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A Member of The IT Group
4005 Port Chicago Highway
Concord, California 94520

Geophysical Survey and Exploratory Trenching
NASA Crows Landing Flight Facility, Crows Landing, California

Environmental Remedial Action Contract Number N62474-98-D-2076, Contract Task Order 0004
Document Control Number 4084, Revision 0 – June 14, 2002

ITP Site 11 Investigation Summary

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IT TRANSMITTAL/DELIVERABLE RECEIPT

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Southwest Division
Naval Facilities Engineering Command
Michelle Crook, 02R1.MC
1230 Columbia St., Suite 870
San Diego, CA 92101-5817

Date : June 14, 2002

CTO : 0004

Location: NASA Crows Landing

FROM: Bob Hulet
Bob Hulet
Project Manager

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Gary Munekawa, 61N1.GM (1C/1E)
Marianna Potacka, 06CM.MP (1C/1E)
Diane Silva, 4MG.DS (1C/3E)

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Don Chuck, NASA (1C/1E)
Francesco D'Onofrio, California Department of Toxic Substances Control (1C/1E)
Mike Sonke, Stanislaus County (1C/1E)
Crispin Wanyoike, Earth Tech, Inc (1C/2E)

Date/Time Received _____/_____

IT Corporation
4005 Port Chicago Highway
Concord, CA 94520-1120
Tel. 925.288.9898

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June 14, 2002

Mr. Charles DePew, Code 06CCCD
Contracting Officer
BRAC Operations, SWDiv
Naval Facilities Engineering Command
1220 Pacific Highway
San Diego, CA 92132-5190

Addressee: Ms. Lynn Hornecker, Code 06CC.LH

Contract: N62474-98-D-2076, Environmental Remedial Action Contract

Contract Task Order: 0004, Interim Response Actions and Clearance Surveys at Various Sites, NASA Crows Landing Flight Facility, Crows Landing, California

Subject: IRP Site 11 Investigation Summary – Geophysical Survey and Exploratory Trenching

Dear Ms. Hornecker:

Attached is a letter report that presents the IRP Site 11 Investigation Summary – Geophysical Survey and Exploratory Trenching. The report consists of the following:

1. Section 1.0, Introduction - Presents the goal of the activities conducted, the scope of the work performed, and an overview of the organization of the report.

2. Section 2.0, Site Background - Presents information on the background of IRP Site 11 including the location, history of disposal activities at the site, and summary of the results of previous investigations at the facility pertinent to the scope of work.

3. Section 3.0, Field Activities - Describes field activities that were conducted and presents a discussion of the results of each phase of the work.

4. Section 4.0, Conclusions and Recommendations - Summarizes the findings from the geophysical surveys and exploratory trenching and proposes recommendations for the use of the data to complete additional activities and support site remediation and closure.

5. Section 5.0, References - Lists the references used in the preparation of this document.

6. Attachment 1 – The site and survey points are shown in Figure 1, "IRP Site 11 UXO and Geophysical Survey Area."

7. Attachment 2 - Preconstruction photographs and unexploded ordnance clearance survey information.

8. Attachment 3 - Geophysical Survey Report

9. Attachment 4 - Test Pit Location Maps

10. Attachment 5 - Summary of Findings, Test Pit Excavation Activities

11. Attachment 6 – Soil Pile Analytical Results

If you have questions concerning this report, please contact the undersigned at (925) 288-2162.

Sincerely,
IT CORPORATION

Bob Hulet

Bob Hulet, C.P.G.
Project Manager

Enclosures:

c: David Kelly
Tom Barry
Project File

INSTALLATION RESTORATION SITE INVESTIGATION SUMMARY
GEOPHYSICAL SURVEY AND EXPLORATORY TRENCHING
NASA CROWS LANDING FLIGHT FACILITY
CROWS LANDING, CALIFORNIA

1.0 Introduction

This report summarizes the results of a surface geophysical survey and subsequent exploratory trenching that was conducted to evaluate the composition and horizontal and vertical distribution of buried waste at Installation Restoration Program (IRP) Site 11 at the National Aeronautics and Space Administration (NASA) Crows Landing Flight Facility in Crows Landing, California. The work was performed under the *Work Plan, Soil Vapor Extraction Optimization for the Remediation of UST Cluster 1 and Site Verification Activities at Various Sites,* Revision 2; Attachment 3, Site 11 Geophysical Survey (IT Corporation [IT], 2001a); and the *Unexploded Ordnance Avoidance Work Plan,* Revision 2 (IT, 2001b). Due to historical operations involving the storage and disposal of Unexploded Ordnance (UXO) and inert ordnance items at the facility, UXO avoidance procedures and radiological screening surveys were implemented as part of the Health and Safety Program during the trenching activities.

Historical information from an Initial Assessment Study (IAS) for the former Naval Auxiliary Landing Field (NALF), Crows Landing (now known as NASA Crows Landing Flight Facility) identified the potential of buried waste and debris at four locations within the IRP Site 11 boundary; three disposal pits within the open field surrounded by the ammunition storage bunkers and access road, and one waste pile located between two concrete pads associated with the former ammunition storage bunkers at the northern end of the site (Naval Engineering and Environmental Support Activity [NEESA], 1984). Previous base personnel later described a total of four disposal pits; two disposal pits within the open field surrounded by the access road, and two disposal pits located near the former location of ammunition storage bunkers at the northern end of the site (PRC Environmental Management, Inc. [PRC], 1992). A magnetometer survey conducted as part of the Site Investigation (SI) identified three anomalies indicating possible disposal pit locations; two anomalies were identified at the northern and western edge of the open field surrounded by the access road, and one near the former location of an ammunition storage bunker at the southern end of the site. Soil borings conducted during the SI and Remedial Investigation (RI) identified fill material, consisting of construction debris. No attempts were made during the RI to identify the horizontal or vertical extent of any of the anomalies identified during the SI (PRC, 1997).

The additional geophysical survey and exploratory trenching described in this report was conducted to verify historical information and previous field investigation results, to evaluate the extent of any anomalies identified, and to identify the type of material contained in the disposal pits.

1.1 Scope of Work

The field activities conducted as part of the geophysical survey and exploratory trenching at IRP Site 11 included site preparation to clear ground surface of any unexploded ordnance (UXO) or ordnance and explosive (OE) material, geophysical surveys to identify magnetic and terrain conductivity anomalies, exploratory trenching to identify the type and extent of waste material identified during the geophysical surveys, and the removal of waste soil deposited in piles throughout the IRP Site 11 Area that interfered with the collection of geophysical data to allow for future testing as necessary.

1.2 Report Organization

The report is organized in the following sections:

- Section 1.0, Introduction – Presents the goal of the activities conducted, the scope of the work performed and an overview of the organization of the report.
- Section 2.0, Site Background – Presents information on the background of IRP Site 11 including the location, history of disposal activities at the site, and summary of the results of previous investigations at the facility pertinent to the scope of work.
- Section 3.0, Field Activities – Describes field activities that were conducted and presents a discussion of the results of each phase of the work.
- Section 4.0, Conclusions and Recommendations – Summarizes the findings from the geophysical surveys and exploratory trenching and proposes recommendations for the use of the data to complete additional activities and support site remediation and closure.
- Section 5.0, References – Lists the references used in the preparation of this document.

2.0 Site Background

IRP Site 11 is located north of the intersection of the two runways (Figure 1). The area is approximately 10 acres with a portion currently surrounded by a chain link fence. Bunkers constructed in 1944 around the perimeter of the site were used to store ammunition. A road that provides access to the bunkers enters and exits the site from the eastern edge and surrounds an open field in the center of the site. In the mid-1960 the ammunition storage bunkers were dismantled (with the exception of one bunker – Building 46), leaving only the concrete foundations (NEESA, 1984).

IRP Site 11 was used for refuse disposal from the mid-1960s to 1982. Waste, including paper, construction debris, and scrap metal was placed in pits and burned. When the pits were full, they were covered with soil and a new pit was dug. The IAS indicated that three large pits, located in the open field south of the concrete pads, were used for waste disposal. A fourth waste pile was identified between the concrete pads at the north edge of the site. It is reported that empty pesticide containers and paint cans were disposed at IRP Site 11. Waste oil was disposed at the fire fighter training area and not at IRP Site 11. From the late 1970s to 1982, waste from the facility was placed in a dumpster located at IRP Site 11 near Building 46 and was shipped off-site for disposal at a local municipal landfill.

In 1979, approximately 300 pounds of metal debris were collected from a nearby practice bombing range and brought to IRP Site 11 for disposal (NEESA, 1984). A pit was dug in the middle of the field. Anything that potentially contained propellant explosive was burned and covered with soil.

Following the publication of the IAS, former base personnel described four waste pit locations, one north of the concrete pads, one between the concrete pads, and two in the open field surrounded by the perimeter access road (PRC, 1992). A depression in the ground surface along the western edge of the open field surrounded by the access road was noted during preparation of the SI activities. An aerial photograph from 1967 indicates that piles of material were present west of the access road (PRC, 1997).

A magnetometer survey was conducted at IRP Site 11 during the SI activities. The survey identified three anomalies that were potential disposal pits. Two of the anomalies were located within the open field surrounded by the access road, one south of the concrete pads, and one at the western edge of the open field at the location of the surface depression. The third anomaly

was located near the southeast corner of the site near a concrete pad. The location of the anomalies is included in Figure 1. Soil borings conducted during the SI identified fill material present to depths of approximately 6 feet below ground surface.

The primary objective of the RI at IRP Site 11 was to evaluate the extent and potential source of the petroleum hydrocarbons detected in groundwater (PRC, 1997). Little information was collected relative to the size of the disposal pits identified in the SI or the type of material encountered. Soil boring conducted at the location of the surface depression indicates that concrete and asphalt rubble, wood fragments, and miscellaneous construction debris were present.

3.0 Field Activities

Additional geophysical testing was conducted at IRP Site 11, including magnetic and terrain conductivity surveys, to verify the location of the disposal pits identified during the SI and to evaluate if additional disposal pits are present. Following the geophysical testing, exploratory trenching was conducted to determine the type of material and size of the source generating the anomalies identified during the geophysical surveys. Piles of waste soil located along the northern and western edges of the site were removed and disposed off-site to facilitate additional testing and remedial actions. The following sections provide a description of the activities completed and summarize the results.

3.1 Site Preparation and UXO Surface Clearance

Scrap metal from the nearby firing ranges was previously disposed at IRP Site 11 and ammunition was stored in the bunkers. There is a potential to encounter UXO and/or OE material during any field activities at IRP Site 11. Prior to conducting the geophysical survey, a surface clearance survey was complete to identify and remove any UXO or OE material. The UXO clearance activities were conducted in accordance with the *Unexploded Ordnance Avoidance Work Plan, Revision 2* (IT, 2001b). Photographs included in Attachment 2 show the condition of several features at IRP Site 11 prior to the UXO clearance activities.

The UXO clearance survey was completed from November 6 through 10, 2000 and included removal of surface vegetation. In addition, a pile of waste construction debris, concrete, and metal was removed from between the concrete foundation of former Buildings 44 and 45. The waste was combined with pre-existing waste near the western side of former Building 47 adjacent to IRP Site 11. A description of the field activities that were completed is included in Attachment 2. A piece of OE material was discovered adjacent to the access road to IRP Site 11 during the UXO clearance survey. The OE material was removed from the site and was and properly disposed. Its final disposition is presented in the memorandum included in Attachment 2.

3.2 Geophysical Surveys

Prior to conducting the geophysical surveys at IRP Site 11 a base grid was established and marked in the field. The survey area at IRP Site 11 was approximately 1,300 feet by 700 feet and within 100 feet by 100 feet grid. The grids were further subdivided into north-south traverses at 5-foot intervals. Surveying equipment was carried over the grids along the traverses and geophysical data and position were recorded simultaneously. The data was later processed

to prepare overlay maps indicating the size, location, and intensity of the geophysical anomalies in relation to site features.

The geophysical surveys were conducted between November 2000 and February 2001. A report detailing the activities conducted to complete the geophysical surveys, including the establishment of the grids, calibration of the equipment, and collection and processing of the data is included in Attachment 3. Maps showing the anomalies identified during the geophysical surveys are also included in Attachment 3.

The data generated from the geophysical survey indicates that several anomalies, both magnetic (EM-61) and terrain conductivity (EM-31) were identified within and to the east of the IRP Site 11 fenced area. Several of the larger anomalies are consistent with historical information and previous geophysical testing conducted at the site. The following sections summaries the results from each survey.

3.2.1 Magnetic Survey (EM-61)

Several small magnetic anomalies that likely represent small isolated pieces of metal scrap were discovered throughout the survey area. A line of small anomalies, trending north/south near the center of the fenced area, likely represent a buried utility or metal conduit. Larger, more intense magnetic anomalies were evident near the fence surrounding the site and at the locations of the existing concrete foundations but are likely a result of interference from the metal fence and rebar in the concrete foundations.

Several areas where significant anomalies were present could represent buried waste pits. Significant anomalies were found surrounding and to the west and southwest of the concrete foundations located at the northern edge of the fenced area, at the location of the surface depression, and surrounding the concrete foundation at the southeast corner of the fenced area. Smaller isolated anomalies located near the center of the fenced area and near the northern gate on the eastern edge of the facility likely represent significant buried metallic debris.

3.2.2 Terrain Conductivity Survey (EM-31)

The range of conductivity values measured during the terrain conductivity survey is typical for clayey earthen materials. Several anomalies were discovered with conductivity value slightly above background levels. Linear anomalies near the eastern edge of the survey are due to an existing gravel road.

Several terrain conductivity anomalies are present that could represent buried waste pits containing non-metal material. A significant anomaly was found surrounding and to the west

and southwest of the concrete foundations located at the northern edge of the fenced area. This anomaly is consistent with the magnetic anomaly and likely represents buried waste. Other conductivity anomalies were discovered near the center of the fenced area and to the east of the fenced area between the fence and the access road. Based on the range of conductivities measured, these anomalies could represent buried non-metallic waste or localized changes in soil type.

3.3 Exploratory Trenching

Based on the results of the geophysical testing, exploratory pits and trenches were excavated at selected locations to investigate the actual size and nature of the anomalies identified. Test pit excavation/trenching activities were conducted in accordance with the Work Plan (IT, 2001a). Test pit locations are included in the attached drawings (Attachment 4). During excavation activities at Site 11, monitoring was conducted for UXO in accordance with the *Unexploded Ordnance Avoidance Work Plan, Revision 2* (IT, 2001b).

Initially the test pits were excavated to a depth of 4 feet below ground surface. Observations were made of the pit sidewalls and excavated material. All observations including a description of the material encountered, the depth of the excavation, and test pit locations were logged. If waste or debris was discovered the material was photographed. No samples were collected for chemical of physical analysis during test pit excavation/trenching activities. Material (soil and/or debris) generated from the test pit excavation/trenching activities was staged near the pits and backfilled into the excavation after it was logged and photographed.

Test pit excavation activities were conducted at IRP Site 11 from May 15 through May 17, 2001. Field notes and photographs of test pit excavation activities are included in Attachment 5. Significant findings include discovery of construction debris in a trench near the western edge of the site (area of surface depression), an area of buried metal debris near the southeast corner of the fenced area, an area of buried waste near the north edge of the site west of the concrete foundations, an area of burned material near the center of the site, an area of construction debris and burned material near the northeast corner of the site, and OE related material near the center of the site. Small pieces of scrap metal, wire, and pipe where found at a majority of the test pit locations where anomalies were identified during the magnetic survey (EM-61). Natural changes in soil type were identified at a majority of the test pit locations where anomalies were identified during the terrain conductivity survey (EM-31). An additional trench, not shown in the figures in Attachment 5 was excavated at the location of an anomaly identified during the SI near the concrete foundation at the southern edge of the facility (PRC 1992). Nothing significant was discovered at this location.

Test trenches in the area of the depression at the western edge of the site (centered on test pit location 28) indicate that a majority of the waste in this area is inert construction debris. The waste at the location includes concrete blocks, rebar, metal debris, wire, asphalt, and bricks. Based on the trenching conducted, the area of the buried construction debris is approximately 120 by 70 feet. The waste was found at a maximum depth of 14 feet below ground surface where native soil was encountered.

Test trenches in the area of the concrete foundation in the southwest corner of the site (centered on test pit location 3) indicate that a majority of the waste in this area consists of metal debris. The waste at the location includes cans, wire, pipe, and potentially ash. Based on the trenching conducted, the area of the buried metal debris is approximately 150 by 70 feet. The waste was found at a maximum depth of 5 feet below ground surface where native soil was encountered.

Test trenches along the north edge at the center of the site (centered on test pit location 18) indicate that a majority of the waste in the area is household waste with some construction debris. The waste discovered includes bottles, cans, glass, burned material, and miscellaneous household scrap metal. A sheet (4 inches thick by 3.5 feet wide) of fibrous material (potentially asbestos-containing) was also discovered and left in place. Based on the trenching conducted, the area of the buried waste is approximately 60 by 100 feet. The waste was found at a maximum depth of 15 feet below ground surface where native soil was encountered.

Test trenches in two areas, near the center of the site (test pit location 14) and near the northeast corner of the site (south of the roadway between test pit locations 25 and 26) identified shallow burn pits. The burn pits (approximately 5 by 11 feet by 2 feet deep and approximately 16 by 21 feet by 3 feet deep, respectively) contained ash, wood, nails, concrete, roofing material, and household waste.

Excavation at test pit location 13, near the center of the site, encountered several pieces of OE material, including a 3.5-inch bazooka round and four 2.75-inch dummy warheads. Excavation was stopped when the OE material was discovered and UXO technicians inspected the material and surveyed the area. The OE material recovered was determined to be practice rounds and did not contain explosive material. The OE material was removed from the site and secured in a controlled area on the facility. On September 6, 2001, the recovered OE material was transferred to Explosive Ordnance Demolition (EOD) specialist from EOD Detachment 787, Moffett Field and the material was removed from the site and disposed of properly. Surveying conducted by the UXO technicians indicate that additional OE material is likely buried at that location and

may cover an area of approximately 15 by 15 feet and may be as deep as 5 feet. No additional test pit excavation was conducted at that location.

3.3.1 Radiation Monitoring

The Naval Sea Systems Command Detachment (NAVSEADET), Radiological Affairs Support Office (RASO) conducted an extensive record search on the use and disposal of radioactive materials and machine sources of radiation at the former NALF Crows Landing, and no records were identified to indicate that any source of radiation was used at NALF Crows Landing. Documentation of the RASO record search is included in Attachment 5. At the request of NAVSEADET RASO, radiological monitoring was conducted in conjunction with test pit excavation/trenching in order to provide an indication of any radioactive materials unearthed during field activities. The radiological monitoring was subcontracted to Environmental Dimensions, Inc. and consisted of scanning material of concern using a Geiger-Mueller counter and a NaI(T1) 2" x 2". An exposure-rate meter was also be used to monitor exposure rates throughout the investigation. Excavated soil and excavation sidewalls were scanned. A reference background was established for each instrument being used that had similar physical, chemical, geological, and biological characteristics as the material being surveyed.

Radiological testing of soil removed during the trenching activities at each location indicated that the radiation levels in areas where waste was expected and areas where waste was discovered are not higher than normal background levels at the site. Field notes generated by Environmental Dimensions, Inc. during the field activities are included in Attachment 5.

3.4 Waste Soil and Debris Removal

Waste piles were located along the western edge of the fenced area and at the northwest corner of the fenced area. These areas could not be accessed to complete the geophysical surveys and are shown as white areas on the geophysical maps in Attachments 3 and 4. From September 10 through 12, 2001, waste soil and construction debris were removed from the soil/waste piles and consolidated near the center of the site. The material was screened for UXO and OE material during removal and stockpiling. The removal was conducted to allow for additional geophysical and unexploded ordnance surveys to better define the extent of buried waste at IRP Site 11. The work was completed by UXO trained workers with a UXO observer present at all times. No UXOs material was discovered during the field activities.

Samples of the waste material were collected on July 10, 2001 to characterize the soil. The analytical results are included in Attachment 6. The analytical results indicated that the material met the requirements for disposal as Class II, Non-Hazardous material. The material was

removed from the site on September 24 and 25 and disposed at an off-site disposal facility. The total volume of waste removed from the site and disposed of was 1,310.81 tons.

4.0 Conclusions and Recommendations

The geophysical surveys and exploratory trenching verify historical information and previous investigation results that indicated that buried waste was present near the concrete foundations at the northern edge of IRP Site 11 and near the western edge of the site in the area of the surface depression. Results from the trenching also indicate that the disposal pits contain mainly construction debris and household waste material. However, some hazardous material may be present (potential asbestos containing material). No waste material was found at the metallic anomaly identified during the SI near the concrete foundation at the southern edge of the site.

Additional waste pits were identified, including buried metal debris in a pit near the southeast corner of the fenced area, burned material in a pit near the center of the site, construction debris and burned material in a pit near the northeast corner of the site, and ordnance and explosive (OE) related material in a pit near the center of the site. Radiological testing did not indicate any areas where radiation levels were above background levels.

Information collected from the geophysical surveys and test pit excavations will be used to evaluate remedial alternatives for IRP Site 11 (waste volume estimates and disposal requirements). Additional geophysical testing and test pit excavation may be conducted, as required, in the areas where waste piles limited the access to complete the work during this study. The discovery of OE material and potential for UXO should be considered in the development of remedial alternatives to ensure that any special requirements are included in the final remedial design and site closure.

5.0 References

Department of the Navy, Naval Sea Systems Command Detachment, Radiological Affairs Support Office 2000. Subject: *Request for Information Regarding Former Naval Auxiliary Landing Field (NALF)*, Crows Landing, California. (Letter dated November 14, 2000)

IT Corporation, 2001a, *Work Plan, Soil Vapor Extraction Optimization for the Remediation of UST Cluster 1 and Site Verification Activities at Various Sites,* Revision 2, Concord, California.

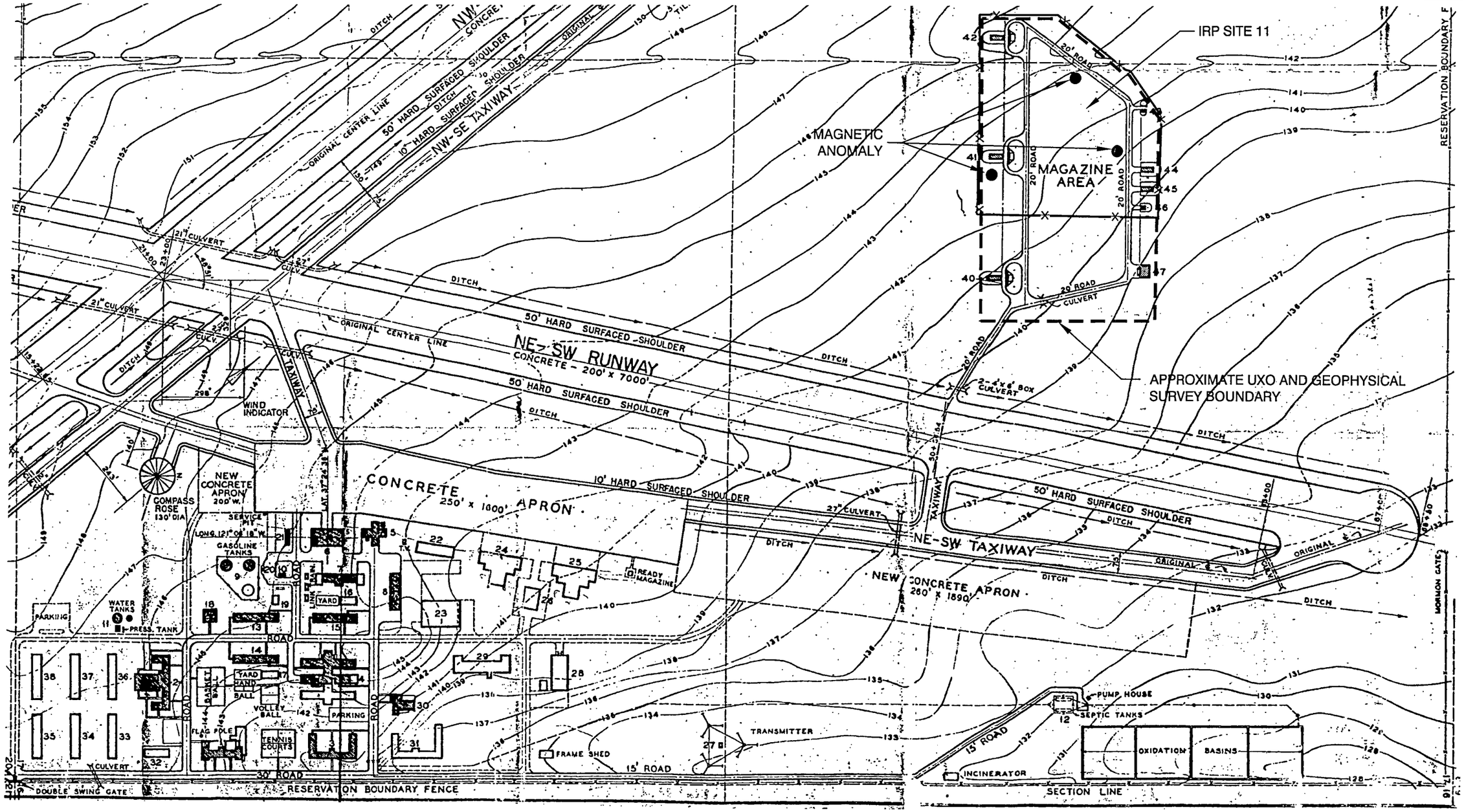
IT Corporation, 2001b, *Unexploded Ordnance Work Plan, National Aeronautic Space Administration, NASA Crows Landing Flight Facility Crows Landing, California,* Revision 2, Concord, California.

Naval Energy and Environmental Support Activity (NEESA), 1984, *Initial Assessment Study of Naval Air Station Moffett Field,* Sunnyvale, California.

PRC Environmental Management, Inc. , 1992, *Naval Auxiliary Landing Field Crows Landing, Site Investigation Report, Installation Restoration Program Sites 11,12,13, and 16,* San Francisco, California.

PRC Environmental Management, Inc., 1997, *Final Remedial Investigation Report, Installation Restoration Program Sites 10, 11, 12, 13, 14, 16, 17, and 18,* San Francisco, California.

ATTACHMENT 1
IRP SITE 11 UXO AND GEOPHYSICAL SURVEY AREA



APPROXIMATE SCALE

0 250 500 750 FEET

NOTE:
BASE MAP DEPICTS FACILITY AS OF JUNE 30, 1944 AND WAS PROVIDED BY THE COMMAND HISTORIAN'S OFFICE, NAVFACENGCOM, PORT HUENEME, CA.

● MAGNETIC ANOMALY IDENTIFIED DURING THE SITE INVESTIGATION (PRC 1992).

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NASA
CROWS LANDING FLIGHT FACILITY
CROWS LANDING, CALIFORNIA

FIGURE 1

IRP SITE 11 UXO AND GEOPHYSICAL SURVEY AREA

IMAGE	X-REF	OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
CROWS	---	Concord	SCHAEFFER	---	---	800063-B71

FORMAT REVISION 2/26/99

ATTACHMENT 2
PRECONSTRUCTION PHOTOGRAPHS AND UNEXPLODED ORDNANCE CLEARANCE SURVEY INFORMATION

Photograph 1 - Demolition debris at Building 40 (6/20/00)

Photograph 2 - Demolition debris at Building 40 (6/20/00)

Photograph 3 - Building 40 (former high explosives magazine) foundation and wall (6/20/00)

Photograph 4 - Building 47 (former storehouse) C364 raised foundation and concrete pipe sections (6/20/00)

Photograph 5 - Atop Building 47 looking at concrete debris and pipe (6/20/00)

Photograph 6 - Concrete debris pipe at Building 47 (6/20/00)

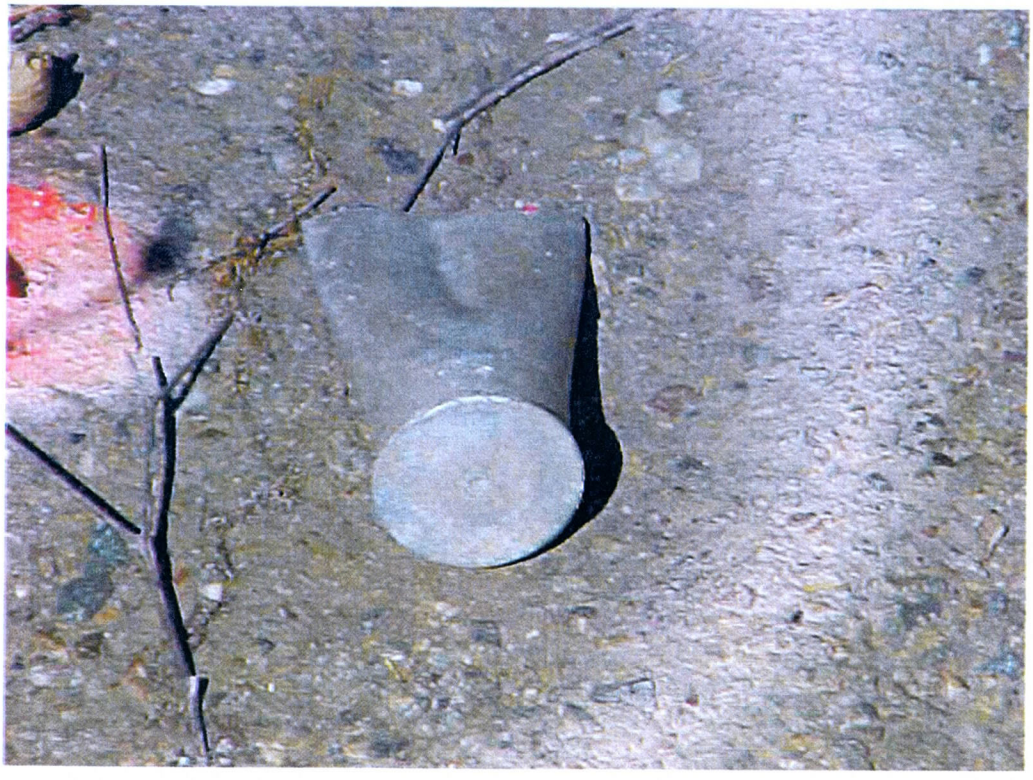
Photograph 7 - Entrance to Site 11 fenced area at Building 46 (6/20/00)

Photograph 8 - Building 46 bunker (former pyrotechnics storage) and construction debris (6/20/00)

Photograph 9 - Building 45 foundation (former small arms magazine) (6/20/00)

Photograph 10 - Building 44 foundation (former small arms magazine) (6/20/00)

Photograph 11 - Typical of small ammo shells found at Building 44 (6/20/00)



Photograph 12 - Large shell casing located between Buildings 43 and 44 (6/20/00)

Photograph 13 – Building 43 (6/20/00)

Photograph 14 - Monitoring well 11-MW-06s located between Buildings 42 and 43 (showing settlement in area) (6/20/00)

Photograph 15 - Area 30 feet east of 11-MW-06s (showing settlement in area) (6/20/00)

Photograph 16 - Long debris pile (containing soil, concrete, and rock mix) adjacent to Building 42 (6/20/00)

Photograph 17 - Building 42 (former high explosive magazine) (6/20/00)

Photograph 18 - Lined area (30 feet by 15 feet) between Buildings 41 and 42 (6/20/00)

Photograph 19 - Building 41 (former high explosive magazine) (6/20/00)

Photograph 20 - Interior of Site 11 (appears flat with no anomalies) (6/20/00)

DESCRIPTION OF FIELD ACTIVITIES

CLEARANCE SURVEY FOR UNEXPLODED ORDNANCE AND WELL CLOSURES AT SITE 11

On November 6 and 7, 2000 and in accordance with the Unexploded Ordnance (UXO) Work Plan for NASA Crows Landing, the ground surface at Site 11 was surveyed for the presence of metallic debris and possible UXO. Vegetation within the fenced area of Site 11 was additionally mowed down (Figure 1). Shoenstedt magnetometers were utilized aid in the surface surveys. The Shoenstedt magnetometers indicated the presence of metallic debris scattered randomly below ground surface throughout Site 11 and within soil piles located inside the northwestern and western boundaries of the Site 11 fence.

On November 8, 2000, former Site 11 monitoring wells 11-MW-01 and 11-MW-02 were closed by removing the upper 5 feet of well casing after exposing the previously grouted 4-inch well casing to a depth of 5 feet below ground surface. The two monitoring wells were grouted in April 1996 (PRC, 1996). A backhoe was utilized to dig a 5-foot deep trench adjacent to each monitoring well. The exposed well casings were then pulled into the trench, thereby breaking the grouted well casings. Concrete encased well casing and any remaining grouted well casing were then removed from the excavation to a depth of 5 feet below ground surface. The excavation was backfilled with native soil and was then compacted at ground surface. Monitoring well 11-MW-01was located outside of the northeastern corner of the Site 11 fence (Figure 2), and monitoring well 11-MW-02 was located between former bunker Buildings 44 and 45 (Figure 3). Metallic debris and burn material were not identified within the trenches of either former monitoring well location.

On November 9 and 10, 2000, waste piles were removed from between the foundations of former bunker Buildings 44 and 45 and the foundations of former bunker Buildings 45 and 6. The waste piles (dirt, construction debris, concrete, metal) were combined with a pre-existing concrete rubble pile located on the western side the foundation of former bunker Building 7. The pre-existent and transported waste piles were cleared for the presence of UXO. When clearing the eastern portion of Site 11 outside the fence on November 9, 2000, the nose-piece of a 2.25-inch practice rocket used for training purposes was identified (Figure 4). The 1940s era nose-piece was determined to be non-hazardous, was removed from the survey area, and was locked and secured on site pending final disposition as ordnance & explosive (OE) scrap. Because the OE scrap was found, UXO personnel remained on site for the performance of Site 11 geophysical grid construction and survey activities.

On November 16, 2000, the Ready Magazine area near Site 17 was surveyed for the presence of surface UXO. While no surface UXO was observed, the Shoenstedt magnetometer did detect a significant amount of metallic debris most likely from the former magazine foundation and the nearby flight pad.

Photograph 1 – UXO technician, mowing vegetation at Site11, looking southwest (11/07/00)

Photograph 2 – Existing condition of 11-MW-01 at Site 11, looking northwest (11/08/00)

Photograph 3 – Existing condition of 11-MW-02 at Site 11, looking southwest (11/08/00)

Photograph 4 –Practice rocket nosepiece found to the east of Site 11, looking north (11/09/00)

IT CORPORATION
A Member of The IT Group

Memorandum

Date: December 12, 2000

To: Bob Hulet

From: Al Grant

Subject: OE Related Scrap found at Crows Landing

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1. As per your request, I am drafting this memo to document the 2.25-Inch nose-piece that was discovered near the culvert along the access road to Site 11 or the Old Ammunition Point. This item is in fact inert OE related scrap, and considered non-hazardous. However, OE related scrap must be segregated from non-OE related scrap, to keep it out of the hands of the local public, and the aforementioned item was stored temporarily in the conex box on site.

2. Since there has not been an OE related scrap problem at Crows Landing in the past, there has not been a site specific procedure for the disposal and disposition of OE related scrap material. Fortunately, I have a good relationship with the OE contractors and the USACE OE Team at Fort Ord California, and I made arrangements for the single item to be properly disposed of at Fort Ord. I transported the item to Fort Ord on November 10th 2000. The item was placed in our OE related scrap area for proper demilitarization.

3. In the future it may become necessary to develop a site specific SOP for handling OE related scrap found on the Crows Landing installation.

4. You can always e-mail me at agrant@theitgroup.com or reach me at 831-883-5805.

ATTACHMENT 3
GEOPHYSICAL SURVEY REPORT

SURFACE GEOPHYSICAL SURVEY REPORT
SITE 11 AND FORMER SANITARY SEWER STRUCTURES
NASA FLIGHT LANDING FACILITY
CROWS LANDING, CALIFORNIA

Environmental Remedial Action
Contract Number N62474-98-D-2076
Contract Task Order 0004

Document Control Number 4084
Revision 0

June 14, 2002

Submitted to:

U.S. Department of the Navy
Southwest Division
Naval Facilities Engineering Command
Environmental Division
1220 Pacific Highway
San Diego, California 92132-5190

Submitted by:

IT Corporation
4005 Port Chicago Highway
Concord, California 94520-1120

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Acronyms and Abbreviations

bgs	below ground surface
DOD	U.S. Department of Defense
EM	electromagnetic
EM-31	Geonics EM-31DL Terrain Conductivity Meter
EM-61	Geonics EM-61 Buried Metal Detector
Facility	Crows Landing Flight Facility
GPR	ground-penetrating radar
GPS	global positioning system
IAS	Initial Assessment Study
IT	IT Corporation
MHz	megahertz
mS/m	milliSiemens per meter
mV	milliVolts
NAD	North American Datum
NASA	National Aeronautics Space Administration
NEESA	Naval Engineering and Environmental Support Activity
ppt	parts per thousand
UST	underground storage tank
UXO	Unexploded Ordnance

1.0 Introduction

This report presents the results of geophysical investigations conducted by IT Corporation (IT) for Environmental Remedial Action Contract No. N62474-98-D-2076 with the US Department of the Navy (IT, 2000). The geophysical surveys were conducted in November and December 2000 at the National Aeronautics Space Administration (NASA) Crows Landing Flight Facility (Facility) in Crows Landing, California. The following section describes the background and objective of the geophysical investigations.

1.1 Background and Objective

The geophysical surveys at the Facility were conducted at several locations within two main sites, Site 11 and the Former Sanitary Sewer System site. A site location map is presented as Figure 1. The Former Sanitary Sewer System structures, located west of and adjacent to Bell Road, included investigation of a former septic tank location, former sewer pipeline, a former transmitter pad location, and a former incinerator pad location. A brief background of each site is presented in the following paragraphs.

Site 11–Site 11 consists of approximately 15 acres of vacant land covered by native vegetation located northwest of the runway intersection. Approximately one-half of the site (western half) is presently surrounded by chain-link fencing. In 1945, two bomb storage magazines and a small-arms ammunition magazine were constructed within the Site 11 boundary. Records from 1951 indicate that seven ammunition storage magazines also existed at Site 11. They were dismantled in the mid-1960s, however some of the concrete foundations remain. Three earth-covered, metal structures that once served as ammunition bunkers are located in the eastern and northern sections of the site.

Other than storage, the only ordnance-related operations at the Facility consisted of hauling, burning, and burying debris collected from a nearby practice bombing range. Practice bombs, explosives, and anything that potentially contained propellant were burned and covered in a disposal pit within Site 11. The total quantity of ordnance-related debris has been estimated to be about 300 pounds (Naval Engineering and Environmental Support Activity [NEESA], 1984).

According to the Initial Assessment Study (IAS) (NEESA, 1984), Site 11 was also used for refuse disposal from the late 1960s until 1982. The refuse included office trash (paper), kitchen waste, scrap metal, and empty paint and pesticide containers. Refuse was dumped into pits and burned. The IAS report describes four disposal pits, all located in the open field and surrounded

by the ammunition storage bunkers and access road. There is no evidence of the exact disposal pit locations or dimensions in the IAS Report. The only visual evidence of a potential disposal location is a slightly elongated surface depression on the western side of the site. Borehole logs from the depression indicate fill material including concrete and asphalt rubble, wood fragments, and miscellaneous construction debris.

The Site 11 survey objectives are to obtain geophysical data that are typical of buried metallic and nonmetallic waste pits and debris. The data will be used to assess the location and extent of any detectable buried unexploded ordnance (UXO) or refuse. That information will be used for estimating potential excavation limits and volume.

Former Sanitary Sewer System and Other Site Features–The former sanitary sewer system was used from 1942 to 1946 and consisted of pipelines that drained from Facility buildings to two redwood septic tanks. The septic tank effluent drained into four oxidation basins. The former sanitary sewer system was connected to buildings where industrial activities occurred and was replaced in 1952, after housing at the Facility caused the system to become overloaded.

During a site investigation of the former sanitary sewer system, the field crew identified that the major portion of the former sewer pipeline is located approximately 275 feet west of Bell Road. This pipeline was the main trunk pipeline for the facility in the 1940s and is no longer used. It is not known whether the main pipeline still exists. The presence of the lateral lines leading from the main pipeline to former or existing buildings in the administration area has not been confirmed. The septic tanks and oxidation ponds no longer exist. The NASA research facility currently occupies the location of a major portion of the former oxidation basins. The former oxidation basins, 200 feet by 200 feet square, each were adjacent to Bell Road.

A brick incinerator is reported to have burned paper wastes in the 1940s. The incinerator was located south of the sanitary sewer system oxidation ponds and was not used extensively, presumably because of interference with aircraft operations.

The objectives of the former sanitary sewer system survey are to locate the former main sanitary sewer pipeline (10-inch diameter vitrified clay), septic tanks, oxidation basins, and transmitter and incinerator foundations (pads). It is not known if there are still remnants of these site features as they may have been excavated and removed. The location of these site features were located in the field after their locations were estimated based on scaled historical maps and according to existing site features that are identifiable on a 1944 base map.

1.2 Report Organization

The general rationale for determining which geophysical method was used at each of the sites is described in further detail in Section 2.0, Theoretical Background. Section 3.0 describes the general field procedures for the geophysical surveys. Section 4.0 describes the general data processing techniques for each method. Section 5.0 presents the specific geophysical investigations and results/interpretations separately for each of the sites.

2.0 Theoretical Background

This section presents the theoretical background and rationale for using electromagnetic and geodetic methods during this investigation.

2.1 Electromagnetic Methods

The methodologies utilized in this investigation are briefly discussed in the following sections. These include the Geonics EM-31DL Terrain Conductivity Meter (EM-31), and Geonics EM-61 Buried Metal Detector (EM-61), a ground-penetrating radar (GPR) system, as well as the global positioning system (GPS). The general theory of operation and type of measured quantity are presented in the following sections.

2.1.1 EM-31 Electromagnetic Induction Ground Conductivity Meter

The EM-31 (Geonics, Ltd., of Mississaugua, Ontario) is a sling-ram electromagnetic (EM) system with a transmitter coil mounted at one end and a receiver coil mounted at the other end of a 12-foot long plastic boom. An audio-frequency alternating current is applied to the transmitter coil, causing the coil to radiate an alternating primary EM field. As described by Faraday's Law of Induction, the time-varying magnetic field generates eddy currents in subsurface materials. According to Lenz's Law these eddy currents have an associated secondary magnetic field with a magnitude and phase shift (relative to the primary field) that is dependent on the conductivity of the medium. The receiver coil measures the resultant effect of both primary and secondary fields. By comparing the signal at the receiver to that at the transmitter, the instrument records the components of the secondary field both in-phase (in-phase) and 90 degrees out-of-phase (quadrature) with the primary field.

The EM-31 is configured so that the out-of-phase component is converted to bulk electrical conductivity in units of milliSiemens per meter (mS/m). The measured conductivity is an apparent conductivity that is the resultant of the varying conductivities of subsurface materials that are sampled by the EM field. It is referred to as terrain conductivity. The in-phase component is read in parts per thousand (ppt) of the primary EM field and is generally adjusted in the field to read zero response over background materials. The in-phase component generally represents current density and is a gross measure of the presence of buried ferrous metal debris.

The EM-31 has a maximum effective exploration depth of about 18 feet when operating in the vertical dipole mode (horizontal coils). In this mode, the maximum instrument response results from materials at a depth equal to about 0.4 of the coil spacing (about 5 feet below ground

surface (bgs) with the instrument at the normal operating height of about 3 feet). However, a somewhat significant response is still measured at depths equal to 1.5 of the coil spacing (18 feet bgs). The EM-31 has an effective exploration depth of about 9 feet when operating in the horizontal dipole mode (vertical coils) and is most sensitive to materials located immediately beneath the ground surface.

2.1.2 EM-61 Time Domain High Sensitivity Metal Detection

The EM-61 (Geonics, Ltd., of Mississaugua, Ontario) is a unique type of EM metal detector. Most standard types of metal detectors are frequency domain electromagnetic tools or magnetometers of some simple type. The EM-61 utilizes time domain theory to explore for both ferrous and non-ferrous buried metal objects. By using time domain theory, the EM-61 is capable of generally discriminating between conductive earth materials and metallic targets such as unexploded ordnance (UXO), underground storage tanks (USTs), drums, and buried metallic waste.

The EM-61 generates 150 EM pulses per second in a general square wave configuration. The system measures during the off-time between square wave pulses. During each EM pulse, secondary EM fields are created in earth materials and in any buried metallic objects that are present from a primary inducing field. In general, the secondary magnetic field associated with the induced current dissipates much faster in earth materials than in buried metal objects. Between each pulse, the EM-61 allows for the response from the earth materials to dissipate and subsequently measures the prolonged buried metal response. By sensing only the buried metal response, the EM-61 can distinguish between conductive soils or rock and metal targets. The EM-61 can also detect shallow bedrock with appreciable amounts of metallic mineralization.

In general, the depth of investigation is dependent upon the size and mass of the buried metallic target. For some of the larger targets it has an exploration depth of approximately 10 feet bgs. The EM-61 system consists of a backpack, data logger, and a two-coil assembly that is towed on wheels behind the operator or carried around the operator using a harness. One coil (upper) is positioned directly over a second coil (lower) and each coil records data separately. Either the upper coil, lower coil, or differential data sets can be used for interpretation. The best data set typically depends on local site conditions. A cable connects the coils, and the entire system is run from a data logger. System power comes from a 12-volt rechargeable battery attached to a backpack. The EM-61 unit used for this investigation consists of 1- by ½-meter coils. These coils furnish higher resolution than the standard 1-meter square coils.

2.2 Global Positioning System Methods

The Global Positioning System (GPS) is a satellite-based positioning system operated by the U.S. Department of Defense (DOD). The 24-hour operational NAVSTAR satellites, which orbit the earth every 12 hours, provide worldwide, all-weather, 24-hour time and position information. The GPS unit used for this investigation was a Trimble Pro XRS manufactured by Trimble Navigation Limited of Sunnyvale, California.

GPS uses satellites in space as reference points for locations on earth. By accurately measuring distance from satellites, the GPS receiver (rover) can triangulate its position anywhere on earth. By ranging from three satellites, an instrument can narrow its position to two points in space. To determine which point is correct, information from a fourth satellite is used. Therefore, a minimum of four satellites is needed to provide usable positioning information. When more satellites are available, the accuracy of the GPS determination increases.

GPS was utilized to provide position data for the EM-61 and EM-31 surveys. GPS receivers were carried at a location above the measuring point of the EM-61 and EM-31 systems during the survey. The Pro XRS GPS system is capable of real-time differential correction and was used in that mode during the survey. GPS was also used to map all surface features at the site (roads, fences, debris piles, bunkers, surface debris, etc.). This will assist in relocating anomalous areas at a later time when the survey reference stakes may not be present.

2.3 Ground-Penetrating Radar

The GPR equipment used during this investigation consists of a Geophysical Survey Systems, Inc., SIR-2 system equipped with 400 megahertz (MHz), and 200 MHz monostatic antennas. The GPR system was used for further inspection of the anomalies detected during the EM surveys. Sometimes GPR data can furnish more accurate information regarding depth and lateral limits of specific anomalies identified in the EM surveys.

To conduct a GPR survey, an antenna containing both a transmitter and a receiver is slowly pulled along the ground surface. The transmitter radiates short pulses of high-frequency EM energy into the ground. When the wave encounters the interface between two materials having a significant contrast in dielectric constants (dielectric permittivity), a portion of the energy is reflected back. The contrast in dielectric permittivity between the two media can be quantified by a reflection coefficient at the media interface. The magnitude of the reflection coefficient increases as the contrast in dielectric constant increases. The signal is transmitted to a control unit, displayed on a color monitor, and digitally recorded. GPR data consist of cross-sections of

magnitude of reflection. The horizontal axis is lateral distance and vertical axis is two-way travel time (depth).

Two-way travel time on the GPR records can furnish estimates of depth if the dielectric constant for subsurface materials is known. If it is unknown, then an approximate depth can be obtained by using published average dielectric constants for soils.

3.0 Field Procedures

This section describes the geophysical field procedures used during this investigation. This includes establishment of the grid systems used for the investigation.

3.1 Site Preparation and Grid Layout

Prior to beginning the geophysical surveys at each site, a base grid was staked. Wooden lath were inserted in a 100- by 100-foot grid pattern over each site. Site 11 consisted of approximately 1,300 by 700 feet of gridded area. The former septic tank location consisted of 200 by 300 feet of gridded area. The former transmitter pad location consisted of 200 by 200 feet of gridded area. The former incinerator pad location consisted of 50 by 30 feet of gridded area. These suspected locations were estimated from historical air photos, and were marked by a survey crew. The grid system for each of these areas extended significantly in four directions around each of the assumed locations of the features. Figure 1 shows the location of all of the sites that were surveyed with geophysics. The grids for the former septic tank location and the former transmitter pad location are located adjacent to the west side of Bell Road and extend westward past the location of each surveyed feature. The grid for the former incinerator pad location is located on Bell Road.

Plastic pin flags were inserted at 10-foot intervals between the wooden laths, in an east west direction. These served as traverse locators for north-south traverses obtained at 5-foot intervals during the survey.

A local coordinate system was then assigned to the sites and marked on the stakes. This coordinate system was used in labeling of survey lines and stations. These base grids were later tied to the California State Planar Zone 3, North American Datum (NAD) 83 by the GPS systems so that real coordinates could be placed on all geophysical maps. Obvious surface cultural features that could potentially affect the geophysical data (e.g., reinforced concrete pads, surface structures, surface metallic debris, fences, or overhead utilities) were noted in the field notes and mapped utilizing GPS.

3.2 EM-31 Electromagnetic Induction Ground Conductivity Meter

Before an EM-31 survey was conducted and prior to collecting data each day, an EM-31 calibration test was conducted. The calibration test was conducted outside of the gridded areas. The purpose of the test was to accurately calibrate the clocks from the EM-31 with the GPS for accurate location of anomalies. After the calibration test was conducted, system checks were

performed to ensure that conductivity readings were repeatable from day to day within the manufacturer's specifications.

Within the grid areas, the EM-31 and GPS data were obtained from north-south traverses located 5 feet apart. The pin flags were used for traverse location. Before collecting field data, the EM-31 data logger was programmed with the appropriate file name (date, instrument, and update number), line name, start station, station increment, line spacing, and operator's initials. EM-31 and GPS data were then obtained simultaneously in the automatic data collection mode. All EM-31 data were stored in a digital data logger, and the field data files and corresponding base station files were downloaded to a laptop computer using the computer program DAT31™, written by Geonics, Ltd. GPS data were obtained in Line Generic mode and stored on the Trimble XRS data logger.

EM-31 data were also obtained along several profiles over the sewer pipeline, oxidation basins, and incinerator pad. Grids were not established at these areas due to the configuration, size, and nature of the targets. The traverses were conducted to assess if an adequate response from the instrument exists at several locations to delineate the target of interest.

3.3 EM-61 High Sensitivity Time Domain Metal Detector

Before an EM-61 survey was conducted and prior to collecting data each day, an EM-61 calibration test was also conducted. As per the EM-31 calibration test, the calibration test was conducted outside of the grid areas and the purpose of the test was to accurately calibrate the clocks from the EM-61 with the GPS for accurate location of anomalies. After the calibration test was conducted, system checks were performed to ensure that EM-61 readings were repeatable from day to day within the manufacturer's specifications.

Within the grid areas, the EM-61 and GPS data were obtained from north-south traverses located 5 feet apart. The pin flags were used for traverse location. Before collecting field data, the EM-61 data logger was programmed with the appropriate file name (date, instrument, and update number), and operator's initials. EM-61 and GPS data were then obtained simultaneously in automatic data collection mode. All EM-61 data were stored in a digital data logger, and the field data files and corresponding base station files were downloaded to a laptop computer using the computer program DAT31™ (Geonics, Ltd). GPS data were obtained in Line Generic mode and stored on the Trimble XRS data logger. EM-61 data were also obtained along several profiles over the sewer pipeline, oxidation basins, and incinerator pad. Grids were not established at these areas due to the configuration, size, and nature of the targets. The traverses

were conducted to assess if an adequate response from the instrument exists at several locations to delineate the target of interest.

3.4 Ground-Penetrating Radar Surveys

Before conducting the GPR survey, test lines were run to determine the optimum recording parameters. These parameters included the range (amount of time the instrument records after transmitting an EM pulse), scan rate (number of recorded traces or scans per second), transmitter pulse rate (frequency at which the EM pulses are transmitted), instrument gains, and filter settings. Once selected at each site, the key instrument parameters were recorded on the GPR. These settings were also automatically stored in a header with the digital GPR data. A marker switch on the antenna unit was used to identify each control point on the GPR records. The digital GPR data were previewed in real time on a color monitor and stored on the SIR-2 hard drive for later downloading.

GPR traverses were conducted over major anomalies detected at Site 11; the septic tank location, and the transmitter pad location for further definition of the anomalies. Several traverses were also conducted over the former sanitary sewer pipeline, the incinerator pad, and the oxidation ponds to assess if the features can be detected.

Throughout the geophysical investigation 200 MHz and 400 MHz antennas were used to conduct the GPR surveys. Both antennas were tested for data quality since the soil conditions at the Facility are not favorable for GPR.

4.0 Data Processing Techniques

This section discusses the processing of EM-31, EM-61, and GPR data acquired during this investigation.

4.1 EM-31 and EM-61 Data Processing

The data processing of EM-31 and EM-61 data is divided into two steps: preprocessing and processing. The preprocessing sequence includes data manipulations made from downloading field instrumentation data to generating the input file for the contouring package. These steps are as follows:

1. Download the raw GPS and EM data after each field day.
2. Check the coverage from the GPS tracking data each day to ensure total coverage.
3. Assess the results of the daily calibration check (EM-31 and EM-61) and apply the proper time correction to each daily file for accurate location of anomalies (EM instrument and GPS clock need to be as close as possible).
4. Merge the daily GPS data with the daily EM instrument data by time matching between the instrument and GPS files (after any time corrections have been applied resulting from the calibration test).
5. Organize the files into separate databases for each individual site and format files for input into contouring software.

Data processing involved the generation of color-enhanced data contour maps using Oasis Montaj™ 5.0 (GeoSoft, Inc) mapping and processing system. Data processing steps generally include gridding the data using a grid cell size less than one-half of the station spacing. One-fifth the station spacing was used for this survey. The basemap indicating the GPS coordinate system (NAD 83, Section 7) was then overlaid onto the color grid. Any subsequent adjustments to the maps for the enhancement of interpretation were then applied to each map (contour interval, adjustment of background data, etc.).

In general, one EM-61 map for each site was generated. The bottom coil data was used to generate the maps. After review of the data, the bottom coil data exhibited better resolution and magnitude of anomalies (generated by the targets) than the top coil data. EM-31 data maps consist of terrain conductivity data (quadrature). Both of the maps represent a different property of the subsurface materials and conditions. The EM-61 bottom coil data represents high resolution of anomalies that are generated by buried metallic debris. The EM-31 maps represent

the conductivity of subsurface materials. These anomalies may be caused by nonmetallic buried debris such as some of the materials reported to be buried (construction debris, burned wastes, etc.).

The data from separate traverses conducted over the sewer pipeline, oxidation basins and incinerator pad are presented in profile form (Appendix A). The horizontal axis is distance along each profile and the vertical axis represents EM-61 or EM-31 data.

5.0 Results and Interpretation

The following subsections contain the results of the geophysical surveys at the Facility. Each site is discussed in a separate subsection. The subsections present the appropriate EM-31 and/or EM-61 contour map. The map grids, as presented, are in California State Planar Zone 3, NAD 83 grid showing the northing and easting coordinates in U.S. Survey Feet. Figures 2A through 2C are color contour maps of Site 11; Figures 3A and 3B are color contour maps of the former septic tank location; Figures 4A and 4B are color contour maps of the former transmitter pad location; and Figures 5A and 5B are color contour maps of the former incinerator pad location. Pertinent GPR records are also included in some of the subsections. Although only selected and pertinent records are provided, the entire GPR database is available for review.

It should be noted that some of the EM-31 terrain conductivity maps may indicate anomalies with negative terrain conductivity values. Theoretically, negative conductivities do not exist. However, the negative numbers are representative of extremely conductive materials. Since the EM-31 operates at low induction numbers, extremely conductive materials (such as ferrous metal) cause the system to lose coupling. Measured (approximated) terrain conductivity values and true conductivity values are approximately equal for the range between zero and 1,000 mS/m. When real conductivities exceed that range, the measured or approximated values become negative due to saturation and loss of coupling of the system. However, the negative values can be used as interpretive tools for extremely conductive materials, such as ferrous metal.

EM-61 surveys are conducted to better define the limits of anomalies that are likely caused by buried metal objects and debris. In general, EM-61 data are more sensitive and exhibit better resolution than EM-31 data. The bottom coil data was utilized for the contour maps. These data exhibit better resolution and definition of anomalies than the top coil data from the site. EM-61 data (in milliVolts [mV]) that are considered background data are represented by low magnitude values that are widespread over a given site. EM-61 anomalies are represented by relatively high magnitude values (anomalies) that are limited in lateral extent.

5.1 Site 11 Area

EM-61 and EM-31 data color contour maps of the Site 11 are presented as Figures 2A through 2C. The maps are discussed separately in the following subsections.

5.1.1 EM-61 Data

Figure 2A is the EM-61 uncorrected data map for Site 11. Background values for the area are generally in the 1 mV to approximately 9 mV range. Several color variations represented by the data in the 1 to 9 mV range can be seen on Figure 2A. These variations represent features such as the access road (semicircular blue area), small insignificant surface and subsurface metal objects, slight variations in background values, and other features. To minimize the appearance of minor variations, the color contours representing background data were adjusted to blue colors and shown in Figure 2B. Therefore, background data on Figure 2B are represented by the blue colors and the remaining data represent significant anomalies caused by surface features or buried metallic debris. Anomalous values range up to 120 mV and occur as red to pink colors. Anomalies caused by surface features are discussed in the following paragraph and anomalies caused by buried metal objects are discussed in paragraphs to follow.

Figure 2B indicates several rectangular anomalies located along the southern border of the field area (at approximately 6383650E; 6384100E; and 6384530E) and near the northern central portion of the area (at approximately 6384200E; and 6384125E). Concrete pads are located on the ground surface at these locations. The anomalous (high) EM-61 response is likely due to metal rebar used for construction of the concrete pads. In addition, the linear accumulation of anomalies surrounding approximately the western two-thirds of Site 11 is caused by the presence of a metal fence surrounding the site. The anomalous values are caused by the EM-61 operating directly adjacent (few feet or less) to the metal fence itself. Areas in the western section and the eastern section of the map have areas that are whited out. Data from these areas are not presented due to the presence of a debris pile (western section) and three earthen bunkers (north eastern and southeastern sections). The instrument could not have safely surveyed on top of these features. The thin anomalous zone surrounding each of the whited areas is due to the presence of metal used for construction of the bunkers and metal debris within the debris pile. The north trending linear accumulation of anomalies at the 6383900E mark in the central part of the field area is caused by a shallow metal conduit.

Most of the surface features were previously surveyed and/or the coordinates were obtained with GPS. The anomalies caused by the surface features are obvious and the remaining anomalies are caused by buried metallic debris.

The dense accumulation of anomalies located in the northern section of the field area centered at approximately 6384050E, 1974900N are typical for anomalies caused by an accumulation of buried metallic debris. This may be the trench that is referenced in previous documents (PRC Environmental Management, Inc., 1992 and 1997). Notice that the access road cuts across the

edge of the anomalous zone and few anomalies are present beneath the road (Figure 2B). The road may have been used for dumping and burial activities.

Several other anomalous areas typical of buried metallic debris occur in the western and southwestern section of the field area, central portion, and some in the eastern portion of the field area.

5.1.2 EM-31 Data

Figure 2C is the (EM-31) terrain conductivity contour map for Site 11. In general, terrain conductivity values range from approximately 20 to 63 mS/m. The range is typical for clayey earth materials. Parts of the fence line are not visible in the data in the middle section of the map. The EM-31 probably was not carried close enough to the fence line to detect interference. The concrete pads appear as blue areas surrounded by red-pink anomalies. This is due to the terrain conductivity values indicating elevated values as the pads are approached with the instrument. However, the EM-31 system is designed to operate at low induction numbers (generally low conductivities) typical of earth materials. When extremely conductive materials such as metal objects or metal rebar occur in the vicinity of the system, the EM-31 system looses coupling and starts to decrease in apparent conductivity approaching values toward and below zero. That is the effect over the pads within Site 11. There is probably not enough rebar to cause the apparent values to go below zero; however, the coupling effect exhibits some effect.

Several anomalous zones occur in the EM-31 data. The EM-61 anomalous zone interpreted to be an area containing buried metallic debris also appears in the EM-31 data (centered at 6384050E, 1974900N). However, it furnishes less resolution. Due to the sampling volume and depth of investigation of the EM-31 system, the presence of an anomaly suggests that the buried debris is relatively shallow. The anomalous values are only 10 to 20 mS/m above background. The values indicate a moderate amount of debris that may represent a good percentage of the 300 pounds of buried metallic debris referenced in previous documents (NEESA, 1984).

Three other major anomalous zones occur in the EM-31 data at Site 11. These are centered at approximately 6384000E, 1974550N; 6384400E, 1974400N; and 6384450E, 1974950N. The anomalous values are only slightly elevated above background terrain conductivity values. The areas do not necessarily coincide with EM-61 anomalies. Some EM-61 anomalies do occur within the EM-31 anomalous zones; however, they cover a minor portion of the anomalous areas. The EM-31 anomalies may be caused by nonmetallic buried debris (i.e.: wood, paper, other materials, etc.) that was discarded and buried. However, the anomalies are low magnitude and may also be caused by an excavation area that was backfilled with clay since the values are

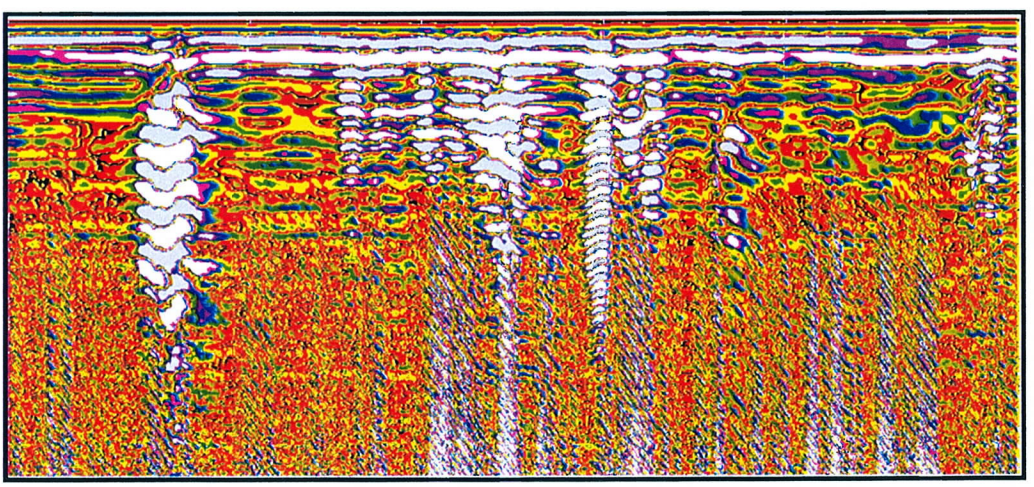
in the expected range of values for clay and other relatively conductive earth materials. The northwest trending linear anomaly in the eastern section of the area coincides with a road at that location. The materials used to build the road may be different than what was used to build other roads in the field area.

5.1.3 Ground-Penetrating Radar Data

Several GPR traverses were conducted over the anomalies at Site 11. In general, the GPR data obtained at the site was marginal at best. The natural background soil conductivity values are high, which effectively limit the GPR depth of investigation. However, the most effective GPR data was obtained from the interpreted burial pit in the north central portion of Site 11. One of the GPR profiles from the pit area is shown below. The profile was oriented north-south and was located at approximately 6384050E. The profile started approximately 50 feet south of the northern boundary of the site, and data was obtained in a southward direction. The portion of the profile indicated below is located over the area containing buried debris. It represents approximately 35 feet of GPR data.

GPR Profile Over Burial Area in Northern Central Portion of Site 11

North **South**



In general, several buried objects are indicated in the GPR data from the profile. They occur as shallow reflectors (showing reverberations) in the upper portion of the profile. The detected objects are likely located between less than 1 foot and up to 4 feet apart. However, due to the high background soil conductivities, the GPR data may only be sensing the uppermost portion of buried material. In general, the objects are relatively shallow. They are likely buried, at maximum, a few feet deep (less than 4 feet deep).

The profile indicated above is one of the best GPR profiles from the Site 11 area. Most of the other profiles did not indicate GPR anomalies. This is due to the high background soil conductivities. The GPR profile obtained over the depression in the western section of the field area is generally featureless. More of the profiles were not included in this report due to the ineffectiveness of GPR at the site. However, all of the GPR records are available if requested.

5.2 Former Septic Tank Location

Figure 3A is the EM-61 data color contour map for the former septic tank location. Data was obtained within the 200 feet by 300 feet area where color contours occur on the map. Figure 3B is the EM-31 contour map for the same area.

5.2.1 EM-61 Survey Data

Figure 3A is the EM-61 data map for the former septic tank location. Background values for the area are generally in the 2 mV to approximately 7 mV range. These are typical for background values, and they occur in areas that are generally shaded blue. Anomalous values range up to 32 mV and occur as red to pink colors. There are no anomalies caused by surface objects at this site, as it is an open field.

In general, the anomalous values at this site have a moderate magnitude. Seven anomalous features form a "circular" pattern in the western section of the field area. One other similar feature is located in the north central section of the field area. The cause of the anomalies is not understood. They may represent concrete reinforced with rebar and may be footings or similar features remaining from the previous structure in the area. The anomalies may also represent concrete or other accumulated metallic debris that was discarded in a circular fashion during excavation of a previous structure at this location. The anomalies range from 25 to almost 50 feet in length and up to 10 feet in width. However, it should be noted that the anomalies represented by the EM-61 data are always larger than the source of each anomaly. The estimated location of the former septic tank, from aerial photos, is shown on Figure 3A. It is located near the center of the circular pattern of EM-61 anomalies.

5.2.2 EM-31 Survey Data

Figure 3B is the EM-31 contour map of terrain conductivity values for the former septic tank location. The eastern section of the area is characterized by background conductivities in the 25 to 30 mS/m range. However, a strong change in background conductivity occurs on the western section of the area. The change occurs at approximately 6386275E. The strong linear change is not typical of natural soil conditions. The values in the western section range from approximately 40 to 55 mS/m. These values are also indicative of earth materials; however,

more conductive earth materials such as an increase in clay or silt. The change in conductivity may represent an excavation and backfill area that was associated with construction of the site. The current landing strip and taxiway are located approximately 200 feet west of the grid area.

An anomalous area located in the extreme northwest corner of the field area exhibits conductivities slightly above background (60 to 70 mS/m). However, due to the low magnitude, the anomaly may be representative of an increase in clay content. The area may also have been previously excavated and backfilled with clay-rich materials. It may also be an area where nonmetallic wastes were buried. However, the anomaly limits are not defined, and the anomaly may represent a change in materials that extend to the north. It may represent backfill material from construction of the building located approximately 100 feet north of the grid. It may be backfill to level the existing runway or potentially previous runway.

5.2.3 Ground-Penetrating Radar Data

Four GPR traverses were conducted within the former septic tank location using both the 400 MHz and 200 MHz antennas. The traverses were conducted over anomalies in the western section of the field area. Traverses were oriented both east west and north south. However, the GPR data is featureless. No reflection patterns typical of buried objects and debris occur in the data. The background conductivities are relatively high and limit the effective depth of investigation of the GPR system. Therefore, GPR data was determined to be ineffective at this site for its intended use.

5.3 Former Transmitter Pad Location

Figure 4A is the EM-61 data color contour map for the former transmitter pad location. Data were obtained within the 200 feet by 200 feet area where color contours occur on the map. Figure 4B is the EM-31 contour map for the same area.

5.3.1 EM-61 Data

Figure 4A is the EM-61 data map for the former transmitter pad location. Background values for the area are generally in the 2 mV to approximately 7 mV range. These are typical for background values, and they occur in areas that are generally shaded blue. Anomalous values range up to 15 mV and occur as red to pink colors that appear to have "point" sources. There are no anomalies caused by surface objects at this site as it is an open field.

In general, the anomalous values at this site are very low magnitude. Buried small metallic debris and objects are likely the cause of the anomalies. The red to pink anomalies (9 to 15 mV) indicated on the map represent the small metallic objects. One elongated anomaly occurs in the

central portion of the area. It extends for approximately 75 feet and likely represents an elongated object such as a piece of metallic construction debris. One rectangular anomaly located adjacent to the road along the eastern border of the area at 1973450N resembles a footing or buried pad. This may be part of the previous structure. It could also be the incinerator pad, which may not have been located accurately on previous site maps.

Figure 4A shows the EM-61 grid and data for the transmitter pad area in relation to Bell Road and other local features. The estimated location of the transmitter pad (from aerial photos) is approximately in the center of the grid near the north-south trending linear anomaly.

5.3.2 EM-31 Data

Figure 4B is the EM-31 contour map of terrain conductivity values for the former transmitter pad location. In general three features of interest occur in the area. The accumulation of small anomalies located in the central part of the field area coincides with the elongated anomaly detected in the EM-61 data referenced in the previous section. The anomaly values are very low (7 mS/m above background) suggesting an object of limited size.

Secondly, the eastern section of the area is characterized by background conductivities in the 30 to 31 mS/m range. However, a strong change in background conductivity occurs in the western section of the area. The change occurs at approximately 6386370E and is not typical of natural soil conditions at the site. The values in the western section range from approximately 31 to 50 mS/m. These values are also indicative of more conductive earth materials, such as clay or silt. The change in conductivity may represent an excavation and backfill area associated with construction at the site.

Finally, the "circular" anomalous area centered at approximately 6386340E, 1973490N exhibits conductivities well above background (greater than 140 mS/m). The anomalous nature of the area, as well as its configuration, is not typical of soil conditions. The area may have been previously excavated and backfilled with materials rich in clay. It may also be an area where nonmetallic wastes were buried. This area is a likely target for exploratory trenching or excavation. Figure 4B shows the EM-31 grid and data for the transmitter pad area in relation to Bell Road and other local features.

5.3.3 Ground-Penetrating Radar Data

GPR traverses were conducted within the transmitter pad area using both the 400 MHz and 200 MHz antennas. The traverses were conducted over major anomalies in the field area. However, the GPR data is featureless. No reflection patterns typical of buried objects and debris occur in

the data. The background conductivities are relatively high and limit the effective depth of investigation of the GPR system. Therefore, GPR data was ineffective at this site.

5.4 Former Incinerator Pad Location

Figure 5A is the EM-61 data color contour map for the former incinerator pad location. Data were obtained within a 110 feet by 60 feet area. The grid was located over Bell Road and adjacent to Bell Road on the west. Figure 5B is the EM-31 contour map for the same area. A local grid was used for the incinerator pad area. However the four corners of the grid were surveyed and used in the GIS database for the Facility. The Incinerator Pad, as determined from aerial photos was approximately 50 by 30 feet and located in the center of the grid area.

5.4.1 EM-61 Data

Figure 5A is the EM-61 contour map for the former incinerator pad location. In general, EM-61 background data indicate a range from negative to approximately 5 mV. These values are very low. The variation in colors is somewhat misleading. Most of the colors contours do not represent buried objects and debris. They represent very slight variations in the background EM-61 data. The only significant anomaly (greater than 60 mV) is located at approximately 20E, 90N, which is caused by the metal manhole cover occupying that location. In general there are no anomalies that are typical of a buried rebar reinforced concrete slab within the EM-31 data from the site. Since Bell Road was likely constructed over the slab (estimated from historical aerial photos), it may have been removed during construction.

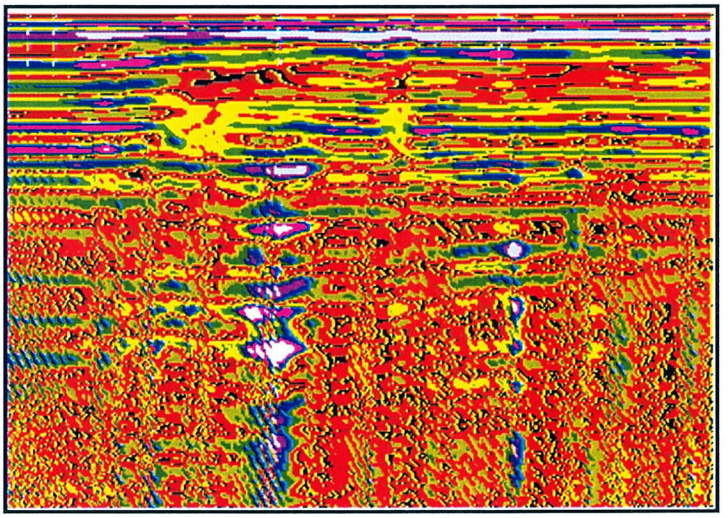
5.4.2 EM-31 Data

Figure 5B is the EM-31 contour map of terrain conductivity values for the former incinerator pad location. In general, terrain conductivities range between 68 and 90 mS/m. Bell Road trends north-south and occupies the eastern two-thirds of the field area. The oval to circular shaped anomaly located at 20E, 90N is likely caused by the manhole (metal cover) at that location. The system is likely losing coupling and the terrain conductivity values are relatively low. The elongated north-south trending anomaly located at approximately 10E is likely caused by a nonmetallic utility trending parallel to Bell Road. It is reported that a water or sewer line is located there. The response is not typical of a metal utility. In general there are no anomalies that are typical of a buried rebar reinforced concrete slab within the EM-31 data from the site. Since Bell Road was likely constructed over the slab (estimated from historical aerial photos), it may have been removed during construction.

5.4.3 Ground-Penetrating Radar Data

A GPR traverse was conducted across the western half of the grid area over the suspected location of the incinerator pad. Both the 400 MHz and 200 MHz antennas were utilized. However, the GPR data is generally featureless. No reflection patterns typical of buried objects and debris or a buried concrete footing occur in the data. One faint GPR anomaly was detected. The anomaly is not typical of the type of reflections expected for a buried concrete slab. The anomaly may be typical of a buried utility adjacent to Bell Road; however, it is only faintly defined. The GPR record is shown below. The anomaly occurs as a faint reflector with reverberations. It is located 5 feet west of Bell Road and may be the presently operating sewer pipeline.

East **West**



5.5 Sewer Pipeline and Oxidation Basin Profiles

EM-61, EM-31, and selected GPR traverses were conducted over the suspected sewer pipeline. EM-31 traverses were conducted over the reported oxidation basin locations. The EM-31 and EM-61 traverse locations are indicated on Figure 6. Profiles are presented in Appendix A. The results are discussed in the following sections.

5.5.1 EM-61 Data

EM-61 data were obtained along Profiles 3 through 8, located over the suspected former sewer pipeline location as indicted in Figure 5. Although the sewer pipeline is reported to consist of vitrified clay (not likely detectable with the EM-61), the EM-61 data were obtained in case the sewer pipeline was actually constructed of rebar reinforced concrete. The traverses were located

such that the previously staked locations of the suspected sewer pipeline (from aerial photos) occurred at approximately the center of each profile line.

Profile 3 indicates a small limited anomaly at the eastern section of the profile. The anomaly is approximately 10 mV in magnitude and is located approximately 25 feet west of Bell Road. The anomaly width and magnitude is typical of a relatively narrow utility that may be parallel to Bell Road. The suspected sewer pipeline (staked location from survey data) has no anomaly associated with the general location. It may not exist or may not contain rebar.

Profiles 4 through 7 are generally featureless. Some small, low magnitude anomalies are present at various locations. However, the anomalies do not coincide with the suspected sewer pipeline location and are not typical of anomalies that are caused by subsurface rebar reinforced structures. They are likely caused by small, scattered shallow metallic debris.

Profile 8 exhibits an anomaly (120mV) at the approximate location of the suspected sewer pipeline. This anomaly is more typical of rebar-enforced concrete or of a metal object. In general, the anomaly only exists on Profile 8 and does not occur along Profiles 3 through 7. The anomaly may represent some other metallic object because the profile is located adjacent to a building with several apparent buried structures. If the anomaly represents the sewer pipeline, it does not likely extend north of the area.

5.5.2 EM-31 Data

The locations of all profile traverses are presented on Figure 5. EM-31 data were obtained along Profiles 1 through 12. The EM-31 profile data are included in Appendix A.

Sewer Pipeline Profiles–Profiles 3 through 10 were located over the suspected former sewer pipeline location (Figure 5). Since the sewer pipeline is reported to consist of vitrified clay (generally not detectable with the EM-61), EM-31 data were obtained in attempt to assess the location of the sewer pipeline. A vitrified clay pipe is a subtle feature. Conductivity changes associated with a shallow buried clay pipe may be detected with the EM-31; however, the likelihood is relatively low. The pipeline may be broken or filled with soil making the detection of the feature almost impossible. The staked location of the sewer pipeline occurs on approximately the center of each profile.

Profiles 3 through 8 indicate relatively featureless data. None of the profiles indicate anomalies that may represent a buried clay pipeline. All of the data (excepting Profile 3) indicate data that are relatively "flat" with no indication of the pipeline. The eastern section of Profile 3 indicates

lower conductivity values. This is consistent with the lateral variation in conductivity in the transmitter pad area data and septic tank area data as described in the previous sections. Generally high background conductivity values may preclude the detection of the pipeline, as it is a very subtle target.

Profiles 9 and 10 are located south of the intersection of Bell Road and the local side access road (Figure 5). A building is located at the intersection. Profile 10 is located south of Profile 9. Both of the profiles extend to Bell Road. Both of the profiles exhibit an anomaly that is likely caused by a buried metallic or reinforced concrete conduit. The anomaly is centered at approximately 6386450E along Profile 10 (adjacent to Bell Road). The anomaly is centered at approximately 6386355E along Profile 9 (approximately 45 feet west of Bell Road). The anomalies have a similar trend to what is indicated on site maps showing the sewer pipeline. If the sewer pipeline is truly reinforced concrete, then the anomalies indicate the location of the conduit. In addition, if the anomalies do represent the sewer pipeline, it does not likely exist in the open field to the north as indicated on site maps. It was not detected at those locations along other profiles.

Oxidation Basin Profiles–Profiles 1, 2, 11, and 12 were conducted over the suspected location of the oxidation basins. Figure 5 indicates the locations of the profiles. Profiles 1 and 11 were conducted in the northern section of the oxidation basins. Profiles 2 and 12 were conducted in the southern section. A building, and other associated structures are presently located between the pairs of profiles in the center section of the basin location estimate. The purpose of the EM-31 profiles was to assess if any changes in terrain conductivity will indicate the location and limits of the oxidation basins. The oxidation basins reported to be constructed of clay. Therefore, local increases in conductivity may indicate the limits of the basins. However, it is a very subtle target and local soils are also high in conductivity likely precluding detection of the basins.

Profile 2 (east-west) and Profile 12 (north-south) are located over the reported surveyed locations of the oxidation basins. They are located south of the building presently occupying the center of the oxidation basin area. The profiles do not indicate terrain conductivity values that are typical of those expected for oxidation basin materials. In fact, they exhibit just the opposite trend in EM-31 data. Terrain conductivity values on the eastern section of Profile 12 are lower (more resistive) than the western section. This correlates with the same effect (lateral east-west conductivity distribution) observed in the septic tank area, transmitter pad area, and some of the profiles in the open field. Therefore, they cannot be indicative of the oxidation basins. First, the effect is the opposite of what is expected for oxidation basin materials, and second, the effect

extends for a very long distance adjacent to Bell Road, much longer than the estimated north-south limits of the basins. The decrease in conductivity likely represents sandier materials. This effect is discussed in previous sections of the report (Sections 5.3.2 and 5.2.2).

Profiles 1 (east-west) and Profile 11 (north-south) were located over the reported survey locations of the oxidation basins (Figure 5). The profiles are located north of the building presently occupying the center of the oxidation basin area. The profiles do not indicate terrain conductivity values that are typical of what would be expected for oxidation basin materials (clay). They exhibit the opposite trend in EM-31 data. Terrain conductivity values on the eastern section of Profile 1 are generally lower (approximately 10 mS/m lower) than terrain conductivity values in the western section. Terrain conductivity values on the southern section of Profile 11 are lower by approximately 10 mS/m (more resistive) than the northern section.

The northern limit of the low conductivity values along Profile 11 occurs at approximately the same general location as the northern extension of the oxidation basins. However, as discussed, the data indicates an opposite trend in values expected for oxidation basin materials (clay basins, higher relative conductivity). The southern limit of the lower conductivity values extends far south (greater than 1,000 feet south) of the southern extension of the estimated oxidation basin limits (from aerial photos). Therefore, the low conductivity values are not interpreted to represent oxidation basin materials, unless the basins extend greater than 1,000 feet south of the expected southern limit, and, were constructed of relatively coarser grained materials (sandier materials).

5.5.3 Ground-Penetrating Radar Data

Several GPR traverses were conducted along most of the EM-61 and EM-31 profile locations over the sewer pipeline. Both the 400 MHz and 200 MHz antennas were utilized. However, the GPR data is generally featureless. No reflection patterns typical of buried objects and debris, sewer pipelines occur in the data. The background conductivity values are relatively high and limit the effective depth of investigation of the GPR system. Therefore, GPR data was ineffective at the Facility.

6.0 References

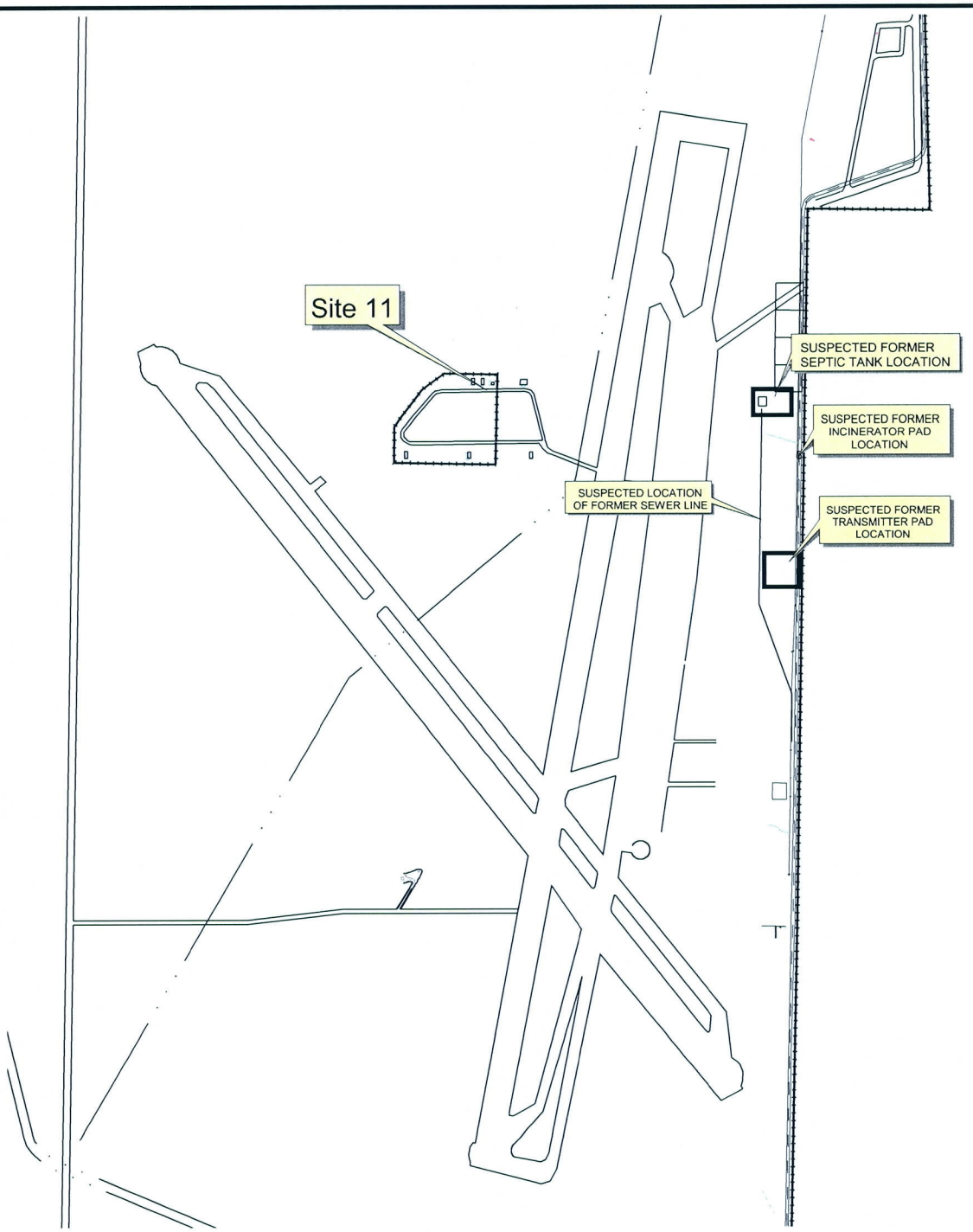
IT Corporation, 2000, *Soil Vapor Extraction Optimization for the Remediation of UST Cluster 1 and Site Verification Activities at Various Sites, Revision 0*, Concord, California, July.

Naval Engineering and Environmental Support Activity, 1984, *Initial Assessment Study of Naval Air Station, Moffet Field, Sunnyvale, California*, March.

PRC Environmental Management, Inc., 1992, NALF Crows Landing, California, *Site Investigation Report, Installation Restoration Program Sites 11,12, 13, 16.*

PRC Environmental Management, Inc., 1997, NALF Crows Landing, California, *Final Remedial Investigation Report, Installation Restoration Program Sites 10 11, 12, 13, 14, 16,17, and 18.*

FIGURES



Scale:

700 0 700 1400 Feet

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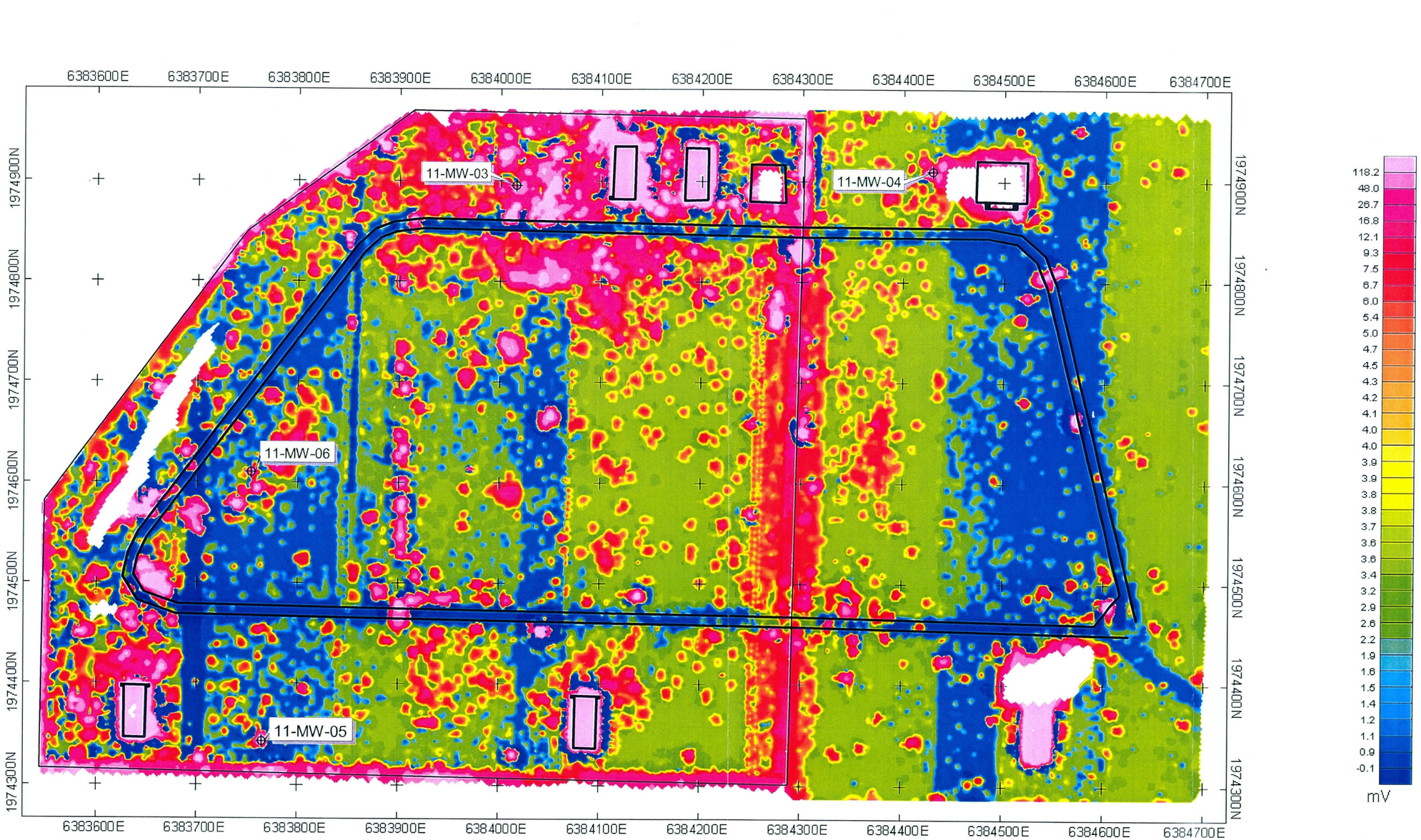
Figure 1
Site Location Map



SCALE:

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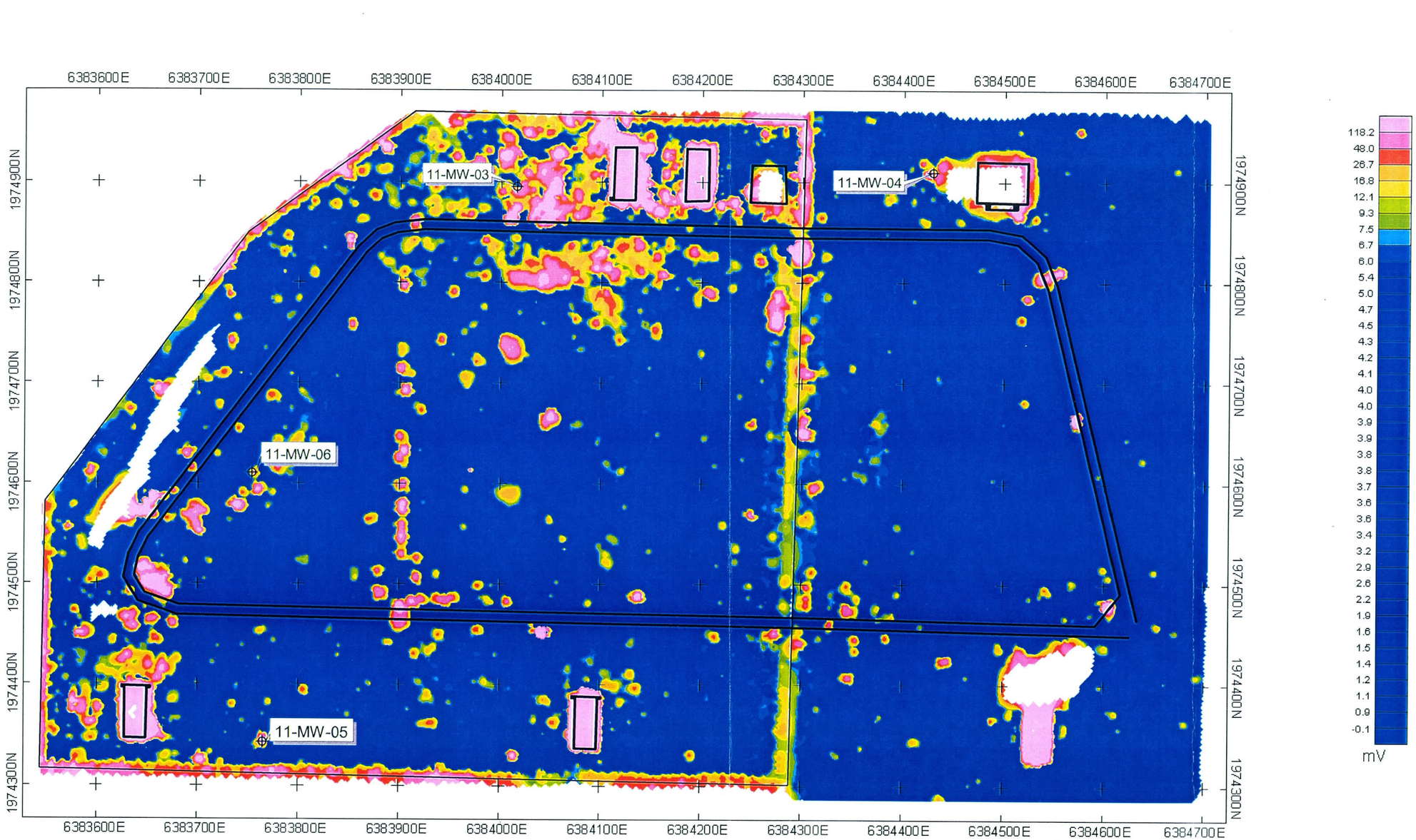
FIGURE 2A
SITE 11
EM-61 DATA BOTTOM COIL (mV)



SCALE:

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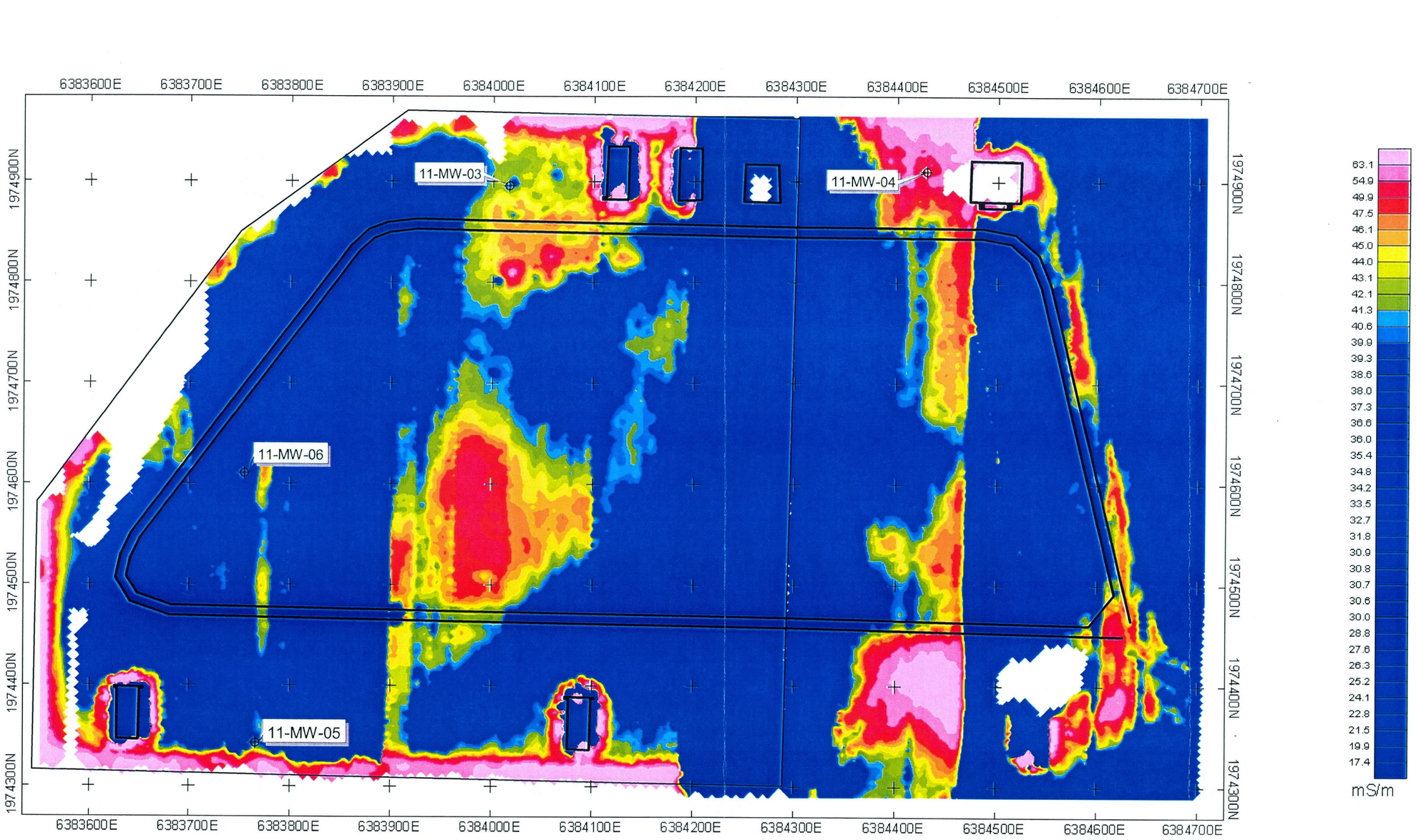
FIGURE 2B
SITE 11 - EM-61 DATA
BACKGROUND REDUCED BOTTOM COIL (mV)



SCALE:

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FIGURE 2C
SITE 11 - EM-31 DATA
TERRAIN CONDUCTIVITY (mS/m)

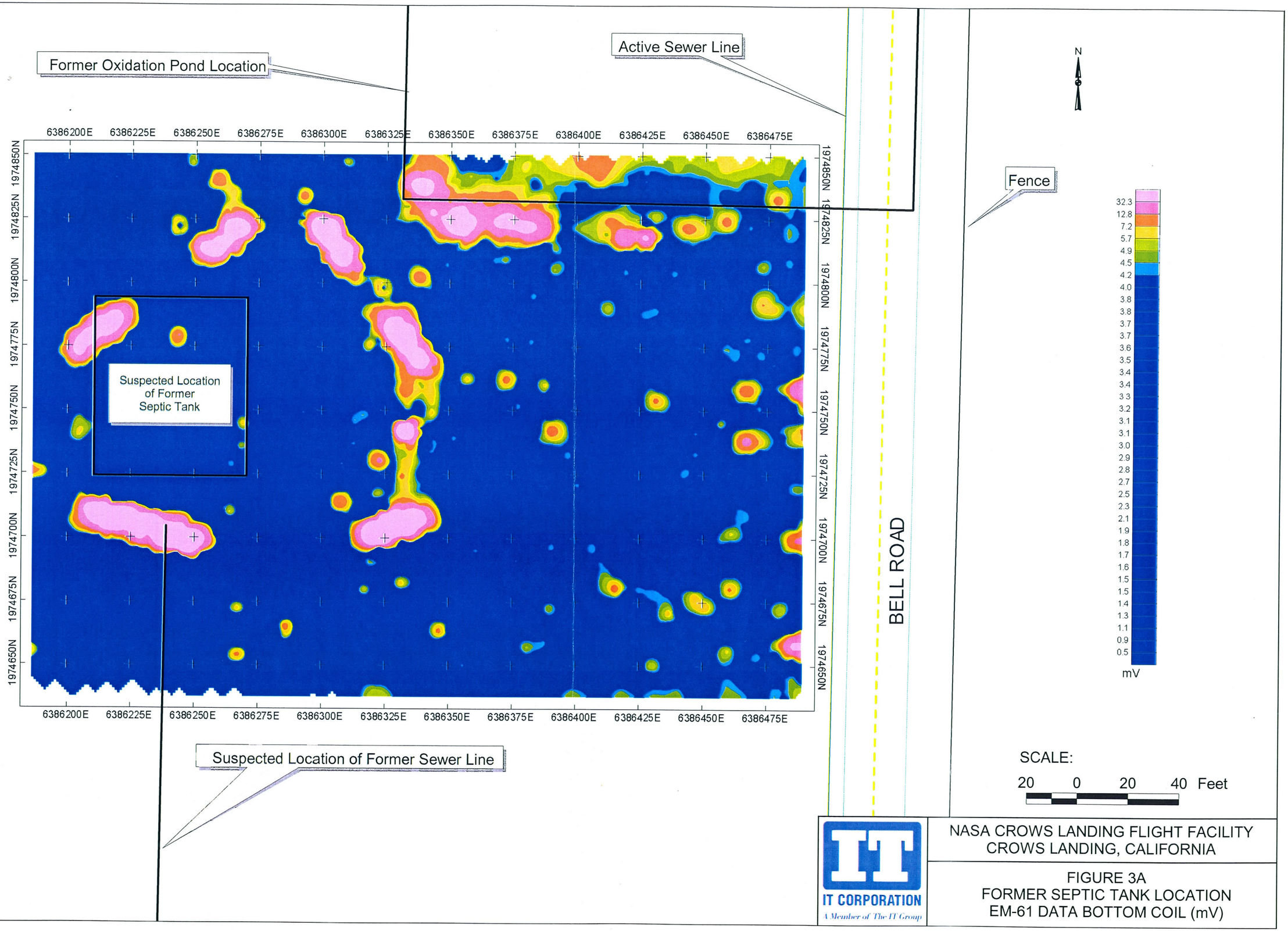

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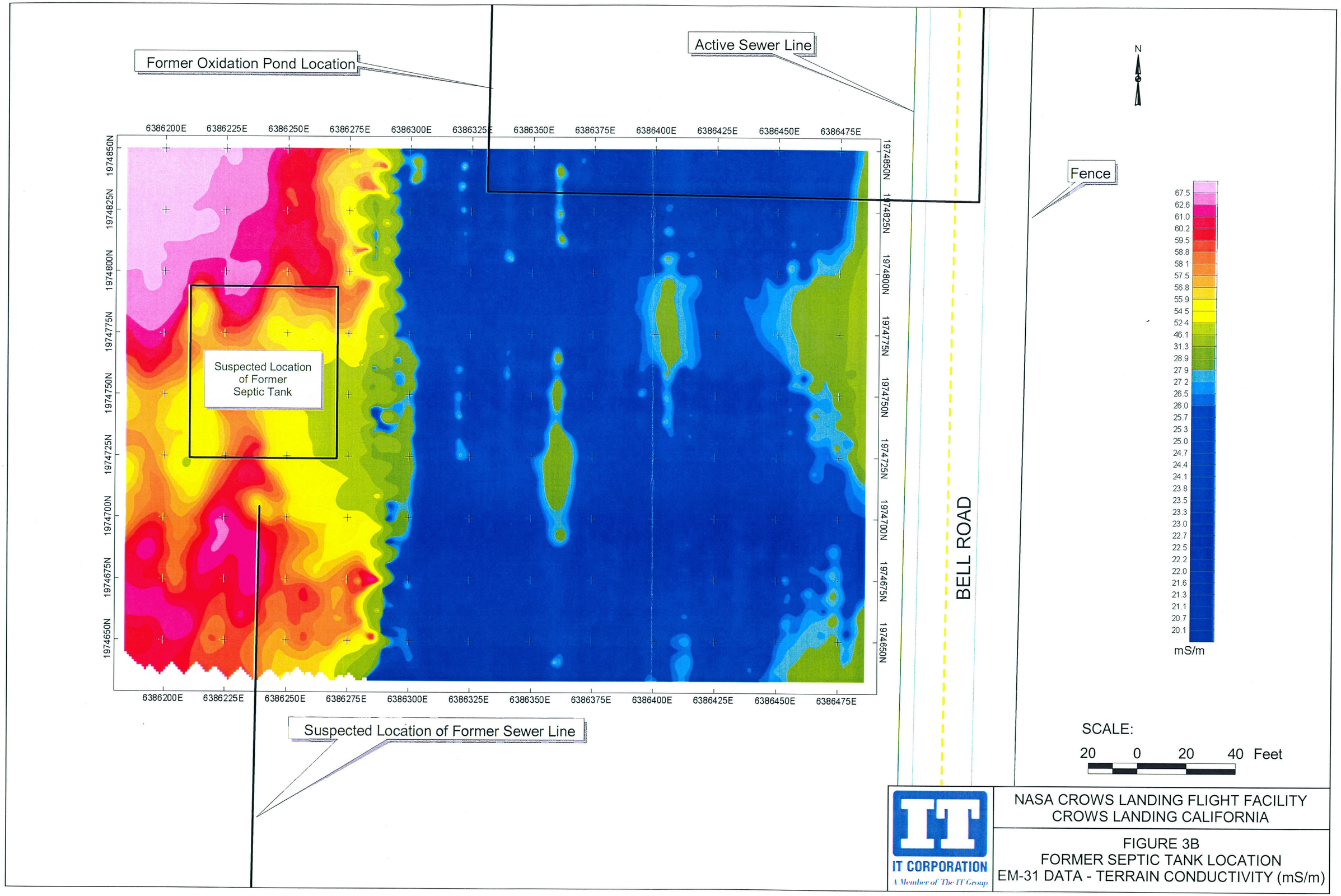
FIGURE 3A
FORMER SEPTIC TANK LOCATION
EM-61 DATA BOTTOM COIL (mV)


Former Oxidation Pond Location
Active Sewer Line
Fence
N
6386200E
6386225E
6386250E
6386275E
6386300E
6386325E
6386350E
6386375E
6386400E
6386425E
6386450E
6386475E
1974850N
1974825N
1974800N
1974775N
1974750N
1974725N
1974700N
1974675N
1974650N
Suspected Location of Former Septic Tank
Suspected Location of Former Sewer Line
BELL ROAD
67.5
62.6
61.0
60.2
59.5
58.8
58.1
57.5
56.8
55.9
54.5
52.4
46.1
31.3
28.9
27.9
27.2
26.5
26.0
25.7
25.3
25.0
24.7
24.4
24.1
23.8
23.5
23.3
23.0
22.7
22.5
22.2
22.0
21.6
21.3
21.1
20.7
20.1
mS/m
SCALE:
20 0 20 40 Feet
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CROWS LANDING CALIFORNIA
FIGURE 3B
FORMER SEPTIC TANK LOCATION
EM-31 DATA - TERRAIN CONDUCTIVITY (mS/m)

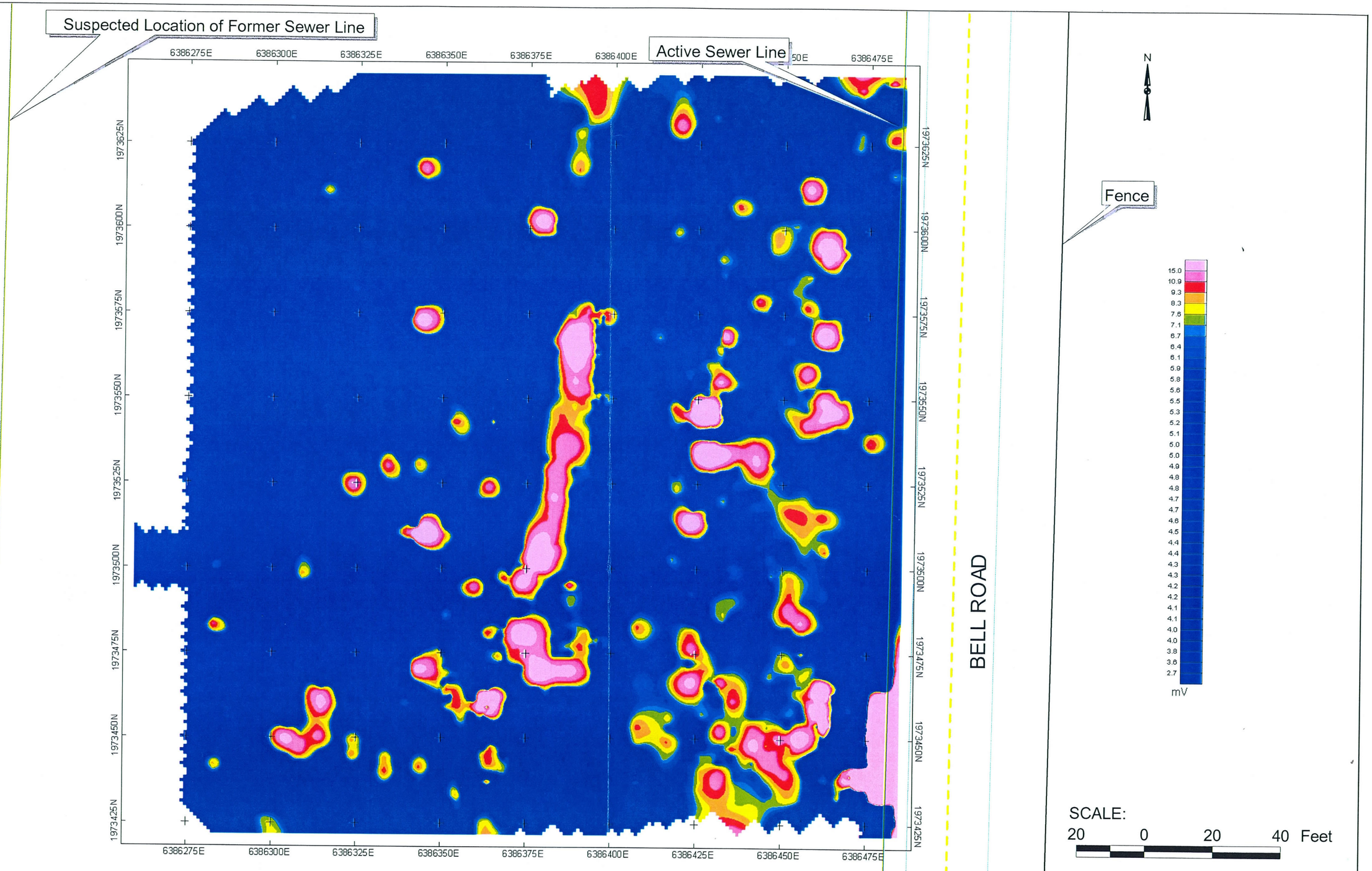

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FIGURE 4A
FORMER TRANSMITTER PAD LOCATION
EM-61 DATA BOTTOM COIL (mV)

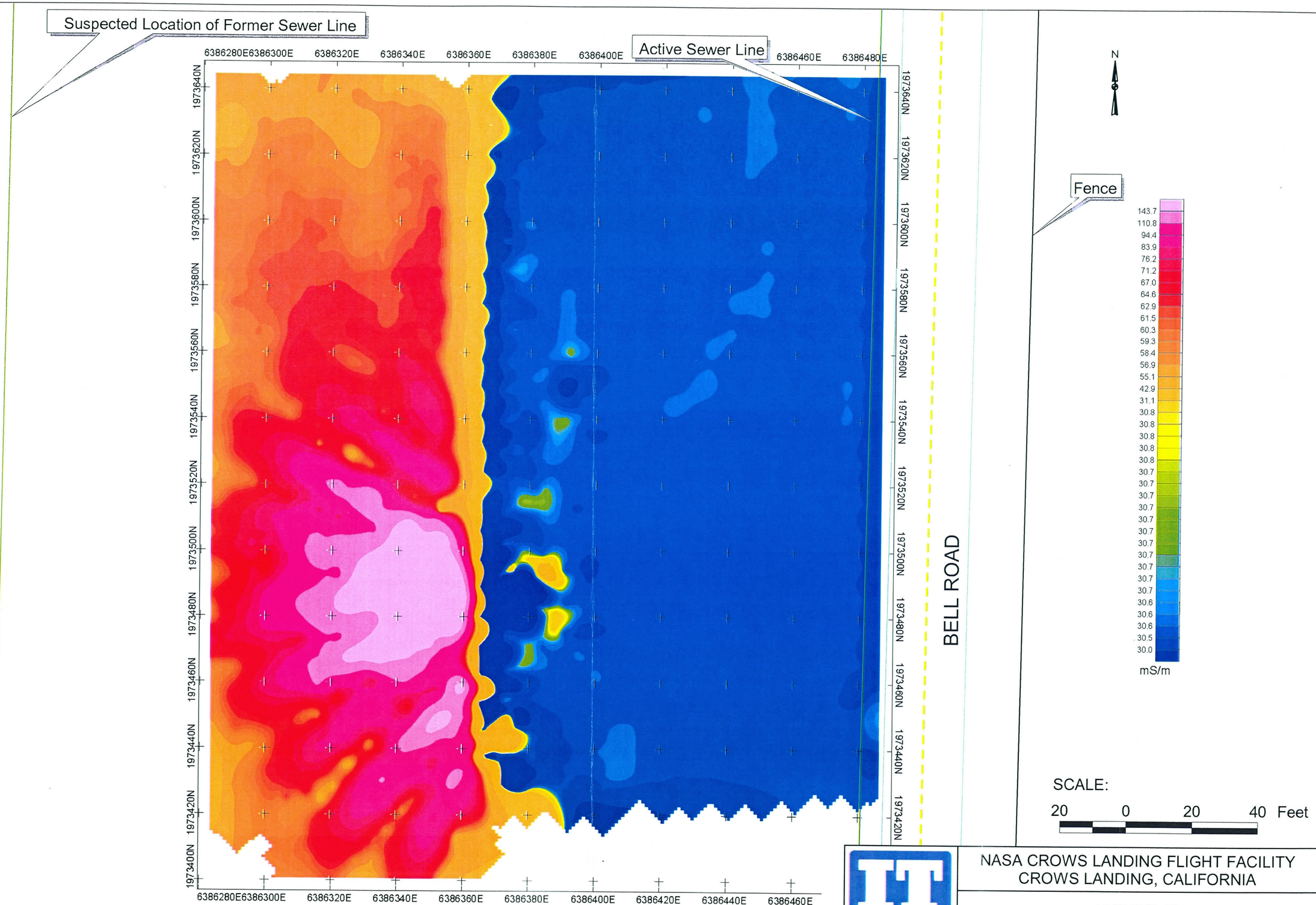

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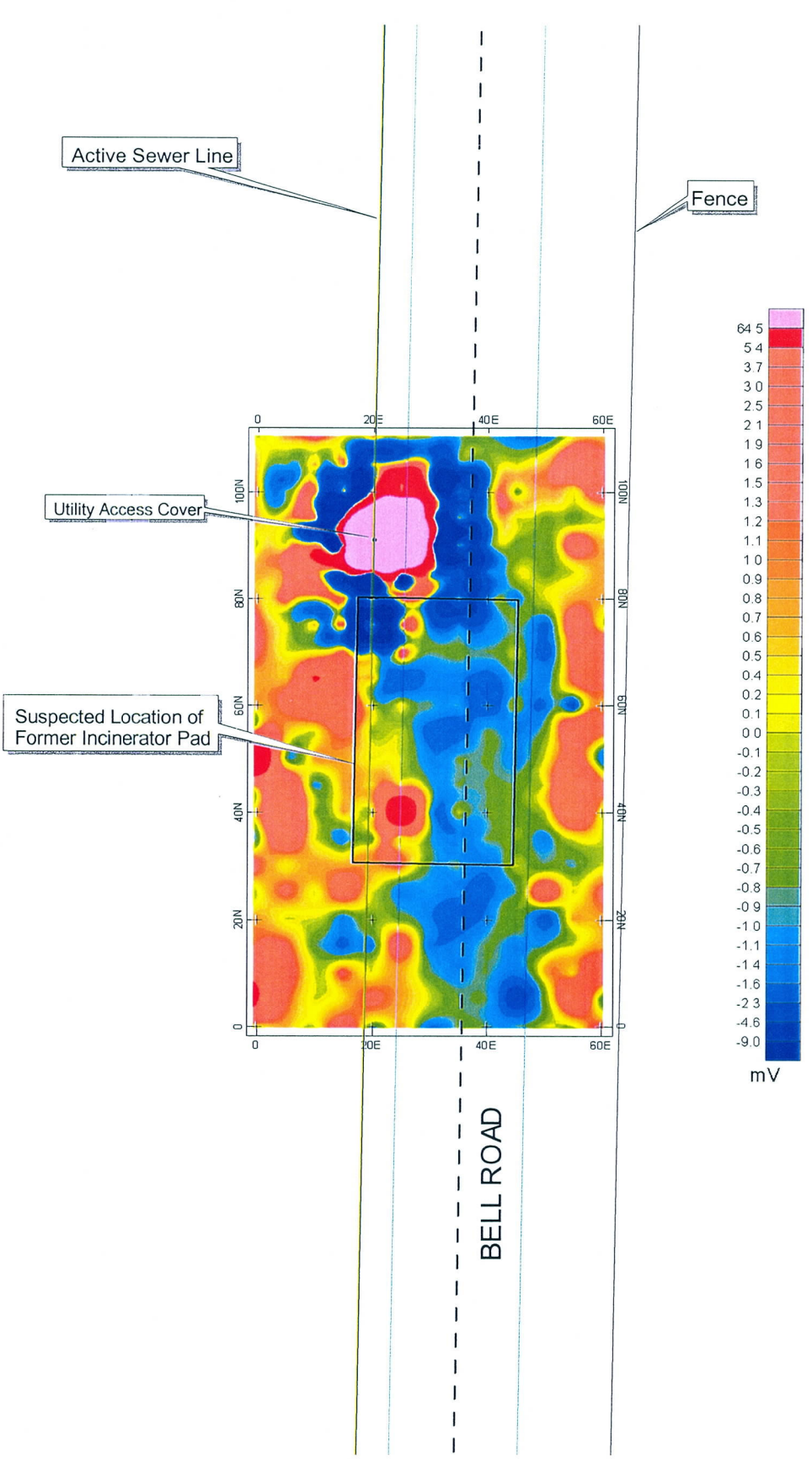
FIGURE 4B
FORMER TRANSMITTER PAD LOCATION
EM-31 DATA - TERRAIN CONDUCTIVITY (mS/m)



SCALE:

20 0 20 40 Feet

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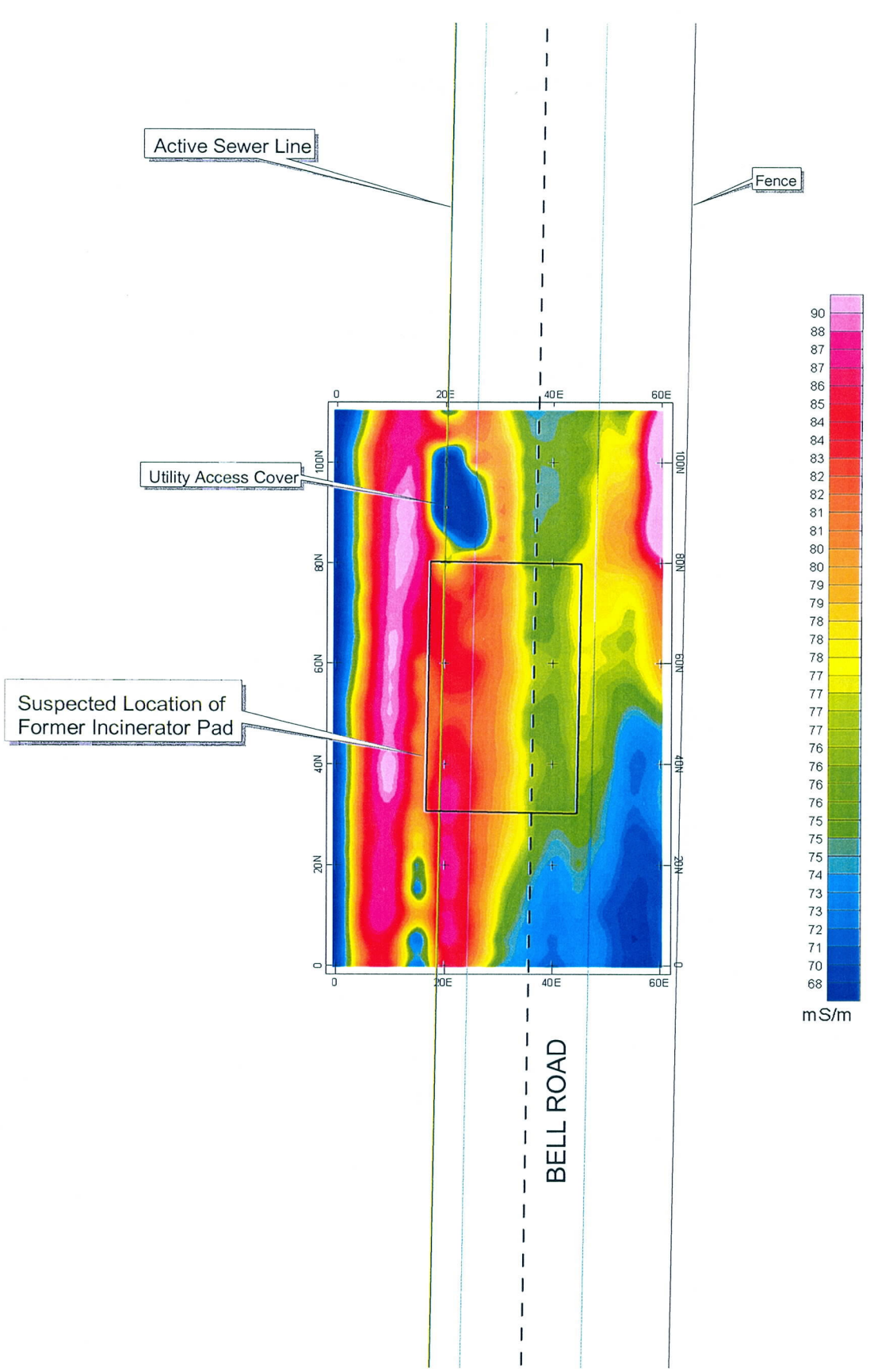
FIGURE 5A
FORMER INCINERATOR PAD LOCATION
EM-61 DATA BOTTOM COIL (mV)



SCALE:

20 0 20 40 Feet

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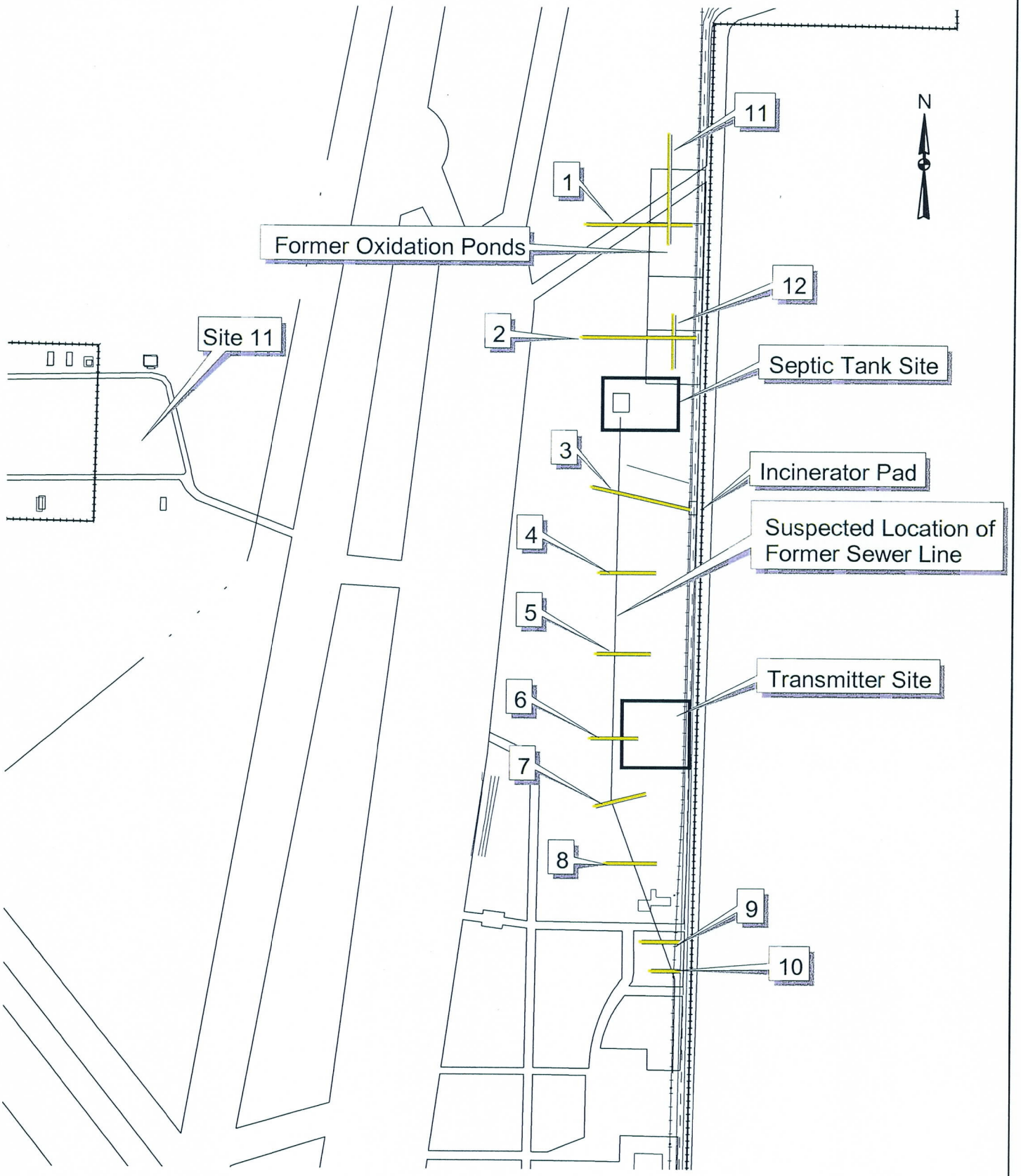
FIGURE 5B
FORMER INCINERATOR PAD LOCATION
EM-31 DATA - TERRAIN CONDUCTIVITY (mS/m)



Scale:

300 0 300 600 900 Feet

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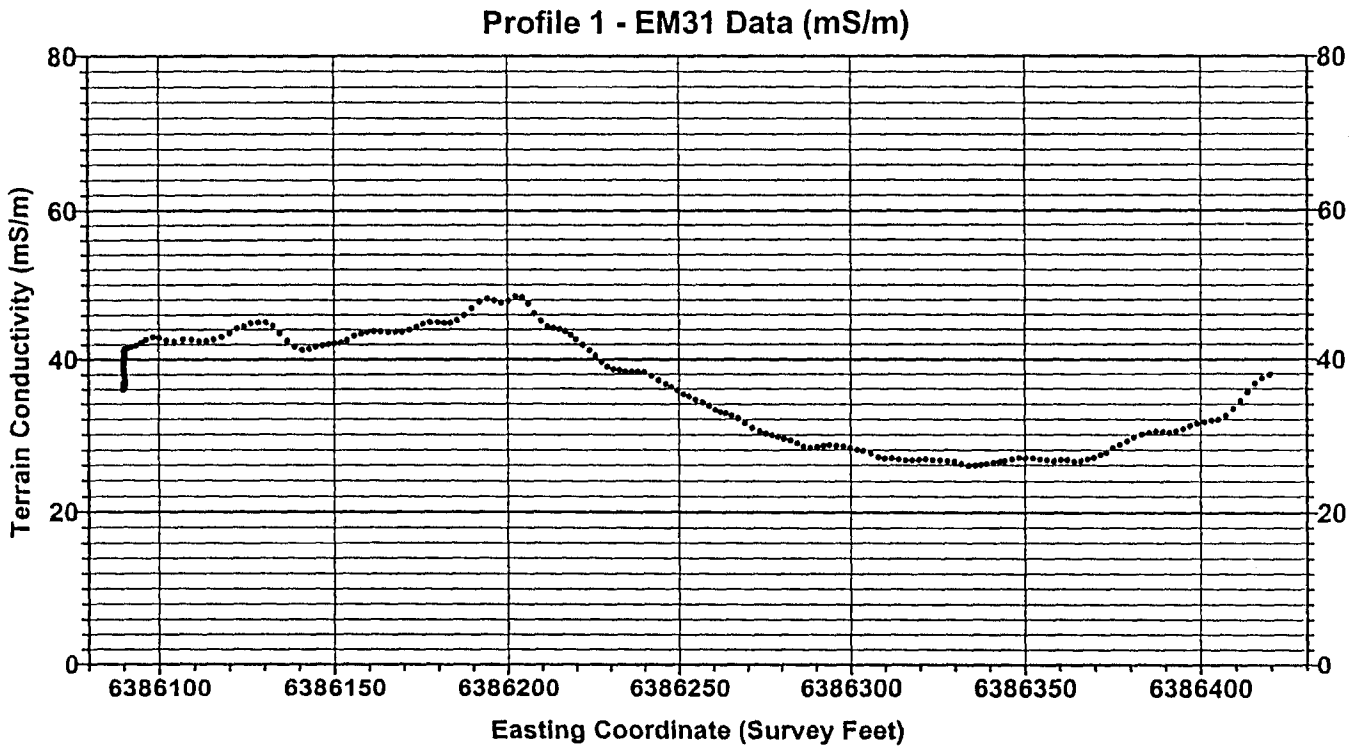
Figure 6
Profile Traverse Locations

APPENDIX A
PROFILE DATA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Terrain Conductivity (mS/m)
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40
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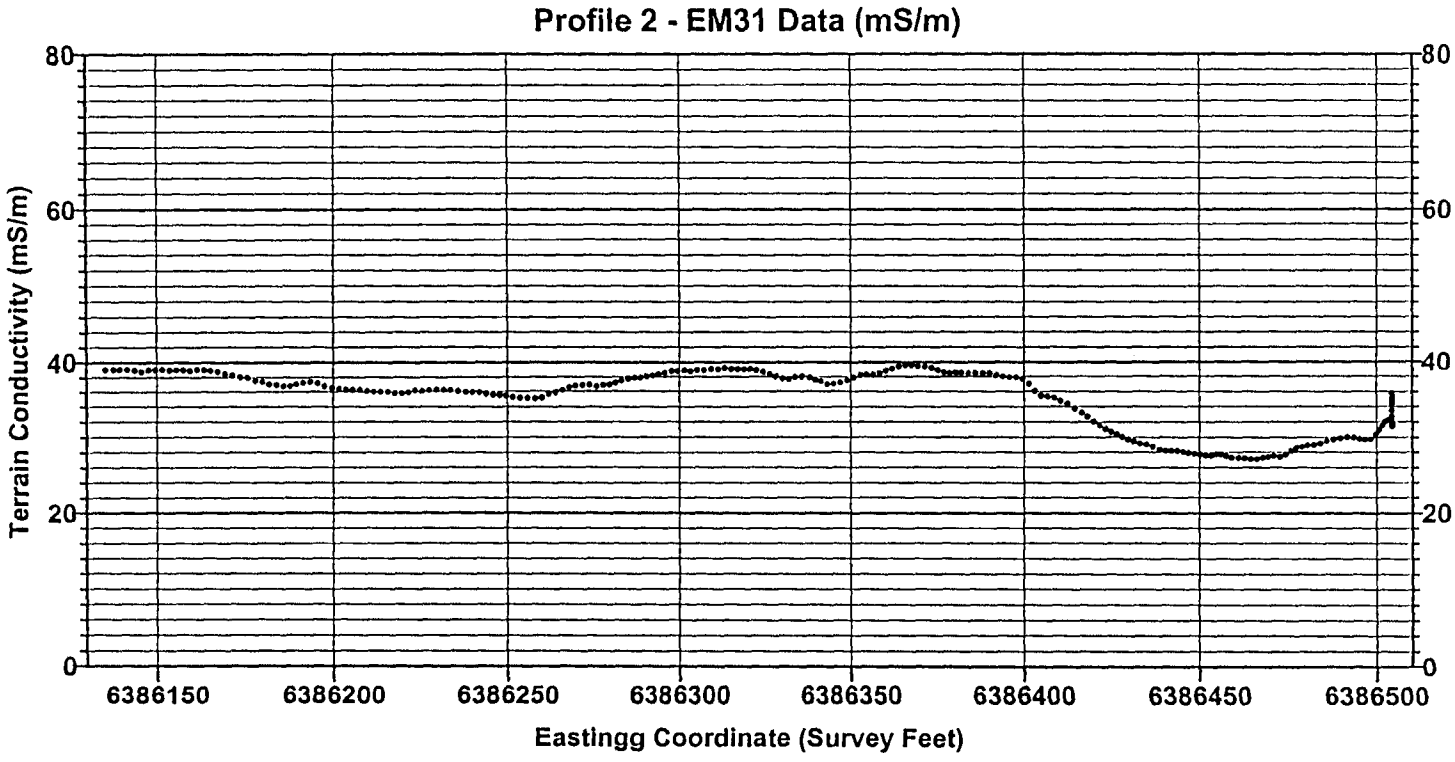
6386150
6386200
6386250
6386300
6386350
6386400
Easting Coordinate (Survey Feet)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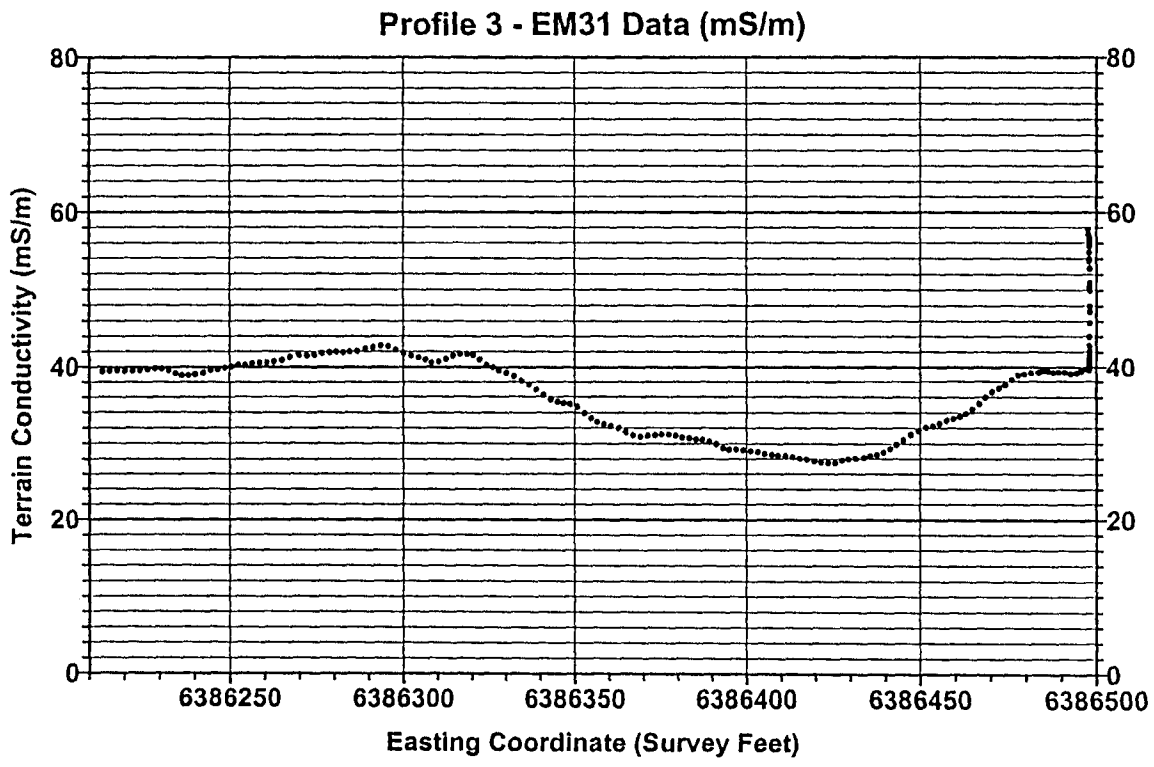
Eastingg Coordinate (Survey Feet)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Terrain Conductivity (mS/m)
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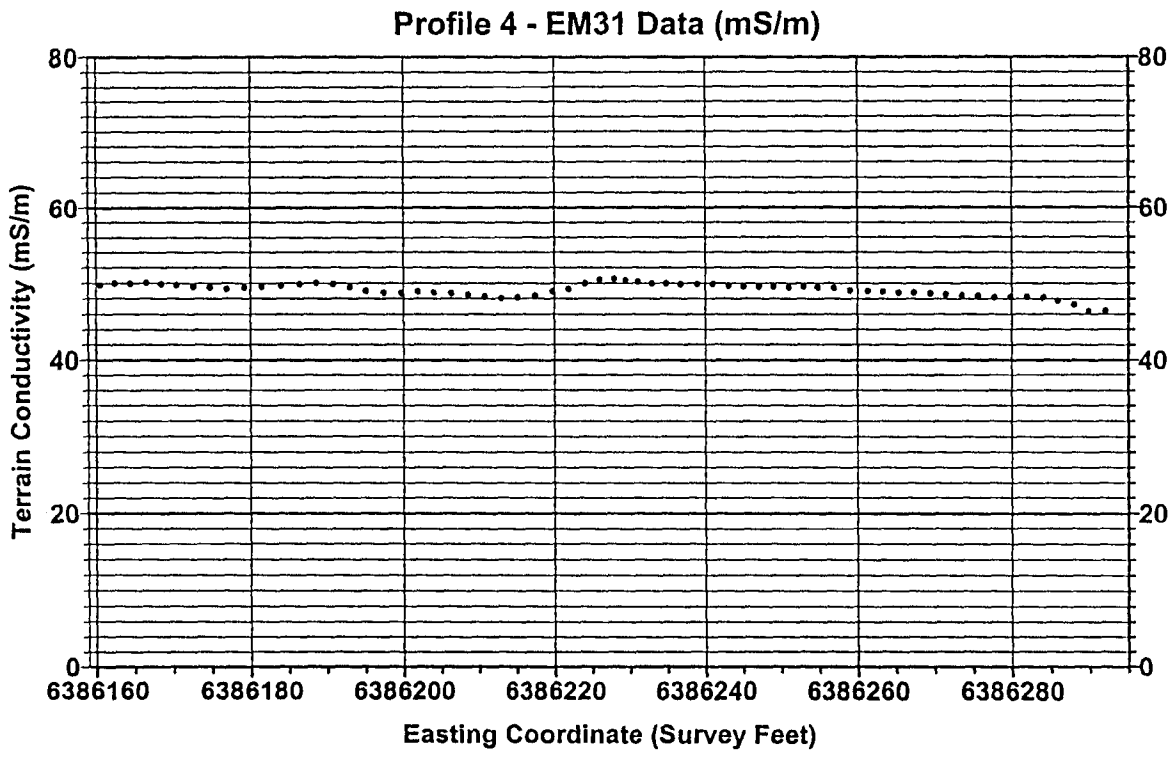
6386500
Easting Coordinate (Survey Feet)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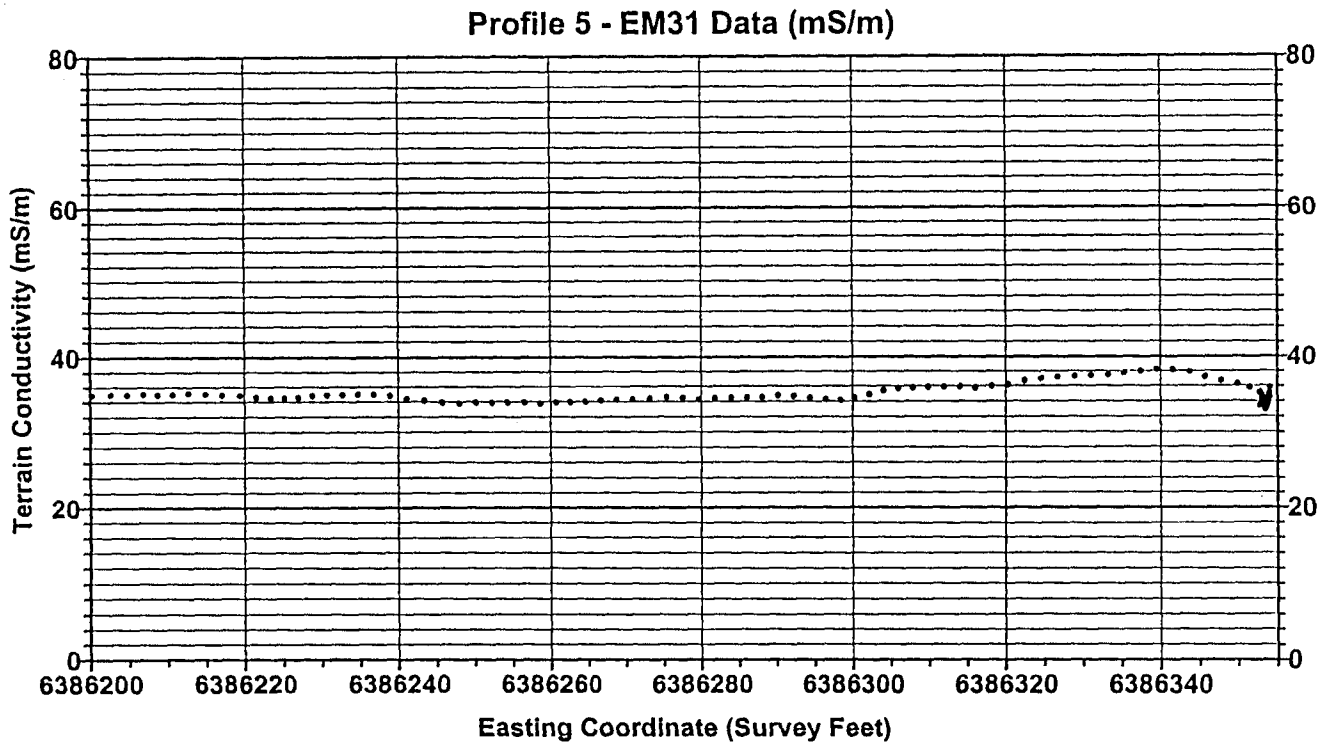
6386260
6386280
Easting Coordinate (Survey Feet)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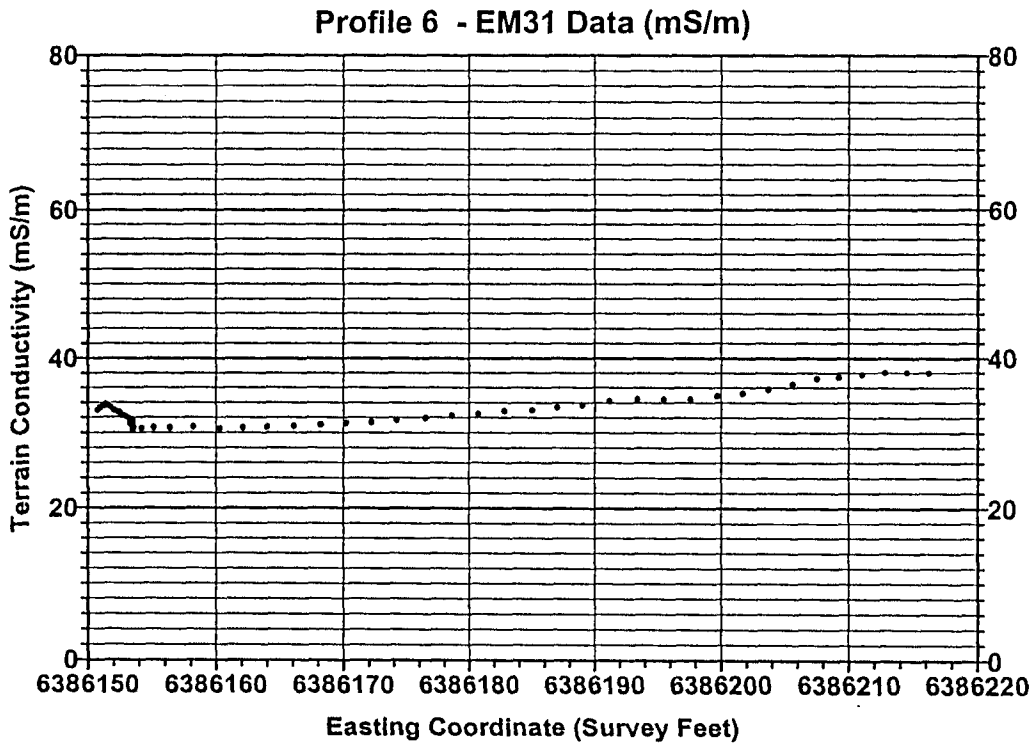
6386340
Easting Coordinate (Survey Feet)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Terrain Conductivity (mS/m)
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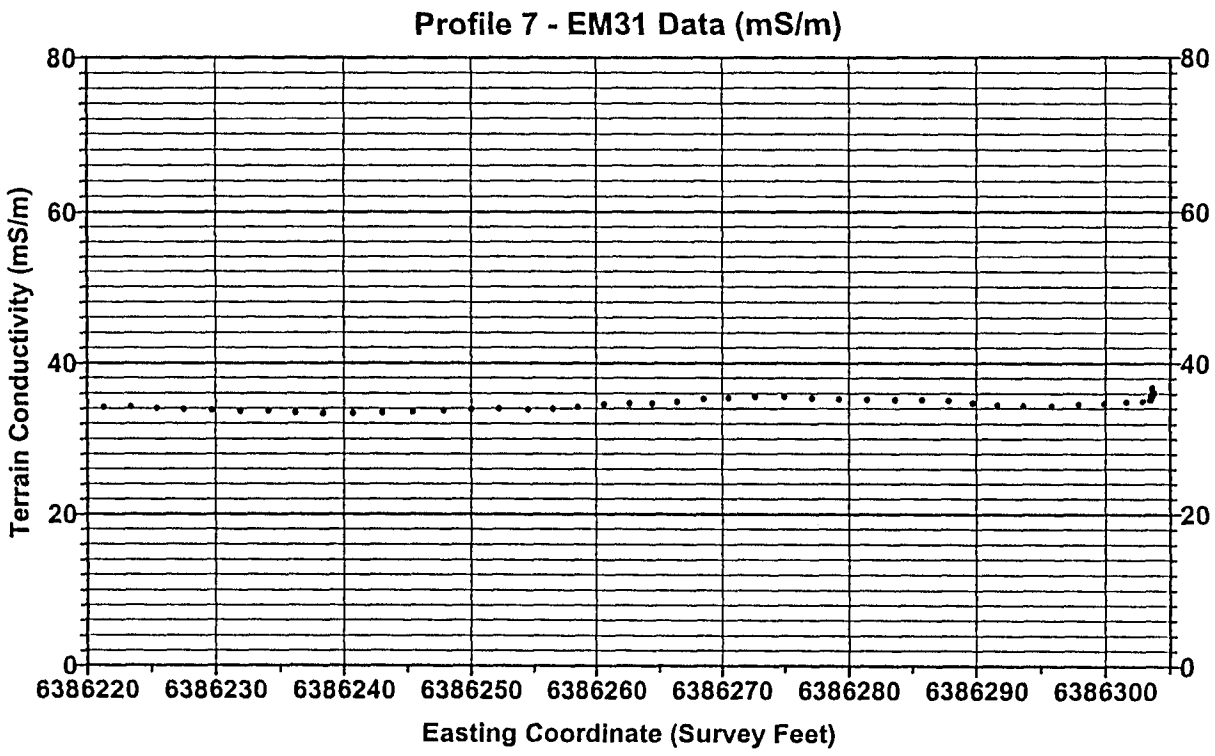
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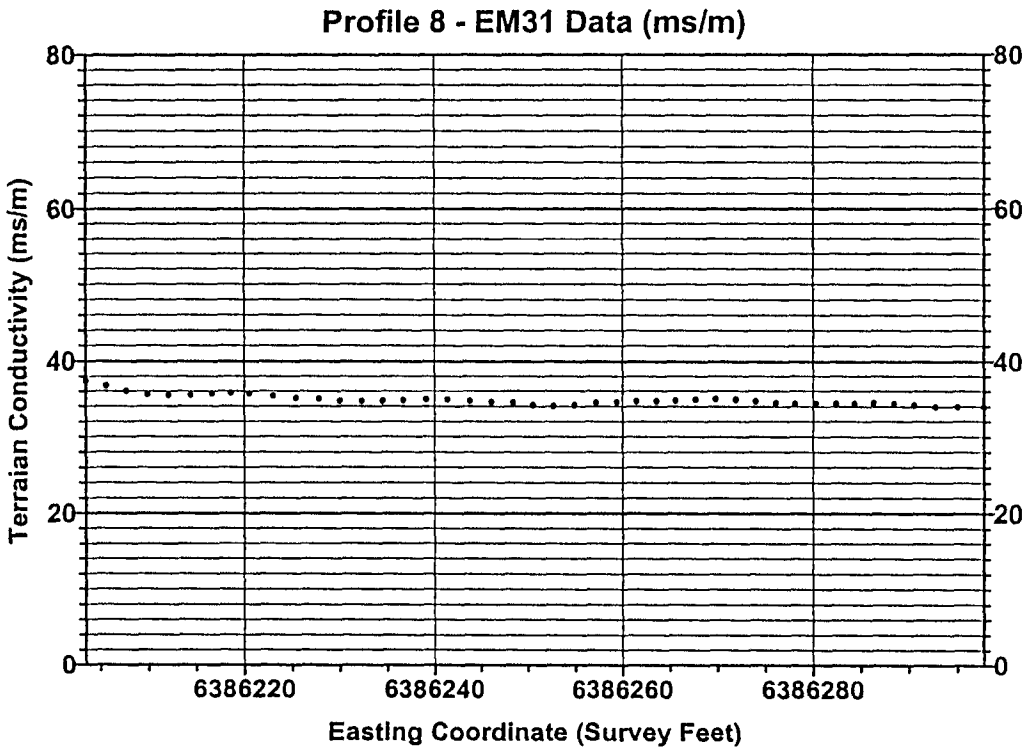
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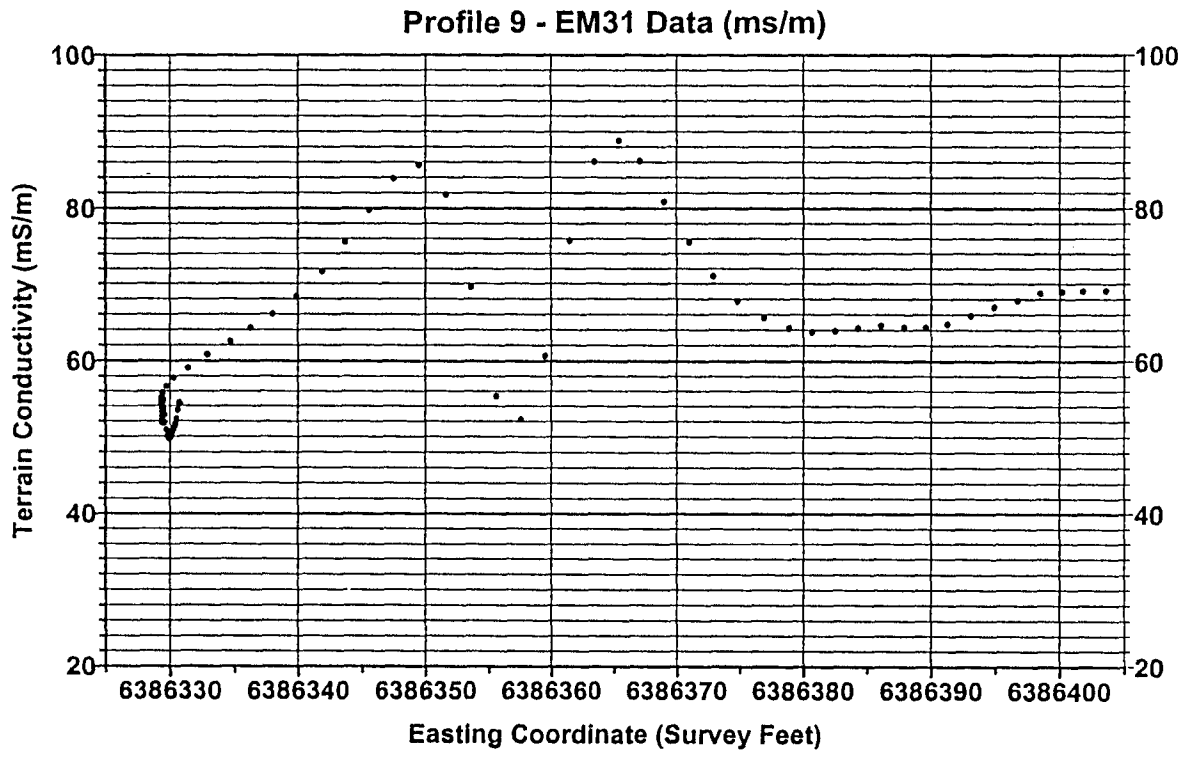
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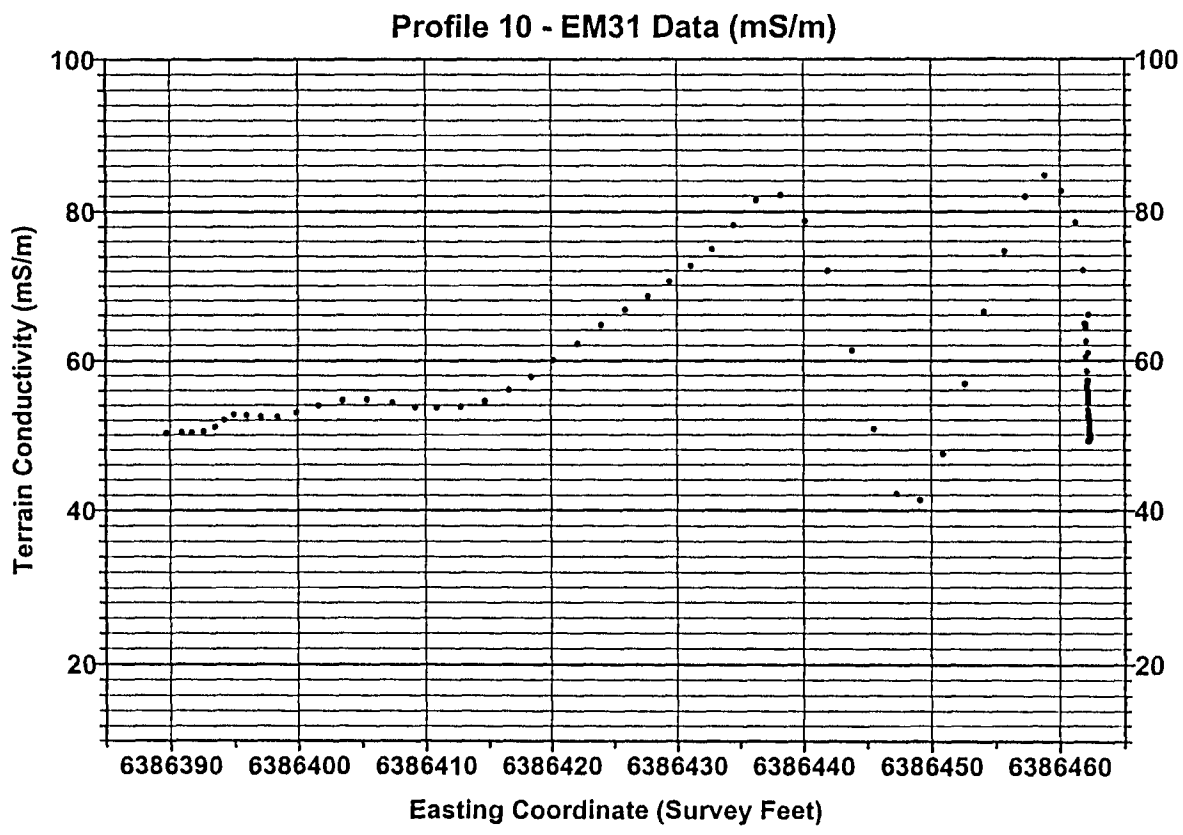
6386400
Easting Coordinate (Survey Feet)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Terrain Conductivity (mS/m)
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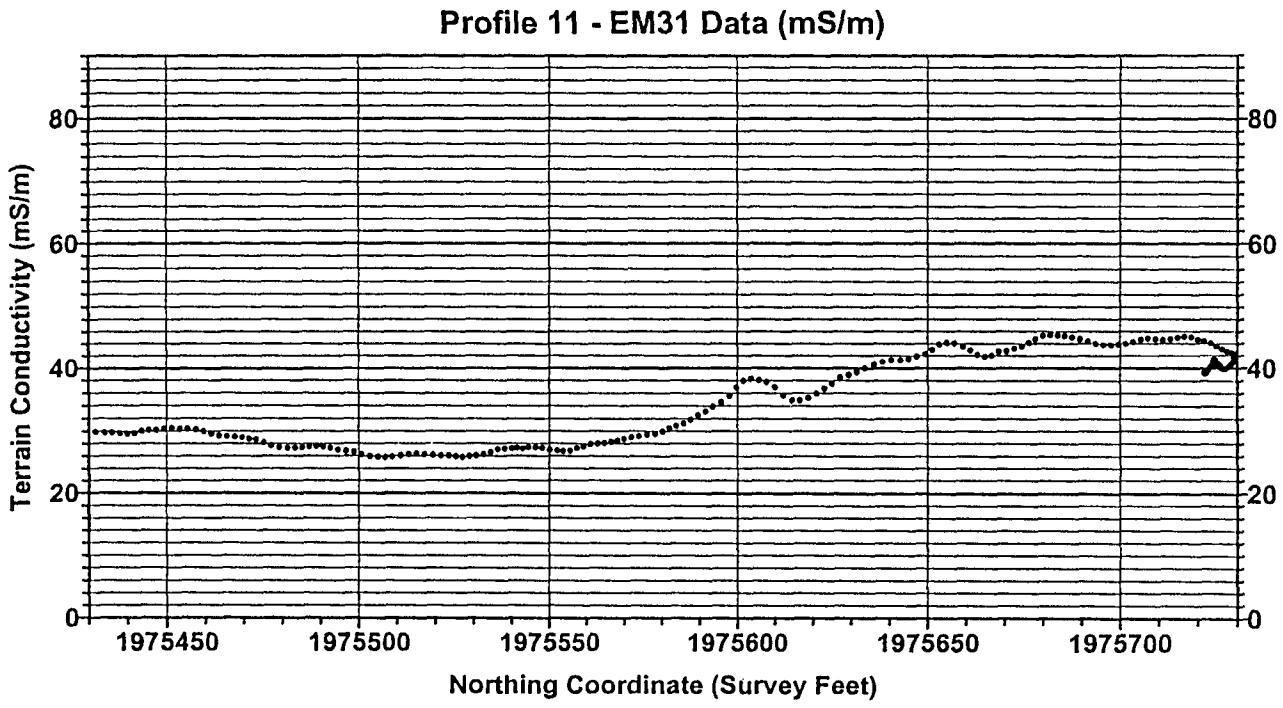
Easting Coordinate (Survey Feet)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1975500
1975550
1975600
1975650
1975700
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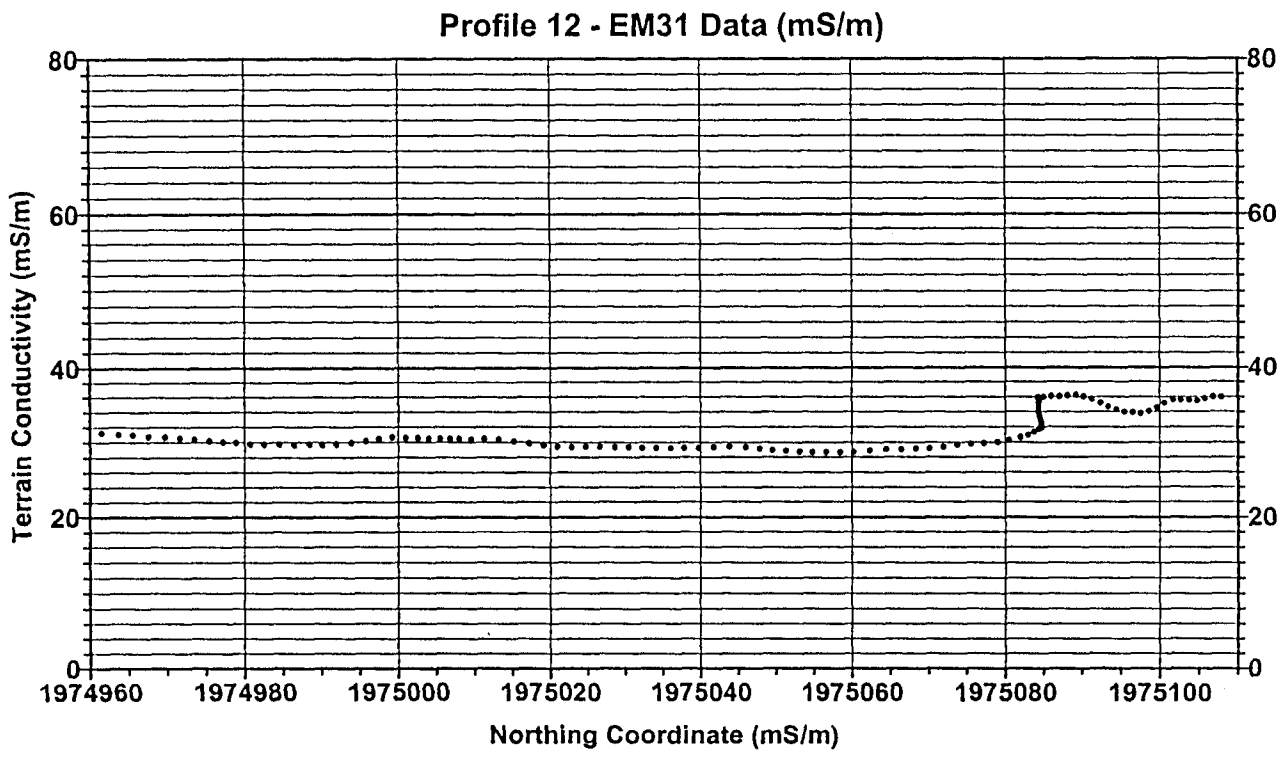
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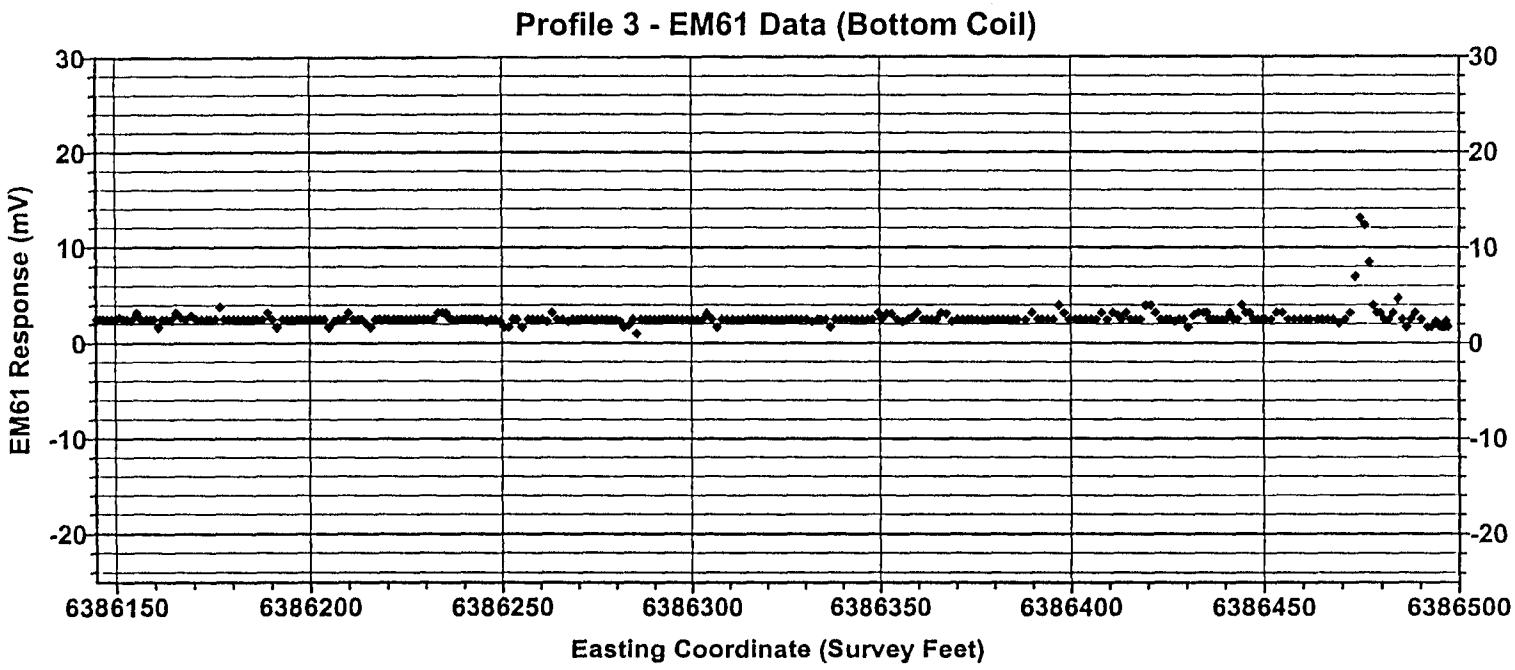
Northing Coordinate (mS/m)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EM61 Response (mV)
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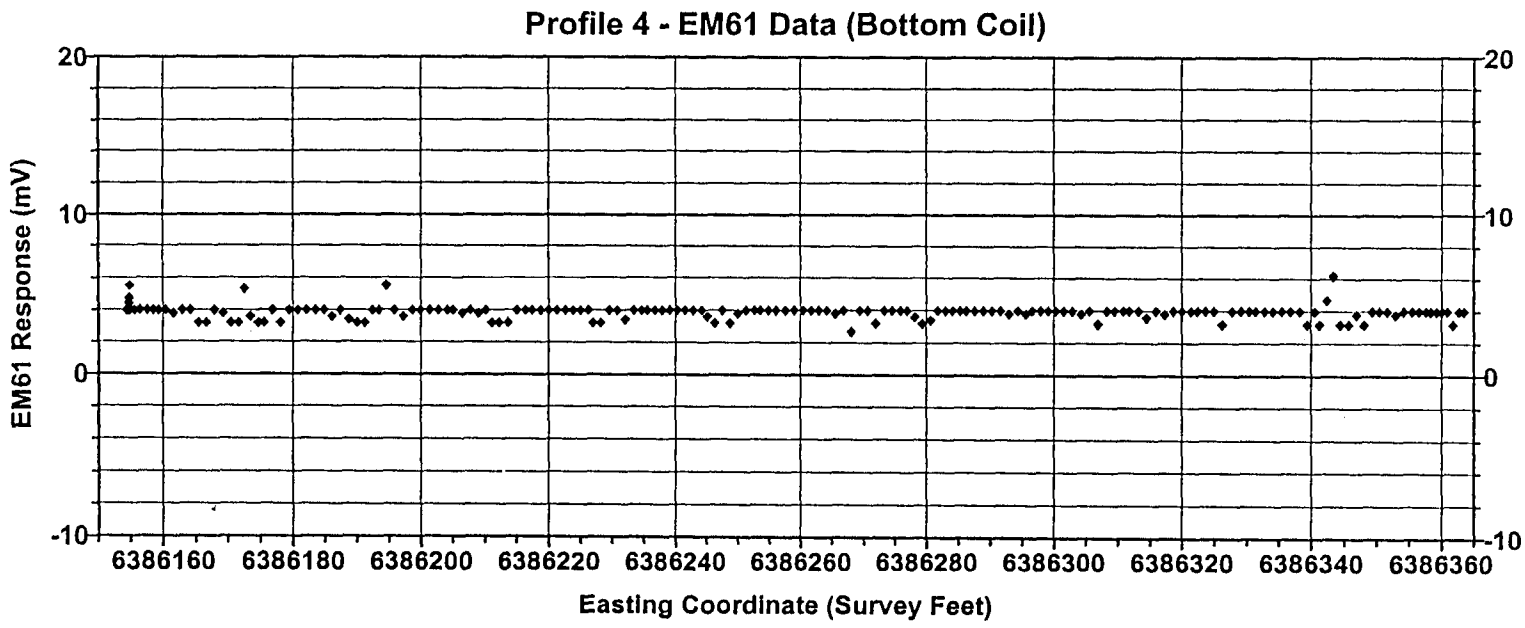
6386350
6386400
6386450
6386500
Easting Coordinate (Survey Feet)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EM61 Response (mV)
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-10
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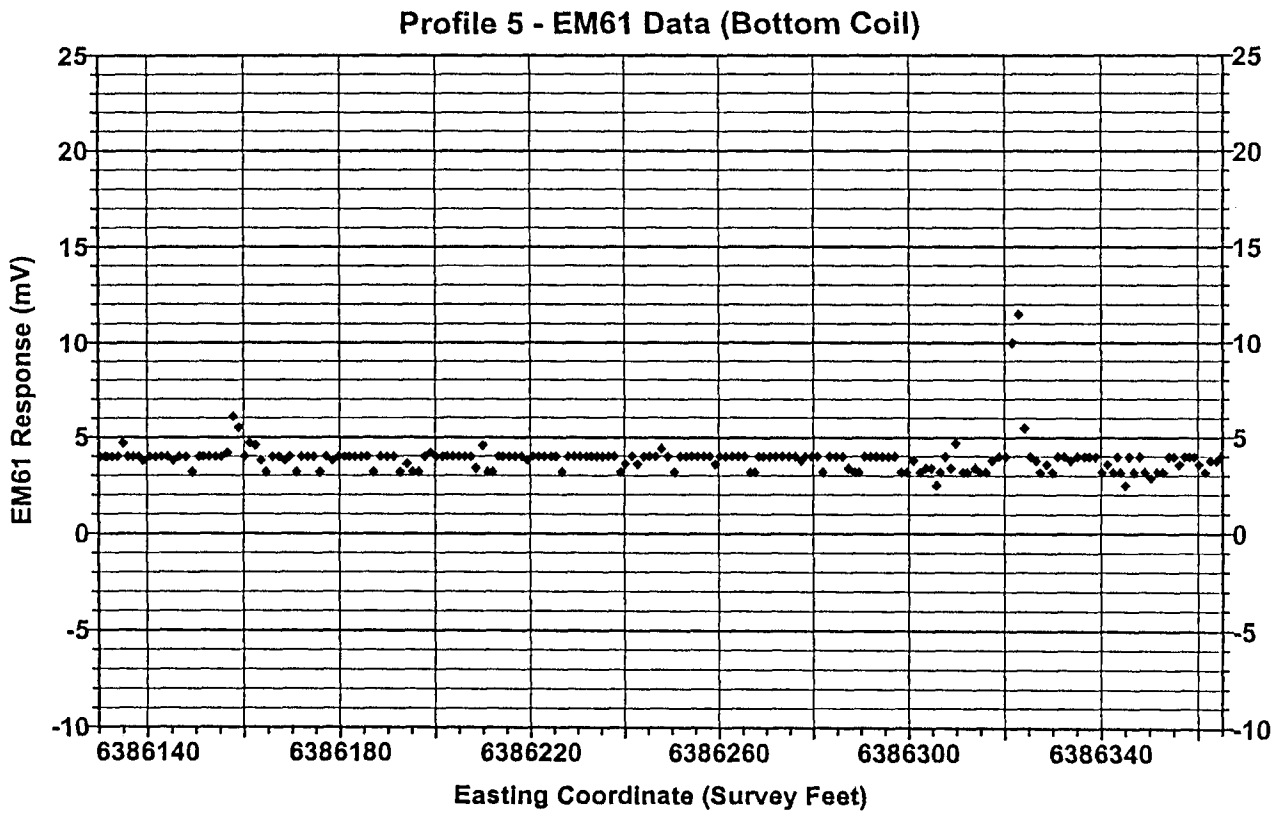
6386240
6386260
6386280
6386300
6386320
6386340
6386360
Easting Coordinate (Survey Feet)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EM61 Response (mV)
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15
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5
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-5
-10
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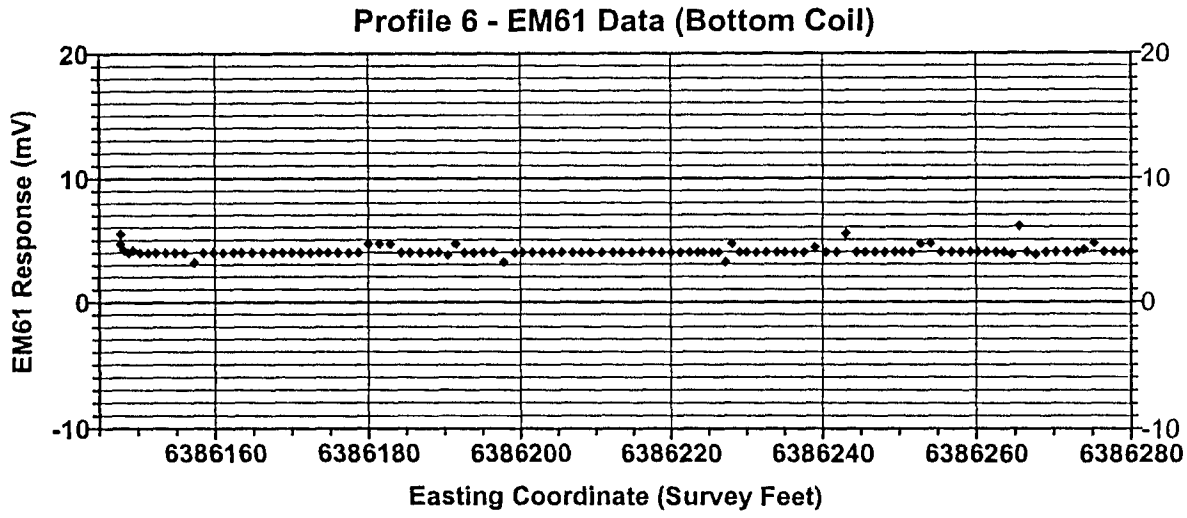
6386300
6386340
Easting Coordinate (Survey Feet)


Profile 6 - EM61 Data (Bottom Coil)
EM61 Response (mV)
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6386200
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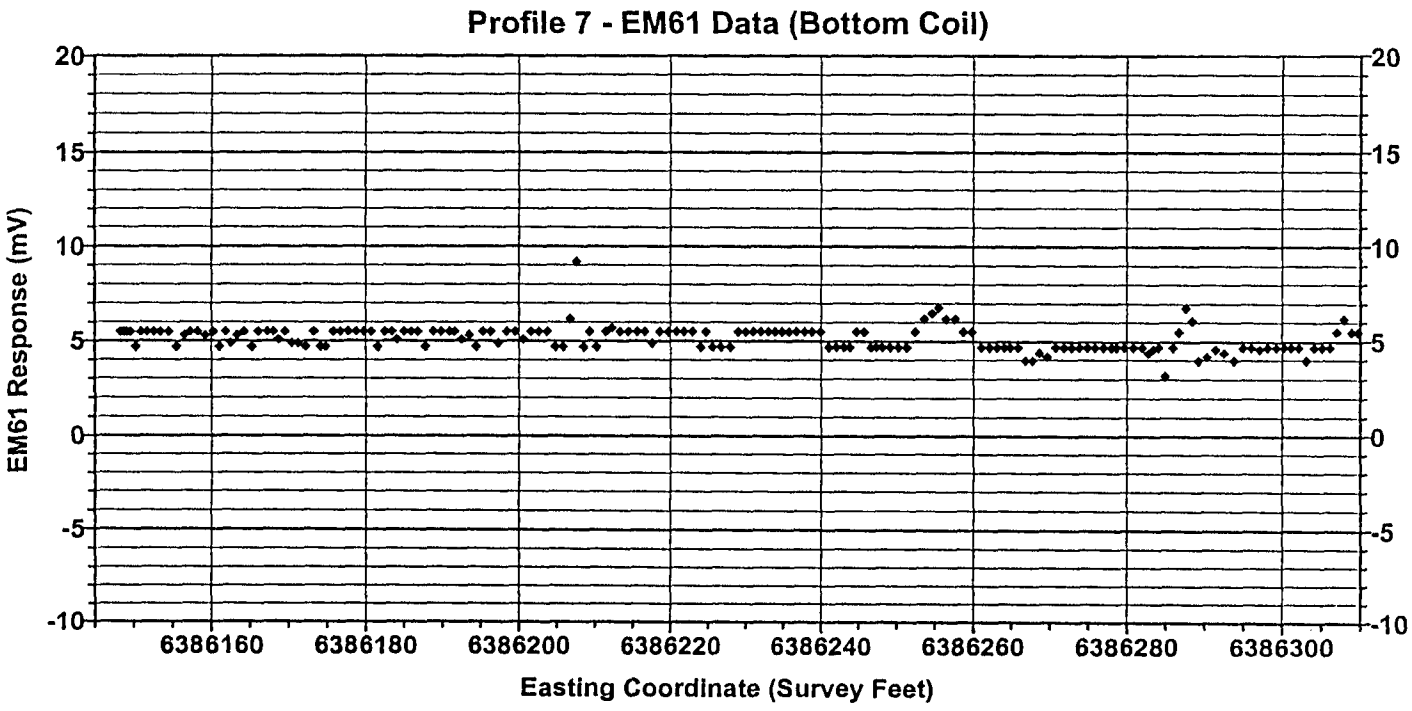
6386280
Easting Coordinate (Survey Feet)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EM61 Response (mV)
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15
10
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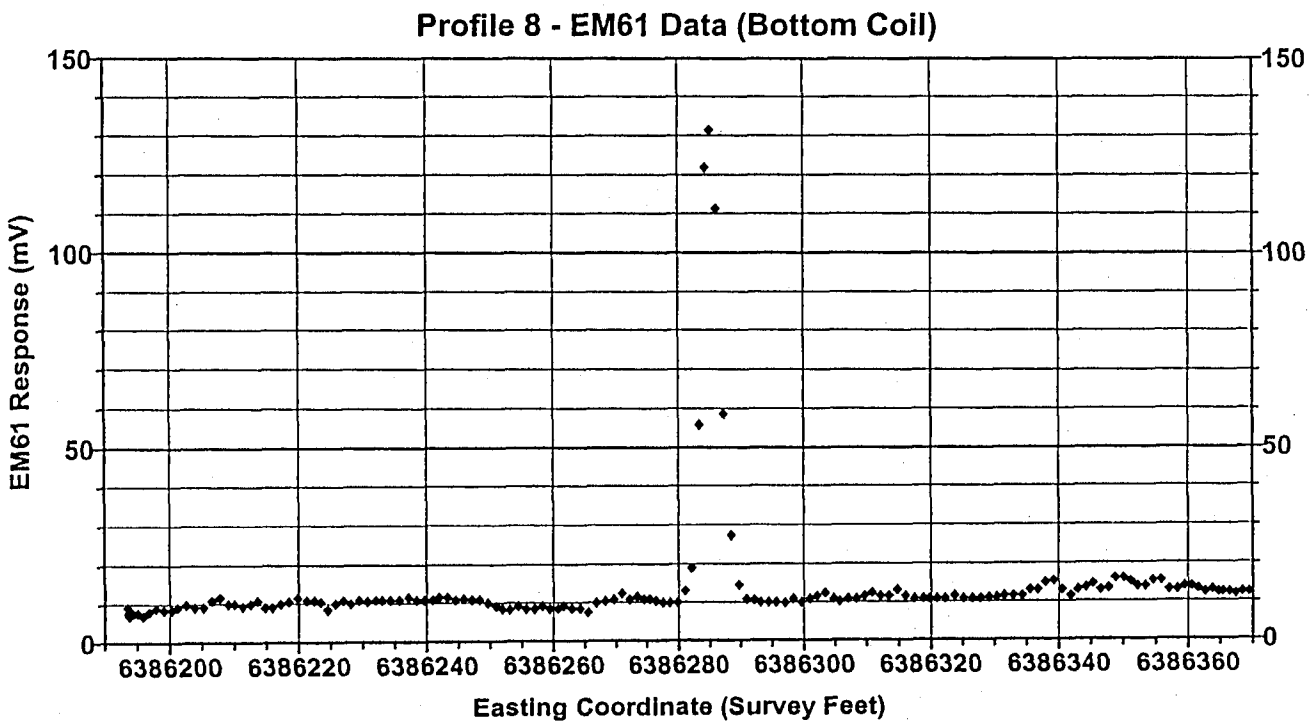
Easting Coordinate (Survey Feet)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6386220
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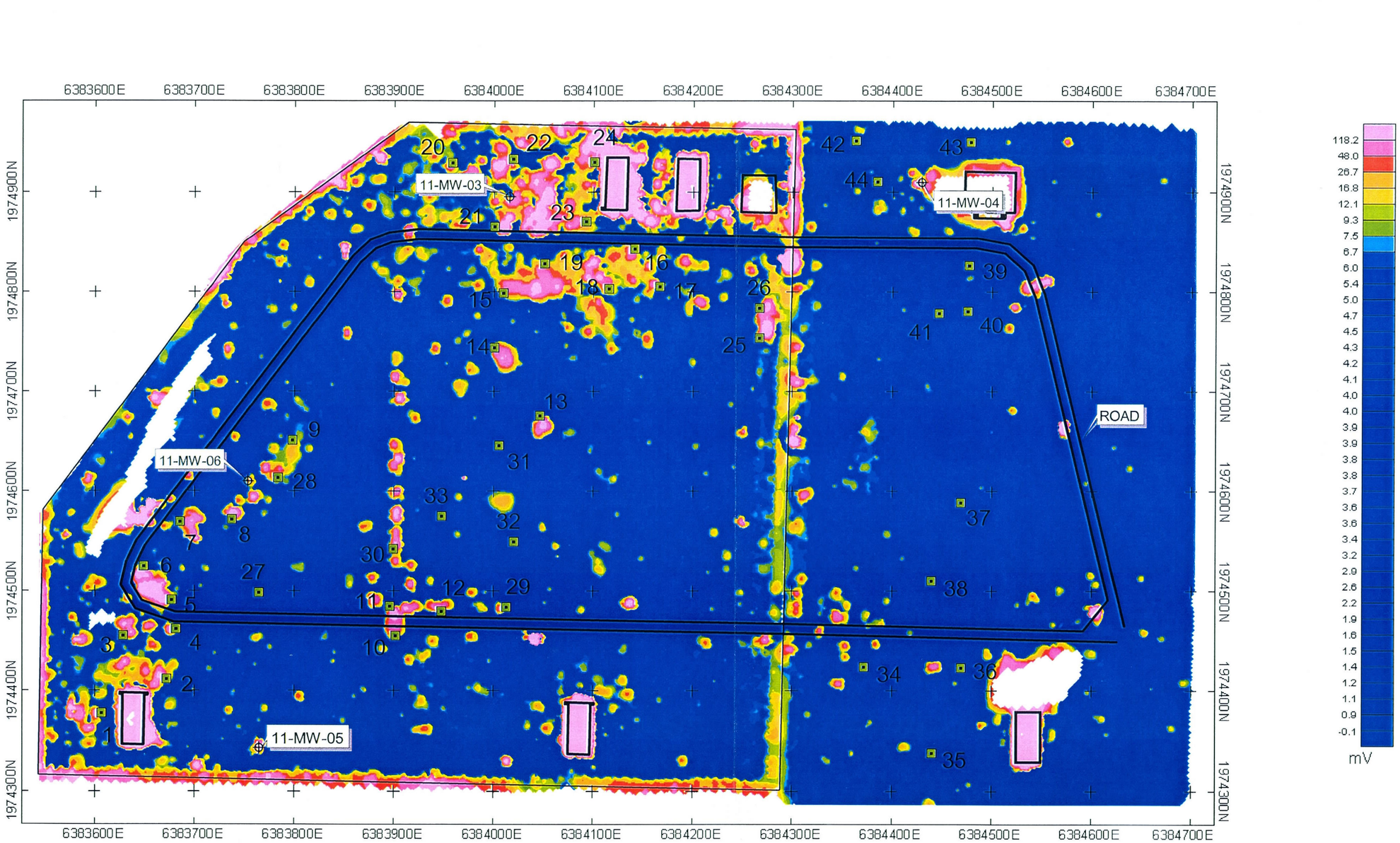
6386340
6386360
Easting Coordinate (Survey Feet)

ATTACHMENT 4
TEST PIT LOCATION MAPS



SCALE:

50 0 50 100 150 200 Feet

NOTES:

LOCATIONS 1-26 ARE BASED ON EM61 DATA.
LOCATIONS 27-44 ARE BASED ON EM31 DATA.

11-MW-05 MONITORING WELL LOCATION AND DESIGNATION

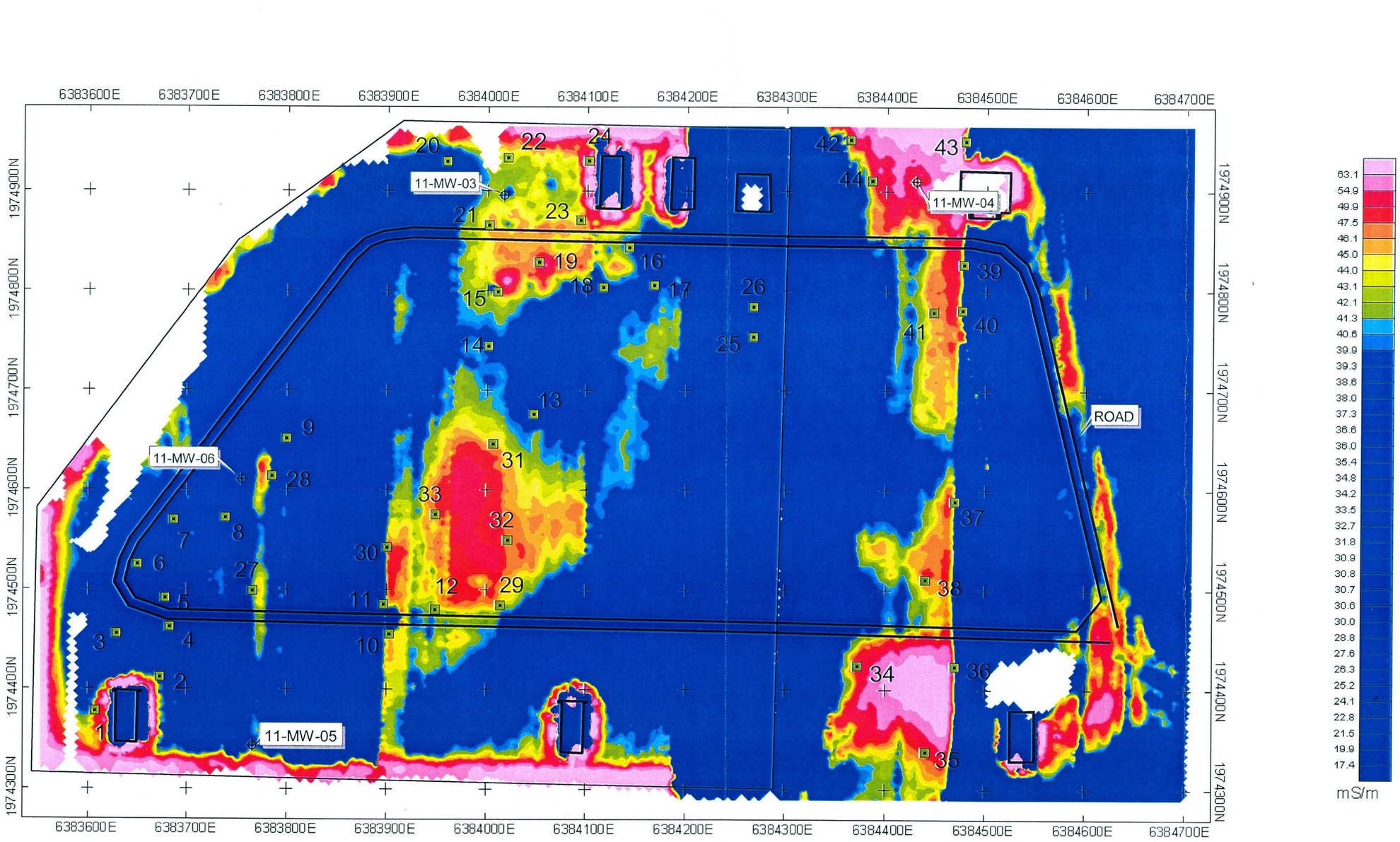
OUTLINE OF EXISTING CONCRETE PAD OR FORMER BUNKER LOCATION

6 PROPOSED TEST PIT LOCATION AND DESIGNATION

IT CORPORATION
A Member of The IT Group

NASA CROWS LANDING FLIGHT FACILITY
CROWS LANDING, CALIFORNIA

PROPOSED PIT LOCATIONS
SITE 11
EM-61 DATA BOTTOM COIL (mV)



SCALE:

50 0 50 100 150 200 Feet

NOTES:

LOCATIONS 1-26 ARE BASED ON EM61 DATA.
LOCATIONS 27-44 ARE BASED ON EM31 DATA.

11-MW-05 MONITORING WELL LOCATION AND DESIGNATION

OUTLINE OF EXISTING CONCRETE PAD OR FORMER BUNKER LOCATION

6 PROPOSED TEST PIT LOCATION AND DESIGNATION

IT CORPORATION
A Member of The IT Group

NASA CROWS LANDING FLIGHT FACILITY
CROWS LANDING, CALIFORNIA

PROPOSED PIT LOCATIONS
SITE 11 - EM-31 DATA
TERRAIN CONDUCTIVITY (mS/m)

ATTACHMENT 5
SUMMARY OF FINDINGS, TEST PIT EXCAVATION ACTIVITIES

SUMMARY OF FINDINGS
TEST PIT EXCAVATION ACTIVITIES
SITE 11

Descriptions of activities at test pits with significant finds are bolded.

May 14, 2001

Test Pit #1 - Trench was excavated from east to west and was approximately 7 ft long by 5 ft deep. Clayey silt soil was found to a depth of 5 ft bgs. A rusty 2-gallon can was found at approximately 4 to 5 ft bgs.

Test Pit #2 – Test pit was excavated to a depth of approximately 4 ft bgs. A steel cable and pieces of steel pipe were uncovered in the test pit at a depth of approximately 2 ft.

Test Pit #3 - Test pit was excavated to a depth of approximately 4 ft bgs. Gravel road base was uncovered to a depth of 8 in. bgs. Native silty clay was found from approximately 8 in. bgs to 4 ft bgs. Material that may include ash was also found.

Test Pit #4 - Test pit was excavated to a depth of approximately 4 ft bgs. Scrap aluminum (riveted) was found in shallow soil, less that 1 ft bgs. Native soil was found from 1 ft bgs to 4 ft bgs.

Test Pits #5 and #6 – Trench was excavated from test pit #5 to test pit #6 to a depth of approximately 4 ft bgs. Scraps of aluminum and steel cable were uncovered in the trench.

Test Pit #7 - Above ground scrap pile (soil and construction debris). No excavation conducted.

Test Pit #8 – Trench was excavated from test pit #8 toward test pit #9 to a depth of approximately 7 ft bgs (photographs 1 and 2). Crushed drum fragments, expended .45-caliber shell casing, and concrete were uncovered in the trench at a depth of 6 ft bgs. Chips of piping material (potentially transite) and wire were also found in the excavation.

May 15, 2001

Test Pits #8, #28, and #9 - The excavation of these three test pit locations was conducted at the same time by trenching between the three points. The trench was approximately 85 feet in length and 14 feet in depth, running in a northeast/southwest direction. The trench teed 6 ft southwest of location #9 in the northwest/southeast direction. This was done to locate the limits of the debris pit. Debris found in the pit consisted of large concrete blocks (3 ft X 5 ft X 18 in), chunks of asphalt, bricks, a small transformer, and other debris from a possible building demolition (photograph 3). Native soil was encountered at approximately 13 ft bgs.

Test Pit #30 - This test pit was excavated from north to south and was approximately 8 ft long by 8 ft deep. A 2-in. diameter steel pipe was uncovered at a depth of 18 in. bgs. The pipe ran north to south. Below 18 in. soil appeared to be native and undisturbed.

Test Pits #10 and #11 - Test pit #11 was excavated from east to west and was approximately 6 ft long by 4 ft deep. A 6-8 in. diameter clay pipe was found at a depth of 2 ft bgs. Below 2 ft the soil appeared to be native and undisturbed. The large anomaly found on the EM-61 survey between pits #11 and #10 appears to correlate to a large steel culvert running under the road. Pit #10 was not excavated because of the discovery of the culvert at test pit #11.

Test Pits #12 and # 29 - Test pit #12 was excavated from east to west and was approximately 6 ft long by 4 ft deep. At a depth of 12 in. bgs the 2 in. diameter steel pipe was located (see test pit #11) as was the clay pipe. Below 12 in. the soil appeared native and undisturbed. Pit #29 was not dug because the anomaly was assumed to be a continuation of the steel pipe.

Test Pit #33 - This test pit was excavated from east to west and was approximately 10 ft long and 4.5 ft deep. The soil appeared native and undisturbed. The top 2.5 ft consisted of clayey silt topsoil and the bottom 2 ft was sandy silt with abundant evaporites.

Test Pit #32 - This test pit was excavated from east to west and was approximately 8 ft long and 4.5 ft deep. The subsurface conditions were similar to those found in pit #33.

Test Pit #31 - This test pit was excavated from north to south and was approximately 8 ft long and 4.5 ft deep. The subsurface conditions were similar to those found in pit #33.

Test Pit #13 - This pit was excavated from northeast to southwest and was approximately 4 ft long and 1.5 ft deep. At a depth of approximately 12 to 18 in. bgs a 3.5-in. bazooka round was found in the excavator bucket and digging was halted (photograph 4). The round was removed by the UXO technicians and moved to a safe location, upon further investigation the round was determined to be a dummy round. The UXO technicians continued to hand dig the location and found four 2.75-in. dummy warheads (photograph 5). Work was stopped for day. The test pit was not investigated any further and was backfilled on 5\17\01.

May 16, 2001

Test Pits #34, #35, #36, #37, #38, #39, #40, #41, #42, #43, and #44 - These test pits were excavated either north to south or east to west depending on their relationship to the anomaly identified by the EM-31 survey and were all approximately 12 ft long and 4.5 ft deep. All of these test pits appeared to be in native and undisturbed soil; 2 to 2.5 ft of topsoil (clayey silt) with sandy silt underlying the topsoil (photograph 6). An evaporite layer was noted at approximately 2 to 2.5 ft bgs.

Test Pit #14 - This test pit was excavated from east to west and was approximately 11 ft long and 4.5 ft deep. Evidence indicates that the site is a former location of an old burn pit; there is abundant charcoal, small wood pieces, and nails in the first 18 in. bgs (photograph 7). Below 18 in the soil is native and undisturbed to a depth of 4.5 ft bgs.

Test Pit #15 - This pit was excavated from north to south and was approximately 12 ft long and 8.5 ft deep. Soil from 0 to 3 ft bgs is fill with many small pieces of metal in the

top 0.5 to 1.5ft. From 3 ft to 8.5 ft bgs large debris was encountered. The debris included large pieces of scrap metal, and wire cables larger that 1 in. in diameter. Excavation depth was limited due to the presence of the wire cable (photograph 8).

Test Pit #15A - This test pit was excavated approximately 15 ft west of #15. This pit was excavated from north to south and was approximately 8 ft long and 5 ft deep. The soil encountered appeared to be native and undisturbed.

Test Pit #15B - This test pit is located 18 ft east of test pit #15. This test pit was excavated from north to south and was approximately 12 ft long and 7.5 ft deep. Fill was encountered at the surface. At approximately 10 in. bgs large amounts of debris/trash were encountered, including glass, tin cans, scrap metal, and plastic. At 3.5 ft bgs large pieces of scrap metal and wire cable were encountered. At 7 ft bgs a sheet of fibrous material (potentially asbestos containing) was found (4 in. thick and 3.5 ft wide) (photographs 9 and 10). Excavation was stopped and the soil stockpile was covered. Work was stopped for the day. On 5/17/01 the pit was backfilled.

May 17, 2001

Test Pit #19 - This test pit was excavated from north to south and was approximately 15 ft long by 8 ft deep. From 0 to 2.5 ft bgs fill with burn debris, glass, and cans was encountered. From 2.5 to 8 ft bgs large diameter wire cable, sheets of steel, trash, burn debris, and fibrous material (potentially asbestos-containing) were encountered (photograph 11).

Test Pit #18 - This test pit was excavated from east to west and was approximately 22 ft long by 15 ft deep. Fill material was encountered from 0 to 11 ft bgs. From 11 to 15 ft bgs trash (office waste, plastic bags, Coke can (1971), glass), wire cable, metal piping, rubber pipe, .50-caliber shell (unfired), and possible transite pipe pieces were encountered (photographs 12 and 13). At 10 ft bgs a strong organic odor (potentially fuel) was noted and the odor cleared quickly. Native undisturbed soil was encountered at 15 ft bgs.

Test Pit #16 - This test pit was excavated from north to south and was approximately 16 ft long by 4.5 ft deep. Fill material was encountered from 0 to 2.5 ft bgs. Native soil was found below 2.5 ft bgs at the test pit location. Approximately 10 feet south of test pit #16 burn pit debris (ash), glass, and cans were encountered from a depth of 2.5 to 4.5 ft bgs.

Test Pit #17 - This test pit was excavated from east to west and was approximately 12 ft long by 4.5 ft deep. Fill material was encountered from 0 to 0.5 ft bgs. Native soil was found below 0.5 ft bgs at the test pit location. To the west of test pit #17 fill with some burn pit debris (ash), glass, and cans were encountered at increasing depths with distance to a maximum depth of 4.5 ft bgs at a distance of 8 ft from the test pit location.

Test Pit #26 - This test pit was excavated from east to west and was approximately 16 ft long by 3 ft deep. From 0 to 2.5 ft bgs a debris pit containing blocks of concrete and

roofing material was encountered (photograph 14). From 2.5 to 3 ft bgs native undisturbed soil was encountered.

Test Pit #25 - This test pit was excavated from north to south and was approximately 21 ft long by 4.5 ft deep. From 0 to 3 ft bgs a shallow burn pit containing ash, glass, and metal cans was encountered. From 3 to 4.5 ft bgs native undisturbed soil was encountered.

Test Pits #20, #21, #22, #23, #24 - These test pits were excavated either from north to south or east to west depending on their relationship to the anomaly identified by the EM-61 survey and were all approximately 12 ft long and 4.5 ft deep. From 0 to 1.5 ft bgs gravel road base with small pieces of metal and nails was encountered. From 1.5 to 4.5 ft bgs native undisturbed soil was encountered.

TEST PIT EXCAVATION ACTIVITIES

Photograph 1 - UXO technicians, visually surveying trench and spoils while excavating from point 8 to 9 at Site 11, looking north (5/14/01)

Photograph 2 - Radiation technician, surveying metal debris from trench from point 8 to 9 at Site 11, looking north (5/14/01)

Photograph 3 - Concrete with rebar removed from area near point 9 at Site 11, looking southwest (5/15/01)

Photograph 4 - Expended ammunition found and removed from trench at point 13 at Site 11, looking south (5/15/01)

Photograph 5 – Preliminarily assessed as inert 3.5 inch diameter, anti-bazooka practice round (1953) found and removed from trench at point 13 at Site 11, looking southeast (5/15/01)

Photograph 6 – Test Pit #37, representative of test pits #34, #35, #36, #38, #39, #40, #41, #42, #43, and #44 (5/16/01)

Photograph 7 – Charcoal-type material in top 1.5 feet of test pit #14 (5/16/01)

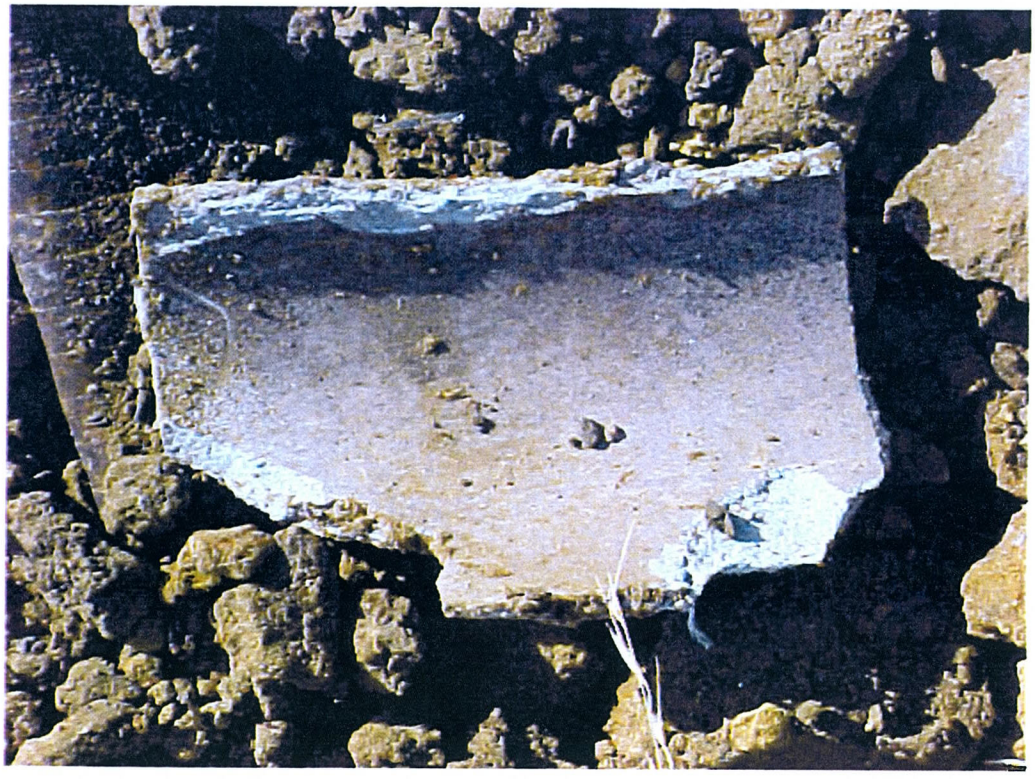
Photograph 8 – Wire cable in test pit #15 (5/16/01)

Photograph 9 - Pieces of fibrous material (possible asbestos-containing) found in test pit #15B (5/16/01)

Photograph 10 – 3.5 foot by 4-inch sheet of fibrous material (possible asbestos-containing) in test pit #15B (5/16/01)

Photograph 11 – Metal debris in test pit #19 (5/17/01)

Photograph 12 – Metal debris in test pit #18 (5/17/01)



Photograph 13 – Possible transite pipe in test pit #18 (5/17/01)

Photograph 14 – Roofing material from test pit #26 (5/17/01)

NAVSEADET RASO RECORDS SEARCH LETTER

DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND DETACHMENT
RADIOLOGICAL AFFAIRS SUPPORT OFFICE (RASO)
NWS P.O. DRAWER 260
YORKTOWN, VA 23691-0260

5104
Ser 02E/00-1310/612
14 November 2000

From: Officer in Charge, Naval Sea Systems Command Detachment, Radiological Affairs Support Office (RASO)
To: Commander, Naval Facilities Engineering Command Southwest Division (ATTN: Ms. Lynn Marie Hornecker)

Subj: REQUEST FOR INFORMATION REGARDING FORMER NAVAL AUXILIARY LANDING FIELD (NALF), CROWS LANDING, CALIFORNIA

Ref: (a) SOUTHWESTNAVFACENGCOM Transmittal of 24 Oct 00

1. As requested in reference (a), NAVSEADET RASO has conducted an extensive record search on the use and disposal of radioactive materials and machine sources of radiation at the former Naval Auxiliary Landing Field (NALF), Crows Landing, California.

2. Based on this search, no records have been identified to indicate any source of radiation was used at NALF Crows Landing.

3. NAVSEADET RASO requests to be kept informed of any radiological anomalies discovered during the trenching activities at the Site 11 landfill.

4. NAVSEADET RASO point of contact is LCDR Vincent DeInnocentiis at DSN 953-4692, commercial (757) 887-4692, commercial fax (757) 887-3235 or e-mail deinnocentiisv@raso.navy.mil.

S. W. DOREMUS

ENVIRONMENTAL DIMENSIONS, INC. RADIOLOGICAL TESTING FIELD NOTES

date 05.14.01
meter M2221
serial # 70675/97317
probe 44-10
serial # 44-10-7
cal date 03.29.01
cal due 09.29.01
batt 6.0
HV 1000
time 0650
bkg 7647 K^DD
source K 226,992 K^DD
source CS 137
serial # 70675/97317 — 2432
ok for use DD

meter L19
serial # 82281/141454
cal date 03.07.01
cal due 09.07.01
batt good
time 0655
bkg 7 mR/hr
source K 280 mR/hr.
source CS 137
serial # 70675/97317 — 2432
for use DD

date	05.14.01
meter	M-3
serial #	70677 / 71729
probe 1	44-9
serial #	44-9-2 / 31464
cal date	03.05.01
cal due	03.09.01
batt	good
time	0657
bkg	20 cpm
source ✓	4100
source	TL-99
serial #	89TC47046009
ok for use	☒

05.14.01

0845 - start work / background (2x2 - 12.3K, L19 15mR/hr, M3 80 cpm

area #1

2x2 12.6 K } initial readings
L19 15mR/hr.

2x2 12.3K
L19 13mR/hr. } pile & debris
M3 ≤ bkg.

area #2

2x2 12.2K } initial
L19 14mR/hr

2x2 12.5
L19 14mR/hr. } pile & debris
M3 ≤ bkg

area #3

2x2 11.7K } initial
L19 14mR/hr

2x2 11.9K
L19 14mR/hr. } pile & debris
M3 ≤ bkg.

area #4

2x2 11.2K } initial
L19 13mR/hr.

no debris

area #5 & 6

2x2 13.1K } initial
L19 15mR/hr.

2x2 12.8
L19 14mR/hr } pile & debris (small alum.)
M3 ≤ bkg.

area #7

bypassed

1150 - 1230 LUNCH

area #8 & 9

2x2 12.9 K } initial
L19 14mR/hr.

2x2 14.2K
L19 14mR/hr.
M3 ≤ bkg.

... still in progress. shut down ~~to~~ due to trackhoe @ 1500

nothing found above background

05.14.01

0845 - start work / background (2x2 - 12.3K, L19 15uR/hr, M3 80 cpm

area #1

2x2 12.6 K
L19 15uR/hr.
} initial readings

2x2 12.3K
L19 13uR/hr.
M3 ≤ bkg.
} pile & debris

area #2

2x2 12.2K
L19 14uR/hr
} initial

2x2 12.5
L19 14uR/hr.
M3 ≤ bkg
} pile & debris

area #3

2x2 11.7K
L19 14uR/hr
} initial

2x2 11.9K
L19 14uR/hr.
M3 ≤ bkg.
} pile & debris

area #4

2x2 11.2K
L19 13uR/hr.
} initial

no debris

area #5 & 6

2x2 13.1K
L19 15uR/hr.
} initial

2x2 12.8
L19 14uR/hr
M3 ≤ bkg.
} pile & debris (small alum.)

area #7

bypassed

1130 - 1230 LUNCH

area #8 & 9

2x2 12.9 K
L19 14uR/hr.
} initial

2x2 14.2K
L19 14uR/hr.
M3 ≤ bkg.

... still in progress. shut down ~~to~~ due to trackhoe @ 1500

nothing found above background

date ... 05.15.01
meter ... M2221
serial #: 70675/97317
probe ... 44-10
serial #: 44-10-7
cal date ... 03.29.01
cal due ... 09.29.01
batt ... 5.8
HV ... 990
time ... 0630
bkg ... 81987
source ... 204,437
source ... Cs 137
serial # ... 70675/97317 - 2432
ok for use ... DD

meter ... ~~982~~ PO 5.15.01 L17
serial # ... 82281/141454
cal date ... 03.07.01
cal due ... 09.07.01
batt ... good
time ... 0634
bkg ... 8 mR/hr
source ... 290 mR/hr.
source ... Cs 137
serial # ... 70675/97317 - 2432
ok for use ... DD

05.15.01

0735 start work / background (2X2-12.7K, L19-12 μR/hr, M3-50cpm)
continue with test pit 8 & 9

1130-1230 lunch

test pit #30

2X2 - 12.9K
L19 - 15 μR/hr. } initial reading

2X2 - 13.6K
L19 15 μR/hr.
M3 ≤ bkg. } pile & debris

test pit #11

2X2 12.7K
L19 16 μR/hr. } initial reading

no debris removed

test pit #12

2X2 12.6K
L19 16 μR/hr. } initial reading

2X2 12.8K
L19 16 μR/hr.
M3 ≤ bkg. } pile & debris

test pit #33

2X2 13.1K
L19 15 μR/hr. } initial reading

no debris found

test pit #32

2X2 12.8K
L19 15 μR/hr. } initial reading

no debris found

test pit #31

2x2 12.9 K

L19 15 uR/hr.

no debris found

test pit #13

2x2 12.5 K

L19 14 uR/hr.

digging ceases due to uxo find

no significant radiological areas found

date ~~06~~ 05 ~~5-16-01~~ 05.16.01
meter M2221
serial #: 70675/97317
probe 44-10
serial #: 44-10-7
cal date 03.29.01
cal due 09.29.01
batt 5.6
HV 790
time 0645
bkg 7385
source ✓ 220098
source Cs 137
serial # 2432
ok for use ∞

meter L19
serial # 82281/141454
cal date 03.07.01
cal due 09.07.01
batt good
time 0647
bkg 8mR/hr.
source ✓ 280 mR/hr
source Cs 137
serial # ~~89704704~~ ∞ 5.16.01 2432
ok for use ∞

date 05.16.01

meter M3

serial # 70677/71729

probe 1 44-9

serial # 44-9-2

cal date 03.05.01

cal due 09.05.01

batt GOOD

time 0649

bkg 30 cpm

source ✓ 4000

source TL-99

serial # 89TC4704689

ok for use ∞

03.16.01

0655 start work / bkg. (2x2-13,150, L19-13 uR/hr, M3-70 cpm)

test pit #44

2x2 13.2K } initial reading

L19 16 uR/hr.

no debris found

~~2x2 12.5K~~ ↔ 52.01

test pit #42

2x2 12.5K } initial reading

L19 13 uR/hr.

no debris found

test pit #43

2x2 12.4K } initial reading

L19 15 uR/hr.

no debris found

test pit #39

2x2 12.2K } initial reading

L19 14 uR/hr.

no debris found

test pit #40

2x2 12.5K } initial reading

L19 14 uR/hr.

no debris found

test pit #41

2x2 12.8K } initial reading

L19 14 uR/hr

no debris found

↔

05.16.01 cont.

test pit #37

2x2 13.3K } initial reading

L19 15 μR/hr.

no debris found

test pit #38

2x2 13.3K } initial reading (no debris found)

L19 15 μR/hr.

test pit #35

2x2 13.1 K } initial reading

L19 16 μR/hr.

no debris found

test pit #36

2x2 12.2K } initial reading

L19 15 μR/hr.

no debris found

1200-1300 lunch / safety meeting

test pit #14

2x2 12.5K } initial reading

L19 15 μR/hr.

no debris found

test pit #15/19 (#15 working towards #19

2x2 12.7 K } initial reading

L19 15 μR/hr.

2x2 12.5 K

L19 15 μR/hr } pile & debris

M3 ≤ bkg.

1627 digging ceases due to possible asbestos content. no radiologically significant areas found

date 05.17.01

meter M2221

serial # ~~44~~ 70675/97317

probe 44-10

serial # 44-10-7

cal date 03.29.01

cal due 09.29.01

batt 5.6

HV 990

time 0640

bkg 7097

source 219,777

source Cs 137

serial # 2432

ok for use ∞

meter L19

serial # 82281/141454

cal date 03.07.01

cal due 09.07.01

batt Good

time 0642

bkg 7 mR/hr.

source 300 mR/hr.

source Cs 137

serial # 2432

ok for use ∞

date 05.17.01

meter M-3

serial # 70677/71729

probe 1 44-9

serial # 44-9-2

cal date 03.05.01

cal due 09.05.01

batt GOOD

time 0644

bkg 30 cpm

source ✓ 4000

source Tc-99

serial # 89+C4704689

ok for use oo

5-17-01

start work / backgrounds

test pit #19

2x2	12.5K	initial reading
L19	15 μR/hr.	
2x2	13.1K	pile & debris
L19	15 μR/hr.	
M3	≤ bkg.	

test pit #18

2x2	11.7K	initial reading
L19	14 μR/hr	
2x2	12.1 K	pile & debris
L19	14 μR/hr.	
M3	≤ bkg.	

test pit #17

2x2	12.4K	initial
L19	15 μR/hr.	

trace trash

test pit #26

2x2	13.3K	initial reading
L19	15 μR/hr.	
2x2	12.1 K	pile — roofing material
L19	15 μR/hr.	

test pit # 25

2x2	12.7K	initial reading
L19	15 μR/hr	

trace trash

51701 cont

test pit #23

2x2 10.2K
L19 13 μR/hr.
} initial reading

2x2 11.7K
L19 14 μR/hr.
M3 ≤ bkg.
} pile's debris

test pit #24

2x2 10.1K
L19 12 μR/hr.
} initial reading

trace trash

test pit #21

2x2 10.2K
L19 13 μR/hr.
} initial reading

surface debris

test pit #20

2x2 12.5K
L19 14 μR/hr.
} initial reading

~~PRC 1992 mag. anom~~ 5.17.01

surface debris

PRC 1992 mag. anom (s.e. area of site)

2x2 12.1K
L19 14 μR/hr.
} initial reading

surface debris

no radiologically significant areas found

ATTACHMENT 6
SOIL PILE ANALYTICAL RESULTS

Applied P & Ch Laboratory
13760 Magnolia Ave. Chino CA 91710
Tel: (909) 590-1828 Fax: (909) 590-1498

APCL Analytical Report

Submitted to:
The IT Group
Attention: Rose Condit
4005 Port Chicago Highway
Concord CA 94520-1120
Tel: (925)288-9898 Fax: (925)288-0888

Service ID #: 801-014634
Collected by: M.Vennemeyer
Collected on: 07/10/01

Received: 07/11/01
Extracted: 07/12-16/01
Tested: 07/12-19/01
Reported: 07/20/01

Sample Description: Soil from Crows Landing
Project Description: 800063 Crows Landing

Analysis of Soil Samples

Component Analyzed	Method	Unit	PQL	Analysis Result 4-LF11-NE-T&D 01-04634-1	Analysis Result 4-LF11-NE-T&D-A,B,C 01-04634-(2 to 4)
PERCENT MOISTURE	ASTM-D2216	W%	0.5	4.1 [a]	4.1
PH	9045	pH unit	0.01	-	7.06

Component Analyzed	Method	Unit	PQL	Analysis Result 4-LF11-SW-T&D 01-04634-5	Analysis Result 4-LF11-SW-T&D-A,B,C 01-04634-(6 to 8)
PERCENT MOISTURE	ASTM-D2216	W%	0.5	3.7 [a]	3.7
PH	9045	pH unit	0.01	-	7.72

Component Analyzed	Method	Unit	PQL	Analysis Result 4-LF11-W-T&D 01-04634-9	Analysis Result 4-LF11-W-T&D-A,B,C 01-04634-(10 to 12)
PERCENT MOISTURE	ASTM-D2216	W%	0.5	4.4 [a]	4.4
PH	9045	pH unit	0.01	-	7.89

Component Analyzed	Method	Unit	PQL	Analysis Result 4-LF11-NE-T&D-A,B,C 01-04634-(2 to 4)
TTLC 17 METALS				
Dilution Factor				1
ANTIMONY	6010B	mg/kg	5	0.83J
ARSENIC	6010B	mg/kg	0.3	13.1
BARIUM	6010B	mg/kg	1	184
BERYLLIUM	6010B	mg/kg	0.2	0.056J
CADMIUM	6010B	mg/kg	0.2	0.16J
CHROMIUM	6010B	mg/kg	0.5	56.3
COBALT	6010B	mg/kg	0.5	20.3

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Component Analyzed	Method	Unit	PQL	Analysis Result 4-LF11-NE-T&D-A,B,C 01-04634-(2 to 4)
COPPER	6010B	mg/kg	0.5	32.0
LEAD	6010B	mg/kg	0.3	42.4
MERCURY	7471A	mg/kg	0.2	0.039J
MOLYBDENUM	6010B	mg/kg	0.2	0.59
NICKEL	6010B	mg/kg	0.3	81.9
SELENIUM	6010B	mg/kg	0.5	1.0
SILVER	6010B	mg/kg	0.5	<0.52
THALLIUM	6010B	mg/kg	0.5	<0.52
VANADIUM	6010B	mg/kg	0.5	51.7
ZINC	6010B	mg/kg	0.5	102
Dilution Factor				1
GASOLINE RANGE ORGANICS	M8015V	mg/kg	0.5	0.02J
Dilution Factor				1
DIESEL RANGE ORGANICS	M8015E	mg/kg	10	16
JP-5	M8015E	mg/kg	10	<10
MOTOR OIL RANGE ORGANICS	M8015E	mg/kg	10	120
SEMI-VOC, 64 COMPOUNDS				
Dilution Factor				4
ACENAPHTHENE	8270C	µg/kg	500	<2100
ACENAPHTHYLENE	8270C	µg/kg	500	<2100
ANTHRACENE	8270C	µg/kg	500	<2100
BENZ(A)ANTHRACENE	8270C	µg/kg	500	<2100
BENZO(A)PYRENE	8270C	µg/kg	500	410J
BENZO(B)FLUORANTHENE	8270C	µg/kg	500	560J
BENZO(G,H,I)PERYLENE	8270C	µg/kg	500	<2100
BENZO(K)FLUORANTHENE	8270C	µg/kg	500	<2100
BIS(2-CHLOROETHOXY) METHANE	8270C	µg/kg	500	<2100
BIS(2-CHLOROETHYL) ETHER	8270C	µg/kg	500	<2100
BIS(2-CHLOROISOPROPYL) ETHER	8270C	µg/kg	500	<2100
BIS(2-ETHYLHEXYL) PHTHALATE	8270C	µg/kg	500	<2100
4-BROMOPHENYL PHENYL ETHER	8270C	µg/kg	500	<2100
BUTYL BENZYL PHTHALATE (BBP)	8270C	µg/kg	500	<2100
4-CHLORO-3-METHYLPHENOL	8270C	µg/kg	1000	<4200
4-CHLOROANILINE	8270C	µg/kg	1000	<4200
2-CHLORONAPHTHALENE	8270C	µg/kg	500	<2100
2-CHLOROPHENOL	8270C	µg/kg	500	<2100
4-CHLOROPHENYL PHENYL ETHER	8270C	µg/kg	500	<2100
CHRYSENE	8270C	µg/kg	500	<2100
DI-N-BUTYL PHTHALATE (DBP)	8270C	µg/kg	500	<2100
DI-N-OCTYL PHTHALATE (DOP)	8270C	µg/kg	500	<2100
DIBENZ(A,H)ANTHRACENE	8270C	µg/kg	500	<2100
DIBENZOFURAN	8270C	µg/kg	500	<2100
1,2-DICHLOROBENZENE	8270C	µg/kg	500	<2100

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APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result 4-LF11-NE-T&D-A,B,C 01-04634-(2 to 4)
1,3-DICHLOROBENZENE	8270C	µg/kg	500	<2100
1,4-DICHLOROBENZENE	8270C	µg/kg	500	<2100
3,3'-DICHLOROBENZIDINE	8270C	µg/kg	1000	<4200
2,4-DICHLOROPHENOL	8270C	µg/kg	500	<2100
DIETHYL PHTHALATE (DEP)	8270C	µg/kg	500	<2100
DIMETHYL PHTHALATE (DMP)	8270C	µg/kg	500	<2100
2,4-DIMETHYLPHENOL	8270C	µg/kg	500	<2100
4,6-DINITRO-2-METHYLPHENOL	8270C	µg/kg	2500	<10000
2,4-DINITROPHENOL	8270C	µg/kg	2500	<10000
2,4-DINITROTOLUENE	8270C	µg/kg	500	<2100
2,6-DINITROTOLUENE	8270C	µg/kg	500	<2100
FLUORANTHENE	8270C	µg/kg	500	<2100
FLUORENE	8270C	µg/kg	500	<2100
HEXACHLOROBENZENE	8270C	µg/kg	500	<2100
HEXACHLOROBUTADIENE	8270C	µg/kg	500	<2100
HEXACHLOROCYCLOPENTADIENE	8270C	µg/kg	500	<2100
HEXACHLOROETHANE	8270C	µg/kg	500	<2100
INDENO(1,2,3-CD)PYRENE	8270C	µg/kg	500	<2100
ISOPHORONE	8270C	µg/kg	500	<2100
2-METHYLNAPHTHALENE	8270C	µg/kg	500	<2100
3/4-METHYLPHENOL (M/P-CRESOL)	8270C	µg/kg	500	<2100
2-METHYLPHENOL (O-CRESOL)	8270C	µg/kg	500	<2100
NAPHTHALENE	8270C	µg/kg	500	<2100
2-NITROANILINE	8270C	µg/kg	2500	<10000
3-NITROANILINE	8270C	µg/kg	2500	<10000
4-NITROANILINE	8270C	µg/kg	2500	<10000
NITROBENZENE	8270C	µg/kg	500	<2100
2-NITROPHENOL	8270C	µg/kg	500	<2100
4-NITROPHENOL	8270C	µg/kg	2500	<10000
N-NITROSO-DI-N-PROPYLAMINE	8270C	µg/kg	500	<2100
N-NITROSODIPHENYLAMINE	8270C	µg/kg	610 (b)	<2500
PENTACHLOROPHENOL (PCP)	8270C	µg/kg	2500	<10000
PHENANTHRENE	8270C	µg/kg	500	<2100
PHENOL	8270C	µg/kg	500	<2100
PYRENE	8270C	µg/kg	500	<2100
1,2,4-TRICHLOROBENZENE	8270C	µg/kg	500	<2100
2,4,5-TRICHLOROPHENOL	8270C	µg/kg	500	<2100
2,4,6-TRICHLOROPHENOL	8270C	µg/kg	500	<2100

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APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result 4-LF11-SW-T&D-A,B,C 01-04634-(6 to 8)	Analysis Result 4-LF11-W-T&D-A,B,C 01-04634-(10 to 12)
TTLC 17 METALS					
Dilution Factor				1	1
ANTIMONY	6010B	mg/kg	5	0.40J	0.34J
ARSENIC	6010B	mg/kg	0.3	9.4	9.6
BARIUM	6010B	mg/kg	1	162	195
BERYLLIUM	6010B	mg/kg	0.2	0.014J	0.075J
CADMIUM	6010B	mg/kg	0.2	<0.21	0.036J
CHROMIUM	6010B	mg/kg	0.5	48.1	33.2
COBALT	6010B	mg/kg	0.5	11.3	12.2
COPPER	6010B	mg/kg	0.5	27.0	84.6
LEAD	6010B	mg/kg	0.3	23.8	50.4
MERCURY	7471A	mg/kg	0.2	0.027J	0.025J
MOLYBDENUM	6010B	mg/kg	0.2	<0.21	<0.21
NICKEL	6010B	mg/kg	0.3	61.0	39.4
SELENIUM	6010B	mg/kg	0.5	1.6	1.4
SILVER	6010B	mg/kg	0.5	<0.52	<0.52
THALLIUM	6010B	mg/kg	0.5	<0.52	<0.52
VANADIUM	6010B	mg/kg	0.5	49.2	50.7
ZINC	6010B	mg/kg	0.5	67.5	86.0
Dilution Factor				1	1
GASOLINE RANGE ORGANICS	M8015V	mg/kg	0.5	0.01J	0.01J
Dilution Factor				1	1
DIESEL RANGE ORGANICS	M8015E	mg/kg	10	<10 (c)	<10
JP-5	M8015E	mg/kg	10	<10	<10
MOTOR OIL RANGE ORGANICS	M8015E	mg/kg	10	27	17
SEMI-VOC, 64 COMPOUNDS					
Dilution Factor				1	1
ACENAPHTHENE	8270C	µg/kg	500	<520	<520
ACENAPHTHYLENE	8270C	µg/kg	500	<520	<520
ANTHRACENE	8270C	µg/kg	500	<520	<520
BENZ(A)ANTHRACENE	8270C	µg/kg	500	<520	100J
BENZO(A)PYRENE	8270C	µg/kg	500	<520	89J
BENZO(B)FLUORANTHENE	8270C	µg/kg	500	93J	140J
BENZO(G,H,I)PERYLENE	8270C	µg/kg	500	<520	<520
BENZO(K)FLUORANTHENE	8270C	µg/kg	500	<520	<520
BIS(2-CHLOROETHOXY) METHANE	8270C	µg/kg	500	<520	<520
BIS(2-CHLOROETHYL) ETHER	8270C	µg/kg	500	<520	<520
BIS(2-CHLOROISOPROPYL) ETHER	8270C	µg/kg	500	<520	<520
BIS(2-ETHYLHEXYL) PHTHALATE	8270C	µg/kg	500	<520	<520
4-BROMOPHENYL PHENYL ETHER	8270C	µg/kg	500	<520	<520
BUTYL BENZYL PHTHALATE (BBP)	8270C	µg/kg	500	<520	<520
4-CHLORO-3-METHYLPHENOL	8270C	µg/kg	1000	<1000	<1000
4-CHLOROANILINE	8270C	µg/kg	1000	<1000	<1000
2-CHLORONAPHTHALENE	8270C	µg/kg	500	<520	<520
2-CHLOROPHENOL	8270C	µg/kg	500	<520	<520

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APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result 4-LF11-SW-T&D-A,B,C 01-04634-(6 to 8)	Analysis Result 4-LF11-W-T&D-A,B,C 01-04634-(10 to 12)
4-CHLOROPHENYL PHENYL ETHER	8270C	µg/kg	500	< 520	< 520
CHRYSENE	8270C	µg/kg	500	< 520	< 520
DI-N-BUTYL PHTHALATE (DBP)	8270C	µg/kg	500	< 520	< 520
DI-N-OCTYL PHTHALATE (DOP)	8270C	µg/kg	500	< 520	< 520
DIBENZ(A,H)ANTHRACENE	8270C	µg/kg	500	< 520	< 520
DIBENZOFURAN	8270C	µg/kg	500	< 520	< 520
1,2-DICHLOROBENZENE	8270C	µg/kg	500	< 520	< 520
1,3-DICHLOROBENZENE	8270C	µg/kg	500	< 520	< 520
1,4-DICHLOROBENZENE	8270C	µg/kg	500	< 520	< 520
3,3'-DICHLOROBENZIDINE	8270C	µg/kg	1000	< 1000	< 1000
2,4-DICHLOROPHENOL	8270C	µg/kg	500	< 520	< 520
DIETHYL PHTHALATE (DEP)	8270C	µg/kg	500	< 520	< 520
DIMETHYL PHTHALATE (DMP)	8270C	µg/kg	500	< 520	< 520
2,4-DIMETHYLPHENOL	8270C	µg/kg	500	< 520	< 520
4,6-DINITRO-2-METHYLPHENOL	8270C	µg/kg	2500	< 2600	< 2600
2,4-DINITROPHENOL	8270C	µg/kg	2500	< 2600	< 2600
2,4-DINITROTOLUENE	8270C	µg/kg	500	< 520	< 520
2,6-DINITROTOLUENE	8270C	µg/kg	500	< 520	< 520
FLUORANTHENE	8270C	µg/kg	500	81J	130J
FLUORENE	8270C	µg/kg	500	< 520	< 520
HEXACHLOROBENZENE	8270C	µg/kg	500	< 520	< 520
HEXACHLOROBUTADIENE	8270C	µg/kg	500	< 520	< 520
HEXACHLOROCYCLOPENTADIENE	8270C	µg/kg	500	< 520	< 520
HEXACHLOROETHANE	8270C	µg/kg	500	< 520	< 520
INDENO(1,2,3-CD)PYRENE	8270C	µg/kg	500	< 520	< 520
ISOPHORONE	8270C	µg/kg	500	< 520	< 520
2-METHYLNAPHTHALENE	8270C	µg/kg	500	< 520	< 520
3/4-METHYLPHENOL (M/P-CRESOL)	8270C	µg/kg	500	< 520	< 520
2-METHYLPHENOL (O-CRESOL)	8270C	µg/kg	500	< 520	< 520
NAPHTHALENE	8270C	µg/kg	500	< 520	< 520
2-NITROANILINE	8270C	µg/kg	2500	< 2600	< 2600
3-NITROANILINE	8270C	µg/kg	2500	< 2600	< 2600
4-NITROANILINE	8270C	µg/kg	2500	< 2600	< 2600
NITROBENZENE	8270C	µg/kg	500	< 520	< 520
2-NITROPHENOL	8270C	µg/kg	500	< 520	< 520
4-NITROPHENOL	8270C	µg/kg	2500	< 2600	< 2600
N-NITROSO-DI-N-PROPYLAMINE	8270C	µg/kg	500	< 520	< 520
N-NITROSODIPHENYLAMINE	8270C	µg/kg	610 (b)	< 630	< 640
PENTACHLOROPHENOL (PCP)	8270C	µg/kg	2500	< 2600	< 2600
PHENANTHRENE	8270C	µg/kg	500	< 520	< 520
PHENOL	8270C	µg/kg	500	< 520	< 520
PYRENE	8270C	µg/kg	500	< 520	140J
1,2,4-TRICHLOROBENZENE	8270C	µg/kg	500	< 520	< 520
2,4,5-TRICHLOROPHENOL	8270C	µg/kg	500	< 520	< 520
2,4,6-TRICHLOROPHENOL	8270C	µg/kg	500	< 520	< 520

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APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result 4-LF11-NE-T&D 01-04634-1
VOLATILE ORGANICS				
Dilution Factor				1.05
ACETONE	8260	µg/kg	100	<110
BENZENE	8260	µg/kg	5	<5.5
BROMOBENZENE	8260	µg/kg	5	<5.5
BROMOCHLOROMETHANE	8260	µg/kg	5	<5.5
BROMODICHLOROMETHANE	8260	µg/kg	5	<5.5
BROMOFORM	8260	µg/kg	5	<5.5
BROMOMETHANE	8260	µg/kg	5	<5.5
2-BUTANONE (MEK)	8260	µg/kg	100	<110
N-BUTYLBENZENE	8260	µg/kg	5	<5.5
SEC-BUTYLBENZENE	8260	µg/kg	5	<5.5
TERT-BUTYLBENZENE	8260	µg/kg	5	<5.5
CARBON DISULFIDE	8260	µg/kg	100	<110
CARBON TETRACHLORIDE	8260	µg/kg	5	<5.5
CHLOROBENZENE	8260	µg/kg	5	<5.5
DIBROMOCHLOROMETHANE	8260	µg/kg	5	<5.5
CHLOROETHANE	8260	µg/kg	5	<5.5
CHLOROFORM	8260	µg/kg	5	<5.5
CHLOROMETHANE	8260	µg/kg	5	<5.5
2-CHLOROTOLUENE	8260	µg/kg	5	<5.5
4-CHLOROTOLUENE	8260	µg/kg	5	<5.5
1,2-DIBROMO-3-CHLOROPROPANE	8260	µg/kg	5	<5.5
1,2-DIBROMOETHANE (EDB)	8260	µg/kg	5	<5.5
DIBROMOMETHANE	8260	µg/kg	5	<5.5
1,2-DICHLOROBENZENE	8260	µg/kg	5	<5.5
1,3-DICHLOROBENZENE	8260	µg/kg	5	<5.5
1,4-DICHLOROBENZENE	8260	µg/kg	5	<5.5
DICHLORODIFLUOROMETHANE	8260	µg/kg	5	<5.5
1,1-DICHLOROETHANE	8260	µg/kg	5	<5.5
1,2-DICHLOROETHANE	8260	µg/kg	5	<5.5
1,1-DICHLOROETHENE	8260	µg/kg	5	<5.5
CIS-1,2-DICHLOROETHENE	8260	µg/kg	5	<5.5
TRANS-1,2-DICHLOROETHENE	8260	µg/kg	5	<5.5
1,2-DICHLOROPROPANE	8260	µg/kg	5	<5.5
1,3-DICHLOROPROPANE	8260	µg/kg	5	<5.5
2,2-DICHLOROPROPANE	8260	µg/kg	5	<5.5
1,1-DICHLOROPROPENE	8260	µg/kg	5	<5.5
CIS-1,3-DICHLOROPROPENE	8260	µg/kg	5	<5.5
TRANS-1,3-DICHLOROPROPENE	8260	µg/kg	5	<5.5
ETHYLBENZENE	8260	µg/kg	5	<5.5

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APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result 4-LF11-NE-T&D 01-04634-1
HEXACHLOROBUTADIENE	8260	µg/kg	5	<5.5
2-HEXANONE	8260	µg/kg	50	<55
ISOPROPYLBENZENE (CUMENE)	8260	µg/kg	5	<5.5
P-ISOPROPYLTOLUENE	8260	µg/kg	5	<5.5
METHYLENE CHLORIDE	8260	µg/kg	5	4J
4-METHYL-2-PENTANONE (MIBK)	8260	µg/kg	50	<55
METHYL-T-BYTYL ETHER (MTBE)	8260	µg/kg	5	<5.5
NAPHTHALENE	8260	µg/kg	5	<5.5
N-PROPYLBENZENE	8260	µg/kg	5	<5.5
STYRENE	8260	µg/kg	5	<5.5
1,1,1,2-TETRACHLOROETHANE	8260	µg/kg	5	<5.5
1,1,2,2-TETRACHLOROETHANE	8260	µg/kg	5	<5.5
TETRACHLOROETHENE	8260	µg/kg	5	<5.5
TOLUENE	8260	µg/kg	5	<5.5
1,2,3-TRICHLOROBENZENE	8260	µg/kg	5	<5.5
1,2,4-TRICHLOROBENZENE	8260	µg/kg	5	<5.5
1,1,1-TRICHLOROETHANE	8260	µg/kg	5	<5.5
1,1,2-TRICHLOROETHANE	8260	µg/kg	5	<5.5
TRICHLOROETHENE	8260	µg/kg	5	<5.5
TRICHLOROFLUOROMETHANE	8260	µg/kg	5	<5.5
1,2,3-TRICHLOROPROPANE	8260	µg/kg	5	<5.5
1,2,4-TRIMETHYLBENZENE	8260	µg/kg	5	<5.5
1,3,5-TRIMETHYLBENZENE	8260	µg/kg	5	<5.5
VINYL CHLORIDE	8260	µg/kg	5	<5.5
XYLENE (TOTAL)	8260	µg/kg	10	<11
T-BUTYL ALCOHOL	8260	µg/kg	20	<22

Component Analyzed	Method	Unit	PQL	Analysis Result 4-LF11-SW-T&D 01-04634-5	4-LF11-W-T&D 01-04634-9
VOLATILE ORGANICS					
Dilution Factor				1.02	1.07
ACETONE	8260	µg/kg	100	<110	<110
BENZENE	8260	µg/kg	5	<5.3	<5.6
BROMOBENZENE	8260	µg/kg	5	<5.3	<5.6
BROMOCHLOROMETHANE	8260	µg/kg	5	<5.3	<5.6
BROMODICHLOROMETHANE	8260	µg/kg	5	<5.3	<5.6
BROMOFORM	8260	µg/kg	5	<5.3	<5.6
BROMOMETHANE	8260	µg/kg	5	<5.3	<5.6

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Component Analyzed	Method	Unit	PQL	Analysis Result 4-LF11-SW-T&D 01-04634-5	Analysis Result 4-LF11-W-T&D 01-04634-9
2-BUTANONE (MEK)	8260	µg/kg	100	<110	5J
N-BUTYLBENZENE	8260	µg/kg	5	<5.3	<5.6
SEC-BUTYLBENZENE	8260	µg/kg	5	<5.3	<5.6
TERT-BUTYLBENZENE	8260	µg/kg	5	<5.3	<5.6
CARBON DISULFIDE	8260	µg/kg	100	<110	<110
CARBON TETRACHLORIDE	8260	µg/kg	5	<5.3	<5.6
CHLOROBENZENE	8260	µg/kg	5	<5.3	<5.6
DIBROMOCHLOROMETHANE	8260	µg/kg	5	<5.3	<5.6
CHLOROETHANE	8260	µg/kg	5	<5.3	<5.6
CHLOROFORM	8260	µg/kg	5	<5.3	<5.6
CHLOROMETHANE	8260	µg/kg	5	<5.3	<5.6
2-CHLOROTOLUENE	8260	µg/kg	5	<5.3	<5.6
4-CHLOROTOLUENE	8260	µg/kg	5	<5.3	<5.6
1,2-DIBROMO-3-CHLOROPROPANE	8260	µg/kg	5	<5.3	<5.6
1,2-DIBROMOETHANE (EDB)	8260	µg/kg	5	<5.3	<5.6
DIBROMOMETHANE	8260	µg/kg	5	<5.3	<5.6
1,2-DICHLOROBENZENE	8260	µg/kg	5	<5.3	<5.6
1,3-DICHLOROBENZENE	8260	µg/kg	5	<5.3	<5.6
1,4-DICHLOROBENZENE	8260	µg/kg	5	<5.3	<5.6
DICHLORODIFLUOROMETHANE	8260	µg/kg	5	<5.3	<5.6
1,1-DICHLOROETHANE	8260	µg/kg	5	<5.3	<5.6
1,2-DICHLOROETHANE	8260	µg/kg	5	<5.3	<5.6
1,1-DICHLOROETHENE	8260	µg/kg	5	<5.3	<5.6
CIS-1,2-DICHLOROETHENE	8260	µg/kg	5	<5.3	<5.6
TRANS-1,2-DICHLOROETHENE	8260	µg/kg	5	<5.3	<5.6
1,2-DICHLOROPROPANE	8260	µg/kg	5	<5.3	<5.6
1,3-DICHLOROPROPANE	8260	µg/kg	5	<5.3	<5.6
2,2-DICHLOROPROPANE	8260	µg/kg	5	<5.3	<5.6
1,1-DICHLOROPROPENE	8260	µg/kg	5	<5.3	<5.6
CIS-1,3-DICHLOROPROPENE	8260	µg/kg	5	<5.3	<5.6
TRANS-1,3-DICHLOROPROPENE	8260	µg/kg	5	<5.3	<5.6
ETHYLBENZENE	8260	µg/kg	5	<5.3	<5.6
HEXACHLOROBUTADIENE	8260	µg/kg	5	<5.3	<5.6
2-HEXANONE	8260	µg/kg	50	<53	<56
ISOPROPYLBENZENE (CUMENE)	8260	µg/kg	5	<5.3	<5.6
P-ISOPROPYLTOLUENE	8260	µg/kg	5	<5.3	<5.6
METHYLENE CHLORIDE	8260	µg/kg	5	4J	5J
4-METHYL-2-PENTANONE (MIBK)	8260	µg/kg	50	<53	<56
METHYL-T-BYTYL ETHER (MTBE)	8260	µg/kg	5	<5.3	<5.6
NAPHTHALENE	8260	µg/kg	5	<5.3	<5.6
N-PROPYLBENZENE	8260	µg/kg	5	<5.3	<5.6

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Component Analyzed	Method	Unit	PQL	Analysis Result 4-LF11-SW-T&D 01-04634-5	Analysis Result 4-LF11-W-T&D 01-04634-9
STYRENE	8260	μg/kg	5	<5.3	<5.6
1,1,1,2-TETRACHLOROETHANE	8260	μg/kg	5	<5.3	<5.6
1,1,2,2-TETRACHLOROETHANE	8260	μg/kg	5	<5.3	<5.6
TETRACHLOROETHENE	8260	μg/kg	5	<5.3	<5.6
TOLUENE	8260	μg/kg	5	<5.3	<5.6
1,2,3-TRICHLOROBENZENE	8260	μg/kg	5	<5.3	<5.6
1,2,4-TRICHLOROBENZENE	8260	μg/kg	5	<5.3	<5.6
1,1,1-TRICHLOROETHANE	8260	μg/kg	5	<5.3	<5.6
1,1,2-TRICHLOROETHANE	8260	μg/kg	5	<5.3	<5.6
TRICHLOROETHENE	8260	μg/kg	5	<5.3	<5.6
TRICHLOROFLUOROMETHANE	8260	μg/kg	5	<5.3	<5.6
1,2,3-TRICHLOROPROPANE	8260	μg/kg	5	<5.3	<5.6
1,2,4-TRIMETHYLBENZENE	8260	μg/kg	5	<5.3	<5.6
1,3,5-TRIMETHYLBENZENE	8260	μg/kg	5	<5.3	<5.6
VINYL CHLORIDE	8260	μg/kg	5	<5.3	<5.6
XYLENE (TOTAL)	8260	μg/kg	10	<11	<11
T-BUTYL ALCOHOL	8260	μg/kg	20	<21	<22

PQL: Practical Quantitation Limit. MDL: Method Detection Limit. CRDL: Contract Required Detection Limit

N.D.: Not Detected or less than the practical quantitation limit. "-": Analysis is not required.

J: Reported between PQL and MDL.

† All results are reported on dry basis for soil samples.

Listed Dilution Factors (DF) are relative to the method default DF. All unlisted DFs are 1.0

(a) Result for composite sample.

(b) MDL reported.

(c) Sample chromatogram contained an unknown peak at about C_{15} range.

Respectfully submitted,

Dominic Lau
Laboratory Director
Applied P & Ch Laboratory

INTERNATIONAL TECHNOLOGY CORPORATION

800063

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 546860
Page 1 of 1

Project Name/No. [1] Crow's Landing CTO-4
Sample Team Members [2] M. Vennemeyer
Profit Center No. [3] 5515001
Project Manager [4] Bob Hulet
Purchase Order No. [6] 173773
Required Report Date [11] 10 Days

Samples Shipment Date [7] 7/10/01
Lab Destination [8] APCL
Lab Contact [9] Mark Heckman
Project Contact/Phone [12] (925) 288-2151 ROSE CONDIT
Carrier/Waybill No. [13] 821519686595 Fed Ex

Bill to: [5] I.T. Corp
4005 Port Chicago Hwy
Concord, CA 94520
attn: Rich Ianicca

Report to: [10] I.T. Corp - Mark Vennemeyer
(925) 288-2383
Fax (925) 827-2179

NOTE: To accompany samples. Attach yellow copy.

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Pre-servative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]
4-LF11-NE-T+D	Soil	0845 7/10/01	5ml core	3x5ml	Ice	VOC	"	
4-LF11-NE-TP(A-C)	Soil	845 7/10/01	~~90z amber~~	3x9oz		CAM-17 Metal 8270-SVOC, 8015-TPH	FOR LAB USE ONLY	
			Amber glass					
4-LF11-W-T+D	soil	0910 7/10/01	Core	3x5ml	ICE	VOC		
4-LF11-W-T+D(A-C)	soil		amber	3x9oz		CAM-17 Metal 8270-SVOC, 8015-TPH	FOR LAB USE ONLY	
4-LF11-SW-T+D		0940 7/10/01	Core	3x5ml		VOC		
4-LF11-SW-T+D(A-C)		0940 7/10/01	amber	3x9oz		CAM-17 Metal 8270-SVOC, 8015-TPH		

Special Instructions: [23] Composite SVOC, TPH and CAM-17 of Like #'s to use as sample

Possible Hazard Identification: [24]
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☒

Sample Disposal: [25]
Return to Client ☐ Disposal by Lab ☒ Archive _____ (mos.)

Turnaround Time Required: [26]
Normal ☒ Rush ☐

QC Level: [27]
I. ☐ II. ☐ III ☒ Project Specific (specify): _____

1. Relinquished by [28] (Signature/Affiliation) Mark Vennemeyer	Date: 7/10/01 Time: 1300	1. Received by [28] (Signature/Affiliation) Fed Ex	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: [29] Archive sample for possible WET on CAM-17 metals

MCA 3/15/91