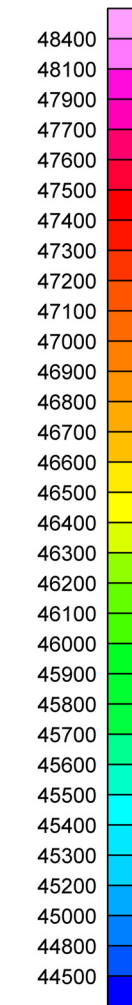


LEGEND

- SM Surface Metallic Object
- P Underground Pipe/Previous Building Footing
- B Small Buried Metallic Object
- A-1 Anomaly as Discussed in Report



Total Magnetic Field Intensity (nT)

Contour Interval: 100 nT



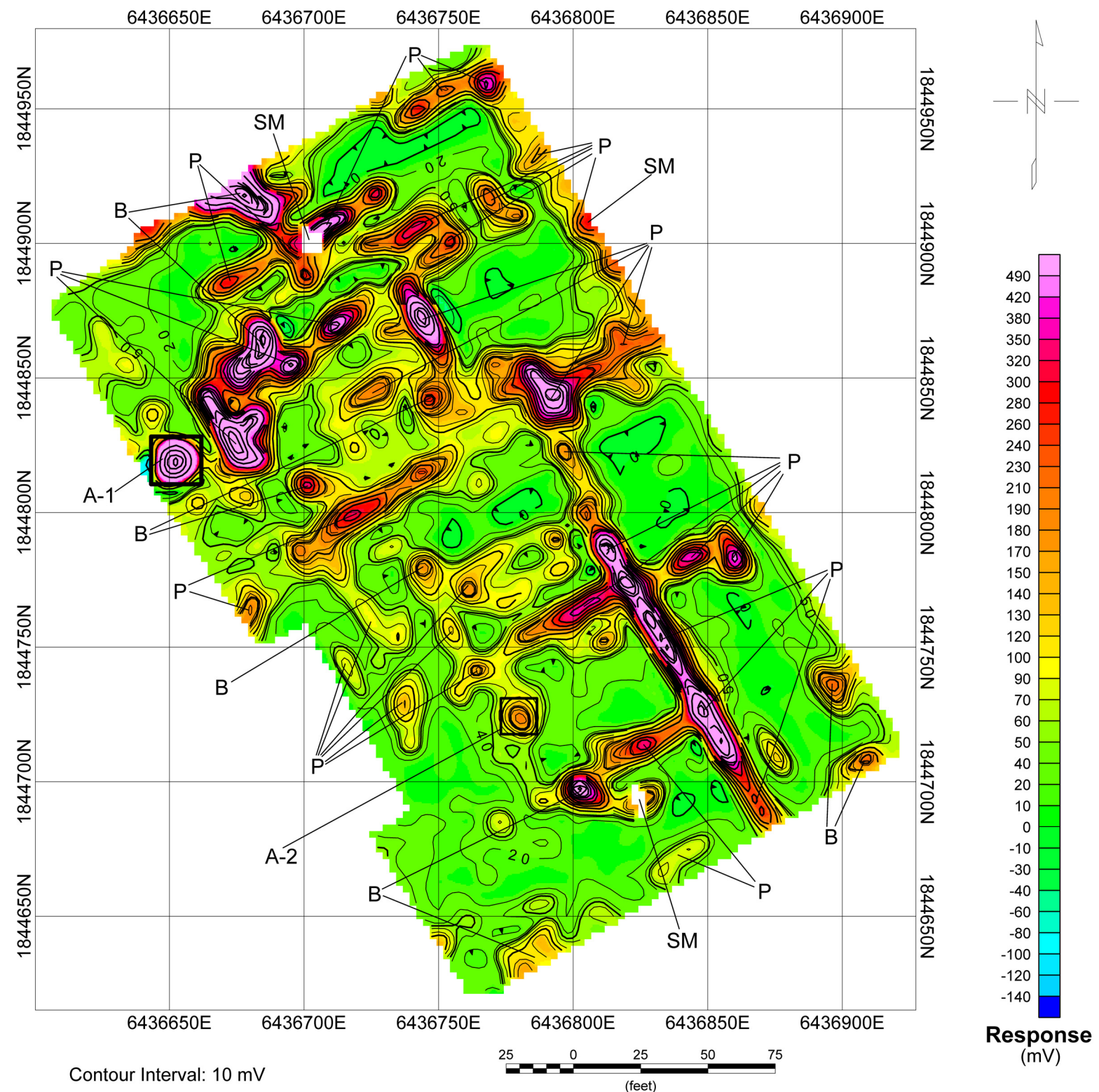
FIGURE 5

G-858 TOTAL MAGNETIC FIELD RESPONSE, LACROSSE FIELD PROJECT NO. 11065

BEVERLY HILLS HIGH SCHOOL
BEVERLY HILLS, CALIFORNIA

PREPARED FOR MACTEC ENGINEERING AND CONSULTING, INC.

Notes: 1. Coordinate System California State Plane, NAD83, Zone V (0405), US Survey Feet
2. Positions collected using a Trimble ProXRS GPS with OmniSTAR real-time, submeter differential corrections



LEGEND

- SM Surface Metallic Object
- P Underground Pipe/Previous Building Footing
- B Small Buried Metallic Object
- A-1 Anomaly as Discussed in Report

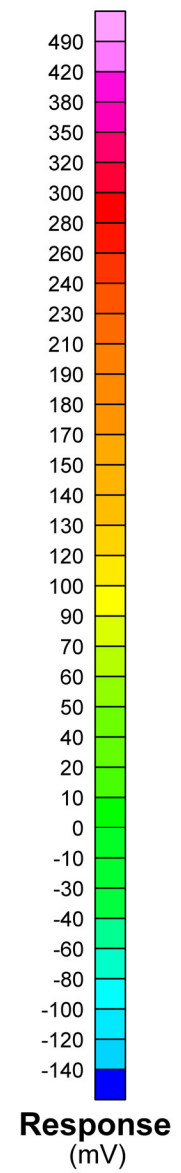


FIGURE 6

**EM-61 MK2A CHANNEL 3 RESPONSE, LACROSSE FIELD
PROJECT NO. 11065**

BEVERLY HILLS HIGH SCHOOL
BEVERLY HILLS, CALIFORNIA

PREPARED FOR MACTEC ENGINEERING AND CONSULTING, INC.



Notes: 1. Coordinate System California State Plane, NAD83, Zone V (0405), US Survey Feet
2. Positions collected using a Trimble ProXRS GPS with OmniSTAR real-time, submeter differential corrections

APPENDICES

GEOPHYSICAL TECHNIQUES FOR SHALLOW ENVIRONMENTAL INVESTIGATIONS



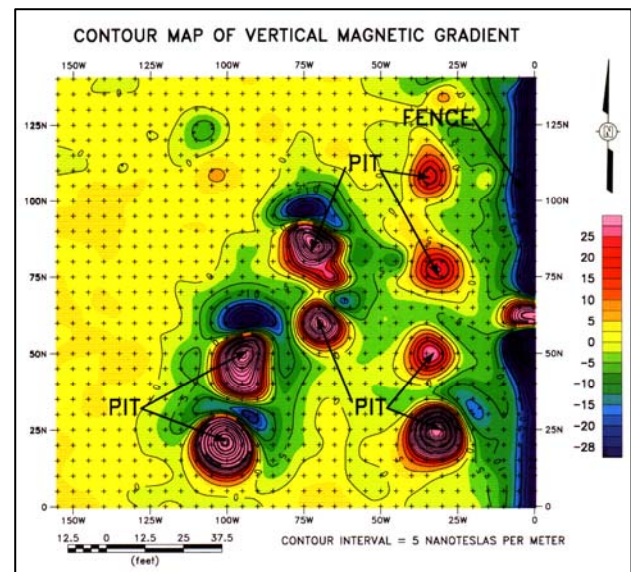
MAGNETIC METHOD

The magnetic method generally involves the measurement of the earth's magnetic field intensity or vertical gradient of the earth's magnetic field. Anomalies in the earth's magnetic field are caused by induced or remanent magnetism. Induced magnetic anomalies are the result of secondary magnetization induced in a ferrous body by the earth's magnetic field. The shape and amplitude of an induced magnetic anomaly is a function of the orientation, geometry, size, depth, and magnetic susceptibility of the body as well as the intensity and inclination of the earth's magnetic field in the survey area. The magnetic method is an effective way to search for small metallic objects, such as buried ordnance and drums, because magnetic anomalies have spatial dimensions much larger than those of the objects themselves. Typically, a single buried drum can be detected to a depth of about 10 feet. Larger metallic objects can often be located to greater depths. Induced magnetic anomalies over buried objects such as drums, pipes, tanks, and buried metallic debris generally exhibit an asymmetrical, south up/north down signature (positive response south of the object and negative response to the north).

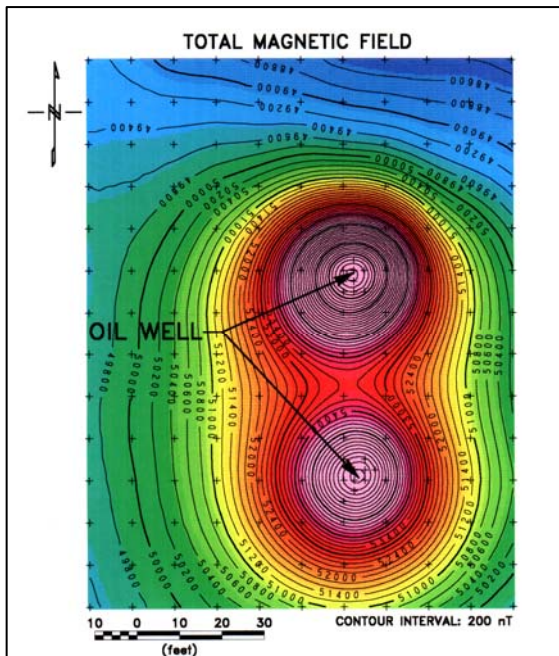
Magnetic data is typically acquired along a grid with results being presented as color-enhanced contour maps generated by the Geosoft™ Mapping System or OASIS montaj. The approximate location and depth of magnetic objects can be calculated using the Geosoft™ UXO System.



Geometrics G858 Cesium Magnetic Gradiometer



Magnetic Survey to Locate Pits Containing Buried Metallic Containers



Magnetic Survey to Locate Abandoned Oil Wells

Magnetic surveys are typically conducted to:

- Locate abandoned steel well casings
- Locate buried tanks and pipes
- Locate pits and trenches containing buried metallic debris
- Detect buried unexploded ordnance (UXO)
- Map old waste sites and landfill boundaries
- Clear drilling locations
- Map basement faults and geology
- Investigate archaeological sites

ELECTROMAGNETIC METHODS

Electromagnetic (EM) methods typically applied to shallow environmental investigations include frequency domain EM methods, such as EM induction and EM utility location methods, time domain electromagnetic (TDEM) metal detection methods, and ground penetrating radar (GPR) methods.

EM Induction Method

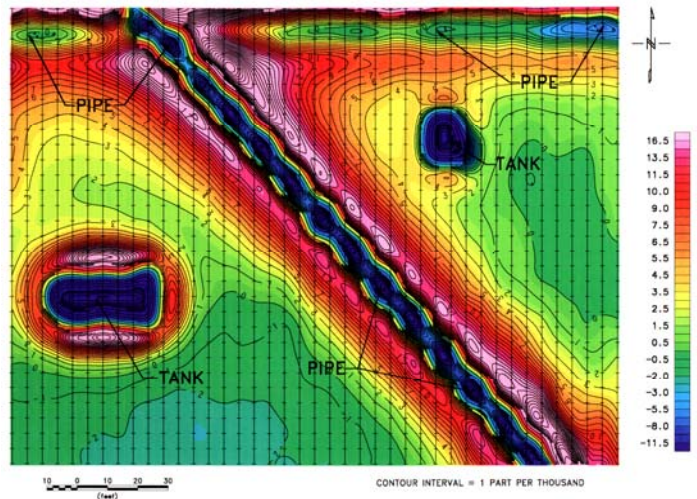
EM induction surveys are often conducted using the Geonics EM-31 terrain conductivity meter (EM-31). The EM-31 consists of a transmitter coil mounted at one end and a receiver coil mounted at the other end of a 3.7-meter long plastic boom. Electrical conductivity and in-phase component field strength are measured and stored along with line and station numbers in a digital data logger. In-phase component measurements generally only respond to buried metallic objects; whereas conductivity measurements also respond to conductivity variations caused by changes in soil type, moisture or salinity and the presence of nonmetallic bulk wastes. The EM-31 must pass over or immediately adjacent to a buried metallic object to detect it. Typical EM-31 anomalies over small, buried metallic objects consist of a negative response centered over the object and a lower amplitude positive response to the sides of the object. When the instrument boom is oriented parallel to long, linear conductors such as pipelines a strong positive response is observed. The EM-31 can explore to depths of about 6 meters, but is most sensitive to materials about 1 meter below ground surface. Single buried drums can typically be detected to depths of about 5 feet.

EM-31 surveys are typically conducted to:

- Locate buried tanks and pipes
- Locate pits and trenches containing metallic and/or nonmetallic debris
- Delineate landfill boundaries
- Delineate oil production sumps and mud pits
- Map conductive soil and groundwater contamination
- Map soil salinity in agricultural areas
- Characterize shallow subsurface hydrogeology
 - Map buried channel deposits
 - Locate sand and gravel deposits
 - Locate conductive fault and fracture zones



Geonics EM-31 Terrain Conductivity Meter



Geonics EM-31 Survey to Locate Underground Storage Tanks



EM Utility Location Methods

EM utility locators; such as the Metrotech 810, Metrotech 9890 and Radiodetection RD400, are designed to accurately trace metallic pipes and utility cables and clear drilling/excavation locations. These utility locators consist of a separate transmitter and a receiver. The transmitter emits a radio frequency EM field that induces secondary fields in nearby metallic pipes and cables. The receiver detects these fields and is used to accurately locate and trace the pipes, often to distances over 200 feet from the transmitter. Many of the utility locators have a passive 60Hz mode to locate live electrical lines. Modern utility locators are also capable of providing rough depth estimates of the pipes.

← **Metrotech EM Utility Locator**

TDEM Metal Detection Methods

A Geonics EM-61 (EM-61) is a high sensitivity, time-domain, digital metal detector which is often used to detect both ferrous and non-ferrous metallic objects. It is designed specifically to locate buried metallic objects such as drums, tanks, pipes, UXO, and metallic debris and to be relatively insensitive to above ground structures such as fences, buildings, and vehicles.

The EM-61 consists of two square, 1-meter coils, one mounted over the other and arranged on a hand-towed cart. The bottom coil acts as both a transmitter and receiver while the top coil is a receiver only. While transmitting the bottom coil generates a pulsed primary magnetic field, which induces eddy currents into nearby metallic objects. When the transmitter is in its off cycle both coils measure the decay of these eddy currents in millivolts (mV) with the results being stored in a digital data logger along with position information. The decay of the eddy currents is proportional to the size and depth of the metallic target. A symmetrical positive anomaly is recorded over metallic objects with the peak centered over the object.

The signal from the top coil is amplified in such a way that both coils record effectively the same response for a metallic object on the surface and the top coil records a larger response for buried metallic objects. The response of near surface objects can, therefore, be suppressed by subtracting the lower coil response from the upper coil response (differential response).

In practice, the usable depth of investigation of the EM-61 depends on the size and shape of the object and the amount of above ground interference encountered at the site. A single buried drum can often be detected at a depth of about 10 feet.

Geonics EM-61 Survey to Map Subsurface Infrastructure



GPR Methods

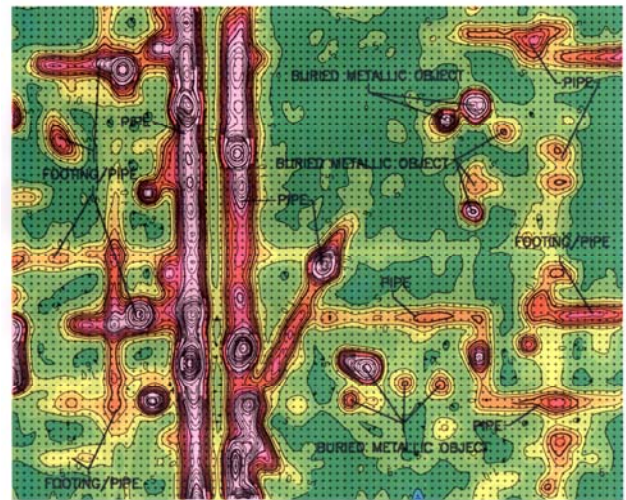
Ground-penetrating radar (GPR) is a high-frequency electromagnetic method commonly applied to a number of engineering and environmental problems.



GSSI SIR-10A GPR Unit



Geonics EM-61 Digital Metal Detector



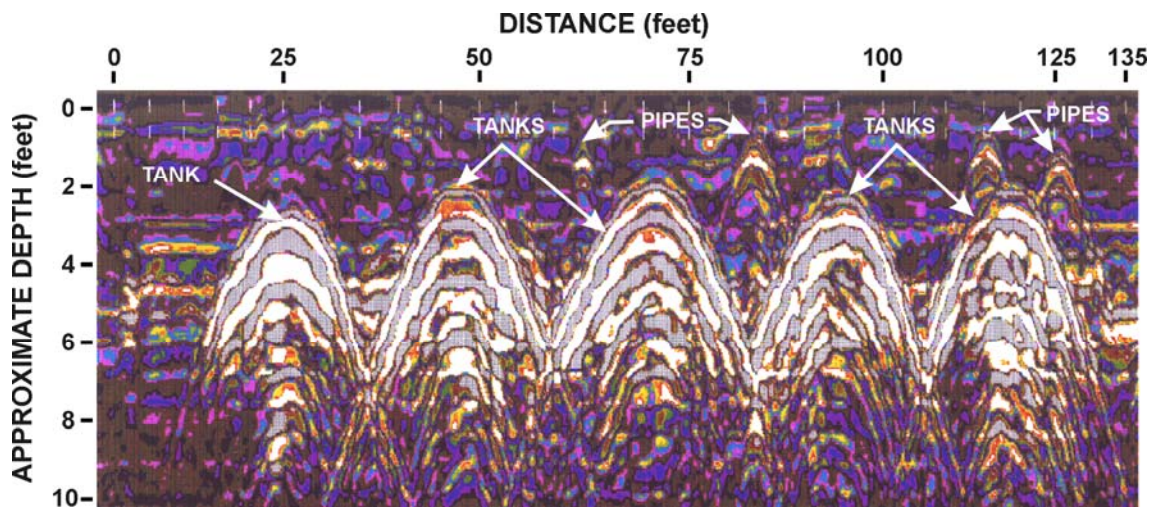
A GPR system radiates short pulses of high-frequency EM energy into the ground from a transmitting antenna. This EM wave propagates into the ground at a velocity that is primarily a function of the relative dielectric permittivity of subsurface materials. When this wave encounters the interface of two materials having different dielectric properties, a portion of the energy is reflected back to the surface, where it is detected by a receiver antenna and transmitted to a control unit for processing and display.

Depth penetration is a function of antenna frequency and the electrical conductivity of the soils in the survey area. Lower frequency antennas achieve greater depth penetration than higher frequency antennas, but have poorer spatial resolution. Conductive soils, such as clays, attenuate the radar waves much more rapidly than resistive dry sand and rock. In many environments in California, depth penetration of 500 and 300 MHz antennas is limited to 3 to 5 feet. Depth penetration may be greater if shallow soils consist of clean sands and less if shallow soils consist of clay.

GPR surveys are typically conducted to:

- Locate and delineate underground storage tanks (metallic and non-metallic)
- Locate metallic and nonmetallic pipes and utility cables
- Map rebar in concrete structures
- Map landfill boundaries
- Delineate pits and trenches containing metallic and nonmetallic debris
- Delineate leach fields and industrial cribs
- Delineate previously excavated and backfilled areas
- Map shallow groundwater tables
- Map shallow soil stratigraphy
- Map shallow bedrock topography
- Map shallow subsurface voids and cavities
- Characterize archaeological sites

Geophysical Survey Systems Inc. (GSSI) SIR-2 or SIR-10 GPR systems with antennas in the frequency range of 50 to 1,000 MHz are often used during GPR investigations. Mala Geoscience and Sensors and Software, Ltd also manufacture GPR systems. GPR data is processed using a variety of software including the RADAN™ or GRADIX software packages by GSSI and Interpex Ltd., respectively.



GPR Survey to Locate Underground Storage Tanks



June 9, 2011

Project Number 11065

Mr. Jay R. Neuhaus
MACTEC Engineering and Consulting, Inc.
2171 Campus Drive,
Irvine, CA 92612
(949) 224-0050

Subject: Geophysical Investigation at Northwest Corner of South Fairfax Avenue and Wilshire Boulevard, Los Angeles, California

Dear Mr. Neuhaus:

A geophysical survey was conducted May 31, 2011 at the above-mentioned property in Los Angeles, California. The purpose of the geophysical survey was to screen an approximate 65 by 160 ft area for a potential abandoned oil well. The site was an asphalt covered parking lot bounded by buildings to the west and east, a sidewalk adjacent to Wilshire Boulevard to the south, and survey bounds to the north. The geophysical method applied to this investigation consisted of the magnetic technique.

METHODOLOGY

The magnetometer used during this investigation consisted of a Geometrics G858 optically pumped cesium-vapor magnetometer (G858). This instrument measures the intensity of the earth's magnetic field in nanoteslas (nT) and, optionally, the vertical gradient of the earth's magnetic field in nanoteslas per meter (nT/m). Buried ferrous metallic objects give rise to anomalies in the earth's magnetic field. These anomalies are generally dipolar with a positive response south and a negative response north of the object. The dimensions and amplitude of a magnetic anomaly are a function of the size, mass, depth, and magnetic properties of the source. Magnetometers can typically locate an object the size of a 550-gallon tank to depths of about 10 feet providing background noise levels are not too high and the tank is not extensively corroded. Massive objects, like oil wells can be located to greater depths. The magnetometer data were collected on a 10 ft by 10 ft grid that was marked on the ground using spray chalk. The geophysical survey grid was later tied to the State Plane Coordinate System and is estimated to have an accuracy of about 2 feet. Obvious surface cultural features that could potentially affect the geophysical data (i.e. manhole covers, light poles, and other surface metallic objects) were identified in the field and surveyed using RTK GPS system. A site map,

transcribed from survey data, showing the location of the geophysical survey area, geophysical survey coordinate system, and surficial features is presented as Figure 1.

Measurements of the earth's total magnetic field intensity were made at 0.3-second intervals as the operator walked along parallel south to north (S-N) survey lines spaced 5 feet apart. A marker was inserted in the data as the operator crossed a 10 ft grid mark. The 0.3-second sampling interval resulted in an average station spacing of about 1 foot. The magnetic data were stored in the internal memory of the magnetometer along with time of measurement. Field magnetic data were downloaded to a laptop computer at the end of the magnetic survey.

Details on the magnetic method can be found in the attached technical note titled "Magnetic Method."

In addition to the Magnetic Method, the Fisher TW-6 deep-search metal detector was selected to compliment this method. The TW-6 is a frequency-domain, electromagnetic (EM) instrument. It operates at a frequency of 82 kHz, with a horizontal transmitter-receiver separation of about 3 feet. The Fisher is useful for locating pipes and buried metallic objects. An audible tone is generated when the instrument passes over a buried metallic object. It was used to locate utility lines or other metallic objects identified from the magnetic data.

RESULTS

A color-enhanced contour map of total magnetic field intensity is presented as Figure 2. The color bar indicates the amplitude of the total magnetic field intensity with the magenta and cyan colors representing high and low amplitudes, respectively. The light orange, yellow and light green colors indicate average "background" values of the measured quantity. Typical magnetic oil well response is shown in the attached Technical Note.

There are several anomalies caused by surface metallic objects such as manhole covers, a sign, and the adjacent buildings evident on the contour map of magnetic data. These anomalies are labeled as "SM" on the contour map. There is a linear anomaly interpreted as a segment of an abandoned pipe. This anomaly is labeled "P" on the contour map.

Anomaly A-1 is centered at approximately 12E, 125N. This anomaly is characterized by a high amplitude magnetic high. The measured values are over 10,000 nT above background values which is common for an oil well. However the anomaly is somewhat elongated in the N-S direction and is not as broad as the typical response from an oil well. The source of this anomaly is a combination of the massive manhole cover centered at 16E, 125N and the pipes in the associated vault.

Based on the magnetic data, there is no evidence of the presence of steel casing typical of an abandoned oil well in the accessible portions of the survey area.

If you have any questions concerning this investigation, please call us at 951-549-1234.

Sincerely,
GEO*Vision* Geophysical Services

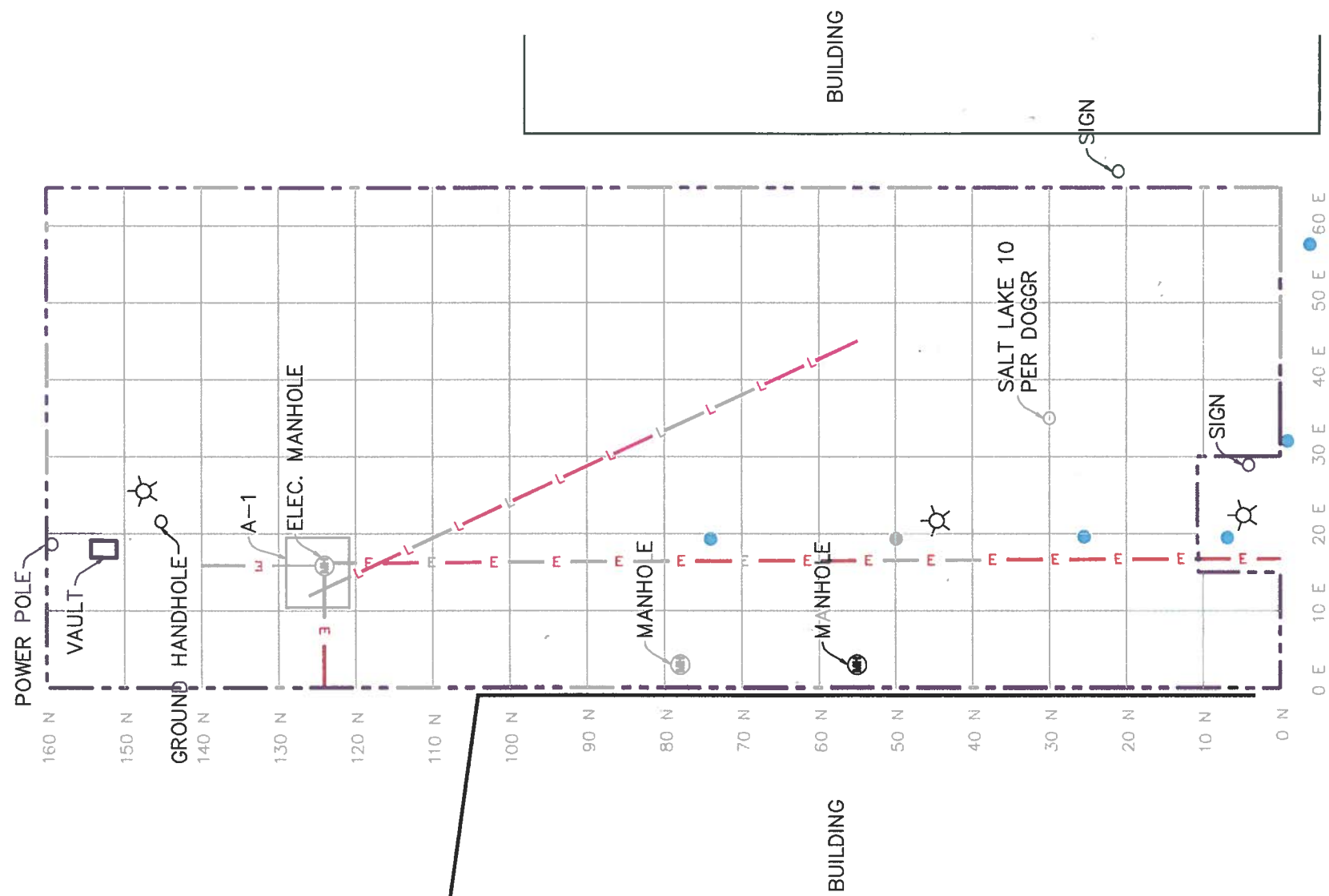
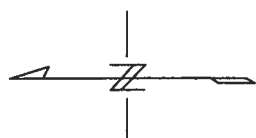
Submitted by:



Charles Carter P.GP
Senior Geophysicist

Attachments:

Figure 1 – Site Map with Geophysical Interpretation
Figure 2 – Total Magnetic Field Intensity
Technical Note – Magnetic Method



NOTE: All the geophysical methods have limitations dependent on instrumentation used, soil conditions, and local cultural noise and other interference. The interpretation of geophysical conditions presented above comprises a declaration of the geophysicist's professional judgment using methods and a degree of care and skill ordinarily exercised under similar circumstances, by reputable members of their profession practicing in the same or similar locality. It does not constitute a warranty or guarantee, expressed or implied, nor does it relieve any other party of its responsibility to abide by contract documents, applicable codes, standards, regulations or ordinances. If you require further information about the limitations of the instruments and/or methods used on this project please contact GEOVISION Geophysical Services.

LEGEND

--- BOUNDARY OF GEOPHYSICAL SURVEY AREA

E=--- E --- E=ELECTRIC

● =BOLLARD

--- L=--- L=UNKNOWN

☆ =STREET LIGHT

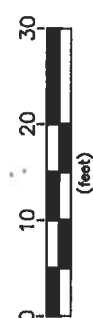


FIGURE 1
SITE MAP WITH GEOPHYSICAL INTERPRETATION

Project #	11065
Developed by	M RICHES Jun 09, 2011
Drawn by	S ORTEGA
Approved by	
	66.V11065\11065-1.dwg

PARKING LOT NW CORNER OF S. FAIRFAX AVE. AND WILSHIRE BLVD. LOS ANGELES, CALIFORNIA
PREPARED FOR MACTEC, INC.

MAGNETIC METHOD



The magnetic method involves the measurement of the earth's magnetic field intensity. Typically the total magnetic field and/or vertical magnetic gradient is measured. Measurements of the horizontal or vertical component or horizontal gradient of the magnetic field may also be made.

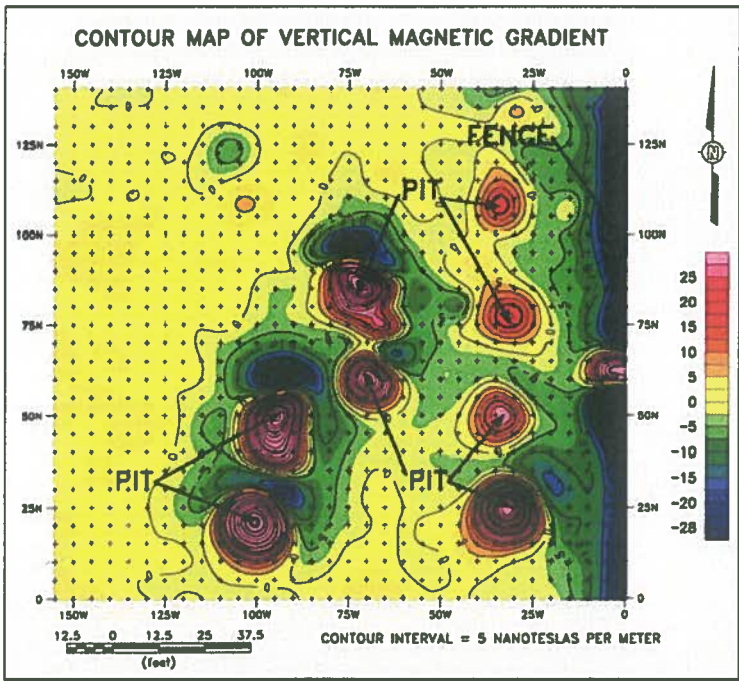
Anomalies in the earth's magnetic field are caused by induced or remanent magnetism. Induced magnetic anomalies are the result of secondary magnetization induced in a ferrous body by the earth's magnetic field. The shape, dimensions, and amplitude of an induced magnetic anomaly is a function of the orientation, geometry, size, depth, and magnetic susceptibility of the body as well as the intensity and inclination of the earth's magnetic field in the survey area. Buried ferrous metallic objects, such as pipes, drums, tanks, and debris generally give rise to dipolar anomalies with a positive response south and a negative response north of the object. The magnetic method is an effective way to search for small metallic objects because magnetic anomalies have spatial dimensions much larger than those of the objects. An oil well typically gives rise to a monopolar anomaly with a very high amplitude, positive peak several feet south of the well and a low amplitude, broad negative response to the north. The magnetic anomaly over a buried oil well often has a diameter of over 50 feet and amplitude of several thousand nanoteslas, depending on depth and casing characteristics. Magnetometers can typically locate an abandoned oil well to depths of over 20 feet providing that background noise levels are not too high and the well casing is not significantly corroded. Magnetometers are not able to detect nonferrous metals such as aluminum and brass.



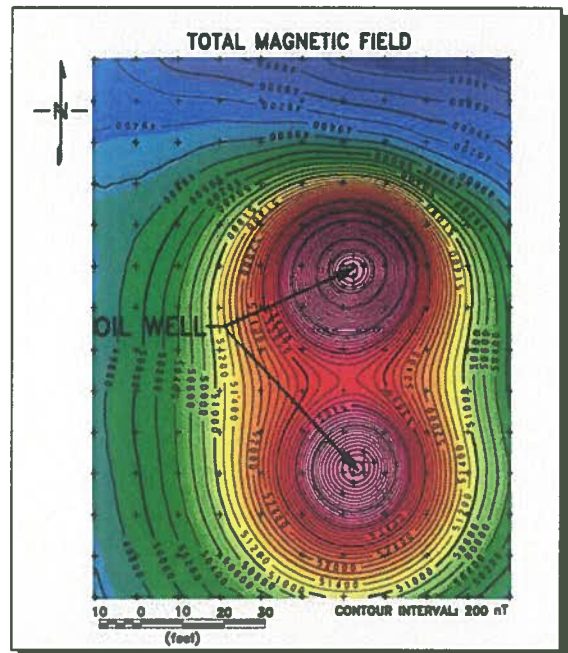
Geometrics G-858 Magnetometer

The magnetic method is typically used to:

- Locate abandoned steel well casings
- Locate buried tanks and pipes
- Locate pits and trenches containing buried metallic debris
- Detect buried unexploded ordnance (UXO)
- Map old waste sites and landfill boundaries
- Clear drilling locations
- Map basement faults and geology
- Investigate archaeological sites

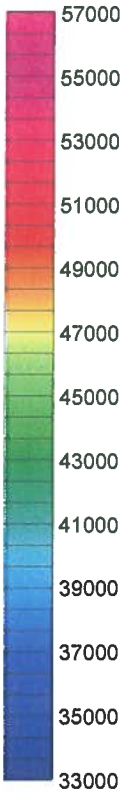


Magnetic Survey to Locate Pits Containing Buried Metallic Containers

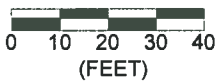


Magnetic Survey to Locate Abandoned Oil Wells

1151 Pomona Road, Unit P, Corona, California 92882, ph. 951-549-1234, fx. 951-549-1236, www.geovision.com



CONTOUR INTERVAL
Variable (nT)



LEGEND

20E, 20N RELATIVE COORDINATE SYSTEM
OF GEOPHYSICAL SURVEY

+ MAGNETIC SURVEY STATION

A-1 ANOMALY DISCUSSED IN
REPORT

P ANOMALY CAUSED BY
BURIED PIPE

SM ANOMALY CAUSED BY
SURFACE METAL

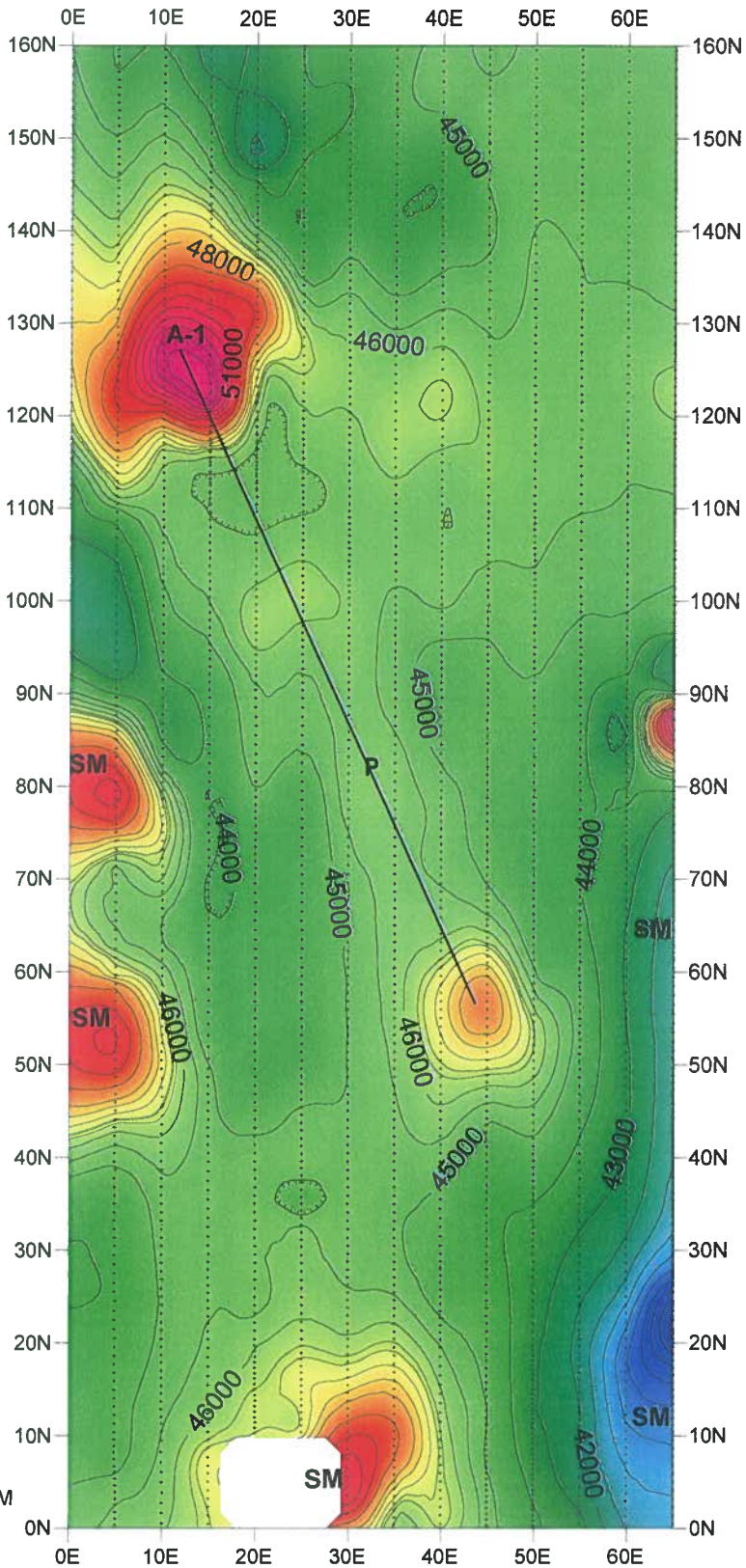


FIGURE 2 - CONTOUR MAP OF TOTAL
MAGNETIC FIELD INTENSITY

PARKING LOT
NW CORNER S. FAIRFAX AVE. & WILSHIRE BLVD.
LOS ANGELES, CALIFORNIA

Project No.
11065

Date
05-31-11

Developed by: Chuck Carter

PREPARED FOR MACTEC, INC.



**REPORT
GEOPHYSICAL INVESTIGATION**

**Geophysical Survey for the
MTA Westside Extension
Santa Monica, California**

GEO Vision Project No. 11065-2

Prepared for:

(Amec) MACTEC Engineering and Consulting, Inc.
2171 Campus Drive
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Prepared by:

GEO Vision Geophysical Services, Inc.
1124 Olympic Drive
Corona, CA 92881
(951) 549-1234

Report 11065-002

July 13, 2011

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2	GEOPHYSICAL TECHNIQUES	2
2.1	Magnetic Method	2
3	FIELD PROCEDURES	4
3.1	Site Preparation	4
3.2	Geometrics G-858 Survey	4
4	DATA PROCESSING AND INTERPRETATION	6
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FIGURE 4	COLOR CONTOUR MAP OF TOTAL MAGNETIC FIELD RESPONSE, NE CORNER OF CONSTELLATION BLVD AND AVE OF THE STARS

APPENDIX A MAGNETIC METHOD

1 INTRODUCTION

A geophysical investigation was conducted on June 30th and July 1st, 2011, for MACTEC Engineering and Consulting, Inc. (now Amec) in Santa Monica, California. The purpose of the investigation was to locate any existing abandoned oil wells in the alignment right of way of the MTA Westside Extension at two locations in Santa Monica: the Bodies in Motion Parking Structure (Figure 1) and the lot located NE of Constellation Blvd and Ave of the Stars (Figure 3). A previous survey was conducted at the Beverly Hills High School and was submitted as **GEOVision** Report 11065-001.

The area surveyed in the Bodies in Motion parking structure consisted of asphalt over concrete floors with reinforced concrete ceilings. The area also consisted of parking stops, metallic debris and a debris/grass planter on the eastern side of the structure (Figure 1). The area survey NE of Constellation Blvd and Ave of the Stars consisted of a concrete sidewalk with desert landscaping and a chain link fence surrounding a former structure. The area of the former structure still contained an old road, railings, high walls and demolition debris. Long grass with flooded sections were located in the northern section of the lot. Areas with standing water limited data collection to the north side of the area, but were also outside the designated survey area and proposed right of way alignment (Figure 3).

The geophysical technique used during this investigation was the magnetic method. The magnetic method is the most commonly used geophysical technique for locating abandoned oil wells because the magnetic anomalies associated with oil wells have very high amplitudes, large spatial dimensions and a different signature from many other types of buried metallic objects.

The geophysical technique used during the investigation is discussed in Section 2. Field procedures are described in Section 3. Data processing and interpretation are discussed in Section 4. The results of the geophysical survey are presented in Section 5 and our professional certification is presented in Section 6.

2 GEOPHYSICAL TECHNIQUES

This section presents background information on the magnetic method used during this investigation. A description of the geophysical method used during this investigation, common applications of the method, photographs of the instrument and example applications are included in Appendix A.

2.1 *Magnetic Method*

The magnetometer used during this investigation consisted of a Geometrics G-858 optically pumped cesium-vapor magnetometer (G-858). This instrument measures the intensity of the earth's magnetic field in nanoteslas (nT) and, optionally, the vertical gradient of the earth's magnetic field in nanoteslas per meter (nT/m). The vertical magnetic gradient is calculated by measuring the total magnetic field with two sensors at different heights, subtracting the top sensor reading from the bottom sensor reading and dividing by the sensor separation. The vertical magnetic gradient has better lateral resolution than total magnetic field measurements and is less sensitive to deep (e.g. geologic) structure.

The earth's magnetic field is believed to originate in convection currents in the earth's liquid outer core. The magnetic field varies in intensity from about 25,000 nT at the equator, where it is parallel to the earth's surface, to about 70,000 nT at the poles where it is perpendicular to the earth's surface. The intensity of the earth's magnetic field in North America varies from about 48,000 to 60,000 nT, and has an associated inclination that varies from about 60 to 75 degrees.

The earth's magnetic field undergoes low-frequency diurnal variations (drift) caused by the earth's rotation. The magnetic field can also undergo short-period, high-amplitude variations during periods of sunspot activity called magnetic storms. Often magnetic field intensity can be so variable during a magnetic storm that meaningful magnetic data cannot be acquired. When necessary to correct for magnetic drift, a base station magnetometer is set up in a quiet portion of the site and programmed to record total magnetic field intensity at fixed increments (i.e. 5-second intervals) throughout the day. This base station data is then used to remove the effects of drift from the field data. In small survey areas, where the data is acquired over a small amount of time and the anomalies have large amplitudes, correction for magnetic drift is not necessary.

Buried ferromagnetic objects give rise to local perturbations (anomalies) in the earth's magnetic field. There are two types of magnetic anomalies: an anomaly induced in an object or rock by the earth's magnetic field (induced magnetic anomaly) and an anomaly associated with remnant or permanent magnetism. In North America, the induced magnetic anomaly associated with an oil well consists of a very high amplitude, positive magnetic anomaly with the maximum response (peak) about 1- foot, or more, south of the well. In very rare cases, the conductor casing or oil well casing may have a permanent magnetism in the opposite direction of the earth's magnetic field, which, therefore subtracts from the induced magnetic field. If the permanent magnetic field associated with the well casing is stronger than the induced magnetic field then a negative magnetic anomaly may result. These cases have been

observed and documented on very few sites previously by **GEOVision** and such wells can be difficult to detect, especially in the presence of other subsurface infrastructure, due to the atypical nature of the magnetic response. Other buried ferrous metallic objects; such as pipes, drums, tanks and debris, generally give rise to dipolar anomalies with a positive response south of the object and a negative response north of the object. The dimensions and amplitude of a magnetic anomaly are a function of the size, mass, depth and magnetic properties of the source. The magnetic anomaly over a buried oil well often has a diameter of over 50 feet and amplitude of several thousand nanoteslas above background, depending on depth and casing characteristics. A magnetometer can typically locate an abandoned oil well to a depth of over 20 feet providing background noise levels are not too high and the well casing is not significantly corroded. Magnetometers are not able to detect nonferrous metals such as aluminum or brass.

Typical applications of the magnetic method include:

- Locating pits and trenches containing ferrous metallic debris
- Locating buried drums, tanks and pipes
- Delineating boundaries of landfills containing ferrous debris
- Locating abandoned steel well casing
- Detecting unexploded ordnance
- Mapping basement faults and geology
- Mapping archeological sites

Some advantages of magnetic surveys are:

- Rapid – modern instruments can acquire up to 10 readings per second as the operator walks down survey lines
- Depth of investigation – magnetometers can often locate buried ferrous metallic objects to greater depths than other methods
- Anomalies are much larger than the source allowing for larger line spacing in some situations

Some limitations of the magnetic surveys are:

- Unable to detect non-ferrous metals such as aluminum or brass
- Magnetic anomalies may be asymmetrical and much larger than the source and it can, therefore, be difficult to determine the precise locations and size of the source
- Ineffective in areas having extensive metallic debris at the surface, as no distinction can be made between anomalies caused by surface and buried debris
- Metallic structures such as buildings, fences, reinforced concrete and light posts interfere with the measurements
- High voltage power lines can often strongly interfere with the measurements
- Data can be very noisy in areas containing volcanic rock, specifically basalt

3 FIELD PROCEDURES

This section describes the field procedures used during the investigation, including site preparation and the magnetometer survey procedures.

3.1 Site Preparation

Bodies in Motion Parking Structure

MACTEC Engineering and Consulting, Inc. (now Amec) was unable to locate the suspected well location of “Wolfskill” 23 within the structure. The survey was conducted to cover the first floor of the parking structure, the alleyway on the eastern side of the structure and part of the road entering the structure. The area was visually inspected for anything that may interfere with the survey and, if possible, it was removed from the survey area. Afterwards, a 5- by 5-foot grid was marked on the ground within the survey area using surveyor paint and a 300 ft survey rope. The geophysical survey grid was not tied to the State Plane Coordinate System and is estimated to have an accuracy of about 2 feet. Obvious surface cultural features that could potentially affect the geophysical data (i.e. parking stops, cleanouts, etc.) were identified in the field and plotted onto a scaled, hand-drawn site map. A site map, transcribed from the hand-drawn site map showing the location of the geophysical survey area and surficial features is presented as Figure 1. A color contour map showing surface metallic objects and the geophysical anomalies is presented as Figure 2.

Area Northeast of Constellation Blvd and Ave of the Stars

Before conducting the geophysical investigation, the three of the suspected well locations in area were marked by GEOVision and a representative from MACTEC Engineering and Consulting, Inc. (now Amec). The magnetometer was used in conjunction with a Trimble ProXRS GPS system with OmniSTAR real-time, submeter differential corrections as discussed below. GPS data were collected in the geodetic coordinate system and then converted to California State Plane, NAD83, Zone V (0405) in US Survey Feet during data processing. Data were not collected in areas where there were surface obstructions or other limiting features, such as standing water or where the GPS did not have sufficient satellite coverage. Obvious surface cultural features that could potentially affect the geophysical data (e.g. vaults, walls and other surface metallic objects) were identified in the field and their positions recorded using the submeter GPS system. A site map, showing the extents of the geophysical survey, geophysical anomalies and an aerial photo of the site is presented as Figure 3. A color contour map showing surface metallic objects and the geophysical anomalies is presented as Figure 4.

3.2 Geometrics G-858 Survey

Gridded Survey

Prior to data acquisition, the G858 was programmed with the appropriate sampling interval and grid settings. Measurements of the earth's total magnetic field intensity and vertical gradient data were made with the G-858 at 0.2-second intervals as the operator walked along parallel south to north (S-N) survey lines spaced 5 feet apart. A marker was inserted in the

data as the operator crossed a 5 ft grid mark. The 0.2-second sampling interval resulted in an average station spacing of about 0.5 feet. The magnetic data were stored in the internal memory of the magnetometer along with time of measurement. If an error was made on a survey line (wrong survey line, etc.), the line was repeated. Magnetic data were downloaded to a laptop computer at the end of the survey using the program MAGMAP 2000 by Geometrics, Inc.

GPS Based Survey

Prior to data acquisition, the G-858 was programmed with the appropriate sampling interval and GPS input settings. Measurements of the earth's total magnetic field and vertical magnetic gradient were made in accessible areas at 0.2-second intervals as the operator walked along approximately south to north (S-N) survey lines nominally spaced 7.5 feet apart. A Trimble ProXRS GPS system with OmniSTAR differential corrections was used for spatial control. Real-time submeter corrections were input every second into the data collector of the magnetometer using a serial cable and a GGA NMEA stream GPS output. The magnetic data were stored in the internal memory of the magnetometer, along with GPS statistics and location data. If a location error was made on a survey line (large data gap, etc.) the line was repeated to attain desired coverage. Magnetic data were downloaded to a laptop computer at the end of the survey using the program MAGMAP 2000 by Geometrics, Inc.

4 DATA PROCESSING AND INTERPRETATION

This section presents the data processing procedures and interpretation of the geophysical data.

4.1 Data Processing

Color-enhanced contour maps of the magnetic data were generated using the GEOSOFT® Oasis montaj™ geophysical mapping system. The maps were color-enhanced to aid in the interpretation of subtle anomalies. Prior to map generation, a number of preprocessing steps were completed and included:

- Backup of all original field data files to computer.
- Correcting of all data acquisition errors (typically removing null data and erroneous GPS points, if applicable).
- Reformatting field data files to free format XYZ files containing at a minimum GPS time and field measurements.
- Merging GPS position data and geophysical data using commercial and in-house software, if applicable.
- Merging of multiple data files into a single file and sorting, if necessary.
- Converting of data files to State Plane northings and eastings, if applicable.

These data adjustments were made using commercial software. All adjustments made to data files and resulting file names were documented and are retained in project files. The outputs of the data preprocessing were data files containing the various data measurements. The magnetic data file contained total field and vertical gradient response.

Data processing steps included the following:

- Reformatting of data files to GEOSOFT® format.
- Generating final map scale.
- Gridding data using down- and cross-line splines or minimum curvature.
- Masking grid in areas where data not acquired (i.e. around site perimeter or building).
- Applying Hanning filter to smooth the data, as necessary.
- Generating color zone file describing color for different data ranges.
- Contouring the data.
- Generating map surrounds (title block, legend, scale, color bar, north arrow, etc.).
- Annotating anomalies.
- Merging various plot files and plotting final map.

The names of the files generated and the processing parameters used were documented and are retained in project files. All files generated during the processing sequence were archived on a backup drive.

4.2 Interpretation

Color-enhanced contour maps of the total magnetic field response generated for each area (the Bodies in Motion Parking Structure and the lot NE of Constellation Blvd and Ave of the Stars) are presented as Figures 2 and 4, respectively. The coordinates shown on the color-enhanced contour map of total magnetic field response of the Bodies in Motion parking structure (Figure 2) reference the relative geophysical grid are not tied to the State Plane coordinate system. The coordinates shown on the total magnetic field color-enhanced contour map for the lot NE of Constellation Blvd and Ave of the Stars reference the California State Plane 1983, NAD83, Zone V (0405) coordinate system, in US Survey Feet. Color-enhanced contour maps of the magnetic vertical gradient data were also generated but are not presented as they did not reveal additional information and were, therefore, considered redundant. The color bar indicates the amplitude of the measured quantity with the magenta and cyan colors representing high and low amplitudes, respectively. The light orange, yellow and light green colors indicate average "background" values of the measured quantity.

An example magnetic anomaly from an oil well is presented in Appendix A. The typical magnetic anomaly characteristics of an oil well are: a monopolar response (large positive peak with only a minor negative response to the north); a large diameter anomaly (50 to 100 ft typical) and a large amplitude for shallow wells. However, in very rare cases, a monopolar, magnetic low have been observed for an oil well response. In these cases, the permanent magnetic field of the oil well casing is stronger than the induced magnetic field and a magnetic low is observed.

4.2.1 Bodies in Motion Parking Structure

The color-enhanced contour map of the total magnetic field response is presented as Figure 2. No abandoned oil well anomalies are interpreted in the magnetic data. The site consisted of a multi-story parking structure with reinforced concrete, parking stops and other metallic debris. Typically, an area with both reinforcement in the floor and ceiling will have a severe impact on the ability of the magnetometer to resolve subsurface structures. However, a very strong anomaly, such as one for a shallow (within 5 ft depth) oil well, may be able to be imaged regardless of the significant surrounding infrastructure. Only one sizable anomaly was interpreted in the magnetic data. The anomaly is linear in nature and is located approximately 81E, 63N to 130E, 55N. There are two cleanouts in the area that may be related to this anomaly and is suspected to be a subsurface utility or other subsurface linear structure. There is no anomaly in the magnetic data that bears the typical response of a steel-cased, abandoned oil well. However, it cannot be fully discounted that the significant metallic structures may be masking any magnetic response of a steel-cased, abandoned oil well in area.

4.2.2 Lot NE of Constellation Blvd and Ave of the Stars

The color-enhanced contour map of the total magnetic field response is presented as Figure 4. Using the coordinates in the DOGGR online database, three wells were suspected to be in the right of way of the proposed subway extension. For reference, the additional, suspected well locations in the same area, were also included on both the site map (Figure 3) and the

total magnetic field response contour map (Figure 4). Several abandoned oil wells were located in the magnetic data. Anomalies were also observed to the north of the survey area and therefore, the survey area was extended in an attempt to characterize the additional anomalies. The survey was not continued north of the original survey area where there were surface obstructions, such as standing water. No attempt was made to differentiate each individual well anomaly, since the wells were located in close proximity to one another and the well bank was outside of the proposed subway right of way. Using the total magnetic field response (Figure 4) and the vertical gradient response (not presented), three areas of abandoned oil well locations were interpreted. Additional abandoned oil wells part of the same bank, may be located north of the survey area. The area located on the northeast corner of Constellation Blvd and Ave of the Stars is considered to be the area of most concern. According to the DOGGR online database, three abandoned oil wells (API No. 03716548, 03716549 and 03716453) may be located in the proposed subway right of way. However, only one anomaly was interpreted in that area and is likely related to large utility vaults. This anomaly does not bear the typical response of one or more steel-cased abandoned oil wells.

5 CONCLUSIONS

A geophysical survey was conducted at the Bodies in Motion Parking Structure and at a lot northeast of Constellation Blvd and Ave of the Stars. The purpose of the survey was to screen both areas for suspected abandoned, steel-cased oil wells in the alignment right of way of the MTA Westside Extension.

Abandoned oil well, “Wolfskill” 23 was suspected to be located in the vicinity of the Bodies in Motion Parking Garage (Figure 1). A suspect location of “Wolfskill” 23 could not be marked out preceding the geophysical survey. The first floor of the parking structure, part of the alley east of the structure and part of the asphalt road west of the structure were included in the survey. No well-like anomalies were interpreted in the geophysical data for the Bodies in Motion Parking Garage (Figure 2). However, there was significant interference from the existing structure that may have masked a typical oil well response. Regardless, a shallow (5 ft deep) oil well within the survey area is expected to present with an interpretable response, even within the parking structure, as surveyed.

Three abandoned oil wells on the northeast corner of Constellation Blvd and Ave of the Stars were suspected to be located in the proposed right of way for the subway extension (Figure 3). These three wells were part of a larger bank of wells in the area. Several oil well anomalies were interpreted in the geophysical section for the area. However, there were no significant well-like anomalies located in the proposed right of way of the subway extension. No attempt was made to further characterize each well located, as the wells were outside the area of interest.

The geophysical survey was designed to map abandoned wells with ferrous metallic pipe in the upper 10 feet. It is our opinion that the geophysical survey was appropriately designed to locate such objects less than about 15 feet deep; except in portions of the survey area where data were affected by surface structures, such as reinforced concrete, utility corridors, obstructing foliage and other large surface metallic objects.

6 CERTIFICATION

All geophysical data, analysis, interpretations, conclusions and recommendations in this document have been prepared under the supervision of and reviewed by a **GEOVision** California Professional Geophysicist.

Prepared by



07/13/11

William Dalrymple
Sr. Project Geophysicist
GEOVision Geophysical Services

Date

Reviewed and approved by



07/13/11

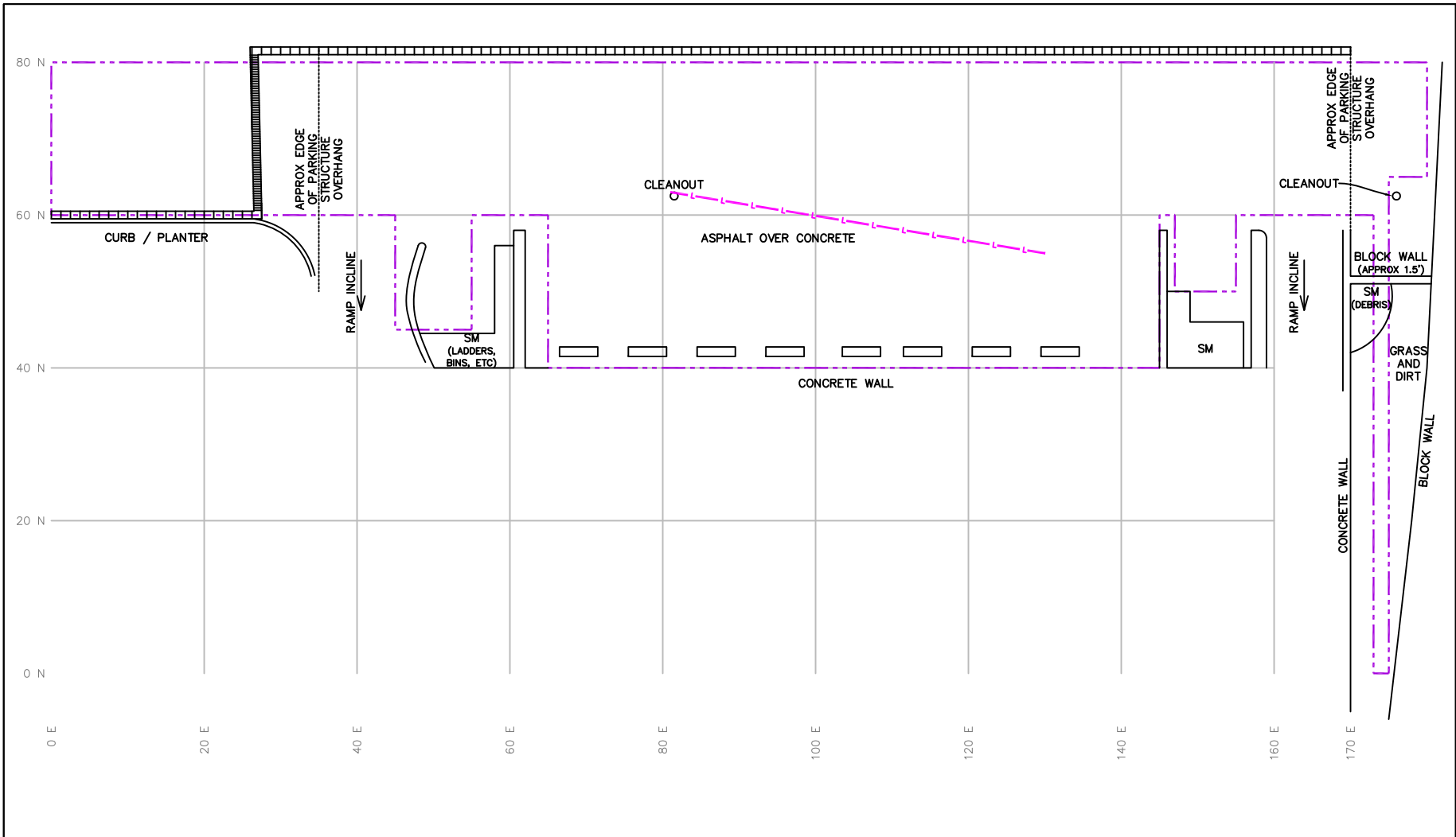
Antony Martin
California Professional Geophysicist, P.GP 989
GEOVision Geophysical Services

Date

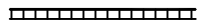
- * This geophysical investigation was conducted under the supervision of a California Professional Geophysicist using industry standard methods and equipment. A high degree of professionalism was maintained during all aspects of the project from the field investigation and data acquisition, through data processing interpretation and reporting. All original field data files, field notes and observations, and other pertinent information are maintained in the project files and are available for the client to review for a period of at least one year.

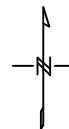
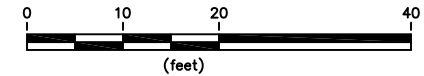
A professional geophysicist's certification of interpreted geophysical conditions comprises a declaration of his/her professional judgment. It does not constitute a warranty or guarantee, expressed or implied, nor does it relieve any other party of its responsibility to abide by contract documents, applicable codes, standards, regulations or ordinances.

FIGURES



Legend

- - - - - APPROXIMATE BOUNDARY OF GEOPHYSICAL SURVEY AREA
- 0 N , 0 E RELATIVE COORDINATE SYSTEM OF GEOPHYSICAL SURVEY AREA
-  STORM DRAIN GRATE
- - - - - UNDERGROUND CONDUIT (UNKNOWN TYPE)

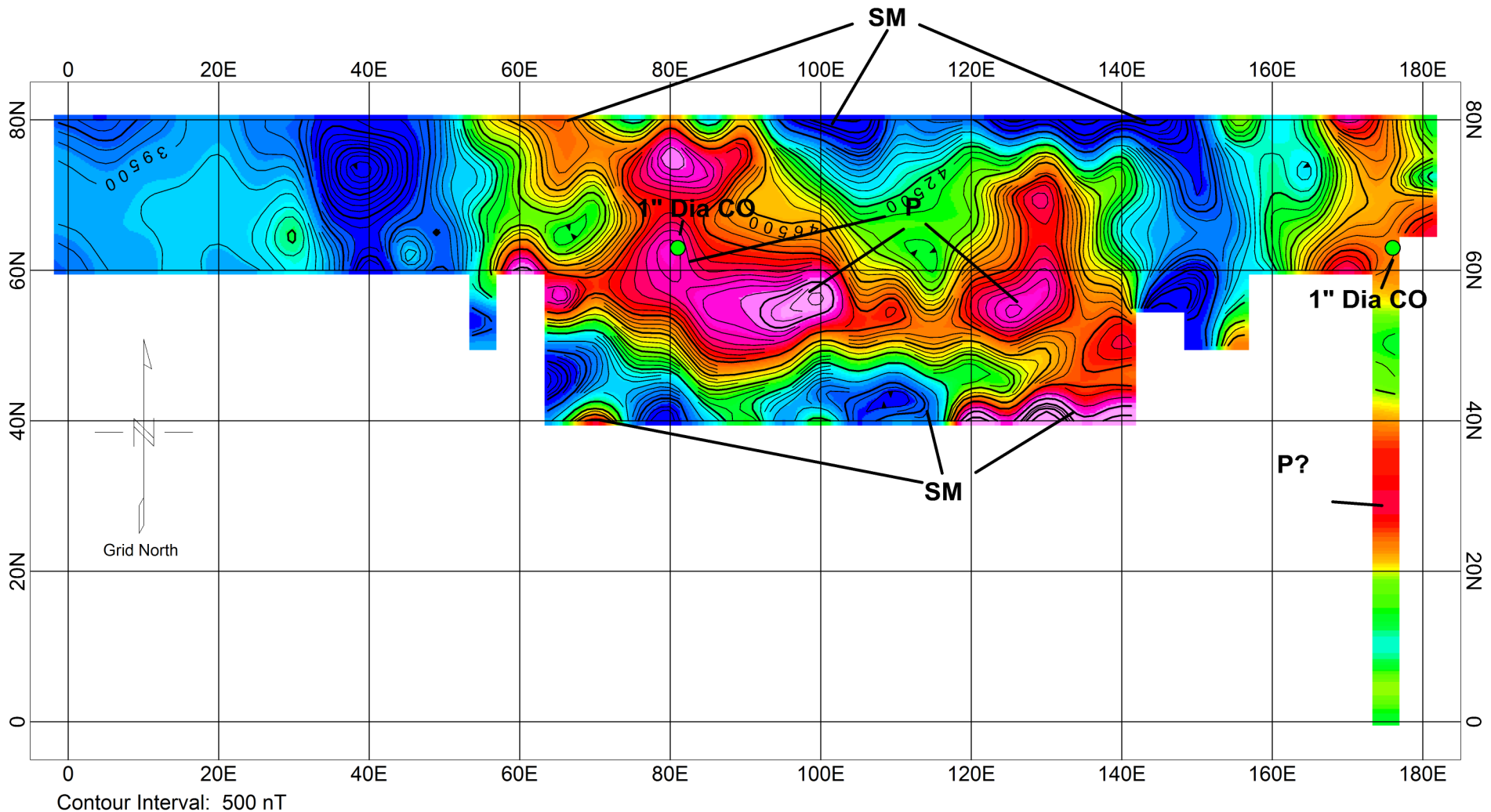


GEOS <i>VISION</i>	
Date:	Jul 13, 2011
Project No.:	11065
Developed by:	W Dalrymple
Drawn by:	T Rodriguez
Approved by:	V Gonzalez
File:	11065-2-1.dwg

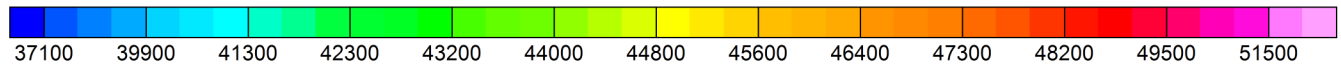
FIGURE 1
SITE MAP WITH
GEOPHYSICAL INTERPRETATION

CONSTELLATION / CENTURY PARK EAST
BODIES IN MOTION PARKING GARAGE
SANTA MONICA, CA

PREPARED FOR
(AMEC) MACTEC
ENGINEERING AND CONSULTING, INC.



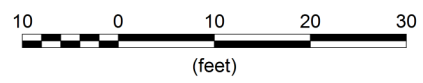
Contour Interval: 500 nT



Total Magnetic Field Response
(nT)

LEGEND

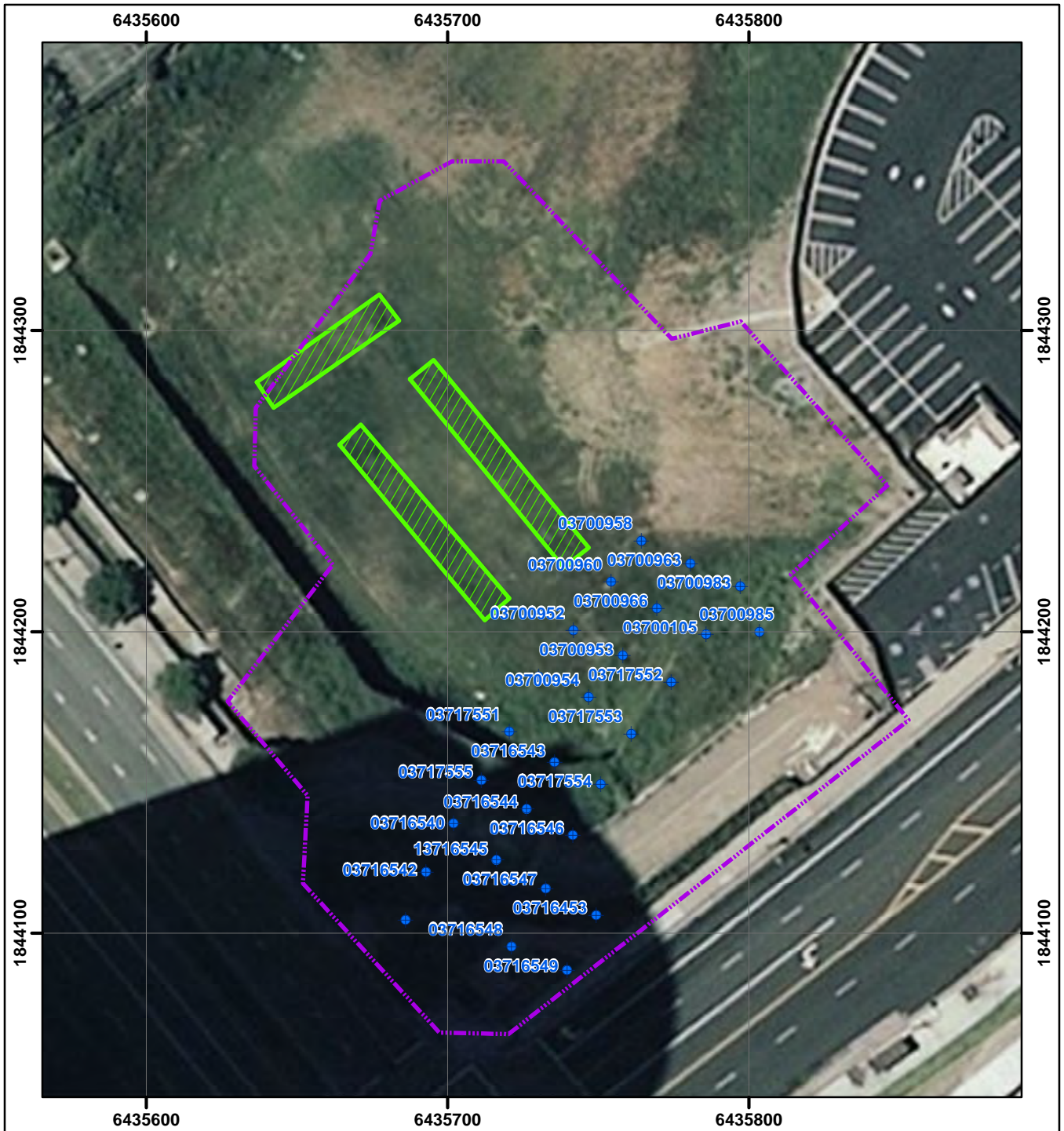
- SM** Surface Metallic Object
- P** Interpreted Underground Utility/Pipe or other Linear Feature



Note: A DOGGR well location was not marked preceding this survey.

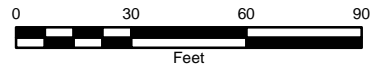
Project No. 11065

	Figure 2
	Bodies in Motion Parking Garage Total Magnetic Field Data
	Near Constellation Blvd and Century Park E Santa Monica, California
	Prepared for Amec Mactec



Legend

- - - Approximate Boundary of Geophysical Survey Area
- ◆ DOGGR Oil Well Location with API No.
- Possible Oil Well Locations



NOTES:

1. CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83 ZONE V (0405) US FEET
2. Image Source: ESRI, i-cubed, USDA FSA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGP

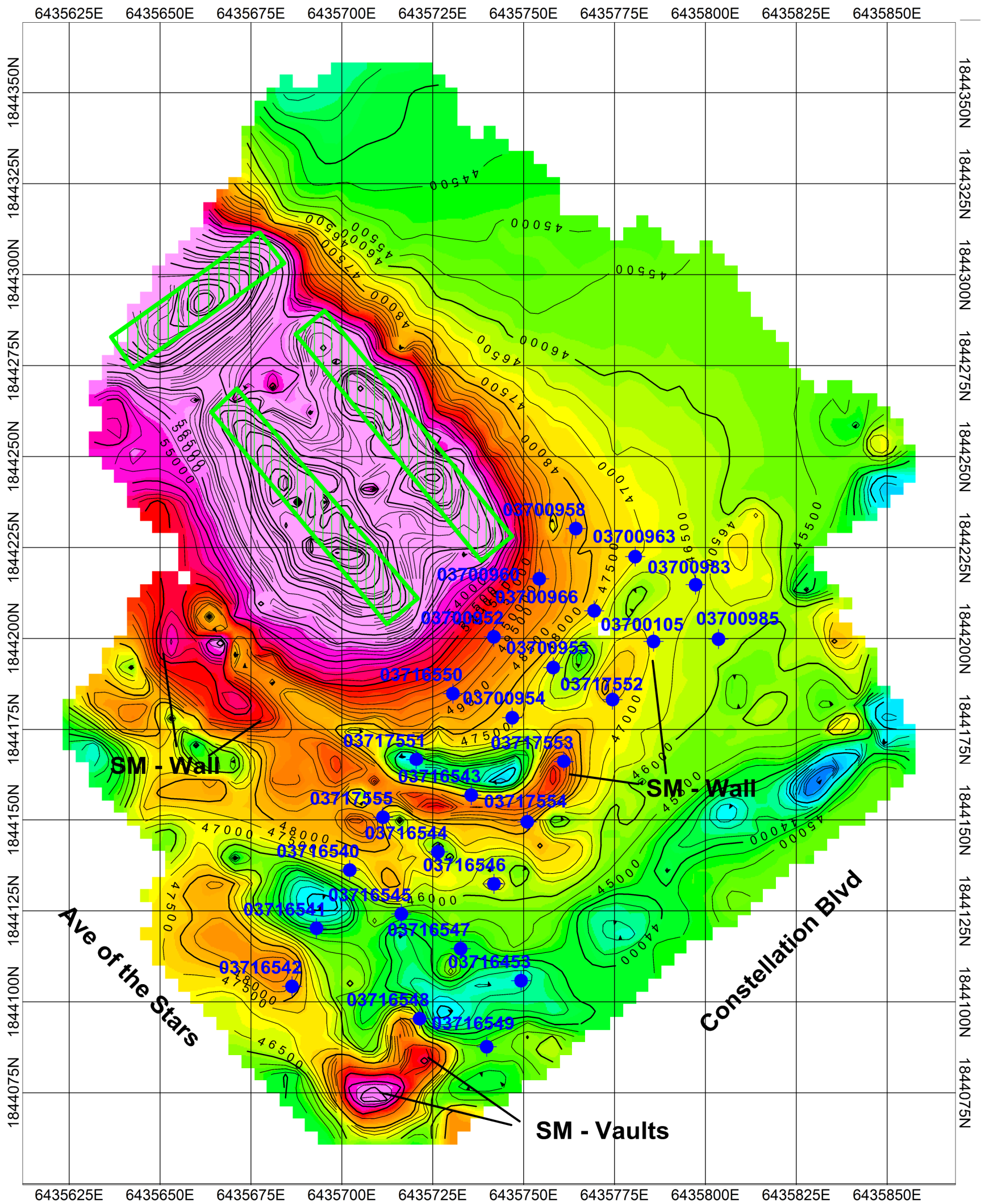


Date:	7/14/2011
GV Project:	11065-2
Developed by:	W Dalrymple
Drawn by:	T Rodriguez
Approved by:	V Gonzalez
File Name:	11065-2-3.MXD

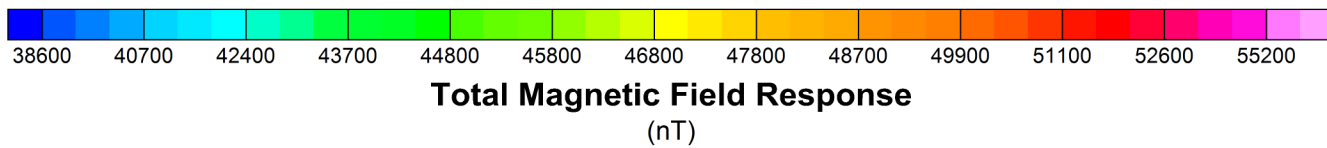
**FIGURE 3
SITE MAP**

**CONSTELLATION / AVE OF THE STARS
SANTA MONICA, CA**



**PREPARED FOR
(AMEC) MACTEC
ENGINEERING AND CONSULTING, INC.**

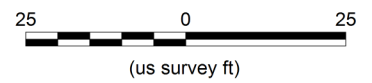


Contour Interval: 500 nT




LEGEND

- SM** Surface Metallic Object / Structure
-  Possible Oil Well Locations
-  DOGGR Oil Well Location with API No.



GV Project No. 11065

- Notes:
1. Coordinates in California State Plane, NAD83 Zone V (0405), US Survey Feet.
 2. Positional data acquired using a Trimble ProXRS GPS system with OmniSTAR real-time submeter differential corrections.
 3. Suspected oil well locations taken from the Department of Oil, Gas and Geothermal Resources online database.

	<p>Figure 4</p> <p>Constellation Blvd and Ave of the Stars</p> <p>Total Magnetic Field Response</p>
	<p>NE Corner of Constellation Blvd and Ave of the Stars</p> <p>Santa Monica, California</p>
	<p>Prepared for Amec Mactec</p>

APPENDICES

MAGNETIC METHOD

The magnetic method involves the measurement of the earth's magnetic field intensity. Typically the total magnetic field and/or vertical magnetic gradient is measured. Measurements of the horizontal or vertical component or horizontal gradient of the magnetic field may also be made.

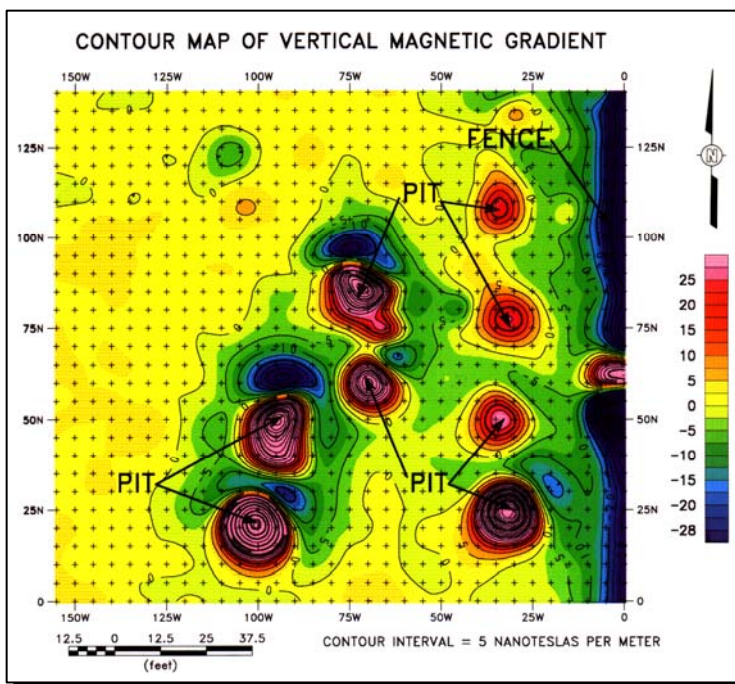
Anomalies in the earth's magnetic field are caused by induced or remanent magnetism. Induced magnetic anomalies are the result of secondary magnetization induced in a ferrous body by the earth's magnetic field. The shape, dimensions, and amplitude of an induced magnetic anomaly is a function of the orientation, geometry, size, depth, and magnetic susceptibility of the body as well as the intensity and inclination of the earth's magnetic field in the survey area. Buried ferrous metallic objects, such as pipes, drums, tanks, and debris generally give rise to dipolar anomalies with a positive response south and a negative response north of the object. The magnetic method is an effective way to search for small metallic objects because magnetic anomalies have spatial dimensions much larger than those of the objects. An oil well typically gives rise to a monopolar anomaly with a very high amplitude, positive peak several feet south of the well and a low amplitude, broad negative response to the north. The magnetic anomaly over a buried oil well often has a diameter of over 50 feet and amplitude of several thousand nanoteslas, depending on depth and casing characteristics. Magnetometers can typically locate an abandoned oil well to depths of over 20 feet providing that background noise levels are not too high and the well casing is not significantly corroded. Magnetometers are not able to detect nonferrous metals such as aluminum and brass.



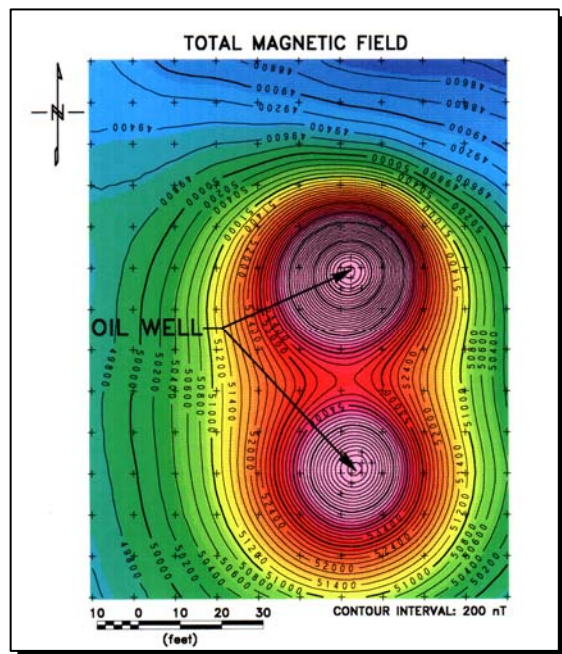
Geometrics G-858 Magnetometer

The magnetic method is typically used to:

- Locate abandoned steel well casings
- Locate buried tanks and pipes
- Locate pits and trenches containing buried metallic debris
- Detect buried unexploded ordnance (UXO)
- Map old waste sites and landfill boundaries
- Clear drilling locations
- Map basement faults and geology
- Investigate archaeological sites



Magnetic Survey to Locate Pits Containing Buried Metallic Containers



Magnetic Survey to Locate Abandoned Oil Wells