



February 1, 2012

Ms. Barbara Cook, P.E.
Acting Assistant Deputy Director, Cleanup Program
Site Mitigation Branch
Department of Toxic Substances Control
700 Heinz Avenue, Suite 200
Berkeley, California

Attention: Lynn Nakashima
Sent via: email

Subject: Field Sampling Work Plan to conduct additional groundwater investigations within and in the vicinity of the BAPB at the University of California Berkeley Richmond Field Station, Richmond, California

Dear Ms. Cook:

Terraphase Engineering Inc. (Terraphase) has prepared this work plan on behalf of Zeneca Inc. (Zeneca), a respondent to the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) Site Investigation Order, Docket No 06/07-004 ("DTSC Order")¹. This work plan describes the procedures and methodologies to conduct additional groundwater investigations at the portion of the biologically active permeable barrier (BAPB) located at the University of California Berkeley Richmond Field Station (RFS), in Richmond, California (Figure 1). The objective of the proposed work is to further assess concentrations of dissolved zinc, nickel and selenium in groundwater upgradient, within, and downgradient of the BAPB. This work plan was required by the DTSC in a December 2, 2011 letter ("the December 2nd DTSC Letter") following submittal of the Terraphase November 18, 2011, "Technical Memorandum For the University of California Richmond Field Station Biologically Active Permeable Barrier Groundwater Sampling Results" ("the Technical Memorandum").

Background

Arcadis-US submitted the November 24, 2010 work plan to DTSC entitled, "Revised Work Plan to Evaluate Groundwater in Select Areas at the University of California Richmond Field Station, Richmond, California," ("the BAPB Work Plan"). In accordance with the BAPB Work Plan, Arcadis-US installed five groundwater monitoring wells at the approximate locations illustrated on Figure 2. Groundwater monitoring wells MW-34, MW-35 and MW-36 were installed in a line perpendicular to the BAPB. Well

¹ The Regents of the University of California (UC) is also a respondent to the DTSC Order.

MW-34 was positioned to be immediately upgradient of the BAPB, well MW-35 was positioned within the BAPB, and well MW-36 was positioned immediately downgradient of the BAPB. In addition, monitoring wells MW-37 and MW-38 were installed within the BAPB, to the west and the east of the well cluster, respectively (Figure 2). Arcadis-US sampled the monitoring wells in January 2011. The groundwater monitoring well construction logs and groundwater sampling results were provided in an Arcadis-US March 11, 2011 letter report, "Transmittal of Groundwater Data Collected in Select Areas at the University of California Richmond Field Station, Richmond California" ("the 2011 Data Transmittal").

As provided in the 2011 Data Transmittal, groundwater samples collected from monitoring wells MW-37 and MW-38 contained dissolved concentrations of zinc, nickel and selenium above the corresponding site-specific screening criteria approved by the DTSC for Campus Bay. The groundwater sample collected from MW-35 contained selenium at a dissolved concentration above the corresponding DTSC approved Campus Bay site specific screening criteria. Table 3 of the Data Transmittal has been provided in Attachment 1 for reference. In the three groundwater monitoring wells positioned within the BAPB, zinc concentrations ranged from less than 20 micrograms per liter ($\mu\text{g/l}$) in well MW-35 to 23,000 $\mu\text{g/l}$ in well MW-37. Nickel ranged from 11 $\mu\text{g/l}$ in well MW-35 to 90 $\mu\text{g/l}$ in well MW-37. Selenium concentrations ranged from 25 $\mu\text{g/l}$ in well MW-37 to 65 $\mu\text{g/l}$ in well MW-35. The corresponding Campus Bay site specific screening values for zinc, nickel and selenium are 410 $\mu\text{g/l}$, 41 $\mu\text{g/l}$ and 25 $\mu\text{g/l}$ respectively (EKL, April 2008).

The intrusive nature of well installation and development activities can have a localized temporary effect on the geochemical conditions of groundwater within the BAPB. Therefore, Terraphase re-sampled the groundwater monitoring wells positioned within the BAPB (MW-35, MW-37 and MW-38) on August 10, 2011. The wells were sampled using the low-flow sampling procedures described in Appendix A of the July 15, 2011 Terraphase document, "Semi-Annual Groundwater and Surface Water Monitoring Report, January 1 Through June 30, 2011, Campus Bay, Richmond, California". The results of the additional groundwater sampling were provided to the DTSC in the Technical Memorandum. The groundwater samples were submitted to a state-certified analytical laboratory for Title 22 Metals analysis using Environmental Protection Agency (EPA) Method 6010 (EPA Method 7470 for mercury).

Table 2 of the Technical Memorandum has been provided in Attachment 1 for reference. The analytical data in the Technical Memorandum indicate that dissolved concentrations of nickel, selenium, and zinc are above the corresponding Campus Bay site-specific goals in groundwater samples collected from wells MW-37 and MW-38. Groundwater samples from well MW-35 contained selenium above the corresponding Campus Bay site-specific goal. Based on the information provided in the 2010 Data Transmittal and the Technical Memorandum, the DTSC issued the December 2nd DTSC Letter requiring that a work plan be prepared to describe additional investigation activities within and in the vicinity of the portion of the BAPB located at the RFS.

Work Plan Objective

The December 2nd DTSC Letter required that a work plan be prepared to describe the following additional field investigation activities:

1. *Verify that the existing monitoring wells are located within the BAPB. If it is determined that any of the wells are not properly positioned, then additional wells should be installed within the BAPB. Those wells should be installed using direct push methods and pre-packed well screens to prevent undue disturbance to the BAPB.*
2. *Collect grab groundwater samples from locations upgradient, downgradient, and to the west of the BAPB. Collect samples from the upper horizon and lower horizon water-bearing zones at each location to better characterize the distribution of metals found in groundwater. Also, include analysis for volatile organic compounds (VOCs) at each location because of the occurrence of VOCs upgradient of the BAPB.*

A review of the monitoring well construction logs provided in the Data Transmittal indicates that the screen interval for well MW-37 may extend below the bottom of the BAPB material. The lithologic log indicates that at the location of well MW-37, the BAPB extends from approximately 2 feet below ground surface (bgs) to approximately 10 feet bgs. According to the monitoring well construction log, the screen interval of well MW-37 extends from approximately 5 feet bgs to approximately 15 feet bgs. Therefore, it appears that approximately 5 feet of the screen interval of well MW-37 is positioned below the BAPB material. Therefore, groundwater samples collected from this well may not be indicative of groundwater conditions within the BAPB. In addition, it is recommended that a shorter screen length be used for the BAPB monitoring wells to more effectively collect groundwater samples that represent groundwater conditions within the BAPB. During groundwater sampling, the longer screen intervals may allow groundwater from outside the vertical extent of the BAPB to influence the field parameter and analytical data.

Therefore, this Work Plan provides the procedures for installing new BAPB monitoring wells and collecting the additional grab groundwater samples as required by the DTSC. In addition, the well construction logs for wells MW-35 and MW-38 indicate poor sample recovery within the BAPB material. Poor sample recovery of the BAPB material is expected due to the physical nature of the BAPB material. Therefore, the lateral and vertical extent of the BAPB material will be reassessed at each location prior to the installation of the BAPB monitoring wells.

Scope of Work

The field activities discussed in this Work Plan will be conducted in accordance with the procedures and methodologies set forth in the following documents previously approved by the DTSC:

- “Lot 3 Field Sampling and Analysis Plan, Campus Bay Site, Former Zeneca, Inc., Richmond Facility, Richmond, California,” dated November 2, 2005 (“the Lot 3 FSAP”);
- “Revised Quality Assurance Project Plan Approval, Former Zeneca Property, Campus Bay Site,” dated July 18, 2005.

The required scope of work is discussed below.

Pre-Field Activities

The “Health and Safety Plan, 1390 South 49th Street, Campus Bay, Richmond, California” (HASP; Terraphase 2011) will be updated to account for the investigation activities described in this Work Plan. Prior to implementing field activities, Underground Service Alert (USA) will be notified at least 48 hours in advance of mobilization to the field. A private utility locator will also be contracted to identify underground utilities at each soil boring location. In addition, Terraphase will coordinate with RFS representatives to review the soil boring locations relative to site construction as-built drawings to support the effort in identifying subsurface utilities in the area of work. Terraphase will also obtain the applicable county and state permits required for the work.

Installation and Sampling of BAPB Monitoring Wells

Prior to installing the BAPB wells, the lateral and vertical extent of the BAPB will be re-assessed at each location. Soil borings will be advanced adjacent to and approximately 5 feet from the existing BAPB wells. The approximate locations of the soil borings coincide with the locations of the proposed BAPB monitoring wells illustrated in Figure 2. Based on the well construction logs provided in the Data Transmittal, the top of the BAPB can be expected between approximately 3 feet bgs and 5 feet bgs. A hand auger will be used identify the location of the top of the BAPB. The soil cuttings will be assessed to identify when the BAPB is encountered. Additional auger borings will be advanced to the north and south to identify the lateral extent of the BAPB material.

After assessing the lateral extent of the BAPB, a direct-push soil boring will be advanced through the BAPB. One soil boring will be advanced adjacent to each BAPB monitoring well. A continuous soil core will be collected from each soil boring. Terraphase will subcontract a California-certified drilling contractor to advance the soil borings under the supervision of Terraphase field staff working under the direction of a California Professional Geologist.

After assessing the vertical and lateral extent of the BAPB at each location, a 1.5-inch-diameter pre-pack monitoring well will be installed into the BAPB at each of the three new well locations. The monitoring well will be positioned so that it is in the center of the lateral extent of the BAPB. The pre-pack well will consist of a 5-foot-long Schedule 40 polyvinyl chloride (PVC) 0.010-inch slotted well screen with Schedule 40 PVC casing. The well will be installed such that the screen interval is centered within the vertical extent of the BAPB material at each location. To install the monitoring well, direct-push rods will be advanced to a pre-determined depth (based on the vertical extent of the BAPB material). The well assembly will be lowered through the rods. The rods will then be retracted to a point above the screen interval. An approximately 1 foot thick layer of bentonite chips will be placed above the sand pack of the screen interval and hydrated to form a coherent seal. The remainder of the annular space will be filled with cement grout. A locking well cap will be placed on top of the well casing. At the ground surface, the wells will be completed with a riser pipe extended approximately 3 feet above grade. A metal casing will be installed to protect the PVC riser pipe. The approximate proposed locations of the BAPB monitoring wells are illustrated on Figure 2.

The monitoring wells will be developed in accordance with the procedures provided in the Lot 3 FSAP. A surveyor licensed in the State of California will be retained to record the location and elevation of the

top of casing for each piezometer installed. The wells will be sampled a minimum of 48 hours after development is completed using the low-flow procedures described in the Lot 3 FSAP.

Groundwater samples collected from the BAPB wells will be submitted to a state certified analytical laboratory for the following analyses:

- California Code of Regulations Title 22 Metals (California Assessment Manual 17 [CAM 17]): antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc, using EPA Method 6010.
- Volatile organic compounds using EPA Method 8260
- Ferrous iron by Standard Method 3500 FeB
- Dissolved sulfide by Standard Method 4500S2-D
- Alkalinity by Standard Method 2320B
- Chloride and sulfate by EPA Method 300.0
- Total dissolved solids and total suspended solids by Standard Method 2540D
- Total organic carbon by Standard Method 5310C

Grab Groundwater Sampling

As required in the December 2nd DTSC Letter, grab groundwater samples will be collected from seven locations. The approximate locations of the grab groundwater samples are illustrated in Figure 2. However, to limit disruption to the marsh, the locations may be shifted to account for access restrictions and to minimize disruption to vegetation. The grab groundwater samples will be collected in accordance with the procedures described in the Lot 3 FSAP. Three soil borings will be advanced at each location using direct push technology. The soil borings will be advanced to approximately 15 feet bgs, approximately 25 feet bgs, and approximately 35 feet bgs. A temporary Schedule 40 PVC casing with a 5 foot length of 0.010-inch screen will be installed in each soil boring. A grab groundwater sample will be collected from each boring and submitted to a state-certified analytical laboratory for the following analyses:

- CAM 17 Metals using EPA Method 6010
- VOC using EPA Method 8260

Investigation-Derived Waste

Investigation-derived waste water and soil generated during this investigation will be temporarily staged at the RFS in 55-gallon drums or an appropriate non-reactive plastic tank, and will be handled and disposed of in accordance with state and federal requirements. The location of the drum storage will be coordinated with RFS representatives prior to implementation of the work. The drums will be properly labeled; drum labels will include the following information:

- Description of waste (i.e., water or soil),
- Location at the RFS from where the waste originated,
- Date generated,

- Contact information, and
- Project name.

When implementing the activities described in this work plan, measures will be taken to minimize disruption of the restored marsh area. Soil boring and well installation activities will be completed using track mounted limited access drilling equipment. Routes to sampling locations will be selected to minimize the disruption to the existing vegetation. In addition, the weather forecast will be taken into account when scheduling the work. If feasible, work will not be scheduled to take place during forecasted rain events.

Upon completion of the additional investigation activities and validation of the additional analytical data, Terraphase will prepare a letter report that will further assess the current effectiveness of the portion of the BAPB at the RFS. The report will be submitted to the DTSC for review and comment. If you have any questions with regard to the procedures described in this Work Plan, please do not hesitate to give me a call at (510) 326-1473.

Sincerely,

For Terraphase Engineering Inc.



Andrew Romolo, P.G. (8110)
Vice President and Principal Geologist

Attachments:

Figure 1: Site Plan

Figure 2: UCRFS BAPB Additional Investigation

Attachment 1: Data Tables From The Data Transmittal and Technical Memorandum

cc:

Bill Marsh, Edgcomb Law Group

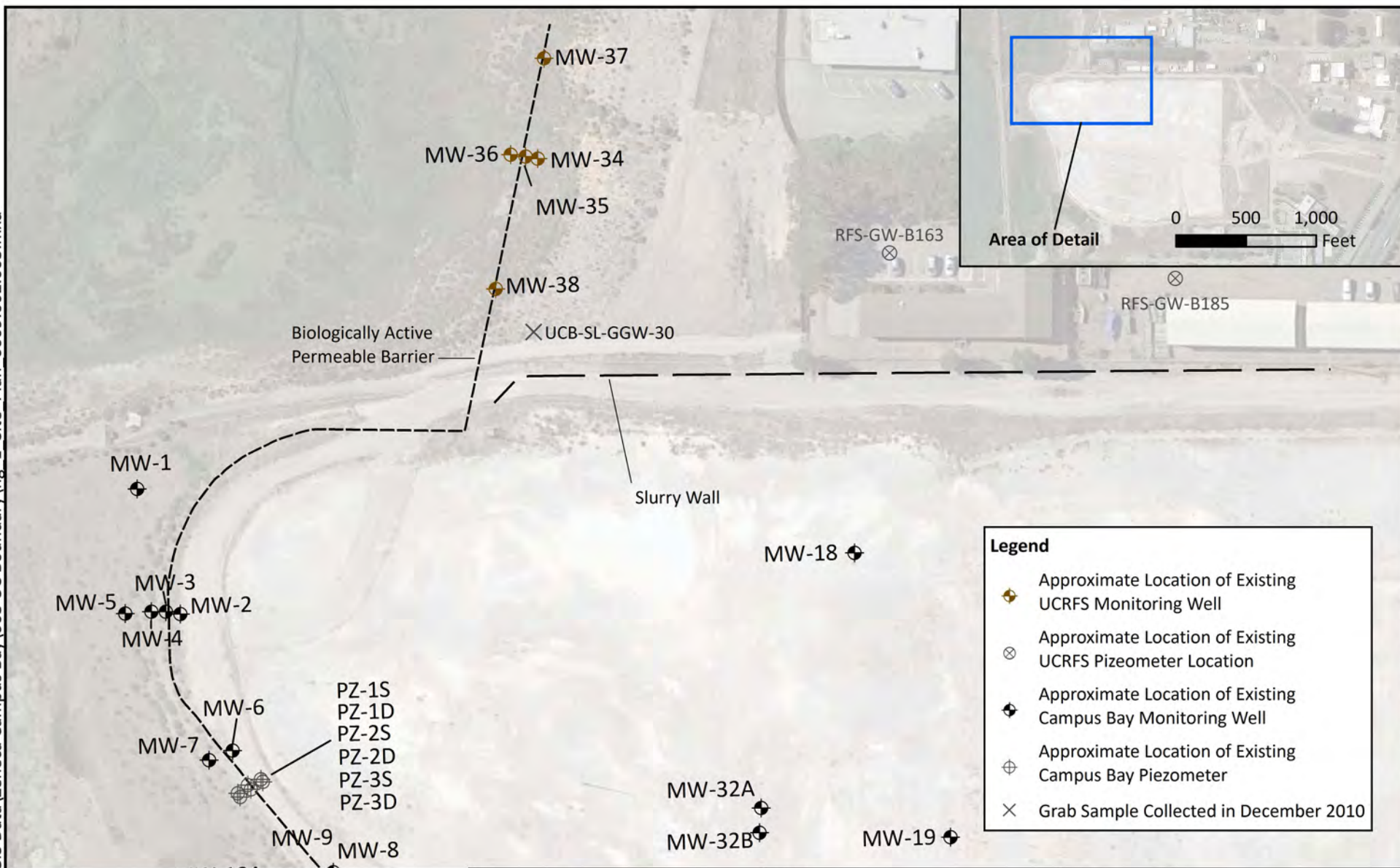
Lynn Nakashima, DTSC

Brian A. Spiller, Zeneca Inc.

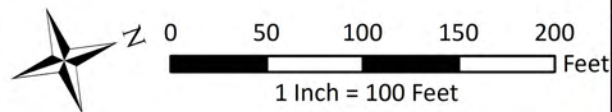
Karl Hans, University of California

Anthony O. Garvin, Esq., University of California Counsel

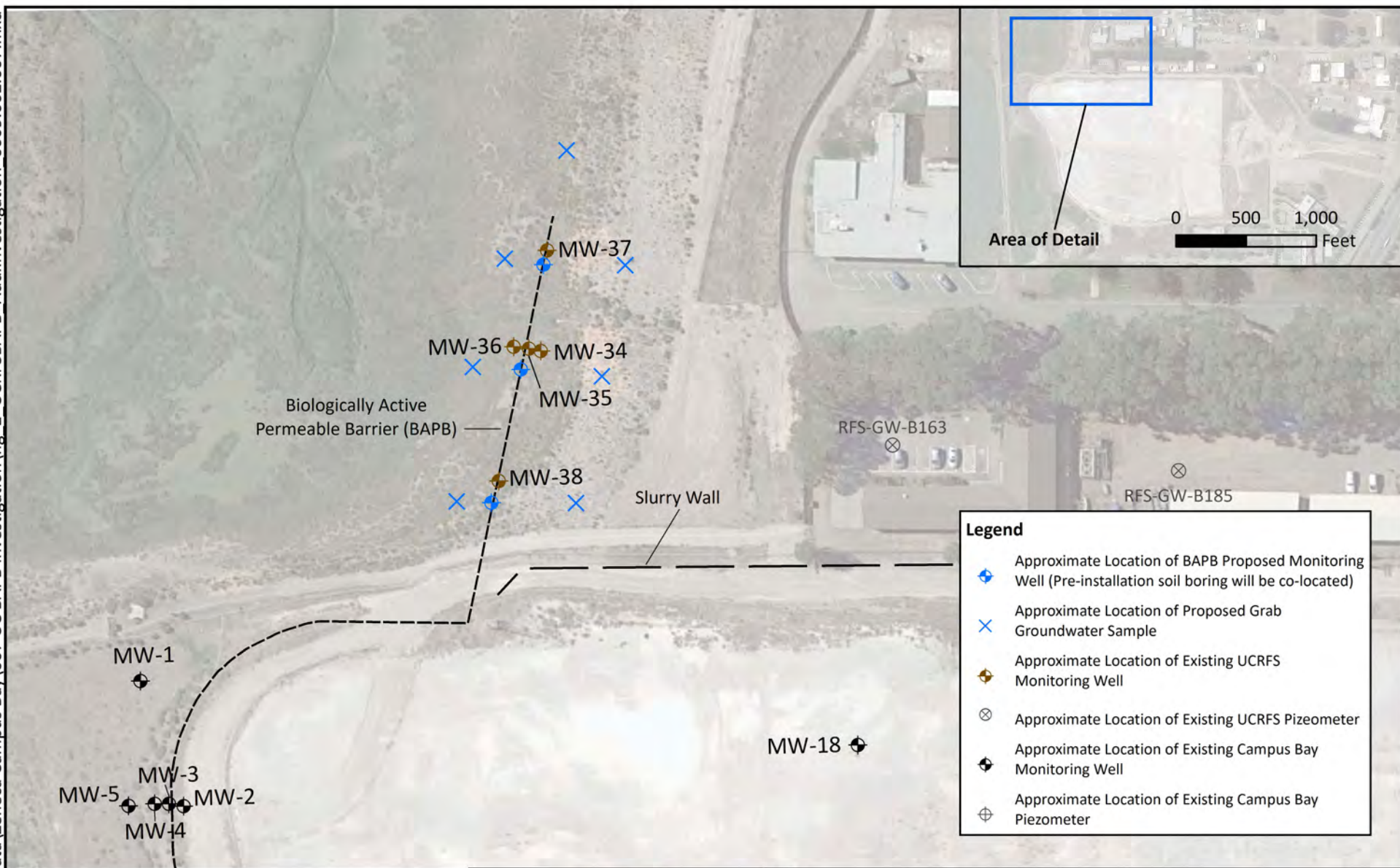
Figures



Legend	
	Approximate Location of Existing UCRFS Monitoring Well
	Approximate Location of Existing UCRFS Piezometer Location
	Approximate Location of Existing Campus Bay Monitoring Well
	Approximate Location of Existing Campus Bay Piezometer
	Grab Sample Collected in December 2010



SAFETY FIRST 	CLIENT:	Zeneca, Inc.	Site Plan
	PROJECT:	Campus Bay Richmond, CA	
	PROJECT NUMBER:	0009.002.003	FIGURE 1



0 50 100 150 200 Feet
1 Inch = 100 Feet

SAFETY FIRST



CLIENT:	Zeneca, Inc.
PROJECT:	Campus Bay Richmond, CA
PROJECT NUMBER:	0009.002.007

**UCRFS BAPB
Additional Investigation**

FIGURE 2

Attachments

Table 3
UC BAPB Sampling Analytical Results
Metals in Groundwater
UC Richmond Field Station
Campus Bay, Richmond, CA

*All results in micrograms per liter (µg/l)**

Sample ID	Sample Type	Sample Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
MW-34	Primary	1/7/2011	< 10	< 5	19	< 2	< 5	6.9	< 5	< 5	< 5	< 0.2	< 5	30	13	7.1	< 10	< 5	< 20
MW-35	Primary	1/7/2011	< 10	< 5	75	< 2	< 5	7.7	6.2	< 5	< 5	< 0.2	5.2	11	65	6.3	< 10	< 5	< 20
MW-36	Primary	1/7/2011	< 10	< 5	31	< 2	< 5	12	160	< 5	< 5	< 0.2	< 5	460	43	7.6	< 10	< 5	310
MW-37	Primary	1/7/2011	< 10	< 5	53	< 2	< 5	7.9	320	< 5	< 5	< 0.2	< 5	360	25	< 5	< 10	< 5	23,000
MW-38	Primary	1/7/2011	< 10	63	100	< 2	< 5	11	19	< 5	< 5	< 0.2	6.4	90	47	7.1	< 10	< 5	590
	Duplicate	1/7/2011	< 10	61	100	< 2	< 5	11	19	< 5	< 5	< 0.2	6.4	91	41	7.2	< 10	< 5	590
RFS-GW-B163*	Primary	9/2/2010	< 1.0	1.6	17	< 0.5	5.2	< 5.0	6	2.5	< 2.0	0.083	0.95	170	< 2.0	< 0.5	< 2.0	< 4.0	9.2
RFS-GW-ETA*	Primary	9/24/2010	< 1.0	22	39	< 0.5	0.93J	5.8	3.8	22	9.8	2.3	2.7	10	< 2.0	< 0.5	< 2.0	5.4	110
	Duplicate	9/24/2010	< 1.0	13	28	< 0.5	< 1.0	2.6	2.4	8	3.2	1.3	2.9	4.9	< 2.0	< 0.5	< 2.0	< 4.0	50
Equipment	Primary	1/7/2011	< 10	< 5	< 5	< 2	< 5	< 5	< 5	< 5	< 5	< 0.2	< 5	< 5	< 10	< 5	< 10	< 5	< 20

Notes:

<0.2 = Concentration not detected at or above indicated laboratory reporting limit

BAPB = Biologically Active Permeable Barrier

J = Estimated Value

MW = monitoring well

* = Sample Collected by Tetra Tech on behalf of the University of California (UC), Berkeley.

Bold values indicate concentrations above laboratory detection limits.

Table 2
UCRFS BAPB Sampling Analytical Results
Campus Bay Richmond, California

Sample ID	Sample Date	Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Cadmium µg/L	Chromium µg/L	Cobalt µg/L	Copper µg/L	Lead µg/L	Mercury µg/L	Molybdenum µg/L	Nickel µg/L	Selenium µg/L	Silver µg/L	Thallium µg/L	Vanadium µg/L	Zinc µg/L
MW-38	10-Aug-11	<10	52	78	<2	<5	<5	22	<5	<5	<0.2	<5	110	48	<5	<10	<5	710
MW-35	10-Aug-11	<10	15	120	<2	<5	<5	<5	<5	<5	<0.2	<5	<5	28	<5	<10	<5	<20
MW-37	10-Aug-11	<10	<7.1	20	<2	<5	<5	500	<5	5.8	<0.2	<5	630	50	<5	<10	<5	43,000
Screening Criteria																		
5x Aquatic Criteria		2.20E+05	1.80E+02	-	-	4.70E+01	-	-	1.60E+01	4.10E+01	1.10E+01	-	4.10E+01	2.50E+01	9.50E+00	3.20E+02	-	4.10E+02

Notes

µg/L = Micrograms per Liter

indicates a detection in upper horizon groundwater above 5x the aquatic criterion (Campus Bay Site Specific, Upper Horizon Near BAPB)