location

Groundwater Monitoring Well Location
- On Site Sampling Location
- Off-Site Sampling Location

Approximate Slope Area

MCL = Maximum Contaminant Level
DWNL = Drinking Water Notification Level
µg/L = Micrograms per liter
mg/L = Milligrams per liter

Note:
CPT locations and groundwater results taken from ARCADIS BBL July 2007 groundwater/hydropunch sampling event.

Monitoring wells GW-7 and MWG-3 sampled by SCS Engineers, May 2007.

0 100 200
SCALE IN FEET

TETRA TECH
348 W. HOSPITALITY LN. SUITE 100
SAN BERNARDINO, CALIFORNIA 92408
(909) 381-1674

TC # 21868.1.1.01

| | | |
|---|---|---|
| DRAWN BY: | SH | 02/21/08 |
| CHECKED BY: | | |
| APPROVED BY: | | |

AVALON AT SOUTH BAY

**Figure 4**
**Groundwater Investigation Sampling Locations and Analyte Results Exceeding MCLs and DWNLs - SW Corner and Off-site Locations - Deep (90-115 feet bgs)**

X:\GIS\CARSON AVALON\PROP SAMP LOCS.MXD

A4

A3

CPT-33

GW-8

CPT-23

CPT-26

CPT-25

CPT-34

GW-7A

GW-7B

GW-7C

CPT-22

CPT-24

CPT-21

CPT-18

CPT-17

CPT-15

GW-6

CPT-20

MWB-4

GW-7.1R

CPT-19

CPT-16

MWB-3

Proposed GW-9

CPT-43

CPT-42

CPT-41

**LEGEND**

Proposed Location of Groundwater Monitoring Well GW-9

Cone Penetrometer Test (CPT) Location

On Site Sampling Location

Off-Site Sampling Location

Groundwater Monitoring Well Location

On Site Sampling Location

Off-Site Sampling Location

Approximate Slope Area

MCL = Maximum Contaminant Level

DWNL = Drinking Water Notification Level

µg/L = Micrograms per liter

mg/L = Milligrams per liter

Note:

CPT locations and groundwater results taken from ARCADIS BBL July 2007 groundwater/hydropunch sampling event.

N

0 100 200

SCALE IN FEET

TETRA TECH
348 W. HOSPITALITY LN. SUITE 100
SAN BERNARDINO, CALIFORNIA 92408
(909) 381-1674

TC # 21868.1.1.01

| | | |
|---|---|---|
| DRAWN BY: | SH | 02/21/08 |
| CHECKED BY: | | |
| APPROVED BY: | | |

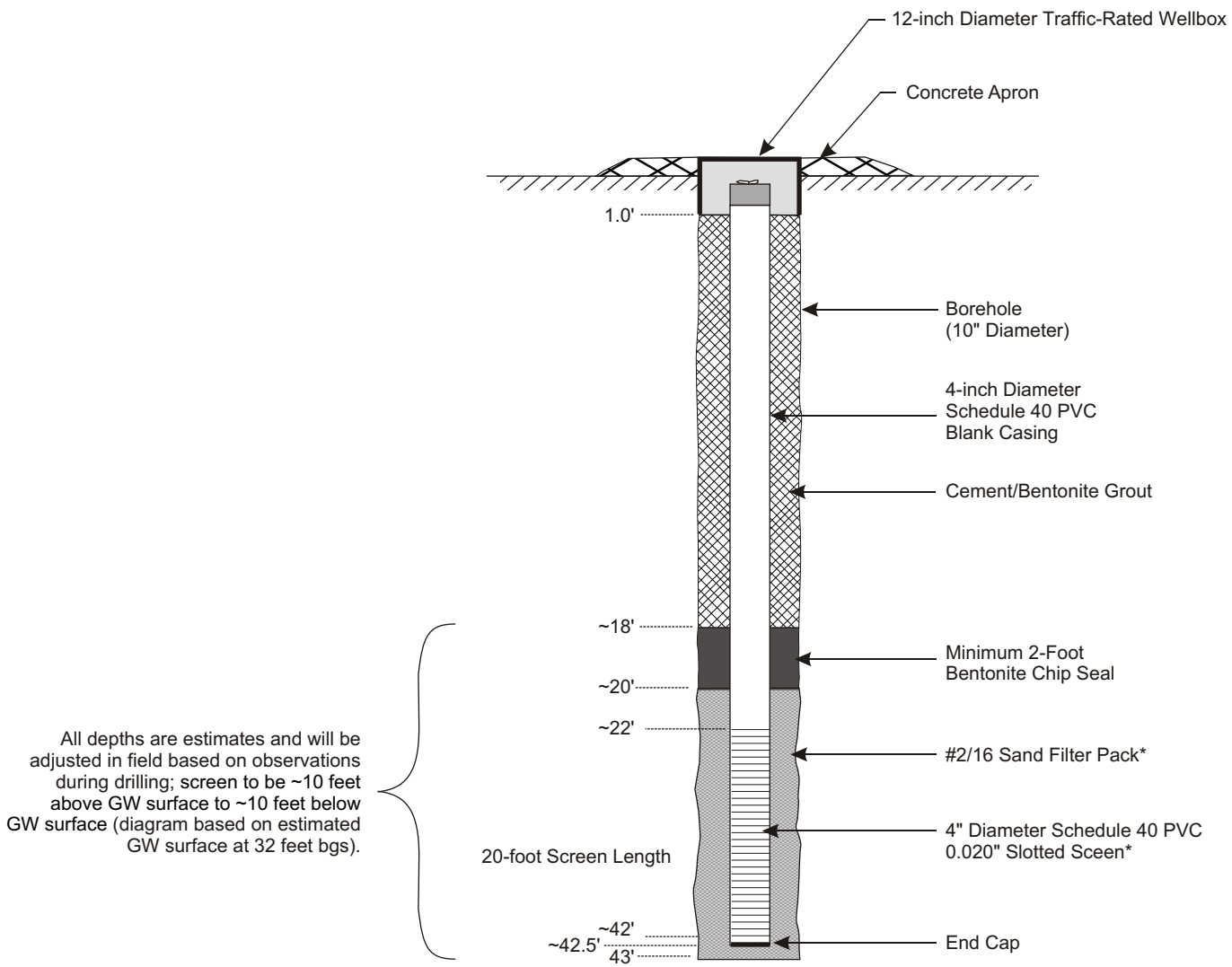
AVALON AT SOUTH BAY

AVALON AT SOUTH BAY

**Figure 5**

**Proposed Groundwater Monitoring Well Location in Off-site CPT-43 Area**

X:\GIS\CARSON-AVALON\WELL CONST.CDR




* Final selection to be determined in field based on soil properties.

TETRA TECH
348 W. HOSPITALITY LN. SUITE 100
SAN BERNARDINO, CALIFORNIA 92408
(909) 381-1674

| TC # 21868.1.1.01 | | |
|---|---|---|
| DRAWN BY: | SH | 02/25/08 |
| CHECKED BY: | | |
| APPROVED BY: | | |

AVALON AT SOUTH BAY

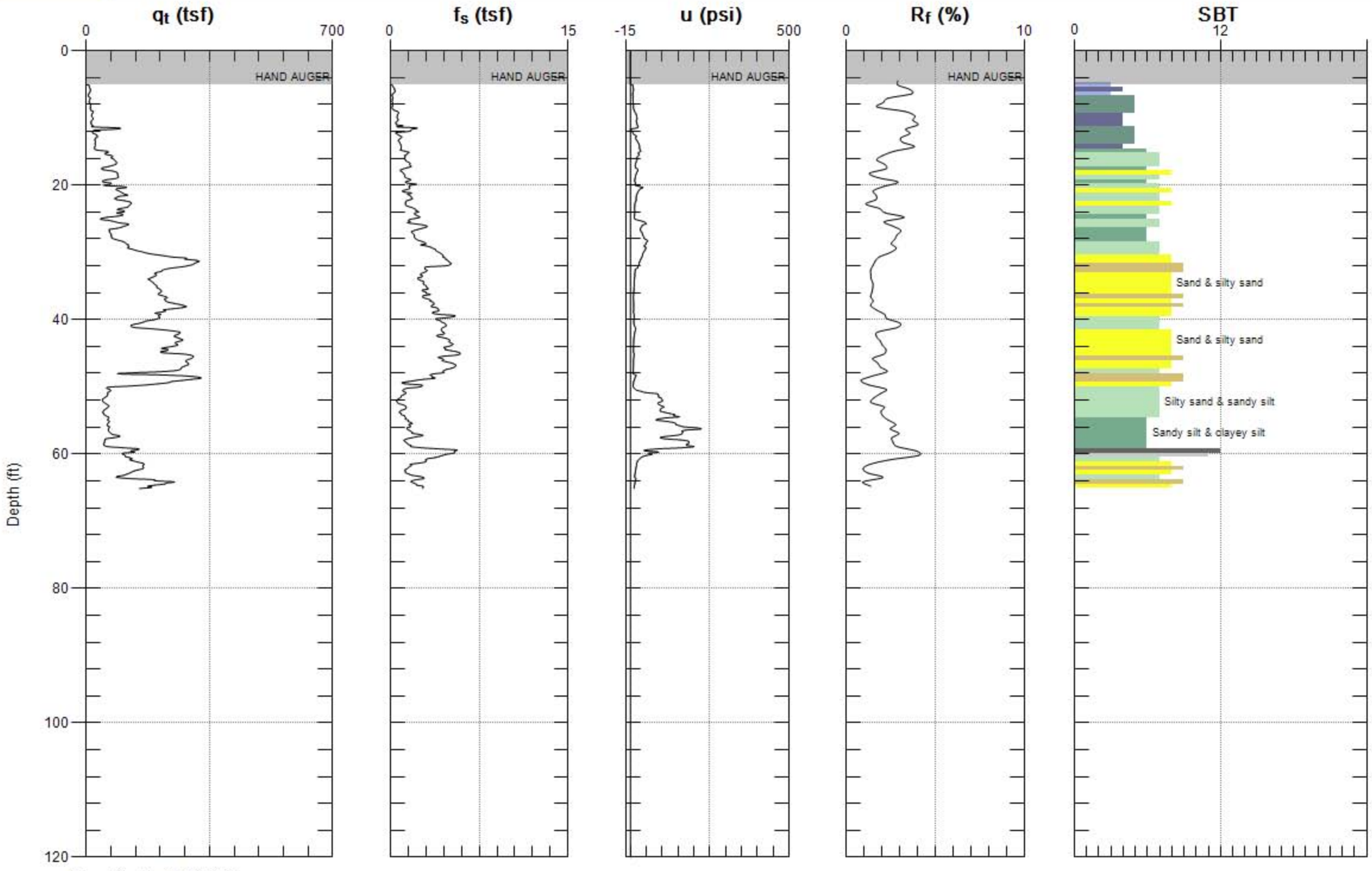
**Figure 6**
**Proposed Well Construction Diagram for GW-9**

# APPENDIX A

# ARCADIS BBL

Site: CARSON MARKETPLACE Engineer: N.SCHULZ

Sounding: CPT-43 Date: 6/29/2007 03:10




Max. Depth: 65.125 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

**Date Start/Finish:** 06/19/07 - 06/19/07
**Drilling Company:** Gregg Drilling
**Driller's Name:** Santiago Vega
**Drilling Method:** Direct Push
**Bit Size:** 2.5 inch / 2 inch Acetate Sleeve
**Rig Type:** Direct Push
**Sampling Method:** Acetate Sleeve / Glass Jars

**Northing:** 1763751.24 ft
**Easting:** 6477907.60 ft

**Borehole Depth:** 20 ft bgs
**Surface Elevation:** 19.59 ft msl

**Description By:** Matt Worthington
**Reviewed By:** Guy Chammas, P.G. No. 7113

**Well/Boring ID:** 43
**Client:** Carson Marketplace LLC
**Location:** Former Cal Compact Landfill
Carson, CA

| DEPTH (ft bgs) / ELEVATION | Sample Interval / Sample ID | Recovery (%) | PID Headspace (ppm) | USCS Code | Geologic Column | Stratigraphic Description | Boring/Well Backfill Description |
|---|---|---|---|---|---|---|---|
| 0 | | | | ML | | 4" Asphalt | Asphalt Patch |
| 1 | | | 5.5 | CL | | SILT (ML), yellowish brown (10YR 5/6), moist, slightly stiff. | |
| 2 | 43-01 (1245) | HA 100 | | | | LEAN CLAY (CL), dark olive gray (5Y 3/2), moist to very moist, slightly stiff, med. plasticity, some debris including glass and wood, slight odor, some staining. | Bentonite Grout |
| 3 | | | | | | | |
| 4 | | | | | | Same as above (SAA), but no debris, moist. | |
| 15 | | | | | | | |
| 5 | 43-05 (1255) | | 6.9 | | | | |
| 6 | | | | | | | |
| 7 | | 100 | | | | | |
| 8 | | | 7.2 | CH | | FAT CLAY (CH), dark olive gray (5Y 3/2), moist, stiff, med. to high plasticity, 10% fine-grained sand, trace silt, slight odor, some staining. | |
| 9 | | | | | | | |
| 10 | | | | | | FAT CLAY (CH), dark olive gray (5Y 3/2), moist, stiff, med. to high plasticity, 10-15% silt, trace fine-grained sand, slight odor, staining. | |
| 10 | | | 6.9 | | | | Bentonite Grout |
| 11 | 43-10 (1300) | 75 | | | | | |
| 12 | | | | ML | | SILT (ML), dark olive gray (5Y 3/2), moist to very moist, stiff, med. plasticity, 10% clay, slight odor, some staining. | |
| 13 | | | 9.3 | | | | |
| 14 | | | | CL | | LEAN CLAY (CL), black (5Y 2.5/2), moist, very stiff, low plasticity, slight odor, staining. | |
| 5 | | | | | | | |
| 15 | 43-15 (1310) | 100 | 8.5 | | | | |
| 16 | | | | | | SAA, but increase in silt. | |
| 17 | | | | | | | |
| 18 | | 100 | 10.3 | ML | | SILT (ML), black (5Y 2.5/2), moist to very moist, stiff, med. plasticity, 10% clay, slight odor, staining. | |
| 19 | | | | | | | |
| 0 | | | | | | | |
| 20 | 43-20 (1320) | | | | | Total Depth of Boring = 20 ft bgs. | |
| 21 | | | | | | | |

REGISTERED GEOLOGIST
GUY A. CHAMMAS
No.: 7113
Exp.: 11/30/08
STATE OF CALIFORNIA

ARCADIS BBL
Infrastructure, environment, facilities

**Remarks:**
bgs = below ground surface
ft = feet
NA = not applicable
med. = medium / moderate
HA = hand auger
SAA = same as above
msl = mean sea level

Soil samples analyzed for porosity, permeability, bulk density, moisture content, and particle-size distribution.
Hand augered to 5 ft bgs to clear utilities.
Odor from soil possibly from petroleum.

Project: 12451.00009
Data File: 43.dat
Template: soilboring-5ftwithfillcolumn.ldf
Date: 07/25/07