ARCADIS
Infrastructure, environment, facilities

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Ms. Karen Kromar, Project Manager
Voluntary Investigation and Cleanup Program
Minnesota Pollution Control Agency
520 Lafayette Road North
ST. Paul, Minnesota 55155-4194

ENVIRONMENT

Subject:
Soil Investigation Report – Baseball Fields - Feature 139
Ford Twin Cities Assembly Plant, St. Paul, Minnesota

Date:
7 September 2007

Contact:
Bryan Zinda

Phone:
612.373.0239

Email:
bryan.zinda@arcadis-us.com

Our ref:

MN000593.0003

Dear Ms. Kromar:

On behalf of Ford Motor Company (Ford), ARCADIS has prepared this Soil Investigation Report for a portion of the Ford Motor Company Twin Cities Assembly Plant (TCAP) which is located at 966 South Mississippi River Boulevard within the City of St. Paul in Ramsey County, Minnesota.

The current operations at TCAP consist of the assembly and painting of light duty trucks (Ford Ranger) using parts that are manufactured elsewhere. Processes include welding, assembly, metal cleaning, painting and curing, windshield and trim installation and preparation of the vehicles for final delivery. In addition, a wastewater treatment plant and steam plant are also associated with current assembly operations at TCAP.

Background

ARCADIS completed a Phase I Environmental Site Assessment (ESA) at TCAP in early 2007 (ARCADIS, 2007). During the Phase I, several recognized environmental conditions (RECs), historical RECs (H REC), and areas of interest (AOI) were identified both inside and outside the buildings. Based on the results form the Phase I ESA, several areas of the TCAP were identified for additional Phase II investigations. These investigations were discussed with the Minnesota Pollution Control Agency (MPCA) during a meeting on Monday July 9, 2007.

The activities discussed in this report include the Soil Investigation that was implemented to evaluate the Potential Battery Waste Disposal Area hereafter referred to as Feature 139, located at the baseball field area east of the plant.

This report presents a description of the activities completed during the investigation; a discussion of the analytical results from the investigation: a summary of findings; and recommendations regarding future investigative work.

Property Location and Description

TCAP is located at 966 South Mississippi River Boulevard in St. Paul, Ramsey County, Minnesota at approximate Latitude (north) 44° 54' 50.8" and Longitude (west) 93° 11' 31.9". TCAP is located in a mixed industrial, commercial and residential use area on the eastern shore of the Mississippi River, along the east side of South Mississippi River Boulevard, south of Ford Parkway and west of South Cleveland Avenue in St. Paul, Minnesota. TCAP is accessed from the west via two entrances on South Mississippi River Boulevard and from the north via three entrances on Ford Parkway (Figure 1).

The area occupied by Feature 139 is approximately 6 acres in size, and presently includes three baseball fields. The area also includes a concession building with restrooms, batting cages, a practice pitching area, graveled surface and grassed areas (Figure 2).

Site Geology

The general geology of TCAP, based on information identified during the Phase I ESA, is outlined below.

Geology

At the surface of the TCAP property a thin mantle of unconsolidated sediments exists over bedrock terraces. Underlying the unconsolidated material are sedimentary bedrock units which were deposited during the middle of the Ordovician geologic period. The sedimentary units are, in descending order, Decorah Shale, Platteville Limestone/dolostone, Glenwood Shale and St. Peter Sandstone.

The soil mantle consists of predominately sandy clay and clayey sand. Weathered shale cobbles are common and in some areas there is two to five feet of peat. In some of the areas investigated at TCAP much of the native material has been disturbed and is mixed with fill material such as building rubble, glass, scrap metal and ash. The Platteville formation lies on top of the Glenwood Shale formation and the contact is gradational. The Glenwood Shale is composed of dark green to gray shale and sandy shale. The formation is thinly laminated and moderately fissile (cleavable) and is approximately seven feet thick in the areas investigated. The St. Peter Sandstone outcrops along the bluffs of the Mississippi River and continues below the elevation of the river bed. The sandstone is composed of medium-grained, well-sorted and well-rounded quartzite. It is white to buff in color and is medium to weakly indurated (hardened). The St. Peter formation is as much as 150 feet thick in the Twin Cities area.

Based on the Phase II Exterior work conducted, the geology of the baseball fields area generally consists of approximately 1 to 4.5 feet of sand and gravel fill material. Below the fill material is unconsolidated terrace deposits. Beneath the unconsolidated material is the Decorah Shale which is in general 4.5 to 8 feet below ground surface (bgs). The Decorah Shale is expected to be approximately 25 to 30 feet thick.

Overview of Soil Investigation

ARCADIS conducted a Soil Investigation of Feature 139 to evaluate soil conditions. Investigative methods were developed based on Minnesota Pollution Control Agency (MPCA) Voluntary Investigation and Cleanup (VIC) program requirements; knowledge of the geology of the site; potential environmental concerns; and agency requirements.

Scope and Rationale

The following scope of work was completed for the Soil Investigation of Feature 139:

- Conducted utility clearance prior to initiating any subsurface work.
- Conducted a geophysical study to evaluate subsurface conditions at Feature 139.

- Completed soil borings and collected soil samples at several areas that were identified during the geophysical survey. Surface soil samples were collected at three locations.

- Surveyed all boring locations.

- Characterized IDW for disposal.

Field Investigation Methods

Utility Clearance

A full utility clearance was performed prior to initiating any subsurface work at TCAP. Gopher One Call was notified so that all utility lines servicing TCAP were marked. In addition, a private utility locator, Hance Utility service, Inc. of Buffalo, Minnesota, was retained to locate private lines in the areas where subsurface work was conducted. Ford Plant personnel assisted the private utility locator for the duration of the work.

When selecting potential drilling locations, ARCADIS conducted a visual inspection for marked subsurface utility locations, manholes and other evidence of subsurface utilities, and referred to client-provided site and utility maps.

Geophysical and Soil Investigation

A geophysical survey was completed at Feature 139 on June 20 through June 21, 2007 by 3Dgeophysics of Chaska, Minnesota. The geophysical study was conducted using EM-31 and EM-61 frequency domain electromagnetic methods. The geophysical surveys were used to identify any metallic anomalies (EM61) in the subsurface and to determine changes in electrical conductivity from differences in soil types, disturbances, etc. (EM31).

Multiple EM anomalies resulting from buried objects were identified by the metal detection survey EM61. No discernable surface metal debris, not related to surface obstructions, was observed during the survey. The EM anomalies present in the dataset are related to unknown buried objects.

The most significant and apparently naturally occurring anomaly detected by the EM31 survey is a northwest trending area of low conductivity within the center of

Feature 139. Typically, sandy and drier sediments exhibit low conductivity, while clayey and moist sediments exhibit higher conductivity.

A copy of the geophysical investigation report is presented in Appendix A.

Following the geophysical investigation, six direct push soil borings (ASB-049 to ASB-054) were completed at Feature 139 at select areas to confirm findings from the geophysical investigation. The soil borings were completed using direct push methods by Matrix Environmental, LLC. of Osseo, Minnesota on July 5, 2007 based on anomalies identified from the geophysical survey.

Three additional surface soil samples were collected from Feature 139 on August 13, 2007. AGM-SS-01 was sampled near ASB-049, AGM-SS-02 was sampled near ASB-051, and AGM-SS-03 was sampled near ASB-053. Surface soil samples were collected from the top six inches of ground surface.

Soil boring logs were prepared for each boring in accordance with MPCA and Minnesota Department of Health (MDH) requirements and present the United Soil Classification System (USCS) classification of the materials encountered. Each soil sample was screened in the field with a photo-ionization detector (PID). PID headspace readings are presented in Table 1. Soil boring logs are presented in Appendix B.

One soil sample was collected from each boring for laboratory analysis. Soil sampling techniques were conducted in accordance with State requirements and guidelines. All soil samples were analyzed for volatile organic compounds (VOCs) using Environmental Protection Agency (EPA) Method 8260, semi-volatile organic compounds (SVOCs) using EPA Method 8270 and Target Analyte List (TAL) Metals using EPA Method 6010.

At each boring location one soil sample per boring was collected for laboratory analysis. Intervals which exhibited the following characteristics were containerized for chemical analysis:

- The interval with the highest field indication of organic vapors and/or visual and/or incidental olfactory evidence of impacts,
- If possible impacts are identified the interval below the impacts were containerized to delineate the extent of soil impacts,

- If organic vapor and/or visual and/or incidental olfactory evidence of impacts are observed at multiple depth intervals that could provide useful assessment or delineation data, those intervals were containerized, or

- If no organic vapor, visual, or incidental olfactory evidence of impacts are observed, the two foot interval above the saturated zone or the lowermost interval of the soil boring (if the saturated zone is not encountered) was containerized.

Soil sampling techniques were consistent with State requirements or guidelines. See the site specific Field Sampling Plan (FSP) for further details (ARCADIS, June 18, 2007). Soil samples collected for laboratory analysis were placed in a cooler with wet ice and transported to the lab via the laboratory courier following standard chain-of-custody procedures. Soil samples were submitted for one or more of the following analytes: VOCs, SVOCs and Metals.

Analytical data collected during the Soil Investigation was verified by Enovis, Inc of Detroit, Michigan to assure that quality control procedures had been followed and that the data met the requirements of the analytical methods. Verification generally consists of reviewing the laboratory report and electronic data deliverable (including the case narrative), sample analytical data, quality control documentation, and chain-of-custody. In addition, verification includes a review of holding times, blank contaminants, laboratory control samples and quality control limits. The verification reports will be included with the laboratory reports in the Phase II Investigation Report-Exterior Phase, which will be submitted at a later date.

Discussion of Results

Based on documentation reviewed during the Phase I Investigation, Feature 139 was potentially used for disposal of battery waste. The purpose of the Soil Investigation was to evaluate the soil conditions in and around Feature 139 and determine whether impacts were present in the soils.

Investigation

A geophysical survey of the area was conducted by 3D geophysics during June 2007 and six direct push borings were advanced within anomalies identified within this Feature. Direct push borings ASB-049, ASB-050, ASB-51, ASB-052, ASB-053, and ASB-054 were advanced to a depth of 8 feet below ground surface (bgs).

The soil samples collected from the direct push borings did not exhibit elevated PID readings (Table 1). In addition, three surface soil samples were also collected in this Feature: AGM-SS-01, AGM-SS-02, and AGM-SS-03. AGM-SS-01 was sampled near ASB-049, AGM-SS-02 was sampled near ASB-051, and AGM-SS-03 was sampled near ASB-053.

One soil sample was collected from each boring, and was submitted for VOC, SVOC, and TAL metals analysis. The results from the soil samples are presented in Table 2. Also presented in Table 2 are applicable MPCA comparison criteria including the Soil Reference Value (SRV) for Recreational and Industrial use.

In general, VOCS and SVOCs were not detected, or were detected at estimated concentrations that are well below applicable Minnesota screening criteria.

Inorganic compounds, including arsenic, copper and iron were detected at concentrations that exceeded applicable Minnesota screening criteria for Recreational use. Arsenic was detected in ASB-049 (6.6 mg/kg), ASB-051 (5.3 mg/kg), ASB-053 (7.2 mg/kg), and AGM-SS-01 (16.4 mg/kg) above the Tier 2 Recreational Soil Reference Value (SRV) of 5 mg/kg. Copper was detected in ASB-049 (18.8 mg/kg), ASB-052 (35.3 mg/kg), ASB-053 (13.2 mg/kg), and all three surface soil samples (AGM-SS-001: 19.4 mg/kg, AGM-SS-002:14.7 mg/kg, AGM-SS-003:13.8 mg/kg) above the Tier 2 Recreational SRV of 11mg/kg. Iron was detected above the Tier 2 Recreational SRV of 12,000 mg/kg in all borings (ASB-049:17,100 mg/kg, ASB-050:16,600 mg/kg, ASB-051:13,600 mg/kg, ASB-052:20,600 mg/kg, ASB-053:18,700 mg/kg, AGM-SS-001:12,900 mg/kg, AGM-SS-002:16,200 mg/kg, and AGM-SS-003:13,300 mg/kg) with the exception of ASB-054. No constituents were detected in any samples above the Tier 2 Industrial SRVs (Figure 2 and Table 2).

Recommendations

Based on the results of the Soil Investigation that has been completed for Feature 139, ARCADIS recommends the completion of additional soil investigations of Feature 139. The purpose of the additional investigations will be to evaluate potential risks that may be posed by surface soil at the baseball fields and gain additional information on the extent of the constituents that exceed the screening criteria. The details for the additional recommended investigations will be presented in a work plan that will be submitted to the MPCA.

If you have questions or require additional information, please contact any of the undersigned.

Sincerely,

ARCADIS U.S., Inc.

Bryan Zinda, PE	Andrew Fiskness, PG	Eric Carman
Project Manager	Staff Geologist	Principal In Charge, VP

Copies:
Ms. Barbara Rusinowski, Ford Motor Company, Dearborn, Michigan
Mr. John Meyers, Ford Twin Cities Assembly Plant, St. Paul, Minnesota

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Tables

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Table 1. Field Screening Headspace Summary
Ford Twin Cities Assembly Plant, St. Paul, Minnesota

Location	Start Depth (ft)	Bottom Depth (ft)	PID Reading (ppm)
ASB-049	0	4	1.1
ASB-049	4	8	0.9
ASB-050	0	4	0.4
ASB-050	4	8	0.2
ASB-051	0	4	0
ASB-051	4	8	0
ASB-052	0	4	0.4
ASB-052	4	8	0.2
ASB-053	0	4	0.5
ASB-053	4	8	0.1
ASB-054	0	4	0
ASB-054	4	8	0.4

Notes:

ASB	Soil boring.
ft	Feet below ground surface.
ppm	Parts per million.
---	Not available or bedrock reading.

Table 2. Summary of Detected Compounds in Soil, Feature 139-VIC Program
Ford Twin Cities Assembly Plant, St. Paul, Minnesota

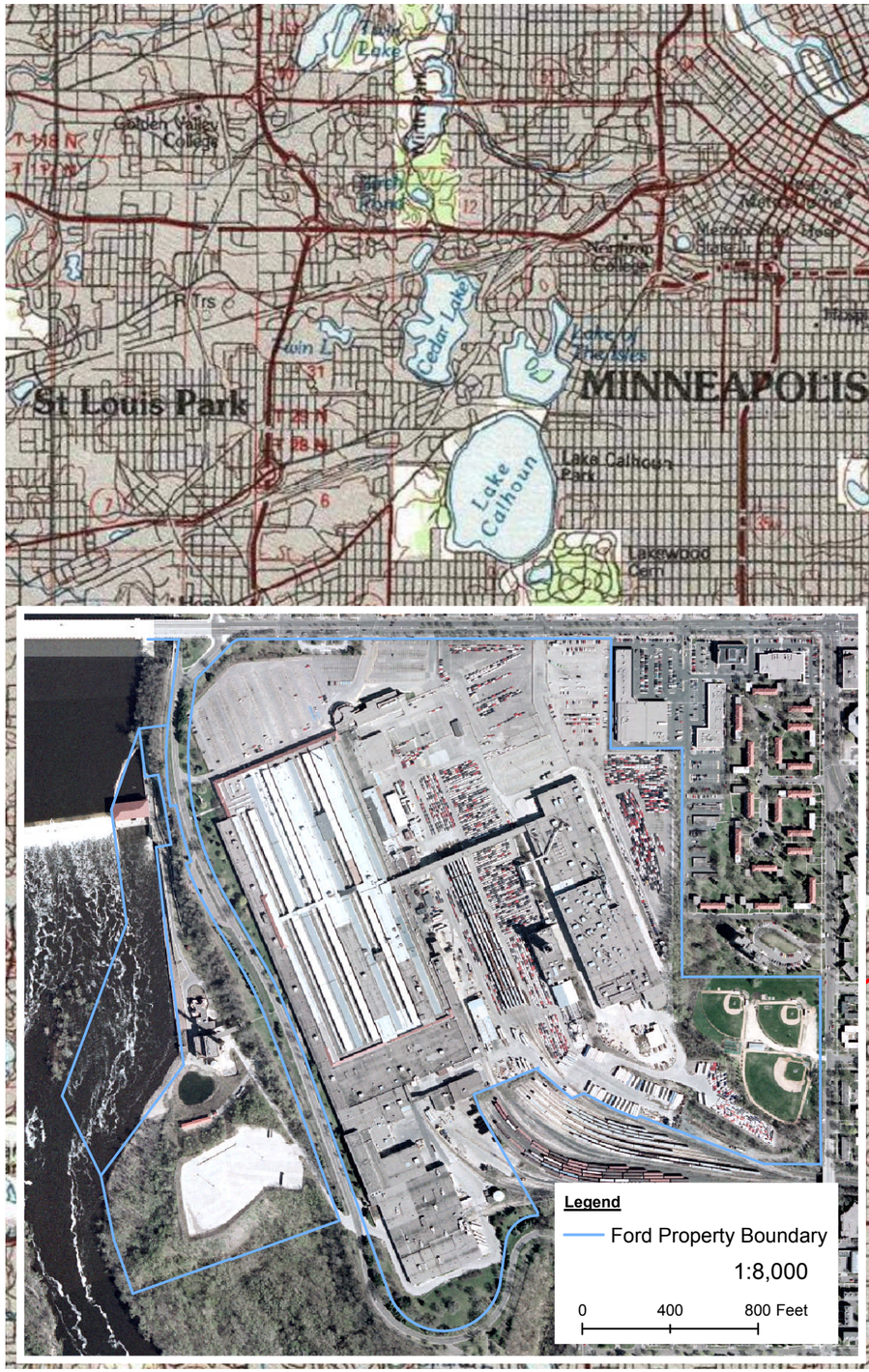
Feature Number				Feature 139								
Location ID		Recreational	Industrial	AGM-SS-001	AGM-SS-002	AGM-SS-003	ASB-049	ASB-050	ASB-051	ASB-052	ASB-053	ASB-054
Depth Interval (ft)		SRV	SRV	0 - 0.5	0 - 0.5	0 - 0.5	4 - 6	4 - 6	2 - 4	2 - 4	2 - 4	4 - 6
Sample Date	Units			8/13/2007	8/13/2007	8/13/2007	7/5/2007	7/5/2007	7/5/2007	7/5/2007	7/5/2007	7/5/2007
VOC												
Methyl acetate	mg/kg	NS	NS	NA	NA	NA	< 0.52	< 0.58	0.1 J	< 0.55	< 0.79	< 0.56
SVOCs												
bis-2-Ethylhexyl phthalate	mg/kg	690	2100	NA	NA	NA	0.07 J	< 0.39	0.026 J	0.02 J	0.042 J	0.038 J
Fluoranthene	mg/kg	1290	6800	NA	NA	NA	< 0.34	< 0.39	< 0.44	< 0.36	0.024 J	< 0.37
Pyrene	mg/kg	1060	5800	NA	NA	NA	< 0.34	< 0.39	< 0.44	< 0.36	0.025 J	< 0.37
Metals												
Aluminum	mg/kg	40000	100000	6380	8410	7090	3120	8250	8420	5610	9020	2780
Antimony	mg/kg	16	100	1.2 J	< 7.7	< 7.5	< 6.2	< 7	< 8	< 6.5	< 9.5	< 6.7
Arsenic	mg/kg	5	20	**16.4**	5	4.8	**6.6**	1.6	**5.3**	2.1	**7.2**	3.1
Barium	mg/kg	1200	18000	111	100	87.5	35.8	70.7	164	60.2	56.8	22.5
Beryllium	mg/kg	75	230	0.17 J	0.35 J	0.29 J	0.3 J	0.49 J	0.75	0.26 J	0.5 J	0.27 J
Cadmium	mg/kg	35	200	0.54 J	0.32 J	0.33 J	< 0.52	< 0.58	< 0.67	< 0.55	< 0.79	< 0.56
Calcium	mg/kg	NS	NS	14300 J	9080	21700	72900	16400	23600	9560	22000	32200
Chromium	mg/kg	120/60000	650/100000	13.1	15.3	12.3	8.7	15.3	14.5	8.8	18.1	8.4
Cobalt	mg/kg	800	2600	4.6 J	6 J	7.4	6.2	5.7 J	17.8	10.7	10.2	7.3
Copper	mg/kg	11	9000	**19.4**	**14.7**	**13.8**	**18.8**	9.5	5.3	**35.3**	**13.2**	9.1
Iron	mg/kg	12000	75000	**12900**	**16200**	**13300**	**17100**	**16600**	**13600**	**20600**	**18700**	**9970**
Lead	mg/kg	300	700	43	22.7	44.2	3	5.3	2.6	2.6	6.8	2.2
Magnesium	mg/kg	NS	NS	4860	4060	4180	19400	8400	4150	5680	4250	12300
Manganese	mg/kg	5000	8100	495	449	545	563	230	589	279	563	309
Nickel	mg/kg	800	2500	10.8	13.3	13.9	14.9	13.6	30.8	26.3	18.6	12.7
Potassium	mg/kg	NS	NS	1370	972	2460	560	722	3700	496 J	3150	639
Sodium	mg/kg	NS	NS	< 676	< 638	< 624	< 520	< 584	< 666	116 J	< 792	< 559
Vanadium	mg/kg	40	250	17.6	28.7	15.8	20.4	18.9	6.8	**34.1**	23.6	13.3
Zinc	mg/kg	12000	75000	56.4	36.4	46.3	16.1	32.1	23.8	30.2	46.6	16
Mercury	mg/kg	1.2	1.5	0.057 J	0.029 J	0.11 J	< 0.1	0.042 J	0.025 J	0.019 J	0.037 J	< 0.11
Other												
pH	none	NS	NS	NA	NA	NA	8.4	8.6	8.7	8.6	7.8	9
Percent Solids	mg/kg	NS	NS	73.9	78.4	80.1	96.1	85.6	75	91.6	63.2	89.5

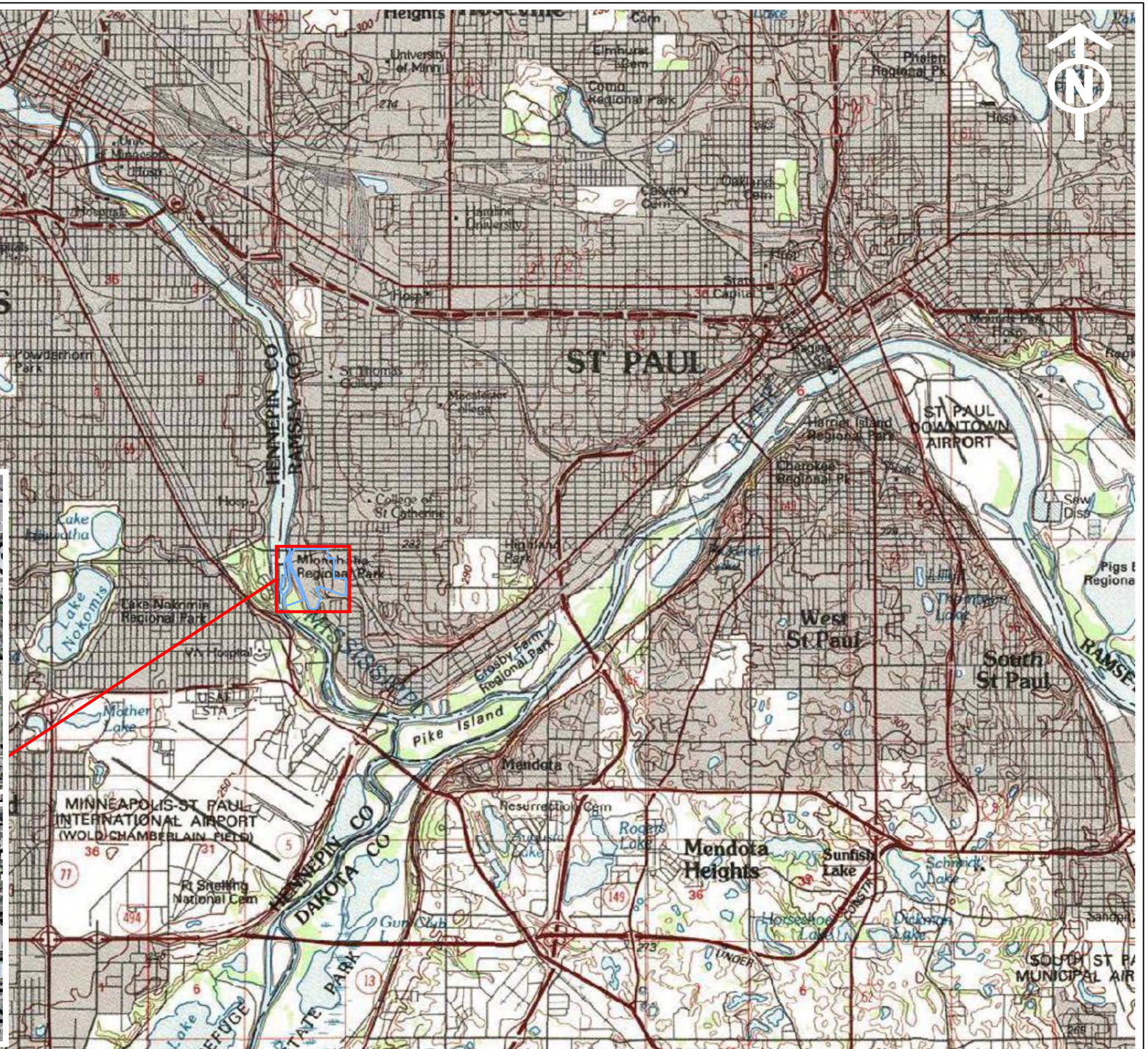
Results are reported in milligrams per kilogram (mg/kg).

Notes:

Feature Number	Environmental feature from Phase I Environmental Site Assesment report.
ASB	ARCADIS Soil Boring Location.
AGM-SS	ARCADIS Surface Soil Sampling Location.
ft	Feet from ground surface.
NA	Not analyzed.
NS	No standard.
J	Estimated result.
	Value is above the Tier 2 Recreational Soil Reference Value (SRV).
Shade	Value is above the Tier 2 Industrial Soil Reference Value (SRV).
VIC	Voluntary Investigation and Cleanup.

Figures





Project Manager E. Carman	Assistant Project Manager B. Zinda	FORD MOTOR COMPANY	Imagery Source: USGS High Resolution Orthoimagery for the Minneapolis-St. Paul, Minnesota Urban Area Topographic Map Source: http://services.arcgisonline.com/v92, © 2007 National Geographic Society	0 0.5 1 2 Miles 1:70,000	ARCADIS 430 First Avenue North, Suite 720 Minneapolis, Minnesota 55401 Tel: (612) 339-9434 Fax (612) 336-4538	**Site Location / Property Layout** **Ford Twin Cities Assembly Plant** **St. Paul, Minnesota**
Drawn M. Gress	Checked T. Nelson-Kalmes					Project Number MN000593 Date 05-SEP-07 Figure 1

G:\GIS\Projects\Ford Ranger\ArcMap\PhaseII_Figures\Site_Location_Topo.mxd - 9/5/2007 @ 10:03:51 AM

G:\GIS\Projects\Ford Ranger\ArcMap\PhaseII_Figures\Ballfields\Ballfield_Exceed_20070830.mxd - 9/5/2007 @ 9:07:21 AM

Project Manager E. Carman	Assistant Project Manager B. Zinda
Drawn M. Gress	Checked T. Nelson-Kalmes

FORD MOTOR COMPANY

Imagery Source: USGS High Resolution Orthoimagery for the Minneapolis-St. Paul, Minnesota Urban Area

0 62.5 125 250 Feet

1:1,200

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Feature 139, Soil Sampling Locations
Exceeding Tier 2 Recreational Soil Reference Values
Ford Twin Cities Assembly Plant
St. Paul, Minnesota

Project Number	MN000593
Date	4-SEP-07
Figure	2

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Appendix A

Geophysical Survey

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info@3dgeophysics.com

LETTER REPORT

Date: July 10, 2007

To: **Andrew Fiskness**
Arcadis G&M, Inc
430 First Avenue North, Suite 720
Minneapolis, MN 55401

From: **Erik Kitt**
3Dgeophysics (3Dg)

Re: Geophysical Investigation at the Ford Field site in St. Paul, Minnesota

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Site

Ford Field baseball field complex located on Cleveland Avenue, St. Paul, MN.

Project Description

Perform electromagnetic metal detection (EM61) and electromagnetic ground conductivity (EM31) surveys in the near surface sediments at the site. The purpose of the work was to locate currently unknown buried objects of potential environmental concern. The results of the work will be used to help direct an invasive sampling program at the site.

Study Area - Conditions

The approximate 270,000 sq ft (6.2 acre) site consists of three fenced baseball fields, gravel covered parking areas, and various support buildings / structures. The survey area was bounded on the west and south by trees, on the east by Cleveland Avenue, and on the north by a residential apartment building. The surveys were complicated by the numerous occurrences of metal objects (fences, light poles, etc.) on the surface of the site, and by tall trees near the southern, northern, and western boundaries of the survey area. The trees degraded GPS data quality, which limited the areal extent of the surveys in some instances and increased the data acquisition time.

Work Tasks

The following tasks were performed to meet the objectives of the project:

1. Mobilization

   A 1-person field crew and equipment mobilized to the site and performed the field survey on June 20 – 21, 2007. **Table 1** lists the equipment used for the project.

2. Data Collection

Two geophysical surveys were conducted at the site. An EM61 metal detection survey was performed to map occurrences of buried metal. An EM31 ground conductivity survey was performed to map changes in the electrical properties of the near subsurface sediments at the site.

The EM61 and EM31, which operated continuously, were systematically pulled across the site to cover the survey area. A non-magnetic and non-conductive instrument trailer and a 6x6 all-terrain vehicle (ATV) were used to tow the EM instruments. A StarFire enabled DGPS with sub-decimeter accuracy (Navcom Model SF-2050G) was connected directly to the EM instruments to provide position control.

The EM instruments were towed along arbitrary survey lines spaced approximately 3 - 6 ft apart. EM data were collected with sufficient spatial sampling to detect buried objects of potential environmental concern. **Tables 2** and **3** summarize the EM61 and EM31 recording parameters, respectively, which were used for the investigation.

DGPS navigation was used for all the geophysical surveys. Accuracy and reliability of the DGPS system was subject to anomalies such as multipath (signal reflection), signal obstructions, variable satellite geometry, and variable atmospheric conditions. DGPS surveying conditions at the site were poor. The trees along the site boundaries obstructed the DGPS signals and limited the data coverage areas for the surveys. The geophysical surveys were interrupted several times to reacquire GPS signals.

After the geophysical surveys were completed, a brief land survey of the site was performed using the DGPS and a handheld Geographic Information System (GIS). Locations of prominent site features and sources of potential EM interference were recorded during the land survey. The geophysical and land survey data were geo-referenced in the UTM Zone 15N (meters) coordinate system (WGS84 datum).

3. Data Processing / Analysis

After the field work was completed the geo-referenced EM data were processed using Oasis Montaj (Geosoft, Inc.) software and a PC workstation. The data were filtered, edited, smoothed, and then interpolated into a regular grid and plotted using the surface mapping features of Oasis Montaj. A minimum curvature routine was used to interpolate the data, and the data were contoured with minimal smoothing to prevent degradation of the high frequency data.

4. Results

Figures 1 – 2 show the data coverage map that displays the sampling locations where the EM61 and EM31 data, respectively, were collected in the survey area. The sampling locations are superimposed on an aerial photograph of the site in the figures. The data

gaps that occurred in the survey area were the result of surface obstructions (such as site buildings, parked cars, fenced areas, bleachers, and trees) which prevented data collection with the EM systems. All of the EM data were reviewed for quality control both in the field and then in the office.

EM61 Metal Detection

Figure 3 shows the EM61 anomaly map for the survey area. This map is a contour map of the EM response (measured in millivolts) across the site. Large EM responses (anomalies) occur over very shallow or large buried metallic objects or surface debris, and are colored cyan, green, yellow, orange, red, and pink. The dark blue-colored zones represent areas of the site with no metallic objects buried in the near subsurface. Some of the prominent site features, the positions of which were recorded during the land survey, are superimposed on the anomaly map with annotated black dots.

The EM61 technique worked very well at the site. Multiple EM anomalies resulting from buried objects were identified by the metal detection survey. The EM map clearly delineates the positions of buried metal objects, the depth and absolute size of which are unknown. Several buried utilities, which are identified by the long linear anomalies in Figure 3, were also imaged during the survey. No discernable surface metal debris, not related to surface obstructions, was observed during the survey. The EM anomalies present in the dataset are related to unknown buried objects.

It is unknown whether the buried metals mapped during the survey are objects of environmental concern. The relative shapes of the anomalies suggest they do not represent buried man-made structures such as old building foundations. Relatively small buried metal objects are scattered throughout the survey area. 3Dg would classify the amount of metal anomalies in the survey area as 'large', given the limited size and current usage of the site. Based on the frequency and distribution of EM61 anomalies the possibility that previous site usage included landfill activities cannot be eliminated.

After reviewing the preliminary data results Arcadis requested that 3Dg locate the positions of some of the most prominent EM61 anomalies on the surface of the site. 3Dg performed the surface locating work on July 3, 2007. The anomalies of interest (as defined by Arcadis) that were located by 3Dg are circled in red on Figure 3. It is expected that these locations will be sampled with a Geoprobe.

EM31 Ground Conductivity

Figure 4 shows the EM31 anomaly map for the survey area. The data plot is a color-coded contour map of the ground conductivity across the survey area. Ground conductivity is measured in millisiemens/meter (mS/m). The color scale for the ground conductivity map has been optimized to isolate conductivity anomalies. In general, high conductivity (low resistance) areas are shaded pink, red, orange, yellow, and green, while

low conductivity (high resistance) areas are shaded cyan and blue. Prominent site features are again annotated on the map. All of the EM data were reviewed for quality control both in the field and then in the office.

The EM31 system measures bulk conductivity of the earth from the ground surface to the maximum depth of penetration (approximately 3 – 5 meters). Ground conductivity measurements are primarily influenced by soil/sediment type, proximity of bedrock to the ground surface, moisture content, and man-made objects. Large concentrations of buried or surface metal interfere with EM31 measurements and create both highly conductive and negative conductivity anomalies. Negative conductivity anomalies can also be generated in the presence of an external EM field, such as those generated from some buried utilities.

Similar to the EM61 data plot the fences and some buried utilities at the site are apparent in the EM31 conductivity map. The most significant and apparently naturally occurring anomaly in the dataset is a northwest trending area of low conductivity within the center of the survey area. The interpreted extents of this anomaly are shown with blacked dashed lines in Figure 4. Typically, sandy and drier sediments exhibit low conductivity, while clayey and moist sediments exhibit higher conductivity. The ground conductivity values measured at the site are consistent with naturally occurring river sediments. It is possible that the northwest trending anomaly in the EM31 data may represent a buried channel, or similarly, a previous topographic low.

Based on the EM31 data alone there are no anomalies that would currently be interpreted as a localized landfill or dumping area at the site. A large, high conductivity anomaly does exist between the northeastern and southern baseball fields which is unexplained. However, the possibility that this anomaly may result from the close proximity of two fences in this area cannot be ruled out.

TABLE 1: DATA ACQUISITION EQUIPMENT

Instrument	Specifications
Geonics Ltd. EM61 metal detector	High Power Mark2, Dual Coil
Geonics Ltd. EM31 conductivity meter	Mark2, Digital output
Navcom Technologies DGPS	Model SF-2050G, StarFire enabled, sub-decimeter accuracy

TABLE 2: EM61 DATA ACQUISITION PARAMETERS

Parameter	EM61 metal detection
Power Mode	Low
Coil Type	1.0 x 0.5 meter
EM61 Operation Mode	Differential: 4 time windows
Sampling Interval	10 samples/sec
No. of Samples	63,319

TABLE 3: EM31 DATA ACQUISITION PARAMETERS

Parameter	EM61 metal detection
Dipole Orientation	Vertical
Sampling Interval	10 samples/sec
Range Setting	1000
No. of Samples	36,103

3Dgeophysics.com
9675 Summit Place
Chaska, MN 55318
Tel: (952) 556-1118 • Fax: (952) 556-1119

Title

EM61 Survey Location Map

Reference
aerial image provided by Google Earth

Figure No.
1

3Dgeophysics.com
9675 Summit Place
Chaska, MN 55318
Tel: (952) 556-1118 • Fax: (952) 556-1119

Title

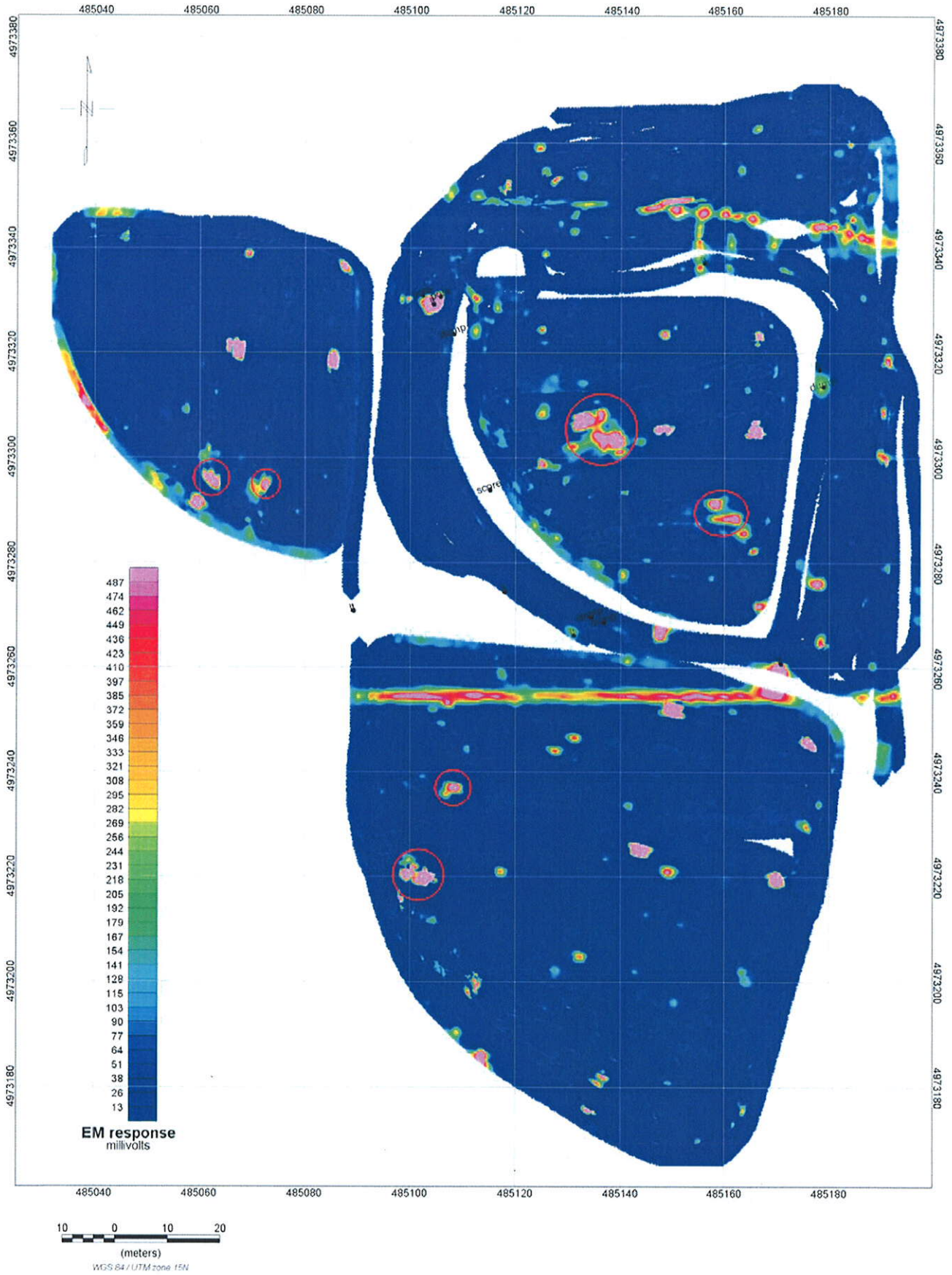
EM31 Survey Location Map

Reference

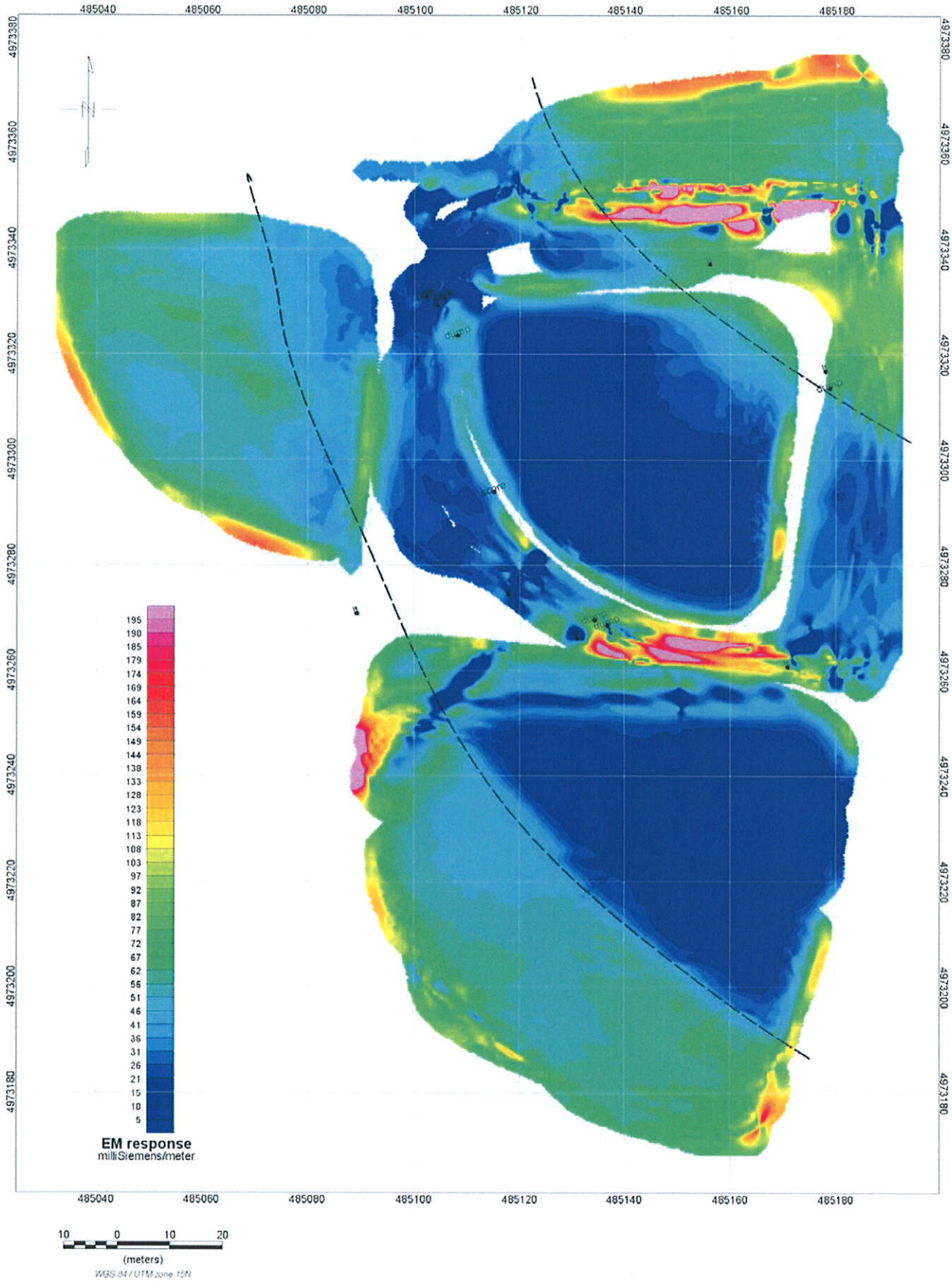
aerial image provided by Google Earth

Figure No.

2



3Dgeophysics.com 9675 Summit Place Chaska, MN 55318 Tel: (952) 556-1118 • Fax: (952) 556-1119	Title EM61 Metal Detection Anomaly Map	Reference	Figure No. 3



3Dgeophysics.com 9675 Summit Place Chaska, MN 55318 Tel: (952) 556-1118 • Fax: (952) 556-1119	Title EM31 Ground Conductivity Anomaly Map	Reference	Figure No. 4

ARCADIS

Appendix B

Soil Boring Logs

ARCADIS

SOIL BORING LOG

WELL NO.: **ASB-049**

TOTAL DEPTH: **8.00**

PROJECT INFORMATION

PROJECT:	**Ford Ranger Plant**
SITE LOCATION:	**St. Paul Minnesota**
LOGGED BY:	**TNK**
DATE STARTED:	**7/5/2007 9:10:00 AM**
DATE COMPLETED:	**7/5/2007 9:30:00 AM**

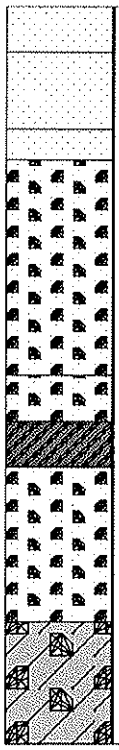
DRILLING INFORMATION

DRILLING CO.:	**Matrix Environmental, LLC**
DRILLER:	**Matrix**
DRILLING METHOD:	**Direct Push**

COORDINATES: **ELEVATIONS (feet MSL):**

Northing: 4973239.6477 **Surface: 832.99**

Easting: 485114.715

DEPTH (feet)	SOIL SYMBOLS	BLOWS (\6 inches)	PID (ppm)	RECOVERY (in.)	USCS/ STRATIGRAPHIC UNITS	SOIL DESCRIPTION
0		NA	1.1	48	SP	(0.0 - 0.5) SP: FILL (POORLY GRADED SAND), light brown, very fine to medium, mostly fine to medium, little silt, loose, dry.
					SP	(0.5 - 1.3) SP: FILL (POORLY GRADED GRAVEL WITH SAND), light yellow, very fine to medium, gravel up to 1", angualr, loose, dry.
2					SP	(1.3 - 1.7) SP: FILL (POORLY GRADED SAND),yellow, very fine to coarse grained, mostly coarse, loose, dry,
					GP	(1.7 - 4.0) GP: FILL (POORLY GRADED GRAVEL WITH SAND), yellowish orange, very fine to coarse grained, mostly coarse, poorly sorted, loose, dry.
4		NA	0.9	48	GP	(4.0 - 4.5) GP: FILL (POORLY GRADED GRAVEL WITH SAND), yellowish orange, very fine to coarse grained, mostly coarse, poorly sorted, loose, dry.
					CH	(4.5 - 5.0) CH: FAT CLAY, stiff, orangish brown, trace fine grained sand, moist.
6					GP	(5.0 - 6.7) GP: POORLY GRADED SAND WITH GRAVEL, light yellow, fine to coarse grained, mostly coarse, loose, dry, gravel subangular, up to 1".
					SHALE	(6.7 - 8.0) SHALE: SHALE, gray, brittle, dry, weathered.
8						

ARCADIS

SOIL BORING LOG

WELL NO.: **ASB-050**

TOTAL DEPTH: **8.00**

PROJECT INFORMATION

PROJECT:	**Ford Ranger Plant**
SITE LOCATION:	**St. Paul Minnesota**
LOGGED BY:	**TNK**
DATE STARTED:	**7/5/2007 9:45:00 AM**
DATE COMPLETED:	**7/5/2007 10:05:00 AM**

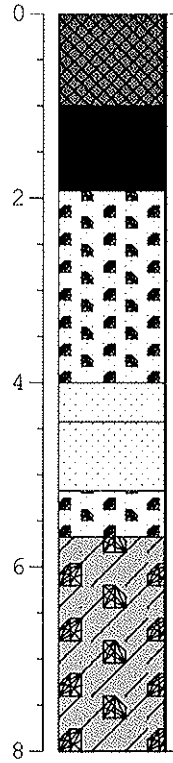
DRILLING INFORMATION

DRILLING CO.:	**Matrix Environmental, LLC**
DRILLER:	**Matrix**
DRILLING METHOD:	**Direct Push**

COORDINATES: **ELEVATIONS (feet MSL):**

Northing: 4973219.5953 **Surface: 831.85**

Easting: 485103.0317



DEPTH (feet)	SOIL SYMBOLS	BLOWS (\6 inches)	PID (ppm)	RECOVERY (in.)	USCS/ STRATIGRAPHIC UNITS	SOIL DESCRIPTION
0		NA	0.4	43	OL	(0.0 - 1.0) OL: FILL (ORGANIC SOIL WITH SAND), black, very fine to medium grained, mostly fine to medium, little silt, loose, dry,
					CL	(1.0 - 1.9) CL: LEAN CLAY, soft, grayish brown, some silt, trace fine grained sand, moist, no odor.
2					GP	(1.9 - 4.0) GP: POORLY GRADED GRAVEL WITH SAND, orangish brown, very fine to very coarse grained, mostly coarse, angular to subangular, up to 1", loose, dry.
4		NA	0.2	44	SP	(4.0 - 4.4) SP: POORLY GRADED GRAVEL WITH SAND, orangish brown, very fine to very coarse grained, mostly coarse, angular to subangular, up to 1", loose, dry.
					SP	(4.4 - 5.2) SP: POORLY GRADED SAND, light brown, fine to coarse grained, well sorted, trace gravel, subrounded, up to 1", loose.
					GP	(5.2 - 5.7) GP: SILTY SAND WITH GRAVEL, light yellow, very fine to very coarse grained, mostly coarse, gravel subangular, up to 1", loose, dry.
6					SHALE	(5.7 - 8.0) SHALE: SHALE, gray, weathered, brittle, dry
8						

Reviewed By:
Approved By:

Project No:
File Location

Date: 9/5/2007

ARCADIS

SOIL BORING LOG

WELL NO.: **ASB-051**

TOTAL DEPTH: **8.00**

PROJECT INFORMATION

PROJECT:	**Ford Ranger Plant**
SITE LOCATION:	**St. Paul Minnesota**
LOGGED BY:	**TNK**
DATE STARTED:	**7/5/2007 10:50:00 AM**
DATE COMPLETED:	**7/5/2007 11:15:00 AM**

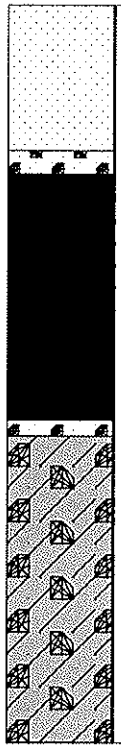
DRILLING INFORMATION

DRILLING CO.:	**Matrix Environmental, LLC**
DRILLER:	**Matrix**
DRILLING METHOD:	**Direct Push**

COORDINATES: **ELEVATIONS (feet MSL):**

Northing: 4973300.5067 **Surface: 834.60**

Easting: 485087.719

DEPTH (feet)	SOIL SYMBOLS	BLOWS (\6 inches)	PID (ppm)	RECOVERY (in.)	USCS/ STRATIGRAPHIC UNITS	SOIL DESCRIPTION
0		NA			SP	(0.0 - 1.6) SP: FILL (ORGANIC SOIL WITH SAND), black, organic rich, very fine to medium grained, mostly fine, little silt, trace gravel, round, up to 1/2", loose, dry.
					GP	(1.6 - 1.8) GP: SILTY SAND WITH GRAVEL, orangish brown, very fine to very coarse grained, mostly coarse,gravel- subangular, up to 1", loose, dry.
2			0.0	44	CL	(1.8 - 4.0) CL: LEAN CLAY, soft, grayish brown, trace gravel, up to 1/2", subrounded, trace fine grained sand, orange mottling.
4		NA			CL	(4.0 - 4.5) CL: LEAN CLAY, soft, grayish brown, trace gravel, up to 1/2", subrounded, trace fine grained sand, orange mottling.
					GP	(4.5 - 4.7) GP: POORLY GRADED GRAVEL, light brown, subrounded, up to 1", loose, dry
					SHALE	(4.7 - 8.0) SHALE: SHALE, gray, weathered, dry, brittle.
6			0.0	48		
8						

Reviewed By:
Approved By:

Project No:
File Location

Date: 9/5/2007

ARCADIS

SOIL BORING LOG

WELL NO.: **ASB-052**

TOTAL DEPTH: **8.00**

PROJECT INFORMATION

PROJECT: **Ford Ranger Plant**
SITE LOCATION: **St. Paul Minnesota**
LOGGED BY: **TNK**
DATE STARTED: **7/5/2007 10:32:00 AM**
DATE COMPLETED: **7/5/2007 10:50:00 AM**

DRILLING INFORMATION

DRILLING CO.: **Matrix Environmental, LLC**
DRILLER: **Matrix**
DRILLING METHOD: **Direct Push**
COORDINATES:
Northing: 4973292.9098
Easting: 485071.6305
ELEVATIONS (feet MSL):
Surface: 833.19

DEPTH (feet)	SOIL SYMBOLS	BLOWS (\6 inches)	PID (ppm)	RECOVERY (in.)	USCS/ STRATIGRAPHIC UNITS	SOIL DESCRIPTION
0		NA	0.4	41	OL	(0.0 - 1.3) OL: FILL (ORGANIC SOIL WITH SAND), organic rich, fine to medium grained, mostly fine, minor silt, trace gravel, up to 1/2", subrounded,dry.
2					GP	(1.3 - 3.2) GP: POORLY GRADED GRAVEL WITH SAND, orangish brown, very fine to very coarse grained, mostly coarse to very coarse, up to 1", subangular, loose, dry.
					CL	(3.2 - 4.0) CL: LEAN CLAY, grayish brown, trace fine sand, orange mottling, soft, moist.
4		NA			CL	(4.0 - 5.8) CL: LEAN CLAY, grayish brown, trace fine sand, orange mottling, soft, moist.
6			0.2	48	GP	(5.8 - 7.3) GP: POORLY GRADED GRAVEL WITH SAND, yellowish brown, very fine to very coarse grained, mostly coarse, subangular to subround, up to 1", loose, dry.
					SHALE	(7.3 - 8.0) SHALE: SHALE, gray, weathered, dry, brittle, orange mottling.
8						

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SOIL BORING LOG

WELL NO.: **ASB-053**

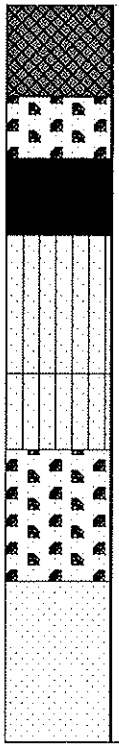
TOTAL DEPTH: **8.00**

PROJECT INFORMATION

PROJECT: **Ford Ranger Plant**
SITE LOCATION: **St. Paul Minnesota**
LOGGED BY: **TNK**
DATE STARTED: **7/5/2007 12:00:00 PM**
DATE COMPLETED: **7/5/2007 12:25:00 PM**

DRILLING INFORMATION

DRILLING CO.: **Matrix Environmental, LLC**
DRILLER: **Matrix**
DRILLING METHOD: **Direct Push**
COORDINATES:
Northing: 4973287.2317
Easting: 485153.4035
ELEVATIONS (feet MSL):
Surface: 838.15

DEPTH (feet)	SOIL SYMBOLS	BLOWS (\6 inches)	PID (ppm)	RECOVERY (in.)	USCS/ STRATIGRAPHIC UNITS	SOIL DESCRIPTION
0		NA	0.5	43	OL	(0.0 - 1.0) OL: FILL (ORGANIC SOIL WITH SAND), dark brown, organics, very fine to medium grained, mostly fine, loose, dry,
					GP	(1.0 - 1.7) GP: FILL (POORLY GRADED GRAVEL WITH SAND), brown, very fine to very coarse grained, mostly coarse, glass, minor silt, metal, brick, loose, dry
2					CL	(1.7 - 2.5) CL: LEAN CLAY, grayish brown, trace gravel, rounded, orange mottling, soft, moist.
					SM	(2.5 - 4.0) SM: SILTY SAND, black, very fine to medium grained sand, mostly medium, some silt, soft.
4		NA	0.1	40	SM	(4.0 - 4.8) SM: SILTY SAND, orangish brown, very fine to medium grained, mostly fine, trace gravel, subrounded, up to 1/2", soft, moist.
					GP	(4.8 - 6.3) GP: POORLY GRADED GRAVEL WITH SAND, light brown, very fine to very coarse grained, mostly coarse, subrounded to angular, up to 1/2", trace pyrite, loose, dry
6					SP	(6.3 - 8.0) SP: SILTY SAND WITY GRAVEL, light brown, fine to coarse grained, mostly medium to coarse, minor gravel, subangular, up to 1", dry.
8						

ARCADIS

SOIL BORING LOG

WELL NO.: **ASB-054**

TOTAL DEPTH: **8.00**

PROJECT INFORMATION

PROJECT: **Ford Ranger Plant**
SITE LOCATION: **St. Paul Minnesota**
LOGGED BY: **TNK**
DATE STARTED: **7/5/2007 11:35:00 AM**
DATE COMPLETED: **7/5/2007 11:55:00 AM**

DRILLING INFORMATION

DRILLING CO.: **Matrix Environmental, LLC**
DRILLER: **Matrix**
DRILLING METHOD: **Direct Push**
COORDINATES:
Northing: 4973293.3182
Easting: 485137.7446
ELEVATIONS (feet MSL):
Surface: 837.26

DEPTH (feet)	SOIL SYMBOLS	BLOWS (\6 inches)	PID (ppm)	RECOVERY (in.)	USCS/ STRATIGRAPHIC UNITS	SOIL DESCRIPTION
0		NA			OL	(0.0 - 0.7) OL: FILL (ORGANIC SOIL WITH SAND), black, organics, very fine to medium coarse, mostly finegrained, minor, silt, loose, dry.
					GM	(0.7 - 2.3) GM: FILL (POORLY GRADED GRAVEL WITH SAND), yellowish brown, very fine to very coarse grained, mostly medium to coarse, subrounded to angular, up to 2 1/2", trace silt, loose, dry.
2			0.0	38		(2.3 - 2.6) SM: FILL (SILTY SAND), black, very fine to medium grained, mostly fine, organics, soft, moist.
					SM	
					ML	(2.6 - 4.0) ML: SILTY SAND, orangish brown, very fine to coarse grained, mostly medium, trace gravel, subrounded, up to 1/2", cohesive, soft, moist.
4		NA			ML	(4.0 - 4.5) ML: SILTY SAND, orangish brown, very fine to coarse grained, mostly medium, trace gravel, subrounded, up to 1/2", cohesive, soft, moist.
					GP	(4.5 - 5.7) GP: POORLY GRADED GRAVEL WITH SAND, light yellowish brown, very fine to very coarse grained, mostly coarse to very coarse, subrounded to angular, up to 2", loose, dry.
6			0.4	42	SP	(5.7 - 7.3) SP: POORLY GRADED SAND, light brown, very fine to coarse grained, mostly medium, trace silt, loose, dry.
					SHALE	(7.3 - 8.0) SHALE: SHALE, gray, weathered, dry, brittle.
8						

Reviewed By:
Approved By:
Project No:
File Location
Date: 9/5/2007