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July 3, 2014

Penny Reddy
Groundwater Remediation Project Manager
Superfund Division SFD-7-3
EPA Region IX
75 Hawthorne Street
San Francisco, CA 94105

Subject: **Work Plan for ISCO Pilot Study Data Collection**
401 National Avenue, Former Fairchild Building 9
Middlefield-Ellis-Whisman Area
Mountain View, California

Dear Ms. Reddy:

Enclosed with this letter is a work plan for data collection to support a proposed in situ chemical oxidation (ISCO) pilot study at the former Fairchild Building 9, located at 401 National Avenue, Mountain View, California.

As indicated in the work plan, the pilot study data collection is scheduled to take place following the demolition of Building 9, which is anticipated to be completed in September 2014. We are therefore requesting approval of the work plan by 31 July 2014 to allow sufficient time for subcontractor scheduling and coordinating site access.

If you have any questions about the enclosed work plan, please feel free to contact me.

Very truly yours,

V. COCIANNI

Virgilio Cocianni
Remediation Manager

Attachment

CC: MEW Distribution List
Victor R. Fracaro, National Avenue Partners, LLC

Geosyntec consultants

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3 July 2014

Ms. Penny Wilson Reddy
USEPA Region IX
75 Hawthorne Street
San Francisco, California 94105

Subject: Work Plan for ISCO Pilot Study Data Collection
401 National Avenue
Mountain View, California

Dear Ms. Reddy:

This work plan presents a scope of work for data collection to support a proposed in situ chemical oxidation (ISCO) pilot study for addressing chlorinated volatile organic compounds (cVOCs) in groundwater at the former Fairchild Semiconductor Corporation (Fairchild) Building 9 facility located at 401 National Avenue[1] in Mountain View, California (Site, Figures 1 and 2). Geosyntec Consultants, Inc. (Geosyntec) has prepared this work plan on behalf of Schlumberger Technology Corporation (STC) based on data available from characterization and remediation activities conducted at the Site since the mid-1980s and results from a data collection field program conducted in September 2013.[2] The September 2013 field program identified treatment areas for the ISCO pilot study outside of the building footprint; however, the distribution of cVOCs beneath the former Building 9 has not been evaluated. The scope of work described herein includes a field program to evaluate the distribution of cVOCs beneath the building and bench-scale testing to assess site-specific oxidant demand. The results of the data collection scope of work will be integrated into the conceptual site model for the former Building 9 and used to finalize the pilot study design. A work plan for implementing the ISCO pilot study is being submitted concurrently with this work plan under separate cover.[3]

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[1] As part of a planned redevelopment, 401 National Avenue and the properties located to the immediate north (620 through 640 National Avenue) have been consolidated into a single address: 600 National Avenue. For consistency with historical project documents, the project site for the ISCO pilot study will be referred to as the Site, former Building 9, or 401 National Avenue throughout this Work Plan.

[2] Geosyntec, 2014. Data Collection Summary Report, 401 National Avenue, Former Fairchild Building 9, Middlefield-Ellis-Whisman Area, Mountain View, California, July 3.

[3] Geosyntec, 2014. Work Plan for In Situ Chemical Oxidation Pilot Study, 401 National Avenue, Former Fairchild Building 9, Middlefield-Ellis-Whisman Area, Mountain View, California, July 3.

BACKGROUND

STC has been performing soil and groundwater remedies for cVOCs, primarily trichloroethene (TCE) and its breakdown products (cis-1,2-dichloroethene [cDCE] and vinyl chloride [VC]), at the former Building 9 facility since 1986. In conformance with the 1989 Record of Decision (ROD) and two subsequent Explanations of Significant Differences (ESDs)[4] issued by the United States Environmental Protection Agency (EPA) for the Middlefield-Ellis-Whisman (MEW) study area, the groundwater remedy consists of groundwater extraction and treatment (pump-and-treat) by means of four recovery wells within an area bounded by a slurry wall constructed to a depth of approximately 40 feet below ground surface. In March 2013, EPA directed the MEW Parties to perform pilot studies at their sites to evaluate alternative technologies or approaches for increasing the rate of cVOC mass removal.[5] On behalf of STC, Geosyntec is planning this ISCO pilot study as a means of increasing the rate of cVOC mass removal at 401 National Avenue.

The 401 National Avenue property was purchased by National Avenue Partners, LLC in 2013 and is slated for redevelopment in conjunction with three properties to the north. Planned redevelopment activities include the demolition of the former Building 9 and the construction of a two-story parking garage over most of the 401 National Avenue property. This ISCO pilot study is being proposed at the former Building 9 site because the proposed redevelopment activities offer a unique opportunity for broader access during redevelopment. ISCO injections are expected to take place following building demolition and prior to parking garage construction. Therefore, while the pilot study is not associated with the redevelopment activities, the timing of the pilot study will consider the development schedule.

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[4] United States Environmental Protection Agency (EPA), 1989. Record of Decision, Fairchild, Intel, and Raytheon Sites, Middlefield-Ellis-Whisman Study Area, Mountain View, California, Superfund Records Center Document No. 2807-02332, May.

EPA, 1990. EPA Superfund Explanation of Significant Differences: Middlefield-Ellis-Whisman Study Area, Mountain View, CA, September 1.

EPA, 1996. EPA Superfund Explanation of Significant Differences: Middlefield-Ellis-Whisman Study Area, Mountain View, CA, April 16.

[5] P.W. Reddy, USEPA, Email Communication, 11 March 2013.

Local Hydrogeology

Cross-sections depicting the hydrogeology at the Site, Figures 3 and 4, were developed using historical information and information generated during the September 2013 supplemental data collection field program. The local Site geology consists of alluvial deposits that are primarily fine-grained, with thin interbedded layers of coarser-grained materials. The A-zone at the Site is heterogeneous laterally and vertically but is generally encountered between 14 and 40 feet below ground surface (bgs). Two relatively continuous layers of coarser-grained material (i.e., sand and silty sand) are present within the planned pilot study area: the shallow coarse-grained layer is generally encountered between 17 and 23 feet bgs and the deep coarse-grained layer is generally encountered between 32 and 37 feet bgs.

Under pumping conditions, the potentiometric surface of the A-zone at the Site generally occurs under confined conditions at a depth of approximately 17 feet bgs, corresponding to groundwater elevations of approximately 26 feet above mean sea level (MSL) in Site monitoring wells during the September 2013 annual gauging event.[6] Based on data collected in September 2013, groundwater elevations within the slurry wall when the extraction wells are not operating may be 4 to 5 feet higher than elevations under pumping conditions.

cVOCs in Groundwater

The primary cVOCs in Site groundwater are TCE and its reductive dechlorination daughter products cDCE and VC, although various other cVOCs have been detected in Site groundwater above current ROD Cleanup Levels and California Maximum Contaminant Limits (MCLs).[7] TCE concentrations in groundwater from Site monitoring wells sampled in 2012 and 2013, and samples collected from temporary points during the September 2013 data collection activities, are presented in Table 1 and shown in Figure 2.

Over the last five years (2008 to 2013), the maximum concentration of TCE detected in Site groundwater monitoring and extraction wells was 13,000 micrograms per liter (µg/L), measured in AE/RW-9-2 in 2013. TCE and total cVOC concentrations in groundwater collected from

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[6] Geosyntec, 2014a. 2013 Annual Progress Report for Former Fairchild Buildings 1-4, 9, and 18, Mountain View, California, April 15.

[7] Other cVOCs detected above ROD Cleanup Levels or California MCLs were trans-1,2-dichloroethene, 1,1-dichloroethane, 1,1-dichloroethene, and trichlorotrifluoroethane (CFC-113, Freon 113).

temporary points set in the shallow and deep coarse-grained layers during the September 2013 supplemental data collection activities ranged from 100 to 560,000 µg/L and 2,500 to 630,000 µg/L, respectively (Figure 2).

TCE and total cVOC concentrations increase with depth within the shallow coarse-grained layer (MIP-12 results on Table 1 and Figure 2). TCE and total cVOC concentrations in groundwater collected from the deep coarse-grained layer were significantly lower than concentrations in the shallow coarse-grained layer, ranging from 100 to 1,200 µg/L and 3,200 to 5,600 µg/L, respectively.

SCOPE OF WORK

The ISCO pilot study data collection scope of work is designed to evaluate the distribution of cVOCs beneath the building and bench-scale testing to assess Site-specific oxidant demand. The work will include the following components:

- Soil and groundwater collection and bench-scale testing to evaluate oxidant formulations and dosing parameters prior to finalizing the ISCO pilot study oxidant injection program;
- Groundwater sample collection to evaluate naturally occurring background levels of inorganic constituents that may be monitored as part of the ISCO pilot study; and
- Borehole logging and depth-discrete grab groundwater sampling to evaluate the distribution of cVOCs beneath the former Building 9 prior to finalizing the injection area for the ISCO pilot study.

The following sections provide descriptions of the activities that will be completed during implementation of the pilot study data collection field effort.

Task 1: Pre-Field Activities

Before implementing the ISCO data collection field work, Geosyntec will perform the following:

- Update the Site-specific project health and safety plan (HASP) as needed;
- Coordinate with National Avenue Partners, LLC for access to the Site;
- Coordinate and subcontract with the drilling contractor and analytical and bench-scale testing laboratories;

- Mark proposed boring locations;
- Notify Underground Services Alert (USA) North a minimum of 48 hours prior to conducting any intrusive subsurface work; and
- Retain a private utility locator to clear underground utilities in the areas where intrusive subsurface work is anticipated.

Task 2: Soil and Groundwater Collection for ISCO Bench Test and Baseline Geochemical Evaluation

Soil from a maximum of four locations and groundwater from AE/RW-9-2 will be collected from the Site to support the bench-scale testing program summarized in Task 3. Details of field work associated with soil and groundwater collection are provided below.

Soil Collection

Soil will be collected at two soil boring locations advanced using direct-push (DP) technology by a drilling subcontractor under the oversight of Geosyntec. The soil borings will be located near the two areas where the highest concentrations of TCE have been observed at the Site (i.e., near MIP-02 and MIP-12, Figure 5). The total depth of each boring will be approximately 30 feet bgs as it is assumed that the geological conditions in the shallow and deep coarse-grained units are comparable.

At each location, continuous soil cores will be collected by advancing dual-tube DP drill rods fitted with vinyl acetate sleeve liners. The cores will be logged for geology by field staff under the direction of a California Professional Geologist using the Unified Soil Classification System (USCS). The soil cores will also be field-screened for total VOCs using a photoionization detector (PID) and the readings recorded on the boring logs.

Soil collection depths will be selected to represent of the variability in the soil types present in the pilot study implementation area based on the geologic logs. Anticipated sample depths based on previous Site investigation activities are as follows:

- Soil collection depths adjacent to MIP-02:
    - Approximately 18.5 to 23.5 feet (representative of coarser-grained soils).
    - Approximately 24 to 26 feet (representative of finer-grained soils).

- Soil collection depths adjacent to MIP-12:
    - Approximately 18 to 23 feet (representative of coarser-grained soils).
    - Approximately 24 to 26 feet (representative of finer-grained soils).

Soil from the selected intervals will be collected by transferring soil from the acetate sleeve to laboratory-provided clean glass jars. The soil will be labeled, placed on ice, and shipped under standard chain-of-custody procedures to SiREM Laboratory of Guelph, Ontario, Canada (SiREM) for use in the ISCO bench-scale test.

Following boring completion, the DP rods will be extracted and the boring will be backfilled with neat cement grout.

Groundwater Collection

Groundwater will be collected from recovery well AE/RW-9-2 for use during the bench-scale testing program. The groundwater will be collected directly from the pump discharge line at the wellhead during normal operation. To measure field parameters (pH, dissolved oxygen [DO], oxidation reduction potential [ORP], temperature, and electrical conductivity) at AE/RW-9-2 during sampling, groundwater will be purged from the extraction well piezometer and pumped through a flow-through cell. Approximately 50 liters of groundwater extracted from AE/RW-9-2 will be collected into 5-gallon new plastic jerricans or a similar container. The groundwater will be labeled, placed on ice, and shipped in coolers under standard chain-of-custody procedures to SiREM for use in the bench-scale testing program.

In addition to the groundwater collected for the bench-scale testing, a groundwater sample will be collected from AE/RW-9-2 and shipped to TestAmerica, Inc. (TestAmerica), an EPA-certified laboratory, for analysis of baseline geochemical parameters:

- Total dissolved solids (TDS) by Method SM 2540C;
- Hexavalent chromium (Cr VI) by EPA Method 7196;
- Sulfate by EPA Method 300.0;
- Dissolved total manganese, iron, and chromium by EPA Method 6010B; and
- Chloride by EPA Method 300.0.

The results of the baseline geochemical sampling will be used to evaluate naturally occurring background levels of inorganic constituents that may require monitoring as part of the ISCO pilot study.

Task 3: ISCO Bench-Scale Tests

Bench-scale testing will be performed using soil and groundwater collected as part of Task 2 to evaluate the site-specific consumption of oxidant mixtures by cVOCs and non-target compounds (e.g., soil organic matter) prior to finalizing the design oxidant dosing for the ISCO pilot study. The two coarser-grained soil samples and the two finer-grained soil samples collected during Task 2 will be combined and homogenized prior to bench-scale testing into one coarse-grained composite sample and one fine-grained composite sample. These samples are expected to be representative of conditions that will be encountered during the ISCO pilot study.

Bench-scale testing will be performed by SiREM and will include the following components:

- Permanganate soil oxidant demand (PSOD) bench-scale testing will be performed to provide information regarding the rate and extent of oxidant consumption by Site soil and groundwater when dosed with permanganate.
- A comparative oxidant performance test will be performed to compare the treatment of Site soil and groundwater when dosed with permanganate, iron activated persulfate, and a mixture of permanganate and persulfate.

Details of the planned bench-scale testing program are provided in Attachment A.

Task 4: Treatment Area Delineation

Following the demolition of the former Building 9, data collection will be performed to evaluate the distribution of cVOC concentrations in the saturated zone beneath the current building footprint and to select the extent of the pilot study implementation area beneath the building. Electrical sensor logging using a soil conductivity probe (SCP)[8] will provide supplemental high

[8] The SCP is an electrical sensor attached to the DP tool that continuously measures soil electrical conductivity. Electrical conductivity, a physical property of the soil matrix, is primarily controlled by the clay mineral percentage and water content. Soils with relatively high clay mineral percentage (i.e., finer-grained soils) are generally more electrically conductive than soils with low clay mineral percentage (i.e., coarser-grained soils). SCP data collected

resolution information on the approximate depths of coarse-grained zone materials within the data collection area, and depth-discrete grab groundwater sample collection will be conducted to evaluate TCE concentrations and select the extent of the pilot study implementation area.

Direct Push SCP Borings

Four DP borings will be advanced by a drilling subcontractor under the oversight of Geosyntec to collect SCP data at the locations identified in Figure 5. The total depth of each boring will be approximately 40 feet bgs (bottom of the A-zone). Data from the four SCP borings will be used to supplement the current understanding of Site hydrostratigraphy and select depth intervals within the coarse-grained layers for depth-discrete grab groundwater sampling. Following boring completion, the DP rods will be extracted and the boring will be backfilled with neat cement grout.

Depth-Discrete Groundwater Samples

Depth-discrete grab groundwater samples will be collected from 11 borings located approximately 30 feet from the September 2013 sample locations, as shown in Figure 5. It is anticipated that samples will be collected from two depth intervals at each boring location (approximately 19-23 and 32-36 feet bgs) unless nearby SCP data indicate that the coarser-grained material is not present at those depth intervals.

Samples will be collected over a depth interval spanning 4 feet or less using a Hydropunch-type sampling device advanced by a DP drilling rig, and new polyethylene tubing will be used for each groundwater sample. Each sample will be collected in laboratory-supplied sample containers and labeled with project identification, sample location, analytical parameters to be measured, time and date of sampling, and any preservative added to the sample. Samples will be stored in an ice-cooled chest and maintained at approximately 4ºC for transport under chain-of-custody procedures to TestAmerica for analysis of VOCs by EPA Method 8260B (8010 analyte list) on a 24-hour rush turn around.

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during the September 2013 data collection field work was generally consistent with continuous core visual-manual logging and demonstrated that the SCP tool could reliably be used for lithologic delineation at the Site.

Based on VOC analytical results from the 11 proposed boring locations, up to 15 supplemental step-out borings will be advanced if needed to define the pilot study treatment area. EPA will be notified of the location and sampled interval of any step-out borings that are advanced.

Following boring completion, the DP rods will be extracted and the boring will be backfilled with neat cement grout.

Quality assurance/quality control (QA/QC) samples will be collected for groundwater cVOC samples. In accordance with the MEW QA/QC plan (QAPP), one duplicate, one field blank, and one equipment blank will be collected for every 20 groundwater samples collected for cVOC analysis. In addition, a laboratory-provided trip blank will be included with each cooler containing groundwater samples for cVOC analysis that is sent to the laboratory.

Task 5: Reporting

Following the completion of pilot study data collection activities, Geosyntec will review the data collection results and assess the need for modifications to the ISCO pilot study scope of work presented in the ISCO Pilot Study Work Plan. If necessary based on the data review, Geosyntec will submit an addendum to the ISCO Pilot Study Work Plan to EPA summarizing the findings of the ISCO pilot study data collection program and proposing adjustments to the ISCO pilot study scope of work (e.g., modifications to the treatment area dimensions, oxidant selection, or design oxidant dosing). A complete report on the pilot study data collection activities and results will be included in the ISCO Pilot Study Implementation Report that will be submitted following completion of the ISCO injection program.

SCHEDULE

Based on a general schedule provided verbally by National Avenue Partners, it is anticipated that building demolition will be completed by the end of September 2014. In order to coordinate implementation of the pilot study with redevelopment activities planned for the Site, we have planned for field work associated with Tasks 2 and 4 to begin on approximately 15 September 2014 and last one to three weeks. The ISCO bench-scale testing will be completed approximately three to four weeks following sample receipt by SiREM. The proposed start date may be adjusted depending on driller availability, changes to the development schedule, and approval of this work plan by EPA. However, in order to meet the schedule proposed above, we request approval of this Work Plan by 31 July 2014 to allow sufficient time for subcontractor scheduling and coordinating Site access. In addition, if approval of this work plan is granted prior to building

demolition, field work associated with the collection of samples for the bench-scale testing (Task 2) may be completed prior to demolition. Please let us know if you have any questions regarding the proposed work.

Sincerely,

Lea Z. Kane
Geologist

John D. Gallinatti, C.Hg.
Principal Hydrogeologist

Attachments: Table 1 – Groundwater Analytical Results: Detected VOCs
Figure 1 – Site Location Map
Figure 2 – Site Map and A-zone TCE Concentrations
Figure 3 – A-zone Cross-Section A-A'
Figure 4 – A-zone Cross-Section B-B'
Figure 5 – Proposed Data Collection Locations
Attachment 1 – Scope of Work for ISCO Bench-Scale Tests

Copies to: Virgilio Cocianni, Schlumberger Technology Corporation
Victor R. Fracaro, National Avenue Partners, LLC

TABLE

Table 1
Groundwater Analytical Results: Detected cVOCs
401 National Avenue
Mountain View, California

Sample Location	Sample Date	Sample Depth (ft bgs)[1]	Concentration in µg/L by EPA method 8260B									
			PCE	TCE	cis-1,2-DCE	trans-1,2- DCE	Vinyl Chloride	1,1,1-TCA	1,1-DCA	1,1-DCE	Freon 113	Total VOCs[2]
Wells Inside Slurry Wall												
35A	9/25/2012	12-37	<0.50	220	130	1.7	1.1	<0.50	3.6	2.5	2.1	400
36A	9/18/2012	35-40	<0.50	110	270	2.1	0.7	<0.50	3.3	2.7	0.64	400
37A	10/23/2013	15-30	<0.50	72	370	3.7	49	7.6	36	8.6	1.1	500
122A	9/26/2012	28-38	<0.50/<0.50	210/230	100/100	1.6/1.6	<0.50/<0.50	<0.50/<0.50	3.0/3.0	2.1/2.1	1.0/0.97	300
137A	10/23/2013	34-36	<5.0	6,400	4,300	41	<5.0	<5.0	<5.0	11	16	10,800
AE/RW-9-1	10/17/2013	8-33	1.5	810	710	7.7	13	45	53	12	3.9	1,700
AE/RW-9-2	10/17/2013	8-37	4.6	13,000	8,800	78	260	49	84	38	190	22,500
RW-20A	10/17/2013	26.5-36.5	1.7	1,100	940	7.0	4.1	9.1	12	9.3	7.2	2,100
RW-21A	10/17/2013	21-36	4.6	410	350	5.8	1.8	1.6	5.0	5.0	9.0	800
Grab Samples Inside Slurry Wall												
MIP-02	9/9/2013	21-25	<1,000	560,000	59,000	<1,000	3,000	<1,000	<1,000	<1,000	7,100	630,000
MIP-02	9/9/2013	33-36	<25	100	5,300	71	86	<25	<25	<25	<25	5,600
MIP-03	9/10/2013	18-22	<50	6,600	15,000	200	56	<50	<50	<50	<50	21,900
MIP-04	9/9/2013	16-20	<50	360	11,000	79	180	<50	<50	<50	<50	11,600
MIP-04	9/9/2013	33-36	<25/<25	1,200/1,200	2,700/2,700	<25/<25	25/25	<25/<25	<25/<25	<25/<25	<25/<25	3,900
MIP-08	9/10/2013	18-22	<50	2,100	1,200	<50	<50	<50	<50	<50	64	3,400
MIP-09	9/10/2013	20-23	<50	76,000	45,000	480	570	50	210	140	410	120,000
MIP-12	9/10/2013	18-22	<25	2,300	180	<25	<25	<25	<25	<25	36	2,500
MIP-12	9/10/2013	22-26	59	120,000	55,000	280	520	<50	310	160	1,200	180,000
MIP-12	9/10/2013	33-35	<50	770	2,400	<50	<50	<50	<50	<50	<50	3,200
Well Upgradient of Slurry Wall												
123A	10/23/2013	28-38	<5.0	510	260	<5.0	<5.0	<5.0	<5.0	<5.0	6.2	800
Wells Downgradient of Slurry Wall												
41A	10/23/2013	13-25	<5.0	580	220	<5.0	<5.0	<5.0	<5.0	<5.0	7.0	800
42A	10/23/2013	10-35	1.9/1.7	480/470	87/85	1.4/1.3	1.1/1.0	1.8/1.7	1.4/1.4	2.2/2.1	6.8/6.5	600
Wells Transgradient of Slurry Wall												
40A	10/23/2013	11.5-27	1.2	560	180	2.0	1.6	3.8	3.6	4.8	10	800
43A	10/23/2013	15-27	1.5	420	96	1.2	1.5	1.4	1.3	1.8	3.5	500
44A	10/23/2013	13.5-28	1.8	330	51	0.79	<0.50	1.0	0.7	1.2	2.4	400
126A	9/25/2012	23-38	<0.50	130	110	1.0	0.59	<0.50	4.0	2.8	1.7	300
138A	10/23/2013	34-37	<0.50	340	920	6.4	16	<0.50	3.2	3.6	<50	1,300

Notes:

1. Sample depth represents screen intervals for monitoring wells or grab sample depths
2. The Total VOCs values were rounded

ft bgs = feet below ground surface
µg/L = micrograms per liter
EPA = Environmental Protection Agency
1,200/1,200 indicates primary and duplicate sample results
< indicates analyte not detected above the reported detection limit

PCE = Tetrachloroethene
TCE = Trichloroethene
cis-1,2-DCE = cis-1,2-Dichloroethene
trans-1,2-DCE = trans-1,2-Dichloroethene
1,1,1-TCA = 1,1,1-Trichloroethane
1,1-DCA = 1,1-Dichloroethane
1,1-DCE = 1,1-Dichloroethene

Freon 113 = Trichlorotrifluoroethane
VOC = volatile organic compounds
cVOCs = chlorinated volatile organic compounds

FIGURES

N

0 5 Miles

Basemap Sources: USGS, ESRI, TANA, AND, DeLorme, NPS

Site Location Map

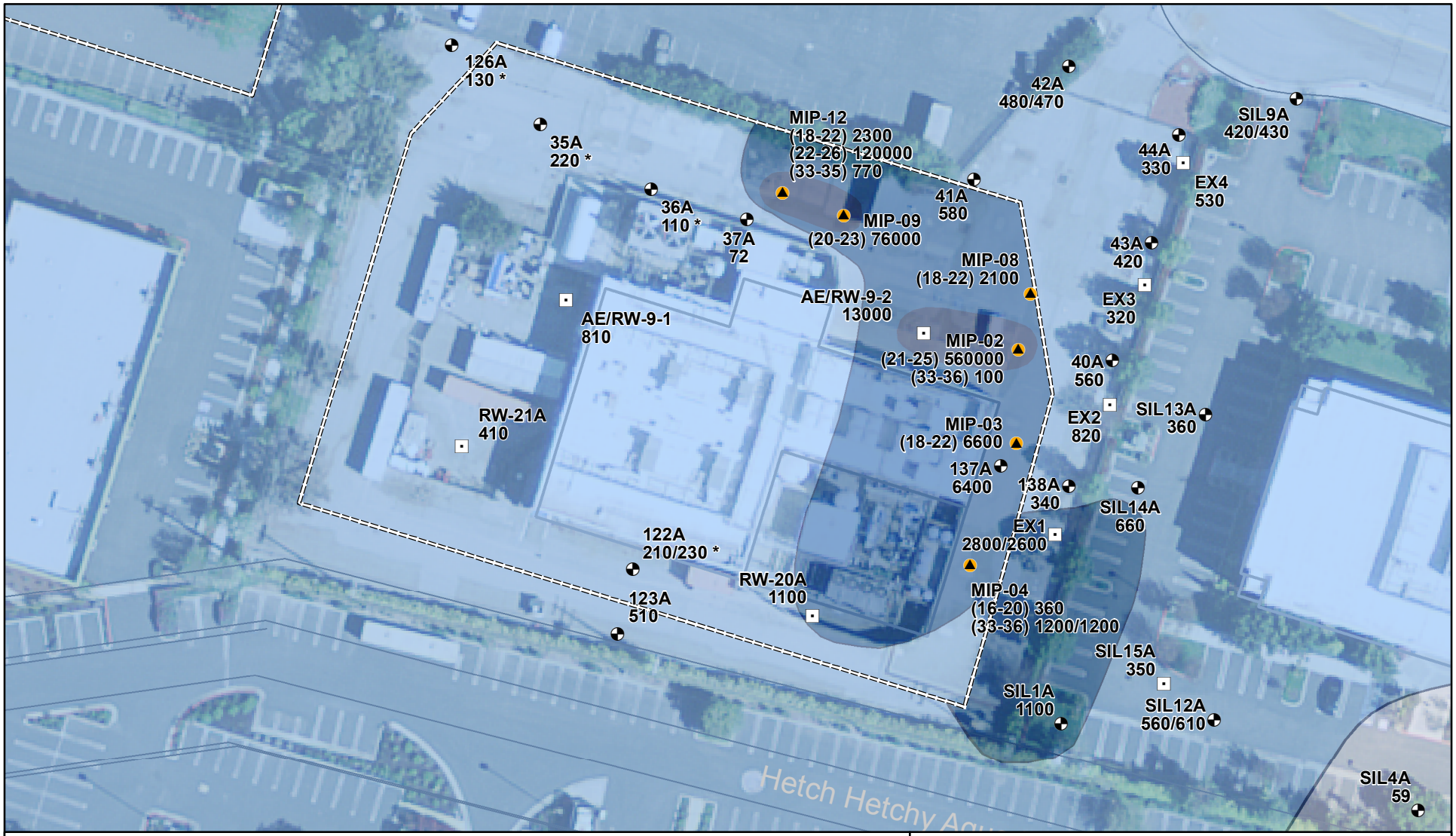
401 National Avenue
Mountain View, California

Geosyntec consultants

Oakland | July 2014

Figure 1

P:\GIS\MEW\Project\Fairchild\Building9\2014_DataCollectionSummary\Fig01_SiteLocation.mxd



Legend

- MIP/SCP Boring Location
- Recovery Well
- Monitoring Well
- MIP-12 (18-22) 2300 — MIP ID (Sample Depth in ft bgs) TCE Concentration

TCE Concentration

- 5 - 100 ug/L
- 100 - 1,000 ug/L
- 1,000 - 10,000 ug/L
- Greater than 10,000 ug/L

==== Slurry Wall †

N

Notes:
TCE = Trichloroethene
ug/L = micrograms per liter ft bgs = Feet below ground surface
* Figure shows results for only those wells sampled in 2012 and 2013 for 401 National Avenue.
Star indicates wells that were last sampled in 2012.
† The slurry wall location in the northeastern portion of the site was revised based on information collected during 2013 utility location activities.

60 30 0 60 Feet

Site Map and A-zone TCE Concentrations

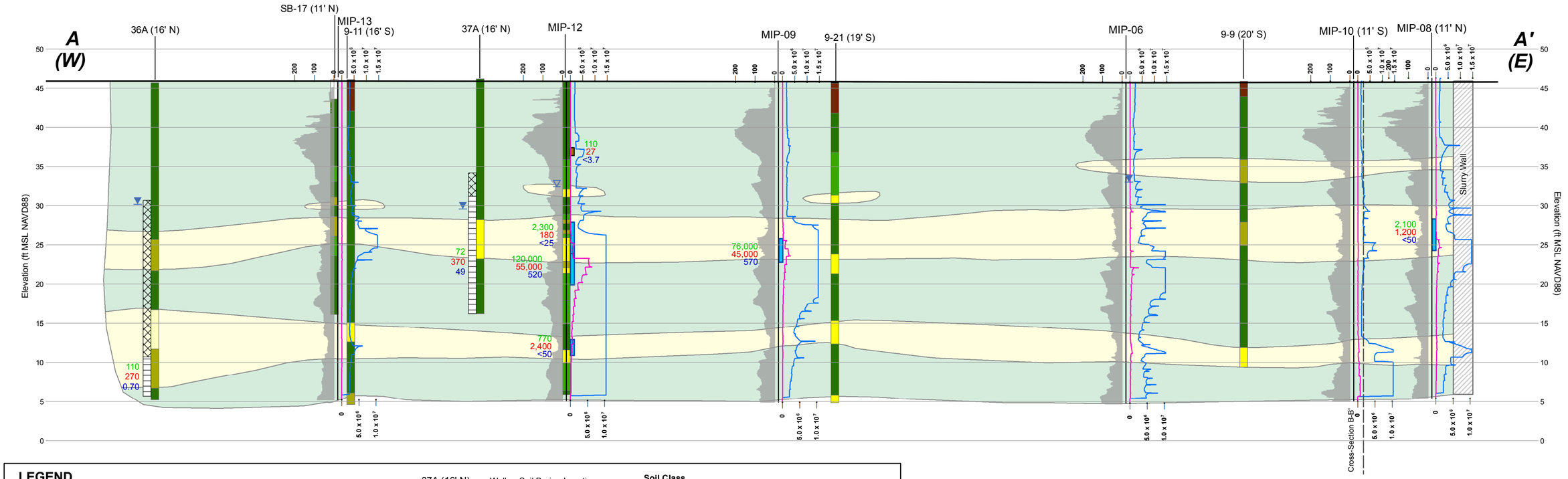
401 National Avenue
Mountain View, California

Geosyntec consultants

Oakland | July 2014

Figure **2**

P:\GIS\MEW\Project\Fairchild\Building9\2014_ISCODataCollectionWorkPlan\Fig02_SiteMapAndAzoneTCEconcentrations.mxd 7/2/2014 10:20:01 AM



LEGEND

MIP Location with Distance and Direction Projected to Cross-Section — **MIP-01 (20' N)**

SCP response range in mS/M — ECD response range in uV

September 2013 Sample Results
Trichloroethene Concentration [ug/Kg] 770
cis-1,2-Dichloroethene Concentration [ug/Kg] 2,400
Vinyl Chloride Concentration [ug/Kg] <50
— Soil Sample

SCP response

ECD response

September 2013 Sample Results
Trichloroethene Concentration [ug/L] 770
cis-1,2-Dichloroethene Concentration [ug/L] 2,400
Vinyl Chloride Concentration [ug/L] <50
— PID response
— Grab Groundwater Sample

PID response range in uV

37A (16' N) — Well or Soil Boring Location with Distance and Direction Projected to Cross-Section

Filter Pack

Well Screen

September 2012 and October 2013 Sample Results (see Note)
190 Trichloroethene Concentration [ug/L]
120 cis-1,2 Dichloroethene Concentration [ug/L]
<0.50 Vinyl Chloride Concentration [ug/L]

Groundwater Elevation (September 2013)

Groundwater Elevation During Drilling (September 2013)

Soil Class

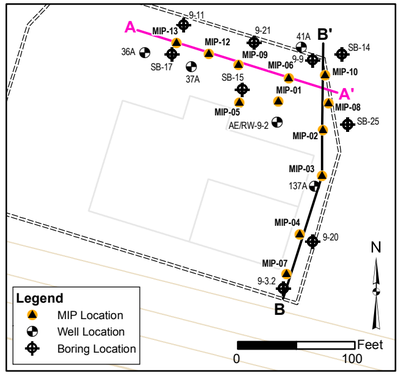
- No Recovery
- Asphalt; Fill
- Sand and Gravel Fill Material
- Topsoil
- CL Clay
- ML Silt
- SC-SM Clayey Sand to Silty Sand
- SP-SW Poorly Graded Sand to Well Graded Sand
- SW-GW Well Graded Gravelly Sand to Well Graded Gravel

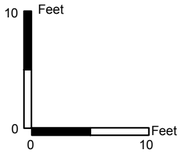
Lithology

- Generalized Fine-Grained Layer
- Generalized Coarse-Grained Layer

Abbreviations:
ft MSL = Feet above Mean Sea Level
MIP = Membrane Interface Probe
PID = Photoionization Detector
ECD = Electron Capture Detector
SCP = Soil Conductivity Probe
mS/M = milliSiemens per meter
uV = microvolts
ug/Kg = micrograms per kilogram
ug/L = micrograms per liter

Notes:
- Groundwater elevation for MIP-12 was measured on 6 September 2013, monitoring well groundwater measurements are from September 2013.
- Monitoring wells 37A and 41A were sampled in October 2013. Monitoring well 36A was sampled in September 2013.
- Boring logs for Site monitoring wells and "9-#" borings were logged using ~12-inch soil samples collected approximately every 5 feet. Lithology interpretations between these samples were estimated on historical boring logs. "MIP" soil borings and SCP borings advanced in 2013 were logged continuously and are expected to be more representative of subsurface conditions.
- Slurry wall location adjusted 5 feet east on cross-section to include log for MIP-8 inside slurry wall.
- Ground surface from topographic survey found in construction drawings provided by Kenneth Rodrigues and Partners, Inc., December, 2013.





A-zone Cross-Section A-A'
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Figure 3

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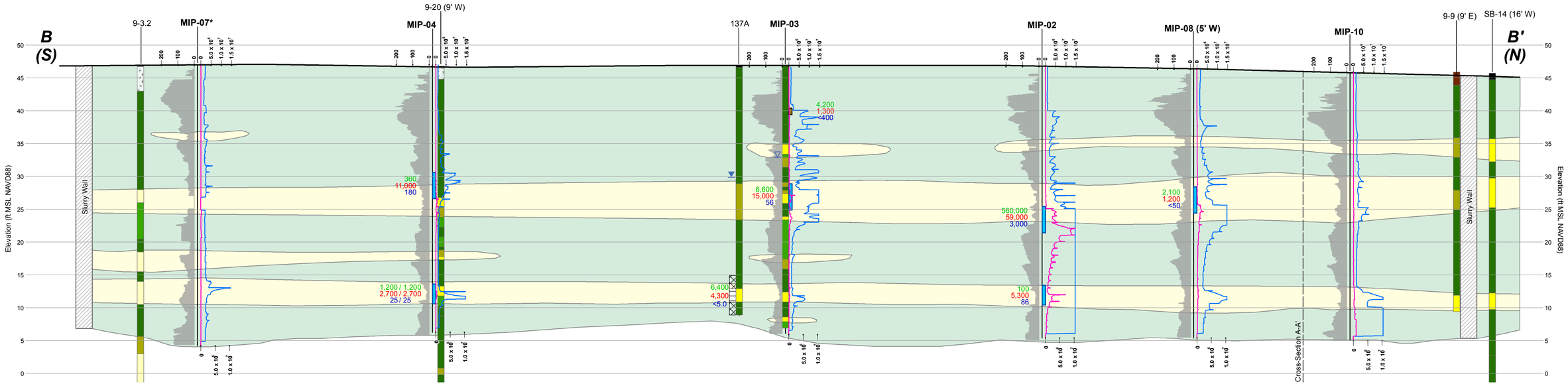


LEGEND

MIP Location with Distance and Direction Projected to Cross-Section — **MIP-X**

SCP response range in mS/M — ECD response range in uV

September 2013 Sample Results
Trichloroethene Concentration [ug/Kg] 770
cis-1,2-Dichloroethene Concentration [ug/Kg] 2,400
Vinyl Chloride Concentration [ug/Kg] <50
Soil Sample

SCP response — ECD response

September 2013 Sample Results
Trichloroethene Concentration [ug/L] 770
cis-1,2 Dichloroethene Concentration [ug/L] 2,400
Vinyl Chloride Concentration [ug/L] <50
PID response
Grab Groundwater Sample

PID response range in uV

37A (16' N) — Well or Soil Boring Location with Distance and Direction Projected to Cross-Section

Filter Pack
Well Screen

September 2013 Sample Results
190 Trichloroethene Concentration [ug/L]
120 cis-1,2 Dichloroethene Concentration [ug/L]
<0.50 Vinyl Chloride Concentration [ug/L]

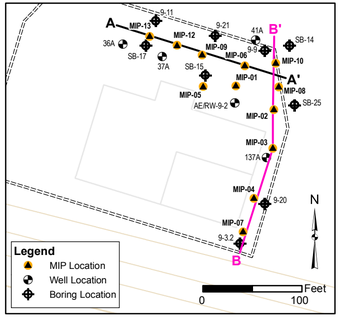
Groundwater Elevation (September 2013)
Groundwater Elevation During Drilling (September 2013)

Soil Class
- No Recovery
- Asphalt; Fill
- Sand and Gravel Fill Material
- Topsoil
- CL Clay
- ML Silt
- SC-SM Clayey Sand to Silty Sand
- SP-SW Poorly Graded Sand to Well Graded Sand
- SW-GW Well Graded Gravelly Sand to Well Graded Gravel

Lithology
- Generalized Fine-Grained Layer
- Generalized Coarse-Grained Layer

Abbreviations:
"/" Indicates duplicate sample
ft MSL = Feet above Mean Sea Level
MIP = Membrane Interface Probe
PID = Photoionization Detector
ECD = Electron Capture Detector
SCP = Soil Conductivity Probe
mS/M = milliSiemens per meter
uV = microvolts
ug/Kg = micrograms per kilogram
ug/L = micrograms per liter

Notes:
- Groundwater elevation for MIP-3 was measured on 3 September 2013, monitoring well groundwater measurements are from September 2013.
- Boring logs for Site monitoring wells and "9-#" borings were logged using ~12-inch soil samples collected approximately every 5 feet. Lithology interpretations between these samples were estimated on historical boring logs. "MIP#" soil borings and SCP borings advanced in 2013 were logged continuously and are expected to be more representative of subsurface conditions.
- Slurry wall depth is approximate.
- Ground surface from topographic survey found in construction drawings provided by Kenneth Rodrigues and Partners, Inc., December, 2013.
- Slurry wall location adjusted 5 feet east on cross-section to include log for MIP-8 inside slurry wall.
* Data for MIP-07 is approximate due to a computer failure at 20 feet bgs. It is likely that no data was collected between 20 and 22 feet bgs.



10 Feet
0 Feet 10

A-zone Cross-Section B-B'
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Figure 4

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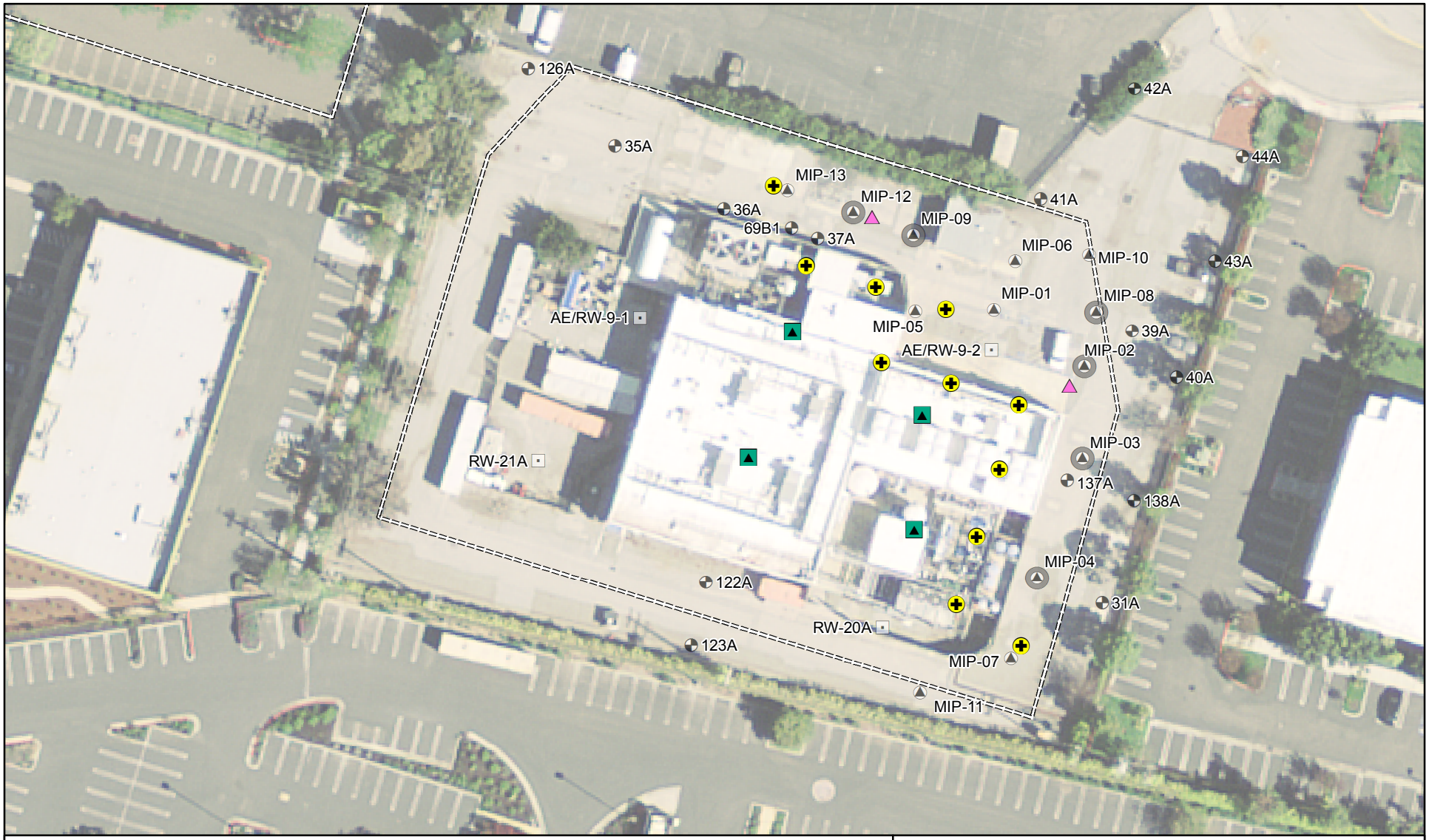

Legend

- Recovery Well
- Monitoring Well
- ==== Slurry Wall †
- Hydropunch Sample Location (Sept 2013)
- MIP/SCP Boring Location (Sept 2013)
- Proposed Hydropunch Location
- Proposed SCP Location
- Proposed Bench Test Sample Location

N

Notes:
SCP = Soil Conductivity Probe
MIP = Membrane Interface Probe
† The slurry wall location in the northeastern portion of the site was revised based on information collected during 2013 utility location activities.

60 30 0 60 Feet

Proposed Data Collection Locations

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Figure **5**

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ATTACHMENT 1
Scope of Work for ISCO Bench-Scale Tests

SiREM

19 June 2014

SiREM Ref: Si-2259-061914

Bruce Marvin
Geosyntec Consultants
1111 Broadway 6th FL
Oakland, CA 94607

Via email: bmarvin@Geosyntec.com

Reference: Proposal for a Laboratory ISCO Treatability Study, MEW Site, California

Dear Bruce:

The document presents a scope of work for SiREM to conduct a treatability study to assess the permanganate soil oxidant demand (SOD) and to conduct a comparative oxidation test in subsurface samples from two locations at the MEW Site in California (the Site).

Geologic materials and groundwater for the study will be provided to SiREM by Geosyntec. Sampling and shipping protocols will be provided upon acceptance of this proposal. This proposal presents:

- Permanganate soil oxidant demand approach and methodology (Section 1);
- Comparative oxidation test approach and methodology (Section 2);
- Reporting (Section 3),
- Schedule (Section 4); and
- Cost estimate (Section 5).

1. PERMANGANATE SOIL OXIDANT DEMAND STUDY APPROACH AND METHODOLOGY

The objectives of the study is to estimate the oxidant demand of the Site geologic materials from two Site locations using permanganate. Standard and/or published methods that are consistent with the recommendations of oxidant manufacturers who supply oxidants for chemical oxidation purposes will be used to complete the treatability study. Site geologic materials will be homogenized to improve reproducibility between replicates and will be used for all tasks of the proposed testing program.

The Permanganate SOD will be tested in two phases:

Task 1) Permanganate SOD screening, and
Task 2) Detailed Permanganate SOD test.

Test Reactor Construction

Treatment reactors will be prepared in 125 milliliter (ml) (nominal volume) glass bottles with Site geologic materials and groundwater to yield an approximate 1:1 ratio by weight. The treatment reactors will be amended with a permanganate solution. One concentration of permanganate (concentration to be determined) will be evaluated in this task. All reactors will be capped with

Teflon®-lined caps and incubated in the dark at room temperature for the reaction period. Table 1 summarizes the treatments for Task 1 and Table 2 summarizes the controls and treatments for Task 2.

Table 1: Permanganate SOD Study Treatments (Task 1)

Treatment	Description	Number of Replicates Location 1	Number of Replicates Location 2
Permanganate	Amended with sodium permanganate (concentration to be determined)	2	2

Table 2: Detailed Permanganate SOD Test (Task 2)

Treatment	Description	Number of Replicates Location 1	Number of Replicates Location 2
Permanganate low	Amended with low concentration sodium permanganate.	2	2
Permanganate med	Amended with medium concentration sodium permanganate.	2	2
Permanganate high	Amended with high concentration sodium permanganate.	2	2

Test Reactor Incubation, Sampling and Analysis

For Task 1 the treatment reactors will be incubated for 48 hours at room temperature. Aqueous samples will be collected by sampling the reactors at 0 and 48 hours for permanganate as described in Table 3. For Task 2 the treatment reactors will be incubated for 10 days at room temperature. Aqueous samples will be collected by sampling the reactors at 0, 1, 2, 5 and 10 days as described in Table 4.

One milliliter (mL) aqueous phase samples will be collected from reactors using a 5 mL plastic syringe. Samples will be filtered through a 0.45 micron (µM) syringe filter. Permanganate will be measured using a UV/VIS spectrophotometer (Biochrom Ultraspec 1000) at a wavelength of 525 nanometers. Samples will be diluted (as required) so that absorbance readings are in the linear range of the standard curve (i.e., <2.0 absorbance units). Calibration curves are produced for each analysis event using known concentrations of a standardized permanganate (MnO_4) solution.

Table 3: Permanganate SOD Screening Study Sampling and Analysis (Task 1)

Analyte	Number of Reactors Per location	Matrix	Number of Sample Events	Number of samples Location 1	Number of samples Location 2
Permanganate	2	Aqueous phase	2 (0 and 48 hours).	4	4

Table 4: Detailed Permanganate SOD Test Sampling and Analysis (Task 2)

Analyte	Number of Reactors Per Location	Matrix	Number of Sample Events	Number of samples Location 1	Number of samples Location 2
Permanganate low	2	Aqueous phase	5 (0,1,2,5 and 10 days)	10	10
Permanganate med	2	Aqueous phase	5 (0,1,2,5 and 10 days)	10	10
Permanganate high	2	Aqueous phase	5 (0,1,2,5 and 10 days)	10	10

2. COMPARATIVE OXIDATION TEST APPROACH AND METHODOLOGY

The objectives of the comparative oxidation test is to compare the treatment of the Site geologic materials from two Site locations using permanganate, iron activated persulfate and a mixture of permanganate and persulfate. Standard and/or published methods that are consistent with the recommendations of oxidant manufacturers who supply oxidants for chemical oxidation purposes will be used to complete the treatability study.

Test Reactor Construction

Treatment reactors will be prepared in 250 milliliter (ml) (nominal volume) glass bottles with Site geologic materials and groundwater to yield a slurry with an approximate 1:1 ratio by weight. Control reactors will be amended with groundwater only. Reactors will be spiked with trichloroethene (TCE) to 200 mg/L and incubated at room temperature for 5 to 7 days. After the incubation period, the treatment reactors will be amended with concentrated oxidant solutions. One concentration of permanganate (concentration to be determined), one concentration of persulfate activated with iron-EDTA (concentrations to be determined) and a mixture of permanganate and persulfate with no activator will be evaluated in this task. All reactors will be capped with Teflon®-lined caps and incubated in the dark at room temperature for the reaction period. Table 5 summarizes the controls and treatments.

Table 5: Comparative Oxidant Test Controls and Treatments

Treatment	Description	Number of Replicates Location 1	Number of Replicates Location 2
Unamended Control	No amendments	2	2
Permanganate	Amended with sodium permanganate.	2	2
Iron Activated Persulfate	Amended with sodium persulfate and iron-EDTA	2	2
Permanganate and Persulfate	Amended with sodium permanganate and sodium persulfate	2	2

Test Reactor Incubation, Sampling and Analysis

Control and treatment reactors will be incubated for 14 days at room temperature. Aqueous samples will be collected by sampling the reactors at 0 and 14 days for permanganate, persulfate, chloride and TCE as described in Table 6.

One milliliter (mL) aqueous phase samples will be collected from reactors using a 5 mL plastic syringe for oxidant measurement. Samples will be filtered through a 0.45 micron (µM) syringe filter. Permanganate will be measured using a UV/VIS spectrophotometer (Biochrom Ultraspec 1000) at a wavelength of 525 nanometers. Samples will be diluted (as required) so that absorbance readings are in the linear range of the standard curve (i.e., <2.0 absorbance units). Calibration curves are produced for each analysis event using known concentrations of a standardized permanganate (MnO_4) solution. Persulfate will be measured by SIREM using the colorimetric method described by Huang et al. (2002). Samples for chloride and TCE analysis will be collected as described above but will not be filtered. Chloride and TCE will be measured by SIREM using ion chromatography and gas chromatography respectively.

In addition a hexane extraction of the full volume (remaining after samples for the analytes described above have been collected) of soil and groundwater will be conducted by SIREM. Oxidant reactions will be first quenched with ascorbic acid, after which a 1:1 volume of hexane will be added to the test reactors. The reactors will then be gently agitated for 24 hours. The hexane will be transferred to vials for TCE analysis by an external laboratory.

Table 6: Comparative Oxidant Test Sampling and Analysis

Analyte	Number of Reactors Per Location	Matrix	Number of Sample Events	Location 1 Number of samples	Location 2 Number of samples
Permanganate	4	Aqueous phase	2	8	8
Persulfate	4	Aqueous phase	2	8	8
Chloride	8	Aqueous phase	2	16	16
VOCs	8	Aqueous phase	2	16	16
Total VOCs	8	Hexane extract	Controls at time 0 and 14 days, treatments at 14 days	10	10

3. REPORTING

SiREM will tabulate the study data and will prepare a report containing the methodology and all data generated from the treatability study. A draft report will be provided to Geosyntec for review and comment, and the final report will be provided after receipt of comments on the draft version.

4. SCHEDULE

Construction of microcosms will commence within 2 weeks of receiving groundwater and geologic samples. A report will be submitted within 2 weeks of receipt of final analytical data.