BLYMYER
ENGINEERS, INC.

October 8, 2002
BEI Job. No. 202041

Ms. Eva Chu
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, 2nd Floor
Alameda, CA 94502-6577

Alameda County
NOV 14 2002
Environmental Health

Subject: Remedial Action Plan
Former J & R Automobile Dismantlers
819-823 East 12th Street
Oakland, California

Dear Ms. Chu:

Blymyer Engineers, Inc. is pleased to present this Remedial Action Plan (RAP) for the subject site (Figures 1 and 2).

1.0 Introduction

1.1 Background

Blymyer reviewed Phase I Environmental Site Assessment (ESA) and Phase II Environmental Site Investigation reports prepared by Basics Environmental (Basics) in 1996. In the Phase I ESA, Basics documented the presence of heavy oil contamination (surface staining and distressed vegetation) in an unpaved area behind the building at the subject site. Basics also determined that a cleanup order had been issued for this contamination by the Alameda County Health Care Services Agency (ACHCSA) in 1991, and that the subject site was shown as an active site on the Regional Water Quality Control Board's Fuel Leak List.

Basics performed a subsurface investigation in the unpaved area which consisted of the installation of four soil bores (B1 through B4, Figure 2) to a depth of 16 to 19 feet below ground surface (bgs). Soil samples were collected at 0.5 feet, 5 feet, 10 feet and 15 feet bgs in each soil bore. Grab groundwater samples were collected from three of the soil bores. All samples were analyzed for Total Recoverable Petroleum Hydrocarbons (TRPH; EPA Method 418.1) and the five metals associated with leaking underground fuel tanks (LUFT; cadmium, chromium, lead, nickel and zinc). Concentrations of TRPH up to 19,000 milligrams per kilogram (mg/kg) and lead up to 870 mg/kg were detected in the soil samples collected at 0.5 feet bgs. TRPH concentrations were non-detectable in the soil samples at 5 feet bgs, indicating that the heavy oil contamination observed during the Phase I ESA was limited to near-surface soil. TRPH was found in two of the soil bores at a depth of 10 feet bgs and in one of the grab groundwater samples. Basics attributed the deeper soil and groundwater contamination to another source, possibly a former sump located in the unpaved area.

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The ACHCSA issued a "Second Notice of Violation," dated March 21, 2001, requesting a technical workplan to delineate soil and groundwater contamination at the site. The letter requested submittal of a workplan by April 23, 2001.

On June 27, 2001, Blymyer Engineers issued a workplan entitled *Phase II Subsurface Investigation Workplan* to the ACHCSA. The ACHCSA approved the workplan, with modifications, in a letter entitled *Work Plan Approval*, dated July 2, 2001. The ACHCSA requested an additional soil bore be advanced in, or near, the former sump and that the grab groundwater samples be collected in non-preserved bottles. Blymyer Engineers responded in a letter to the ACHCSA entitled *Modified Bore Locations for Phase II Subsurface Investigation Workplan*, dated July 11, 2001. In the referenced Blymyer Engineers letter, bore B8 was relocated to the depression identified as the former sump, in that it would be reasonably considered a worst-case location. The referenced letter also included a fifth bore (B9) at the former location of B8, and the collection of two soil samples at a depth of 2 feet bgs in bore B9 and B7, in an attempt to limit the vertical depth of elevated metal concentrations. These modifications were verbally accepted by the ACHCSA in a telephone conversation on July 24, 2001.

On August 7, 2001, Blymyer Engineers installed four soil bores to depths ranging between 20 to 24 feet bgs at the site (Figure 2), and a fifth bore to a depth of 2.5 feet bgs. The soil bores were installed using a Geoprobe hydraulic push system. Soil was collected continuously in isobutylene sleeves and soil samples were collected for lithologic description and organic vapor field-screening with a Photoionization Detector (PID). Groundwater was encountered in each bore at between approximately 14 to 18.5 feet bgs, but field stabilized at higher elevations depending on the length of time the bore was allowed to remain open. Soil samples were selected for laboratory analysis based upon depth and elevated PID readings.

Temporary PVC well screen was placed in each deeper soil bore in order to collect grab groundwater samples for laboratory analysis. When obtained, the grab groundwater sample from each bore was noted as turbid. After collection of the groundwater samples, all soil bores were backfilled with bentonite grout. The soil cuttings from the advancement of the soil bores were contained in labeled, DOT-approved, 5-gallon pails, pending proper disposal by the client.

The soil and groundwater samples were sent to a California-certified laboratory. The soil and groundwater samples were analyzed for TRPH using EPA Method 418.1 and the five LUFT metals using EPA Method 6010. The grab groundwater samples were filtered by the laboratory prior to analysis. The three soil samples and two grab groundwater samples with the highest TRPH concentrations were additionally analyzed for Volatile Organic Compounds (VOCs) using EPA Method 8240 and Semi-VOCs (SVOCs) using EPA Method 8270. Soil sample B9-2, collected for metals analysis, was additionally analyzed for TRPH. Analytical results for the soil samples are summarized in Tables I and II, while analytical results for groundwater samples are summarized in Table III. Table IV contains the results of the geotechnical soil sample analysis.

In general, the site is underlain by a minimum of 6 feet of silty clay; however, the silty clay or clayey silt did extend to a depth of 15.5 feet bgs in B6. Beneath the silty clay in most other soil bores, a clayey gravel was encountered. The bottom of the clayey gravel was encountered at the depths ranging from 10.5 to 15 feet bgs. A second silty clay was encountered beneath the clayey gravel and extended to depths ranging from 12 to 18 feet bgs. Beneath this silty clay an intermix of more granular bedding units was encountered. Groundwater was generally associated within these more granular units. It is suspected, but not confirmed, that groundwater is confined.

The following conclusions were made from the data generated during the subsurface investigation at the site:

- Detectable concentrations of TRPH are present in all near surface soil at the site, and appear to extend up to an approximate depth of 3.5 feet bgs. Elevated concentrations of TRPH are present within the stained area of distressed vegetation, and additionally at bore B2.

- Discolored soil is present to a depth of approximately 3.5 feet and again from 10.5 feet bgs to 16.5 feet bgs in bore B7. A zone of relatively non-discolored soil appears to separate the two zones. A similar separation of discolored soil has previously been observed in bores B2, B3, and B4.

- A very soft, potential void was encountered at a shallow depth during the installation of bore B7. A bit of metal and dark oily blobs were also noted at depth in this bore and may also suggest additional fill (or sumps) may have previously been present at the site.

- Except for minor layers, discolored soil is present from the surface to total depth in bore B8b.

- Bore B8a appeared to encounter fill and highly impacted soil to the total explored depth of 12 feet bgs.

- Except for the surface detection of TRPH in bores B5 and B6, and a thin, potentially discolored, water-bearing zone in bore B6, soil from bores B5 and B6 appeared to be largely non-impacted.

- Elevated concentrations of each of the five LUFT metals are present in the vicinity of the depression identified as a sump (B8). These concentrations are above 10 times the Soluble Threshold Limit Concentration (STLC) value or above the Total Threshold Limit Concentration (TTLC) for some of the metals.

- Near surface stained soil (bores B1, B2, B3, B4, B5, B7, and B8) consistently contained lead concentrations over one or more regulatory value (STLC or TTLC).

- Toluene, ethylbenzene, and total xylenes were the only detectable VOCs present in heavily impacted soil samples. This suggests that gasoline or diesel may have been used and disposed of at the site.

- The significant increase in toluene, ethylbenzene, and total xylenes at a depth of 15 feet in bore B8b may suggest a second, petroleum-fuel-related source is impacting the site.

- The only SVOCs detected at the site were 2-methylnaphthalene and naphthalene.

- TRPH was present in all grab groundwater samples submitted for analysis. Elevated concentrations were present in bore B8b. Elevated concentrations of benzene, toluene, ethylbenzene, and total xylenes (BTEX) were present only in the grab groundwater sample collected from bore B8b. These compounds were present above their respective Maximum Contaminant Levels (MCLs); however the laboratory noted that the groundwater sample contained over 5% suspended sediment. This may indicate that the higher result is representative of the suspended sediment rather than dissolved concentrations in groundwater.

- Only cadmium was present in one filtered, non-preserved grab groundwater sample, at a concentration slightly above the MCL. No other metals were detected in the groundwater samples.

- Use of the Oakland Risk-Based Corrective Action (ORBCA) or San Francisco - Regional Water Quality Control Board (SF-RWQCB) risk assessment programs is inappropriate at this site.

Additionally, the following conclusions were made from the data generated from the health risk evaluation of the contaminants at the site:

- Two principal assumptions were employed to generate the risk evaluation:
    - Preclusion of residential soil exposure by remedial actions and/or capping
    - On- or off-site groundwater ingestion is not a complete pathway, except at a relatively unlikely exposure at a hypothetical old hand dug well

- For all modeled contaminants, health-based risks including carcinogenic target risks and toxic hazard quotient and hazard indexes were not exceeded onsite, and are significantly below the appropriate risk goal.

- With first-order biodegradation allowed, only the groundwater source (sump) concentration of benzene exceeded offsite Point of Exposure (POE) limits at the property line (MCL limit) and at the unlikely, but potential, residential hand dug well POE.

- In order to eliminate offsite degradation of groundwater over MCL concentrations, a reduction in groundwater benzene source concentrations from 1.7 mg/L to 3.9 μg/L would be required. This also eliminates the residential occupant exposure to groundwater via a hand dug well.

- Lead was excluded from the analysis due to the lack of a published Reference Dose (RfD) for lead by the EPA. The SF - RWQCB promulgated remedial goals have been relied on as an alternative method to define a SSTL for lead. To meet these concentration limits, a reduction in the concentration of lead to 255 mg/Kg at the site would be required, unless otherwise negotiated with the SF-RWQCB.

1.2 Further Regulatory Discussions

In further discussing the project with Mr. Roger Brewer of the SF-RWQCB a known association between older auto dismantler facilities and the scrapping of polychlorinated biphenyl (PCB)-oil containing transformers has been documented in the Bay Area. Mr. Brewer recommended that possible PCB impacts be investigated.

1.3 Geophysical Survey

1.3.1 Purpose

On July 11, 2002, Norcal Geophysical Consultants (Norcal), under the direction of Blymyer Engineers, conducted a geophysical survey at the site. The survey was conducted to address the following issues:

- A significant jump in VOC concentrations was noted at groundwater in soil bore SB8-B. This suggested that an underground storage tank (UST) might be a source of these contaminants and it was recommended that an onsite investigation be conducted due to this potential.

- One known sump was located at the site and it was judged possible that additional unknown sumps might exist, particularly in light of the discovery of elevated concentrations of TRPH and metals at depth in bore B7, and other current surface depressions in the vicinity of bore B7, at some distance to the known sump.

1.3.2 Results

Norcal conducted geophysical investigations at the site using vertical magnetic gradient (VMG), terrain conductivity (TC), hand-held metal detector (MD), and ground penetrating radar (GPR) techniques. Contour maps were generated for the VMG and TC data sets. A report of the results and associated contour maps is included as Appendix A to this RAP.

The VMG data contour map indicates numerous boundary magnetic effects, likely the result of the perimeter sheet metal and chain-link fences. Additionally, two areas were detected and mapped with closed contours ("bull's eyes"). The areas are small in size and are closely associated with two MD anomalies. It was suggested that the anomalies could be produced by relatively minor metal debris such as "...balls of wire, paint can lids, short sections of metal pipes, etc."

The TC data contour map also indicate boundary magnetic effects, again likely the result of the sheet metal and chain-link fences, or large aboveground structures outside of the investigation area. Additionally, one large closed contour anomaly area was mapped. The area is located beneath and southwest of the surficial physical expression of the sump. Because the anomaly is not associated with VMG or MD anomalies, it indicates, at a minimum, a disturbance of soil. Additional causes for the TC anomaly provided by the report are burial of non-ferrous materials such as wood or concrete.

The results of the GPR survey were inconclusive. Additional unknown sumps, or an onsite UST, were apparently not located by the survey. It should be noted that an area 5 feet in width around the perimeter property boundary of the site could not be surveyed due to the sheet metal and chain-link fence lines. The perimeter fence additionally did not allow the geophysical survey to extend into the public sidewalk, used at numerous sites for UST burial. For further details, please consult the geophysical report attached as Appendix A.

1.4 Site Conditions

The property is located in the city of Oakland, Alameda County, California (Figure 1). It is bounded on the northeast by 12th Street and on the southeast, southwest, and northwest by commercial buildings. Across 12th Street are located additional commercial buildings. The property is located approximately 1,650 feet north of the Brooklyn Basin of the Alameda - Oakland Estuary. The site is predominately unpaved, with a relatively small concrete slab located in the northeastern portion of the site, immediately adjacent to the 12th Street sidewalk.

2.0 Remedial Action Goals

Site-Specific Target Levels (SSTLs; remedial action goals) for soil and groundwater were established for all contaminants of concern (COCs) at the site (Table V); however, only the following COCs require remedial actions:

- TRPH (soil): Risk analysis indicates that existing contaminant concentrations are not a residential health-risk for future site occupants. The identified residential health-risk was defined to be above the highest concentration present at the site. However, because long term site-specific groundwater monitoring data is not available for the site, and secondary nuisance-based goals may be triggered due to the leaching of heavy hydrocarbons from soil, a secondary nuisance-based screening level remedial action goal will be utilized. For residential facilities this remedial goal was defined to be 500 milligrams per kilogram (mg/Kg) for motor oil (residual fuels) in surface soil up to approximately 10 feet bgs and 1,000 mg/Kg for soil deeper than 10 feet bgs (*December 2001 Update to Risk-Based Screening Levels for Impacted Soil and Groundwater*, SF-RWQCB, dated December 26, 2001).

- Lead (soil): Lead was excluded from the risk analysis due to the lack of a published Reference Dose (RfD) for lead by the EPA. The SF-RWQCB observes the Department of Toxic Substance Control (DTSC) promulgated remedial goal of 255 mg/Kg lead was relied upon as an alternative method to define an SSTL for lead.

- Benzene (groundwater): Risk analysis indicated that in order to eliminate offsite degradation of groundwater over MCL concentrations, a reduction in benzene source concentrations from 1.7 mg/L to the SSTL of 3.9 μg/L is required.

3.0 Proposed Remedial Action Plan Scope of Work

The following scope of work is proposed for the RAP:

1.0 Prepare a technical workplan for submittal to the ACHCSA

This workplan has been prepared to describe the proposed work and to document standard operating procedures.

2.0 Generate a Health and Safety Plan for Level C site control

A health and safety plan (HASP) will be generated to outline potentially hazardous work conditions and contingencies for an emergency. The HASP will be reviewed and signed by a Certified Industrial Hygienist (CIH) due to Level C site safety control required by the surface lead contamination documented at the site.

3.0 Additional pre-excavation soil sampling

Prior to remedial excavation activities at the site, ~~two soil samples will be collected at a depth of 0.5 feet bgs in order to determine if PCB may be present at the site~~. A number of older auto dismantlers are known to have imported PCB-oil-containing transformers for the purposes of obtaining scrap metal. Although there is not such an association at this site, it was judged prudent to further investigate the possibility due to a lack of knowledge of past practices at the site, and due to inclusion of residential units in the site redevelopment plan.

The soil samples will be submitted to and analyzed by a California-certified laboratory on a standard 1-week turnaround for PCBs using EPA Methods 8080 or 8082. The resulting data will be reviewed for appropriate measures.

4.0 Remove upper 1.5 to 2 feet of lead- and TRPH-impacted soil

The upper 1.5 to 2 feet of lead- and TRPH-impacted soil will be excavated and stockpiled for characterization (Figure 3). Dust emissions will be controlled by the application of water spray, or other dust control measure. The stockpiles will be covered with heavy plastic sheeting (minimum 10 mills) to control fugitive dust emissions after excavation. Efforts to segregate heavily contaminated material from less contaminated material will be undertaken in order to attempt to minimize disposal cost. An estimated 325 to 425 cubic yards of soil will be generated depending on the depth of stripping. Final excavation depth will be determined by laboratory analysis.

5.0 If required, explore VMG and TC anomalies

Further exploration of the two VMG and MD anomalies should be undertaken if the likely causes of these anomalies are not located by the completion of Task 3.0. It is assumed that relatively minimal additional exploration excavation may be required. It is also assumed that a significant change in excavation operational procedures will not be required.

6.0 Collect near surface excavation confirmation soil samples

Soil samples will be collected from the bottom and sidewalls of the near surface soil excavation (and any VMG or MD anomaly excavation if appropriate) in order to confirm the removal of TRPH and lead to the appropriate SSTLs. As planned, the excavation will initially be selectively sampled to determine if the assumed initial removal depth (1.5 feet) will achieve the SSTLs. Final clearance bottom and sidewall samples will be collected according to the following schedule:

- Sidewall samples: One grab soil sample for every 20 feet of linear sidewall.
- Bottom samples: The excavation bottom will be subdivided into an approximately equal-dimensional grid pattern (approximately fifty - 12 foot by 10 foot grids), each will be numbered, and a random number generator will be used to select 20 grids for final clearance analytical sampling.

7.0 Submit near surface soil excavation samples for laboratory analysis

The soil samples will be submitted to and analyzed by a California-certified laboratory on a standard 1-week turnaround for Total Petroleum Hydrocarbons (TPH) as motor oil using EPA Method 8015 and total lead using EPA Method 6010. An estimated 25 to 30 soil samples will be submitted for bottom confirmation, and approximately 20 soil samples will be submitted for sidewall confirmation of the lateral excavation limits.

8.0 Characterize stockpiles for disposal purposes

After the results of the final excavation clearance samples are available and it has been determined that the SSTLs have been achieved, the soil excavation stockpiles will be characterized for disposal purposes. A four-point composite will be collected for each 250 yards of stockpile volume, or as otherwise required by the selected disposal facility. Each composite will be submitted to and analyzed by a California-certified laboratory on a standard 1-week turnaround for TPH as motor oil using EPA Method 8015, volatile organic compounds (VOC) using EPA Method 8260, semivolatile organic compounds (SVOC) using EPA Method 8270, and the seventeen California Metals (CAM 17) using various appropriate EPA methodologies. The results will be reviewed to help identify the appropriate disposal location.

Should analyte concentrations indicate that all or portions of the stockpiled soil be potentially hazardous, selective additional analytical testing will be conducted. Additional analysis may include a Reactivity, Corrosivity, and Ignitability (RCI) panel, and the Soluble Threshold Limit Concentration (STLC) Waste Extraction Test (WET) for selected metal contaminants exceeding the applicable Total Threshold Limit Concentrations (TTLC) regulatory levels (California Title 22), or the Toxicity Characteristic Leaching Procedure (TCLP) for selected metals exceeding the TTLC or STLC. All tests will be conducted using appropriate California or Federal EPA methodologies.

9.0 Transport near surface excavated soil offsite

The soil stockpile will be managed and transported offsite under manifest to an appropriate designated disposal facility. The facility will be selected in consultation with our client based on the results of the analytical characterization program, and the resulting cost and long-term liability that will be realized by our client. Dust emissions will be controlled by the application of water spray, or an alternative dust palliative. Dust control measures such as trailer tarping will be instituted during transportation to the selected disposal facility.

10.0 Excavate known sump

~~Excavation of the sump~~ will be focused on the visible surface depression located approximately mid-lot at the site. An initial ~~15-foot by 15-foot area, approximately 15 feet in depth will be defined~~ in bid documents for excavation; however, based on the results of the TC geophysical survey conducted at the site (Appendix A), the sump ~~may extend another~~ approximate~~ly 20 feet to the southwest~~. Dust emissions will be controlled by the application of water spray, or another dust palliative. The stockpile generated will be covered with heavy plastic sheeting (minimum 10 mills) to control fugitive dust emissions after excavation. Efforts to segregate heavily contaminated material from less contaminated material will be undertaken in an attempt to minimize disposal cost. An estimated 125 to 275 cubic yards of soil will be generated depending on the size of the final excavation. Final excavation depth will extend to groundwater (encountered at between 14 to 18 feet bgs); however, laboratory analysis will determine the lateral extent of the excavation.

11.0 Explore cause and extent of impacted soil at depth in bore B7

Amorphous blobs of oil were encountered at a depth of 14.5 feet bgs in soil bore B7. When laboratory analyzed the soil sample yielded a concentration of 2,400 mg/Kg TRPH. Additionally, a soft zone was identified by the driller and metal bits (the latter potentially dragged down from the surface) were encountered at a depth of 7 to 9 feet bgs in the bore. Further, there are several relatively minor surface depressions in the vicinity of the bore location. Although these depressions do not appear to be the site of unauthorized surface discharges, other previously used and currently unknown sumps may be located in proximity to bore B7. The extent of the excavation will be determined by field observations.

To investigate this area, an initial 8-foot by 8-foot area will be excavated to an approximate depth of 15 feet bgs. Dust emissions will be controlled by the application of water spray, or another dust palliative. The stockpile generated will be covered with heavy plastic sheeting (minimum 10 mills) to control fugitive dust emissions after excavation. Efforts to segregate heavily contaminated material from less contaminated material will be undertaken in an attempt to minimize disposal cost. An estimated 40 to 75 cubic yards of soil will be generated depending on the size of the final excavation. Final excavation depth will extend to groundwater (encountered at between 14 to 18 feet bgs); however, laboratory analysis will determine the lateral extent of the excavation.

12.0 Collect sump and B7 excavation confirmation soil samples

Soil samples will be collected from the sidewalls of the sump and other soil excavations in order to confirm the removal of TRPH, BTEX, and lead to the appropriate SSTLs. The sidewall samples will be collected according to the following schedule:

- Sidewall samples: One grab soil sample for every 20 feet of linear sidewall
- Bottom samples: No bottom samples will be collected since the excavation will extend into groundwater.

13.0 Submit sump and B7 excavation samples for laboratory analysis

The soil samples will be submitted to and analyzed by a California-certified laboratory on a standard 1-week turnaround for Total Petroleum Hydrocarbons (TPH) as motor oil using EPA Method 8015, BTEX by EPA Method 8020, and total lead using EPA Method 6010. An minimum of 4 soil samples will be submitted for sidewall confirmation of the lateral excavation limits should the initial 15-foot by 15-foot excavation be adequate to remove the sump to the defined remedial goals. An equal number of soil samples may be required for the planned excavation in the vicinity of bore B7. Should additional excavation be required, the number of additional soil samples will depend on the extent of the additional excavation.

14.0 Apply ORC to deep remedial excavations

After determinating the lateral and vertical limits for both deep remedial excavations (sump and bore B7), Oxygen Releasing Compound (ORC) will be applied, according to the manufacturers specifications, to the open excavations. This application will assist in achieving degradation of any groundwater contaminant plume.

15.0 Characterize stockpiles for disposal purposes

After the results of the final excavation clearance samples are available and it has been determined that the SSTLs have been achieved, the soil excavation stockpiles will be characterized for disposal purposes. A four-point composite will be collected for each 250 cubic yards of stockpile volume, or as otherwise required by the selected disposal facility. Each composite will be submitted to and analyzed by a California-certified laboratory on a standard 1-week turnaround for TPH as motor oil using EPA Method 8015, VOC using EPA Method 8260, SVOC using EPA Method 8270, and CAM 17 metals using various appropriate EPA methodologies. The results will be reviewed to help identify the appropriate disposal location.

Should analyte concentrations indicate that all or portions of the stockpiled soil be potentially hazardous, selective additional analytical testing will be conducted. Additional analysis may include an RCI panel, and the STLC WET for selected metal contaminants exceeding the applicable TTLC regulatory levels, or the TCLP for selected metals exceeding the TTLC or STLC. All tests will be conducted using appropriate California or Federal EPA methodologies.

16.0 Transport sump and other excavation soil offsite

The soil stockpile will be managed and transported offsite under manifest to an appropriate designated disposal facility. The facility will be selected in consultation with our client based on the results of the analytical characterization program, and the resulting cost and long-term liability that will be realized by our client. Dust emissions will be controlled by the application of water spray, or an alternative dust palliative. Dust control measures such as trailer tarping will be instituted during transportation to the selected disposal facility.

17.0 Backfill all excavations

All resulting excavations will be backfilled to the required construction surface subgrade with appropriate fill materials and to an appropriate density for structural support. The determination of construction subgrade, or the selection of appropriate backfill material, is not a part of this RAP, and shall be identified by others.

18.0 Generate a remedial action summary report

A Remedial Action Summary Report will be generated at the completion of all phases of remedial action at the site. The report shall include summaries of data and conclusions and recommendations for further work, if required. A report on the required installation of three groundwater monitoring wells will be submitted under a separate cover.

4.0 Project Schedule

A Gannt chart (Table VI) has been generated to provide an overview of project tasks and the estimated duration of remedial action activities at the site. Work can be initiated within approximately one week of regulatory approval of the RAP and client funding. These two items will likely not be co-incident. The current intent is to wrap remedial action and construction activities into a single construction loan.

Based on similar projects Blymyer Engineers estimates remedial actions will require approximately 15 weeks to complete, and is dependant on several unknowns, including weather and unanticipated additional remedial activities.

Should you have any questions, please contact Mark Detterman at (510) 521-3773.

Sincerely,

Blymyer Engineers, Inc.

By: Mark E. [signature]
Mark Detterman, C.E.G. 1788
Senior Geologist

REGISTERED GEOLOGIST
MARK E. DETTERMAN
No. 1788
CERTIFIED ENGINEERING GEOLOGIST
5/31/03
STATE OF CALIFORNIA

And: [signature]
Michael S. Lewis
Vice President, Technical Services

Enclosures:	Figure 1	Site Location
	Figure 2	Site Plan
	Table I	Results of Soil Sample Hydrocarbon, VOC, and SVOC Analysis
	Table II	Results of Soil Sample Metal Analysis
	Table III	Results of Groundwater Sample Hydrocarbon, VOC, and SVOC Analysis
	Table IV	Results of Geotechnical Soil Sample Analysis
	Table V	Summary of Site Specific Target Levels
	Table VI	Project Schedule
	Appendix A	Norcal Geophysical Consultants, Inc, *Geophysical Investigation*, August 13, 2002

Tables

Table I, Results of ~~Soil~~ Sample Hydrocarbon, VOC, and SVOC Analysis
BEI Job No. 201064, Robert Mintz Design Studio
819-823 East 12th Street, Oakland, California

Sample I.D.	Depth	Sample Date	EPA Method 418.1	VOCs EPA Method 8240[1]				SVOCs EPA Method 8270	TOC EPA Method 9060
	(feet)		TRPH (mg/Kg)	Benzene (μg/Kg)	Toluene (μg/Kg)	Ethylbenzene (μg/Kg)	Total Xylenes (μg/Kg)	(mg/Kg)	(mg/Kg)
B1-1*	0.5	9/16/96	**600**	NA	NA	NA	NA	NA	NA
B1-2*	5	9/16/96	<10	NA	NA	NA	NA	NA	NA
B1-3*	10	9/16/96	<10	NA	NA	NA	NA	NA	NA
B2-1*	0.5	9/16/96	**4,400**	NA	NA	NA	NA	NA	NA
B2-2*	5	9/16/96	<10	NA	NA	NA	NA	NA	NA
B2-3*	10	9/16/96	**5,300**	NA	NA	NA	NA	NA	NA
B3-1*	0.5	9/16/96	**19,000**	NA	NA	NA	NA	NA	NA
B3-2*	5	9/16/96	<10	NA	NA	NA	NA	NA	NA
B3-3*	10	9/16/96	<10	NA	NA	NA	NA	NA	NA
B4-1*	0.5	9/16/96	**89**	NA	NA	NA	NA	NA	NA
B4-2*	5	9/16/96	<10	NA	NA	NA	NA	NA	NA
B4-3*	10	9/16/96	**340**	NA	NA	NA	NA	NA	NA
B5-0.5	0.5	8/7/01	**32**	NA	NA	NA	NA	NA	NA
B5-5	5	8/7/01	**13**	NA	NA	NA	NA	NA	NA
B5-10	10	8/7/01	<10	NA	NA	NA	NA	NA	NA
B5-15	15	8/7/01	<10	NA	NA	NA	NA	NA	NA

Table I, Results of Soil Sample Hydrocarbon, VOC, and SVOC Analysis BEI Job No. 201064, Robert Mintz Design Studio 819-823 East 12th Street, Oakland, California									
Sample I.D.	Depth	Sample Date	EPA Method 418.1	VOCs EPA Method 8240[1]				SVOCs EPA Method 8270	TOC EPA Method 9060
	(feet)		TRPH (mg/Kg)	Benzene (μg/Kg)	Toluene (μg/Kg)	Ethylbenzene (μg/Kg)	Total Xylenes (μg/Kg)	(mg/Kg)	(mg/Kg)
B6-0.5	0.5	8/7/01	**26**	NA	NA	NA	NA	NA	NA
B6-5	5	8/7/01	<10	NA	NA	NA	NA	NA	715
B6-10	10	8/7/01	<10	NA	NA	NA	NA	NA	NA
B6-15	15	8/7/01	<10	NA	NA	NA	NA	NA	260
B7-0.5	0.5	8/7/01	**330**	NA	NA	NA	NA	NA	NA
B7-2	2	8/7/01	NA	NA	NA	NA	NA	NA	NA
B7-7.5	7.5	8/7/01	<10	NA	NA	NA	NA	NA	NA
B7-10	10	8/7/01	<10	NA	NA	NA	NA	NA	NA
B7-14.5	14.5	8/7/01	**2,400**	NA	NA	NA	NA	NA	NA
B8B-0.5	0.5	8/7/01	**54,000**	<10	**50**	**30**	**240**	<8.0 to 40	NA
B8B-5.5	5.5	8/7/01	**1,100**	NA	NA	NA	NA	NA	NA
B8B-10	10	8/7/01	**600**	<5.0	<5.0	**58**	**110**	<0.33 to 1.6[2]	NA
B8B-15	15	8/7/01	**7,900**	<100	**140**	**1,400**	**11,000**	<1.0 to 5.0[3]	NA
B9-2	2	8/7/01	**54**	NA	NA	NA	NA	NA	NA

Table I, *Results of Soil Sample Hydrocarbon, VOC, and SVOC Analysis*; continued

Notes:			
	EPA	=	Environmental Protection Agency
	mg/Kg	=	milligrams per kilogram (parts per million)
	μg/Kg	=	micrograms per kilogram (parts per billion)
	VOC	=	Volatile organic compounds
	SVOC	=	Semi-volatile organic compounds
	TOC	=	Total Organic Carbon
	NA	=	Not analyzed
	N/A	=	Not applicable
	*	=	Collected by Basics Environmental in 1996
	B7-15	=	Sample number: e.g. Bore 7 at a depth of 15 feet below grade surface
	[1]	=	All other VOC analytes were non-detectable at elevated limits of detection. Please see the laboratory report for details.
	[2]	=	2-Methylnaphthalene and Naphthalene detected at **0.36** and **0.38** mg/Kg, respectively. All other SVOC analytes were non-detectable at the indicated elevated limits of detection.
	[3]	=	2-Methylnaphthalene and Naphthalene detected at **6.0** and **7.2** mg/Kg, respectively. All other SVOC analytes were non-detectable at the indicated elevated limits of detection.

Results in **bold** indicate detectable concentrations.

Table II, Results of Soil Sample Metal Analysis
BEI Job No. 201064, Robert Mintz Design Studio
819-823 East 12th Street, Oakland, California

Sample I.D.	Depth (feet)	Sample Date	EPA Method 6010				
			Cd (mg/Kg)	Cr (mg/Kg)	Pb (mg/Kg)	Ni (mg/Kg)	Zn (mg/Kg)
B1-1*	0.5	9/16/96	0.72	34	**270**	26	320
B1-2*	5	9/16/96	<0.5	29	6.0	15	20
B1-3*	10	9/16/96	<0.5	31	4.3	36	36
B2-1*	0.5	9/16/96	7.3	40	**870**	39	1,100
B2-2*	5	9/16/96	<0.5	8.1	<3.0	10	6.3
B2-3*	10	9/16/96	<0.5	37	8.2	34	41
B3-1*	0.5	9/16/96	3.8	40	**750**	43	650
B3-2*	5	9/16/96	<0.5	25	10	40	17
B3-3*	10	9/16/96	<0.5	38	5.4	48	40
B4-1*	0.5	9/16/96	0.6	33	**83**	25	77
B4-2*	5	9/16/96	<0.5	27	5.0	17	20
B4-3*	10	9/16/96	<0.5	40	5.5	43	34
B5-0.5	0.5	8/7/01	<0.5	28	16	19	43
B5-5	5	8/7/01	<0.5	26	6.3	26	22
B5-10	10	8/7/01	<0.5	31	7.6	63	37
B5-15	15	8/7/01	<0.5	20	6.0	32	34
B6-0.5	0.5	8/7/01	<0.5	32	9.8	23	19
B6-5	5	8/7/01	<0.5	29	6.9	36	30
B6-10	10	8/7/01	0.70	37	5.8	58	44
B6-15	15	8/7/01	<0.5	25	5.9	48	49
B7-0.5	0.5	8/7/01	0.95	26	**270**	43	220
B7-2	2	8/7/01	<0.5	33	8.4	24	21
B7-7.5	7.5	8/7/01	<0.5	33	7.0	27	15
B7-10	10	8/7/01	<0.5	24	7.9	24	14
B7-14.5	14.5	8/7/01	<0.5	30	6.6	27	33

Table II, Results of Soil Sample Metal Analysis
BEI Job No. 201064, Robert Mintz Design Studio
819-823 East 12th Street, Oakland, California

Sample I.D.	Depth (feet)	Sample Date	EPA Method 6010				
			Cd (mg/Kg)	Cr (mg/Kg)	Pb (mg/Kg)	Ni (mg/Kg)	Zn (mg/Kg)
B8B-0.5	0.5	8/7/01	**52**	**110**	**3,100**	**240**	2,100
B8B-5.5	5.5	8/7/01	<0.5	41	12	15	23
B8B-10	10	8/7/01	<0.5	33	9.8	64	42
B8B-15	15	8/7/01	0.57	35	**74**	28	43
B9-2	2	8/7/01	<0.5	28	11	30	21
STLC	N/A	N/A	1.0	5	5.0	20	250
TTLC	N/A	N/A	100	2,500	1,000	2,000	5,000

otes: EPA = Environmental Protection Agency
mg/Kg= milligrams per kilogram (parts per million)
B7-15 = Sample number: e.g. Bore 7 at a depth of 15 feet below grade surface
N/A = Not applicable
STLC = Soluble Threshold Limit Concentration (Title 26, State of California)
TTLC = Total Threshold Limit Concentration (Title 26, State of California)
Cd = Cadmium
Cr = Chromium
Pb = Lead
Ni = Nickel
Zn = Zinc
* = Collected by Basics Environmental in 1996

Results in **bold** indicate concentrations ten times above the respective STLC value.
Shaded results indicate concentrations above the respective TTLC value.

Table III, Results of Grab Groundwater Sample Hydrocarbon, VOC, SVOC and Metals Analysis
BEI Job No. 201064, Robert Mintz Design Studio
819-823 East 12th Street, Oakland, California

Sampl e I.D.	Sample Date	EPA Method 418.1	VOCs EPA Method 8240[1]				SVOCs EPA Method 8270	EPA Method 6010				
		TRPH (mg/L)	Benzen e (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	(µg/L)	Cd (mg/L)	Cr (mg/L)	Pb (mg/L)	Ni (mg/L)	Zn (mg/L)
B2-W*	9/16/96	**2,000**[2, 4]	NA	NA	NA	NA	NA	<0.005[uf]	<0.005[uf]	0.13[uf]	0.16[uf]	<0.05[uf]
B3-W*	9/16/96	**13**[2, 4]	NA	NA	NA	NA	NA	<0.005[uf]	<0.005[uf]	0.077[uf]	0.060[uf]	0.073[uf]
B4-W*	9/16/96	**<1.0**[2]	NA	NA	NA	NA	NA	0.005[uf]	0.007[uf]	0.082[uf]	0.080[uf]	0.11[uf]
B5W	8/7/01	**41**[2]	NA	NA	NA	NA	NA	<0.005	<0.02	<0.005	<0.05	<0.05
B6W	8/7/01	**1.5**	NA	NA	NA	NA	NA	<0.005	<0.02	<0.005	<0.05	<0.05
B7W	8/7/01	**4.8**[2]	<1.0	<1.0	**7.6**	<1.0	<10 to 50	**0.0061**	<0.02	<0.005	<0.05	<0.05
B8W	8/7/01	**2,000**[2]	**1,700**	**2,500**	**790**	**4,100**	<25 to 125[3]	<0.005	<0.02	<0.005	<0.05	<0.05
MCLs	N/A	N/A	1.0	150	700	1,750	various	0.005	0.05	0.015[5]	0.1	5[6]

Table III Results of Grab Groundwater Sample Hydrocarbon, VOC, SVOC and Metals Analysis; continued

Notes: EPA	=	Environmental Protection Agency			
VOC	=	Volatile organic compounds			
SVOC	=	Semi-volatile organic compounds	MCLs	=	Maximum Contaminant Level
*	=	Collected by Basics Environmental in 1996			
mg/L	=	milligrams per liter (parts per million)	μg/L	=	micrograms per liter (parts per billion)
N/A	=	Not applicable	NA	=	Not analyzed
Cd	=	Cadmium	Cr	=	Chromium
Co	=	Cobalt	Pb	=	Lead
Ni	=	Nickel	Zn	=	Zinc
[uf]	=	Unfiltered groundwater sample			
[1]	=	All other VOC analytes were non-detectable at elevated limits of detection. Please see the laboratory report for details.			
[2]	=	Laboratory notes that the liquid sample contained greater than approximately 5% by volume sediment.			
[3]	=	2-Methylnaphthalene and Naphthalene detected at **280** and **430** μg/L, respectively. All other SVOC analytes were non-detectable at the indicated elevated limits of detection.			
[4]	=	Laboratory notes indicate a lighter than water immiscible sheen is present			
[5]	=	Federal level			
[6]	=	California Secondary MCL			

Results in **bold** indicate detectable concentrations.
Shaded results indicate concentrations above the respective MCL value.

Table IV, Results of Geotechnical Soil Sample Analysis BEI Job No. 201064, Robert Mintz Design Studio 819-823 East 12th Street, Oakland, California							
Sample I.D.	Depth (Feet)	Sample Date	Soil Description	Hydraulic Conductivity	Moisture Density	Porosity	Percent moisture
				cm/sec	pounds/ cubic foot	Percent	Percent
B6-17-18	17 to 18	8/7/01	Brown Clayey Sand to Brown Sandy Silt	NA	105.6	36.9	22.1
B7-16.5-17.5	16.5 to17.5	8/7/01	Brown Clay with sand	8 X 10^{-8}	NA	NA	NA

Notes:

cm/sec = centimeters per second
B6- 17-18 = Bore 6 at a depth of 17 to 18 feet below grade surface
NA = Not analyzed

Table V, Summary of Site Specific Target Levels BEI Job No. 202041, Former J & R Automobile Dismantlers 819-823 East 12th Street, Oakland, California											
Media	Benzene	Toluene	Ethylbenzene	Total Xylene	TPH Aliph. (TPH as motor oil)	Naphthalene	Cd	Cr	Pb	Ni	Zn
Soil SSTL (mg/Kg)	0.057	160	3,300	62,000	>16.0	100,000	700	>3.0E+11	255*	39,000	560,000
Calculated Representative Concentration (mg/Kg)	0.0025	0.18	1.8	14	13,000	3.1	11	**48**	**730**	72	580
SF- RWQCB Nuisance Threshold (mg/Kg)	NA	NA	NA	NA	500	NA	NA	NA	NA	NA	NA
Groundwater SSTL (mg/L)	0.0039	150	19	>200	>0.0000025	>31	0.066	>170,000	NA	2.6	39
Calculated Representative Concentration (mg/L)	**1.7**	2.5	0.79	4.1	2,000	0.71	0	0	0	0	0
SF- RWQCB Nuisance Threshold (mg/L)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

>	=	Indicates Site Specific Target Level (SSTL) is greater than constituent residual saturation value.
SSTL	=	Site Specific Target Level
SF - RWQCB	=	San Francisco Regional Water Quality Control Board
mg/Kg	=	Milligrams per kilogram
mg/L	=	Milligrams per liter
*	=	SF-RWQCB remedial goal

Results in **bold** indicate calculated representative concentration of analyte is over SSTL.

ID	Task Name	Duration
1	Receive Approval to Proceed	0 wks
2	Generate HASP	5 days
3	PCB Sample and Analysis	10 days
4	Begin Surface Remediation	2 days
5	Explore VMG/TC Anomalies	1 day
6	Sample bottom / Stockpiles	1 day
7	Lab Analysis	10 days
8	Offhaul Stockpile	1 day
9	Excavate Sump	3 days
10	Explore B7 Area	1 day
11	Sample Sump & B7	1 day
12	Lab Analysis	10 days
13	ORC Application	1 day
14	Offhaul Stockpiles	2 days
15	Backfill excavations	5 days
16	Generate RA Report	3 wks

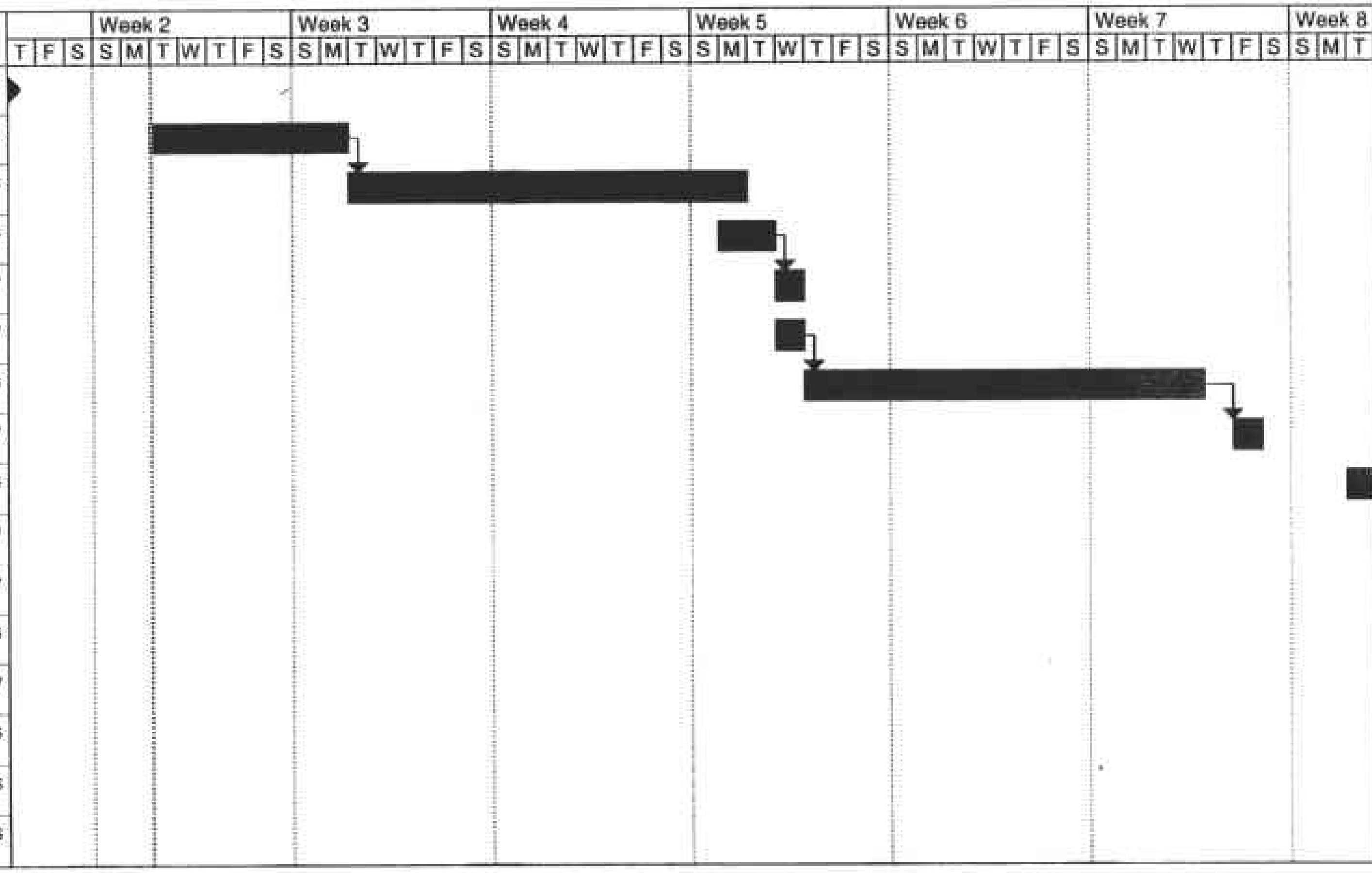


Table VI: Project Schedule
Former J & R Automobile Dismantlers
Date: October 3, 2002

Task		Rolled Up Task		External Tasks	
Progress		Rolled Up Milestone		Project Summary	
Milestone		Rolled Up Progress			
Summary		Split			

ID	Task Name
1	Receive Approval to Proceed
2	Generate HASP
3	PCB Sample and Analysis
4	Begin Surface Remediation
5	Explore VMG/TC Anomalies
6	Sample bottom / Stockpiles
7	Lab Analysis
8	Offhaul Stockpile
9	Excavate Sump
10	Explore B7 Area
11	Sample Sump & B7
12	Lab Analysis
13	ORC Application
14	Offhaul Stockpiles
15	Backfill excavations
16	Generate RA Report

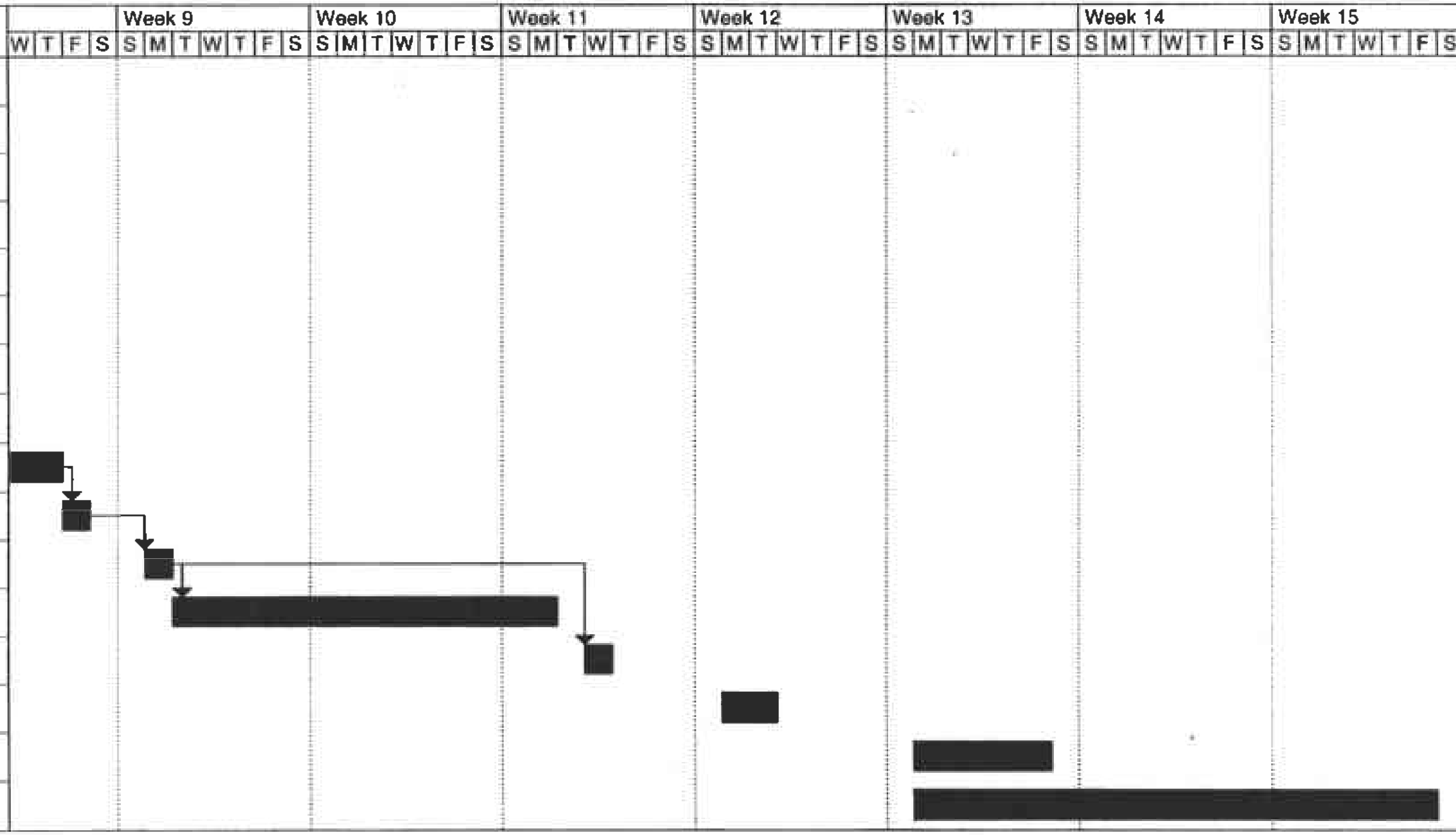
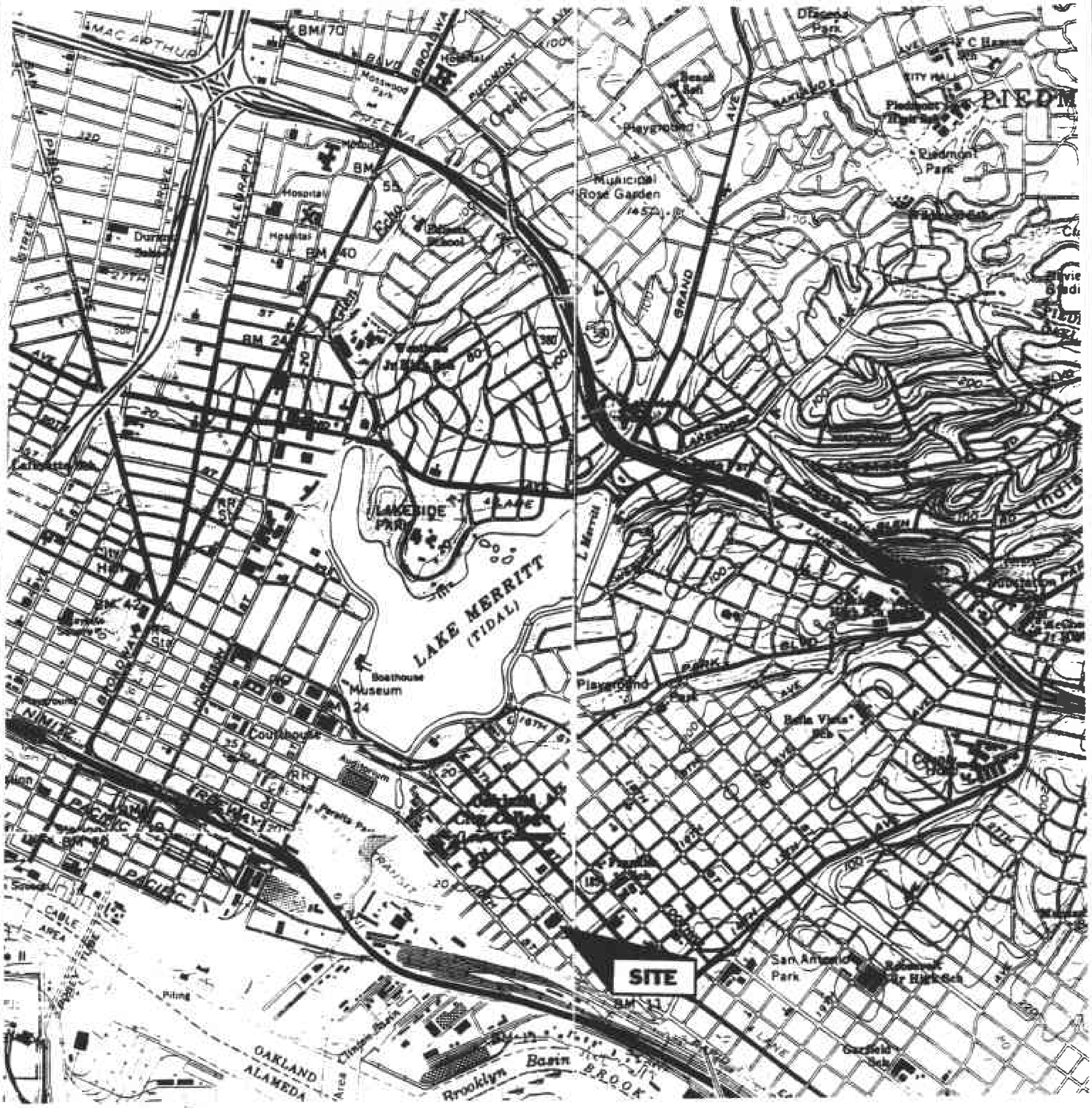


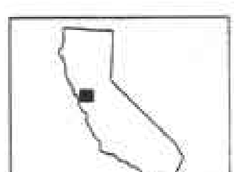
Table VI: Project Schedule
Former J & R Automobile Dismantlers
Date: October 3, 2002

Task | Rolled Up Task | External Tasks
Progress | Rolled Up Milestone | Project Summary
Milestone | Rolled Up Progress
Summary | Split

Figures



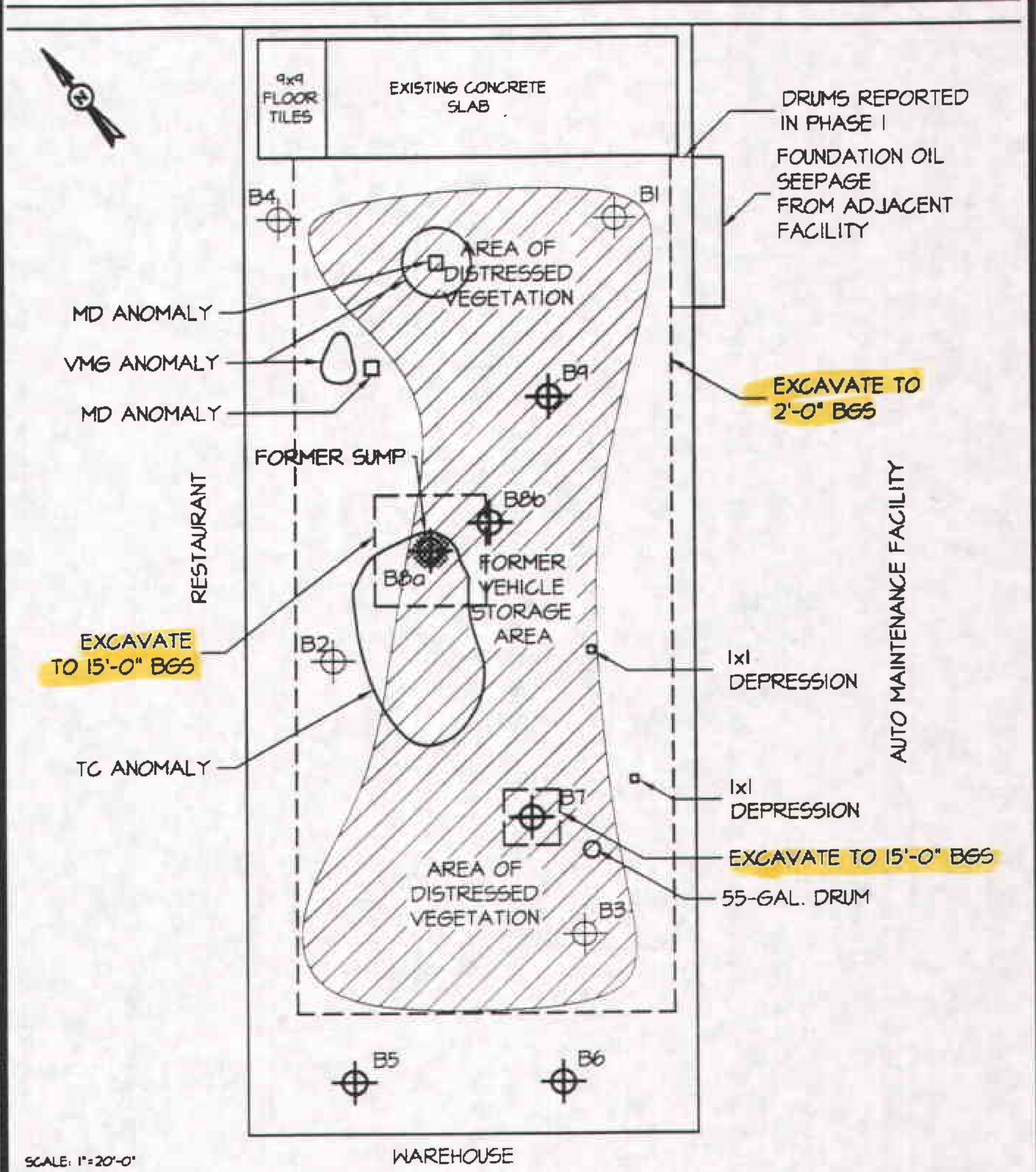
UNITED STATES GEOLOGICAL SURVEY 7.5' QUADS. "OAKLAND EAST" & "OAKLAND WEST, CA", PHOTOREVISED 1980.



QUADRANGLE LOCATION

BLYMYER ENGINEERS, INC.	0 1000 2000 SCALE IN FEET	N	**SITE LOCATION MAP** FORMER J & R AUTOMOBILE DISMANTLERS 819-823 EAST 12TH ST. OAKLAND, CA
BEI JOB NO. 202041	DATE 10-3-02		FIGURE 1

EAST 12TH STREET



SCALE: 1"=20'-0"

WAREHOUSE

BLYMYER ENGINEERS, INC.

BEI JOB NO.	DATE
202041	10-3-02

LEGEND

- BLYMYER ENGINEERS BORES
- PREVIOUS BASICS ENVIRONMENTAL BORES

BGS BELOW SURFACE GRADE
MD METAL DETECTOR
TC TERRAIN CONDUCTIVITY
VMG VERTICAL MAGNETIC GRADIENT

SITE PLAN
FORMER J & R AUTOMOBILE DISMANTLERS
819-823 12th ST.
OAKLAND, CA

FIGURE 2

Appendix A

Norcal Geophysical Consultants, Inc,
***Geophysical Investigation*,**
August 13, 2002

NORCAL GEOPHYSICAL CONSULTANTS, INC.

August 13, 2002

Mr. Mark Detterman
Blymyer Engineers, Inc.
1829 Clement Avenue
Alameda, CA 94501-1396

Subject: Geophysical Investigation
Vacant Lot
Oakland, California

Dear Mr. Detterman:

This letter presents the findings of a geophysical investigation performed on a portion of a vacant lot in Oakland, California. Geophysicist David Bissiri and Field Technician Jeff Blom conducted the field investigation on July 11, 2002. Site logistics were provided by Mr. Mark Detterman of Blymyer Engineers, Inc.

SITE DESCRIPTION

The site is located at 819-823 East 12th Street. The site is a rectangular open dirt lot bordered by a chain link fence along 12th Street on the east, and other assorted fences and walls of the adjoining buildings on the south, west, and north (see Site Map, Plate 1). The reported previous use of the site was that of an automobile dismantling facility. The proposed investigation area encompass an approximately 140- by 50-foot portion of the lot and is depicted on the site map with the dashed green line. Notable site features within the investigation area include a concrete pad and chain link fence in the eastern portion; a 55-gallon steel drum and two nearby surface depressions along the southern boundary; and a known sump in the central portion. Fences and walls of various adjacent buildings surround the site.

PURPOSE

The purpose of the investigation was to determine if various buried objects that may be associated with the former facility still exist. Possible anticipated buried objects include underground storage tanks (UST's), unknown sumps, and miscellaneous debris.

METHODOLOGY

We performed the geophysical investigation using vertical magnetic gradient (VMG), terrain conductivity (TC), hand-held metal detector (MD), and ground penetrating radar (GPR) techniques. Detailed descriptions of these techniques and the geophysical instrumentation we used are provided in Appendix "A".

DATA ACQUISITION

The first task undertaken at the site was to establish a survey grid to provide horizontal control during the VMG and TC data acquisition. Using a site map supplied by Blymyer Engineers we established a baseline 5 feet west of, and parallel to, the eastern fence. The survey grid consisted of a series of east-west lines spaced 5 feet apart oriented perpendicular to the baseline. Data measurement points were then distributed at 5-foot intervals along each line. Following the grid set-up, we used a proton precession magnetometer to collect VMG data and an electromagnetic terrain conductivity meter to collect TC data. After the VMG and TC data collection, the data sets were up-loaded to a field computer and processed to produce preliminary VMG and TC contour maps. We then analyzed these contour maps to determine the locations of VMG and TC anomalies that might be caused by buried objects or disturbed soil.

Following the VMG and TC surveys, we used the MD method in two ways. The first was to perform site-specific investigations of anomalous areas identified on the VMG and TC contour maps. These site-specific MD investigations involved multi-directional traverses over selected VMG and TC anomalies to determine the general extent and orientation of detected buried object or objects causing such anomalies. The second way we used the MD was to conduct a reconnaissance of the perimeter area outside of the VMG/TC investigation area. This perimeter area was comprised of the site within five feet of the fences and walls. This was done since experience has shown that any VMG and TC data which would have been obtained in this portion of such sites is usually adversely affected by these above ground objects.

The next field procedure was to use the GPR to obtain data from bidirectional traverses at five suspect areas: two areas in the immediate vicinity of buried metal objects delineated by the MD; one area west of the known sump; and two areas located at the two surface depressions along the southern boundary. The locations of the GPR traverses are depicted on Plate 1 as the solid red lines.

The final task undertaken was to map the site and the locations of detected subsurface features.

RESULTS

A site map depicting the locations of the VMG/TC investigation area, pertinent above ground objects, and interpreted subsurface features is presented on Plate 1. The geophysical data is presented in the form of VMG and TC contour maps on Plates 2 and 3, respectively. These contour maps show the data contour lines, the limits of the investigation area, and pertinent site features. Specific results and interpretations for the VMG, TC, MD and GPR methods are discussed below. A general discussion of data analysis, contour map interpretation and limitations is presented in Appendix B.

VMG

The VMG contour map displays numerous closely spaced and convoluted contour lines, primarily along the boundary of the investigated area. Such contours result from the magnetic effects of ferrous objects. While most of the contours can be attributed to the effects of the nearby walls and fences, or the 55-gallon drum, there are two assemblages of contours that could not be attributed to such effects. These anomalous contours appear as two small closures, or "bull's eyes" in the northeast portion of the site and are depicted on Plate 2 as the shaded red circles labeled Roman numerals "I" and "II". The location of these VMG anomalies are coincident or close to the locations of two metal-detector anomalies (see below). The extent and magnitude of these two VMG anomalies are consistent with those produced by minor amounts of metal debris such as of balls of wire, paint can lids, short sections of metal pipe, etc.

TC

The TC data is shown on Plate 3. Similar to the VMG contour map, this TC data also displays numerous closely spaced and convoluted contour closures. These convoluted contours indicate variations in terrain conductivity. Inspection of the data shows that the contours are most closely spaced in two portions of the investigation area. The first area where the TC contours are closely spaced is along the boundary of the investigation area. Here, the contour lines for the most part appear somewhat parallel to the boundary. Such contours are typical of the TC effects of large above ground objects *outside* of the investigation area, in this case the buildings and fences along the boundary.

The second area of closely spaced contours is immediately west of the known sump. Here the contours appear as a monopole or "bull's eye" of localized low TC values. This localized low is interpreted as consisting of contours below 50 milliSiemens/meter and is considered anomalous since there is no nearby above ground object which could be the source. This interpreted zone is depicted on Plate 3 as the shaded light blue oval area. The location of this TC anomaly does not coincide with the location of either a VMG or MD anomaly. This indicates that this TC anomaly is probably caused by non-ferrous materials such as wood, concrete, or perhaps disturbed soils. The proximity of this anomaly to the known sump further suggests that they may be related to each other. One possibility is that perhaps the known sump may have more compartments to the west than what is expressed on the surface.

MD

The site specific investigation of VMG and TC anomalies with the MD resulted in the delineation of two small shallowly buried metallic anomalies. The locations of these two anomalies are in the eastern portion of investigation site and are depicted on Plates 1 and 2 as the shaded dark blue squares labeled "A" and "B". The MD instrument response suggests that the metal objects at these locations are relatively small, perhaps only a foot or two across, and buried within two feet or so of the surface. Such instrument response is typical of that produced by minor amounts of metallic debris. The approximate centers of these two anomalies were marked in the field with plastic "brush flags".

The MD reconnaissance of the perimeter portion of the site did not detect any notable buried metallic objects.

GPR

The GPR results were generally inconclusive. Even though the MD instrument indicated that the suspected metal objects causing the MD anomalies A and B were shallowly buried and within the normal expected range of GPR detection we were unable to image them to any satisfactory degree. Likewise, we were unable to further characterize any buried features west of the known sump or at either surface depression along the southern boundary.

STANDARD CARE AND WARRANTY

The scope of NORCAL's services for this project consisted of using geophysical methods to characterize the shallow subsurface. The accuracy of our findings is subject to specific site conditions and limitations inherent to the techniques used. The services were performed in a manner consistent with the level of skill ordinarily exercised by members of the profession currently employing similar methods. No warranty, with respect to the services or products delivered under this agreement, expressed or implied, is made by NORCAL.

We appreciate having the opportunity to provide you with this information.

Respectfully,

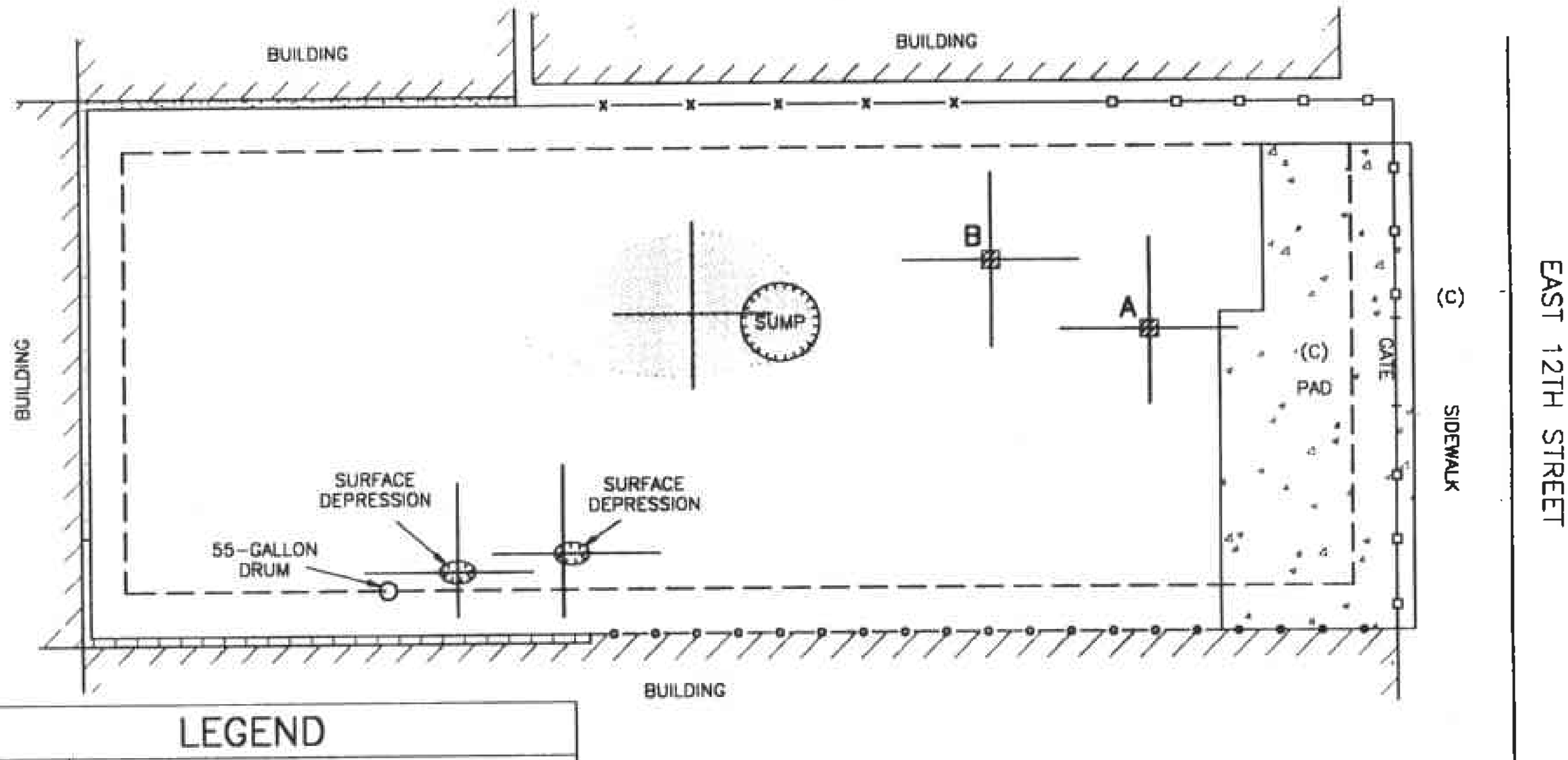
NORCAL Geophysical Consultants, Inc.

David Bissiri
Geophysicist GP-1009

DJB/WEB/jm

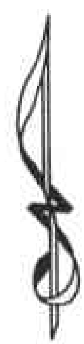
Enclosures: Plates 1 through 3

Appendix A GEOPHYSICAL METHODOLOGY AND INSTRUMENTATION
Appendix B DATA ANALYSIS, CONTOUR MAP INTERPRETATION AND LIMITATIONS



LEGEND

— — —	LIMITS OF GEOPHYSICAL SURVEY
A	METAL DETECTOR ANOMALY
	INTERPRETED LOCALIZED ZONE OF ANOMALOUSLY LOW TERRAIN CONDUCTIVITY VALUES
	GPR TRAVERSE
—x—	CHAIN-LINK FENCE
	SHEET METAL FENCE
	WOODEN WALL
	CONCRETE WALL
	BRICK WALL
(c)	CONCRETE



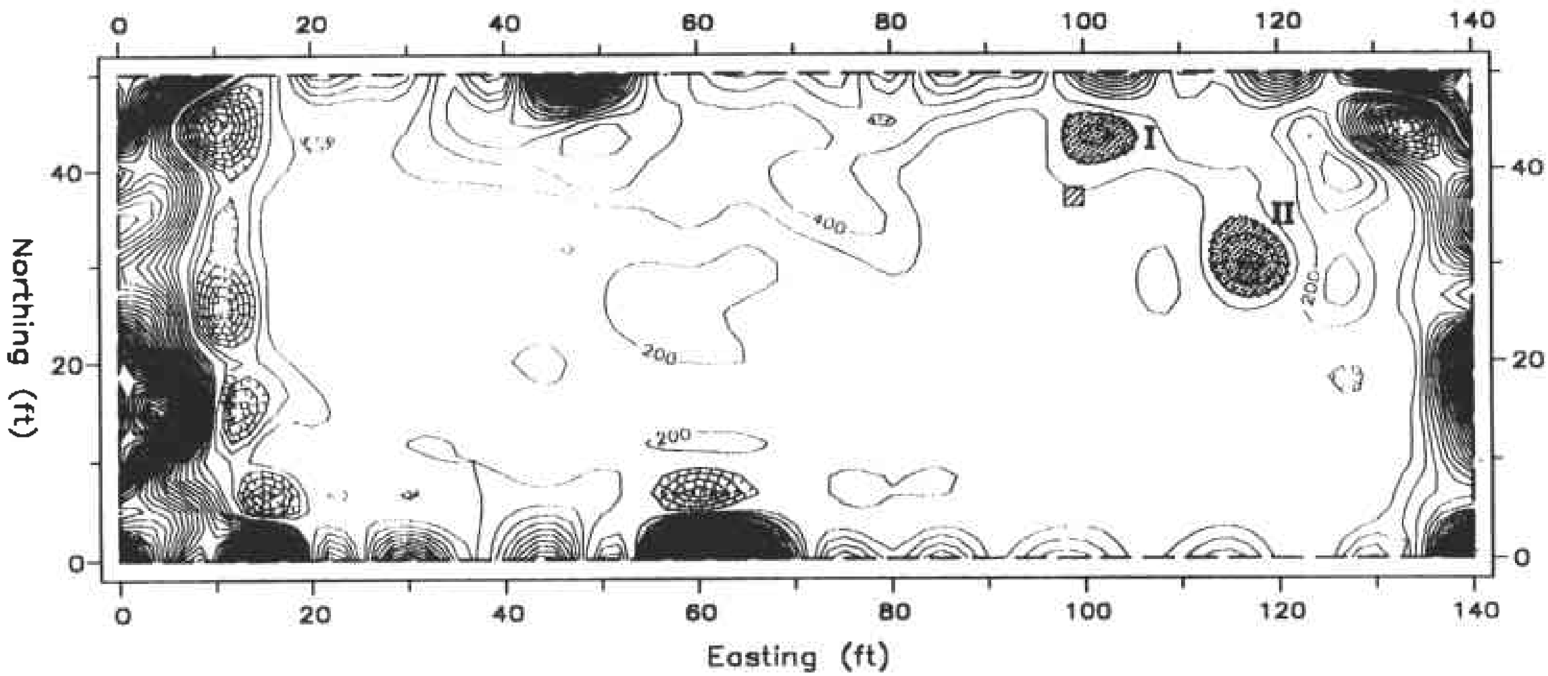
SCALE

0 10 20 40
(1 inch = 20 feet)

NORCAL

SITE MAP
FORMER J&R AUTO DISMANTLERS

LOCATION: OAKLAND, CALIFORNIA
CLIENT: BLYMYER ENGINEERS, INC.
NORCAL GEOPHYSICAL CONSULTANTS INC.
JOB #: 02-531.02
DATE: JUL. 2002
DRAWN BY: G RANDALL
APPROVED BY: DJB
PLATE 1



SCALE
0 10 20 40
(1 inch = 20 feet)

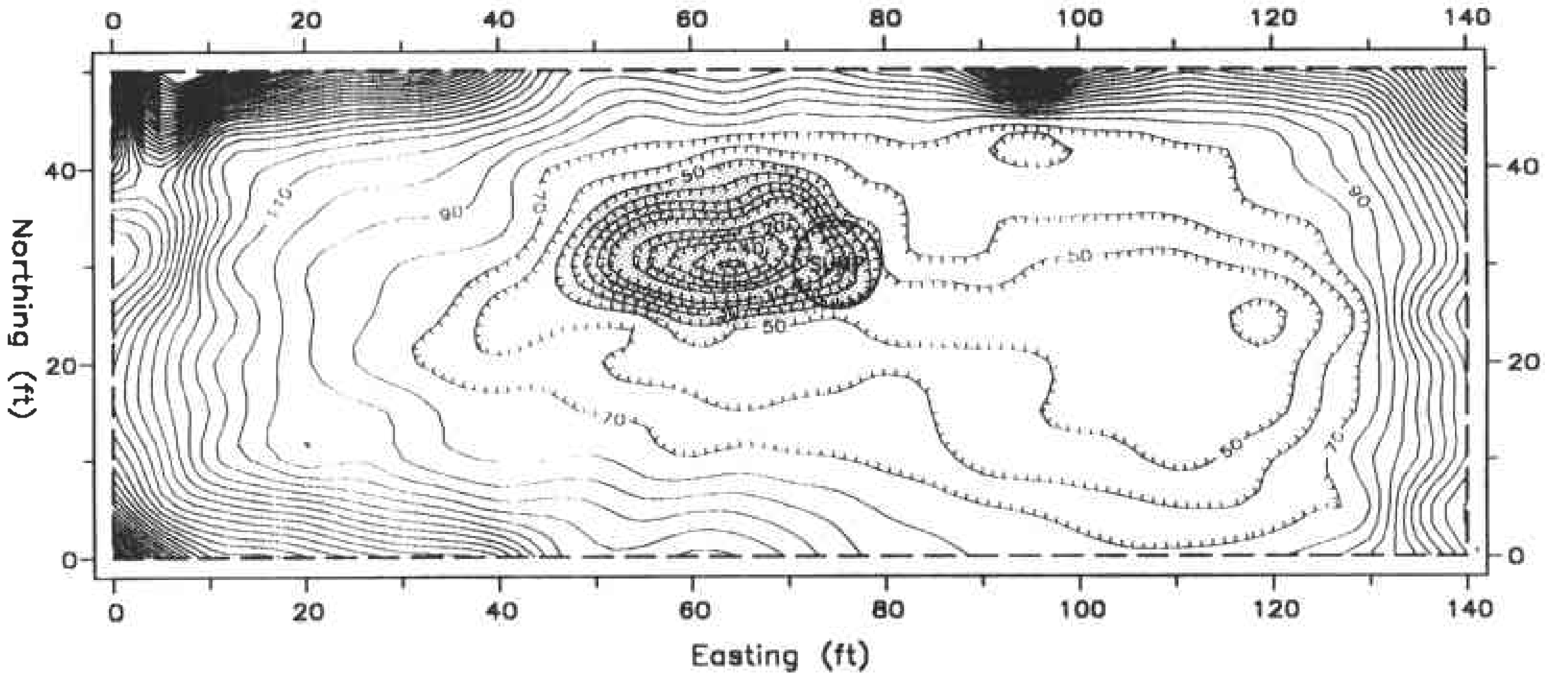
LEGEND

— — —	LIMITS OF GEOPHYSICAL SURVEY
0	VERTICAL MAGNETIC GRADIENT CONTOUR (CONTOUR INTERVAL = 200 nT/m)
I	INTERPRETED LOCALIZED ZONE OF ANOMALOUSLY LOW VERTICAL MAGNETIC GRADIENT VALUES
	METAL DETECTOR ANOMALY

NORCAL

VERTICAL MAGNETIC GRADIENT CONTOUR MAP
FORMER J&R AUTO DISMANTLERS

LOCATION: OAKLAND, CALIFORNIA
CLIENT: BLYMYER ENGINEERS, INC.
JOB #: 02-531.02
NORCAL GEOPHYSICAL CONSULTANTS INC.
DATE: JUL. 2002
DRAWN BY: C.RANDALL
APPROVED BY: DJB
PLATE 2



SCALE

0 10 20 40

(1 inch = 20 feet)

LEGEND

— — —	LIMITS OF GEOPHYSICAL SURVEY
~~0~~~	TERRAIN CONDUCTIVITY CONTOUR (CONTOUR INTERVAL = 20 mS/m)
	INTERPRETED LOCALIZED ZONE OF ANOMALOUSLY LOW TERRAIN CONDUCTIVITY VALUES

NORCAL

TERRAIN CONDUCTIVITY CONTOUR MAP FORMER J&R AUTO DISMANTLERS

LOCATION: OAKLAND, CALIFORNIA

CLIENT: BLYMYER ENGINEERS, INC.

JOB #: 02-531.02

NORCAL GEOPHYSICAL CONSULTANTS INC.

DATE: JUL 2002

DRAWN BY: G.RANDALL

APPROVED BY: DJB

PLATE 3

Appendix A

GEOPHYSICAL METHODOLOGY and INSTRUMENTATION

Appendix A

GEOPHYSICAL METHODOLOGY and INSTRUMENTATION

Vertical Magnetic Gradient (VMG) Magnetics

The magnetic field at any given point on the earth's surface is the vector sum of the earth's field combined with the magnetic fields of nearby magnetic objects. Most magnetometers measure the total intensity of the resulting magnetic field. These are referred to as "Total Field" measurements (TF) and are recorded in units of nanoTesla (nT). In environmental investigations it is often useful to measure the vertical gradient of the magnetic field as well. The vertical magnetic gradient is the vertical rate of change of the total field magnetic intensity. These are referred to as "Vertical Magnetic Gradient" (VMG) measurements, and are recorded in units of nanoTesla/meter (nT/m). While both TF and VMG measurements are related to the same phenomena (i.e. the magnetic field), each has certain advantages over the other. The VMG method is often chosen for environmental investigations because of the following advantages:

1) VMG measurements are generally less affected by nearby *above* ground objects, especially objects to the side of the instrument.

2) VMG measurements are not affected by temporal (diurnal) variations in the earth's magnetic field, unlike TF measurements.

3) VMG effects attenuate more rapidly with increasing distance from magnetic sources, thus allowing more precise determination of a buried object's location.

It should be noted, however, that because the VMG method is very sensitive, small near surface objects can be a source of "noise" in VMG data.

A vertical magnetic gradiometer is the device that is used to obtain the VMG data. This is accomplished by simultaneously measuring the total magnetic field intensity at two sensors which are vertically separated by a fixed distance (in this case, about one meter). The difference in magnetic intensity at each sensor is then divided by their separation distance to yield the vertical magnetic gradient. For this investigation, we used a Scintrex EnviMag magnetometer. This instrument consists of a console and two total field magnetic sensors that are positioned on a vertical staff. The staff is carried by the operator, with the lower sensor at about shoulder-level and the upper sensor at about head-level. The magnetometer features a built-in memory that stores the TF, VMG and survey grid information. The survey information can later be up-loaded to a computer for further processing.

Terrain Conductivity (TC)

The electrical conductivity of the near sub-surface can be measured through electromagnetic induction (EM). This is typically accomplished by some form of high frequency signal (primary field) produced by a transmitter coil inducing a secondary (induced) signal in the earth. A receiver coil located a short distance away from the transmitter reacts to the resulting magnetic field associated with both the primary signal and that of the induced signal. However, by careful design of a TC instrument, only the effects of the secondary induced current flow can be isolated and measured. This secondary signal has both quadrature and in-phase components (as measured in reference to the primary signal). Analysis of these two compónents can provide useful information about subsurface conditions. For most earth materials, the quadrature component provides the most useful information. This is because the amplitude of the quadrature component is linearly proportional to the electrical conductivity of the resistive material. This allows an absolute measurement of electrical conductivity in units of milliSiemens/meter (mS/m). Since the measured value at any given surface location represents the conductivity of a certain volume of material rather than individual elements within that volume, it is an *apparent* value and is referred to as "terrain conductivity". With conductive materials such as buried metal, the quadrature response is not linearly proportional. This non-linear behavior makes the TC device also useful as a metal detector.

Terrain conductivity values can be processed to form contour maps. These maps can then be interpreted to determine the location of buried metal, some types of contaminant plumes, variations in soil type or moisture content, and large back-filled areas. Interpretation of TC contour maps is similar in may ways to the interpretation of VMG contour maps. Contour map interpretation and is described in more detail in Appendix B - Data Analysis. Generally speaking, areas that are relatively free of sharp conductivity contrasts and/or large amounts of buried metal will result in smooth, evenly spaced contours with positive values. In contrast, areas containing significant amounts buried metal will exhibit closely spaced contours of both positive and negative values that may locally form closures. In some cases negative TC values are measured. Intuitively, negative conductivity is meaningless. However, negative values do occur. They result from measurements taken in the proximity of discrete, highly conductive objects. When such an object is buried somewhere beyond either of the two coils, the receiving coil detects a normal, or "positive image" of the object. However, if the object is buried between the two coils, the receiver coil detects a "mirror image" of the object and this results in a "negative" data value.

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Ground Penetrating Radar (GPR)

Ground penetrating radar is a method that provides a continuous, high resolution graphical cross-section which depicts variations in the electrical properties of the shallow subsurface. The entails repeatedly radiating an electromagnetic pulse into the ground from an antenna as it is moved along a traverse. Reflected signals are received by an antenna (often the same one used to generate the signal) and sent to a control unit for processing. The processed data are then printed in cross-sectional form on a graphical recorder.

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For this investigation, we used a Geophysical Survey Systems, Inc. SIR-2 Subsurface Interface Radar System equipped with a 500 megahertz (MHz) transducer. This unit is comprised of a combined control and data recording unit that is connected by a telemetry cable to the antenna. This system usually provides both the resolution and depth penetration for characterizing the shallow subsurface at a site such as this.

Metal Detection (MD)

This method is used to detect buried near surface metal objects such as UST's, metal conduits, rebar in concrete, manhole covers, and various metallic debris. This is done by carrying a hand-held radio transmitter-receiver unit above the ground and continuously scanning the surface. The unit utilizes two orthogonal coils that are mounted on a common staff. 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 (that is, in a "null" position), it is unaffected by the primary field. However, a buried metal object is not in a similar "null" position and therefore the secondary magnetic field produced by the buried metal object will generate an audible response from the unit. The peak of this response usually occurs when the unit is directly over the metal object. Our MD instrument for this investigation was a Fisher TW-6 pipe and cable locator. The TW-6 does not provide a recordable data output that can be used for later computer processing. Results are generally limited to marking the interpreted outlines of detected objects in the field and mapping their locations.

NORCAL

Appendix B

DATA ANALYSIS, CONTOUR MAP INTERPRETATION AND LIMITATIONS

Appendix B

DATA ANALYSIS

Computer Processing

We up-loaded the VMG, and TC data we obtained in the survey area to a portable computer at the end of each field day. The data were then converted into a format suitable for contouring. The contouring program SURFER from Golden Software was used to calculate an evenly spaced array of values (data grid) based on the measured field data. The gridded values were then contoured to produce various draft contour maps for preliminary analysis in the field. Final processing of the data was done at NORCAL's Petaluma office.

CONTOUR MAP INTERPRETATION

Generally speaking VMG and TC contour maps share common characteristics and interpretation criteria, even though they represent different physical parameters. In a region with uniform conditions VMG and TC values vary smoothly from one area to another. In contrast, in areas where variations are strong, the contours are moderately to closely spaced. In many cases, the variations are so strong that the contours are highly contorted and convoluted, with differences of several hundred units. These contorted contours may appear as roughly concentric circles forming "bull's eyes", tightly wound loops and whorls, or elongated parallel lines. If the source of a particular anomaly is an isolated object or a group of closely spaced objects, the contours may form isolated, somewhat symmetric closures known as "monopoles" (bull's eyes) or paired positive-negative closures known as "dipoles". If the source of a particular anomaly is a group of several objects not very closely spaced, then the contours will often form highly irregular, non-symmetric closures.

Areas that are typically considered anomalous are those which display large differences in data readings from one locality to the next. This is particularly the case when there are no obvious nearby above ground sources that could cause the variation. Actual anomaly magnitude and shape are dependent on the relative position and size of the buried objects with respect to the location of the measuring instrument. In general, anomaly magnitude decreases and anomaly width increases as distance (depth) to the source increases. Monopoles that are centered on a single data point and limited in extent to roughly the data point spacing of the sampling grid are often caused by small, near surface objects. Such objects may consist of well caps, pull boxes, balls of wire, etc. Larger monopoles that extend across an area equal to several data points are typically associated with larger objects. Isolated dipoles are often, but not always, attributed to a single object such as a UST, vault, buried ordnance, etc. A large accumulation of buried objects may appear as a group of closely spaced, contorted anomalies or a single large, less contorted anomaly. Elongated anomalies with parallel contour lines or a linear alignment of circular or elliptical closures is often indicative of a buried pipeline or other elongate object. Those anomalies that are neither monopoles or dipoles often are associated with multiple objects buried near each other, such as those comprising a debris field.

LIMITATIONS

Magnetic Methods

Buried ferrous metal objects produce localized variations in the earth's magnetic field. The magnetic intensity associated with these objects 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 in contrast to the intensity of background variations. The intensity of background variations is based on the amount of above and below ground metal that is present within the survey area. Cultural features such as chain link fences, buildings, debris, railroad spurs, utilities, above ground electric lines, etc. typically produce 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.

Terrain Conductivity (TC)

Many of the same general comments made above for magnetics applies to the TC method as well. The primary differences are that variations due to non-metallic material can be detected as well and usually TC variations are not as precisely determined as they are w[illegible] magnetics.

Ground Penetrating Radar (GPR)

The ability to detect subsurface targets is dependent on si[illegible] conditions. These conditions include depth of burial, the size or diameter of the targ[illegible] condition of the specific target in question, the type of backfill material associated with the target, and the surface conditions over the target. Typically, the GPR depth of detection will be reduced as the clay and/or moisture content in the subsurface increases. Therefore, it is possible that targets such as UST's and utilities buried greater than 2 to about 4 feet, may not be detectable by the GPR technique.

Appendix A

Norcal Geophysical Consultants, Inc,
***Geophysical Investigation*,**
August 13, 2002

August 13, 2002

Mr. Mark Detterman
Blymyer Engineers, Inc.
1829 Clement Avenue
Alameda, CA 94501-1396

Subject: Geophysical Investigation
Vacant Lot
Oakland, California

Dear Mr. Detterman:

This letter presents the findings of a geophysical investigation performed on a portion of a vacant lot in Oakland, California. Geophysicist David Bissiri and Field Technician Jeff Blom conducted the field investigation on July 11, 2002. Site logistics were provided by Mr. Mark Detterman of Blymyer Engineers, Inc.

SITE DESCRIPTION

The site is located at 819-823 East 12th Street. The site is a rectangular open dirt lot bordered by a chain link fence along 12th Street on the east, and other assorted fences and walls of the adjoining buildings on the south, west, and north (see Site Map, Plate 1). The reported previous use of the site was that of an automobile dismantling facility. The proposed investigation area encompass an approximately 140- by 50-foot portion of the lot and is depicted on the site map with the dashed green line. Notable site features within the investigation area include a concrete pad and chain link fence in the eastern portion; a 55-gallon steel drum and two nearby surface depressions along the southern boundary; and a known sump in the central portion. Fences and walls of various adjacent buildings surround the site.

PURPOSE

The purpose of the investigation was to determine if various buried objects that may be associated with the former facility still exist. Possible anticipated buried objects include underground storage tanks (UST's), unknown sumps, and miscellaneous debris.

METHODOLOGY

We performed the geophysical investigation using vertical magnetic gradient (VMG), terrain conductivity (TC), hand-held metal detector (MD), and ground penetrating radar (GPR) techniques. Detailed descriptions of these techniques and the geophysical instrumentation we used are provided in Appendix "A".

DATA ACQUISITION

The first task undertaken at the site was to establish a survey grid to provide horizontal control during the VMG and TC data acquisition. Using a site map supplied by Blymyer Engineers we established a baseline 5 feet west of, and parallel to, the eastern fence. The survey grid consisted of a series of east-west lines spaced 5 feet apart oriented perpendicular to the baseline. Data measurement points were then distributed at 5-foot intervals along each line. Following the grid set-up, we used a proton precession magnetometer to collect VMG data and an electromagnetic terrain conductivity meter to collect TC data. After the VMG and TC data collection, the data sets were up-loaded to a field computer and processed to produce preliminary VMG and TC contour maps. We then analyzed these contour maps to determine the locations of VMG and TC anomalies that might be caused by buried objects or disturbed soil.

Following the VMG and TC surveys, we used the MD method in two ways. The first was to perform site-specific investigations of anomalous areas identified on the VMG and TC contour maps. These site-specific MD investigations involved multi-directional traverses over selected VMG and TC anomalies to determine the general extent and orientation of detected buried object or objects causing such anomalies. The second way we used the MD was to conduct a reconnaissance of the perimeter area outside of the VMG/TC investigation area. This perimeter area was comprised of the site within five feet of the fences and walls. This was done since experience has shown that any VMG and TC data which would have been obtained in this portion of such sites is usually adversely affected by these above ground objects.

The next field procedure was to use the GPR to obtain data from bidirectional traverses at five suspect areas: two areas in the immediate vicinity of buried metal objects delineated by the MD; one area west of the known sump; and two areas located at the two surface depressions along the southern boundary. The locations of the GPR traverses are depicted on Plate 1 as the solid red lines.

The final task undertaken was to map the site and the locations of detected subsurface features.

RESULTS

A site map depicting the locations of the VMG/TC investigation area, pertinent above ground objects, and interpreted subsurface features is presented on Plate 1. The geophysical data is presented in the form of VMG and TC contour maps on Plates 2 and 3, respectively. These contour maps show the data contour lines, the limits of the investigation area, and pertinent site features. Specific results and interpretations for the VMG, TC, MD and GPR methods are discussed below. A general discussion of data analysis, contour map interpretation and limitations is presented in Appendix B.

VMG

The VMG contour map displays numerous closely spaced and convoluted contour lines, primarily along the boundary of the investigated area. Such contours result from the magnetic effects of ferrous objects. While most of the contours can be attributed to the effects of the nearby walls and fences, or the 55-gallon drum, there are two assemblages of contours that could not be attributed to such effects. These anomalous contours appear as two small closures, or "bull's eyes" in the northeast portion of the site and are depicted on Plate 2 as the shaded red circles labeled Roman numerals "I" and "II". The location of these VMG anomalies are coincident or close to the locations of two metal-detector anomalies (see below). The extent and magnitude of these two VMG anomalies are consistent with those produced by minor amounts of metal debris such as of balls of wire, paint can lids, short sections of metal pipe, etc.

TC

The TC data is shown on Plate 3. Similar to the VMG contour map, this TC data also displays numerous closely spaced and convoluted contour closures. These convoluted contours indicate variations in terrain conductivity. Inspection of the data shows that the contours are most closely spaced in two portions of the investigation area. The first area where the TC contours are closely spaced is along the boundary of the investigation area. Here, the contour lines for the most part appear somewhat parallel to the boundary. Such contours are typical of the TC effects of large above ground objects *outside* of the investigation area, in this case the buildings and fences along the boundary.

The second area of closely spaced contours is immediately west of the known sump. Here the contours appear as a monopole or "bull's eye" of localized low TC values. This localized low is interpreted as consisting of contours below 50 milliSiemens/meter and is considered anomalous since there is no nearby above ground object which could be the source. This interpreted zone is depicted on Plate 3 as the shaded light blue oval area. The location of this TC anomaly does not coincide with the location of either a VMG or MD anomaly. This indicates that this TC anomaly is probably caused by non-ferrous materials such as wood, concrete, or perhaps disturbed soils. The proximity of this anomaly to the known sump further suggests that they may be related to each other. One possibility is that perhaps the known sump may have more compartments to the west than what is expressed on the surface.

MD

The site specific investigation of VMG and TC anomalies with the MD resulted in the delineation of two small shallowly buried metallic anomalies. The locations of these two anomalies are in the eastern portion of investigation site and are depicted on Plates 1 and 2 as the shaded dark blue squares labeled "A" and "B". The MD instrument response suggests that the metal objects at these locations are relatively small, perhaps only a foot or two across, and buried within two feet or so of the surface. Such instrument response is typical of that produced by minor amounts of metallic debris. The approximate centers of these two anomalies were marked in the field with plastic "brush flags".

The MD reconnaissance of the perimeter portion of the site did not detect any notable buried metallic objects.

GPR

The GPR results were generally inconclusive. Even though the MD instrument indicated that the suspected metal objects causing the MD anomalies A and B were shallowly buried and within the normal expected range of GPR detection. we were unable to image them to any satisfactory degree. Likewise, we were unable to further characterize any buried features west of the known sump or at either surface depression along the southern boundary.

STANDARD CARE AND WARRANTY

The scope of NORCAL's services for this project consisted of using geophysical methods to characterize the shallow subsurface. The accuracy of our findings is subject to specific site conditions and limitations inherent to the techniques used. The services were performed in a manner consistent with the level of skill ordinarily exercised by members of the profession currently employing similar methods. No warranty, with respect to the services or products delivered under this agreement, expressed or implied, is made by NORCAL.

We appreciate having the opportunity to provide you with this information.

Respectfully,

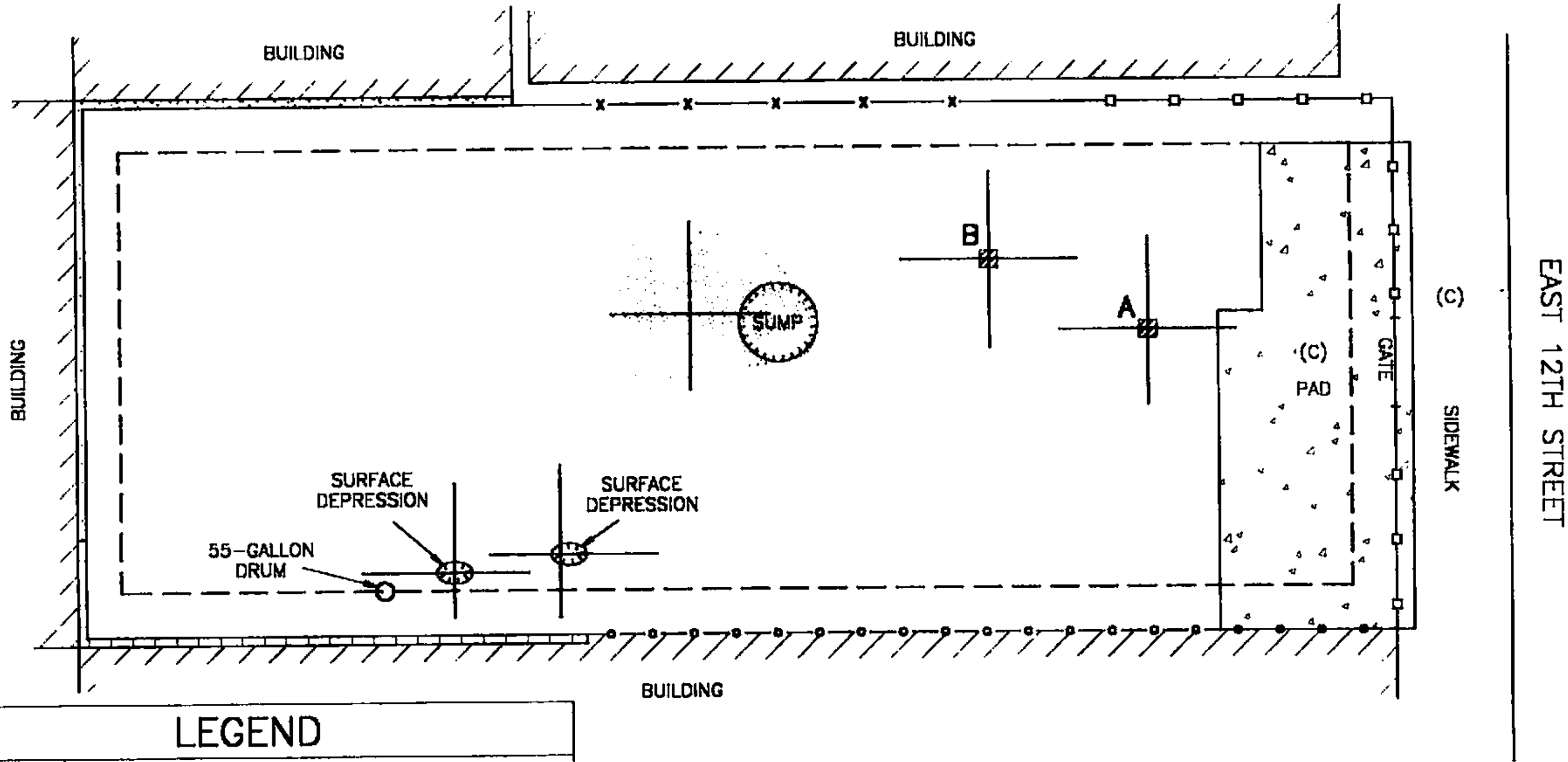
NORCAL Geophysical Consultants, Inc.

David Bissiri
Geophysicist GP-1009

DJB/WEB/jm

Enclosures: Plates 1 through 3

Appendix A GEOPHYSICAL METHODOLOGY AND INSTRUMENTATION
Appendix B DATA ANALYSIS, CONTOUR MAP INTERPRETATION AND LIMITATIONS



LEGEND

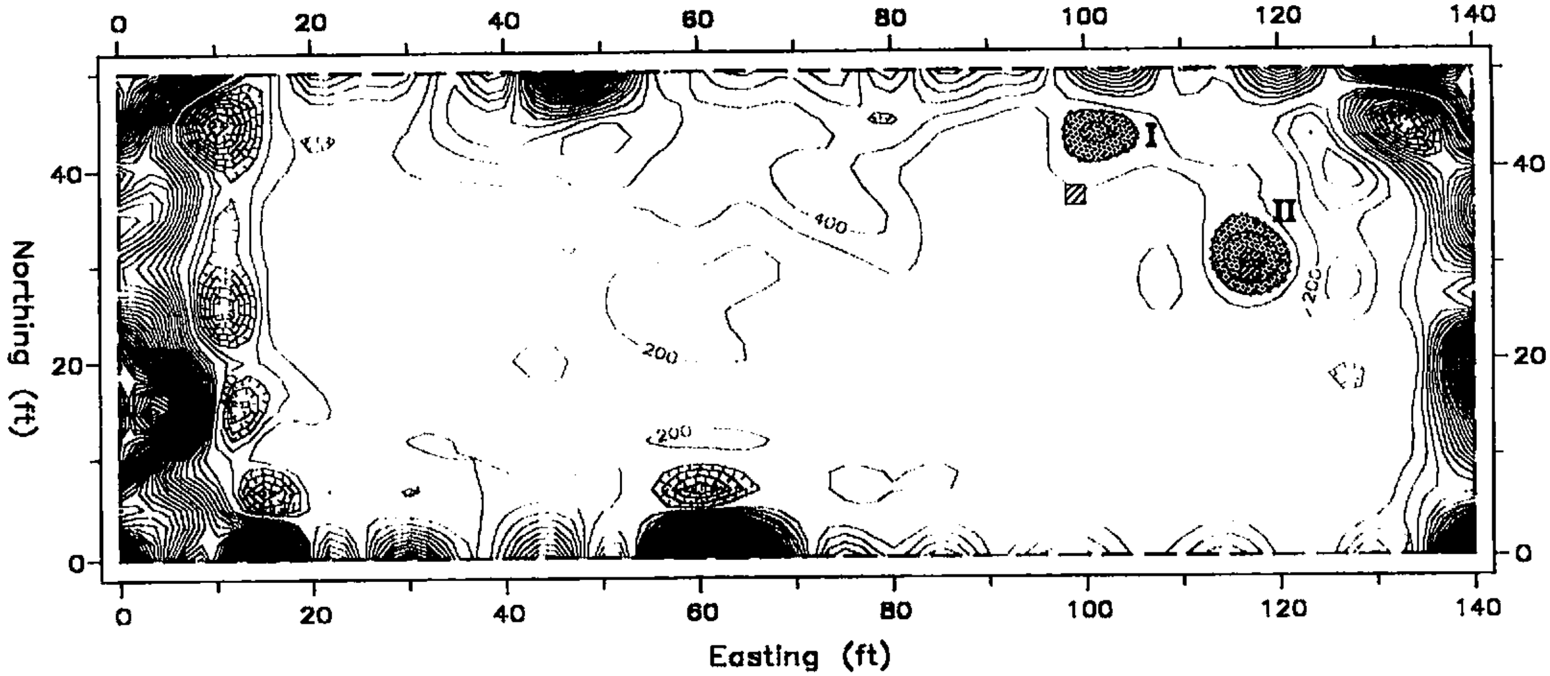
	LIMITS OF GEOPHYSICAL SURVEY
A	METAL DETECTOR ANOMALY
	INTERPRETED LOCALIZED ZONE OF ANOMALOUSLY LOW TERRAIN CONDUCTIVITY VALUES
	GPR TRAVERSE
	CHAIN-LINK FENCE
	SHEET METAL FENCE
	WOODEN WALL
	CONCRETE WALL
	BRICK WALL
(c)	CONCRETE

SCALE

0 10 20 40

(1 inch = 20 feet)

NORCAL	SITE MAP FORMER J&R AUTO DISMANTLERS	
	LOCATION: OAKLAND, CALIFORNIA	PLATE
	CLIENT: BLYMYER ENGINEERS, INC.	1
JOB #: 02-531.02	NORCAL GEOPHYSICAL CONSULTANTS INC.	
DATE: JUL. 2002	DRAWN BY: G.RANDALL — APPROVED BY: DJB	



SCALE

0 10 20 40
(1 inch = 20 feet)

LEGEND

— — —	LIMITS OF GEOPHYSICAL SURVEY
——0——	VERTICAL MAGNETIC GRADIENT CONTOUR (CONTOUR INTERVAL = 200 nT/m)
I	INTERPRETED LOCALIZED ZONE OF ANOMALOUSLY LOW VERTICAL MAGNETIC GRADIENT VALUES
▨	METAL DETECTOR ANOMALY

NORCAL	VERTICAL MAGNETIC GRADIENT CONTOUR MAP FORMER J&R AUTO DISMANTLERS	
	LOCATION: OAKLAND, CALIFORNIA	
	CLIENT: BLYMYER ENGINEERS, INC.	PLATE 2
JOB #: 02-531.02	NORCAL GEOPHYSICAL CONSULTANTS INC.	
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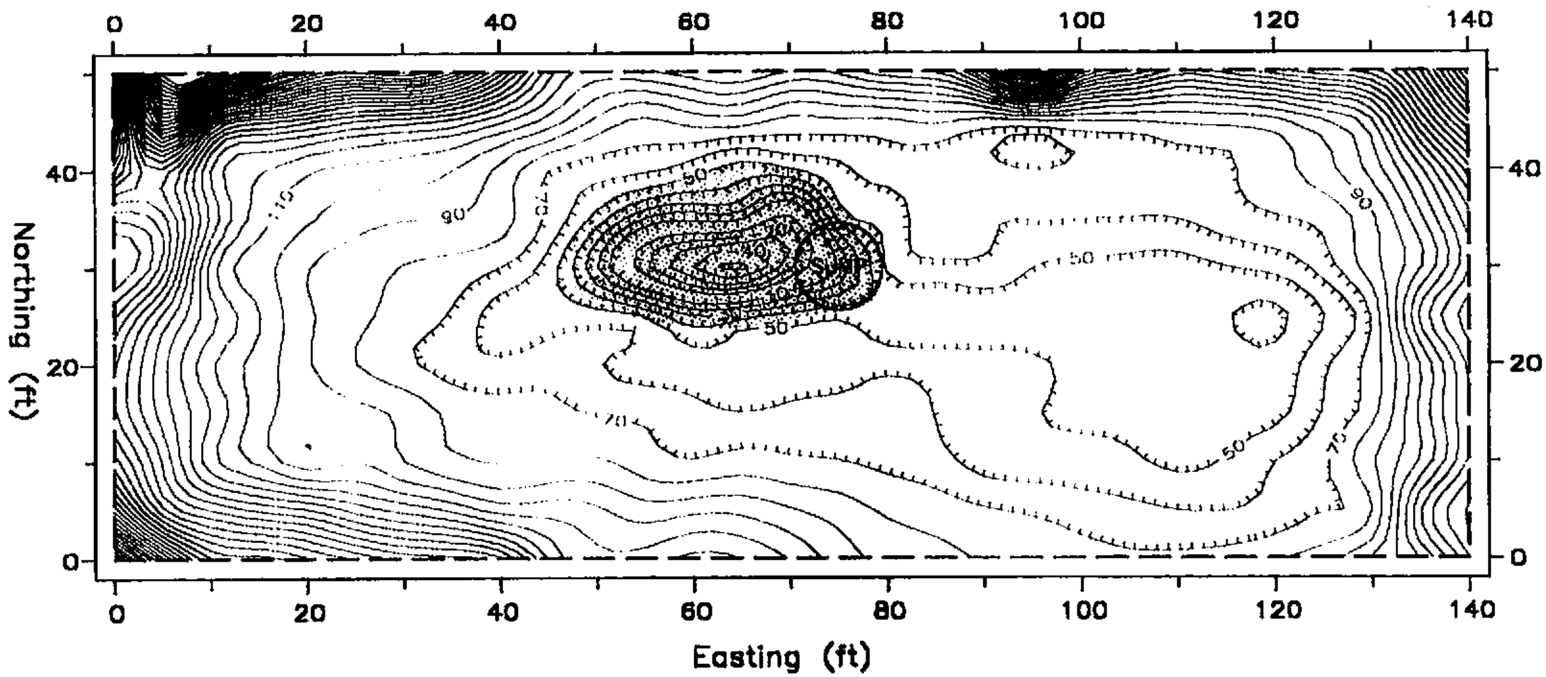

SCALE
0 10 20 40
(1 inch = 20 feet)

LEGEND

— — —	LIMITS OF GEOPHYSICAL SURVEY
—0—	TERRAIN CONDUCTIVITY CONTOUR (CONTOUR INTERVAL = 20 mS/m)
	INTERPRETED LOCALIZED ZONE OF ANOMALOUSLY LOW TERRAIN CONDUCTIVITY VALUES

NORCAL

TERRAIN CONDUCTIVITY
CONTOUR MAP
FORMER J&R AUTO DISMANTLERS

LOCATION: OAKLAND, CALIFORNIA

CLIENT: BLYMYER ENGINEERS, INC.

NORCAL GEOPHYSICAL CONSULTANTS INC.

JOB #: 02-531.02

DATE: JUL. 2002

DRAWN BY: G.RANDALL

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NORCAL

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We up-loaded the VMG, and TC data we obtained in the survey area to a portable computer at the end of each field day. The data were then converted into a format suitable for contouring. The contouring program SURFER from Golden Software was used to calculate an evenly spaced array of values (data grid) based on the measured field data. The gridded values were then contoured to produce various draft contour maps for preliminary analysis in the field. Final processing of the data was done at NORCAL's Petaluma office.

CONTOUR MAP INTERPRETATION

Generally speaking VMG and TC contour maps share common characteristics and interpretation criteria, even though they represent different physical parameters. In a region with uniform conditions VMG and TC values vary smoothly from one area to another. In contrast, in areas where variations are strong, the contours are moderately to closely spaced. In many cases, the variations are so strong that the contours are highly contorted and convoluted, with differences of several hundred units. These contorted contours may appear as roughly concentric circles forming "bull's eyes", tightly wound loops and whorls, or elongated parallel lines. If the source of a particular anomaly is an isolated object or a group of closely spaced objects, the contours may form isolated, somewhat symmetric closures known as "monopoles" (bull's eyes) or paired positive-negative closures known as "dipoles". If the source of a particular anomaly is a group of several objects not very closely spaced, then the contours will often form highly irregular, non-symmetric closures.

Areas that are typically considered anomalous are those which display large differences in data readings from one locality to the next. This is particularly the case when there are no obvious nearby above ground sources that could cause the variation. Actual anomaly magnitude and shape are dependent on the relative position and size of the buried objects with respect to the location of the measuring instrument. In general, anomaly magnitude decreases and anomaly width increases as distance (depth) to the source increases. Monopoles that are centered on a single data point and limited in extent to roughly the data point spacing of the sampling grid are often caused by small, near surface objects. Such objects may consist of well caps, pull boxes, balls of wire, etc. Larger monopoles that extend across an area equal to several data points are typically associated with larger objects. Isolated dipoles are often, but not always, attributed to a single object such as a UST, vault, buried ordnance, etc. A large accumulation of buried objects may appear as a group of closely spaced, contorted anomalies or a single large, less contorted anomaly. Elongated anomalies with parallel contour lines or a linear alignment of circular or elliptical closures is often indicative of a buried pipeline or other elongate object. Those anomalies that are neither monopoles or dipoles often are associated with multiple objects buried near each other, such as those comprising a debris field.

LIMITATIONS

Magnetic Methods

Buried ferrous metal objects produce localized variations in the earth's magnetic field. The magnetic intensity associated with these objects 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 in contrast to the intensity of background variations. The intensity of background variations is based on the amount of above and below ground metal that is present within the survey area. Cultural features such as chain link fences, buildings, debris, railroad spurs, utilities, above ground electric lines, etc. typically produce 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.

Terrain Conductivity (TC)

Many of the same general comments made above for magnetics applies to the TC method as well. The primary differences are that variations due to non-metallic material can be detected as well and usually TC variations are not as precisely determined as they are [illegible] magnetics.

Ground Penetrating Radar (GPR)

The ability to detect subsurface targets is dependent on [illegible] conditions. These conditions include depth of burial, the size or diameter of the [illegible] condition of the specific target in question, the type of backfill material associated with the target, and the surface conditions over the target. Typically, the GPR depth of detection will be reduced as the clay and/or moisture content in the subsurface increases. Therefore, it is possible that targets such as UST's and utilities buried greater than 2 to about 4 feet, may not be detectable by the GPR technique.