LNAPL INVESTIGATION WORK PLAN
TMW-130 AREA

FORMER GENERAL MOTORS FAIRFAX I PLANT
KANSAS CITY, KANSAS

JUNE 2007
REF. NO. 012559 (14)

TABLE OF CONTENTS

LIST OF FIGURES
(Following Text)

1.0 INTRODUCTION AND BACKGROUND

Investigations have been conducted at the former General Motors (GM) Fairfax I Plant Site in Kansas City, Kansas (Site) in 1998, 1999, 2000, 2001, 2004, 2005, and 2006 to summarize soil and groundwater conditions at the Site. This Site comprises the property of the Former GM Fairfax I manufacturing facility with the exception of a parcel of land (Tract 2) which has been addressed under a separate program.[1] The results of these investigations have been reported to the Kansas Department of Health and Environment (KDHE). The most recent correspondence from the KDHE for this Site dated March 12, 2007 and entitled "Former GM Fairfax I Plant, Voluntary Cleanup Investigation (VCI) Report" presented KDHE's responses to their review of the report entitled "Additional Groundwater and Soil Sampling Data" (CRA, February 2007). As a result of the March 12, 2007 correspondence, this Work Plan has been prepared by Conestoga-Rovers & Associates (CRA) on behalf of GM for soil and groundwater investigations to be conducted at the Site. Refer to Figure 1.1 for the Site location. Figure 1.2 presents the Site plan and the approximate locations of the monitoring wells at the former Fairfax I Plant Site.

In their March 12, 2007 correspondence and in a subsequent March 22, 2007 conference call, the KDHE expressed the following concerns at the areas within the former GM Fairfax I Site:

i) additional investigation is required with concern to temporary monitoring well TMW-130 to demonstrate that the light non-aqueous phase liquid (LNAPL) present in the well is not affecting the condition of the downgradient wells;
ii) additional investigation using sampling policy #BER-RS-46 is recommended to determine whether arsenic levels in the groundwater from temporary monitoring wells TMW-127 and TMW-123 is "attributable to site-wide conditions"; and
iii) additional monitoring wells are to be installed in areas "where new contamination has been identified".

This Work Plan details the investigative sampling and analytical protocols to be used during the soil and groundwater sampling activities presented in this report which will address the concerns expressed by KDHE. This Work Plan is prepared as an addendum to the previously approved work plan entitled "Pre-Design Investigations Work Plan" (CRA, August 2001) (Approved Work Plan). Activities not explicitly in the Approved

[1] Please refer to the February 13, 2007 letter from the KDHE confirming the No Further Action Determination for this Tract 2 Site.

Work Plan (such as LNAPL sampling) are provided in this addendum. GM's overall goal in this investigation is to pursue a No Further Action (NFA) Determination for the former GM Fairfax I Plant Site.

The Scope of Work (SOW) discussed in this Work Plan is primarily focused on addressing the presence and distribution of LNAPL in the vicinity of monitoring well TMW-130. As such, the work proposed to be completed in this phase or stage of LNAPL studies will be on the presence of a separate phase of petroleum hydrocarbons in soil and in groundwater. Once the LNAPL distribution and source are better understood, then dissolved phase sampling may be initiated in groundwater samples at existing or at additional proposed monitoring wells.

The SOW of this Work Plan also includes repeat groundwater sampling for arsenic; however, this repeat sampling is specific to two existing temporary monitoring wells.

Finally, as requested in the March 12, 2007 letter from the KDHE, CRA (on behalf of GM) has prepared a Work Plan for routine quarterly groundwater sampling across the Site. This SOW will be submitted to the KDHE under separate cover and is not included herein.

2.0 SCOPE OF WORK

In order to address the concerns expressed by KDHE in the March 12, 2007 correspondence, two separate investigations will be conducted:

i) ***Part 1*** - sampling of groundwater from existing temporary monitoring wells TMW-123 and TMW-127 for arsenic; and

ii) ***Part 2*** - investigation of the source and extent of LNAPL detected previously at temporary monitoring well TMW-130.

2.1 PART 1

Part 1 of the investigation consists of sampling groundwater from temporary monitoring wells TMW-123 and TMW-127 for both total and dissolved arsenic. The sampling activities are being conducted to demonstrate that past sampling at these wells included analysis of suspended material which skewed the arsenic result. These wells will therefore be redeveloped, sampled with low stress/low flow techniques, and analyzed for both total and dissolved fractions. These sample results should establish that arsenic is not present in the groundwater above the KDHE criteria. Part 1 includes the following tasks:

- Redevelop/repurge temporary monitoring wells TMW-123 and TMW-127;
- Resample using low stress/low flow techniques;
- Collect both filtered and unfiltered samples;
- Analyze samples for arsenic only; and
- Report findings to the KDHE under separate cover.

2.2 PART 2

Part 2 of the investigation consists of investigating the source and distribution of LNAPL previously observed at TMW-130. This investigation will initially focus on the presence or absence of LNAPL in soils and groundwater in and near TMW-130. The methods of LNAPL studies will rely on visual, physical, and odor indications initially. A separate program may be necessary to evaluate the dissolved phase. As such, groundwater sampling for volatile organic compounds (VOCs) may be implemented at existing monitoring wells or at additional new monitoring wells. Again, the focus of Part 2

presented herein is to identify the source type and general distribution of the LNAPL. Part 2 includes the following tasks:

- Conduct bailout tests of LNAPL at TMW-130 (see procedure in Section 5.1). Collect an LNAPL sample for typing/age analyses and physical characteristics (e.g., specific gravity and viscosity);
- Install four similar temporary monitoring wells (TMWs) around TMW-130 approximately 50 feet from TWM-130 (one in each direction [N/S/E/W]). At two to three of these TMW boring locations, collect soil samples for analysis of grain size, bulk density, and fraction of organic carbon (foc). The final quantity of soil samples will be determined based on field observations;
- Following well installation, develop newly installed temporary wells;
- Advance from 10 to 15 additional soil borings around TMW-130 (approximately 15 feet below ground surface) and observe and log soil conditions (physical characteristics, photoionization detector (PID) readings, and visual oil/petroleum impacts);
- Perform hydraulic monitoring/visual observation of fluid/LNAPL levels in the four new temporary wells for approximately 1 to 2 weeks. For each TMW where LNAPL is detected (including TMW-130), perform bailout test and collect an LNAPL sample for typing/age analyses and physical characteristics;
- Depending on field observations and geotechnical and laboratory data, the need to install four additional TMWs to further evaluate LNAPL extent will be determined;[2]
- Monitor fluid levels in all TMW locations around TMW-130 weekly for 1 month;
- Compile data and evaluate; and
- Prepare a Remedial Action Plan for this focused area.

The LNAPL bailout tests are intended to evaluate if the LNAPL is originating in the soils just around the well and has entered the well due to capillary pressure differences, or if the LNAPL is more prevalent and a continuous, extensive area of soil and groundwater impacts exist.

The installation of new temporary monitoring wells around TMW-130 with a program of fluid level measurements and bailout tests will determine the general distribution of LNAPL within the groundwater, if any. Monthly measurements will allow for an investigation of water table fluctuations and its role in the detection of LNAPL in wells.

[2] The location of the additional TMWs will be based upon the distribution of the LNAPL, if any.

The LNAPL product, if more than negligible quantities are found, will be analyzed to determine its source type and relative age.

Soil borings are to be drilled in the area around the TMW-130 location and, should it become necessary, around other newly installed temporary wells which show measurable levels of LNAPL. The main purpose of these soil borings is to evaluate if the vadose zone contains sufficient quantities of residual hydrocarbon which may be acting as a source of LNAPL to only TMW-130 or to groundwater itself in this area.

Section 3.0 of this Work Plan presents procedures for equipment cleaning. General sampling protocols, such as proper labeling, chain of custody procedures, and sample containers and handling can be found in Section 4.0. Section 5.0 presents the field sampling procedures, including LNAPL bailout test methods, soil screening techniques, borehole advancement procedures, soil sampling protocols, temporary monitoring well installation, and groundwater sampling methods, including hydraulic monitoring, purging, and low stress/low flow sampling techniques. Analytical protocols and methods are presented in Section 6.0. Materials and equipment to be used for purging, sampling, etc. are listed in Section 7.0. Section 8.0 presents waste handling protocols.

Field activities will be conducted in accordance with the previously submitted Approved Work Plan (CRA, August 2001) and, where appropriate, GM's ENCORE Field Method Guidelines). A Site-Specific Health and Safety Plan (HASP) (CRA, October 2006) has been prepared and will be kept on Site during performance of the work.

3.0 EQUIPMENT CLEANING

A temporary equipment decontamination facility will be constructed and operated at the Site. See the Approved Work Plan (CRA, August 2001) for drilling and sampling equipment cleaning protocols. Decontamination water will be containerized per Section 8.0.

4.0 GENERAL SAMPLING PROTOCOLS

4.1 SAMPLE LABELING

Each sample will be labeled with a unique sample code that will facilitate tracking and cross-referencing of sample information. Sample labeling protocols are provided in the Approved Work Plan (CRA, August 2001).

4.2 CHAIN-OF-CUSTODY FORMS

CRA chain-of-custody records will be used to track all samples from time of sampling to the arrival of samples at the laboratory. Chain-of-custody protocols are provided in the Approved Work Plan (CRA, August 2001).

4.3 SAMPLE CONTAINERS AND HANDLING

All samples will be placed in appropriate sample containers, labeled and properly sealed. Foam chips or bubble pack will be used to cushion sample containers. Samples will be kept cool by the use of sealed plastic bags of ice. A trip blank will accompany each shipment of groundwater samples submitted for VOC analysis. Additional sample container handling protocols are provided in the Approved Work Plan (CRA, August 2001).

5.0 FIELD SAMPLING PROCEDURES

5.1 LNAPL BAILOUT TEST

LNAPL bailout tests will be performed prior to LNAPL sampling at each well where LNAPL is present. Each bailout event will begin with fluid phase measurements in each of the wells included in the sampling event through the use of an oil/water interface probe, as well as a notation of the diameter of the well. Each well exhibiting the presence of LNAPL will be bailed until the standing oil within the well has been removed.

LNAPL will be removed from the well using a well-dedicated polyethylene bailer. Care should be taken that the removal of any water present in the well is kept to a minimum.

The LNAPL will be placed directly into a container that can be securely covered. During filling, the container will be placed either on a sheet of polyethylene covered with absorbent material or within a larger container. Once the bailout test at a well is complete, the container will be securely covered, transported to a designated drum storage area, and the contents carefully transferred into a secure container for storage prior to off-Site disposal.

After a period of 24 hours has passed, fluid phase measurements will be conducted at each well where a bailout test was conducted to determine the quantity of LNAPL which as recovered into the well. Both the post-bailout LNAPL level and the post-bailout water level will be recorded.

5.2 LNAPL SAMPLING PROCEDURES

If LNAPL is present in a monitoring well in any quantity greater than a sheen, LNAPL samples will be collected according to the following procedures:

i) A new pair of disposable nitrile or latex gloves will be used for each sample.

ii) Prior to use at each sampling location all sampling equipment will be decontaminated in accordance with Section 3.0.

iii) The sample shall be collected using a disposable bailer. The LNAPL shall be poured directly into the sample containers.

iv) Sample containers will be placed in a shipping container.

v) To prevent cross-contamination of samples, all equipment used during the sampling procedures that may have come in contact with LNAPL will be dedicated and disposed of or decontaminated in accordance with Section 3.0.

5.3 SOIL SCREENING TECHNIQUES

During advancement of soil borings and boreholes for monitoring wells, all soil samples will be screened for the presence of petroleum hydrocarbons using field-screening techniques. Field screening will be performed using a PID as well as using visual and olfactory techniques. Soil samples will be prepared for field screening in the following manner.

- A discrete, representative portion of soil will be collected from each split-spoon and half will be deposited into a polyethylene bag. The bag shall be sealed immediately and labeled with the location, date, time, and sample depth;
- The soil will remain undisturbed for several minutes to equilibrate;
- The PID will be used to monitor the air contained in the bag for the presence of petroleum hydrocarbon vapors;
- Visual observations of petroleum impacts will be noted in the log book; and
- Odor or petroleum smells will be noted in the log book.

5.4 BOREHOLE ADVANCEMENT

Geoprobe Soil Borings

The locations of proposed boreholes will be cleared through a process which includes consultation with the Fairfax Drainage District. Boreholes will be advanced using direct push (e.g., Geoprobe®) drilling methods. Each delineation boring will be advanced to a depth of approximately 14 feet below ground surface (bgs). Continuous soil samples will be collected in advance of the drilling equipment. Soil samples will be described and classified according to the Unified Soil Classification System (USCS) by a CRA geologist. Field screening will be conducted on each soil sample in accordance with Section 5.3.

The soil sample collection interval will be determined by a combination of PID headspace readings and/or visual observations.

Those soil borings that are being converted into temporary monitoring wells will be completed following the procedures outlined in Section 5.5. All other soil borings will be abandoned by backfilling with cement/bentonite grout. The ground surface at each location will be returned, as closely as possible, to its original condition.

5.5 TEMPORARY MONITORING WELL INSTALLATION

The locations and construction of the temporary monitoring wells will be cleared through a process which includes consultation with the Fairfax Drainage District. Temporary monitoring wells will be installed using a hollow-stem auger (HSA) drill rig with between 2.5- and 4.25-inch inside diameter augers. The temporary wells will be constructed of nominal 2-inch diameter PVC screens (No. 10-slot), and nominal 2-inch diameter schedule 40 PVC riser pipe. The temporary wells will be installed through the hollow stem of the augers. During construction, the riser pipe will be capped temporarily to prevent the entrance of foreign materials into the well.

The TMW will be backfilled with sand to a minimum depth of 1 foot above the well screen and will be completed to the surface with bentonite. All drill cuttings will be drummed and disposed of accordingly.

The PVC riser at each temporary monitoring well location will be completed above grade. The well casing will be capped with either a screw on cap or with an expandable locking cap.

Temporary monitoring well identifiers will begin with TMW-139. The temporary monitoring wells will remain in place until this investigation program is completed, after which time they will be abandoned in accordance with State regulations.

5.6 TEMPORARY MONITORING WELL DEVELOPMENT

In order to establish good hydraulic communication with the aquifer and reduce the volume of sediment in the wells, the temporary wells will be developed. Well development will be conducted in accordance with the procedures outlined below:

i) Water will be purged from the well using a peristaltic pump or an electronic submersible pump and dedicated tubing.

ii) Groundwater will be collected at regular intervals and the pH, temperature, and conductivity measured using field instruments. These instruments will be

calibrated daily according to the manufacturer's specifications. Additionally, observations such as color, odor, and turbidity of the purged water will be recorded.

Development will continue until the turbidity of the monitoring wells are significantly reduced and three consistent readings of pH, temperature, and conductivity are recorded, or a minimum of ten well volumes are purged.

5.7 MONITORING WELL GROUNDWATER SAMPLING PROTOCOLS

5.7.1 GROUNDWATER HYDRAULIC MONITORING

As detailed in the Approved Work Plan (CRA, August 2001), prior to collecting groundwater samples, the groundwater level in each monitoring well will be measured using an electronic sounding device, and the water level will be recorded in the field log.

5.7.2 MONITORING WELL PURGING AND SAMPLING

Groundwater samples for arsenic analyses will be collected at temporary monitoring wells TMW-123 and TMW-127. Each groundwater monitoring well will be purged prior to sampling using low stress/low flow methods to minimize the presence of fine-grained, suspended sediment. During monitoring well purging the turbidity, temperature, pH, conductivity, dissolved oxygen (DO), and oxidation-reduction potential (ORP) of the groundwater will be monitored to confirm stabilization of groundwater within the monitoring well with the screened formation and thus collection of representative groundwater samples from the aquifer. Specifically, groundwater samples will be collected in accordance with the following protocols.

Prior to groundwater sample collection a static water level measurement will be taken at each well. The shallow wells each will be purged by peristaltic pump, bladder pump, or submersible electronic pump at a rate of from 100 to 500 milliliters per minute (mL/min). During purging, the water level should be monitored approximately every 5 minutes, or as appropriate, and drawdown should not exceed 0.3 feet. Field parameters should be recorded approximately every 5 minutes. Purging is considered complete once sediment free groundwater is obtained and three consecutive readings for each parameter are within the following limits:

pH ± 0.1 pH units of the average value of the three readings;

temperature	± 3 percent of the average value of the three readings;
conductivity	± 0.005 milliSiemen per centimeter (mS/cm) of the average value of the three readings for conductivity <1 mS/cm and ± 0.01 mS/cm of the average value of the three readings for conductivity >1mS/cm;
ORP	± 10 millivolts (mV) of the average value of the three readings;
DO	± 10 percent of the average value of the three readings; and
turbidity	± 10 percent of the average value of the three readings, or a final value of less than 5 nephelometric turbidity units (NTU).

If stabilization of the field parameters has not occurred for all field parameters, purging is continued until a maximum of 20 well screen volumes have been purged from the well. The screen volume is based on a 5-foot screen length. After purging 20 screen volumes, purging is continued if the purge water remains visually turbid but appears to be clearing or if stabilization parameters are slightly outside of the stabilization criteria but appear to be approaching stabilization.

Samples collected for dissolved analyses will be field filtered prior to sample preservation using a dedicated 0.45-micron filter. The filtered sample will be placed directly into a preserved laboratory-supplied sample container.

5.8 SURVEYING

Upon monitoring well installation completion, a qualified, licensed land surveyor will survey the locations of all new monitoring wells. Ground surface elevations will also be measured at each location, as will the elevations of the tops of monitoring well risers. Soil borings will be surveyed for location and elevation. The survey will locate horizontal coordinates to an accuracy of ±0.1 foot and vertical elevations to ±0.01 feet based on a Site-specific datum.

6.0 ANALYTICAL PROTOCOLS AND METHODS

Groundwater samples collected at TMW-123 and TMW-127 will be analyzed for total and dissolved arsenic by U.S. EPA SW-846 Method 6010B.

Soil samples collected during this program will be analyzed for grain size, bulk density, and fraction of organic carbon.

LNAPL samples collected during this program will be analyzed for physical characteristics (e.g., specific gravity and viscosity) and also submitted for typing/age analyses.

6.1 QUALITY ASSURANCE/QUALITY CONTROL

To ensure the validity of the sampling and analysis program, field quality control (QC) samples will be collected with the investigative samples. Field QC samples for total and dissolved arsenic analysis will consist of collection of one matrix spike/matrix spike duplicate (MS/MSD) groundwater sample during each monitoring event to be analyzed by the laboratory to provide information on the precision of the sampling procedures. A duplicate sample will not be collected for arsenic analysis.

More specifics on the Quality Control process are provided in the Sampling and Analysis Plan (SAP) and the Quality Assurance Project Plan (QAPP) for the Site. The SAP is provided as Appendix A and the QAPP is provided as Appendix B of the Approved Work Plan (CRA, August 2001).

7.0 MATERIALS AND EQUIPMENT

The following equipment may be used for well development, purging, and sampling at the Site depending on well configuration, groundwater flow rate and quality, depth to water table, and parameters of interest.

Bailers

Reusable or disposable bailers may be used for well development, purging, and sampling. Reusable bailers will be constructed of stainless steel. Disposable single-use bailers will be constructed of polyethylene, polyvinyl chloride (PVC), or Teflon®.

Rope

Rope will be made of braided nylon. New rope will be used for each well or sampling point.

Pumps

The following pumps may be used for well development and purging:

- submersible impeller driven pumps (e.g., Grundfos® pumps, Typhoon pumps, Monsoon pumps, whale pumps);
- submersible pneumatic pumps (e.g. bladder pumps); and
- peristaltic pumps.

The following pumps may be used for well sampling:

- Submersible impeller driven pumps – stainless steel construction (e.g., Grundfos® pumps, Typhoon pumps, Monsoon pumps);
- Submersible impeller driven pumps – PVC construction (e.g., whale pumps) will be not be used for collecting VOC samples (including formaldehyde);
- Submersible pneumatic pumps (e.g. bladder pumps); and
- Peristaltic pumps.

8.0 WASTE HANDLING PROTOCOLS

All wastes that are generated during the investigation will be stored, transported, and disposed in accordance with all applicable State and Federal regulations. Every effort will be made to minimize the amount and toxicity of wastes generated. It is anticipated that the following wastes will be generated during the investigation:

i) All purge water removed during monitoring well development and sampling will be collected in 55-gallon steel drums or polyethylene temporary storage tanks and will be characterized for off-Site disposal;

ii) Decontamination fluids, primarily water, will be generated to assure equipment is properly cleaned between locations. Decontamination waters will be collected in 55-gallon steel drums or polyethylene temporary storage tanks along with well development and purge waters. Every effort will be made to minimize the amount of decontamination fluids generated by using dedicated and/or disposable equipment;

iii) Soils from soil borings will be containerized in 55-gallon steel drums. Upon completion of investigation activities, a sample of the containerized soils will be obtained for waste characterization and profiling;

iv) Any LNAPL bailed from TMWs will be containerized in lined 55-gallon steel drums or polyethylene temporary storage tanks. Upon completion of investigation activities, a sample of the containerized LNAPL will be obtained for waste characterization and profiling; and

v) Disposable personal protective equipment (PPE) used during the investigation will be containerized and disposed of with the other material.

All waste manifests, bills of lading, and other related paperwork will be maintained in the project files. All waste will be stored, transported, and disposed in accordance with applicable Federal and State rules and regulations.

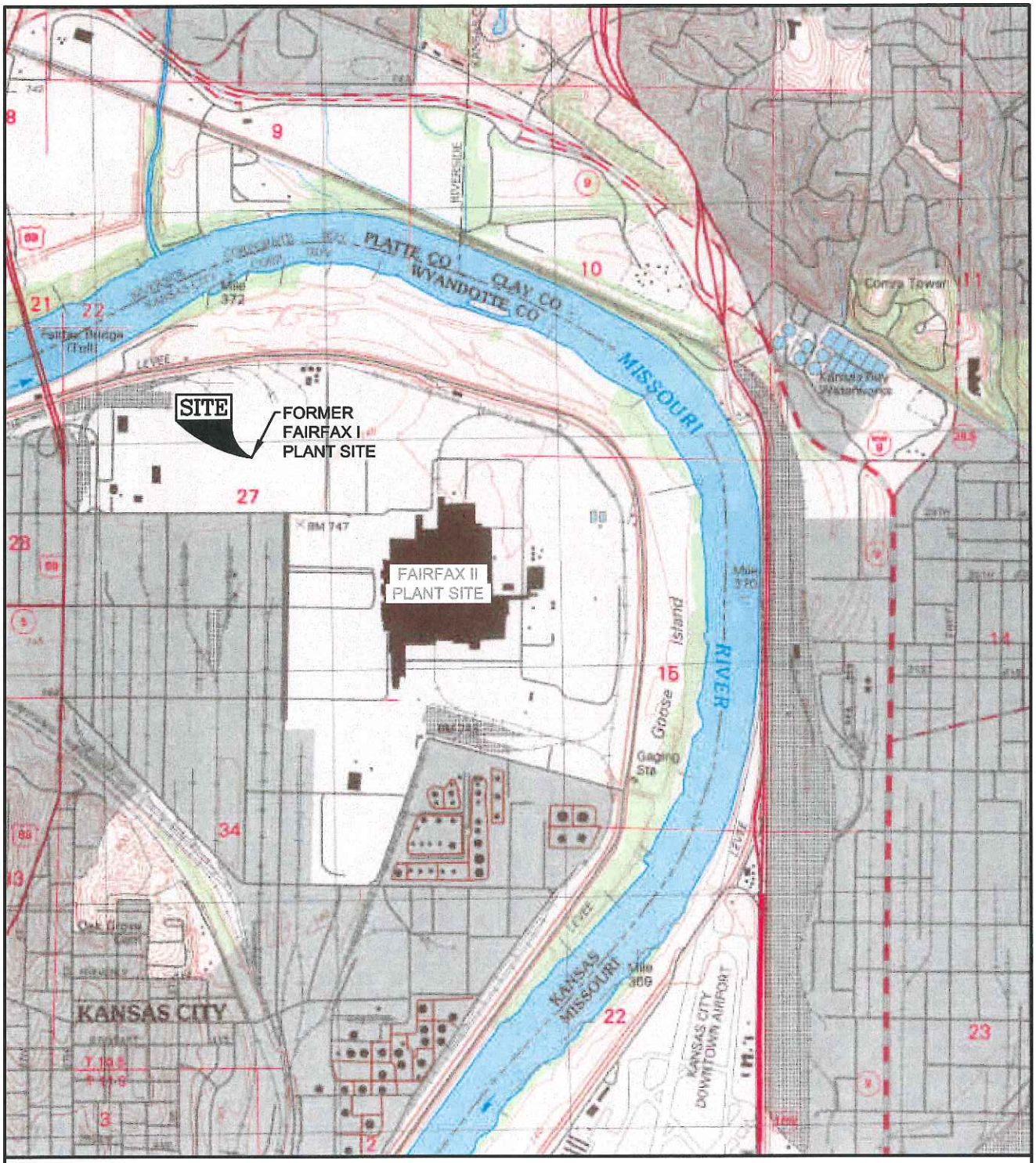
All drums will be labeled as to their origin and contents and stored at a suitable location on Site pending final disposal disposition. GM via CRA will be responsible for preparing waste profiles and manifests or bills of lading for all waste shipments.

9.0 REPORTING OF FINDINGS

GM will prepare summary documents describing the field studies and the results of the investigations presented in this Work Plan. Upon receipt of final laboratory data and upon an evaluation of the new Site data with existing information, GM will prepare the following letter format reports:

- Result of LNAPL Investigations in the Vicinity of TMW-130 (Part 1 of this Work Plan); and
- Results of Groundwater Sampling and Analysis for Arsenic at TMW-123 and TMW-127 (Part 2 of this Work Plan).

These letter reports will be submitted to the KDHE along with pertinent supporting information relevant to the specific studies. It is also anticipated that these letter reports will provide the next steps for further investigation or remediation as necessary for each area of interest.



BASE SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE;
NORTH KANSAS CITY, MO-KS 1990

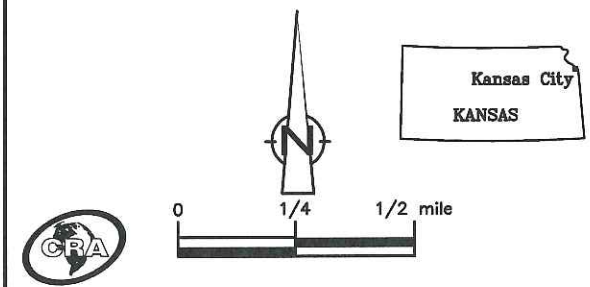


figure 1.1

SITE LOCATION MAP
FORMER FAIRFAX I PLANT SITE
Kansas City, Kansas

012559-04(014)GN-CO001 MAY 15/2007

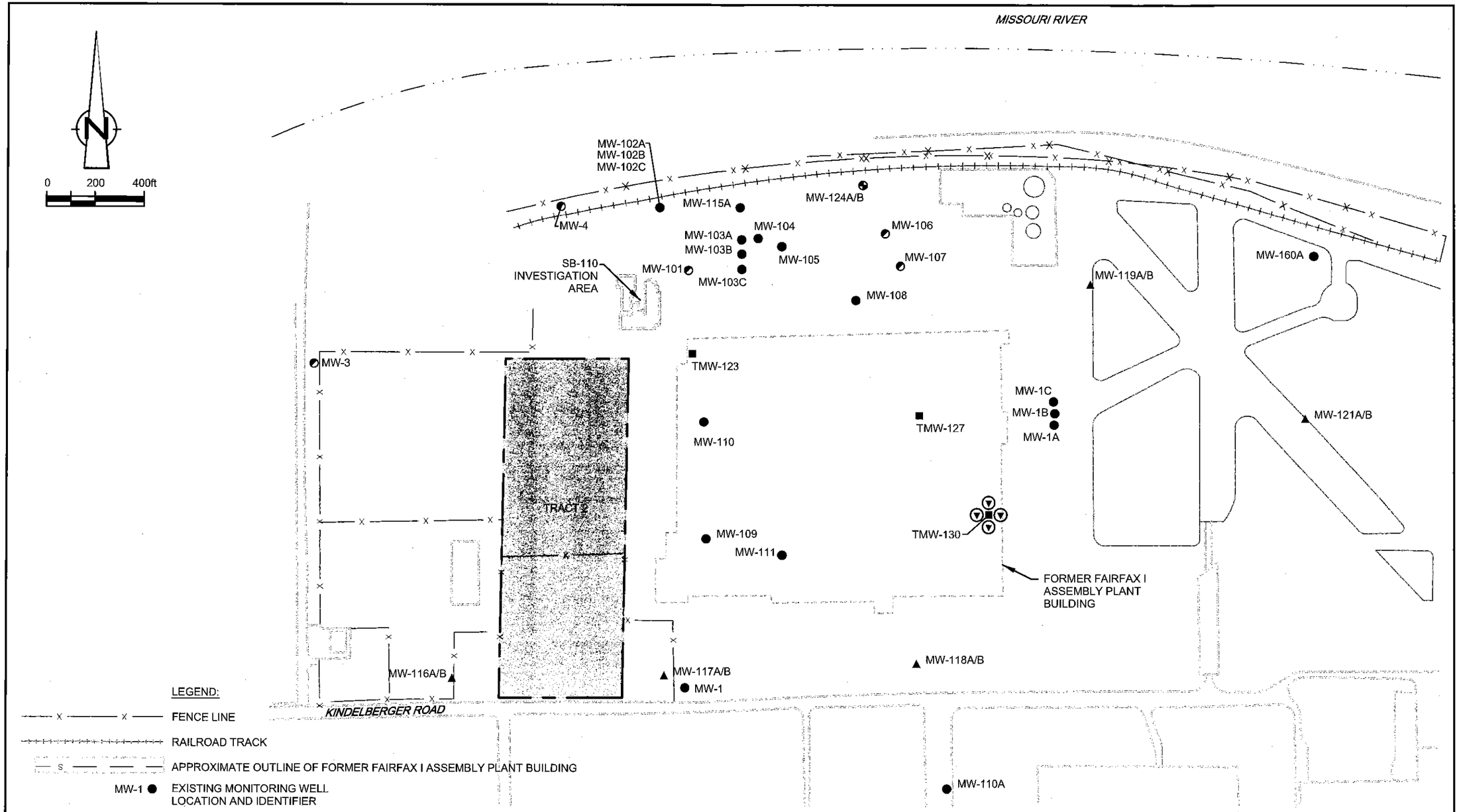


figure 1.2

SITE PLAN
FORMER FAIRFAX I PLANT
Kansas City, Kansas

012559-04(014)GN-CO002 JUN 12/2007