SUPPLEMENTAL GROUDWATER INVESTIGATION REPORT
WEST OF WESTERN AVENUE INVESTIGATION
MONTROSE SUPERFUND SITE
20201 S. Normandie Avenue, Los Angeles, California

November 10, 2010

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1.0 INTRODUCTION AND BACKGROUND

This report presents the results of supplemental groundwater investigation activities associated with the Montrose Chemical Corporation of California (Montrose) Superfund Site (Site) located at 20201 S. Normandie Avenue in Los Angeles, California (Property) (**Figure 1**). The purpose of these supplemental investigation activities was to characterize the occurrence and extent of monochlorobenzene (MCB) and para-chlorobenzene sulfonic acid (pCBSA) in groundwater west of the Property and south of a former sewer line. Prior to 1953, Montrose discharged wastewater to a 10-inch diameter sewer line which connected with the East Torrance Extension Trunk. This sewer trunk, now abandoned, extended approximately 3,500 feet west of the Property before connecting with the District No. 5 Main Trunk Sewer as shown in **Figure 2**. The investigation area shown in Figure 2 is identified as the west of Western Avenue area.

Groundwater conditions west of Western Avenue were previously investigated from 2006 to 2008 as reported in a Technical Memorandum entitled *Results of the West of Western Avenue Groundwater Assessment, Montrose Site, Torrance, California* (Hargis + Associates [H+A], 2009). As indicated in this memorandum, MCB was detected in the Middle Bellflower C Sand (MBFC) Aquifer at a concentration of 390 micrograms per liter (ug/L) in well GGWMW-3 located near the abandoned sewer line (Figure 2), exceeding the California Maximum Contaminant Level (MCL) of 70 ug/L.

In a letter dated May 27, 2009, the Environmental Protection Agency (EPA) requested installation of three monitoring wells to further characterize the extent of MCB in groundwater west of Western Avenue and south of the former sewer line as follows:

- One well near Western Avenue, about 200 to 300 feet south of the former sewer line;
- One well about 300 to 400 feet south of well GGWMW-3; and
- One well between these two wells.

In accordance with EPA's request and as documented in the letter from de maximis, inc. dated September 25, 2009 (de maximis, 2009), groundwater conditions west of Western Avenue were further investigated in 2010. After negotiating access with the City of Torrance, three temporary groundwater monitoring wells were installed in June 2010 at the locations requested by EPA (**Figure 3**) and tested for the presence of MCB and pCBSA. Low concentrations of MCB significantly below the California MCL were detected in groundwater at all three locations. As a result, EPA concurred that permanent monitoring wells would

not be required at these locations and authorized abandonment of the three temporary monitoring wells on June 9, 2010. This report documents the results of the supplemental groundwater investigation activities conducted west of Western Avenue in June 2010.

2.0 WELL INSTALLATION AND GROUNDWATER SAMPLING

The following sections summarize the well installation and groundwater sampling activities. All well installation and groundwater activities were overseen by CH2M Hill on behalf of EPA.

2.1 Right-of-Way Access and Well Construction Permitting

A license agreement between Montrose and the City of Torrance was negotiated for installation of groundwater monitoring wells in right-of-way areas as shown in Figure 3 and summarized as follows:

- One well located on 205th Street (WOW-1-BFS), approximately 800 feet west of Western Avenue and approximately 1,100 feet south of the former sewer line;
- One well located on Del Amo Boulevard (WOW-3-BFS), approximately 350 feet south/southwest of well GGWMW-3; and
- One well located on Gramercy Place (WOW-2-BFS) and between the other two investigation wells.

Negotiations with the City of Torrance commenced in December 2009 and were concluded in May 2010. A License Agreement for construction of monitoring wells in the right-of-areas was agreed upon by the Torrance City Council and executed by City of Torrance officials on May 4, 2010. A well construction permit was subsequently approved the City of Torrance on May 18, 2010, a copy of which is provided in **Appendix A**. Well construction permits were additionally obtained from the Los Angeles County Department of Environmental Health on December 23, 2009, a copy of which is also provided in Appendix A.

2.2 Utility Clearance and Traffic Control

Underground Service Alert of Southern California (Dig Alert) was notified in advance of the well installation activities west of Western Avenue. Information regarding underground utilities was obtained from the City of Torrance and neighboring property owners prior to well installation activities. The monitoring wells were positioned in the City streets at locations where no underground utilities were known to be present as indicated by the utility owners. Additionally, the well locations were cleared of underground utilities using geophysical methods prior to the start of drilling activities. Finally, the upper 10 feet of soil was initially drilled using hand-auger methods to confirm the absence of underground utilities before proceeding with planned drilling and well construction activities.

Vehicular traffic at the three well installation locations was controlled in accordance with City of Torrance requirements. Barricades, electronic signs, and lights were used to delineate and direct traffic around the three work areas. Following completion of the investigation activities, the traffic control equipment was removed and normal traffic patterns were resumed at the three work areas.

2.3 Drilling

Well installation activities were conducted using roto-sonic drilling methods between June 1 and 4, 2010. Cascade Drilling of La Habra, California provided the roto-sonic drilling services. An 8-inch outside diameter roto-sonic casing was advanced into the subsurface, and a 6-inch diameter continuous core was recovered in 2 to 5-foot lengths from 10 feet bgs to total depths between 120 and 130 feet below ground surface (bgs). Each core was immediately placed in a plastic sleeve and closed prior to field screening. The top and bottom depths of the core were labeled. To field screen the core material, the plastic sleeve was cut open along its entire length, and soil samples were collected from the center of the core material for evaluation of sample headspace concentrations. The remaining core materials were used for lithologic description. Borehole logs are provided in **Appendix B,** and photographs of the continuous core material are provided in **Appendix C**.

2.3.1 FIELD SCREENING

A photo-ionization detector (PID), MiniRAE Model 2000, was used to field screen the soil core for the presence of organic vapors. The PID was calibrated daily prior to the start of work in accordance with manufacturer specifications using a known calibration standard of 100 parts per million by volume (ppmv) isobutylene gas. For field screening, a soil sample from each sample interval, every 2 to 5 vertical feet, was placed in a plastic bag and allowed to volatilize in the bag for approximately 5 to 10 minutes. At the end of this time, the bag was pierced with a metal tool and the intake probe on the PID was inserted into the bag**.** The concentration of organic vapors present in the headspace of the bag was recorded on the borehole logs (Appendix B). Field headspace concentrations were low and consistently between 0 and 20 ppmv at WOW-1-BFS and WOW-2-BFS. However, at WOW-3-BFS, elevated headspace concentrations were observed in the saturated zone, up to 760 ppmv at 74 feet bgs, as a result of fuel hydrocarbon impacts associated with the ExxonMobil Torrance Refinery. WOW-3-BFS was located at the eastern boundary of the dissolved fuel hydrocarbon plume associated with the ExxonMobil Torrance Refinery (Refinery Subsurface Cleanup Progress Report, ERM, 2007).

2.4 Well Construction

Upon completion of the soil coring and field screening, three temporary groundwater monitoring wells were constructed in the MBFC as indicated in Table 1 below:

Table 1
Temporary Well Construction Details

Construction Item	WOW-1-BFS	WOW-2-BFS	WOW-3-BFS
Construction Date	June 2, 2010	June 3, 2010	June 4, 2010
Screen Interval	102-122 ft bgs	100-120 ft bgs	103.5-123.5 ft bgs
Screen Slot Size	0.02-inches	0.02-inches	0.02-inches
Casing Diameter	2-inches	2-inches	2-inches
Casing Type	PVC Sch 40	PVC Sch 40	PVC Sch 40
Annular Sand Pack	100-122 ft bgs	98-120 ft bgs	101.5-123.5 ft bgs
Sand Pack Grain Size	No. 2/12	No. 2/12	No. 2/12
Annular Bentonite Seal	95-100 ft bgs	93-98 ft bgs	99-101.5 ft bgs
Blank Casing	0-102 ft bgs	0-100 ft bgs	0-103.5 ft bgs
Temporary Conductor	0-95 ft bgs	0-93 ft bgs	0-99 ft bgs

Notes:
ft bgs = feet below ground surface
PVC = Polyvinylchloride
Sch = Schedule

After reaching total depth, the temporary wells were constructed through the roto-sonic drive casing. While slowly raising the roto-sonic drive casing, the annular sand pack and bentonite seal were placed around the well screen and casing using a tremmie pipe to prevent potential bridging during construction. The depth to the top of the annular fill materials was measured during construction to ensure that bridging had not occurred. The drive casing was left in place from the top of the annular seal to surface to serve as a temporary conductor and protect the borehole from collapse.

2.5 Well Development

The wells were developed using surging, bailing, and pumping techniques between June 2 and 4, 2010. Groundwater parameters including temperature, pH, conductivity, oxygen reduction potential, and turbidity were collected during well purging activities. Development was considered complete when:

- A minimum of ten well casing volumes were removed;
- Temperature, pH, conductivity, and oxygen reduction potential readings were within 10 percent of the previous three readings; and

- Turbidity was below 20 Nephelometric Turbidity Units (NTUs).

Groundwater parameters and purge rates/volumes were recorded on development logs provided in **Appendix D**. Static groundwater was observed at depths between 57.1 and 59.0 feet bgs or -10.92 feet mean sea level (MSL) at WOW-3-BFS to -11.37 feet MSL at WOW-1-BFS. Between 139 and 205 gallons of groundwater was purged from each 2-inch diameter well at approximately 2 gallons per minute (gpm) using a small diameter Grundfos Redi-Flo submersible pump. The pump and associated tubing was decontaminated before each use by steam cleaning.

2.6 Sample Collection

Once the groundwater quality parameters had stabilized, the pump was shut off and removed from the well. After groundwater levels had recharged to more than 80% of static conditions, each well was sampled using a disposable bailer. The groundwater sample from the bailer was transferred into laboratory certified containers. All laboratory sample containers were labeled, packed in coolers, and transported to the analytical laboratory under proper chain-of-custody procedures. EPA collected split samples from all three temporary groundwater monitoring wells.

2.7 Surveying

Following sampling, the locations and elevations of the monitoring wells were surveyed by a certified land surveyor, WM Surveys, Inc. The well locations were surveyed on June 7, 2010 to the nearest 0.05-foot and included the well casing elevation and the easting (X) and northing (Y) coordinates in Universal Transverse Mercator (UTM), Zone 11, North American Datum (NAD) 1983 coordinate system. The final survey coordinates and elevations for all monitoring wells are summarized in **Appendix E**.

2.8 Equipment Decontamination and Waste Management

Prior to well installation activities, drilling equipment was steam cleaned and allowed to air dry. Rinse water and decontamination fluids were transferred to labeled 55-gallon drums and temporarily stored pending characterization for off-Site disposal. Soil cuttings were loaded into a 20-yard roll-off bin pending characterization for off-Site disposal. Waste characterization samples were collected and analyzed for the following analyses:

- Volatile organic compounds (VOCs) by EPA Method 8260B
- Pesticides by EPA Method 8081A
- Metals by EPA Method 6010/6020

- pCBSAs by EPA Method 314.0

The liquid waste was subsequently characterized as non-hazardous waste and transported for off-Site disposal under proper manifest documentation to the Crosby & Overton, Inc. facility in Long Beach, California on July 9, 2010. The soil cuttings were subsequently characterized as non-hazardous waste and transported for off-Site disposal under proper manifest documentation to the U.S. Ecology facility in Beatty, Nevada on July 29, 2010. Waste characterization sample analytical results and copies of the waste manifests are provided in **Appendix F**.

3.0 LABORATORY RESULTS

Laboratory analysis of groundwater samples was conducted by Test America, Inc. located in Irvine, California. All groundwater samples were analyzed on an expedited basis (24-hour turnaround) for the following constituents:

- VOCs by EPA Method 8260B
- pCBSA by EPA Method 314.0 modified

The analytical results for MCB and pCBSA are summarized below in **Table 2**, and an electronic copy of the analytical reports is provided on compact disk in **Appendix G**. MCB concentrations in groundwater are shown in **Figure 4**.

Table 2
MCB and pCBSA in Groundwater
West of Western Avenue Supplemental Investigation

Analyte	Groundwater Standard[1] (µg/L)	WOW-1-BFS (µg/L)	WOW-2-BFS (µg/L)	WOW-3-BFS (µg/L)
MCB by EPA 8260B				
MCB	70	0.46J	0.37J	2.6
pCBSA by EPA 314.0 modified				
pCBSA	NA[2]	4.9J	30	76

Notes:
[1]In-Situ Groundwater Standards, Table 9-1, Record of Decision for Dual Site Groundwater Operable Unit (EPA, 1999)
[2]EPA established a re-injection standard of 25,000 ug/L for pCBSA in the 1999 ROD
pCBSA = para-chlorobenzene sulfonic acid
J = estimated value between method detection limit and the reporting limit
µg/L = micrograms per liter

Chlorobenzene concentrations in groundwater at the three temporary wells ranged from 0.37J to 2.6 ug/L (Figure 4) and were significantly below the groundwater standard of 70 ug/L. Similarly, pCBSA concentrations in groundwater at the three temporary wells were low and ranged from 4.9J to 76 ug/L. These results indicate that MCB does not occur above groundwater standards in the MBFC Aquifer at distances of 350 feet or more south of well GGWMW-3 and the former East Torrance Extension Trunk Sewer.

Other VOCs detected in groundwater during this investigation are summarized in **Table 3** below.

Table 3
Other VOCs in Groundwater
West of Western Avenue Supplemental Investigation

Analyte	Groundwater Standard[1] (µg/L)	WOW-1-BFS (µg/L)	WOW-2-BFS (µg/L)	WOW-3-BFS (µg/L)
Other VOCs by EPA 8260B				
Benzene	1	<0.5	<0.5	**340**
Bromochloromethane	100*	0.63	<0.5	<0.5
Bromodichloromethane	100*	2.5	0.90	1.5
Bromoform	100*	0.99	<0.5	0.5
sec-Butylbenzene	61	<0.5	<0.5	0.3J
Chloroform	100*	6.9	2.9	5.2
Dibromochloromethane	100*	2.0	0.96	1.0
Dibromomethane	NA	0.38J	<0.5	<0.5
Ethylbenzene	300	<0.5	<0.5	0.57
Isopropylbenzene	61	<0.5	<0.5	1.5
Methylene Chloride	5	<5	<5	1.8J
Naphthalene	6.2	<0.5	<0.5	**23**
n-propylbenzene	61	<0.5	<0.5	3.5
Tetrachloroethene	5	7.2	0.91	1.0
Toluene	150	<0.5	<0.5	2.4
m,p-xylenes	1,750	<1.0	<1.0	2.8
o-xylenes		<0.5	<0.5	0.4J

Notes:
[1]In-Situ Groundwater Standards, Table 9-1, Record of Decision for Dual Site Groundwater Operable Unit (EPA, 1999)
*Groundwater standard for total trihalomethanes is 100 ug/L
J = estimated value between method detection limit and the reporting limit
µg/L = micrograms per liter
NA = not available
340 = Concentrations exceeding the in-situ groundwater standard are shown in bold lettering

Benzene and naphthalene were detected in concentrations above their respective groundwater standard at WOW-3-BFS located on Del Amo Boulevard. However, this well is located within the eastern boundary of the dissolved benzene plume originating from the ExxonMobil Torrance Refinery (Refinery Subsurface Cleanup Progress Report, ERM, 2007). Dissolved benzene concentrations exceeding 10,000 ug/L have been reported by ExxonMobil at wells located less than 200 feet from WOW-3-BFS. Additionally, ExxonMobil has reported a free-phase hydrocarbon product located approximately 1,200 feet northwest of WOW-3-BFS.

Evaluation of Groundwater Sample Results

The groundwater sample results were submitted to EPA via email on June 7, 2010, and the results were discussed with EPA during a conference that same day. Pending receipt of split sample results, EPA preliminarily agreed during the June 7 call that permanent monitoring wells would not be required at any of the three locations based on the low concentrations of MCB and pCBSA detected in groundwater. On June 9, EPA reported split sample results which showed nearly identical concentrations of MCB in the three temporary wells, 0.3J to 2.2 ug/L. Having met the objectives of the supplemental groundwater investigation west of Western Avenue, EPA authorized abandonment of the three temporary wells via email on June 9 and confirmed that no permanent wells would be required (EPA, 2010).

4.0 WELL ABANDONMENT

The three wells were abandoned between June 15 and 17, 2010. Abandonment permits were obtained from the City of Torrance on June 10, 2010. The wells were abandoned by advancing the roto-sonic drive casing to total depth and removing all temporary well materials. Once at depth, the drive casing was removed from the borehole, and a bentonite-cement grout was tremmied into the borehole to fill the resulting void space. After the cement had cured, the surface was repaved in accordance with City of Torrance requirements. All markings on city streets and right-of-ways generated during the investigation activities were removed or covered in accordance with City of Torrance requirements. The final inspection approving the surface locations was on June 30, 2010. The City of Torrance inspected and approved the asphalt resurfacing on June 30, 2010 (see inspection card in Appendix A).

5.0 REFERENCES

de maximis, 2009. Letter to Carolyn d'Almeida, US EPA Region 9, West of Western Supplementary Evaluation, Montrose Site, Los Angeles, CA, September 25.

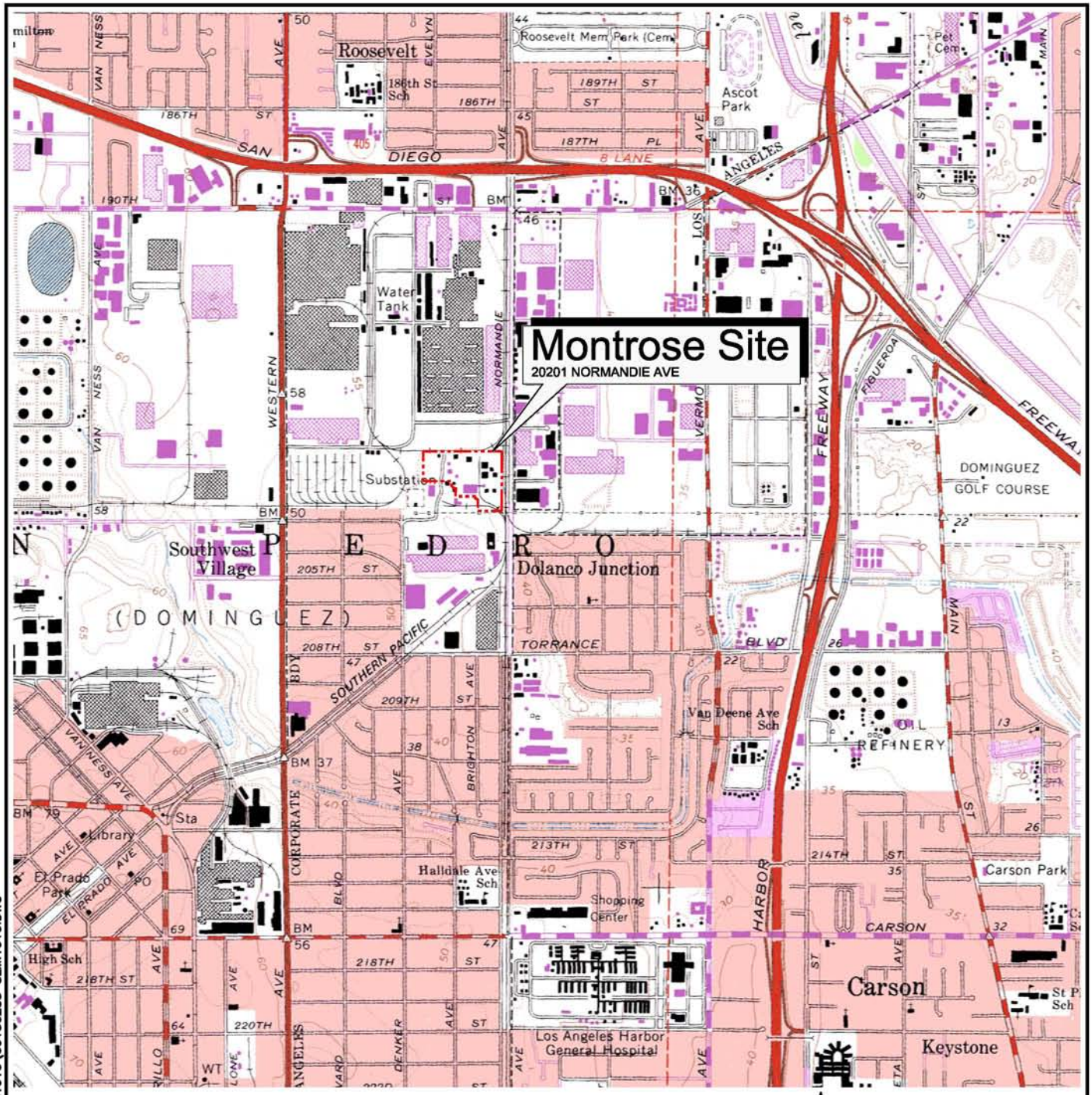
EPA, 2009. Letter to Mr. Joseph Kelly, Review of Technical Memorandum – Results of the Evaluation of the West of Western Avenue Groundwater Assessment Montrose Chemical Corporation Superfund Site, Torrance, California, May 27.

EPA, 2010. Email to Brian Dean and Mike Palmer from Carolyn d'Almeida, US EPA Region 9, Preliminary analysis of five water samples for the Montrose project, June 9.

ERM, 2007. Refinery Subsurface Cleanup Progress Report, ExxonMobil Oil Corporation, July, 13.

H+A, 2009. Technical Memorandum, Results of West of Western Avenue Groundwater Assessment, Montrose Site, Torrance, California, April 24.

FIGURES



Reference:

1. U.S.G.S. Topographic Map, Torrance, California 7.5 Minute Quadrangle. Georeferenced using the State of California's CASIL On-line GIS Database, Copyright 2010.

Montrose Chemical Corporation

Site Location Map

Date: 10-10	Montrose Superfund Site	Figure
Project No. 60150255	AECOM	1

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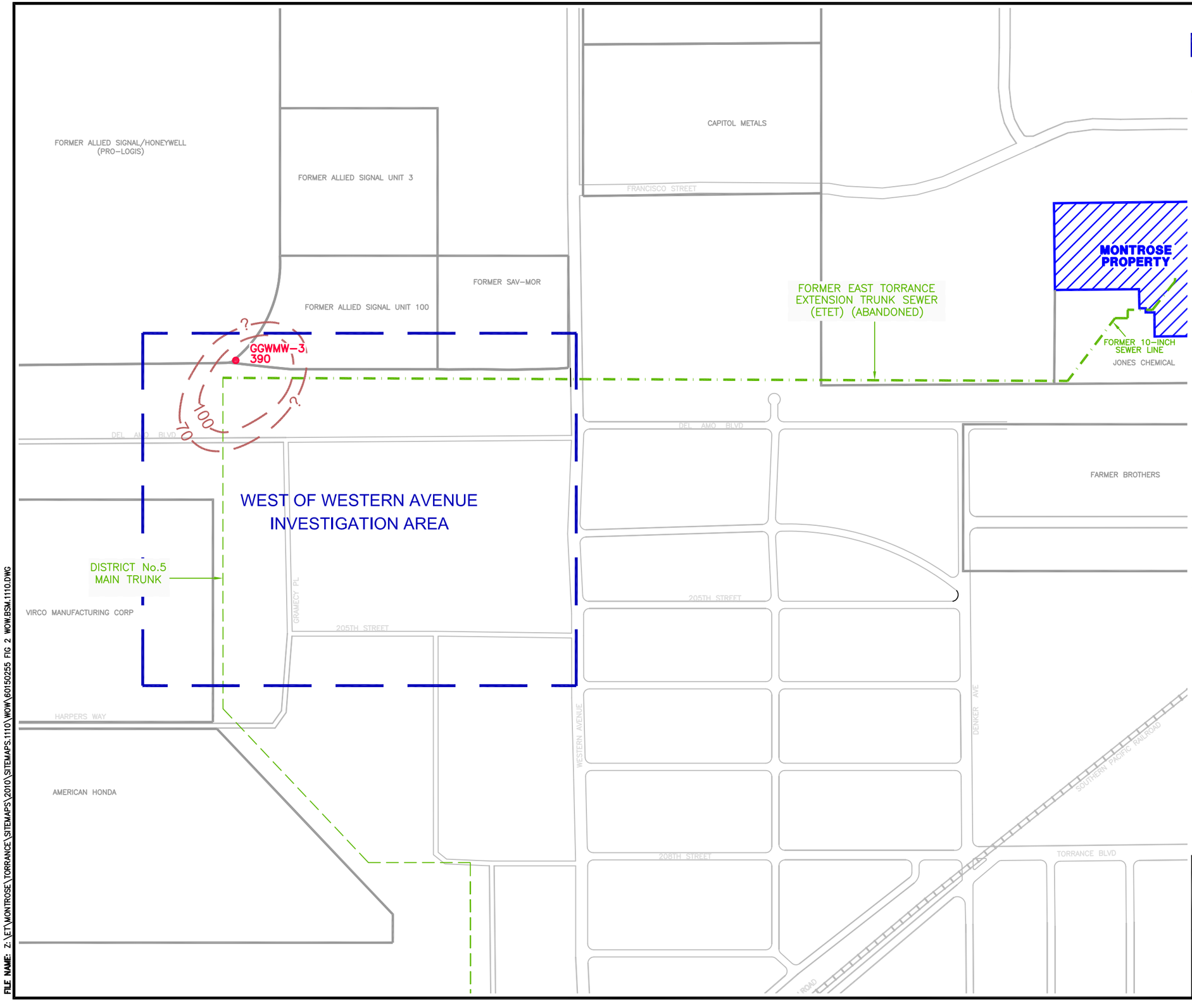

Legend:

- West Of Western Avenue Investigation Area
- GGWMW-3● Existing Monitoring Well
- Sewer (Abandoned)
- Sewer (Other)
- — 70 — Contour Line Of Equal Concentration of MCB In Micrograms Per Liter Dashed Where Approximate, Queried Where Inferred Based on Most Recent Available Sampling Result Through October 2008
- 390 MCB concentration in Bellflower C Sand (ug/L)

References:

1. Source of base map information from Hargis+Assoicates, Inc. dated December 2009. Not a Surveyed Map, locations are approximate.

NORTH

0 200 400 FEET

SCALE: 1"= 400'

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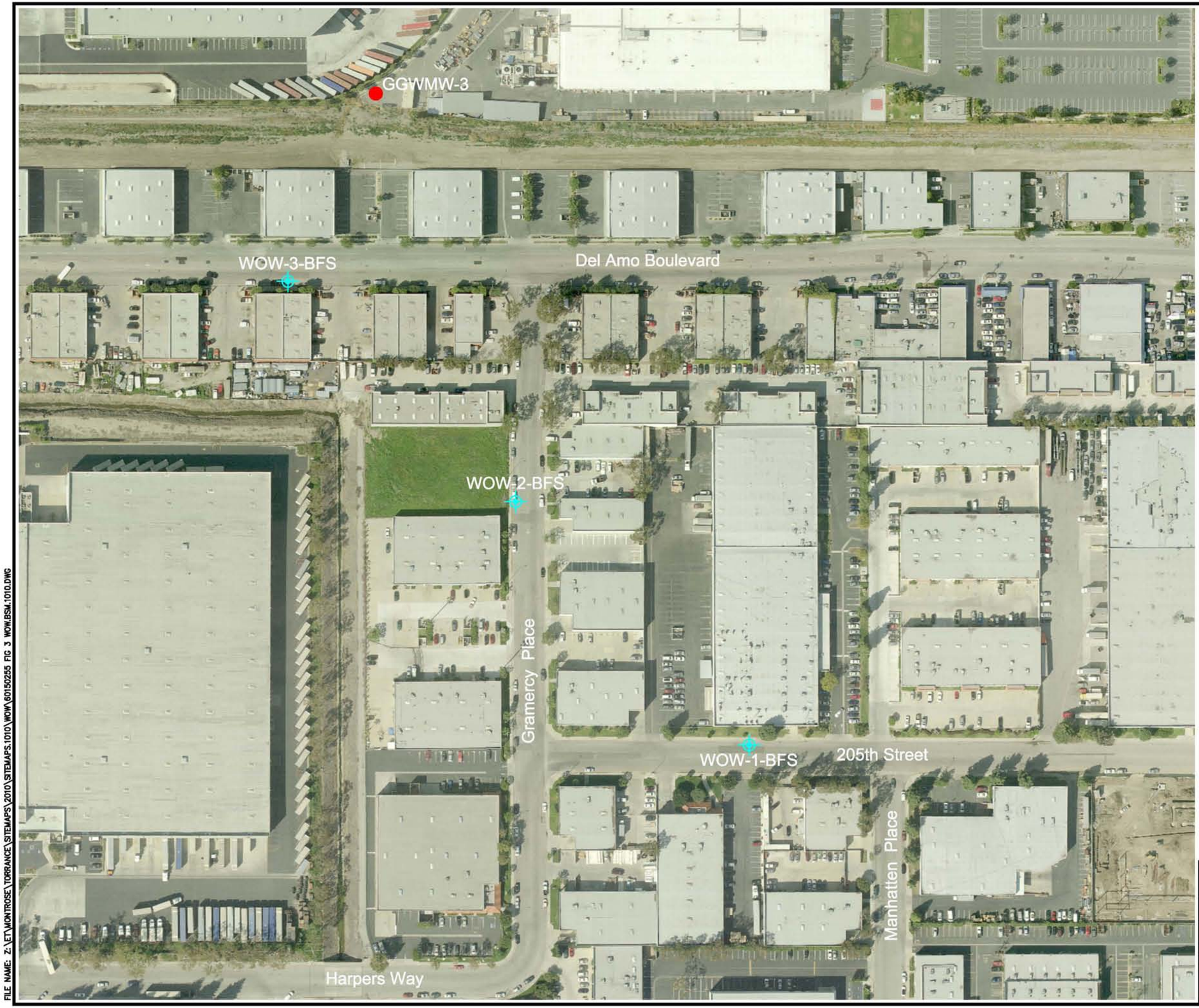
Investigation Area Map

Date: 11-10	Montrose Superfund Site	Figure 2
Project No. 60134337	AECOM	

FILE NAME: Z:\ET\MONTROSE\TORRANCE\SITEMAPS\2010\SITEMAPS.1110\WOW\60150255 FIG 2 WOW.BSM.1110.DWG



Legend:

- WOW Bellflower Sand Wells
- Existing Monitoring Well

References:

1. Monitoring Well Locations shown were surveyed by WM Surveys Inc. on July 9, 2010.
2. Satellite/Aerial Photos Reference: U.S.G.S Orthorectified Image, Dated July 29, 2009.

NORTH

0 75 150 FEET

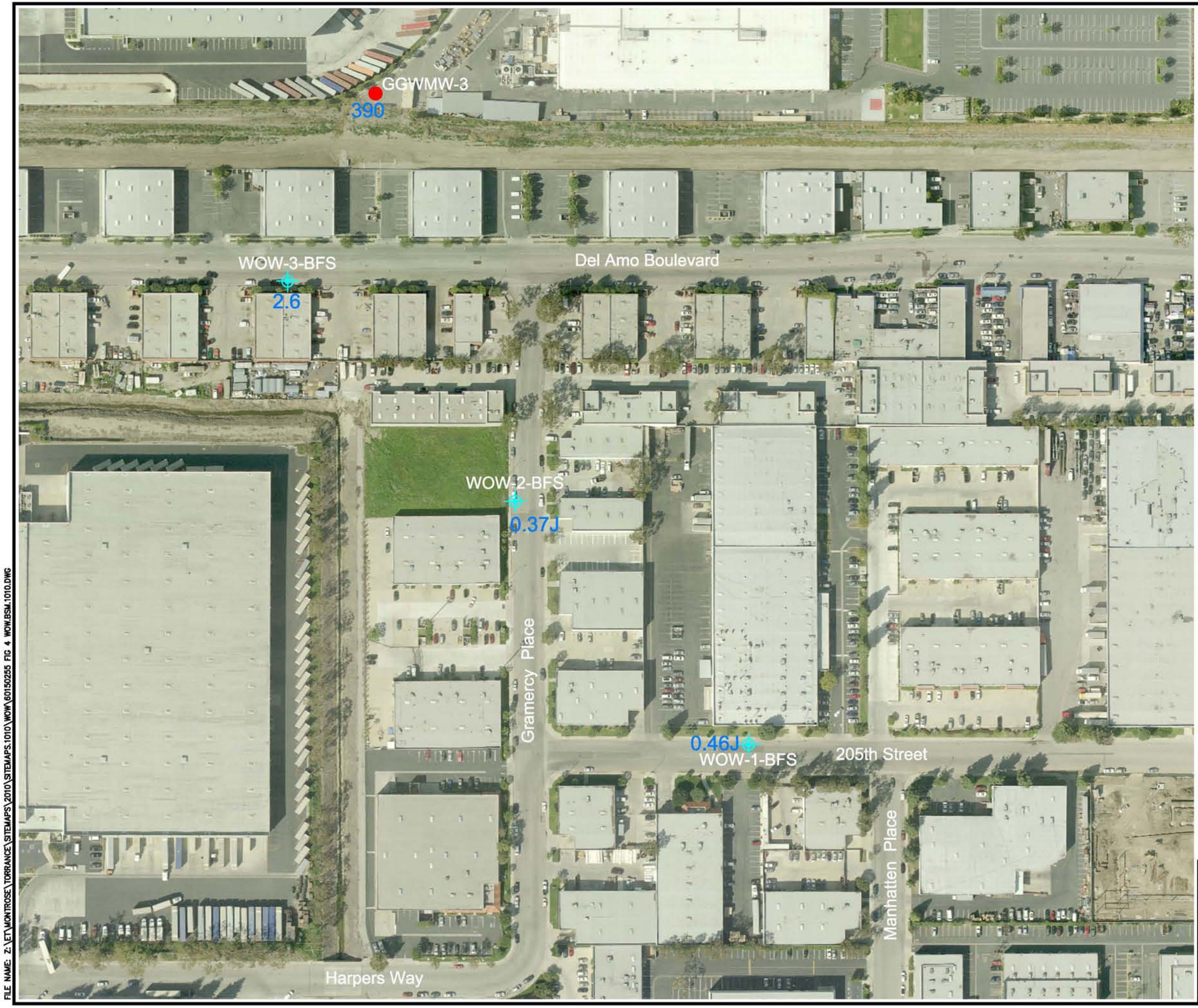
SCALE: 1"= 150'

Montrose Chemical Corporation

WOW Bellflower Sand Wells

Date: 10-10	Montrose Superfund Site	Figure 3
Project No. 60134337	AECOM	

FILE NAME: Z:\ET\MONTROSE\TORRANCE\SITEMAPS\2010\SITEMAPS.1010\WOW\60150255 FIG 3 WOW.BSM.1010.DWG



Legend:

- WOW Bellflower Sand Wells
- Existing Monitoring Well
- 2.6 — MCB concentration in Bellflower C Sand (ug/L)

References:

1. Monitoring Well Locations shown were surveyed by WM Surveys Inc. on July 9, 2010.
2. Satellite/Aerial Photos Reference: U.S.G.S Orthorectified Image, Dated July 29, 2009.

NORTH

0 75 150 FEET

SCALE: 1"= 150'

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MCB in Groundwater

Date: 10-10	Montrose Superfund Site	Figure 4
Project No. 60134337	AECOM	

FILE NAME: Z:\ET\MONTROSE\TORRANCE\SITEMAPS\2010\SITEMAPS.1010\WOW\60150255 FIG 4 WOW.BSM.1010.DWG