GEOCON
CONSULTANTS, INC.
GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

ADDITIONAL SITE INVESTIGATION

MERCURY CLEANERS
1419 16TH STREET
SACRAMENTO, CALIFORNIA

PREPARED FOR

MR. MARC DE LA VERGNE
CAPITOL AREA DEVELOPMENT AUTHORITY
1522 14TH STREET
SACRAMENTO, CALIFORNIA 95814-5958

GEOCON PROJECT NO. S9322-06-01

FEBRUARY 2008

GEOCON
CONSULTANTS, INC.

G E O T E C H N I C A L ▪ E N V I R O N M E N T A L ▪ M A T E R I A L S

Project No. S9322-06-01
February 29, 2008

Mr. Marc de la Vergne
Capitol Area Development Manager
Capitol Area Development Authority
1522 14th Street
Sacramento, California 95814-5958

Subject: MERCURY CLEANERS
1419 16TH STREET
SACRAMENTO, CALIFORNIA
ADDITIONAL SITE INVESTIGATION

Dear Mr. de la Vergne:

The enclosed report presents the results of an additional site investigation at the Mercury Cleaners facility (the Site) located at 1419 16th Street in Sacramento, California. We performed these services for the Capitol Area Development Authority in accordance with our proposal dated September 11, 2007. The purpose of the additional site investigation was to further assess the extent of volatile organic compounds (VOCs) in soil gas and groundwater and petroleum hydrocarbons in soil and groundwater based on the results of a Phase II Environmental Site Assessment performed by Ninyo & Moore in November 2005 and presented in their report dated September 21, 2006.

We appreciate the opportunity to provide our services to CADA on this project. Please call us if you have any questions or if we may be of further service.

Sincerely,

GEOCON CONSULTANTS, INC.

Rich Brown
Senior Staff Scientist

Jim Brake, PG
Senior Geologist

RB:JB:jaj

(1) Addressee

3160 Gold Valley Drive, Suite 800 ▪ Rancho Cordova, California 95742 ▪ Telephone (916)852-9118 ▪ Fax (916)852-9132

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

ADDITIONAL SITE INVESTIGATION

1.0 INTRODUCTION

We have performed an additional site investigation for the Mercury Cleaners facility (the Site) located at 1419 16th Street in Sacramento, California. These services were performed for the Capitol Area Development Authority (CADA) in accordance with our *Proposal for Additional Soil, Soil Gas and Groundwater Investigation* dated September 11, 2007 (Appendix A).

This section provides a brief description of the Site, its location, the proposed development of the Site and the purpose and objectives of the investigation. Section 2.0 provides background information including a summary of previous investigation of the Site. Section 3.0 describes the investigative methods used, and Section 4.0 presents the results of the investigation. Section 5.0 provides conclusions and recommendations based on the results of this and previous investigations.

1.1 Site Description and Location

The Site is located on the northeast corner of 16th and O Streets in downtown Sacramento, California, as depicted on the Vicinity Map, Figure 1. The Site consists of two contiguous parcels that form a 0.29-acre rectangle with a single structure occupied by Mercury Cleaners in the northern portion of the Site. The southern portion of the Site is a paved asphalt parking lot.

1.2 Proposed Development

CADA intends to redevelop the Site with a mixed-use, first floor commercial/retail, second floor residential structure.

1.3 Purpose and Objectives

The purpose of the additional site investigation was to further assess the extent of volatile organic compounds (VOCs) in indoor air, soil gas and groundwater and petroleum hydrocarbons in soil and groundwater. The primary objective was to collect indoor air, soil, soil gas and groundwater samples from appropriate locations and analyze these samples to provide a better understanding of the extent of impacts. We used the soil and soil gas results and site-specific information to perform a human health risk evaluation (HHRE) to assess the potential health risk resulting from intrusion of tetrachloroethene (PCE) in soil gas to indoor air in current or future site buildings.

2.0 BACKGROUND

This section provides information on previous investigations performed at the Site. Previous investigations included a Phase I Brownfields Site Investigation (BSI) performed by Ecology and Environment, Inc. (E&E) in 2000, and a Phase II Environmental Site Assessment (ESA) performed by Ninyo & Moore in 2005. The findings of these reports are summarized in the following sections.

2.1 Phase I BSI

CADA retained E&E to perform a Phase I BSI for ten sites in Sacramento. Based on the findings for the Site, E&E recommended that an evaluation of soil conditions be conducted to investigate potential subsurface contamination relating to historical use of the Site as an auto repair facility and its past and continuing use as a dry cleaning facility.

2.2 Phase II ESA

Ninyo & Moore performed a Phase II ESA to assess potential impacts from past uses of the Site as an auto repair facility and dry cleaners. The results of the Phase II ESA were presented in their report *Limited Phase II Environmental Site Assessment, 1419 16th Street, Sacramento, California,* dated September 21, 2006. The Phase II ESA included collection and analysis of soil, soil gas and groundwater samples. Soil and groundwater samples collected during the Phase II ESA were analyzed for contaminants of potential concern (COPCs) including TPH as gasoline (g), diesel (d) and motor oil (mo), VOCs, and metals (chromium, cadmium, lead, nickel and zinc). Soil gas samples were analyzed for VOCs. Laboratory analysis of soil samples detected TPHd and TPHmo, the VOCs cis-1,2-dichloroethene (cis-1,2-DCE), PCE, total xylenes, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, naphthalene, and lead. Analysis of groundwater samples detected TPHg and cis-1,2-DCE, PCE and trichloroethene (TCE). Analysis of soil gas samples detected several VOCs. However, only PCE was detected at concentrations that exceed regulatory health screening criteria.

Based on the results of the Phase II ESA, Ninyo & Moore recommended additional investigation of soil, soil gas and groundwater in their report. We were retained by the Sacramento County Business Environmental Resource Center (BERC) under an agreement with CADA to review and provide comments on the draft Phase II ESA report and concurred with the recommendation for further investigation.

3.0 INVESTIGATIVE METHODS

This section describes the site investigation activities performed at the Site. Investigative methods are divided into pre-field and field activities and laboratory analysis.

3.1 Pre-field Activities

Pre-field activities consisted of the following tasks:

- Provided a five working-day notification to CADA and the site occupants prior to beginning field sampling activities;
- Contacted Underground Service Alert (USA) a minimum of 48 hours prior to the start of drilling activities. USA notified subscribing public utilities so that they could attempt to delineate utilities and conduits in proximity to the Site. Prior to contacting USA, the proposed boring locations were marked with white paint as required by law;

- Retained the services of Cruz Brothers Locators, to further assess the potential presence of subsurface public and private utilities and conduits in proximity to the proposed exploration locations as a supplement to the USA notifications;
- Obtained a boring permit from Sacramento County Environmental Management Department (SCEMD) and an encroachment permit from the City of Sacramento for advancing borings on city property prior to the start of drilling activities;
- Retained the services of Resonant Sonic International (RSI), a California C57-licensed drilling subcontractor, to advance borings using direct-push techniques;
- Retained the services of LA Testing., a California-certified analytical laboratory and an American Industrial Hygiene Association accredited laboratory located in Los Alamitos, California, to perform chemical analysis of indoor air industrial hygiene samples;
- Retained the services of Advanced Technology Laboratories (ATL), a California-certified analytical laboratory located in Signal Hill, California, to perform chemical analysis of soil and groundwater samples; and
- Retained the services of Air Toxics Ltd., a California-certified analytical laboratory and NELAP accredited laboratory located in Folsom, California, to perform chemical analysis of soil vapor samples.

3.2 Field Activities

Field activities included advancing, logging and sampling of six direct-push borings at the Site and collection of indoor air samples. A limited-access, direct-push sampling rig was used to advance two borings inside the site building and a larger, truck-mounted rig was used to advance four borings outside the building. Figure 2 shows the approximate boring locations and indoor air sampling locations.

3.2.1 Indoor Air Sampling

On December 7, 2007, we collected indoor air samples in three 6-liter Summa canisters fitted with flow regulators. Indoor air sampling locations were selected to assess concentrations of VOCs in indoor air in three locations within the site building near dry cleaning equipment. The canisters were placed at approximate breathing zone height and the valves opened. The regulators were set to allow filling of the canisters over a 4 to 8-hour period

3.2.2 Soil Borings

On December 8, 2007, RSI advanced six direct-push borings at the Site. The locations of the four borings advanced outside the site building were selected to assess concentrations of VOCs in soil gas and groundwater and TPHg in soil and groundwater both upgradient and downgradient of the previous sampling locations. The locations of the two indoor borings were selected to assess concentrations of VOCs in soil gas and groundwater in other possible source areas within the building – adjacent to a floor drain and beneath a room with dry cleaning equipment not previously assessed.

Soil cores were collected in each boring for purposes of logging and soil sample collection. We logged the soil cores from each boring according to the Unified Soil Classification System (USCS). Two soil samples were collected for analysis from boring DP2 (DP2S-15.5 and DP2S-18.0) where staining, a hydrocarbon odor, and elevated photoionization detector (PID) readings were encountered. Soil boring logs are included in Appendix B.

Soil gas samples were collected from borings DP1, DP2, and DP3 at a depth of 5 feet below ground surface (bgs) in accordance with the Department of Toxic Substances Control (DTSC) advisory on active soil gas investigations. The reason for following DTSC protocol for collection of soil gas samples is to be able to assess potential intrusion of VOCs to indoor air within the site building. In accordance with the DTSC protocol, soil gas samples were collected through a retractable tip (threaded point holder) sampling device on the end of the drive rods. Once the desired sampling depth was reached, a 6-foot-long section of 1/4-inch-diameter polyethylene tubing with stainless steel post-run tubing on the end was inserted through the hollow rods and threaded to the sampling tip. A three-way valve was attached to the other end of the tubing to allow extraction of gas using a 60-cubic-centimeter (cc) syringe. The top of the boring was sealed with hydrated bentonite to ensure that ambient air on the surface did not seep into the boring. The hollow rods were then retracted one foot above the bottom of the boring to allow for soil gas to enter the polyethylene tubing. Prior to purging, ambient air in the boring was allowed to equilibrate for a minimum of 20 minutes. Prior to sample collection, ambient air was evacuated from the tubing by hand purging approximately 180 cc (three tubing volumes) of soil gas with a 60 cc syringe. Following purging, a soil gas sample was collected directly from the tubing attached to a pre-cleaned, laboratory-provided, one-liter vacuum summa canister. During sampling, a leak check was performed by spraying 1,1-difluoroethane around the bentonite seal and on the sample tubing exposed on the surface. Each of the sample containers were labeled with a unique sample identification number, sample time and date, and project number.

Upon reaching groundwater, a groundwater grab sample was collected from each boring. Groundwater samples were collected with a reusable, stainless steel bailer lowered through the interior of the direct-push rods. Groundwater samples were decanted into laboratory-supplied containers, labeled and placed in a chilled cooler for transportation to the laboratory. A duplicate was collected from DP1SGW and labeled as DP7SGW. The bailer was cleaned prior to each use.

Each boring was backfilled with a cement/bentonite grout to the ground surface in accordance with SCEMD requirements following completion of logging and sampling.

3.3 Laboratory Analysis

Ambient indoor air samples obtained from the Site building were submitted to LA Testing Laboratory of Los Alamitos, California, for chemical analysis. The air samples were analyzed using the United

States Environmental Protection Agency (EPA) Method TO-15. Samples were analyzed for the measurement of the 97 VOCs that are included in the 189 hazardous air pollutants (HAPs) listed in Title III of the Clean Air Act Amendments of 1990.

Soil samples obtained from the boring DP2 were submitted to ATL Laboratories of Signal Hill, California, for chemical analysis for gasoline range organics (GRO) via modified EPA Method 8015B.

Soil gas samples obtained from the borings were submitted to Air Toxics Ltd. of Folsom, California, for chemical analysis. The laboratory performed analysis via modified EPA Method TO-15.

The groundwater samples were analyzed by ATL for the following analyses: GRO following EPA Test Method 8015 Modified; and VOCs including benzene, toluene, ethylbenzene and total xylenes (BTEX) following EPA Test Method 8260. The laboratory reports and chain-of-custody documentation are presented in Appendix C.

4.0 INVESTIGATION RESULTS

This section summarizes conditions observed in the soil borings and presents the results of laboratory analysis of the ambient indoor air, soil, groundwater, and soil gas samples.

4.1 Indoor Air Sample Analysis Results

Table 1 shows that several VOCs including propylene, chloromethane, 2-butanone (MEK), toluene and PCE were detected in the indoor air samples. VOCs were detected at concentrations of 0.6 to 27 parts per billion by volume (ppbv) with PCE concentrations ranging from 2.4 to 20 ppbv. The distribution of the indoor air samples and PCE analysis results are shown on Figure 3.

None of the reported VOC concentrations exceed California Division of Occupational Safety and Health (Cal/OSHA) permissible exposure limits (PELs). The PELs are employee exposure limits that are 8-hour time-weighted averages (TWA) for an airborne contaminant during a normal workday.

4.2 Soil Boring Observations

Fill and native alluvial soil was observed in each boring. Fill thickness ranged from 0 to 2 feet and consisted primarily of gravelly sand. Moderate yellowish brown sandy silt and clay was encountered underlying the fill to a total depth of approximately 20 feet bgs (Appendix B).

Grayish/olive stained soil that exuded a petroleum hydrocarbon odor was encountered in borings DP2 and DP3 (Figure 2) between depths of 14 and 20 feet bgs. Elevated PID readings were also recorded in borings DP2 and DP3 and are presented on the boring logs (Appendix B). In both borings the stained soil was encountered above groundwater and at the groundwater surface.

4.3 Soil Sample Analysis Results

GRO was detected at concentrations of 1,400 milligrams per kilogram (mg/kg) in soil sample DP2S-15.5 and 5,500 mg/kg in soil sample DP2S-18.0. These samples were collected from the stained, odorous soil observed in boring DP2 (Figure 4).

4.4 Soil Gas Sample Analysis Results

Table 2 shows that several VOCs were detected in the soil gas samples. PCE was detected at the highest concentrations ranging from 39,000 micrograms per cubic meter ($\mu g/m^3$) in DP3SG-5 to 2,600,000 $\mu g/m^3$ in DP1SG-5. Benzene was not detected in any of the soil gas samples, but reporting limits were elevated for DP1SG-5 and DP2SG-5 due to the high concentrations of PCE in these samples. Therefore, benzene may be present at concentrations less than the reporting limit. Figure 5 shows the distribution of the soil gas samples and concentration of selected VOCs for each sample.

Several VOCs were detected at concentrations that exceed regulatory screening criteria including the California EPA's California Human Health Screening Levels (CHHSLs) and the San Francisco Bay Regional Water Quality Control Board's Environmental Screening Levels (ESLs). The potential intrusion of VOCs in soil gas to indoor air and the resulting health risk was evaluated and is discussed in Section 5.0.

4.5 Groundwater Sample Analysis Results

Table 3 shows that GRO and the VOCs PCE, TCE, and cis-1,2-DCE were detected in all six groundwater samples collected and analyzed. Other VOCs including benzene, 1,1-dichloroethene, trans-1,2- dichloroethene and vinyl chloride were also detected, but not in every groundwater sample. Concentrations of GRO ranged from 170 micrograms per liter (µg/l) in DP6GW to 78,000 µg/l in DP2GW (Figure 6). These concentrations exceed the ESL for GRO of 100 µg/l. However, it is not known if the GRO detections are reflective of a release of gasoline or Stoddard Solvent.

The VOCs cis-1,2-DCE, TCE, and PCE were reported at the highest concentrations with cis-1,2-DCE concentrations ranging from 12 µg/l in DP5GW to 16,000 µg/l in DP2GW; TCE ranging from 5.8 µg/l in DP6GW to 1,400 µg/l in DP1GW and DP2GW; and PCE ranging from 79 µg/l in DP6GW to 3,600 µg/l in DP2GW. The highest concentrations of VOCs were reported for groundwater samples collected from borings DP1 and DP2, which were advanced beneath the portion of the site building containing dry cleaning equipment. With the exception of trans-1,2-DCE, all reported VOC concentrations exceed their respective California Regional Water Quality Control Board's (CRWQCB) Maximum Contaminant Levels (MCLs) (Table 3). Figures 7 through 9 show the distribution of groundwater samples and concentrations of PCE, TCE and cis-1,2-DCE, respectively.

4.6 Comparison of Results to Ninyo & Moore Limited Phase II Results

4.6.1 Soil

Ninyo & Moore collected and analyzed nine soil samples from three borings for TPHg, TPHd, and TPHmo. All three of the borings were located outside the south wall of the site building. Low concentrations of TPHd and TPHmo were detected in five of the nine soil samples and from a depth of 10 feet or shallower. The highest concentrations were reported for samples collected from the upper 5 feet of soil. Concentrations of TPHd and TPHmo met or exceeded regulatory screening levels for residential land use in only one soil sample. Our boring advanced nearest to Ninyo & Moore's borings with TPH impacts was boring DP5 (Figure 4). No evidence of impacts (staining, odors and/or PID readings) was observed in soil from DP5. This suggests that the impacts observed in Ninyo & Moore's borings may be limited to shallow soil in the immediate vicinity of their borings and may not be laterally or vertically extensive.

We collected soil samples for analysis only from borings where evidence of impacts suggested the presence of impacts. The only borings in which we observed such evidence of impacts were DP2 advanced inside the building near drycleaning equipment and DP3 advanced outside the north wall of the site building in the alley (Figure 2). Ninyo & Moore noted in their boring log for boring DP5, which was advanced near the location of DP2, a "petroleum odor between 10 and 11 foot depth." They did not analyze a soil sample from this boring, however.

4.6.2 Soil Gas

Ninyo & Moore collected and analyzed soil gas samples from two borings – one located inside the building near our boring DP2 and one outside the south wall of the site building. We collected soil gas samples from three borings – two inside the site building (DP1 and DP2) and one outside the north wall of the building in the alley (DP3). They collected their soil gas samples from 6 feet bgs into 6-liter summa canisters and we collected ours from 5 feet bgs (per the DTSC soil gas advisory) into 1-liter summa canisters. Both our and their samples were analyzed by Air Toxics by EPA Method TO-15.

The concentrations of VOCs reported for our soil gas samples were several orders of magnitude higher than those reported for Ninyo & Moore's. Our sample DP2SG5, which was collected in approximately the same location as their B5SG, had a PCE concentration of 200,000 $\mu g/m^3$ while their sample was reported to contain 780 $\mu g/m^3$. The reason for the difference in sample concentrations is unknown but could be due to differences in sample collection methods used by our respective subcontractors.

4.6.3 Groundwater

Ninyo & Moore collected and analyzed two groundwater samples – both from borings advanced outside the south wall of the site building. Their groundwater samples were analyzed for TPHg and

VOCs. We collected and analyzed groundwater samples from six borings – one on the upgradient (north) side of the Site, two beneath the site building, and three downgradient of Ninyo & Moore's borings.

Comparison of Ninyo & Moore's analytical results to ours shows good correlation or "fit" between the results. We plotted their results along with ours on Figures 6 through 9 to show this correlation.

5.0 HUMAN HEALTH RISK EVALUATION

This section describes the methods and results of a human health risk evaluation to assess volatilization of VOCs to indoor air. The purpose of the HHRE was to assess the potential threat to human health from volatilization of the VOCs found to be present in soil gas beneath the Site to indoor air.

The HHRE was performed in accordance with the methods and procedures described in the following regulatory documents:

- California EPA (Cal-EPA). *Use of California Human Health Screening Levels (CHHSLs) in Evaluation of Contaminated Properties.* January 2005.
- Cal EPA, DTSC. *Preliminary Endangerment Assessment Guidance Manual.* June 1999.
- EPA. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A).* December 1989.
- EPA. *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings.* Revised February 2004.
- San Francisco Bay Regional Water Quality Control Board. *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater.* Interim Final November 2007.

The HHRE included an initial comparison of VOCs detected in soil gas samples to regulatory screening criteria. The VOCs concentrations were compared to both the CHHSLs and the ESLs. We then used the DTSC's modified *Johnson and Ettinger Screening Model for Subsurface Vapor Intrusion Into Buildings* (1998) (J&E Vapor Model) to evaluate the potential transport of the COPCs from soil gas to indoor air and the resulting incremental human health risk.

5.1 Initial Screening Evaluation

The detected VOCs were compared to the CHHSLs and the ESLs for both residential and commercial land use scenarios. Several VOCs including PCE, TCE, 1,2-dichloroethane, cis-1,2-DCE, and methylene chloride were detected in one or more soil gas samples at concentrations exceeding their respective CHHSLs and ESLs (Table 2). Benzene was not reported at or greater than the reporting limit for any of the soil gas samples analyzed. However, the reporting limits for samples DP1SG-5 and DP2SG-5 were elevated due to the elevated concentrations of PCE in these samples. Therefore, one-half the reporting limits for benzene was compared to and exceeded its respective CHHSL and ESL.

None of the other reported VOC detections exceeded their respective CHHSLs or ESLs. Because several of the VOCs were detected in soil gas samples at concentrations exceeding their CHHSLs and ESLs, we performed a Tier II assessment.

5.2 General Assumptions

The Tier II assessment included the following assumptions and parameters:

- An excess cancer risk of $1x10^{-6}$ (one increased cancer risk in a population of 1,000,000) defines the acceptable risk for carcinogens. The EPA defines the $1x10^{-6}$ risk level as the risk level at or below which there exists no significant risk (i.e., one or fewer excess cancer cases per 1,000,000 exposed persons) from exposure to COCs. The EPA has a risk management range of $1.0x10^{-4}$ to $1.0x10^{-6}$.
- A hazard index of 1.0 defines the acceptable risk for non-carcinogens.
- The carcinogenic VOCs in soil gas are PCE, TCE, 1,2-DCA, methylene chloride, potentially chloroform and benzene. California-specific inhalation unit risk values of $2.0x10^{-6}$ and $2.9x10^{-5}$ $\mu g/m^3$ were used for TCE and benzene, respectively.
- The non-carcinogenic VOCs in soil vapor are PCE, TCE, toluene, 1,2-DCA, cis-1,2-DCE, trans-1,2-DCE, methylene chloride, hexane, chloroform, acetone, and benzene.
- The residential exposure frequency is 350 days per year. The commercial exposure frequency is 250 days per year.
- The residential exposure duration is 30 years. The commercial exposure duration is 25 years.
- The averaging time (the period over which the exposure is averaged [in days]) for carcinogens is 30 years. The averaging time for non-carcinogens is 25 years.

Risk values for the VOCs were obtained from the Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA) and USEPA Integrated Risk Information System (IRIS) websites. A copy of the website information is included in Appendix D.

5.3 Exposure Pathways

Dermal contact, soil (dust) inhalation and ingestion, and inhalation of soil gas are potential exposure pathways for VOCs. However, the dermal contact, soil inhalation and ingestion exposure pathways for current site workers, visitors and potential future site occupants are incomplete because the Site is covered with asphalt and concrete. Therefore, the complete exposure pathway for current and potential future site occupants is from potential inhalation of VOCs in indoor air as a result of the migration of the VOCs from soil gas through soil and the building slabs into indoor air spaces.

5.4 Soil Gas

5.4.1 Site-specific Parameters and Assumptions – J&E Vapor Model

Default J&E Vapor Model parameter values were used except where site-specific data were available. The following site-specific parameters and assumptions were incorporated into the evaluation.

- The risk evaluation was based on both a residential and commercial exposure scenario.
- The Site was evaluated based on one building foundation type - a slab-on-grade foundation.
- The maximum detected VOC concentrations (Table 2) were used as the representative exposure concentrations (ECs). Since benzene's non-detect reporting limits exceed the screening levels, a value of one-half the detection limit was used to model potential benzene exposures.
- The soil vapor sampling depth was approximately 5 feet (152 centimeters [cm]). Therefore, the thickness of the soil stratum for the samples was 5.0 feet (152 cm).
- The average soil temperature of 16.5° C was used based on the average monthly soil temperatures from the *California Irrigation Management Information System* (CIMIS) website, Sacramento Valley, Fair Oaks Station Number 131. A copy of the CIMIS website report is presented in Appendix E.
- The soil stratum was modeled as a silty clay loam (SICL) based on the soil boring logs. A silty clay loam classification was used based on comparing the particle size distribution for the sample with Table 4 in the *User's Guide* (2004). A copy of Table 4 in the *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings* (2004) is presented in Appendix F.
- The default J&E model settings for soil dry bulk density and soil total porosity were used to model the soil in Stratum A (no soil Stratum B was identified).
- The average interior floor dimensions are 68 by 65 feet (2,073 by 1,981 cm).
- The indoor air exchange rate (ACH) of 0.83 per hour was used in the model based on the commercial use of the building. This is a conservative value since the report *Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil* (Revised January 2005) published by OEHHA and Cal/EPA recommend an indoor ACH of 1.0 per hour for commercial/industrial land use scenario. However, the ASTM *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*, September 1995, recommends a commercial indoor ACH of 0.83 per hour. The Michigan Department of Environmental Quality, Environmental Response Division in August 21, 1998, published a technical document that recommends a residential ACH of 1.0 per hour and a commercial ACH of 2.0 per hour. Therefore, the default residential and commercial ACH used in this J&E Model of 0.5 and 0.83 ACH's per hour, respectively, is conservative.
- An estimated ceiling height of 9 feet (274 cm) was used to model the building interior.

5.4.2 J&E Vapor Model Results

The results from the J&E Vapor Model are summarized below for each category. The J&E Vapor Model results are summarized on Table 4. The J&E Vapor Model input and results are presented as Appendix G.

5.4.3 Residential Exposure Scenario

Under a residential exposure scenario, using the respective maximum ECs for the VOCs and one-half the reporting limit for benzene, we calculate the cancer risk to be 1.24×10^{-4}. The respective cumulative hazard index is 1.6557. The calculated cancer risk exceeds the target risk of 1.0×10^{-6} and also exceeds the EPA's risk management range of 1.0×10^{-4} to 1.0×10^{-6}. The calculated cumulative hazard index result also exceeds the risk value of 1.0 for non-carcinogens. However, if a higher ACH is used, the residential cancer risk falls within the EPA's risk management range and the calculated cumulative hazard index is less than 1.0.

5.4.4 Commercial Exposure Scenario

Under a commercial exposure scenario, using respective maximum ECs for the VOCs and one-half the reporting limit for benzene, we calculate the cancer risk to be 4.44×10^{-5} and the respective cumulative hazard index is 0.7119. The calculated cancer exceeds the target risk of 1.0×10^{-6} but is within the EPA's risk management range of 1.0×10^{-6} and 1.0×10^{-4} and the non-cancer hazard index less than 1.0. If a higher ACH is used, the calculated cancer and non-cancer risk is even lower.

6.0 CONCLUSIONS AND RECOMMENDATIONS

This section provides conclusions and recommendations based on the findings of the ASI.

6.1 Indoor Air Assessment

As shown on Table 1 and Figure 3, the VOC concentrations reported for the three indoor air samples that we collected from the working areas inside the site building are several orders of magnitude less than the PELs. These results suggest that employees are not being exposed to concentrations of PCE and other VOCs that exceed regulatory health criteria for workers.

6.2 Soil

The source and nature of the petroleum hydrocarbons encountered in borings DP2 and DP3 is not known. The staining and GRO detections may be due to the presence of Stoddard Solvent, a petroleum-based dry cleaning solvent, and not a gasoline release. Stoddard Solvent and gasoline mixtures share some similar hydrocarbon characteristics. However, given the reported past use of the Site as an auto service facility, a gasoline source may also be present. It is not known if underground storage tanks (USTs), whether for gasoline or dry cleaning solvents, are or were present beneath the Site.

6.3 Soil Gas

Analysis of two soil gas samples collected from beneath the portion of the building containing dry cleaning equipment and one sample from outside the portion of the building containing dry cleaning equipment detected several VOCs at concentrations exceeding CHHSLs and ESLs (Table 2 and Figure 4). Therefore, the VOCs concentrations were evaluated in a Tier II risk assessment to estimate the excess cancer and non-cancer health risk resulting from the potential intrusion of these VOCs to indoor air. As described above in Section 5.4, the J&E Vapor Model calculated risk levels that exceed EPA risk criteria for a residential scenario. The risk levels for a commercial scenario are within the EPA's "risk management" range. If less-conservative air exchange rates are applied in the model, the calculated risk levels do not exceed EPA risk criteria for the residential or commercial scenarios.

The contribution of PCE in the indoor air samples from current dry cleaning operations emissions versus intrusion of soil gas to indoor air is not known. However, the concentrations of VOCs in soil gas and the results of the J&E vapor model suggest that corrective action to reduce VOC concentrations in soil gas and/or inclusion of protective measures during future construction such as a vapor barrier and/or a passive venting system may be necessary.

6.4 Groundwater

As discussed above in Section 4.5, PCE, TCE and cis-1,2-DCE were detected in each groundwater sample and at the highest concentrations of all the VOCs detected. TCE and cis-1,2-DCE are breakdown products of PCE (as are other VOCs detected such as trans-1,2-DCE, 1,1-DCE and vinyl chloride). Figures 7 through 9 depict concentration contours for PCE, TCE and cis-1,2-DCE, respectively. These figures show that the highest concentrations of these VOCs are present beneath the portion of the building containing dry cleaning equipment and that they extend toward the southwest. The downgradient extent of VOCs in groundwater has not been completely defined, and it appears that the VOC plume extends beneath 16th Street. Similarly, the upgradient extent is not defined.

6.5 Recommendations

The concentration of VOCs in groundwater and soil gas beneath the Site warrant further action to reduce the mass of contaminants in groundwater and soil gas and to minimize further migration of VOCs in groundwater. The lateral and vertical extent of VOCs in groundwater should be confirmed through installation of groundwater monitoring wells and regular monitoring of groundwater flow direction and VOC concentrations. The results of this and previous investigation should be provided to the SCEMD for their review. They will likely enter the site into their local oversight program (LOP) and require quarterly groundwater monitoring and reporting and preparation of a Corrective Action Plan (CAP).

The potential presence of a UST beneath the building should be evaluated if the building is removed in the future. Evaluation of the presence of a UST would be possible while the building is in place, but more intrusive and costly and, if present, removal of a UST would be much more costly than if the building were removed.

7.0 REPORT LIMITATIONS

This report has been prepared exclusively for the CADA. The information obtained is only relevant as of the date of this report. The Client should recognize that this report is not a comprehensive site characterization and should not be construed as such. The findings presented in this report are predicated on the results of the limited sampling and laboratory analyses described herein.

Therefore, the report should only be deemed conclusive with respect to the information obtained. No guarantee of the results of the study is implied within the intent of this report. The services performed were conducted in accordance with the local standard of care in the geographic region at the time the services were rendered.

8.0 REFERENCES

American Society for Testing and Materials (ASTM). *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites* (ASTM/RBCA). E1739. September 1995.

Ashok Singh et. Al. EPA, Office of Solid Waste and Emergency Response. *Technical Support Center Issue: The Lognormal Distribution in Environmental Applications.* 600/S-97/006. December 1997.

Cal-EPA, DTSC. *Preliminary Endangerment Assessment Guidance Manual.* June 1999.

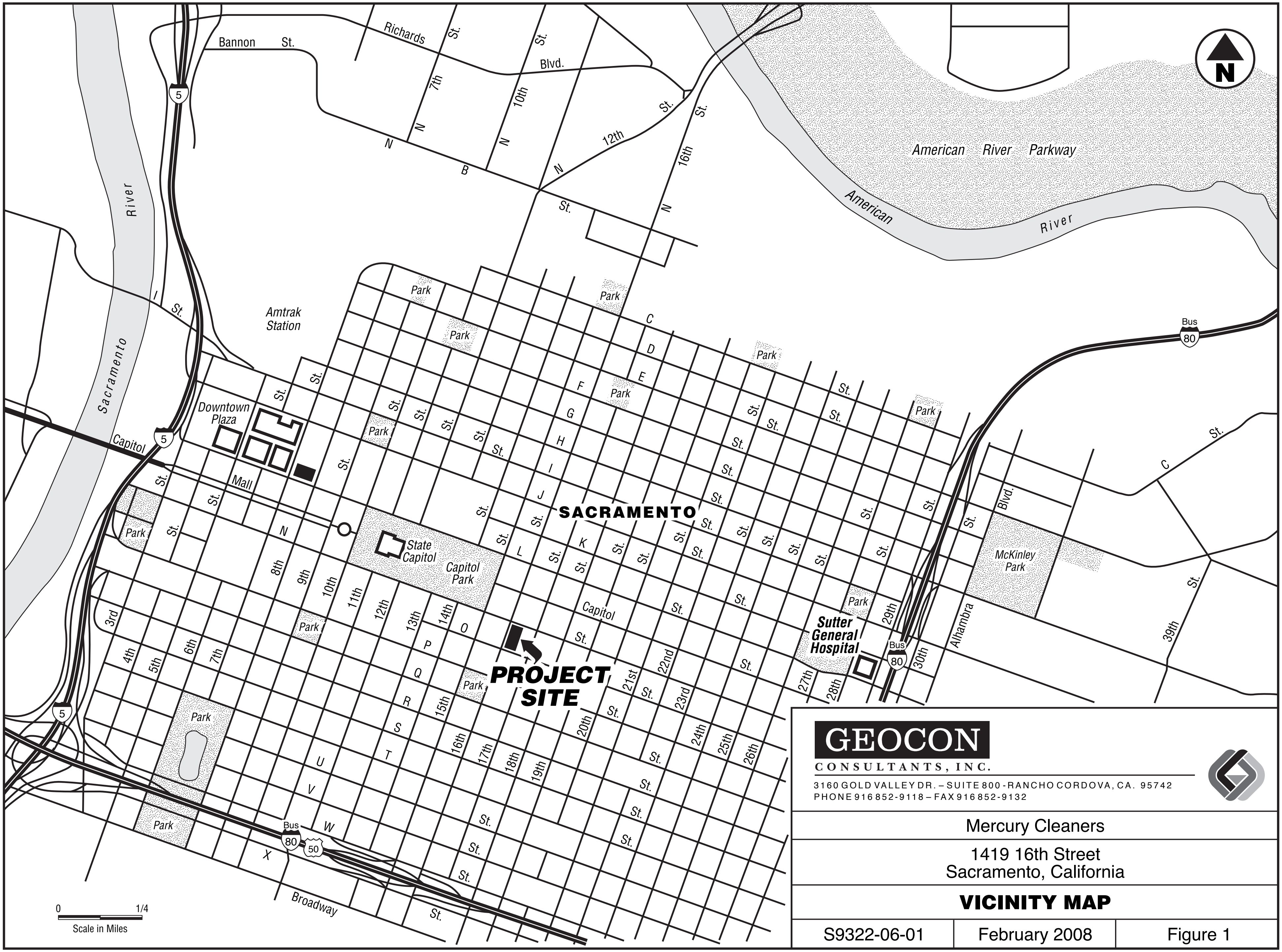
Cal-EPA. *Use of California Human Health Screening Levels (CHHSLs) in Evaluation of Contaminated Properties.* January, 2005.

EPA. *Region 9 PRGs Table – 2004 Update.* October 2004. http://www.epa.gov/region9/waste/sfund/prg/files/04prgtable.pdf.

EPA. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A).* December, 1989.

EPA. *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings.* Revised February 2004.

San Francisco Bay Regional Water Quality Control Board. *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater.* Interim Final November 2007.



GEOCON
CONSULTANTS, INC.

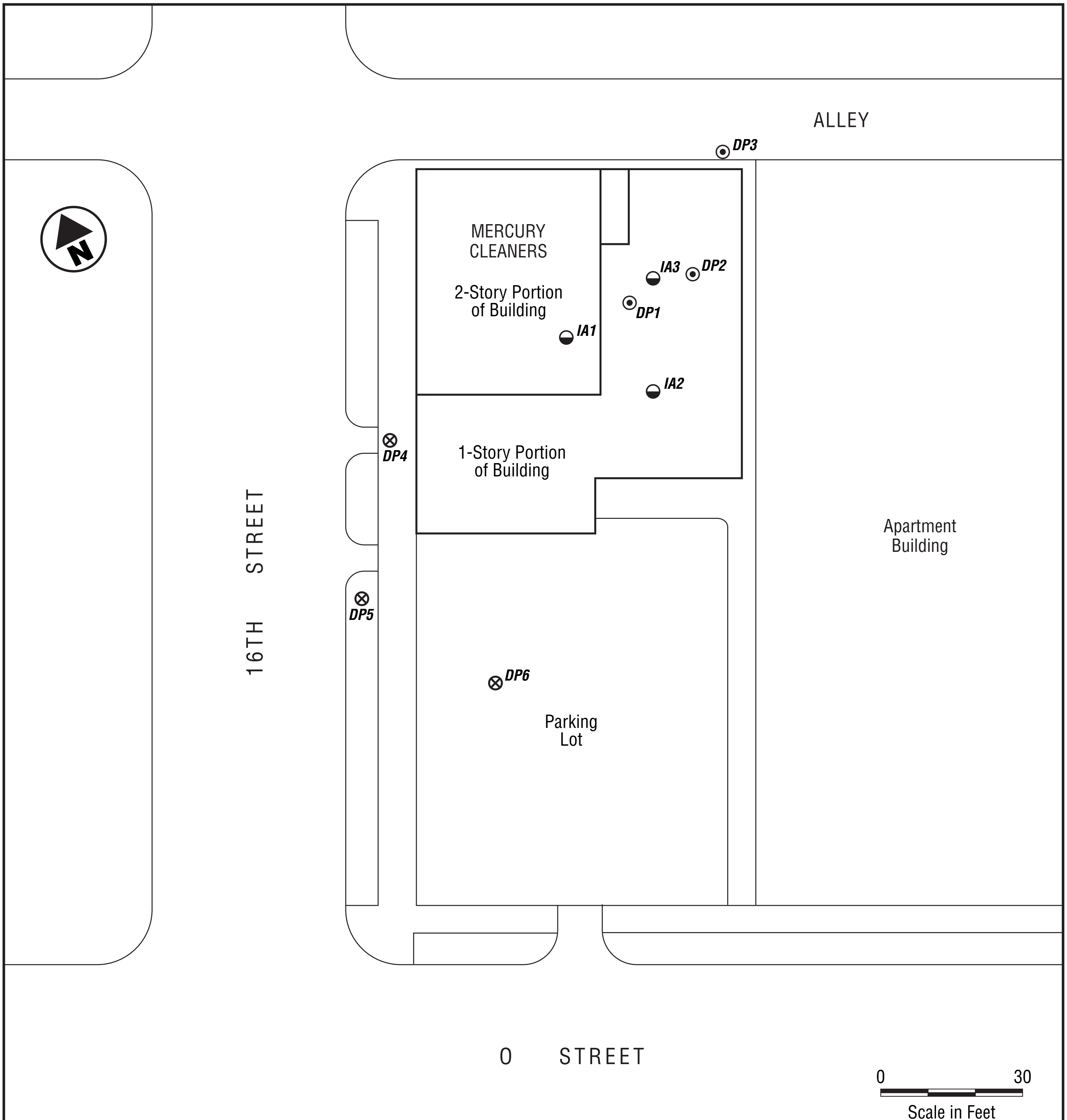
3160 GOLD VALLEY DR. – SUITE 800 - RANCHO CORDOVA, CA. 95742
PHONE 916 852-9118 – FAX 916 852-9132

Mercury Cleaners

1419 16th Street
Sacramento, California

VICINITY MAP

S9322-06-01	February 2008	Figure 1



LEGEND:

- DP4 ⊗ Approximate Soil & Groundwater Sampling Location
- DP1 ⊙ Approximate Soil Gas & Groundwater Sampling Location
- IA1 ◒ Approximate Indoor Air Sampling Location

Ref: Ninyo & Moore, 9/06

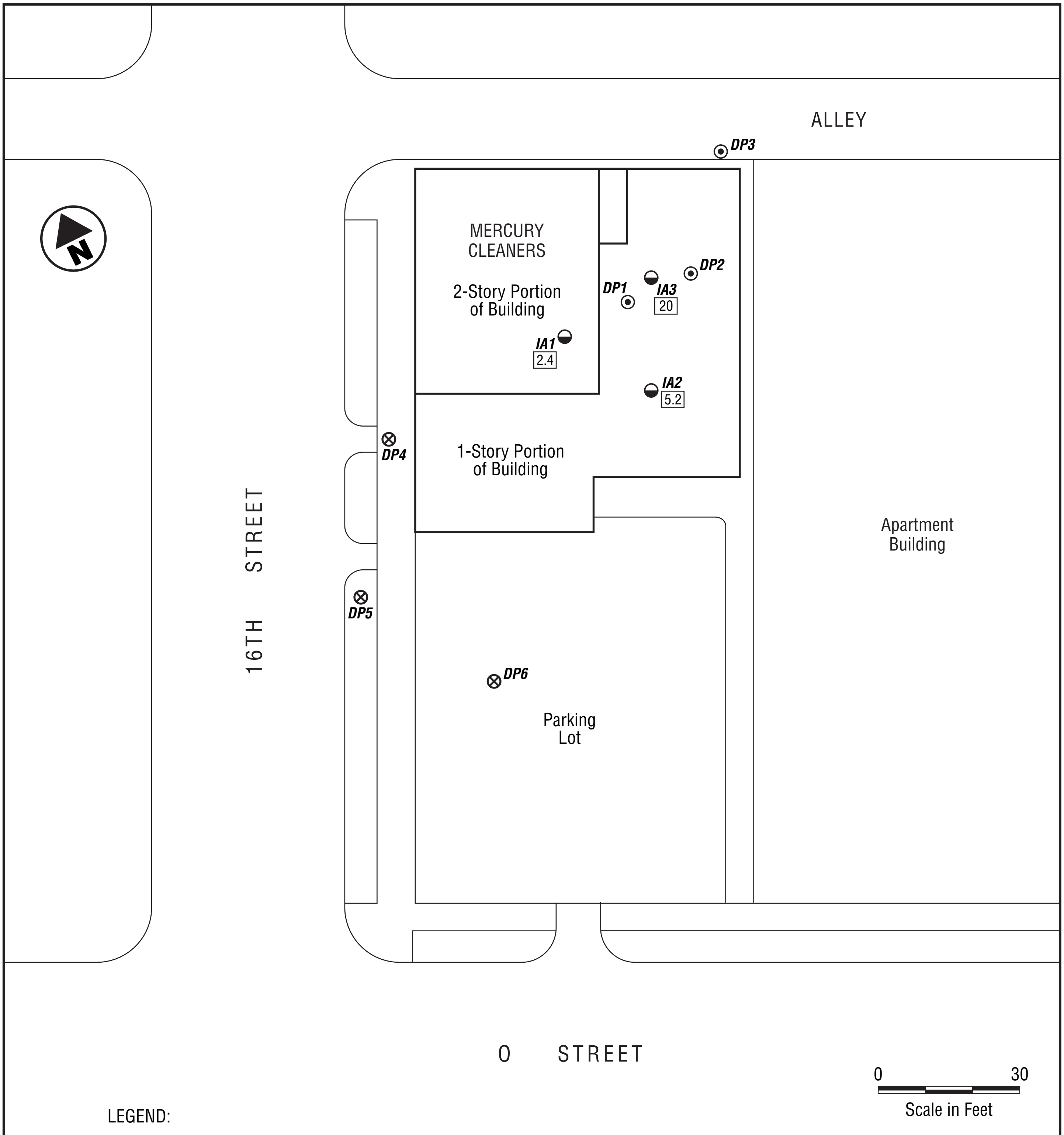
GEOCON
CONSULTANTS, INC.
3160 GOLD VALLEY DR. – SUITE 800 - RANCHO CORDOVA, CA. 95742
PHONE 916 852-9118 – FAX 916 852-9132

Mercury Cleaners

1419 16th Street
Sacramento, California

SITE PLAN

S9322-06-01	February 2008	Figure 2



LEGEND:

DP4 ⊗ Approximate Soil & Groundwater Sampling Location

DP1 ⊙ Approximate Soil Gas & Groundwater Sampling Location

IA1 ◒ Approximate Indoor Air Sampling Location

PCE = Tetrachloroethene

20 PCE Concentration (ppbv)

Ref: Ninyo & Moore, 9/06

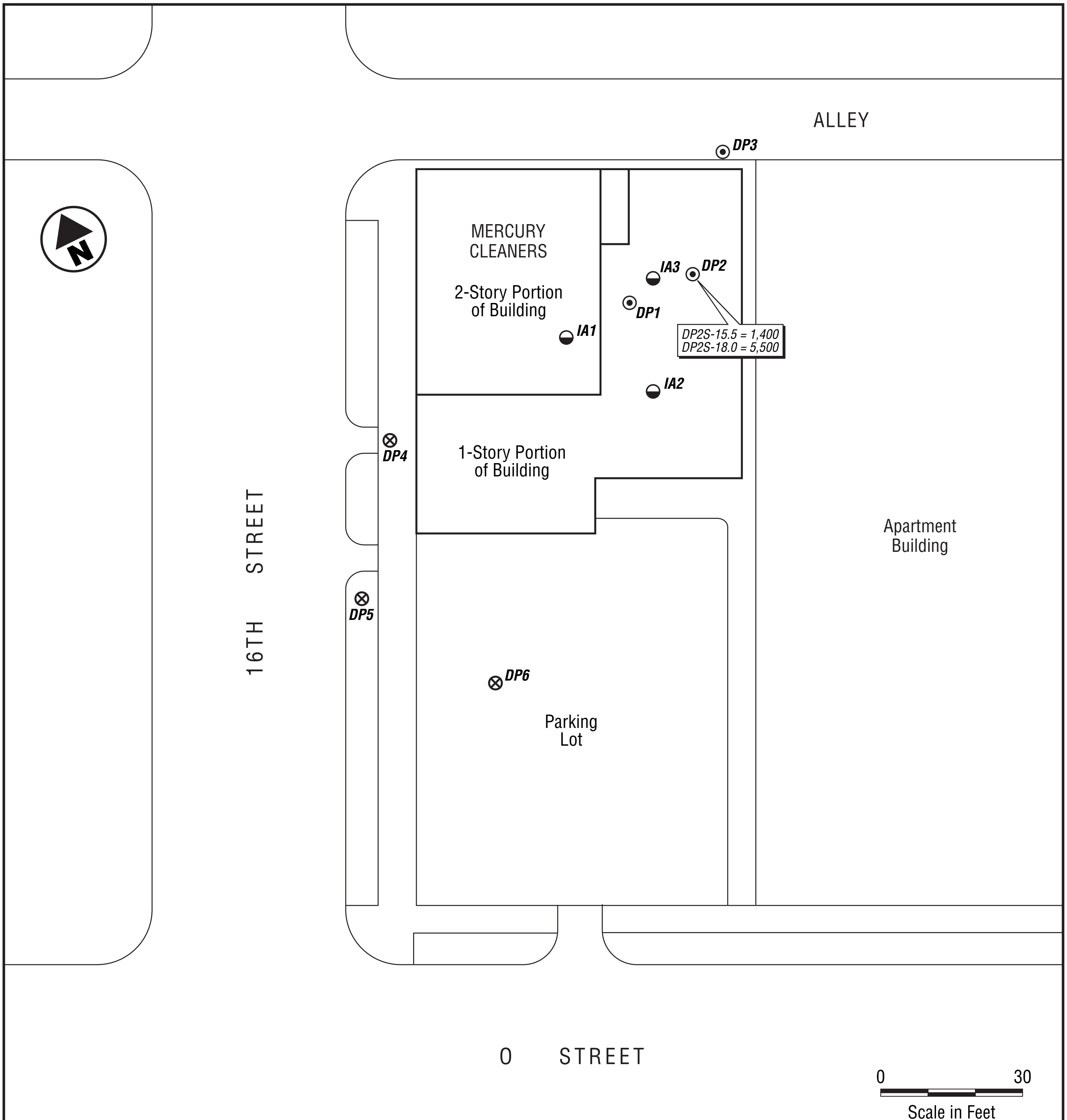
GEOCON CONSULTANTS, INC.
3160 GOLD VALLEY DR. – SUITE 800 - RANCHO CORDOVA, CA. 95742
PHONE 916 852-9118 – FAX 916 852-9132

Mercury Cleaners

1419 16th Street
Sacramento, California

Indoor Air Sampling Locations

S9322-06-01	February 2008	Figure 3



LEGEND:

DP4 ⊗ Approximate Soil & Groundwater Sampling Location

DP1 ⊙ Approximate Soil Gas & Groundwater Sampling Location

IA1 ◒ Approximate Indoor Air Sampling Location

DP2S-15.5 = 1,400
DP2S-18.0 = 5,500 — Gasoline Range Organics Concentrations (mg/kg)

Ref: Ninyo & Moore, 9/06

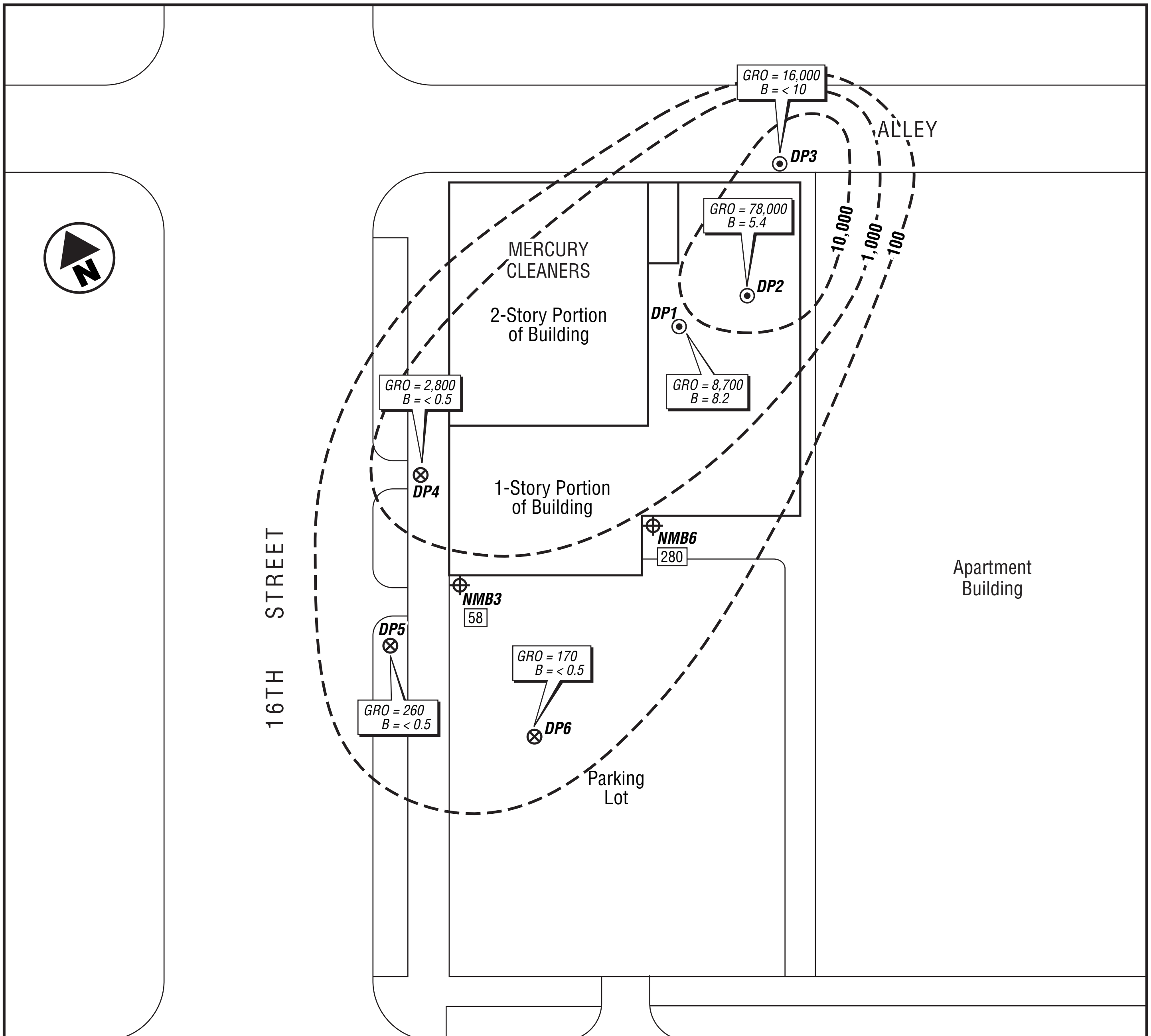
GEOCON
CONSULTANTS, INC.
3160 GOLD VALLEY DR. – SUITE 800 - RANCHO CORDOVA, CA. 95742
PHONE 916 852-9118 – FAX 916 852-9132

Mercury Cleaners

1419 16th Street
Sacramento, California

SITE PLAN

S9322-06-01	February 2008	Figure 4



O STREET

0 30
Scale in Feet

LEGEND:

DP4 ⊗	Approximate Soil & Groundwater Sampling Location
DP1 ⊙	Approximate Soil Gas & Groundwater Sampling Location
NMB3 ⌖	Approximate Ninyo & Moore Boring Location
280	TPHg Concentration (ug/l)
GRO	Gasoline Range Organics (ug/l)
B	Benzene (ug/l)
10,000 – – – –	GRO Isoconcentration Contour (ug/l)
TPHg	Total Petroleum Hydrocarbons as Gasoline

Ref: Ninyo & Moore, 9/06

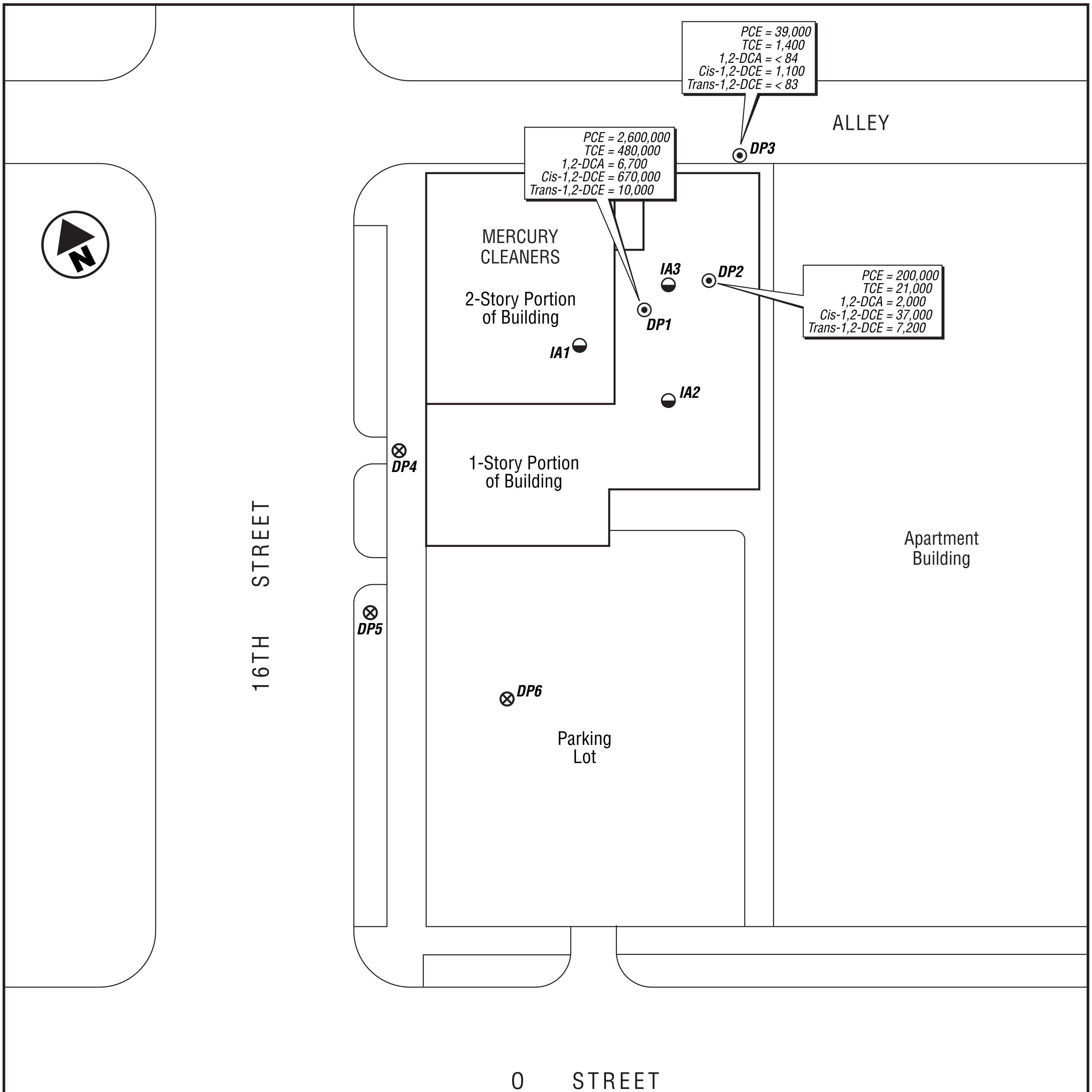
GEOCON
CONSULTANTS, INC.
3160 GOLD VALLEY DR. – SUITE 800 - RANCHO CORDOVA, CA. 95742
PHONE 916 852-9118 – FAX 916 852-9132

Mercury Cleaners

1419 16th Street, Sacramento, California

Groundwater Sampling Locations and Results – GRO and Benzene

S9322-06-01	February 2008	Figure 5



0 30

Scale in Feet

LEGEND:

DP4 ⊗ Approximate Soil & Groundwater Sampling Location

DP1 ⊙ Approximate Soil Gas & Groundwater Sampling Location

IA1 ◒ Approximate Indoor Air Sampling Location

PCE = *Tetrachloroethene (ug/m^3)*
TCE = *Trichloroethene (ug/m^3)*
1,2-DCA = *1,2-Dichloroethane (ug/m^3)*
Cis-1,2-DCE = *Cis-1,2-Dichloroethylene (ug/m^3)*
Trans-1,2-DCE = *Trans-1,2-Dichloroethylene (ug/m^3)*
ug/m^3 = *Micrograms Per Cubic Meter*

Ref: Ninyo & Moore, 9/06

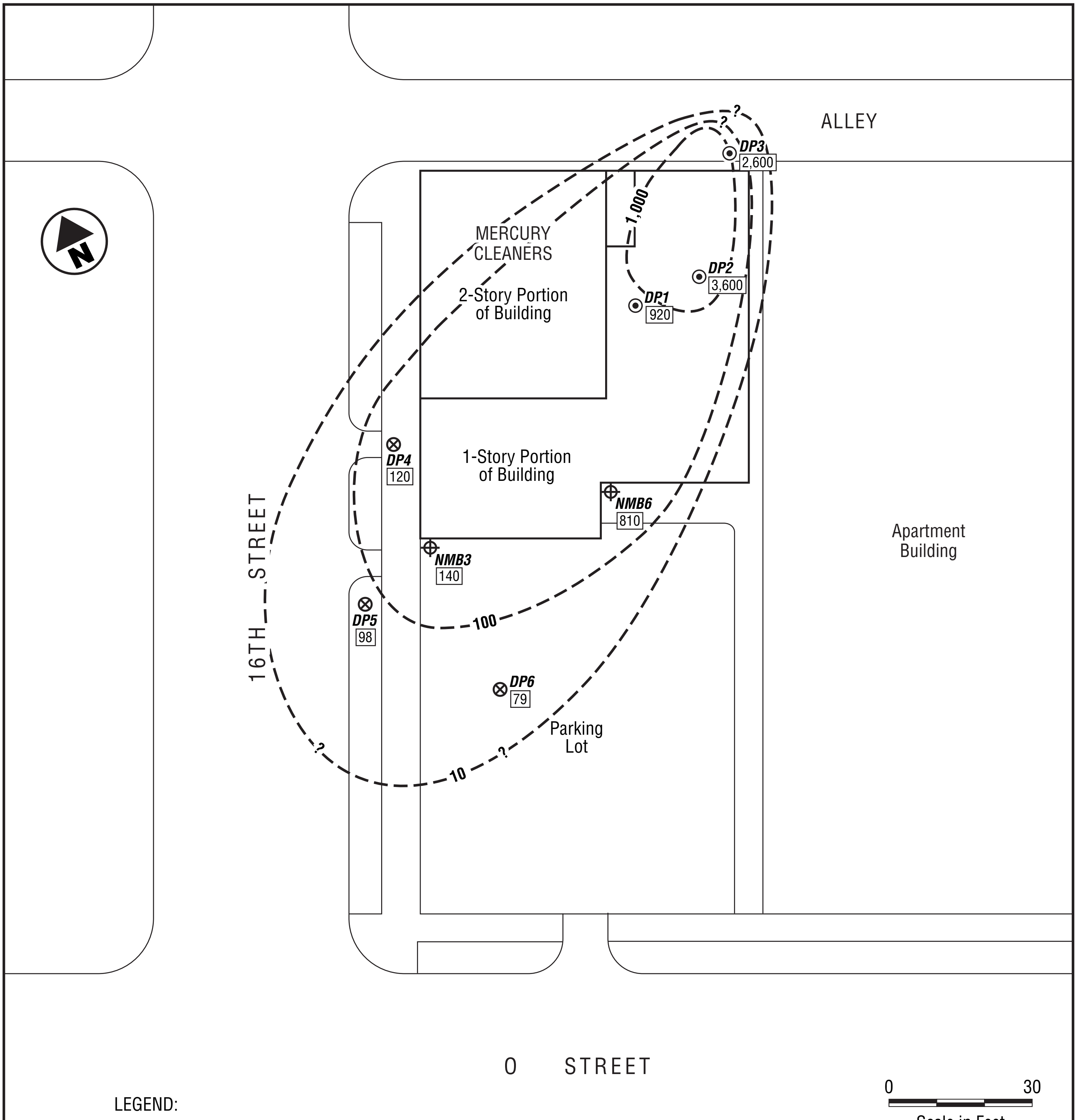
GEOCON
CONSULTANTS, INC.
3160 GOLD VALLEY DR. – SUITE 800 - RANCHO CORDOVA, CA. 95742
PHONE 916 852-9118 – FAX 916 852-9132

Mercury Cleaners

1419 16th Street
Sacramento, California

Soil Gas Sampling Locations

S9322-06-01	February 2008	Figure 6



LEGEND:

DP4 ⊗ Approximate Soil & Groundwater Sampling Location

DP1 ⊙ Approximate Soil Gas & Groundwater Sampling Location

NMB3 ⊕ Approximate Ninyo & Moore Boring Location

PCE = Tetrachloroethene

3,600 PCE Concentration (ug/l)

1,000 — — — — PCE Isoconcentration Contour (ug/l)

Ref: Ninyo & Moore, 9/06

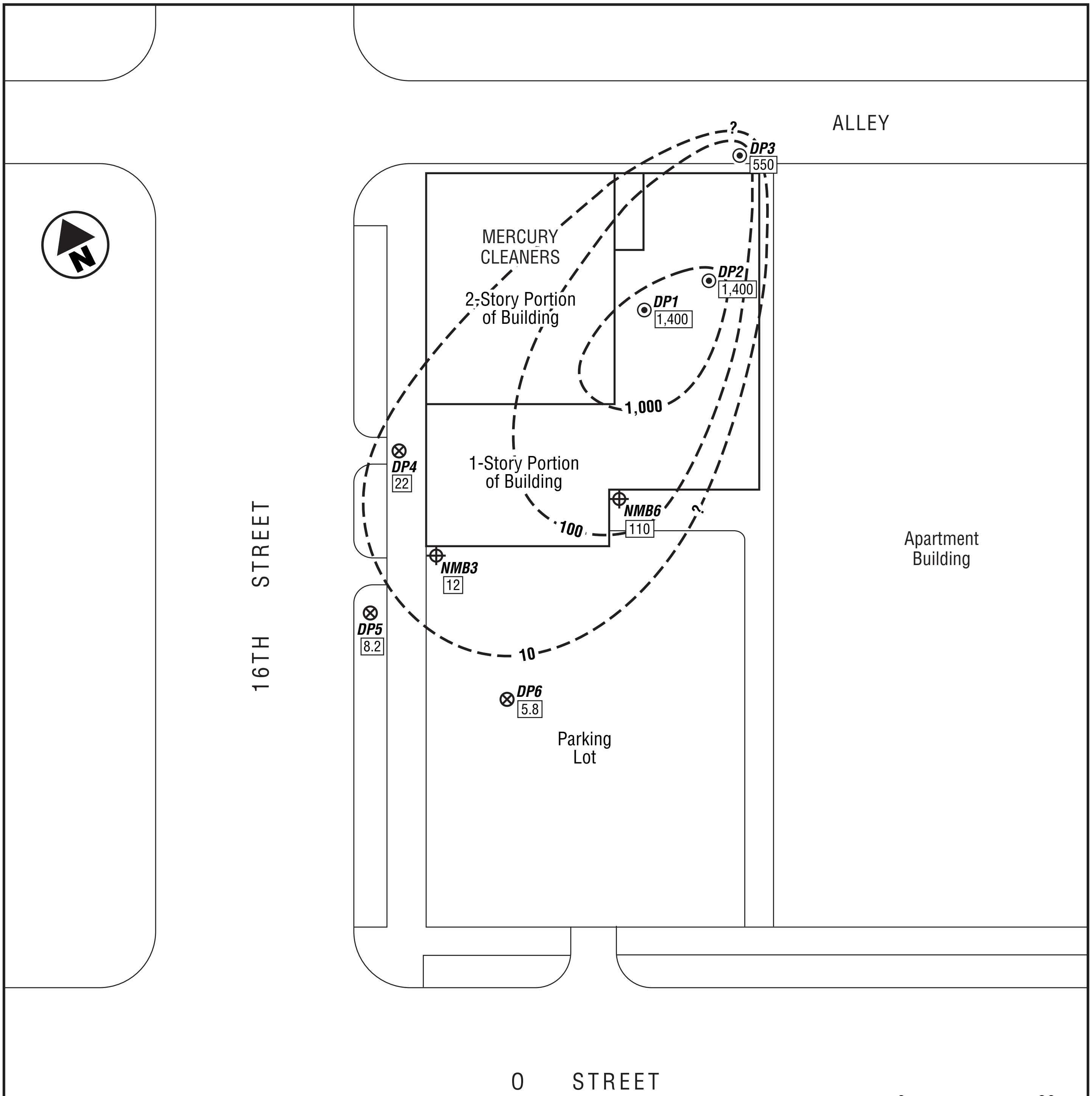
GEOCON
CONSULTANTS, INC.
3160 GOLD VALLEY DR. – SUITE 800 - RANCHO CORDOVA, CA. 95742
PHONE 916 852-9118 – FAX 916 852-9132

Mercury Cleaners

1419 16th Street
Sacramento, California

PCE Isoconcentration Map

S9322-06-01	February 2008	Figure 7



0 30
Scale in Feet

LEGEND:

DP4 ⊗ Approximate Soil & Groundwater Sampling Location

DP1 ⊙ Approximate Soil Gas & Groundwater Sampling Location

NMB3 ⊕ Approximate Ninyo & Moore Boring Location

TCE = Trichloroethene

1,400 TCE Concentration (ug/l)

1,000 — — — — TCE Isoconcentration Contour (ug/l)

Ref: Ninyo & Moore, 9/06

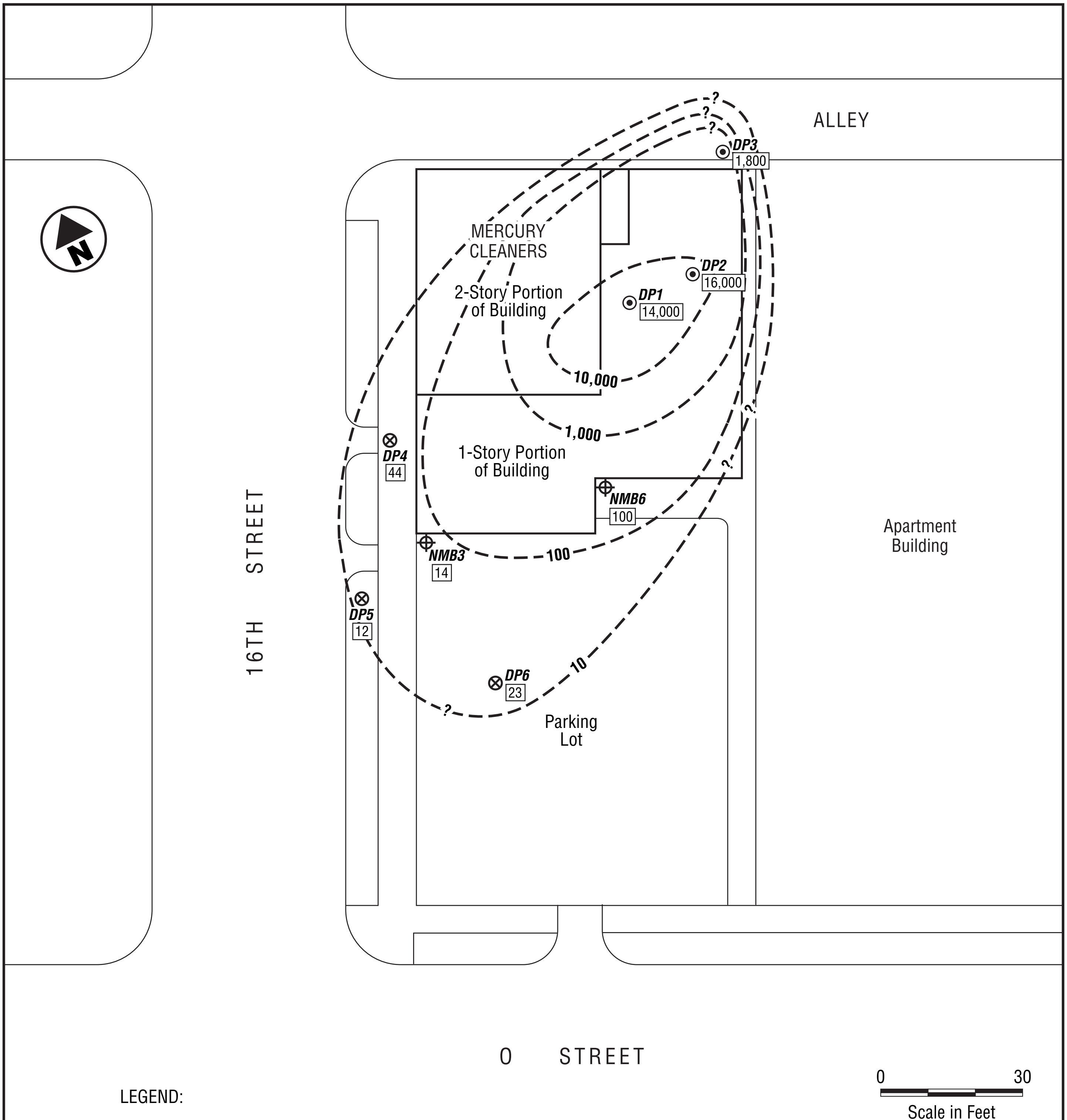
GEOCON
CONSULTANTS, INC.
3160 GOLD VALLEY DR. – SUITE 800 - RANCHO CORDOVA, CA. 95742
PHONE 916 852-9118 – FAX 916 852-9132

Mercury Cleaners

1419 16th Street
Sacramento, California

TCE Isoconcentration Map

S9322-06-01	February 2008	Figure 8



LEGEND:

DP4 ⊗ Approximate Soil & Groundwater Sampling Location

DP1 ⊙ Approximate Soil Gas & Groundwater Sampling Location

NMB3 ⊕ Approximate Ninyo & Moore Boring Location

DCE = Dichloroethylene

16,000 cis-1,2-DCE Concentration (ug/l)

10,000 — — — — cis-1,2-DCE Isoconcentration Contour (ug/l)

Ref: Ninyo & Moore, 9/06

GEOCON
CONSULTANTS, INC.
3160 GOLD VALLEY DR. – SUITE 800 - RANCHO CORDOVA, CA. 95742
PHONE 916 852-9118 – FAX 916 852-9132

Mercury Cleaners

1419 16th Street
Sacramento, California

cis-1,2-DCE Isoconcentration Map

S9322-06-01	February 2008	Figure 9

TABLE 1

SUMMARY OF INDOOR AIR ANALYTICAL DATA - VOLATILE ORGANIC COMPOUNDS

MERCURY CLEANERS

SACRAMENTO, CALIFORNIA

SAMPLE ID	DATE	Propylene	Chloromethane	Ethanol	Acetone	2-Butanone(MEK)	Toluene	PCE
		Results in ppbv						
IA1	12/7/2007	1.5	0.6	27	12	2.5	0.7	2.4
IA2	12/7/2007	1.2	<0.5	18	7.9	<1.5	0.6	5.2
IA3	12/7/2007	1.1	1.8	15	12	2.4	0.7	20
PEL (8-hr)		---	5,000	1,000,000	500,000	200,000	50,000	25,000

Notes:

MEK = Methylethylketone

PCE = Tetrachloroethene

ppbv = Parts Per Billion Volume

< = Less than the respective laboratory test method reporting limits for each tested analyte

PEL = Permissible Exposure Limit in ppbv

TABLE 2
SUMMARY OF SOIL GAS ANALYTICAL DATA – VOLATILE ORGANIC COMPOUNDS
MERCURY CLEANERS
SACRAMENTO, CALIFORNIA

SAMPLE ID	Sample Depth (feet bgs)	DATE	PCE	TCE	Toluene	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	Methylene Chloride	Hexane	Chloroform	Acetone	Ethanol	B	MTBE
			Results in μg/m³												
CAS No.			*127-18-4*	*79-01-6*	*108-88-3*	*107-06-2*	*156-59-2*	*156-60-5*	*75-09-2*	*110-54-3*	*67-66-3*	*67-64-1*	*64-17-5*	*71-43-2*	*1634-04-4*
DP1SG-5	5.0	12/8/2007	2,600,000	480,000	5,100	6,700	670,000	10,000	13,000	7,700	<5,400	24,000	24,000	<3,500	<4,000
DP2SG-5	5.0	12/8/2007	200,000	21,000	1,100	2,000	37,000	720	3,200	700	<550	2,800	2,200	<360	<400
DP3SG-5	5.0	12/8/2007	39,000	1,400	<79	<84	1,100	<83	<73	<74	110	<200	240	<67	<75
CHHSLs (Residential)			180	528	135,000	50	15,900	31,900	---	---	---	---	---	36	4,000
CHHSLs (Commercial)			603	1,770	378,000	167	44,400	88,700	---	---	---	---	---	122	13,400
ESLs (Residential)			410	1,200	63,000	94	7,300	15,000	5,200	---	460	660,000	---	84	9,400
ESLs (Commercial)			1,400	4,100	180,000	310	20,000	41,000	17,000	---	1,500	1,800,000	---	280	31,000

Notes:
bgs = below ground surface
PCE = Tetrachloroethene
TCE = Trichloroethene
DCA = Dichloroethane
DCE = Dichloroethylene
B = Benzene
MTBE = Methyl tert-butyl ether
CHHSLs = California Human Health Screening Level
ESLs = Environmental Screening Levels
$\mu g/m^3$ = Micrograms per cubic meter
< = Less than the respective laboratory test method reporting limits for each tested analyte
--- = No established screening level

TABLE 3

SUMMARY OF GROUNDWATER ANALYTICAL DATA - GASOLINE RANGE ORGANICS AND VOLATILE ORGANIC COMPOUNDS

MERCURY CLEANERS

SACRAMENTO, CALIFORNIA

SAMPLE ID	DATE	GRO	Benzene	1,1-DCE	trans 1,2-DCE	cis-1,2-DCE	PCE	TCE	VC
		Results in µg/l							
DP1GW	12/8/2007	8,700	8.2	6.6	100	14,000	920	1,400	2.0
DP2GW	12/8/2007	78,000	5.4	6.9	260	16,000	3,600	1,400	2.7
DP3GW	12/8/2007	16,000	<10	<10	19	1,800	2,600	550	<10
DP4GW	12/8/2007	2,800	<0.5	<0.5	1.1	44	120	22	<0.5
DP5GW	12/8/2007	260	<0.5	<0.5	0.59	12	98	8.2	<0.5
DP6GW	12/8/2007	170	<0.5	<0.5	<0.5	23	79	5.8	<0.5
MCLs		(ESL = 100 µg/l)	1	6	10	6	5	5	0.5

Notes:

GRO = Gasoline Range Organics (TPHg)
DCE = Dichloroethene
TCE = Trichloroethene
PCE = Tetrachloroethene
VC = Vinyl Chloride
µg/l = micrograms per liter
ESL = San Francisco Bay Regional Water Quality Control Board Environmental Screening Level - Table F1a, Water is a Potential Drinking Water Source
MCLs = California Regional Water Quality Control Board, Central Valley Region Maximum Contaminant Levels

TABLE 4
SUMMARY OF JOHNSON & ETTINGER SOIL VAPOR MODEL RESULTS
MERCURY CLEANERS
SACRAMENTO, CALIFORNIA

Soil Gas Boring	Chemical	Maximum Concentration (µg/m³ of vapor)	Carcinogens IELCR [1]	Non-Carcinogens Hazard Quotient/ Hazard Index
Residential				
DP1SG-5	PCE	2.60E+06	1.15E-04	1.30E+00
DP1SG-5	TCE	4.80E+05	7.22E-06	1.40E-02
DP1SG-5	Toluene	5.10E+03	NA	2.99E-04
DP1SG-5	1,2-DCA	6.70E+03	1.07E-06	2.96E-04
DP1SG-5	cis-1,2-DCE	6.70E+05	NA	3.35E-01
DP1SG-5	trans-1,2-DCE	1.00E+04	NA	2.50E-03
DP1SG-5	Methylene Chloride	1.30E+04	9.84E-08	5.74E-04
DP1SG-5	Hexane	7.70E+03	NA	7.28E-04
DP1SG-5	Chloroform	1.10E+02	4.42E-09	6.48E-06
DP1SG-5	Acetone	2.40E+04	NA	1.23E-03
DP1SG-5	Benzene*	1.75E+03	3.83E-07	1.03E-03
		Totals	**1.24E-04**	**1.6557**
Commercial				
DP1SG-5	PCE	2.60E+06	4.13E-05	5.59E-01
DP1SG-5	TCE	4.80E+05	2.59E-06	6.04E-03
DP1SG-5	Toluene	5.10E+03	NA	1.29E-04
DP1SG-5	1,2-DCA	6.70E+03	3.82E-07	1.27E-04
DP1SG-5	cis-1,2-DCE	6.70E+05	NA	1.44E-01
DP1SG-5	trans-1,2-DCE	1.00E+04	NA	1.08E-03
DP1SG-5	Methylene Chloride	1.30E+04	3.53E-08	2.47E-04
DP1SG-5	Hexane	7.70E+03	NA	3.13E-04
DP1SG-5	Chloroform	1.10E+02	1.58E-09	2.79E-06
DP1SG-5	Acetone	2.40E+04	NA	5.27E-04
DP1SG-5	Benzene*	1.75E+03	1.37E-07	4.41E-04
		Totals	**4.44E-05**	**0.7119**

Notes:
µg/m³ = micrograms per cubic meter
PCE = Tetrachloroethene
TCE = Trichloroethene
DCA = Dichloroethane
DCE = Dichloroethylene
MTBE = Methyl tert-butyl ether
NA = Not applicable
[1] =Individual excess lifetime cancer risk
* = Soil gas concentration taken as one-half the maximum non-detect reporting limit