SCHUTZE & ASSOCIATES, INC
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October 7, 2010
Project No. SCS370.2

**Mr. Loyal Moore**
30689 Prestwick Avenue
Hayward, CA 94541

**Assistant Fire Marshal Leroy Griffin**
**City of Oakland, Fire Prevention Bureau**
250 Frank H. Ogawa Plaza, Suite 3314
Oakland, CA 94612

**Reference:** **2700 23rd Avenue**
**Oakland, Alameda County, California**

**Subject:** **Geophysical Survey Report**

Dear Mr. Moore and AFM Griffin:

SCHUTZE & Associates, Inc. is pleased to submit this Report regarding a Geophysical Survey of the property located at 2700 23rd Avenue in Oakland, California (subject site). The purpose of the work was to investigate if subsurface structures, such as product lines or underground storage tanks (USTs), exist beneath the subject site, formerly the location of a gasoline service station.

The work was supervised by a California Professional Geologist (P.G.).

## A. BACKGROUND

SCHUTZE & Associates, Inc. reviewed a Local Regulatory Agency File Review of the subject site prepared by Basics Environmental, Inc. (Basics).[1] According to Basics' findings, the subject site was developed with a gasoline service station from approximately 1928 to 1964. A dispenser island was at the southwestern corner of the property and a "kiosk" was at the northeastern corner. By 1936, an auto repair shop had been added to the eastern portion of the site.

According to information from the Oakland Building Department (OBD), a permit was issued in 1964 to demolish a "service station and lube room" at the subject site address. In 1968, plans were submitted for the construction of the current building, a liquor store.

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[1] Basics Environmental, Inc., *Local Regulatory Agency File Review, 2700 23rd Avenue, Oakland, CA*, May 7, 2010

A note on the 1968 plans referred to the intended removal of the gasoline storage tanks which existed at the site (the number, capacity and location of the tanks was not given). The OBD records viewed by Basics did not include confirmation that the tank removal was completed.

## B. INITIAL SUBSURFACE INVESTIGATION

SCHUTZE & Associates, Inc. performed a Subsurface Investigation at the subject site on July 29, 2010. Four soil borings were advanced in the asphalt-paved parking area. Soil and groundwater samples were collected from each boring and analyzed. Four additional soil borings were advanced to depths of 5 feet below ground surface (ft bgs) in order to collect soil vapor samples.

The following conclusions are based on the laboratory results:

- Soil at the south portion of the parking area has been impacted by diesel-range and motor oil-range petroleum hydrocarbons.
- Shallow perched groundwater (approximately 15 ft bgs) at the south portion of the parking area has been impacted by gasoline-range, diesel-range and motor oil-range petroleum hydrocarbons, as well as naphthalene.
- Shallow perched groundwater (approximately 13 ft bgs) at the west portion of the parking area has been impacted by motor oil-range petroleum hydrocarbons.
- Soil vapor at the south central portion of the parking area has been impacted by ethylbenzene and naphthalene.

TPH-g, TPH-d, TPH-mo[2], naphthalene and ethylbenzene were detected at the subject site above the corresponding Environmental Screening Levels (ESLs) of the San Francisco Bay Area Regional Water Quality Control Board (RWQCB). The likely sources of the contamination were former leaking underground storage tanks (USTs) and/or associated product lines.

Based on the results of the soil, groundwater and soil vapor survey, SCHUTZE & Associates, Inc. recommended further investigation of the subject property, including a geophysical survey of the asphalt parking lot and any other accessible areas of the subject site, to investigate whether USTs and associated product lines still exist in the subsurface at the site.

## C. GEOPHYSICAL SURVEY

### C.1 Purpose and Location of Survey Area

SCHUTZE & Associates, Inc. completed a subsurface geophysical survey at the subject site on August 27, 2010. The purpose of the geophysical survey was to locate subsurface structures, such as potentially existing USTs and associated product lines, using a variety of geophysical methods. SCHUTZE & Associates, Inc. subcontracted

[2] Total petroleum hydrocarbons as gasoline, diesel and motor oil

NORCAL Geophysical Consultants, Inc. to perform the survey.

The geophysical survey was performed in the area of the asphalt-paved parking lot west of the building (Ed's Liquors) at the subject site (see the attached Plate 1). The concrete-paved area south of the building and portions of the sidewalks bordering the site along 23rd Avenue and East 27th Street were included in the survey area. A survey grid was established consisting of parallel lines oriented perpendicular to the front of the building.

Aboveground objects in the survey area included: a light standard and four steel bollards situated on a concrete pad at the southwestern corner of the parking lot; a metal storm drain catch basin in the southeastern portion of the parking lot; and a utility pole, a traffic control box and a street sign located in the sidewalk areas bordering the site. Steel bollards and steel window bars located at and on the western side of the Ed's Liquors building limited the extent of the survey area to approximately 5 feet west of the building.

### C.2 Methodologies

The methodologies utilized included electromagnetic line location/metal detection (EMLL/MD), a vertical magnetic gradient (VMG) survey and a ground penetrating radar (GPR) survey. Descriptions of the EMLL/MD, VMG and GPR methodologies used by NORCAL are included as Appendix A.

EMLL/MD was used to detect shallow subsurface metal objects such as utilities. The GPR method was used to provide images that represent variations in the electrical properties of the shallow subsurface. These images may indicate possible locations and dimensions of USTs, buried objects and fill boundaries.

The VMG method was used to identify the location of buried ferrous metal that may indicate the presence of a UST. The data from this method was used to produce a VMG contour map for interpretation. The contour map was evaluated for magnetic variations indicative of the presence of large ferrous objects.

The locations of identified magnetic variations were compared with those of known above-ground objects and with the locations of suspected subsurface features previously delineated with the EMLL/MD. Those variations that could not be attributed to either source were considered anomalous. The results of the VMG survey are illustrated on the Geophysical Survey Map (Plate 1).

### C.3 Geophysical Results

The results of the geophysical investigation are shown on Plate 1. Plate 1 depicts:

- the approximate limits of the VMG and GPR investigation areas;
- the locations of pertinent aboveground objects;
- the locations of interpreted subsurface objects; and
- VMG contour data (the VMG contours depict the variations of the magnetic field within the survey area and how they correlate to identified and suspected cultural

objects).

Also depicted on Plate 1 are four proposed monitoring well locations. These proposed locations were investigated for evidence of nearby underground utilities that could interfere with drilling.

Based on interpretation of the geophysical data and instrument responses in the field, evidence was not found for an intact UST within the designated survey area. However, a localized metal detector anomaly was detected approximately 10 feet west of the southwest corner of the Ed's Liquors building (the anomaly is depicted on Plate 1 as a pale blue rectangle). The anomaly may be buried metal debris or possibly remnants of a small, crushed UST.

An undifferentiated metallic utility line was observed at the central portion of the property using the VMG method (Plate 1). The utility line was likely cut off at both ends and does not appear to lead to any currently existing structures or to the street. The southern terminus of the utility line appeared to end at what is assumed to be the approximate location of the pump islands for the former gasoline service station.

Other magnetic variations evident in the VMG contour data can be attributed to aboveground metallic objects and identified underground utility lines.

## D. CONCLUSIONS / RECOMMENDATIONS

Based on the results of the geophysical survey, a metal anomaly exists in the asphalt-paved area approximately 10 feet west of the southwest corner of the Ed's Liquors building. Based on the VMG results, the object is not an intact UST, but may be buried metal debris or possibly the remnants of a small, crushed UST.

An undifferentiated, subsurface utility line exists in the central portion of the property. Based on the VMG results, the utility line was likely cut off at both ends and does not lead to any currently existing structures or to the street. There is a potential that the utility line is a former product line, used to pump petroleum products from former USTs to the former service station pumps. This potentially existing former product line may be contributing to the contamination at the site.

SCHUTZE & Associates, Inc. recommends excavating a series of test pits at the location of the potentially existing former product line and at the location of the metal anomaly discovered at the south portion of the parking area, an area which coincides with high TPH and naphthalene concentrations detected at the site during the previous investigation.

We have enjoyed working on this project and appreciate the opportunity to be of service. Please call SCHUTZE & Associates, Inc. at (510) 434-1333 with questions or comments about this report.

Respectfully submitted:
**SCHUTZE & ASSOCIATES, INC.**


Jan H. Schutze, P.G., M.Sc.
President

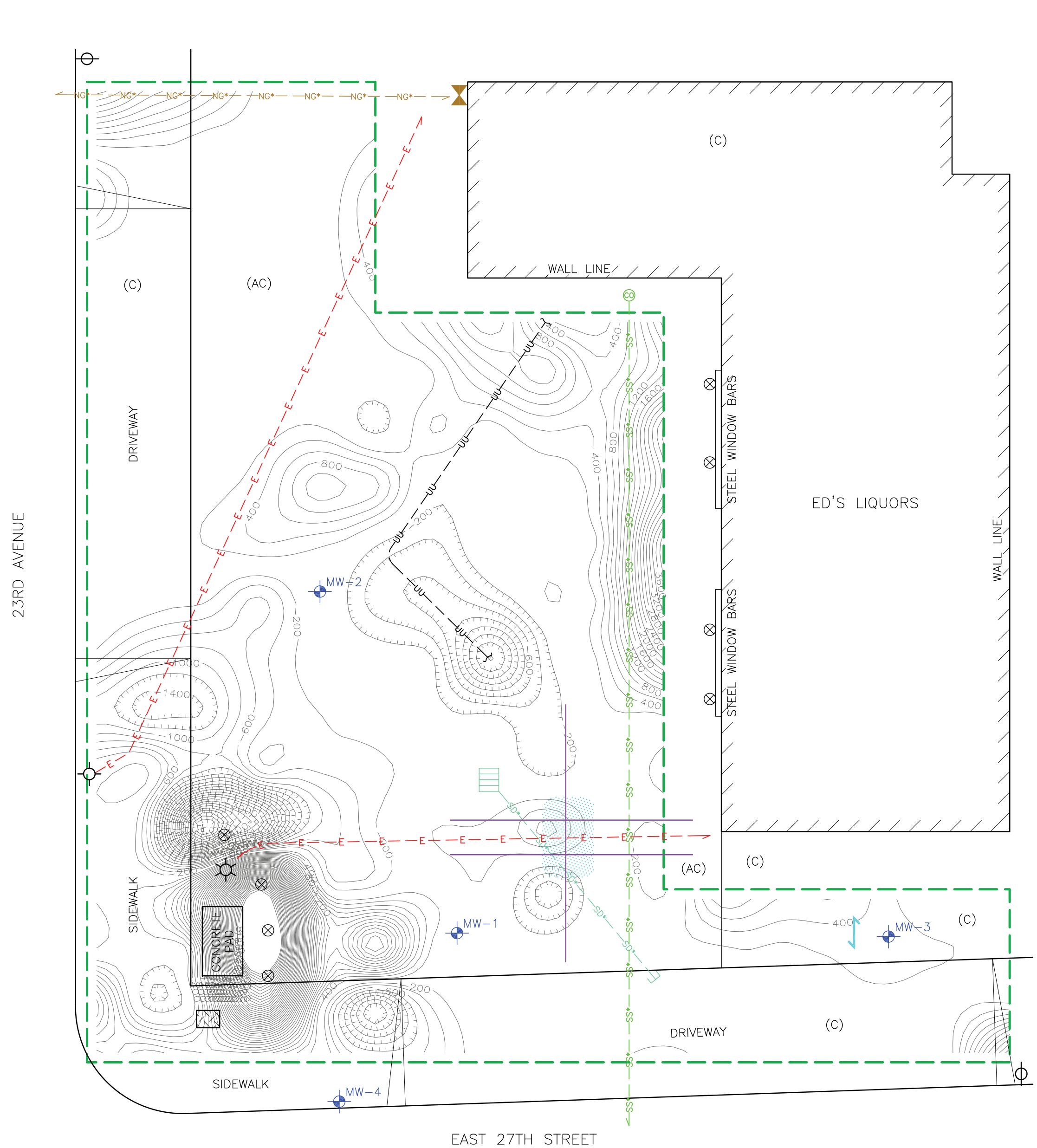
Attachment: Plate 1 – Geophysical Survey Map

Appendix A: Geophysical Methodology

cc: Mr. Mark Bryant
MJB Associates
4617 Davenport Avenue
Oakland, CA 94619

# PLATE 1

# GEOPHYSICAL SURVEY MAP




SCALE

0 5 10 20

(1 inch = 10 feet)

# LEGEND

| | |
|---|---|
| — — — | LIMITS OF VERTICAL MAGNETIC GRADIENT SURVEY |
| — 0 — | VERTICAL MAGNETIC GRADIENT CONTOUR (CONTOUR INTERVAL = 200 nT/m) |
| | METAL DETECTOR ANOMALY |
| | GPR TRAVERSE |
| | LOCALIZED GPR ANOMALY |
| — E — | ELECTRIC LINE |
| — NG — | NATURAL GAS LINE (AS MARKED BY OTHERS) |
| — SS — | SANITARY SEWER LINE (AS MARKED BY OTHERS) |
| — SD — | STORM DRAIN LINE (AS MARKED BY OTHERS) |
| — UU — | UNDIFFERENTIATED UTILITY LINE |
| | LIGHT STANDARD |
| | PROPOSED MONITORING WELL |
| | NATURAL GAS VALVE |
| | SANITARY SEWER CLEANOUT |
| ⊗ | STEEL BOLLARD |
| | STORM DRAIN CATCH BASIN |
| | STREET SIGN |
| | TRAFFIC CONTROL BOX |
| | UTILITY POLE |
| (AC) | ASPHALT |
| (C) | CONCRETE |

NORCAL

GEOPHYSICAL SURVEY MAP
ED'S LIQUORS
2700 23RD AVENUE

LOCATION: OAKLAND, CALIFORNIA

CLIENT: SCHUTZE & ASSOCIATES

NORCAL GEOPHYSICAL CONSULTANTS INC.

JOB #: 10-657.16

DATE: AUG. 2010

DRAWN BY: G.RANDALL

APPROVED BY: DJB

PLATE 1

# APPENDIX A

# GEOPHYSICAL METHODOLOGY

## Appendix A

## VERTICAL MAGNETIC GRADIENT

### Methodology

Vertical magnetic gradient surveys are used to determine the presence of buried ferrous objects. A magnetic gradiometer measures the vertical gradient of the earth's magnetic field. It consists of two total field magnetic sensors separated vertically by one-half meter. The magnetic field strength is measured simultaneously at both of these sensors. The difference in magnetic intensity between these measurements is proportional to the vertical gradient of the earth's magnetic field. Because the vertical gradient is constant with respect to time, the effect of diurnal variations is eliminated. Therefore, a gradiometer provides higher sensitivity and better resolution of near surface sources than total field magnetometers. Areas with significant amounts of buried metal typically produce anomalously steep magnetic gradients. Since it is sensitive to ferrous metal sources both above and below ground, site and vicinity surface conditions can affect survey results.

We typically use a Geometrics G-858 cesium vapor magnetometer to obtain vertical magnetic gradient data. This instrument features a built-in memory that stores the vertical magnetic gradient and survey grid information. The information can be down loaded to a computer for further processing.

### Data Analysis

Computer Processing

The VMG data are down loaded to a lap-top computer and converted it into a format for contouring. The contouring program (SURFER Version 9.0 by Golden Software) calculates an evenly spaced array of values (grid) based on the observed field data. Finally, these gridded values are contoured to produce a VMG contour map.

Contour Map Interpretation

The VMG contour map illustrates the variations in the vertical magnetic gradient across the site. Areas without below or above ground ferrous metal are characterized by very low magnetic gradients. In these areas, there are very few contours. In areas with above or below ground ferrous metal, the magnetic gradient is relatively steep. These areas are characterized by numerous closely spaced contours and are considered anomalous. If the source of the anomaly is linear (e.g. underground utilities or fence lines), then the contours tend to be parallel and evenly distributed. If the source of the anomaly is localized (e.g. sign post, buried drum, etc.), then the contours tend to form circular or elliptical closures proportional to the size of the object. The larger the object and the closer it is to the magnetometer, the denser the concentrations of contours. Magnetic anomalies that cannot be attributed to above ground objects (fences, vehicles, buildings, etc.) are probably caused by buried objects.

USTs are often characterized by circular to elliptical contour closures. These closures have magnitudes ranging from several hundred to several thousand nano-Tesla per meter (nT/m) depending on the size and depth of the tank. If the UST is cylindrical and lying horizontally, it will often produce a bi-polar VMG anomaly. This consists of two adjacent contour closures. One has VMG values that increase towards the center of the closure and is referred to as a positive lobe. The second has VMG values that decrease towards the center of the closure and is referred to as a negative lobe. Typically, the positive lobe is situated directly above the UST and the negative lobe is to the north of the UST. Utilities and scattered metal debris, on the other hand, are generally characterized by single circular or irregular shaped negative lobes, or a group of alternating positive and negative lobes (closures). These closures typically have magnitudes ranging from less than fifty to several hundred nano-Tesla per meter (nT/m) depending on the size, depth, and amount of utilities and debris in a given area.

### Limitations

Below ground metal ferrous objects produce localized variations in the earth's magnetic field. The magnetic intensity associated with buried metal depends on the mass of the metal and the distance the metal object is from the magnetometer sensor. As the distance between the object and the magnetometer sensor increases, the intensity of the associated field decreases, thereby making detection more difficult. In addition, the ability to detect a buried metal object is based on the intensity of these variations versus the intensity of the background variations. Background variations can be caused by other nearby above or below ground metallic sources. Cultural features such as chain link fences, buildings, debris, railroad spurs, utilities, above ground electric lines, etc. typically produce numerous magnetic variations with high intensities. These variations may mask effects from buried metal objects, or make it very difficult to determine whether the magnetic variations are associated with below ground metal or above/below ground cultural features.

## ELECTROMAGNETIC LINE LOCATION/METAL DETECTION (EMLL/MD)

### Methodology

Electromagnetic line location techniques are used to locate the magnetic field resulting from an electric current flowing on a line. These magnetic fields can arise from currents already on the line (passive) or currents applied to a line with a transmitter (active). The most common passive signals are generated by live electric lines and re-radiated radio signals. Active signals can be introduced by connecting the transmitter to the line at accessible locations or by induction.

The detection of underground utilities is affected by the composition and construction of the line in question. Utilities detectable with standard line location techniques include any continuously connected metal pipes, cables/wires or utilities with tracer wires. Unless the utilities carry a passive current, they must be exposed at the surface or in accessible utility vaults. These generally include water, electric, natural gas, telephone, and other conduits related to facility operations. Utilities that are not detectable using standard electromagnetic line location techniques include those made of non-electrically conductive materials such as PVC, fiberglass, vitrified clay, and pipes with insulated connections.

Buried objects can also be detected, without direct contact, by using the induction mode. This is used to detect buried near surface metal objects such as rebar, manhole covers, USTs, and various metallic debris. The induction mode is used by holding the transmitter-receiver unit above the ground and continuously scanning the surface. The unit utilizes two orthogonal coils that are separated by a specified distance. One of the coils transmits an electromagnetic signal (primary magnetic field) which in turn produces a secondary magnetic field about the subsurface metal object. Since the receiver coil is orthogonal to the transmitter coil, it is unaffected by the primary field. Therefore, the secondary magnetic fields produced by buried metal object will generate an audible response from the unit. The peak of this response indicates when the unit is directly over the metal object.

The instrumentation typically used for the EMLL survey consists of a Radio Detection RD-400 and a Fisher TW-6 inductive pipe and cable locator.

### Data Analysis

The EMLL instrumentation indicates the presence of buried metal by emitting an audible tone; there are no recorded data to analyze. Therefore, the locations of buried objects detected with the EMLL method are marked on the ground surface during the survey.

### Limitations

The detection of underground utilities is dependent upon the composition and construction of the line of interest, as well as depth. Utilities detectable with standard line location techniques include any continuously connected metal pipes, cables/wires or utilities with tracer wires. Unless carrying a passive current these utilities must be exposed at the surface or accessible in a utility vault. These generally include water, electric, natural gas, telephone, and other conduits related to facility operations. Utilities that may not be detectable using standard electromagnetic line location techniques include certain abandoned utilities, utilities not exposed at the ground surface, or those made of non-electrically conductive materials such as PVC, fiberglass, vitrified clay, and metal pipes with insulating joints. Pipes generally deeper than about five to seven feet may not be detected.

## GROUND PENETRATING RADAR (GPR)

### Methodology

Ground penetrating radar is a method that provides a continuous, high resolution cross-section depicting variations in the electrical properties of the shallow subsurface. The method is particularly sensitive to variations in electrical conductivity and electrical permittivity (the ability of a material to hold a charge when an electrical field is applied).

The GPR system operates by radiating electromagnetic pulses into the ground from a transducer (antenna) as it is moved along a traverse. Since most earth materials are transparent to electromagnetic energy, the signal spreads downward into the subsurface.

However, when the signal encounters a variation in electrical permittivity, a portion of the electromagnetic energy is reflected back to the surface. When the signal encounters a metal object, all of the incident energy is reflected. The reflected signals are received by the same transducer and are printed in cross-section form on a graphical recorder. Changes in subsurface reflection character on the GPR records can provide information regarding the location of USTs, sumps, buried debris, underground utilities, and variations in the shallow stratigraphy.

The GPR system typically used is a Geophysical Survey Systems, Inc. SIR-3000 Subsurface Interface Radar Systems equipped with a 400 megahertz (MHz) transducer. This transducer is near the center of the available frequency range and is used to provide high resolution at shallow depths.

**Data Analysis**

GPR records are examined to identify reflection patterns characteristic of USTs, utilities, and other buried debris. Typically, USTs are manifested by broad localized hyperbolic (upside-down "U" shape) reflection patterns that vary in intensity. The intensity of a reflection pattern is usually dependent upon the condition of the respective UST, its burial depth, and the type of fill over the UST. Utilities and other buried debris are typically manifested by narrow localized hyperbolic reflections that also vary in intensity.

**Limitations**

The ability to detect subsurface targets is dependent on site specific conditions. These conditions include depth of burial, the size or diameter of the target, the condition of the specific target in question, the type of backfill material associated with the target, and the surface conditions over the target. Under ideal conditions, the GPR can generally detect objects buried to approximately six feet. However, as the clay content in the subsurface increases, the GPR depth of detection decreases. Therefore, it is possible that on-site soil conditions and target features may limit the depth of detection to the upper one to two feet below ground surface.