REMEDIAL WELLFIELD AND TREATMENT SYSTEM PERFORMANCE EVALUATION TEST PLAN

TGRS Construction
Montrose Superfund Site
20201 S. Normandie Avenue
Los Angeles, California

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ACRONYMS AND ABBREVIATIONS

Abbreviation	**Term**
AECOM	AECOM Technical Services, Inc
APT	Applied Process Technologies, Inc.
BHC	Benzene Hexachloride
gpm	Gallons per minute
HDPE	High Density Polyethylene
HiPOx	High Pressure Oxidation (patented APT technology)
ISGS	In-Situ Groundwater Standards
LADWP	Los Angeles Department of Water and Power
LGAC	Liquid-Phase Granular Activated Carbon
Montrose	Montrose Chemical Corporation of California
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
pCBSA	para-Chlorobenzene Sulfonic Acid
PID	Photo-Ionization Detector
PLC	Programmable Logic Controller
psig	Pounds per square inch
ROD	Record of Decision
SCAQMD	South Coast Air Quality Management District
Site	Montrose Superfund Site
SOW	Statement of Work
TGRS	Torrance Groundwater Remediation System
TO	Toxic Organics
UPRR	Union Pacific Railroad
USEPA	United States Environmental Protection Agency
VGAC	Vapor-Phase Granular Activated Carbon

1.0 INTRODUCTION

This remedial wellfield and treatment system performance evaluation test plan (Test Plan) was prepared for construction of the Torrance Groundwater Remediation System (TGRS) at the Montrose Superfund Site (Site) in Los Angeles, California (**Figure 1**). The Remedial Design of the TGRS was finalized in June 2012 (Geosyntec, 2012b) and conditionally approved by USEPA in September 2012 (USEPA, 2012b). A Partial Consent Decree for construction of the Dual Site Groundwater Operable Unit treatment system was executed by Montrose Chemical Corporation of California (Montrose), the United States Environmental Protection Agency (USEPA), and the State of California in August 2012 (USEPA, 2012a). On behalf of Montrose, this Test Plan was prepared as required under Item 3.1(a) of the Statement of Work (SOW) included as Appendix B of the Partial Consent Decree.

This plan identifies the testing activities to be conducted at the conclusion of TGRS construction for purposes of certifying that the system meets the performance criteria established in the Remedial Design. Following construction activities, the various components of the TGRS will be tested to demonstrate proper function and compliance with performance standards for flow rate and reduction of dissolved-phase contaminant concentrations to In-Situ Groundwater Standards (ISGS) as established in the Groundwater Record of Decision (ROD; USEPA, 1999). The results of the wellfield and system testing will be documented in a final Construction Completion Report which certifies that construction of the TGRS is complete and that the system is ready for operation as intended.

1.1 ORGANIZATION OF THE TEST PLAN

This Test Plan is organized into six sections as follows:

- Section 2: Site Information and Scope of Work
- Section 3: Remedial Wellfield Performance Evaluation and Testing
- Section 4: Treatment System Performance Evaluation and Testing
- Section 5: Reporting
- Section 6: References

Section 2 describes the Site background and construction scope of work. Sections 3 and 4 address the performance evaluation and testing to be conducted for the remedial wellfield and treatment system, respectively. Section 5 summarizes the reporting of testing results.

2.0 SITE INFORMATION AND SCOPE OF WORK

The Montrose Property is located at 20201 South Normandie Avenue in the City of Los Angeles, California (Figure 1). The Site is located within a portion of the City of Los Angeles identified as the Harbor Gateway, which extends from Western Avenue to Normandie Avenue. The City of Torrance is located west of the Harbor Gateway, and unincorporated Los Angeles County is located east of the Harbor Gateway.

The Montrose Property occupies approximately 13 acres and is bounded by the Union Pacific Railroad (UPRR) right-of-way and Normandie Avenue to the east, the Jones Chemical Inc. property and a right-of-way owned by the Los Angeles Department of Water and Power (LADWP) to the south, the GLJ Holdings property to the north, and Frito-Lay Sales, Inc. to the west. The Montrose Property and other surrounding properties are shown in **Figure 2**. The area east of the Property is occupied by manufacturing and commercial facilities. The area to the west is occupied by manufacturing and an oil refinery. Land uses south and southeast of the Property are mixed manufacturing, commercial, and residential zoning.

Currently, the Site is unoccupied, fenced, and covered with asphalt. Entrance to the Property is from Normandie Avenue through a locking gate located in the northeast corner of the Property. The on-Property features include three large, raised, asphalt building pads (constructed in 1985) and six temporary soil cells containing soil excavated from along the historical stormwater pathway in a portion of the residential neighborhood (i.e., Kenwood Avenue). Additionally, there is a storage container on-Site for storage of field equipment and supplies. Water service is available through a metered line located at the northeast corner of the Property at this time. Electrical and telephone services are not yet available at the Property. Surface water drainage is toward the southeast corner of the Montrose Property and the Normandie Avenue Ditch.

2.1 SITE BACKGROUND

Montrose manufactured technical grade dichlorodiphenyltrichloroethane (DDT) at the Property from 1947 until 1982. Montrose manufactured DDT by combining chlorobenzene and chloral in the presence of a powerful sulfuric acid catalyst (oleum). The Montrose plant produced as much as eighty million pounds of technical grade DDT annually. Montrose supplied technical grade DDT to, among others, the Department of Defense, United Nations, and the World Health Organization. In addition to the Montrose operations, Stauffer Chemical Company operated a small benzene hexachloride (BHC) plant on the southeast corner of the Property from approximately 1954 until 1963 when the plant was dismantled and removed from the Site.

Montrose terminated its production process and completely ceased operating the plant in 1982. The plant was fully dismantled and demolished by early 1983. During 1984 and 1985, Montrose graded and covered the property with asphalt. The USEPA proposed the Site for the Superfund National Priorities List (NPL) in 1984, and the proposal was finalized in 1989.

Remedial investigations conducted at the Montrose Site have documented chemical impacts including chlorobenzene to the three upper water-bearing zones at the Site, which are the upper Bellflower Aquitard, the Bellflower Sand, and the Gage Aquifer (USEPA, 1998). A Record of Decision (ROD) for remediation of dissolved-phase chlorobenzene in groundwater was issued by USEPA in 1999 (USEPA, 1999). A number of groundwater pilot tests and studies were conducted over the last decade. Remedial design of the TGRS was completed in June 2012 and was subsequently approved by USEPA on September 20, 2012.

2.2 PROJECT SCOPE

The ROD specifies a remedial action that provides both contaminant and volume reduction of the chlorobenzene plume exceeding the In-Situ Groundwater Standards (ISGSs). The ROD also requires the prevention of adverse migration of contaminants laterally and vertically.

Containment of dissolved-phase volatile organic compounds (VOCs), including chlorobenzene, will be achieved by utilizing hydraulic extraction of groundwater from extraction wells to mitigate contaminant migration. The wellfield and relative pumping rates of the wells will be optimized to limit the lateral and vertical migration of contaminants and to maximize containment during remedial action. This optimization will be conducted in accordance with the requirements and provisions of the ROD.

Groundwater will be extracted from a series of wells, located primarily down the center of the dissolved-phase plumes, and conveyed to the Montrose Property for aboveground treatment using a combination of advanced oxidation, air stripping, and carbon adsorption. Treated groundwater will be conveyed from the Montrose Property to a series of wells, located primarily along the perimeter of the dissolved-phase plumes, for reinjection. Some of the extraction and injection wells were previously installed as part of field pilot testing activities. The remaining wells, underground conveyance pipelines, certain aboveground infrastructure, and groundwater treatment plant will be constructed during this project. The layout of the extraction and injection wells and pipelines is shown in **Figure 3**.

The TGRS construction SOW was provided in Appendix B of the Partial Consent Decree. A brief description of the six primary construction work tasks is provided in the following sections.

2.2.1 EXTRACTION WELL INSTALLATION

A series of extraction wells will be installed to extract groundwater from the dissolved chlorobenzene plumes in each of the three upper water-bearing zones. A total of 14 extraction wells are planned as shown in Figure 3. Previous construction activities completed during the investigation stage of the program involved the installation of six extraction wells. Therefore, the remaining eight extraction wells will be installed during this project and pursuant to the SOW including: two wells in the Upper Bellflower Aquitard, four wells in the Bellflower C Sand Aquifer, and two wells in the Gage Aquifer.

The installation phase will include drilling to the appropriate depth, disposing of the removed soils, placing the well casing, installing the filter pack and annular seal, placing the well cap, and developing and testing the extraction well. Following this installation and testing phase, drop pipes and submersible well pumps will be placed in the well casing. A concrete vault will be placed around the well head to provide protection and controlled access. Each well vault will be equipped with a float switch for level detection, a manual isolation valve and an automated flow control valve, and a leak detection sensor and valve to isolate the well from the rest of the extraction pipeline conveyance system, and electrical equipment for controlling the extraction pumps and monitoring pumping performance. The electrical equipment will be connected to instrumentation and controls, a meter, and a connection to a power supply.

2.2.2 INJECTION WELL INSTALLATION

A series of injection wells will be installed to inject the treated groundwater back into the aquifer systems. A total of eight injection wells are currently planned as shown in Figure 3. Previous construction activities completed during the investigation stage of the program resulted in the installation of five injection wells. Therefore, the remaining three injection wells will be installed during this project and pursuant to the SOW including: one well in the Bellflower C Sand Aquifer and two wells in the Gage Aquifer.

The installation phase will include drilling to the appropriate depth, disposing of the removed soils, placing the well casing, installing the filter pack and annular seal, placing the well cap, and developing and testing the injection well. Following this installation and testing phase, drop pipes will be placed in the well casing. A concrete vault will be placed around the well head to provide protection and controlled access. Each well vault will be equipped with a float switch for level detection, a manual isolation valve and an automated flow control valve, and a leak detection sensor and valve to isolate the well from the rest of the injection pipeline conveyance system, and electrical equipment for controlling the extraction pumps and monitoring pumping performance. The electrical equipment will be connected to instrumentation and controls, a meter, and a connection to a power supply.

2.2.3 EXTRACTION PIPELINE INSTALLATION

The extraction pipelines will convey contaminated groundwater from the extraction wells to the treatment facility. Due to the highly developed land use of the area, a combination of trenching, directional drilling (if required), and a crossing under a pedestrian bridge will be used to route the pipes and electrical conduits between the wells and the treatment facility. Double-walled high density polyethylene (HDPE) pipes will be used for the extraction system as a leak prevention measure.

Installation of the extraction pipelines will involve trenching, directional drilling (if required), installing bridge crossings, assembling and installing the pipes, and installing the associated electrical wires, fiber optic cable, and conduits. Including separate piping for wells with high arsenic concentrations, approximately 13,000 linear feet of double-walled pipe will be installed during this project. The majority of the piping will be installed within approximately 10,000 linear feet of trenches located in City of Los Angeles and Los Angeles County streets. The existing asphalt and concrete overlying the trench area will be sawcut and removed. The excavated soil will be transported off-Site for disposal, placed back into the pipeline trench or pipe-jack trench, or re-compacted and used as fill material on the Montrose Property for construction of the main treatment facility. Sand will be placed in the trench as pipe bedding, and following installation of the piping and conduit, the trenched area will be repaved.

One section of the pipeline, including pipes and conduits, will cross under the Javelin Street pedestrian bridge. This element of the construction will involve installing brackets on the undersides of the bridges, placing steel casing, installing a valve vault on each side of the bridge, and placing the piping and conduits.

2.2.4 INJECTION PIPELINE INSTALLATION

The injection pipelines will convey treated water from the treatment facility on the Montrose Property to the injection wells. The treatment system effluent will be treated water, and therefore, single-walled HDPE pipes will be sufficient for the injection system piping. Due to the highly developed land use of the area, a combination of trenching, directional drilling (if required), and pipe crossings under a bridge will be used to route the pipes and electrical conduits between the wells and the treatment facility. The injection wells are expected to require periodic redevelopment to maintain injection capacities. In addition to the injection piping, development return piping will be installed adjacent to the injection water lines to convey redevelopment water back to the treatment plant.

Installation of the injection pipelines will involve trenching, directional drilling (if required), installing bridge crossings, assembling and installing the pipes, and installing the associated electrical wires and conduits. Including injection well redevelopment return piping, a total of approximately 24,000 linear feet of injection piping will be installed during this project. The majority of the piping will be installed within approximately 8,500 linear feet of trenches beneath the City of Los Angeles and Los Angeles County streets. The existing asphalt and concrete overlying the trench area will be sawcut and removed. The excavated soil and pavement will be transported off-Site for disposal, placed back into the pipeline trench or pipe-jack trench, or re-compacted and used as fill material on the Montrose Property for construction of the main treatment facility. Sand and gravel will be placed in the trench as pipe bedding, and following installation of the piping and conduit, the trenched area will be repaved.

One section of the pipeline will cross the Torrance Lateral Bridge at the intersection of Torrance Boulevard and Vermont Boulevard. This element of the construction will involve installing brackets on the undersides of the bridges, placing steel casing, installing a valve vault on each side of the bridge, and placing the piping.

The original TGRS design included an injection pipeline running through the 204th Street alley historically under the jurisdiction of the County of Los Angeles (the "County"). In March 2012, Montrose learned that the County had vacated the alley several years beforehand, and that residents adjacent to the alley had built patios, fences, and other encroachments into the alley. Rather than disturb the residents, Montrose evaluated alternative routes and is pursuing an easement agreement with Triton Diagnostics (a Shell subsidiary) to route the pipeline further to the north, parallel to the alley, through a large parcel of vacant land owned by Triton Diagnostics. Montrose and Triton Diagnostics are still negotiating the terms of an agreement, and at this time access appears promising. Montrose expects to soon finalize negotiations with Triton Diagnostics, and an executed easement agreement is anticipated sometime in the January 2013. Montrose has elected to proceed with the redesign of this portion of the treatment system. Montrose will submit a set of revised design drawings when this activity is complete.

2.2.5 PIPE JACKING

Pipe jacking will be used to place pipes under the UPRR railroad tracks in two locations, one on Normandie Avenue near Del Amo Boulevard and another near the treatment facility. This will involve excavating a thrust pit and a reception pit, constructing a thrust wall in the thrust pit, driving pipes through the soil with a hydraulic jack, connecting the pipes on each end, backfilling the pits, and compacting and repaving the disturbed area. The total length of pipe jacking will be approximately 300 feet.

2.2.6 TREATMENT FACILITY CONSTRUCTION

The purpose of the treatment facility is to remove groundwater contaminants from the Chlorobenzene Plume at or around the Montrose and Del Amo Superfund Sites, to the levels specified in the ROD. The treatment facility will be located on the Montrose Property. A Site Plan from the Remedial Design showing the treatment facility is provided as **Figure 4**.

Prior to any construction, the existing asphalt in the area of the treatment system will be removed from the Montrose Property and the foundation will be excavated. The plant Site will be surveyed and treatment facility bedding materials will be installed. The ground floor slab and truck ramp will then be constructed. A control building and fence will be installed at the plant Site. Treatment facility Site lighting, power drops, electrical conduits, and electrical wires will then be connected.

Treatment components will be installed on the floor slab. Currently, the major treatment components include the following:

- An advanced oxidation system ("HiPOx");
- An air stripper system consisting of three air strippers;
- A liquid-phase granular activated carbon ("LGAC") adsorber system;
- A vapor-phase granular activated carbon ("VGAC") adsorber system; and
- A post-treatment filtration system.

Several pumps, storage tanks, and other appurtenances required for operation of the TGRS will also be installed.

3.0 REMEDIAL WELLFIELD PERFORMANCE EVALUATION AND TESTING

TGRS construction activities will include installation of an additional 8 extraction and 3 injection wells at the Site. Following installation, these wells will be tested to verify their ability to meet design flow rates. TGRS construction activities will additionally include installation of wellhead controls at all 14 extraction and 8 injection wells to be used as part of the groundwater remedy. Functional tests of the wellhead controls will be conducted in order to certify that the system is ready for operations. The remedial wellfield performance evaluation testing to be conducted at the conclusion of construction activities is summarized in the sections below.

3.1 STEP-RATE DRAWDOWN TESTING

Following installation and development, a short-term step-rate drawdown test will be conducted at each of the 11 new extraction and injection wells to be installed during TGRS construction activities. These tests will evaluate the water level drawdown at varying groundwater extraction rates, i.e., well specific capacity. The recovery data from the testing will also be used to estimate the hydraulic conductivity of the aquifer at each of the well locations.

Each well will be tested at three different extraction rates for 60 minutes at each rate (180 minutes of total extraction time per well). The test rates will be based on the design flow rate for the well, i.e., testing both below and above the design flow rate. The approximate step-rates for the planned 11 additional TGRS extraction and injection wells are summarized below. Test rates will be modified if necessary based on initial well performance, i.e., an unusually small or large drawdown is observed.

Step-Rate Drawdown Test Rates
Wells Installed During TGRS Construction

Well Name	Design Flow Rate (gpm)	Step Drawdown Test Rates (gpm)
Extraction Wells		
UBA-EW-1	6	3, 6, 9
UBA-EW-2	12	8, 12, 16
BF-EW-3	64	40, 64, 90
BF-EW-4	132	90, 132, 170
BF-EW-5	35	20, 35, 50
BF-EW-6	35	20, 35, 50

Well Name	Design Flow Rate (gpm)	Step Drawdown Test Rates (gpm)
G-EW-4	57	40, 57, 80
G-EW-5	48	30, 48, 70
Injection Wells		
BF-IW-3	57	40, 57, 80
G-IW-4	125	75, 125, 175
G-IW-5	125	75, 125, 175

The groundwater level in the well will be continuously monitored using down-well pressure transducers and a datalogger. The datalogger will be programmed to record water levels every few seconds, with a higher frequency at the start of each step test. The extraction rate will be held constant over each 60 minute step by manually adjusting a flow control valve. A digital flowmeter will be placed in line for continuous monitoring of the extraction rate, and the calibration of the flowmeter over the test range will be verified in the field prior to use in step-rate testing. At the conclusion of the drawdown test, the rebound to static levels will also be logged for evaluating hydraulic conductivity. Water level versus time graphs will be generated for each of the wells tested, and the test data will be analyzed to estimate transmissivity, hydraulic conductivity, and storativity using Aqtesolv™.

Prior to step-rate drawdown testing, a groundwater sample will be collected from each new well and analyzed at a State-certified environmental laboratory for VOCs by EPA Method 8260B and para-chlorobenzene sulfonic acid (pCBSA) by EPA Method 314 modified. The extraction well samples will additionally be analyzed for arsenic by EPA Method 6020 for purposes of updating the estimated initial influent chemical concentrations at the Site. The injection wells samples will additionally be analyzed for metals by EPA Methods 6010B/7470A series and general minerals in support of injection testing and geochemical evaluation.

The extracted groundwater will be filtered to remove particulates and treated using LGAC as needed to remove dissolved VOCs. The treated groundwater will be temporarily accumulated in portable tanks pending laboratory results of water quality samples. The samples will be analyzed at a State-certified environmental laboratory for all constituents listed under the existing National Pollutant Discharge Elimination System (NPDES) permit from the Los Angeles RWQCB. Upon receipt of laboratory results demonstrating permit compliance, the treated groundwater will be discharged to the storm drain, consistent with the methods previously used at the site for step-rate testing. The cumulative volume of groundwater discharged at each distinct storm drain outfall will be recorded for quarterly reporting as required under the permit. In the event that a storm drain outfall is not in relatively close proximity to the well, the non-hazardous water will be temporarily accumulated and characterized for off-Site transport and disposal in accordance with Federal and State requirements.

3.2 INJECTION TESTING

Three new injection wells will be installed, developed, and hydraulically tested to verify injection capacity in accordance with the Remedial Design. The existing five injection wells have either been tested previously or will be tested in advance of or concurrently with TGRS construction. The target injection rates for each of the new wells to be hydraulically tested are summarized below.

Injection Test Rates
Wells Installed During TGRS Construction

Well Name	Injection Test Rate (gpm)
BF-IW-3	57
G-IW-4	125
G-IW-5	125

Groundwater will be injected at a constant rate for a period of 7 days. This duration was found to reliably demonstrate injection capacity during prior testing. Groundwater will be extracted from a nearby well to provide a continuous source for the injection test. G-IW-3 will be the source well for injection testing at BF-IW-3, and either G-IW-2 or monitoring well G-11 will be the source well for injection testing at G-IW-4 and G-IW-5. An electric submersible pump will be placed in the source well and will be powered using a portable diesel generator. Groundwater will be pumped from the source well to the injection well without using a tank in order to minimize oxygen entrainment and reduce the potential for mineral fouling. A drop pipe will also be placed in the injection well to minimize air entrainment. Any particulates greater than 0.5 micron will be removed from the groundwater prior to injection using bag filters. A high pressure switch will be placed in line to automatically shut off the submersible pump in the event of a high pressure condition at the extraction well. A low flow switch will additionally be placed in line to automatically shut off the submersible pump in the event of a low flow condition at the injection well, e.g., a line break between wells.

The geochemical compatibility of the groundwater between the source and injection wells will be evaluated in advance of testing. Groundwater from the Gage Aquifer can be slightly alkaline, and acid addition was required to control mineral fouling during prior injection well testing. Accordingly, small doses of muriatic acid will be added to the extracted groundwater to reduce the potential for mineral fouling during injection testing. The acid drum and chemical metering pump will be located within a secondary containment area and secured with locked temporary fencing and windscreen. A pH probe and digital display will be used to monitor groundwater pH during injection testing.

The groundwater level in both the extraction and injection wells will be continuously monitored using down-well pressure transducers and dataloggers. The dataloggers will be programmed to record water levels every few minutes and will be downloaded daily to evaluate injection test progress. At the conclusion of the injection test, the rebound to static levels will also be logged for evaluating hydraulic conductivity. Water level versus time graphs will be generated for each of the extraction and injection wells tested. Additionally, the recovery data will be used to estimate hydraulic conductivity using Aqtesolv™.

3.3 SUBMERSIBLE PUMP TESTING

An electric submersible pump will be placed in each of the 14 extraction wells associated with the TGRS system. A functional test of the electric submersible pumps will be conducted aboveground and prior to placing them in the wells. A drum or PVC pipe will be filled with tap water for use in testing the pumps aboveground. The test duration will be very short, i.e., just a few seconds. This short-term test will demonstrate that the pump is functional, spins the correct direction, and discharges water. Functional pumps will then be installed into each of the extraction wells to the target depth.

3.4 WELL VAULT LEAK DETECTION LEVEL SENSOR TESTING

Each well vault will be equipped with a float switch for purposes of leak detection. Each float switch will be manually raised to simulate a water leak. The programmable logic controller (PLC) will be monitored to verify detection of the alarm condition, and to verify the automated shutdown of the associated well/water source.

3.5 PRESSURE TRANSDUCER TESTING

Each of the extraction and injection wells will be equipped with a pressure transducer for electronic monitoring of water level in the well. The pressure transducers will be installed to a specific target depth, measured in feet below top of static water level. The water column height will not be displayed at the well vault, and therefore, the height of the water column above the transducer will be manually verified using a separate water level meter. The PLC will be monitored to verify (a) that the transducer shows a zero reading prior to submergence, and (b) that the water column height detected at the PLC is consistent with the manual value measured at the well.

3.6 MOTORIZED VALVE TESTING

Each extraction and injection well will be equipped with a motorized actuator valve for controlling groundwater flow. The position of the actuator valves will be controlled from the PLC. The motorized actuator valve position will be varied from fully closed to fully open at the PLC, and the position of the valve will be inspected at the wellhead to verify valve operation in accordance with the PLC.

3.7 FLOWMETER CALIBRATION AND TESTING

Each extraction and injection well will be equipped with a magnetic flowmeter for groundwater flow monitoring. The flowmeters are factory calibrated and do not require any additional calibration prior to use. However, the accuracy of the flowmeters, as installed within the wellhead piping, can be verified in the field by pumping a known volume of water through the flowmeter over a known duration. This will be accomplished using a small volume of water (less than 200 gallons) over short durations (less than 5 minutes). Flowmeter calibration testing will be done at three different rates consistent with approximately 50%, 100%, and 150% of the design flow rate of the well. The magnetic flowmeters will have an indicating digital display. The flow as displayed at the wellhead will be compared against the flow displayed at the PLC to ensure that electronic data is being accurately transmitted and interpreted by the PLC program. A zero flow reading at the PLC will also be verified during periods of no flow. A record of calibration testing will be kept on file for each flowmeter tested.

Depending on the results of the testing, it may not be necessary to individually test all 22 wellhead flowmeters if purchased from the same manufacturer. The Remedial Design specifies five different size magnetic flowmeters for the wellheads, varying from 1-inch to 4-inch diameter. If field verification of factory calibration demonstrates accurate flow readings in accordance with the manufacturer specifications for at least one flowmeter of each size, then field verification of the remaining wellhead flowmeters is likely unnecessary.

3.8 PRESSURE TRANSMITTER TESTING

Each extraction and injection well will be equipped with a pressure transmitter. Although the transmitter will not be equipped with a digital display, a manual pressure gauge will be located in the wellhead piping. The PLC will be monitored to verify that the transmitted pressure is zero with no flow and consistent with the value reflected by the manual gauge at the wellhead. The accuracy of the pressure gauge will not be as accurate as the transmitter, and therefore, it may be necessary to temporarily use a high accuracy gauge to complete testing of the pressure transmitter.

4.0 TREATMENT SYSTEM PERFORMANCE EVALUATION AND TESTING

The TGRS treatment system utilizes three different treatment technologies for groundwater including advanced oxidation, air stripping, and liquid-phase granular activated carbon (LGAC). The TGRS treatment system additionally utilizes vapor-phase granular activated carbon (VGAC) to treat the off-gas from the air strippers. There are additionally a number of groundwater tanks, pumps, valves, controls, and water conditioning systems associated with the TGRS. This section describes the functional tests and evaluations that will be conducted to certify that the TGRS will operate in accordance with the Remedial Design performance criteria. Additionally, this section assumes that side-stream treatment of groundwater for arsenic will not be required as discussed in a letter submitted to USEPA on November 12, 2012 (L&W, 2012).

4.1 FUNCTIONAL TESTING

Following completion of system construction, functional testing of the TGRS system components will be conducted. Functional testing will be conducted in advance of extracting any contaminated groundwater and will be conducted using municipal tap water. Clean tap water will be added to the influent tanks and pumped through the various TGRS components for functional testing. Function testing activities will include:

- Energizing equipment and verifying power supply;
- Rotation of motors and pumps;
- Electrical continuity and loop checks;
- Testing of hand switches and disconnects;
- Operation of all transfer and sump pumps;
- Testing of the LGAC backflush system; and
- Operation of key valves, controls, and digital displays.

During the functional testing, no ozone or hydrogen peroxide will be added to the water from the HiPOx™ system. Similarly, no chemical amendments will be added to the water as a result of air stripper operation. Functional testing using municipal water will be done over short durations (minutes for each component) for verifying fundamental operation of the equipment. The TGRS system includes storage/feed tanks before and after each of the three treatment technologies, and municipal water will be recycled back to the influent tanks as frequently as needed to complete functional testing of all system components. No municipal water will be pumped to the injection wells during functional testing. Other related functional tests for specific TGRS system components are described in the following sections.

4.2 PRESSURE TESTING OF PROCESS PIPING

Groundwater process piping, both underground conveyance piping and aboveground treatment system piping, will be pressure tested to verify the absence of leaks and the integrity of the pipe welds. The underground groundwater conveyance piping will be tested in segments due to the extent (more than 21,000 linear feet of trench). Each segment of the underground conveyance piping will be pressure tested in the field prior to backfilling. Pressure caps or flanges will be welded onto each end of the piping segment and fitted with valves and pressure gauges for conducting the pressure testing. The pressure testing will be conducted using municipal water sources where available (i.e., fire hydrant). The air in the piping will be bled out as the pipe is filled with water. Once water reaches the far end of the pipe, the isolation valve will be sealed exposing the underground piping to municipal water pressure (roughly 80 to 120 pounds per square inch gauge [psig]). The pressure in the line will be held for a short duration (less than one hour) but sufficiently long to demonstrate the integrity of the pipe. The full segment of the pipe will be visually inspected for evidence of leaks while the pipe is at pressure. There should be negligible or no reduction in pressure during the test. The pressure and duration of the test will be recorded for each underground piping segment. At the conclusion of the test, the municipal water in the pipe will be evacuated and either re-used for dust control purposes or discharged to the storm drain under the existing NDPES permit for the Site.

Where a pressurized groundwater source is unavailable, compressed air may be used in lieu of water for pressure testing of the pipes. If compressed air is used, each weld must be checked for air leaks using a soap or leak detection solution. Compressed air leaks are not as readily detected as water leaks, but pressure testing with air requires only minimal equipment and materials.

Prior to extracting any contaminated groundwater, aboveground process piping at the groundwater treatment facility will be tested using municipal water as part of the functional testing for this equipment. Municipal water will be added to the TGRS influent tanks and pumped through the system to verify that there are no leaks in the aboveground process piping. This functional test will be done at standard operating pressure and will not be at elevated municipal water pressure. The TGRS system will be equipped with a secondary containment concrete pad and berm to contain leaks.

4.3 FLOWMETER CALIBRATION AND TESTING

The equipment compound will be equipped with four magnetic flowmeters that are factory calibrated. The accuracy of the flow readings will be verified in the field as described in Section 3.7. Flow verification will be conducted during functional testing of the treatment system using municipal water.

City water will be pumped through each of the four flowmeters at three different rates of approximately 500, 700, and 900 gpm. The volumetric flow rate displayed at each meter will be compared against the rate determined from changes in feed tank liquid levels and the known inner diameter of the tanks.

4.4 PRESSURE TRANSMITTER TESTING

The treatment system is equipped with a number of pressure transmitters. Testing of the pressure transmitters will be done in an identical fashion as described in Section 3.8 for the wellhead controls.

4.5 TANK LEVEL SENSOR CALIBRATION AND TESTING

The treatment system is equipped with six large groundwater influent or feed tanks. Each of the tanks is equipped with a liquid level sensor and indicating transmitter. The liquid level sensor/transmitter will be programmed in the field as needed, and the accuracy of the liquid level will be verified in the field using a manual water level meter. The PLC will also be monitored to verify that the transmitted liquid level is consistent with the level displayed at the indicating transmitter.

4.6 EMERGENCY SHOWER TESTING

The TGRS will be equipped with two emergency shower and eye wash stations. Each of the stations will be tested in accordance with manufacturer recommendations and/or the ANSI standard Z358.1-1990. Both the shower and eye wash station will be manually activated as a functional test. The results of the emergency shower testing will be documented in a log and kept on file.

4.7 ADVANCED OXIDATION SYSTEM TESTING

Advanced Process Technologies (APT) will be subcontracted to conduct initial testing of the HiPOx™ advanced oxidation system. This system will require some programming and testing in the field to verify that the ozone and hydrogen peroxide are being mixed in the correct proportions for treatment of dissolved-phase contaminants, specifically pCBSA. APT will additionally verify proper operation of the oxygen/ozone generators and associated HiPOx™ equipment skid process controls.

4.8 AIR STRIPPER SYSTEM TESTING

The TGRS will be equipped with three QED 48.6 EZ Tray air strippers. Each of the three air strippers will be tested in accordance with manufacturer recommendations. This testing will be conducted as part of the functional testing using municipal water. The air to water ratio across the trays in each stripper system will be optimized. The controls and alarm settings for each air stripper will be tested. QED will be subcontracted as needed to assist with initial setup and testing of the air strippers.

4.9 DISCHARGE STACK EQUIPMENT TESTING

The TGRS will be equipped with an air discharge stack and continuous concentration meter. The meter will be a photo-ionization detector (PID) and will be used to measure low concentrations of VOCs in the air stripper off-gas following treatment using VGAC, if any. Site-specific calibration of the PID will be conducted. A zero calibration of the PID will be completed using ambient air. A span calibration of the PID will be completed using 50 parts per million by volume isobutylene. The PID will include a digital display. The PLC will be monitored to verify that the transmitted concentration reading is consistent with the zero and span calibration reading.

The discharge stack will also be equipped with a pitot tube and differential pressure indicating transmitter for monitoring the flow rate of exhaust air. The PLC will be monitored to verify that the exhaust air flow rate is consistent with the equivalent differential pressure reading displayed at the transmitter.

4.10 TEMPERATURE TRANSMITTER TESTING

The TGRS discharge stack and each of the VGAC vessels will be equipped with temperature transmitters. Although the transmitters will not be equipped with a digital display, manual temperature gauges will be used to verify the values transmitted to the PLC. A high temperature alarm setting will also be programmed for the temperature sensors at the VGAC vessels. The relative accuracy of the sensors at temperatures up to the alarm setpoint will be tested in the field by using a heated air gun or by placing the temperature sensors in a heated water bath.

4.11 BACKFLOW PREVENTER TESTING

The TGRS system will be equipped with a backflow preventer to protect the tap water source against backflow. The backflow preventer will be tested in accordance with municipal requirements. A subcontractor that routinely conducts backflow preventer testing within the City of Los Angeles will be hired to conduct the test.

4.12 CHEMICAL METERING SYSTEMS TESTING

The TGRS will be equipped with three chemical metering systems including sequestering agent, defoaming agent, and muriatic acid for pH control. Each of the three systems will be independent of each other but will have similar controls. For each system, a small amount of chemical will be pumped from the supply tote through the metering pump, associated tubing, and into a temporary container suitable for that chemical (e.g., plastic bucket or glass jar). The rate of chemical delivery to the temporary container will be verified and compared against the metering rate displayed at the pump. Following testing, any chemical pumped to the temporary container will be returned to the chemical tote for future use. All chemical metering testing will be conducted within the bermed equipment pad and secondary containment area. The chemicals will be stored in containers provided or recommended by the chemical supplier. Field personnel will be required to follow all applicable health and safety precautions for handling chemicals as indicated by the supplier and in the construction HASP.

4.13 DUCT HEATER TESTING

The TGRS system will be equipped with a duct heater to reduce the humidity of the air stripper off-gas prior to treatment by VGAC. During initial testing of the air strippers and off-gas treatment system, the humidity of the off-gas will be monitored using a humidity meter, both before and after the duct heater. Additionally, the off-gas air temperature will be monitored before and after the duct heater to verify that the air temperature was raised in accordance with the system design.

4.14 PLC SCREEN DEVELOPMENT TESTING

The PLC programmer will provide a computer operating interface for the PLC (e.g., SCADA) and will develop a series of screens offering various functions. The functions will allow the system operator to monitor system performance, turn pumps on/off, and trend/download operating data. The screen functions will be tested to verify system performance in accordance with the programming objectives and TGRS Remedial Design.

4.15 TESTING OF ALARM RELAYS AND AUTOMATED SHUTDOWN PROCESSES

The treatment system will be equipped with a number of alarm relays, and the PLC will be programmed to automatically shutdown groundwater processes in accordance with the Remedial Design logic. Prior to extracting contaminated groundwater from any of the extraction wells, all of the alarm relays will be tested to verify that the alarm registers at the PLC and that the appropriate shutdown process occurs. A tabulated record of alarm function will be prepared, dated, signed, and kept on record. Processing of contaminated groundwater will not occur until 100% of the alarm relays have been verified to operate as intended.

4.16 GROUNDWATER TREATMENT PERFORMANCE EVALUATION

Once the functional aspects of the TGRS have been verified as described in the above sections, the performance of the system in treating dissolved-phase contamination will be evaluated. Approximately 20,000 gallons of groundwater (one injection feed tank load) will be pumped from the extraction wells for purposes of testing the effectiveness of the treatment system. The groundwater will be pumped from the influent tanks through each of the three groundwater treatment systems and into the injection feed tank. The groundwater will be pumped at the design flow rate of 700 gpm, which will take approximately 30 minutes. The treated groundwater will not be discharged to the injection wells, but instead, will be retained within the effluent tank pending results of laboratory testing. During the short-term treatment period, samples will be collected at the following points:

- Influent groundwater
- Post-HiPOx™ water
- Post-air stripper water
- Post-air stripper off-gas/air
- Post-LGAC water
- Post-VGAC off-gas/air

For this initial evaluation testing, the air stripper will be operated without use of a sequestering agent, defoaming agent, or acid for pH control. This approach will allow evaluation of changes in groundwater chemistry resulting from the treatment technologies, particularly the HiPOx™ and air stripper technologies, which may oxidize some minerals. The results of this testing will be used to optimize the rates for the water conditioning chemicals.

The groundwater samples will be analyzed for the presence of dissolved contaminants and inorganics including:

- VOCs by EPA Method 8260B plus fuel oxygenates
- SVOCs by EPA Method 8270C
- pCBSA by EPA Method 314 modified
- Pesticides by EPA Method 8081A
- Metals by EPA Method 6010B/7470A
- Arsenic by EPA Method 6020
- General Minerals including at a minimum:
  - Anions by EPA Methods 300.0
  - Alkalinity by EPA Methods 310.1
  - Hardness by EPA Method 130.2
  - pH by EPA Method 9045D

The concentration of arsenic in influent groundwater will additionally be evaluated during this initial batch treatment. Upon receipt of laboratory results demonstrating that the treated groundwater meets the ISGS requirements established in the ROD, the treated groundwater will be pumped to the injection wells. Prior to injection, the groundwater chemistry and/or pH will be modified as needed to prevent mineral fouling at the injection wells.

The air stripper off-gas samples will be collected using pre-evacuated Summa™ canisters and analyzed for the presence of toxic organics (TO) by EPA Method TO-15. The results of the air stripper off-gas samples will be compared against State emission limits established by the South Coast Air Quality Management District (SCAQMD) and as referenced in the Revised Basis of Design Report (Geosyntec, 2012a).

Additional batch treatment of contaminated groundwater will be conducted as needed to optimize TGRS system performance prior to full-scale operations. The HiPOx™ advanced oxidation system may require more extensive testing in order to optimize the amendment concentrations for ozone and peroxide. Additional testing of inorganic groundwater chemistry may also be required to optimize conditions for re-injection. If subsequent batch treatment is conducted, water conditioning chemicals may be added in order to evaluate changes in groundwater chemistry.

4.17 SHAKEDOWN AND DEMONSTRATION TESTING

Once the results of the initial performance evaluation testing demonstrates that the TGRS effectively treats groundwater and air stripper off-gas to regulated discharge limits, the system will be operated for a period of approximately one week for equipment shakedown and demonstration testing. At the start of the week, the system will be operated only during normal business working hours in order to shakedown the equipment and resolve any issues with system controls and optimization. The air stripper will be operated normally during this period using the optimized flow rates for water conditioning chemicals including a sequestering agent, defoaming agent, and/or muriatic acid for pH control, as needed.

By the end of the week, the performance of the TGRS system in meeting design and discharge criteria will be demonstrated over a continuous 24-hour per day cycle. Influent, intermediate, and effluent water samples will again be sampled and analyzed in an identical manner as specified in Section 4.16. Influent and effluent air stripper off-gas samples will also be collected as described in Section 4.16. The purpose of the demonstration testing is to show the effectiveness of the system as a whole and demonstrate that the system is ready for operations. Following collection of demonstration testing samples, further testing or operation of the TGRS will be halted pending laboratory results and approval of the Final Construction Inspection Report by USEPA and DTSC.

5.0 REPORTING

Results of the remedial wellfield and treatment system performance evaluation testing will be documented in a Construction Completion Report. The testing data generated by the activities described in Sections 3 and 4 will be presented in this completion report. This report will document that the remedial wellfield performs as designed in extracting and re-injecting 700 gpm of groundwater. The report will additionally document that the treatment system effectively reduces dissolved contaminant concentrations to the In-Situ Groundwater Standards established in the ROD.

The report will be signed by a California registered Professional Engineer certifying that the treatment system is fully constructed and ready for operation as intended. This report will be submitted to USEPA and the State of California within 60 days following approval of the Final Construction Inspection Report.

6.0 REFERENCES

Geosyntec, 2012a Revised Basis of Design Report, Dual Site Groundwater Operable Unit, Montrose Chemical and Del Amo Superfund Site, April.

Geosyntec, 2012b Final Design Drawings and Specifications, Dual Site Groundwater Operable Unit, Unilateral Administrative Order No. 2008-04A, Los Angeles, California, June 5.

L&W, 2012 Letter to Mr. Richard Hiett, U.S. EPA Region 9, Treatment of Arsenic in the Montrose Torrance Groundwater Treatment System, November 12.

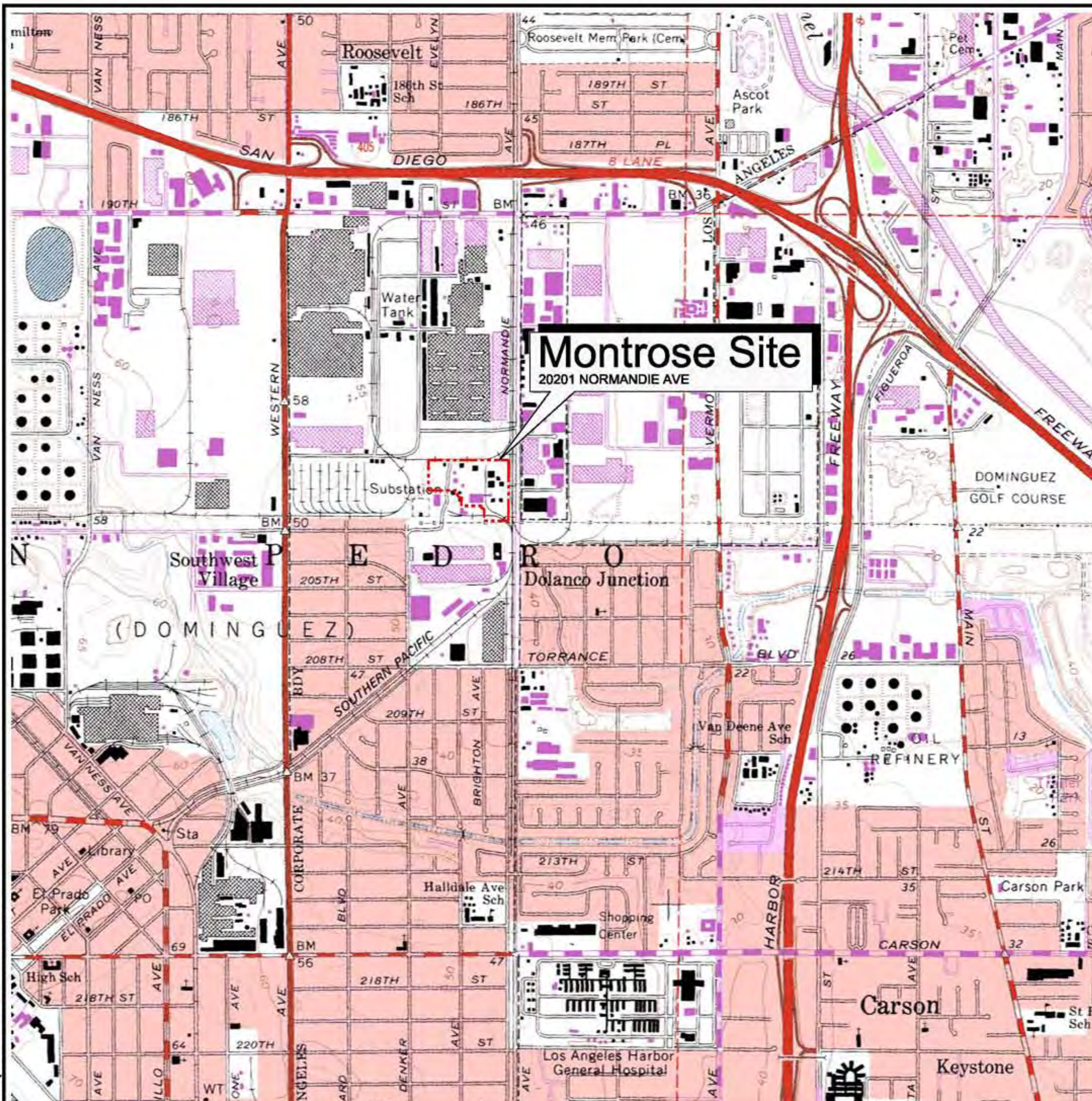
USEPA, 1998 Final Remedial Investigation Report for the Montrose Superfund Site, Los Angeles, California, May 18.

USEPA, 1999 Record of Decision for Dual Site Groundwater Operable Unit, Montrose Chemical and Del Amo Superfund Sites, Volume I: Declaration and Decision Summary, March.

USEPA, 2012a Partial Consent Decree, Construction of the Dual Site Groundwater Operable Unit Treatment System, August 22.

USEPA, 2012b Letter to Mr. Joe Kelly, President, Montrose Chemical Corporation of California, Approval of Final Dual Site Groundwater Operable Unit Remedial Design Report, Unilateral Order No. 2008-04A, Dual Site Groundwater Operable Unit, Montrose Chemical and Del Amo Superfund Sites, Los Angeles, California, September 19.

FIGURES



NORTH

0 1,000 2,000 FEET

SCALE: 1"= 2,000'

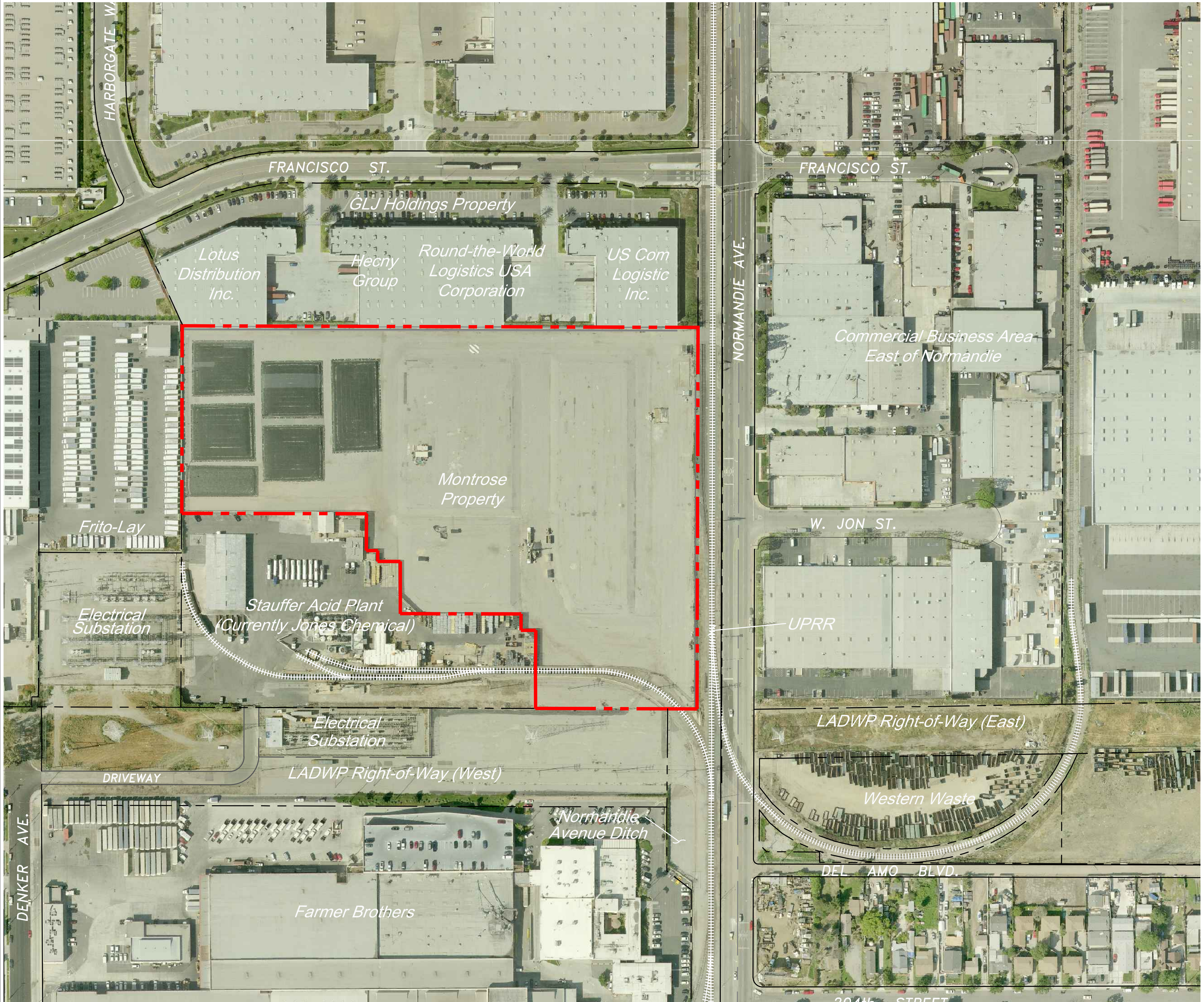
Reference:

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

FILE NAME: Z:\ET\MONTROSE\TORRANCE\SLM\2010\SLM.1010\60150255 SLM.1010.DWG

FILE NAME: Z:\ET\MONTROSE\TORRANCE\HASP\2012\HASP\HASP FIG 2 60250553.04.SVM.1112.DWG



Legend:

- Location of Current Montrose Property Boundary
- Parcel Boundary / Right-of-Way
- LADWP — Los Angeles Department of Water and Power
- Existing Railroad Tracks

References:

1. Parcel Boundary Information from Los Angeles, CA, Department of Public Works, Online GIS data set, ©2009. Montrose Chemical Corporation Boundary Survey conducted August 13, 2001 by Dulin & Boynton Land Surveyors.
2. Satellite/Aerial Photos Reference: U.S.G.S Orthorectified Image, Dated July 29, 2009.

NORTH

0 100 200 FEET

SCALE: 1"= 200'

Montrose Chemical Corporation

Site Vicinity Map

Date: 11-12

Montrose Superfund Site

Project No. 60250553

AECOM

Figure 2

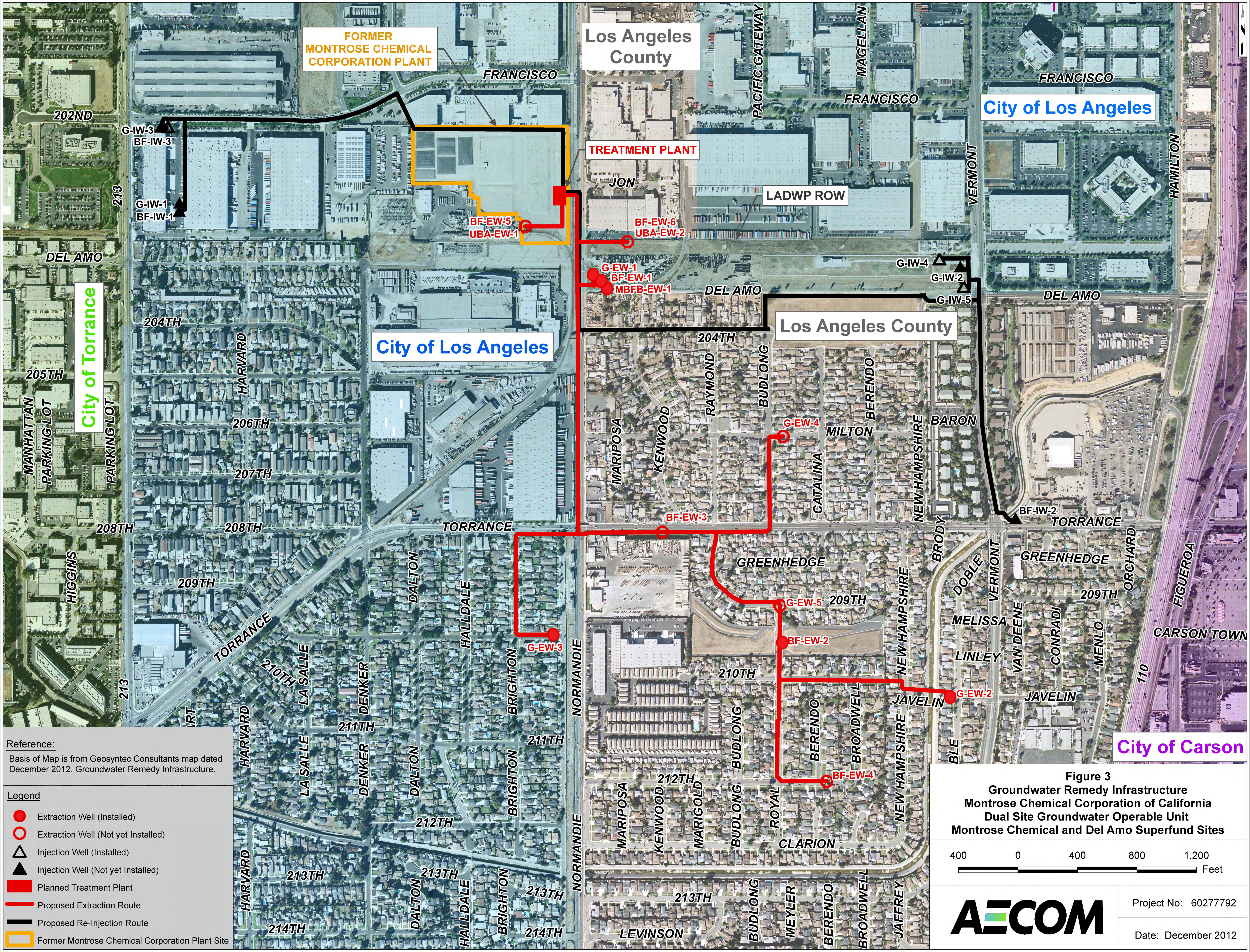


Figure 3
Groundwater Remedy Infrastructure
Montrose Chemical Corporation of California
Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

LEGEND

- AECOM GEOTECHNICAL BORINGS
- INJECTION ALIGNMENT
- EXTRACTION ALIGNMENT
- PROPOSED CONCRETE
- PROPOSED A.C.
- PROPOSED TELECOMMUNICATION
- PROPOSED SEWER LINE
- PROPOSED ELECTRICAL LINE
- EXISTING SOUTHERN PACIFIC RAILROAD
- EXISTING FENCE LINE
- PROPOSED FENCE LINE
- EXISTING SEWER LINE
- TRAFFIC SIGNAL
- TRAFFIC CONTROL
- FIRE HYDRANT
- UTILITIES EXISTING WATER
- ELECT VAULT
- MANHOLE UNIDENT
- WATER VALVE

30 0 30 60
SCALE IN FEET

EXISTING SURVEY CONTROL POINTS

POINT ID	NORTHING	EASTING	ELEVATION
HV-32	1768032.180	6470070.390	56.85
HV-31	1767805.510	6469204.260	57.54
HV-33	1766030.050	6469316.510	42.31
HV-26	1766962.120	6471324.250	43.81
HV-23	1767897.950	6472617.380	36.32
HV-22	1765836.520	6472448.670	33.70

NOTE: POINTS MAY BE USED AS LOCAL DATUM FOR CONSTRUCTION.

REV	DATE	DESCRIPTION	DRN	APP
A	06.01.12	FINAL COMPLETE SET SUBMITTAL	YBZ	BLP

Geosyntec consultants
2100 MAIN STREET, SUITE 150
HUNTINGTON BEACH, CALIFORNIA USA
PHONE: 714.969.0800

TITLE: SITE PLAN

PROJECT: TREATMENT PLANT
MONTROSE CHEMICAL CORPORATION OF CALIFORNIA

SITE: DUAL SITE GROUNDWATER OPERABLE UNIT
MONTROSE CHEMICAL AND DEL AMO SUPERFUND SITES

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE: Mark Schultz
DATE: 6/03/12

REGISTERED PROFESSIONAL ENGINEER — MARK D SCHULTHEIS — No. C 50857 — Exp: 3/31/14 — CIVIL — STATE OF CALIFORNIA

DESIGN BY:	CSC	DATE:	JUNE 1, 2012
DRAWN BY:	SLB	PROJECT NO.:	HM0450
CHECKED BY:	YBZ	FILE:	SB0450-C101.dwg
Figure No: 4		SHEET NO.:	OF