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Supplemental RFI - Volume I
(Methodologies and Results)
General Motors Powertrain Group
Moraine Engine Plant &
General Motors Truck Group
Moraine Assembly Plant
Moraine, Ohio
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1. Introduction

This Supplemental Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) report presents the technical approach, methodologies, investigation results, and conclusions for investigations conducted for the General Motors Truck Group Moraine Assembly Plant (Moraine Assembly) and the General Motors Powertrain Group, Moraine Engine Plant (Moraine Engine). These investigations were designed to supplement investigations previously conducted for Delphi Harrison Thermal Systems Moraine Plant (Delphi Thermal Moraine) presented in the draft RCRA Facility Investigation Final Report (Geraghty & Miller, Inc. 1996 and ENVIRON Corporation 1996). For the purposes of RCRA Corrective Action, the General Motors Corporation (GM) "site" in Moraine, Ohio, comprises Moraine Assembly, Moraine Engine, and Delphi Thermal Moraine (Figure 1-1). The Moraine Assembly and Moraine Engine facilities will be referred to as the GM Eastern Facilities.

Delphi Thermal Moraine, formerly Harrison Radiator Division, received an Administrative Order (Docket No. V-W-91R-2) from the United States Environmental Protection Agency (U.S. EPA) Region V, which became effective on January 30, 1991. The Administrative Order, issued under Section 3008(h) of RCRA, as amended, 42 U.S.C. 6928(h), required GM to implement a RCRA Corrective Action program at the Delphi Thermal Moraine facility consisting of the following: (1) perform Interim Measures, (2) conduct an RFI, and (3) conduct a RCRA Corrective Measures Study (CMS), if necessary.

GM is currently meeting the requirements of the Administrative Order by implementing an Interim Measure and through the completed two-phased RFI investigation. As part of the RCRA Corrective Action process, a Description of Current Conditions (DOCC) and RFI Work Plans were prepared for Delphi Thermal Moraine (Geraghty & Miller, Inc. 1991, 1992, 1993, 1994). The Interim Measure was implemented per the Final Interim Measures Design Plans (Geraghty & Miller, Inc. 1995), which was approved by the U.S. EPA in a July 31, 1995 letter. The current, on-going interim measures consist of controlling migration of volatile organic compounds (VOCs) in the shallow and deep aquifers at the southern property boundary through groundwater extraction at TW-2 and DN-13, respectively. The findings of the RFI for Delphi Thermal Moraine, including a Baseline Risk Assessment, were reported to the U.S. EPA in a draft RCRA Facility Investigation Final Report (Geraghty & Miller, Inc. 1996 and ENVIRON Corporation 1996). The draft RCRA Facility Investigation Final

Report determined a CMS was not necessary for the solid waste management units (SWMUs) investigated in the RFI at Delphi Thermal Moraine.

In April 1991, a Preliminary Assessment/Visual Site Inspection (PA/VSI) of the GM Eastern Facilities was conducted on behalf of the U.S. EPA (PRC Environmental Management, Inc. 1991a and b). In response to the findings of the PA/VSI reports, on-going RFI activities at the adjacent Delphi Thermal Moraine, and extensive discussions between U.S. EPA and GM, the U.S. EPA issued an Amendment to the Administrative Order (Docket No. VW-R-002-91), effective on April 24, 1997, which included the GM Eastern Facilities in the Corrective Action program. This Amendment required GM to conduct a supplemental RFI at the two additional facilities.

The Supplemental DOCC and the Supplemental RFI Work Plan were submitted to the U.S. EPA on July 21, 1997 (Geraghty & Miller, Inc. 1997a and b). The Supplemental DOCC report included a description and evaluation of each Area of Interest (AOI) at the GM Eastern Facilities (including AOIs identified in the PA/VSIs and others identified by GM) and the current state of knowledge regarding the environmental setting. The Supplemental RFI Work Plan presented an investigation strategy to characterize AOIs where releases of hazardous constituents may have occurred. The U.S. EPA provided comments on these work plans to GM on October 7, 1997 and GM submitted responses to these comments to the U.S. EPA on November 5, 1997. On December 22, 1997, GM received an approval letter with some modifications regarding these work plans from the U.S. EPA (U.S. EPA December 19, 1997). Copies of Supplemental RFI correspondence are provided in Appendix A.

1.1 Supplemental RFI Objectives and General Approach

The principal objectives of the Supplemental RFI were to identify potential releases from AOIs, to determine the nature and extent of any identified release where possible, and to evaluate the risks posed by the conditions at each AOI. If the risks were found to exceed acceptable levels, an additional interim measures and/or CMS would be recommended. Secondary objectives of the Supplemental RFI were to collect information necessary to support planning for an interim measure/CMS, if required, and to fulfill general requirements of the Administrative Order and the Amendment to the Administrative Order.

Following review of the 36 AOIs presented in the Supplemental DOCC, further investigation was recommended at six AOIs: AOI 7 - Former Oil House Area; AOI 13 - Buildings 4, 6, and 13; AOI 17 - Building 15; AOI 34 - Excavation Area 1; AOI 35 -

Excavation Area 2; and AOI 36 - Former Southwest Above Ground Storage Tanks (ASTs). Locations of these AOIs are indicated on Figure 1-2. The AOI investigations consisted of soil sampling and analysis. In addition, groundwater flow and quality was investigated. A summary of the Supplemental RFI field program implemented during 1997 and 1998 is presented in Table 1-1.

The general approach for these investigations was to first determine the scope of analyses based upon previous RFI work, site data, and process knowledge. Soil and groundwater sampling was conducted at AOIs for release determination and selected monitor wells were sampled to evaluate groundwater on a site-wide basis. This soil and groundwater data were intended to be used to support an evaluation of risk.

Consistent with the findings of the Delphi Thermal Moraine RFI and Baseline Risk Assessment, results of an evaluation of groundwater quality data historically collected from wells at the GM Eastern Facilities, presented in Section 2.6 of the Supplemental DOCC, indicated that chlorinated VOCs were believed to be the only potential constituents of concern in groundwater. Semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, herbicides, and cyanide were not detected in wells at or downgradient from the GM Eastern Facilities. Total metals and dissolved metals in groundwater (where analyses were available) were either not detected or were found at concentrations within the range of constituent concentrations evaluated at the Delphi Thermal Moraine facility, which were determined to not be of concern based on the Delphi Thermal Moraine Baseline Risk Assessment. Therefore, the site-wide groundwater quality investigation proposed for the Supplemental RFI focused on chlorinated VOCs. U.S. EPA requested that additional groundwater data be collected around the AOIs, GM agreed with this request, and as a result wells near AOIs were sampled and analyzed for VOCs, SVOCs, PCBs, and metals (U.S. EPA 1997 and Delphi 1997b). Copies of these letters are provided in Appendix A.

As a result of U.S. EPA's review of the Draft RFI Final Report for Delphi Harrison Thermal Systems (Geraghty & Miller, Inc. 1996 and ENVIRON Corporation 1996), the issue of groundwater plume delineation downgradient of the site was discussed in correspondence between U.S. EPA and GM (U.S. EPA correspondence to GM dated June 11, 1996; GM correspondence to U.S. EPA dated September 11, 1996; U.S. EPA correspondence to GM dated October 1, 1996). To address the U.S. EPA's concerns identified in this correspondence, additional evaluation of the groundwater quality associated with the three GM facilities was addressed within the Supplemental RFI Work Plan on a site-wide basis, and a new off-site, downgradient monitor well was installed.

1.2 Site Ownership

The current owner of the entire Moraine Facilities site is GM. In the near future, ownership of specific portions of the site (North/South Settling Lagoons and Landfills L1, L2, and L3 [shown on Figure 1-1]) will be transferred to the Remediation and Liability Management Company, Inc. (REALM). REALM is a wholly-owned subsidiary of GM and was formed for the purpose of providing strategic environmental management services for GM-owned sites.

1.3 GM Eastern Facilities Description

The GM Eastern Facilities occupy approximately 300 acres. The Moraine Engine and Moraine Assembly facilities are located in the City of Moraine in Montgomery County in southwestern Ohio, at 4100 Springboro Road and 2601 Stroop Road, respectively (Figure 1-1). A small portion of the GM property east of the Moraine Assembly facility is located in the City of Kettering. The approximate coordinates for the site boundaries are as follows: latitude 39° 41' 45" N and longitude 84° 13' 11" W. Figure 1-1 also indicates the property boundaries.

The GM site in Moraine, Ohio was acquired by Frigidaire from the World War I Wright Airplane Company in the mid-1920s. Frigidaire (a division of GM) produced appliances from the late 1920's until 1979. GM announced the shut down of all Frigidaire operations in January 1979. During 1980 and 1981, the majority of the former Frigidaire Plant 2 was converted to the Moraine Engine facility, and the former Frigidaire Plant 3 and the northeast corner of former Frigidaire Plant 2 were converted to the Moraine Assembly facility. The conversion at the Moraine Assembly facility included adding approximately 500,000 square feet (ft) to the existing structure. Several smaller additions occurred at the Moraine Assembly facility during the 1990s including the addition of the utility vehicle production operation and a new paint building in 1993 in preparation for building the redesigned utility vehicle (Figure 1-1).

Since 1981, Moraine Engine operations have included the machining, painting (this operation was discontinued in September 1995), and assembly of diesel truck engines. These engines are shipped to several truck assembly plants within GM and other commercial and industrial operations. Since 1981, Moraine Assembly operations initially included the manufacture, assembly, and painting of small trucks. Currently, Chevrolet Blazers, GM Jimmies, and Oldsmobile Bravadas are produced at this facility.

Since completion of the Supplemental DOCC in 1997, several site features have been modified. These features are shown on an updated basemap presented as Figure 1-1. The Former West Haulaway structures were removed in 1998 so that the DMAX Engine Plant (joint venture between GM and Isuzu) construction could begin. Construction activities are currently ongoing and the anticipated completion date is August-September 1999. An Overflow Parking Lot was constructed south of Moraine Engine and over AOIs 13, 17, and 36 (AOIs are discussed in Section 2.1) to support Moraine Assembly. This asphalt parking lot was completed during the summer of 1998. Construction of the Moraine Assembly expansion began in late 1997, where a new assembly plant and parking lot are being constructed east of the existing Plant 1 and constructed over AOI 35. A new employee parking lot and guard house was constructed in 1998, north of the Engine Plant and over AOI 34.

1.4 Supplemental RFI Report Organization

This Supplemental RFI report (Volume I) presents the technical approach and methodologies used for the field program; AOI investigation results and conclusions; groundwater flow and quality; the Supplemental Baseline Risk Assessment executive summary; and a summary of the Supplemental RFI findings and conclusions. The Supplemental Baseline Risk Assessment, completed by ENVIRON Corporation, is presented under separate cover as Volume II and is being submitted concurrently with Volume I.

2. Overview Of Supplemental RFI Activities

During the Supplemental RFI, groundwater and soil samples were collected and analyzed as proposed in the approved Supplemental RFI Work Plan and other sampling plans submitted to the U.S. EPA when additional AOI-specific investigations were recommended by GM. The Supplemental RFI was designed to collect the data necessary to support the Supplemental Baseline Risk Assessment (Volume II), to support planning for additional interim measures or a CMS (if required), and to fulfill the requirements of the Administrative Order and the Amendment to the Administrative Order.

2.1 Summary Of AOIs

A summary of the AOIs that were investigated as part of the Supplemental RFI is presented in the following sections. More detailed information was presented on these AOIs in Section 3.0 of the Supplemental DOCC (Geraghty & Miller, Inc. 1997a). AOI locations are indicated on Figure 1-2.

2.1.1 AOI 7 - Former Oil House Area

The Former Oil House (Building 7) was located north of the Moraine Engine Plant 3 (former Frigidaire Plant 2, Figure 1-1), and was built at least as early as 1949. The Former Oil House Area consisted of the Oil House (Building 7) and an outdoor area that contained underground storage tanks (USTs), ASTs, and a drum storage area. This AOI was removed from service in 1979 when at least three buildings were demolished and all tanks were removed and either replaced or reused. The Oil House Building 7 and associated outside structures covered a total area of approximately 48,000 square ft.

Virgin paints and chemicals necessary for production at the Frigidaire facilities were stored and mixed in the Oil House, and pumped or transferred to various production areas. Materials were stored in both drums and tanks. Materials were shipped to this area by railroad tank cars and tanker trucks. Virgin chemicals including oils, paints, thinners, solvents, acids, toluene diisocyanate (TDI) and resins were stored inside the Oil House. Alcohols were reclaimed and solvent blending activities were conducted at the Oil House.

The outdoor area just north of the Oil House had seventeen 8,000 to 15,000-gallon ASTs used to store oil, solvents, acids and other production materials, and three

15,000-gallon USTs used to store oil. According to the 1976 Spill Prevention Control and Countermeasure (SPCC) Plan (General Motors Corporation 1976), these tanks had a gravel floor and concrete containment dikes for spill containment. A drummed waste storage area was also located just north of the Oil House and was used to store drummed waste oils, thinners, alcohols, still bottoms from the Oil House and sludges containing chromium, nickel, and phosphorus.

Additionally, a May 1979 aerial photograph shows an area north of the Oil House was used for temporary storage of equipment, boxes, and drums during the conversion of Frigidaire Plant 2. As stated in the Supplemental DOCC, GM announced the shut down of all Frigidaire operations in January 1979. During 1980 and 1981, the majority of the former Frigidaire Plant 2 was converted to the Moraine Engine facility. A November 1979 aerial photograph showed that Building 7 had been demolished, and did not show evidence of the equipment, boxes, and drums seen in the May 1979 aerial photograph. Copies of both the aerial photographs were included in the October 16, 1998 letter from Delphi Thermal to U.S. EPA, which is presented in Appendix A.

AOI 7 is currently covered with asphalt, concrete, and the new Moraine Engine Tank Farm. This aboveground tank farm and pump house were constructed in 1980 over the footprint of the former Oil House tank farm. As concluded in the Supplemental DOCC, AOI 7 may be a potentially significant source for soil and groundwater contamination, and further investigation was warranted under the Supplemental RFI.

2.1.2 AOI 13 - Former Buildings 4, 6, And 13

Buildings 4, 6, and 13 of the Frigidaire facilities were located south of the Moraine Engine Plant 3 (Figure 1-1). Buildings 4 and 6 (also known as Moraine Engine Plant 4) consisted of approximately 300,000 square ft. Buildings 4 and 6 were constructed in 1917 and 1926, respectively, and the buildings had many previous uses including manufacturing of service parts, chemical storage, storage for oil recovery, and offices. Frigidaire discontinued operations in 1979, and by late 1981 these buildings were unoccupied without heat.

In 1983, GM removed ten PCB-contaminated electrical transformers from Buildings 4 and 6 and disposed of them off site at a Toxic Substances Control Act (TSCA)-approved facility. Prior to 1985, GM removed asbestos from piping within Buildings 4 and 6 and disposed of this material in an approved off-site facility. In 1990, GM conducted a comprehensive study of the wood floor block in these buildings. The results indicated that PCB's were present in the floor block. The wood floor block was

removed, the concrete floor beneath the wood floor block was cleaned and PCB sampling was conducted. Additionally, an area on the south side of Building 4, formerly used for plating, was impacted by metals (primarily cadmium). Decontamination activities began in 1995 and demolition of Buildings 4 and 6 took place in 1996.

Building 13 (also known as Moraine Engine Plant 5) was built in 1916 by the Cleveland and Lake Erie Railroad Company (C&LE) and was used for railroad maintenance. It covered an area of approximately 60,000 square ft. GM acquired the building in 1941. From 1941 until 1979, the building was used for maintenance purposes and storage. After 1979, part of Building 13 was used as a Hazardous Waste Storage Pad. The concrete storage pad covered an area of 2,400 square ft and had the capacity to store 250 55-gallon drums. It was used for storage of drummed quantities of waste paint thinner and sludges, chlorinated solvents, and non-hazardous waste oil and process fluids prior to removal from the facility. The former Hazardous Waste Storage Pad was clean closed in 1993, and closure was approved by the Ohio Environmental Protection Agency (Ohio EPA). Cleaning and decontamination activities of the remainder of the building began in 1995, and demolition of Building 13 took place in 1996. During demolition, a portion of a UST was found. The partial tank was approximately 5,000 gallons in volume and was determined to previously have contained fuel oil used for heating purposes. The UST was taken out of service prior to 1970. Soil samples were collected from the cavity wall during demolition activities and the results were well below the applicable Bureau of Underground Storage Tank Regulations (BUSTR) standards.

AOI 13 is currently covered with an asphalt parking lot that was constructed in 1998. As concluded in the Supplemental DOCC, there was a potential for AOI 13 to have been a potentially significant source for soil and groundwater contamination, and further investigation was warranted under the Supplemental RFI.

2.1.3 AOI 17 - Building 15

AOI 17 includes Building 15 and a former Frigidaire Plant 2 used-oil UST. Building 15 covered an area of approximately 17,000 square ft, and based on a review of aerial photographs, it was constructed prior to 1949. The building was used for maintenance purposes and included a truck maintenance repair area, an equipment steam booth area and a maintenance spray booth area located in the center of the building. The 900-gallon steel UST located south of Building 13 and north of Building 15 was used to store used oil from garage operations. It is unknown when this tank began operation.

The used oil present in the UST at closure contained VOCs (ethylbenzene, tetrachloroethene [PCE], toluene, and xylenes), but no VOCs were detected in the soil tested during closure activities. It was removed and clean closed under the BUSTR in 1994.

AOI 17 is currently covered with an asphalt parking lot that was constructed in 1998 (Building 15 was demolished and removed for off-site disposal as part of the parking lot construction). As concluded in the Supplemental DOCC, there was a potential for AOI 17 to have served as a historical source of chlorinated VOCs detected in monitoring well GM-21, and further investigation was warranted under the Supplemental RFI.

2.1.4 AOI 34 - Excavation Area 1

AOI 34 was located north of the Moraine Engine Plant 3 and west of Springboro Road, and was identified from a 1956 aerial photograph. The excavation area was approximately 300 ft long by 40 ft wide, with the southern end containing a depression that was possibly filled with liquid. This area was covered with grass at the time the Supplemental DOCC was completed and during the Supplemental RFI sampling (conducted in August 1997). No information was available regarding the types of materials which may have been handled in this area and their potential for releasing hazardous constituents. As concluded in the Supplemental DOCC, no specific basis existed for further investigation at AOI 34; however, a limited investigation to assess the potential presence of contamination was recommended. AOI 34 is currently covered with an asphalt parking lot that was constructed in 1998.

2.1.5 AOI 35 - Excavation Area 2

AOI 35 was located north of the Moraine Assembly Plant 1 and east of Springboro Road, and was identified from a 1956 aerial photograph. The excavation area was approximately 200 ft long by 150 ft wide. This area was covered by a parking lot at the time the Supplemental DOCC was completed and during the Supplemental RFI sampling (conducted in August 1997). No information was available regarding the types of materials which may have been handled in this area and their potential for releasing hazardous constituents. As concluded in the Supplemental DOCC, no specific basis existed for further investigation at AOI 35; however, a limited investigation to assess the potential presence of contamination was recommended. AOI 35 is currently covered by the parking lot associated with the new Moraine

Assembly plant. Construction activities began in late 1997 and will be completed in 1999.

2.1.6 AOI 36 - Former Southwest Above Ground Storage Tanks

AOI 36 was located in the southwest corner of the Moraine Engine facility and consisted of four sets of concrete AST saddles. The two southern-most sets of saddles consisted of four larger saddles per tank and were contained in an earthen dike area approximately 50 ft by 70 ft. The two northern-most sets of saddles consisted of two saddles per tank and were contained in a separate 40 ft by 55 ft earthen dike area. These tank saddles and earthen berms were identified during a site walkover in June 1997. A review of aerial photographs indicated that the two southern-most tanks were installed prior to 1949. One tank was installed on the northern-most set of saddles between 1949 and 1956. These three tanks were present in the 1975 aerial photograph, but had been removed prior to the 1990 aerial photograph. There was no evidence that the fourth set of saddles was ever used. Use of these tanks was thought to have ceased prior to the early 1970's; however, the tank saddles and earthen berms were still present during the Supplemental RFI investigation. No information was available regarding the types of materials which may have been handled in this area and their potential for releasing hazardous constituents. AOI 36 is currently covered with an asphalt parking lot that was constructed in 1998. As concluded in the Supplemental DOCC, no specific basis existed for further investigation at AOI 36; however, given the probable use of the area for storage of liquid materials, a limited investigation to determine if a release had occurred was recommended under the Supplemental RFI.

2.2 Technical Approach

2.2.1 Groundwater

Groundwater on the Moraine Engine and Moraine Assembly portion of the site has been characterized as a result of sampling conducted under various monitoring programs. During the Supplemental RFI, groundwater was characterized on a site-wide basis, including select wells upgradient from the site, on the three GM facilities, and downgradient from the site. A listing of groundwater sampling and analyses conducted at the site is found in Table 1-1, and well locations are shown on Figures 2-1 and 2-2. The primary objectives of the Supplemental RFI site-wide groundwater sampling were to:

1. Collect site-wide data to characterize groundwater with respect to flow direction and occurrence of Appendix IX VOC constituents and cis-1,2-dichloroethene (cis-1,2-DCE).

2. Collect data further downgradient of the site to characterize groundwater with respect to flow direction and occurrence of Appendix IX VOC constituents and cis-1,2-DCE.

3. Collect data which will support the Supplemental Baseline Risk Assessment.

4. Evaluate site-wide intrinsic attenuation of VOCs.

An evaluation of the presence of VOCs and the intrinsic attenuation of VOCs in groundwater is presented in Section 4.0.

In addition to the site-wide groundwater sampling for VOCs, groundwater quality data were also collected from select wells to better characterize the potential effects on groundwater from soil at AOI's 7, 13, 17, and 36. Monitor wells that were upgradient and downgradient from these AOIs were sampled and analyzed for Appendix IX VOCs and cis-1,2-DCE, Appendix IX SVOCs, Appendix IX PCBs, and Appendix IX total and dissolved metals (Table 1-1). Groundwater quality data were not required for AOI's 34 and 35, since the completed investigation determined that no significant release of hazardous constituents had occurred (Section 3.1).

The groundwater data collected during the Supplemental RFI was used to better characterize, from a risk perspective, the potential effects on groundwater from soil contamination at an AOI; however, there are difficulties and limitations associated with this data usage. To address U.S. EPA comments on the 1996 Baseline Risk Assessment, the Supplemental Baseline Risk Assessment evaluates potential exposures via groundwater transport of constituents in soil/waste at both the AOIs and SWMUs using the alternate method for estimating groundwater source concentrations as described in the September 11, 1996 response to U.S. EPA comments. As discussed in the September 11, 1996 response, the alternate method was designed to minimize incorrect attribution of groundwater impact to soil/waste at a SWMU or AOI by using soil/waste characterization data rather than groundwater data (where justified) to estimate the potential for soil/waste to affect groundwater. Potential exposures at current and reasonably expected points of groundwater use are evaluated by combining potential contributions from both the AOIs at the GM Eastern Facilities and the

SWMUs at Delphi Thermal Moraine, to provide a comprehensive assessment of potential exposures to constituents in soil/waste via groundwater transport.

The extensive characterization of AOI 7 during the Supplemental RFI found evidence that dense nonaqueous-phase liquids (DNAPL) may be present in the shallow saturated zone underlying AOI 7 above the upper clay till. The constituents present in the shallow groundwater at AOI 7 consist of primarily PCE, trichloroethene (TCE) and their degradation products (i.e.,1,2-DCE and vinyl chloride). Because AOI 7 is upgradient of most of Moraine Engine and Delphi Thermal Moraine, the contamination in the shallow groundwater above the upper clay till at AOI 7 is likely the primary source of VOCs in site-wide groundwater at these facilities. Furthermore, considering the composition and concentrations of VOCs in groundwater at AOI 7, the contamination in groundwater at AOI 7 is the primary contributor of the VOCs being addressed by the interim measures at the downgradient boundary of Delphi Thermal Moraine.

Because site-wide groundwater is primarily affected by contamination from the shallow groundwater at AOI 7, the Supplemental Baseline Risk Assessment is focused on evaluation of the effects of groundwater conditions at AOI 7 on site-wide groundwater. Specifically, potential exposures to constituents in groundwater at AOI 7 are evaluated to determine whether groundwater at AOI 7 warrants corrective measures. This evaluation is done separately from the evaluation of potential exposures to constituents in soil at AOI 7, so that the need for corrective measures to address each medium at AOI 7 can be determined separately. Unlike groundwater contamination across other areas of the site which cannot be causally linked to specific SWMUs or AOIs in those areas, the groundwater contamination at AOI 7 can be confidently attributed to AOI 7. Evaluation of potential exposures, if any, to existing constituents in site-wide groundwater not attributable to AOI 7 will be done as part of the assessment of the effectiveness of a proposed interim measure to address the AOI 7 groundwater contamination.

2.2.2 Soil

During the Supplemental RFI, investigations of soil were performed at AOI 7 - Former Oil House Area; AOI 13 - Buildings 4, 6, and 13; AOI 17 - Building 15; AOI 34 - Excavation Area 1; AOI 35 - Excavation Area 2; and AOI 36 - Former Southwest ASTs. A summary of the soil sampling performed for the Supplemental RFI is presented in Table 1-1.

The primary objectives of the Supplemental RFI soil investigations were to:

1. Determine if a release of hazardous constituents to soils had occurred from AOIs.

2. Evaluate nature and extent of any hazardous constituents released from AOIs, as required to support the Supplemental Baseline Risk Assessment.

Judgmental sampling was used to collect soil samples from AOI 13 - Buildings 4, 6, and 13, AOI 17 - Building 15, AOI 34 - Excavation Area 1, AOI 35 - Excavation Area 2, and AOI 36 - Former Southwest ASTs to determine if a release to soil had occurred. If no release of hazardous constituents was confirmed, then no additional sampling was completed. Additionally, field screening data collected at AOIs 13 and 17 was used to determine whether a release had occurred, but was not used to support the Supplemental Baseline Risk Assessment. If a release was confirmed, supplemental sampling was performed based on an evaluation of the newly acquired data to determine the nature and extent of the release, as necessary to support the Supplemental Baseline Risk Assessment. Based on the evaluation of the initial supplemental data, additional investigations were determined to be required at AOI 7 and AOI 36 as discussed below.

2.2.2.1 AOI 7 - Former Oil House Area

A judgmental sampling approach to evaluate nature and extent, as required to support the Supplemental Baseline Risk Assessment, was used at AOI 7 for the initial investigation in February 1998 because past releases were likely. Soil samples were collected at a shallow depth and immediately above the water table. These depths were selected to: (1) provide data concerning potential surface and deep soil contamination from hazardous constituents for the Supplemental Baseline Risk Assessment, and (2) evaluate the nature and extent of any releases of hazardous constituents. Shallow soil samples would allow characterization of potential exposure from surface contamination. Deep soil samples would help evaluate the nature and extent of soil contamination just above the water table. Additional samples based on field screening were also collected, on the basis of the highest HNu reading.

Based on the findings of the initial phase of the AOI 7 investigation, additional investigations were conducted. These also followed a judgmental sampling approach; however, during these additional investigations soil borings were drilled to the first encountered clay-rich aquitard (upper clay till) to evaluate the presence of the upper

clay till and DNAPLs. The specific objectives for these additional investigations conducted at AOI 7 in August and November 1998 were as follows:

1. Determine whether a significant source of PCE and its potential degradation products exists in the vadose zone soil at AOI 7;

2. Determine whether PCE exists in the saturated zone, possibly as a DNAPL at AOI 7 and characterize its presence;

3. Determine the potential for the lithology in the vicinity of AOI 7 to affect migration of PCE, if PCE is present as a DNAPL; and

4. Determine if a vadose zone source of PCE or DNAPL in the saturated zone exists upgradient (or north) beyond OH-BH1.

2.2.2.2 AOI 36 - Former Southwest ASTs

Based on the findings of the initial investigation conducted at AOI 36, an additional investigation was conducted to evaluate the presence of arsenic in shallow soil using a judgmental sampling approach. Since the source of arsenic may not be associated with materials which were likely stored in the Southwest ASTs, sampling data were obtained from a 3-acre area around AOI 36 which historically has been unpaved. The area of investigation was divided into seven subareas for sampling purposes. Shallow soil samples were collected from each subarea, composite samples were created for each subarea, and discrete samples were held by the laboratory for future analysis, if necessary.

2.2.3 Laboratory Analytical Methods

In accordance with the approved Supplemental RFI Work Plan, all samples were analyzed by TestAmerica, Inc. (formerly National Environmental Testing, Inc. [NET]) of Dayton, Ohio or Microseeps of Pittsburgh, Pennsylvania, for the parameters specified, using the appropriate analytical methods (refer to Table 1-1) and data quality objectives. During the course of the Supplemental RFI field investigations, the VOC analytical method was updated from SW 846 Method 8240B to SW 846 Method 8260B, as approved by the U.S. EPA. During field screening activities for AOIs 13 and 17, soil samples were analyzed for VOCs using an on-site field gas chromatograph (GC). Appropriate methods and procedures were followed during field screening activities. The field GC was supplied by Microseeps. The Supplemental RFI

analytical results and quality assurance/quality control (QA/QC) results are included in Appendix B. A list of duplicate samples and their associated primary sample are presented in Table B-1 in Appendix B.

The analytical data were validated by ARCADIS Geraghty & Miller personnel. The data validation was performed at Level III (based on quality control criteria from the U.S. EPA document Data Quality Objectives for Remedial Response Activities [U.S. EPA 1987] and on quality control criteria from the U.S. EPA document Test Methods for Examining Solid Waste, SW 846 [U.S. EPA 1986 with revision updates]). In addition, the two U.S. EPA Contract Laboratory Program documents National Functional Guidelines for Inorganic Data Review (U.S. EPA 1994a) and National Functional Guidelines for Organic Data Review (U.S. EPA 1994b) were used as guidance for validating and assigning qualifier codes to the analytical results. A summary of the overall data quality objectives for the Supplemental RFI is provided in Appendix C.

2.3 Field Investigation Methodologies

The following sections describe the methodologies used to collect or evaluate groundwater and soil samples during the Supplemental RFI for the Moraine Engine and Moraine Assembly facilities. Oversight was provided during most field activities (February, March, and August 1998) by the U.S. EPA's oversight contractor Tetra Tech.

2.3.1 Groundwater Methodology

During the Supplemental RFI, water-level measurements were taken from all on-site wells, wells located east of the site (Miami Conservancy monitoring wells) and wells located south of the site, within the Dryden Road North Wellfield and the Dryden Road South Wellfield (a total of 78 wells). One shallow monitor well (GM-26) was installed off-site and downgradient in February 1998 and two shallow monitor wells (GM-27 and GM-28) were installed for the AOI 7 investigation in August 1998. Additionally, 26 monitor wells were sampled in March 1998 and 7 wells were sampled in August 1998.

During the additional AOI 7 investigations, the Hydropunch II™ technique was used to collect groundwater samples at the top of the upper clay till during the advancement of borings for VOC delineation and DNAPL evaluation. Additionally, the Hydropunch II™ technique was used in the upper aquifer below the upper clay till to support well

screen placement during installation of monitor well GM-27 for the AOI 7 investigation.

2.3.1.1 Water Level Measurements

Water-level measurements were taken on March 11 and 12, 1998. A measurement was taken by lowering a probe into the well until contact with water was indicated by an audible alarm or by a light. The tape, marked off in increments of 0.01 ft, was held at the measuring point, designated by a mark or notch in the well casing, and the depth to water was noted. The measurement was repeated at each well to ensure accuracy. The electronic water-level probe and tape were decontaminated with a distilled water rinse prior to use in each well. All measurements were recorded on a field data sheet and were performed in accordance with the approved Supplemental RFI Work Plan.

A thinner probe with only 5-ft markings was needed to measure groundwater elevations from several production wells. In this case, the distance from the designated measuring point to the 5-ft markings on the tape was measured with a tape measure to obtain depth to water measurements accurate to within 0.01 ft. Decontamination and recording procedures for this probe were the same as stated above.

2.3.1.2 Installation and Development of Shallow Aquifer Wells

During the Supplemental RFI three shallow monitor wells were installed (GM-26, GM-27, GM-28). The locations of these wells are shown on Figure 2-1. GM-26 was installed to further characterize off-site, downgradient groundwater quality. GM-27 and GM-28 were installed to further characterize groundwater quality at AOI 7. These wells were drilled in accordance with procedures defined in the approved Supplemental RFI Work Plan. Belasco Drilling Services, Inc. of Columbus, Ohio conducted the drilling activities. The lithologic and well construction logs are provided in Appendix D.

On November 26, 1997, Delphi Thermal received approval from Montgomery County to install GM-26 on their property. Monitor well GM-26 was installed on February 24, 1998 in proximity to MT-69, a deep aquifer Montgomery County well. The well was installed using hollow stem auger drilling techniques with conventional 4 ¼-inch inner diameter hollow stem augers. During drilling, continuous headspace readings were collected from the boring and visual screening of the boring was conducted. Soil samples were not collected during drilling because all photo-ionization detector (HNu) readings were 0 parts per million (ppm), there was no visual evidence of

contamination, and the well was installed in a non-source area. The boring was drilled to a depth of 60 ft, which was the top of the regional till. GM-26 was constructed with 2-inch diameter PVC casing and a 10-ft long PVC screen having 0.01 slot size. The well screen was set between 50 ft and 60 ft below land surface (bls). GM-26 was developed by pumping on March 2, 1998, until pH, specific conductivity, and temperature readings stabilized.

To determine whether VOCs were present as a DNAPL at AOI 7 and whether VOCs have migrated vertically to the lower portion of the upper aquifer, well GM-27 was installed between August 4 and 13, 1998, east of existing shallow well GM-23 and screened below the upper clay till. The boring was advanced using hollow stem auger drilling techniques down to the regional confining unit. During drilling, continuous headspace readings were collected from the boring and visual screening of the boring was conducted. Soil samples were collected using procedures described in Section 2.3.2.2. A 12-inch protective casing was installed from 0 ft to 33.5 ft (the depth to the upper clay till). The hole was cased off in the upper clay till before advancing through the upper clay till. A telescoping well casing was used to drill the well within the protective casing to prevent vertical migration of VOCs from above the upper clay till. The boring was drilled to a depth of 58 ft, which was the top of the regional till. GM-27 was constructed with 2-inch diameter PVC casing and a 10-ft long PVC screen having 0.01 slot size. The well screen was set between 40 ft and 50 ft bls, based on the highest VOC concentration in groundwater samples collected in the upper aquifer below the upper clay till using Hydropunch II™ techniques. GM-27 was developed by pumping on August 24, 1998 until pH, specific conductivity, and temperature readings stabilized.

To evaluate the presence of the upper clay till south of AOI 7 and groundwater quality downgradient of AOI 7, well GM-28 was installed on August 5, 1998 southwest of GM-27. The well was installed using hollow stem auger drilling techniques with conventional 4 ¼-inch inner diameter hollow stem augers down to the upper clay till. The boring was drilled to a depth of 32 ft. During drilling, continuous headspace readings were collected from the boring and visual screening of the boring was conducted. A soil sample was collected using procedures described in Section 2.3.2.2. The boring was drilled to a depth of 32 ft, which was the top of the upper clay till. GM-28 was constructed with 2-inch diameter PVC casing and a 10-ft long PVC screen having 0.01 slot size. The well screen was set between 22 ft and 32 ft bls. GM-28 was developed by pumping on August 17, 1998 until pH, specific conductivity, and temperature readings stabilized.

2.3.1.3 Groundwater Sampling

Groundwater samples were collected from monitor wells during March and August 1998 to characterize groundwater quality. Prior to sampling each well, monitoring equipment was decontaminated and field parameter equipment was calibrated. A 2-inch submersible pump or a site-dedicated Teflon bailer was used to evacuate three well volumes. Field parameters (pH, specific conductance, and temperature) were measured on each water sample, and analytical samples were collected for VOCs, SVOCs, metals, and other remaining analytes in that order. All groundwater sampling was performed in accordance with the approved Supplemental RFI Work Plan. Water sampling logs are provided in Appendix D.

For those shallow monitor wells where bioattenuation indicator parameters were analyzed, a low flow purging and sampling technique was used to collect the groundwater sample. An in-line flow-through cell equipped with pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), specific conductivity, and temperature electrodes; and an adjustable-rate, low-flow, positive displacement pump were used for this sampling method. The field parameters were monitored, and once stabilized, the samples were collected from the discharge tube. Groundwater samples were analyzed for nitrogen, ammonia; manganese (total and dissolved); iron (total and dissolved); sulfate; sulfide; total organic carbon (TOC); chlorides; light hydrocarbon scan; and permanent gases. Field test kits were used to analyze samples for nitrate, nitrite, and iron (ferrous). All manufacturer's instructions were followed for the field test kits. All low-flow groundwater sampling was performed in accordance with the approved Supplemental RFI Work Plan. Water sampling logs are provided in Appendix D.

As part of the AOI 7 - Former Oil House Area investigation, groundwater samples were collected above the upper clay till using the Hydropunch II™ technique to obtain additional groundwater quality data and assess the presence of DNAPL. The Hydropunch II™ is a 4-ft long enclosed device driven ahead of the hollow stem augers into the subsurface. The hammer weight on the drill rig was used to drive the Hydropunch II™ slightly into the upper clay till only to confirm the upper clay till was reached. The Hydropunch II™ was then pulled back to expose a stainless steel well screen used to collect the water sample. After some time had elapsed, the Hydropunch II™ was withdrawn from the auger so that the groundwater sample could be collected directly into laboratory prepared containers from the spigot. If sufficient water was not collected in the Hydropunch II™ device to fill the sample containers, another Hydropunch II™ was attempted. Additional time elapsed and, in some cases, the

equipment was allowed to sit overnight. If sufficient water was still not present, a sample was either collected by bailing from the augers (only done at one location, OH-BH7) or a temporary well was installed to collect the groundwater sample. The temporary well consisted of 2-inch diameter PVC casing with a 5-ft long screen. A sand pack was placed around the screen and a bentonite seal was placed above the screen. After allowing the temporary well to sit overnight, a groundwater sample was collected using a bailer. Once the sample was collected, the PVC casing was removed, and the borehole was appropriately abandoned. All Hydropunch II™ groundwater sampling was performed in accordance with the approved Supplemental RFI Work Plan. Soil sampling logs for AOI 7 (Appendix D) indicate whether the groundwater samples were collected using the Hydropunch II™ or a temporary well.

2.3.1.4 Slug Tests

Slug tests were conducted on monitoring wells GM-23, GM-27, and GM-28 during the November 1998 AOI 7 investigation. Slug testing is a useful technique for obtaining order-of-magnitude approximations of hydraulic conductivity in the immediate vicinity of a well. Both falling head and rising head slug tests were conducted. For a falling head slug test, a slug was rapidly lowered into the water and water level versus time was recorded until the well recovered to nearly static water level condition. A rising head slug test was conducted by lowering a slug into the water until it was fully submerged. Once the static water level was reestablished, the slug was quickly withdrawn and water level versus time was recorded until the well recovered. Results of the slug tests were recorded on field logs and are further discussed in Appendix E.

2.3.2 Soil

During the Supplemental RFI, soil samples were collected using direct push drilling, hollow-stem auger drilling, and hand augers. Direct push drilling and hollow-stem auger drilling was conducted by Belasco Drilling Services, Inc. The methodologies used to obtain soil samples and conduct field screening (PCBs and DNAPLs) are discussed below. All soil sampling was conducted in accordance with the approved Supplemental RFI Work Plan.

2.3.2.1 Direct Push Soil Sampling

Surface and subsurface soil samples were collected during the AOIs 13 and 17 investigation using a direct-push sampling system. When the designated sampling location was reached the ARCADIS Geraghty & Miller personnel donned the

appropriate personal protective equipment (PPE) and established the exclusion zone. Plastic sheeting was placed near the work area. The appropriate sample containers were selected and labeled. Prior to drilling at each location, the sampler equipment was decontaminated using a high-pressure steam cleaner. Following the collection of each sample, the samplers were decontaminated in accordance with the approved Supplemental RFI Work Plan. Disposable PPE and sampling equipment were collected and discarded appropriately. Pertinent information was recorded on a soil log (Appendix D).

The direct-push sampling unit utilized a probe-drive sampler to retrieve a 100-gram (or larger) soil sample at the desired depth (approximately 4 ft bls or 8 ft bls based on field screening). The borings were drilled to a depth of 8 ft bls to correspond to the approximate base of the former tank, pit, or sump locations. The probe-drive sampler remained completely sealed by a piston tip at the end of the sample tube while it was pushed or driven to the desired sampling depth. A piston stop-pin at the opposite end of the sampler was removed by means of extension rods inserted down the inside diameter of the probe rods after the sampler had been driven to the sample depth. This enabled the piston to retract into the sample tube while the sample was taken. When the sampler was removed, the soil was scanned with an HNu, placed in the appropriate containers, and described on a boring log. The sample containers were given directly to the on-site laboratory for screening of VOCs and to the ARCADIS Geraghty & Miller geologist to conduct PCB field screening. Split samples were held in a cooler containing ice for possible off-site laboratory confirmation analysis. Chain-of-custody forms were completed prior to submitting the confirmation samples to the laboratory. Upon completion of each direct push, the hole was grouted to the surface.

2.3.2.2 Hollow-Stem Auger Soil Sampling

Surface and subsurface soil samples were collected using a drilling rig and conventional 4 ¼- inch inner diameter hollow-stem augers. Prior to drilling at each location, drilling equipment (including augers, plugs, and split-spoon samplers) was decontaminated using a high-pressure steam cleaner. Following the collection of each sample, split-spoon samplers were decontaminated in accordance with the approved Supplemental RFI Work Plan. Disposable PPE and sampling equipment were collected and discarded appropriately. Pertinent information was recorded on a soil sampling log for samples submitted to the laboratory (Appendix D). Chain-of-custody forms were completed prior to submitting the samples to the laboratory.

When the designated sampling location was reached, the ARCADIS Geraghty & Miller personnel donned the appropriate PPE and established the exclusion zone. Plastic sheeting was placed near the work area. The appropriate sample containers were selected and labeled. During drilling, the hollow-stem augers were advanced to the designated sampling depth where the plug was removed from inside the augers and replaced with a decontaminated split-spoon sampler. The split spoon sampler was then driven 2 ft below the bottom of the augers. Samples were collected using a decontaminated 24-inch long, 3-inch diameter, stainless-steel, split-spoon sampler. When the split-spoon sampler was removed, the soil was scanned with an HNu, placed in the appropriate containers, and described on a boring log by an ARCADIS Geraghty & Miller geologist (Appendix D). The sample containers were placed in a cooler containing ice. Upon completion of each borehole, the borehole was grouted using the tremie method. All water and soil generated during drilling and decontamination were contained in labeled drums and disposed appropriately by GM.

For AOIs 7 and 36, soil samples were collected at depths of 0 to 2 ft and above the water table from each boring. In addition, visual screening was conducted and continuous headspace readings of each split-spoon using an HNu were collected during drilling. One additional sample from the soil boring was selected from the sample with the highest HNu headspace reading and/or visual evidence of contamination. If all HNu readings were background levels, then the soil samples collected from 0 to 2 ft and above the water table were the only samples submitted to the laboratory for analysis.

For AOIs 34 and 35, a soil boring was advanced through the fill until native soil was identified at each AOI. Continuous headspace readings of each split-spoon using an HNu were collected during drilling. One sample from the soil boring within the fill was selected from the sample with the highest HNu headspace reading and/or visual evidence of contamination and submitted to the laboratory. A second soil sample, collected from immediately below the base of the fill, was submitted to the laboratory. If all HNu headspace readings were background levels, a soil sample was collected from the top 2 ft of the fill and native soil below the base of the fill for laboratory analysis.

2.3.2.3 Hand Auger Soil Sampling

Shallow soil samples (0 to 2 ft and 2 to 4 ft intervals) were collected for the additional investigation conducted at AOI 36. These samples were collected using a hand auger (or power auger in areas where soil had been compacted during construction of the

Overflow Parking Lot). When the designated sampling location was reached, the ARCADIS Geraghty & Miller personnel donned the appropriate PPE and established the exclusion zone. Plastic sheeting was placed near the work area. The appropriate sample containers were selected and labeled. Prior to sampling and following collection of each sample, the hand auger and other sampling equipment were decontaminated in accordance with the approved Supplemental RFI Work Plan.

The hand auger used to collect shallow soil samples was a stainless steel, 2 ¾-inch diameter auger. When the sample was removed, the soil was placed in the appropriate containers and described on a sampling log by an ARCADIS Geraghty & Miller geologist (Appendix C). The sample containers were placed in a cooler containing ice. Disposable PPE and sampling equipment were collected and discarded appropriately. Pertinent information was recorded on a soil sampling log for samples submitted to the laboratory (Appendix D). Chain-of-custody forms were completed prior to submitting the samples to the laboratory.

2.3.2.4 PCB Immunoassay Test Kits

To support the investigation at AOIs 13 and 17, soil samples were field screened for PCBs using immunoassay test kits. The samples were screened using a D TECH model TK-1002-1 PCB test kit. Results of the test kits were interpreted using a portable instrument (DTECHTOR) to obtain a semi-quantitative result. All manufacturer's instructions and QA/QC procedures were followed. Duplicate analyses using the PCB test kit were performed on one out of every 20 samples, as recommended by the manufacturer. In addition, operator's name, time, date, sample identification, raw data, calculations, and final results for each sample were recorded on a soil sampling log.

2.3.2.5 Hydrophobic Dye Tests

During the August and November 1998 investigations at AOI 7, a visual field test was used to assess the presence of DNAPL in saturated soil samples collected above the upper clay till (Cohen, R. M., et. al. 1992; U.S. EPA 1992). This technique included placing the saturated soil sample in a clean, laboratory prepared soil sample jar and adding a sufficient quantity of distilled water such that once the jar was closed, there was enough airspace to mix the soil-water mixture. Approximately 2 milligrams of Sudan IV, a hydrophobic red dye, was then added to the jar to facilitate visual identification. The contents of the jar were then mixed for 30 seconds by vigorously shaking by hand. If DNAPL was present, it turned red and was visible as a separate

phase as a result of the red dye. Results of the hydrophobic dye shake tests were recorded on field logs and are discussed in Section 3.0.

3. AOI Investigation Results

The following sections provide a summary of the investigations conducted during the Supplemental RFI for each AOI, a discussion of results, and a presentation of conclusions regarding whether Supplemental RFI objectives have been met. Locations of these AOIs are indicated on Figure 1-2. The discussion of site-wide groundwater quality in terms of VOC concentrations is presented in Section 4.0. A complete set of analytical results (including QA/QC samples) is presented in the Appendix B tables. Boring and sampling logs are provided in Appendix D.

3.1 AOI 34 - Excavation Area 1 and AOI 35 - Excavation Area 2

Excavation Area 1 and Excavation Area 2 were identified as AOI 34 and AOI 35, respectively, in the Supplemental DOCC as requiring further investigation (Figure 3-1). Due to expansion plans at the Moraine Assembly facility in the vicinity of these AOIs, investigative work at these two AOIs was performed in August 1997. Prior to investigating these AOIs, Mr. Norman Sawdey of GM provided Mr. William Buller of the U.S. EPA with details regarding the expansion project in a letter dated August 6, 1997 and requested that U.S. EPA expedite their review of Sections 3.2.4 and 3.2.5 of the Supplemental RFI Work Plan (Geraghty & Miller, Inc. 1997b) in order to reach an agreement on the RFI sampling at these AOIs. On August 19, 1997, Mr. William Buller of U.S. EPA sent Mr. Norman Sawdey a facsimile approving the sampling plan concerning AOIs 34 and 35 (Appendix A). It should be noted that currently, a parking area has been constructed over the area of AOI 34 and the parking lot for the new Moraine Assembly plant covers the area of AOI 35.

3.1.1 Investigative Summary

Prior to implementing the subsurface investigation, a site walk over was conducted on July 30, 1997 by Mr. James Reid of Geraghty & Miller, Inc., Mr. Vince Festa of the Moraine Engine facility, and Messrs. Dave Kloppenburg and Ed Beckley of the Moraine Assembly facility. The purpose of this site walk over was to identify and survey the suspected locations of AOI 34 and AOI 35. Using the 1956 aerial photographs, the locations of these AOI's were determined by scaling distances from the excavation areas to recognizable landmarks (such as Moraine Assembly Plant 1 and Moraine Assembly Plant 2). McDougal Associates of Miamisburg, Ohio conducted the surveying on July 30, 1997.

Following surveying of these AOIs, GM identified a topographic map dated March 1968 showing the location and depth of each AOI (Appendix F). Based on this topographic map, it was determined that the surveyed boring location for AOI 34 was in the correct location. However, it was determined that the boring location for AOI 35, proposed based on scaling off of the 1956 aerial photograph, needed to be moved south and east of the originally surveyed location to be positioned in the deepest portion of the excavation depicted on the 1968 topographic map. Figure 3-1 provides a revised location of boring EA2-BH01 within AOI 35.

To characterize AOIs 34 and 35, one soil boring was installed at each AOI on August 28, 1997. Each soil boring (located to approximate the center of the historic excavation areas) was advanced using hollow stem augers (Section 2.3.2.2).

Headspace readings were measured using an HNu for each soil sample collected. One soil sample from within the fill was selected for laboratory analyses based on having the highest HNu headspace reading. A second soil sample was collected from immediately below the base of the fill and submitted to NET for analysis. During the investigation, one rinseate blank (equipment blank) sample (RB-26), one duplicate sample (DUP-39), and one trip blank sample (TB-30) were collected for QA/QC purposes. A matrix spike (MS) and matrix spike duplicate (MSD) was also taken.

Samples were delivered directly to NET for analyses under proper chain of custody protocols. These samples were analyzed for TCL VOCs and SVOCs, PCBs, and TAL metals (excluding the six essential nutrients). The trip blank TB-30 was analyzed for TCL VOCs only.

3.1.2 Soil Results

3.1.2.1 Lithologic Characterization

Boring EA1-BH01 was advanced at AOI 34 to a total depth of 14 ft bls. Fill consisting of varying percentages of clay, sand, and gravel was found to a depth of approximately 10 ft bls. Headspace readings from fill samples ranged from 10 parts per million (ppm) (0 to 2 ft bls) to 115 ppm (6 to 8 ft bls). The sample of fill material from 6 to 8 ft was selected for laboratory analyses based on the highest headspace reading. DUP-39 is the duplicate sample that corresponds to EA1-BH01 (6-8).

Native soil, which consists mainly of sand and gravel of varying percentages, was found at a depth of approximately 10 ft bls. Determination of native soil was based on

the lack of clay in the soil. This depth of fill is consistent with the depth of the excavation area shown on the 1968 topographic map. Split-spoon refusal occurred at 8 inches into the 10 to 12 ft bls interval, and the sample volume recovered was inadequate for laboratory analyses. As a result, soil collected at a depth of 12 to 14 ft bls was submitted to the laboratory for analyses of native soil below the fill. Headspace readings within the native soil ranged from 5.8 ppm (10 to 12 ft bls) to 9.0 ppm (12 to 14 ft bls).

Boring EA2-BH01 was advanced at AOI 35 to a total depth of 24 ft bls. Drilling and sampling at this location was difficult because auger refusal occurred at a depth of 3 ft bls due to the presence of non-native materials (such as boulders) in the subsurface. The boring was then moved 3 ft to the north and drilling resumed. Split-spoon refusal occurred at a depth of 10 to 12 ft bls, resulting in no sample recovery. Also, no samples were recovered at depths of 14 to 16 ft bls and 18 to 20 ft bls.

Fill consisting of varying percentages of clay, sand, and gravel was found within AOI 35 to a depth of approximately 20 ft bls. Asphalt pieces were noted to a depth of approximately 12.25 ft bls. Headspace readings from fill samples at AOI 35 ranged from 4.0 ppm (8 to 10 ft bls and 16 to 18 ft bls) to 68 ppm (6 to 8 ft bls). The fill sample from 6 to 8 ft was selected for laboratory analyses based on the highest headspace reading.

Native soil, which consists mainly of sand and gravel of varying percentages, was found at a depth of approximately 20 ft bls. Ease of drilling at a depth from approximately 20 ft to 24 ft bls may also be indicative of a change from fill to native soil. This determination of native soil is consistent with depth of the excavation area shown on the 1968 topographic map. Sample recovery was poor at a depth of 20 to 22 ft bls, and soil volume was inadequate for laboratory analyses. As a result, soil collected at a depth of 22 to 24 ft bls was submitted to the laboratory for analyses of native soil below the fill. Headspace readings within the native material ranged from 1.0 ppm (20 to 22 ft bls) to 3.2 ppm (22 to 24 ft bls).

3.1.2.2 Analytical Results

Table 3-1 provides a summary of constituents detected by the laboratory analysis. No VOCs were detected in fill sample EA1-BH01(6-8) or native soil sample EA1-BH01(12-14) from AOI 34. Based on the HNu readings recorded for EA1-BH01 (Section 3.1.2.1), the presence of VOCs was suspected. However, VOCs were not detected in these soil samples; therefore, the HNu readings were not a good indicator

of the presence of VOCs within this soil boring. Fluoranthene (449 micrograms per kilogram [ug/kg]) and pyrene (450 ug/kg) were detected in the fill. No SVOCs were detected in native soil. No PCBs were detected in either the fill or native soil samples. Of the TAL metals analyzed, arsenic, barium, beryllium, chromium, cobalt, copper, lead, manganese, mercury, nickel, vanadium, and zinc were detected in the fill sample. In the native soil sample, TAL metals detected include: arsenic, barium, lead, manganese, nickel, thallium, and zinc.

No VOCs were detected in fill sample EA2-BH01(6-8) or native soil sample EA2-BH01(22-24) from AOI 35. Fluoranthene (402 ug/kg) and pyrene (472 ug/kg) were detected in the fill. No SVOCs were detected in native soil. No PCBs were detected in either the fill or native soil samples. Of the TAL metals analyzed, arsenic, barium, chromium, lead, manganese, mercury, nickel, and zinc were detected in the fill sample. In the native soil sample, TAL metals detected include: arsenic, barium, lead, manganese, nickel, thallium, and zinc.

DUP-39 was taken as a duplicate of the 6 to 8 ft sample from soil boring EA1-BH01. Of the TAL metals analyzed in DUP-39, arsenic, barium, beryllium, chromium, cobalt, copper, lead, manganese, mercury, nickel, vanadium and zinc were detected in the duplicate sample. These were the same metals detected in the original sample. VOCs and PCBs were not detected in the duplicate sample nor in the original sample. No SVOCs were detected in the duplicate sample. However, the SVOCs fluoranthene and pyrene were detected in the original sample.

No SVOCs, PCBs, or metals were detected in rinseate blank sample RB-26. VOCs detected in rinseate blank RB-26 include chloroform, ethylbenzene, and xylenes. However, these constituents were not detected in any soil samples, therefore there is no indication of possible cross contamination due to decontamination or sampling procedures. No VOCs were detected in trip blank TB-30, indicating no cross contamination of VOCs occurred during sample collection and handling.

3.1.3 Conclusions

ARCADIS Geraghty & Miller is confident that the survey procedure correctly identified appropriate boring locations for the AOIs because (1) the 1968 topographic map provided reference points used to measure the location of the excavation areas more accurately than the reference points obtained from the 1956 aerial photograph, and (2) soil samples indicated the presence of fill material and drilling was difficult while in the excavation area depths shown on the 1968 topographic map. Based on an

evaluation of the type of fill materials encountered during the advancement of borings, there is no evidence that industrial waste materials were placed in AOIs 34 and 35.

To allow for continuation of plant expansion activities, a preliminary determination of the need for additional sampling at these AOIs was conducted and submitted to the U.S. EPA (Geraghty & Miller, Inc. 1997c). To conduct this preliminary evaluation, the concentrations of detected SVOC constituents (fluoranthene and pyrene) present in the fill material at AOIs 34 and 35 were compared to maximum soil concentrations evaluated in the Baseline Risk Assessment during the Delphi Thermal Moraine RFI (Table 2-4 of the RFI Baseline Risk Assessment [ENVIRON Corporation 1996]). The highest concentrations of fluoranthene (86.0 milligrams per kilogram [mg/kg]) and pyrene (83.0 mg/kg) evaluated in the risk assessment during the Delphi Thermal Moraine RFI were found in soil at the Waste Pile Staging Area. According to the RFI Baseline Risk Assessment, these concentrations did not contribute a significant risk. The concentrations of fluoranthene and pyrene detected in fill samples are two orders of magnitude lower than the maximum concentrations found during the Delphi Thermal Moraine RFI. Because the potential exposures to workers at AOIs 34 and 35 would be similar to those at the Waste Pile Staging Area, the concentrations of fluoranthene and pyrene in the fill samples also would not contribute significant risk.

Further, detected inorganic constituents for AOI 34 and AOI 35 were compared to background concentrations found in Table 2-1 of the RFI Baseline Risk Assessment (ENVIRON Corporation 1996). Detected inorganic constituents did not exceed background concentrations, with the exception of arsenic in fill material from AOI 34. The estimated background concentration of arsenic is 28.5 mg/kg, while the concentrations of arsenic in fill samples EA1-BH01(6-8) and DUP-36 are 46.5 mg/kg and 124J mg/kg, respectively. However, arsenic was detected at a concentration of 3.18 mg/kg in the native soil sample EA1-BH01 (12-14), which is well below the background concentration for arsenic, and indicates arsenic has not migrated from the fill to native soil.

Investigative activities conducted at AOIs 34 and 35 have provided sufficient detail to meet the RFI objectives.

1. The lateral extent of each AOI has been adequately characterized by review of the 1968 topographic map. The vertical extent of each AOI has been clearly delineated by a distinct change in soil characteristics detected during the advancement of the soil borings (see the soil boring logs in Appendix D).

2. The Supplemental RFI soil samples were collected at a location within the former excavation areas at depths most likely to identify releases of hazardous constituents to surface and subsurface soils per the Supplemental RFI Work Plan. Therefore, analytical results from these samples would likely represent the highest concentrations of any constituents released to soil that may result in potential exposure to workers or that may affect groundwater quality. A review of the results from these samples indicates that there are no hazardous constituents in the soil at these AOIs at concentrations which would be expected to pose a threat to human health or the environment. The RFI sampling results provide no evidence of any significant release of hazardous constituents from AOI 34 and/or AOI 35.

Based on these conclusions, no additional investigative activity is required at AOIs 34 and 35. These results are evaluated in the Supplemental Baseline Risk Assessment (Section 5.0 and Volume II).

3.2 AOI 13 - Buildings 4, 6, and 13 and AOI 17 - Building 15

Buildings 4, 6, and 13, and Building 15 were identified as AOI 13 and AOI 17, respectively in the Supplemental DOCC as requiring further investigations (Figure 1-2). Since the Supplemental DOCC identified AOIs 13 and 17 as requiring further investigation, GM has completed construction activities in this area to support the on-going Moraine Assembly expansion projects. The U.S. EPA was notified of these pending construction activities in a letter from Mr. Norman Sawdey of GM to Mr. William Buller of U.S. EPA, dated March 3, 1998 which transmitted the AOI 13 and 17 field screening results (Appendix A). The need to move forward with the plant expansion activities was also discussed during a telephone conversation between Mr. Sawdey and Mr. Buller on March 5, 1998. Construction activities conducted after the investigation discussed below was completed, include the demolition of Building 15 (AOI 17) and construction of a parking lot over an area covering AOI 13, AOI 17 and AOI 36 (discussed in Section 3.3). The Overflow Parking Lot was constructed by placing and compacting engineered fill over the former building foundations (concrete slabs), as required to achieve the desired elevation, then placing multiple layers of compacted asphalt.

3.2.1 Investigative Summary

Per the approved Supplemental RFI Work Plan, a two-phase sampling approach was proposed at AOI 13 and AOI 17. Samples would first be collected using a judgmental approach and field screened to determine if additional sampling with laboratory

analysis would be necessary to confirm/deny a release and to support the Supplemental Baseline Risk Assessment. Field screening activities were conducted at this AOI on February 17 through 19, 1998. Oversight of field activities was conducted by Tetra Tech.

To determine if field screening results of soil samples from AOIs 13 and 17 indicated that no significant release of VOCs or PCBs had occurred, and that no additional samples would be collected, the concentrations were to be compared to a screening level of 1 mg/kg for any individual VOC (developed based on conservative leaching and transport assumptions used in the Delphi Thermal Moraine Baseline Risk Assessment) and 25 mg/kg for PCBs (U.S. EPA, 1990). As discussed below, the screening levels were not exceeded, and additional soil borings as detailed in the Supplemental RFI Work Plan were not required.

3.2.1.1 AOI 13 Soil

To identify potential areas of contamination from chlorinated VOCs and PCBs within AOI 13, a review of the file records from the recent demolition activities and a June 1997 site inspection of the building foundation were conducted. Samples were then collected from 13 areas selected based on knowledge of past operations and visual observations made during the site walk, using a direct-push sampling methodology (Section 2.3.2.1). The foundations for Buildings 4, 6, and 13 were in place during drilling. These 13 potential areas are shown on Figure 3-2 and consist of former pits, sumps and drains, areas with staining present on the concrete floor, an oil recovery room and a plating area. Additionally, six sample locations were selected to provide areal coverage of the AOI. Samples were collected at these 19 locations (Figure 3-2) to a depth of 8 ft bls (to correspond to the approximate base of the tanks, pits, or sumps). Samples were evaluated for visual evidence of contamination and continuous headspace readings were taken with an HNu. Samples (BDG-DP1 through DP19) were then selected from each location based on visual evidence and HNu readings and field screened for VOCs using a field GC supplied and operated by Microseeps and field screened for PCBs by ARCADIS Geraghty & Miller using immunoassay test kits (Section 2.3.2.4). One sample (BDG-DP1, 4 to 8 ft) was split and submitted to NET for laboratory confirmation analysis of PCBs because the test kit result was greater than the screening level.

One additional soil sample (BDG-DP13, 0 to 4 ft), collected at AOI 13, was submitted to NET based on visual evidence of staining in the screening phase for analysis of TAL metals (excluding the six essential nutrients). The results of this analysis were

compared to background levels established during the Delphi Thermal Moraine RFI (Geraghty & Miller, Inc. 1996). As discussed below, background levels were not exceeded, and additional soil borings were not required.

For QA/QC purposes, four duplicate soil samples were taken during the direct-push sampling at AOI 13. Duplicate samples were taken from direct push locations BDG-DP1, BDG-DP8, and BDG-DP18 and were field screened with an HNu and PCB test kit. Duplicate sample BDG-DP14 was submitted to the on-site GC for VOC analysis. Rinseate blank RB-28 was taken prior to the soil sample at direct push location BDG-DP16 and was sent to the off-site laboratory and analyzed for VOCs, PCBs, and metals. Trip blank TB-32 accompanied samples submitted to NET.

3.2.1.2 AOI 17 Soil

To evaluate AOI 17, soil samples were collected using a judgmental approach from three former maintenance areas within the building where materials containing chlorinated VOCs may have been managed, and field screened to determine if additional sampling with laboratory analysis was necessary to confirm/deny a release. Samples were collected from these three areas using a direct-push sampling methodology (Section 2.3.2.1). These areas include the truck maintenance repair area, steam booth, and maintenance spray booth (Figure 3-3). The samples were collected to a depth of 8 ft bls to correspond to approximate depths of pits or sumps. Samples were evaluated for visual evidence of contamination and continuous headspace readings were taken with an HNu. Samples were then selected based on visual evidence and/or HNu readings and field screened for VOCs using a field GC and for PCBs using immunoassay test kits, similar to AOI 13.

Two duplicate samples were taken during the direct-push soil sampling at AOI 17 from direct push locations BD15-DP2 and BD15-DP3. These samples were screened with an HNu. BD15-DP2 was submitted to the on-site GC for analysis of VOCs and duplicate sample BD15-DP3 was screened with a PCB test kit.

3.2.1.3 Groundwater

To provide groundwater data around AOIs 13 and 17 which could be used to further evaluate the soil data collected at these AOIs, three upper aquifer monitor wells were sampled in March 1998: upgradient monitor well GM-22 (March 10, 1998), monitor well EAST (March 5, 1998) which is located on Delphi Thermal Moraine property downgradient/crossgradient of AOI 13, and monitor well GM-21 (March 10, 1998)

which is downgradient of both AOI 13 and AOI 17 (Figure 2-1). These monitor wells were sampled using low-flow sampling techniques (Section 2.3.1.3) and the groundwater samples were submitted to NET for analysis of VOCs and cis-1,2-DCE, SVOCs, PCBs, Total Metals, and Dissolved Metals per the required analytical methods. The biogeochemical parameters were also analyzed (Table 1-1) by NET and Microseeps. During the sampling of GM-22, a duplicate sample was taken (DUP-57), a rinseate blank was taken (RB-33), and an MS/MSD.

3.2.2 Soil Results

Table 3-2 summarizes the field screening results of the direct-push soil sampling performed at AOI 13 and AOI 17. Continuous headspace readings were taken using a HNu and all readings at AOIs 13 and 17 were 0 ppm. Based on this screening data, the sample from the deepest interval (6 to 8 ft bls) was submitted for VOC analyses using the on-site field GC. Samples from direct-push locations BDG-DP1 through BDG-DP4, BDG-DP10, BDG-DP18, and BDG-DP19 were all below detection limits for all VOCs analyzed. VOC results from all other on-site field GC analysis at AOI 13 and AOI 17 were below the 1 mg/kg screening criteria (Table 3-2).

There were only three positive test kit results for PCBs (all within AOI 13), as shown on Table 3-2. A positive test kit result occurred at BDG-DP2 (0.5 - 1.0 mg/kg) and the other two occurred at BDG-DP1. The initial test kit result at BDG-DP1 was greater than 25 ppm, but a duplicate test kit result was 1.1 - 4 ppm. Per the Supplemental RFI Work Plan, a split of this sample (BDG-DP1) was submitted to NET for confirmation. Based on the analytical results (Table 3-3), only Aroclor 1254 was detected at 7.86J mg/kg, which is well below the RFI screening criteria of 25 mg/kg. This result is also below the U.S. EPA soil PCB action level of 10 to 25 mg/kg, presented in U.S. EPA's comments on the Supplemental RFI Work Plan and received by GM on October 7, 1997 (Appendix A).

One soil sample from AOI 13 (BDG-DP13) was collected based on visual evidence of staining and submitted to NET for metals analysis. As shown on Table 3-3, metals results were below soil background levels determined during the Delphi Thermal Moraine RFI (Table 2-1 of the RFI Baseline Risk Assessment [ENVIRON Corporation 1996]).

The HNu headspace reading was 0 ppm for each of the four duplicate samples. The PCB test kit result for BDG-DP1 was 1.1- 4 ppm. This compares with a reading of >25 ppm in the original sample. The duplicate samples from direct push locations

BDG-DP8 and BDG-DP18 were below detection limits (<0.5 ppm), as were the original samples. On-site GC analysis of duplicate sample BDG-DP14 indicated the presence of PCE (0.004 ppm), TCE (0.07 ppm), and 1,1,1-trichloroethane (1,1,1-TCA) (0.003 ppm).

No constituents were detected in the rinseate blank RB-28, indicating that cross contamination of samples did not occur. No VOCs were detected in trip blank TB-32, indicating that cross contamination of samples during handling and transport did not occur.

On-site GC analysis of duplicate sample BD15-DP2 indicated the presence of PCE (0.064 ppm) and TCE (0.005 ppm). In the original sample, these constituents were detected at concentrations of 0.065 ppm and 0.004 ppm, respectively. A duplicate sample was taken of the sample from direct push location BD15-DP3. The HNu headspace reading was 0 ppm and the PCB test kit result for replicate sample BD15-DP3 was below detection limits (<0.5 ppm), as was the original sample.

These data were presented to U.S. EPA in a letter from GM dated March 3, 1998 (submitted via facsimile and Federal Express) to accommodate GM's need to pave the area at the southern end of the Engine Plant, encompassing AOIs 13 and 17, as part of the on-going expansion projects. Acknowledgment of the screening results and GM's need to proceed with the paving of this southern area of the Moraine Engine Plant was received in a letter to GM from U.S. EPA, dated March 5, 1998 (Appendix A).

3.2.3 Groundwater Results

Depth to water measurements prior to the March 1998 sampling of GM-22, GM-21 and EAST were 24.58 ft (elevation of 703.70 ft mean sea level [msl]) 20.52 ft (elevation of 703.68 ft msl) and 27.39 ft (elevation of 703.59 ft msl), respectively. Groundwater parameters (specific conductivity, pH, ORP, temperature and dissolved oxygen) after they had stabilized to within 10%, and before filling the sample containers are provided on the groundwater sampling logs in Appendix D.

Tables 3-4 and 3-5 provide a summary of constituents detected by the laboratory analysis. No SVOCs or PCBs were detected in any of the three monitor wells sampled to further characterize the area around AOIs 13 and 17. Biogeochemical analytical results are provided and discussed in Section 4.6.

In upgradient monitoring well GM-22, PCE (5.1 micrograms per liter [ug/L]), TCE (4.5 ug/L), 1,1-dichloroethane (1,1-DCA) (1.3 ug/L) and cis-1,2-DCE (1.6 ug/L) were detected. Of the metals analyzed, dissolved barium, dissolved manganese and dissolved nickel were detected.

In downgradient/crossgradient monitoring well EAST, PCE (66.2 ug/L), TCE (64.0 ug/L), 1,1,1-TCA (17.5 ug/L), 1,1-DCA (6.4 ug/L), 1,1-dichloroethene (1,1-DCE), (1.3 ug/L), cis-1,2-DCE (13.9 ug/L) and trans-1,2-dichloroethene (trans-1,2-DCE) (6.4 ug/L) were detected. Of the metals analyzed, dissolved antimony, dissolved barium, dissolved manganese and dissolved nickel were detected.

In downgradient monitoring well GM-21, PCE was below detection limits, while TCE (356 ug/L), 1,1,1-TCA (55.0 ug/L), 1,1-DCA (7.6 ug/L), 1,1-DCE, (4.5 ug/L), fluorotrichloromethane (4.9 ug/L), cis-1,2-DCE (74.5 ug/L) and trans-1,2-DCE (3.6 ug/L) were detected. Of the metals analyzed, dissolved barium and dissolved manganese were detected.

Groundwater sample DUP-57 was taken from monitoring well GM-22. The VOCs detected were PCE (5.0 ug/L), TCE (4.6 ug/L) and 1,1-DCA (1.3 ug/L), which are consistent with results from the original sample. Cis-1,2-DCE, which had been detected in the original sample at a concentration of 1.6 ug/L, was not detected in the duplicate sample. In sample DUP-57, detected metals included dissolved antimony, dissolved barium, dissolved manganese and dissolved nickel. Dissolved antimony had not been detected in the original sample. No SVOCs or PCB's were detected in sample DUP-57 or the original GM-22 sample.

Rinseate blank RB-33 was taken prior to the groundwater sample from monitoring well GM-22. All constituents analyzed were below detection limits except for the VOC chloroform, the metal chromium, and sulfate. Since chloroform and chromium were not detected in monitoring well GM-22, it may be concluded that cross-contamination of samples by field equipment likely did not occur. Since sulfate was detected in monitoring well GM-22, it may be concluded that any possible cross-contamination was likely minimal. Trip blanks TB-40 and TB-41 accompanied groundwater VOC samples taken to the laboratory. No VOCs were detected in any trip blanks, indicating no cross contamination.

3.2.4 Conclusions

Investigative activities at AOI 13 and AOI 17 have provided sufficient detail to meet the Supplemental RFI objectives, as presented below for soil and groundwater media.

1. The screening results for soil from AOIs 13 and 17 determined the following; (1) all VOC results from the on-site field GC were below the 1 mg/kg screening criterion, (2) no PCBs were detected above the U.S. EPA action level of 10 to 25 mg/kg presented in U.S. EPA's October 7, 1997 comments on the Supplemental RFI Work Plan, and (3) for the one sample collected in the only area which exhibited visual evidence of staining, the metals results were below the site-specific soil background levels established in Delphi Thermal Moraine Baseline Risk Assessment (ENVIRON Corporation 1996). A review of the results from these samples indicates that there are no hazardous constituents in the soil at these AOIs at concentrations which would be expected to pose a threat to human health or the environment. The Supplemental RFI sampling results provide no evidence of any significant release of hazardous constituents from these AOIs.

2. Groundwater data collected from EAST and GM-21 is not representative of the contribution of VOCs to groundwater from AOI 13 or AOI 17. This is based on the fact that several VOCs not detected in, or detected at low concentrations in, soil samples collected and analyzed in these AOIs are present in groundwater, and similar VOCs are present in monitor wells upgradient of these two AOIs. It is likely that the VOCs found in groundwater in this area of the facility are from other sources. Groundwater is further discussed on a site-wide basis in Section 4.0.

Based on these conclusions, no additional investigative activity is required at AOIs 13 and 17. Laboratory results are evaluated in the Supplemental Baseline Risk Assessment (Section 5.0 and Volume II).

3.3 AOI 36 - Former Southwest Above Ground Storage Tanks

Since the Supplemental DOCC identified AOI 36 as requiring further investigation, GM has completed construction activities in this area to support the on-going Moraine Assembly expansion projects. The U.S. EPA was notified of these construction activities in a letter from Mr. John Ridd of GM to Mr. William Buller of U.S. EPA, dated May 29, 1998, which transmitted the soil analytical results from the February 1998 sampling (discussed below) as well as a sampling plan recommending that

additional sampling be completed (discussed below). Construction activities began after the February 1998 data was collected and were on-going during the period when the additional sampling was conducted (June 1998). The construction activities which have been completed include the leveling of the soil containment dikes which surrounded the former southwest ASTs, through grading, removal of the concrete tank saddle supports, and construction of a parking lot over an area covering AOI 36 and both AOI 13 and AOI 17 (discussed in Section 3.2). This parking lot was constructed by grading existing soils, placing and compacting engineered fill as required to achieve the desired elevation, then placing multiple layers of compacted asphalt. Additionally a soil berm around the southern and eastern edge of this area was constructed using a combination of existing soil and fill material.

3.3.1 Investigative Summary for February and March 1998

3.3.1.1 Initial Sampling

A judgmental sampling approach was used to install two soil borings immediately adjacent to each tank dike area (Figure 3-3) on February 19, 1998. These borings were installed to the water table (approximately 20-25 ft bls) using hollow-stem auger drilling (Section 2.3.2.2). U.S. EPA oversight of field activities was conducted by Tetra Tech. Soil samples were collected continuously throughout the boring for visual inspection and screening with an HNu. Since all HNu headspace readings were at background levels, and there was no visual evidence of contamination, the soil samples collected from 0 to 2 ft and above the water table were the only samples submitted to the laboratory for analysis. The soil samples were analyzed for TCL VOCs and SVOCs, PCBs, and TAL metals (excluding the six essential nutrients). One duplicate sample (DUP-53) and one rinseate blank (RB-29) were taken during this initial supplemental sampling event. Trip blank TB-32 was submitted with the samples from this AOI.

3.3.1.2 Groundwater

To provide groundwater data around AOI 36 which could be used to further evaluate the soil data collected at this AOI, two upper aquifer monitor wells were sampled in March 1998: upgradient monitor well GM-21 (March 10, 1998) and downgradient monitor well GM-2 (March 4, 1998) (Figure 2-1). These monitor wells were sampled using low-flow sampling techniques (Section 2.3.1.3) and the groundwater samples were submitted to NET for analysis of Appendix IX VOCs and cis-1,2-DCE, SVOCs,

PCBs, Total Metals and Dissolved Metals by the required analytical methods. The biogeochemical parameters were also analyzed (Table 1-1) by NET and Microseeps.

3.3.2 Initial Supplemental Soil Results

Analytical results from the February 1998 sampling at AOI 36 are presented in Table 3-6. The laboratory analysis indicated that the concentration of VOCs was below the laboratory method detection limit for all samples, except the 20 to 22 ft interval in boring AST-BH1 where PCE (6 ug/kg) and TCE (6.5 ug/kg) were detected. Similarly, SVOCs were non-detect for all samples except the 20 to 22 ft interval at AST-BH1 where bis(2-ethylhexyl)phthalate (1,230 ug/kg) was detected. Of the metals analyzed, arsenic, barium, copper, lead, manganese, nickel, and zinc were detected in all of the samples. Beryllium and selenium were detected in all samples, except AST-BH1 at the 20 to 22 ft bls interval. Chromium, cobalt, mercury, and vanadium were detected in all samples, except AST-BH1 (20 to 22 ft bls) and AST-BH2 (22 to 24 ft bls). Thallium was only detected in AST-BH2 (22 to 24 ft bls).

Soil sample DUP-53 was taken as a duplicate of the 22 to 24 ft sample from soil boring AST-BH2. TCE (5.9 ug/kg) was detected in DUP-53; TCE was not detected in the original sample. SVOC's and PCB's were not detected in the duplicate sample nor in the original sample. Of the TAL metals analyzed in DUP-53, arsenic, barium, beryllium, copper, lead, manganese, nickel and zinc were detected in the duplicate sample and the original sample. Selenium and thallium, which were detected in the original sample, were not detected in the duplicate sample.

RB-29 was taken prior to the 22 to 24 foot soil sample from soil boring AST-BH2. VOCs, SVOCs, and PCBs were not detected in rinseate blank RB-29. Metals that were detected in RB-29 included arsenic and manganese. Since these concentrations are three to four orders of magnitude lower than those reported in the 22 to 24 foot soil sample from soil boring AST-BH2, any possible cross-contamination can be considered minimal. No VOCs were detected in trip blank TB-32, indicating no cross contamination of VOCs occurred during sample collection and handling.

A review of the metals data from the February 1998 sampling event indicates that the concentrations of arsenic in the two shallow soil samples are above site-specific background levels determined during the RFI for Delphi Thermal Moraine and reported in the Delphi Thermal Moraine Baseline Risk Assessment (ENVIRON Corporation 1996) and presented on Table 3-3. No concentrations of other metals

exceed the site-specific background levels. The concentrations of arsenic in the deeper soil samples also do not exceed the site-specific background levels.

3.3.3 Groundwater Results

Depth to water measurements prior to sampling for GM-21 and GM-2 were 20.52 ft (elevation of 703.68 ft msl) and 33.02 ft (elevation of 702.79 ft msl), respectively. Groundwater parameters (specific conductivity, pH, ORP, temperature and dissolved oxygen) after they had stabilized to within 10%, and before filling the sample containers are provided on the groundwater sampling logs in Appendix D.

Tables 3-4 and 3-5 provide a summary of constituents detected by the laboratory analysis. The analytical results for monitoring well GM-21 were discussed in Section 3.2.3. In monitoring well GM-2, PCE (8.5J ug/L), TCE (75.1J ug/L), 1,1,1-TCA (5.9J ug/L), 1,1-DCA (1.7J ug/L) and cis-1,2-DCE (10.5J ug/L) were detected. Of the metals analyzed, dissolved barium was the only dissolved metal detected. No SVOCs or PCBs were detected in monitoring well GM-2.

No duplicate samples or rinseate blanks were taken with groundwater samples from monitoring wells GM-21 and GM-2. Trip blanks TB-37, TB-40A and TB-41 accompanied groundwater VOC samples taken to the laboratory. No VOCs were detected in any trip blanks, indicating no cross contamination of VOCs occurred during sample collection and handling.

3.3.4 Additional Soil Sampling Investigative Summary for June 1998

Based on a preliminary review of the February 1998 soil characterization data for AOI 36, GM determined that additional soil sampling was needed to further characterize arsenic concentrations in the shallow soil at the area around AOI 36. This determination was made since the concentrations of arsenic in shallow soil samples were above background levels and there was uncertainty regarding the cause for the presence of arsenic at these concentrations. This recommendation was presented to the U.S. EPA in a letter from GM dated May 29, 1998. The May 1998 letter included a proposed sampling plan. This proposed plan was amended based on telephone conversations with the U.S. EPA on June 9 and 10, 1998. Upon receipt of the U.S. EPA's verbal approval in the June 10, 1998 telephone call, the supplemental soil sampling for arsenic in the area around AOI 36 was conducted on June 10 and 11, 1998. The U.S. EPA's approval letter submitted via facsimile on June 11, 1998 was received by GM on June 12, 1998 (Appendix A).

Figure 3-4 details the area at the south end of the Engine Plant and shows where additional sampling was conducted to evaluate the presence of arsenic detected in shallow soil in the vicinity of AOI 36. Since the source of the arsenic may not be associated with materials which were likely stored in the Southwest ASTs, the sampling plan was developed to obtain arsenic data for the area around AOI 36 which historically had been unpaved. To further refine the evaluation of the data to be collected, this area was divided into Areas A, B, C and D. The surface area for Area A is approximately 34,028 square ft (sq ft), for Area B is approximately 34,028 sq ft, for Area C is approximately 34,028 sq ft, and Area D is approximately 34,028 sq ft.

Soil samples from the 0 to 2 ft and 2 to 4 ft intervals were collected at four locations within each Area. Samples were collected using either a manual hand auger or powered auger (Section 2.3.2.3). The shallow soil samples were split, with half retained as a discrete sample and half combined into one representative composite sample for each Area. The four shallow interval composite samples were analyzed for arsenic by NET. The shallow discrete samples and deeper discrete samples were retained and the need to analyze these samples was determined based on an evaluation of the analytical results of the composite sample.

As part of the construction of a parking lot in this southern area of the Engine Plant, a landscaping berm (requested by the City of Moraine) was created along the eastern, southern and western boundaries of the Areas (Figure 3-4). This berm was constructed using a mixture of top soil from Areas A, B, C and D and fill material brought onto the site. Additional soil samples were collected to evaluate the presence of arsenic in the berm. The berm was divided into three sections (Berm Area E, Berm Area F and Berm Area G). Soil samples from the mid-depth of the berm were collected from five locations in Berm Areas E and F and from six locations within Berm Area G. The samples were split with a portion retained as a discrete sample and a portion combined into a composite sample. The composite samples were analyzed for arsenic by NET. The discrete berm samples were retained and the need to analyze these samples was determined based on an evaluation of the analytical results of the composite sample.

3.3.5 Additional Soil Results from June 1998

The results of the additional shallow soil sampling are presented on Table 3-7. The additional sampling data indicates that for all seven composite samples (four soil area and three berm composite samples) the concentrations of arsenic were well below the 325 mg/kg screening criteria presented in the additional sampling work plan

(concentration expected to pose no significant risk based on preliminary risk assessment) (Delphi Thermal Moraine, May 29, 1998).

Soil sample DUP-59 was taken as a duplicate of the composite sample from Soil Area A. Arsenic was detected at a concentration of 41.6J mg/kg, compared to a concentration of 20.1J mg/kg in the original sample. Rinseate blank RB-35 was taken prior to using the hand auger for collecting soil samples. Rinseate blank RB-36 was taken prior to using the power auger for collecting soil samples. Arsenic was below detection limits in both rinseate blanks; therefore, it may be concluded that cross contamination of samples did not occur.

3.3.6 Conclusions

Investigative activities at AOI 36 have provided sufficient detail to meet the Supplemental RFI objectives, as presented below for soil and groundwater media.

1. The Supplemental RFI soil samples were collected initially at selected locations around the former tanks at depths most likely to identify releases of hazardous constituents to surface and subsurface soils per the Supplemental RFI Work Plan. Therefore, analytical results from these samples would likely represent the highest concentrations of any constituents released to soil that may result in potential exposure to workers, or that may affect groundwater quality. A review of these results indicates that there are no hazardous constituents in soil at this AOI at concentrations which would be expected to pose a threat to human health or the environment, except for arsenic. The initial Supplemental RFI sampling results provide no evidence of any significant release of hazardous constituents from this AOI, except potentially arsenic.

2. Additional Supplemental RFI soil samples were collected at selected locations in the area around AOI 36 to further characterize the presence of arsenic in shallow soil samples. This additional data indicates that concentrations of arsenic are below screening criteria approved by the U.S. EPA, and therefore, arsenic is not present at concentrations which would be expected to pose a threat to human health and the environment.

3. Groundwater data collected from GM-2 is not representative of the contribution of VOCs to groundwater from AOI 36. This is based on the fact that several VOCs not detected in (or detected at low concentrations) in soil samples collected and analyzed in this AOI are present in groundwater, and VOCs are present in

groundwater data from upgradient monitor well GM-21. It is likely that the VOCs found in groundwater in this area of the facility are from other sources. Groundwater is further discussed on a site-wide basis in Section 4.0.

Based on these conclusions, no additional investigative activity is required at AOI 36. These results are evaluated in the Supplemental Baseline Risk Assessment (Section 5.0 and Volume II).

3.4 AOI 7 - Former Oil House Area

AOI 7 - Former Oil House Area was investigated during the Supplemental RFI because it may be a potentially significant source for soil and groundwater contamination at the site. An initial investigation was conducted in February 1998. The preliminary results of this investigation were summarized in a July 16, 1998 report to the U.S. EPA, along with recommendations for the collection of additional data. Once U.S. EPA approval was received on the proposed additional investigation, the field work was implemented in August 1998. The preliminary results of this additional investigation were summarized in an October 16, 1998 letter report to the U.S. EPA, along with recommendations for the collection of additional data. Once U.S. EPA approval was received on the proposed additional investigation, the field work was implemented in November 1998. Copies of these reports are provided in Appendix A. The following sections present these AOI 7 investigations.

3.4.1 Initial Investigation Conducted In February 1998

3.4.1.1 Investigative Summary

A judgmental sampling approach was used to install and sample four borings (OH-BH1 through OH-BH4) on February 20 and 23, 1998. The borings were installed to the water table in the vicinity of the Former Oil House Area, in locations shown on Figure 3-5. Boring locations were determined based on the assumptions that the former USTs and ASTs north of the Former Oil House Building 7 were located under the current Moraine Engine tank farm and pump house. In order to avoid compromising the existing secondary containment structures, borings were advanced outside of the Tank Farm containment structures. The boring locations were at former Tank #15 within the middle of the small tank farm (downgradient of an oil storage tank) (OH-BH1), west of former Tanks #8 and #9 as these contained chlorinated solvents (OH-BH2), at the former drum storage pad (OH-BH3), and near the southern end of the former foundation of Building 7 where drums of oil were stored.

Continuous soil samples were collected using hollow-stem auger drilling and screened with an HNu (Section 2.3.2.2). The samples, collected at 0 to 2 ft, the top of the water table and a third sample if an elevated HNu reading or soil staining was detected, were submitted to NET under proper chain-of-custody protocols for analyses of TCL VOCs and SVOCs, PCBs, and TAL metals (excluding the six essential nutrients). Two duplicate samples (DUP-54 and DUP-55) and two rinseate blanks (RB-30 and RB-31) were also collected. Trip blanks TB-33 and TB-34 were also submitted during sampling.

To provide groundwater data around AOI 7 which could be used to further evaluate the soil data collected at this AOI, two upper aquifer wells (GM-23 and HR-11) were sampled on March 9, 1998 using low-flow sampling techniques (Section 2.3.1.3). GM-23 is located within AOI 7 - Former Oil House Area, north of the Moraine Engine Plant building and HR-11 is located north and upgradient of AOI 7 and the Moraine Engine Plant (Figure 2-1). Samples were submitted to NET under proper chain-of-custody protocols for analyses of Appendix IX VOCs and cis-1,2-DCE, Appendix IX SVOCs, Appendix IX PCB's, Appendix IX total and dissolved metals. The biogeochemical parameters were also analyzed (Table 1-1) by NET and Microseeps.

3.4.1.2 Soil Results

Borings OH-BH1, OH-BH2, OH-BH3 and OH-BH4 were advanced to the water table, with total depths ranging from 26 ft bls to 32 ft bls. The location of these borings and the lithologic and analytical data are depicted on Figures 3-6 (line of cross section) 3-7, and 3-8 (AOI 7 cross section). Development of Figures 3-7 and 3-8 was ongoing throughout the AOI 7 investigation, as a result it contains data that is presented later in this section. Headspace readings from borings OH-BH1, OH-BH3, and OH-BH4 typically ranged from 0 ppm to 4.0 ppm. Headspace readings from boring OH-BH2 were 0 ppm throughout the entire depth of the boring, which may not be indicative of the soil because PCE was detected, as discussed below. Table 3-8 provides a summary of constituents detected by the laboratory analysis.

In soil boring OH-BH1, PCE was detected in all three sampled intervals at concentrations of 53.7 ug/kg (0 to 2 ft), 125 ug/kg (6 to 8 ft), and 505 ug/kg (28 to 30 ft). Of the TAL metals analyzed, arsenic, barium, beryllium, chromium, copper, lead, manganese, mercury, nickel, and zinc were detected in one or more of the soil samples. No other VOCs and no SVOCs or PCBs were detected in soil boring OH-BH1.

In soil boring OH-BH2, PCE was detected in both sampled intervals at concentrations of 56.4 ug/kg (1 to 3 ft) and 7,690 ug/kg (29 to 31 ft). SVOCs were detected in the 1 to 3 ft interval. These included fluoranthene (4,570 ug/kg) and phenanthrene (3,770 ug/kg). Of the TAL metals analyzed, arsenic, barium, beryllium, copper, lead, manganese, mercury, nickel, and zinc were detected in one or more of the soil samples. No other VOCs or SVOCs and no PCBs were detected in soil boring OH-BH2.

In soil boring OH-BH3, PCE was detected in all three sampled intervals at concentrations of 41.4 ug/kg (0 to 2 ft), 29.3 ug/kg (14 to 16 ft), and 247 ug/kg (24 to 26 ft). Additionally, TCE was detected in the 24 to 26 ft interval at a concentration of 521 ug/kg. Of the TAL metals analyzed, arsenic, barium, beryllium, cobalt, copper, lead, manganese, mercury, nickel, and zinc were detected in one or more of the soil samples. No other VOCs and no SVOCs or PCBs were detected in soil boring OH-BH3.

In soil boring OH-BH4, PCE was detected in all three sampled intervals at concentrations of 123 ug/kg (0 to 2 ft), 113 ug/kg (6 to 8 ft), and 474 ug/kg (22 to 24 ft). Additionally, TCE (20.6 ug/kg) was detected in the 0 to 2 ft interval. Of the TAL metals analyzed, arsenic, barium, beryllium, copper, lead, manganese, mercury, nickel, and zinc were detected in one or more of the soil samples. No other VOCs and no SVOCs or PCBs were detected in soil boring OH-BH4.

DUP-54 was taken as a duplicate of the 29 to 31 ft sample from soil boring OH-BH2. PCE (9,290 ug/kg) was the only VOC detected as was the case with the original sample. Of the TAL metals analyzed in DUP-54, arsenic, barium, beryllium, copper, lead, manganese, nickel and zinc were detected in the duplicate sample. These were the same metals detected in the original sample. SVOCs and PCBs were not detected in the duplicate sample, nor in the original sample.

DUP-55 was taken as a duplicate of the 28 to 30 ft sample from soil boring OH-BH1. PCE (377 ug/kg) was the only VOC detected as was the case with the original sample. Of the TAL metals analyzed in DUP-55, arsenic, barium, copper, lead, manganese, nickel and zinc were detected in the duplicate sample. These were the same metals detected in the original sample, except that beryllium was also detected in the original sample. SVOCs and PCBs were not detected in the duplicate sample, nor in the original sample.

Rinseate blank RB-30 was taken prior to the 0 to 2 ft soil sample from soil boring OH-BH3. VOCs, SVOCs, and PCBs were not detected in RB-30. Manganese was present at a concentration slightly above its detection limit and was present in the 0 to 2 ft soil sample from soil boring OH-BH3 (302 mg/kg), any possible cross-contamination can be considered negligible. Rinseate blank RB-31 was taken prior to the 0 to 2 ft sample from soil boring OH-BH4. VOCs, SVOCs, PCBs, and metals were not detected in RB-30; therefore, it may be concluded that cross-contamination did not occur.

No VOCs were detected in trip blanks TB-33 and TB-34, indicating no cross contamination of VOCs occurred during sample collection and handling.

3.4.1.3 Groundwater Results

Depth to water measurements prior to the March 1998 sampling of GM-23 and upgradient monitor well HR-11 were 25.03 ft (elevation of 705.96 ft msl) and 36.38 ft (elevation of 707.02 ft msl), respectively. Groundwater parameters (specific conductivity, pH, ORP, temperature, and DO), after they had stabilized to within 10% and before filling the sample containers, are provided on the groundwater sampling logs in Appendix D.

Tables 3-4 and 3-5 provide a summary of constituents detected by the laboratory analysis. No SVOCs or PCBs were detected in the two monitor wells sampled to further characterize the area around AOI 7. Biogeochemical analytical results are provided and discussed in Section 4.6.

In upgradient monitoring well HR-11, 1,1-DCA (6.8 ug/L) and cis-1,2-DCE (1.4 ug/L) were detected. Of the metals analyzed, dissolved barium, dissolved manganese, and dissolved nickel were detected.

In monitoring well GM-23, located within AOI 7, PCE (11,200J ug/L); TCE (3,870J ug/L); cis-1,2-DCE (3,870J ug/L); and vinyl chloride (766J ug/L) were detected. Of the metals analyzed, dissolved barium, and dissolved manganese were detected.

No VOCs were detected in trip blank TB-40, indicating no cross contamination of VOCs occurred during sample collection and handling.

3.4.1.4 Conclusions

A review of the soil characterization data for AOI 7 (Table 3-8), showed that the concentrations of PCE in the soil samples collected per the approved Supplemental RFI Work Plan generally increased with depth from ground surface. The highest concentrations of PCE in each soil boring were at the water table (where the boring was terminated). At borings OH-BH1, OH-BH3, and OH-BH4, the concentrations at the water table were approximately 5 to 10 times higher than those in the shallower samples. At boring OH-BH2, the concentration of PCE at the water table was more than 130 times higher than in the shallower samples. The concentrations of PCE in the shallow soil samples (0 to 2 ft) among OH-BH1 through OH-BH4 ranged from 41 ug/kg to 123 ug/kg. These concentrations are more than 500 times lower than the concentration of PCE in shallow soil (3 to 5 ft) measured during installation of monitoring well GM-23 in 1994 (63,500 ug/kg, presented in Appendix A-8 of the Supplemental DOCC [Geraghty & Miller, Inc. 1997a]). TCE (530 ug/kg) was also detected at this interval in the GM-23 soil boring. The concentration of PCE (11,200J ug/L) measured in groundwater at monitoring well GM-23 during the Supplemental RFI was consistent with the concentration measured in 1994 (8,570 ug/L, presented in Table 2-6 of the Supplemental DOCC).

Four other organic constituents were detected at low frequencies and low concentrations in soil samples at borings OH-BH1 through OH-BH4 and during installation of GM-23. The presence of TCE in one of the four soil samples (OH-BH3) collected at the water table during the Supplemental RFI may be related to the presence of PCE in groundwater in the vicinity of this location. The concentrations of the other organic constituents detected (i.e., the SVOCs) were expected to pose no significant risk under the site-specific exposure scenarios developed for evaluating AOI 7 in the Supplemental Baseline Risk Assessment. The concentrations of metals in soil samples at borings OH-BH1 through OH-BH4 were all within the site-specific background levels determined during the RFI for Delphi Thermal Moraine and reported in the Baseline Risk Assessment (ENVIRON Corporation 1996).

The three VOCs other than PCE (i.e., TCE, cis-1,2-DCE, and vinyl chloride) detected in the groundwater sample collected from GM-23 during the Supplemental RFI may be degradation products related to the presence of PCE in soil and groundwater in the vicinity of this monitoring well.

Based on the PCE data from the soil and groundwater samples collected at AOI 7, in particular, the higher PCE concentrations at the water table and no apparent shallow

source for the presence of PCE and its potential degradation products in soil and groundwater, the original objectives of the Supplemental RFI program for AOI 7 (Section 2.2.2) were determined by GM to not be met. Therefore, additional investigation was deemed appropriate to further characterize the presence of PCE and its potential degradation products in the vadose zone soil and in groundwater at AOI 7 and to assess the potential effect of local geologic conditions on the movement of VOCs. Specific objectives for the additional investigation are presented in Section 2.2.2.1. The AOI 7 investigation results from February 1998 and the proposed scope of work for the additional investigation at AOI 7, was presented to the U.S. EPA in a report dated July 16, 1998 (ARCADIS Geraghty & Miller 1998).

3.4.2 Additional Investigation Conducted In August 1998

A conference call was held on July 30, 1998 between U.S. EPA, Tetra Tech, GM, ENVIRON Corporation, and ARCADIS Geraghty & Miller to discuss the scope of work proposed for the additional investigation at AOI 7 presented in the report dated July 16, 1998. As a result of this call, the proposed investigation was modified and finalized. A summary of the scope modifications was presented in a memorandum to U.S. EPA and Tetra Tech from ARCADIS Geraghty & Miller, dated August 6, 1998. During implementation of the additional investigation discussed below, another conference call was held on August 20, 1998 between U.S. EPA, Tetra Tech, GM, and ARCADIS Geraghty & Miller. The purpose of this call was to discuss preliminary investigation results, to make decisions so that the field program could be finalized, and to discuss other pertinent Supplemental RFI issues. A summary of this conference call was presented in a memorandum to U.S. EPA and Tetra Tech from ARCADIS Geraghty & Miller, dated September 11, 1998.

3.4.2.1 Investigative Summary

A judgmental sampling approach to further evaluate the AOI 7 source area, as required to support the Supplemental Baseline Risk Assessment, was used during the August 1998 investigation. The work included the installation of six soil borings (OH-BH5 through OH-BH10) and two monitor wells (GM-27 and GM-28) between August 5, and 26, 1998. Soil boring and monitor well locations are indicated on Figure 3-5. Boring locations were determined based on the historical layout of the area and the soil analytical results from the initial phase of the investigation. These boring locations were also expected to provide verification of the presence of a lower permeability upper clay till layer within the upper aquifer, detected during the installation of GM-23 in 1994.

Boring OH-BH5 was located between borings OH-BH2 and OH-BH3 and immediately west of the current Moraine Engine Tank Farm, in order to evaluate the potential source of VOCs in shallow and deep soil associated with what is believed to be the historic tank farm unloading area. Boring OH-BH6 was located between the former oil house building and former oil house tank farm, in order to delineate and further investigate VOCs reported during installation of GM-23. Boring OH-BH7 was located between boring OH-BH4 and GM-23, in order to delineate and further investigate VOCs reported during installation of GM-23. Boring OH-BH8 was located immediately north of the existing Moraine Engine Tank Farm, in order to evaluate the potential source of VOCs in shallow and deep soil associated with the former oil house tank farm. Boring OH-BH9 was located north of OH-BH1 and a new chip pad, in order to evaluate the lateral extent of VOCs in shallow and deep soil north of the former oil house ASTs. Boring OH-BH10 was located west of OH-BH2, in order to evaluate the lateral extent of VOCs in shallow and deep soil west of the former oil house tank farm.

Continuous soil samples were collected using hollow-stem auger drilling and screened with an HNu (Section 2.3.2.2). To evaluate the presence of the upper clay till beneath AOI 7, each of the six borings were advanced until the upper clay till was reached or advanced up to 15 ft below the water table in accordance with the Preliminary AOI Evaluation and Recommendations Report (ARCADIS Geraghty & Miller 1998). If the upper clay till was present, a groundwater sample was collected using Hydropunch II™ techniques for laboratory analysis (Section 2.3.1.3). To assess if a DNAPL was present on the upper clay till, a saturated soil sample was collected from the interval immediately above the upper clay till at each boring location. A hydrophobic dye test was conducted on these saturated soil samples, as described in Section 2.3.2.5.

An AOI-specific parameter list was used for laboratory analysis during the additional investigation at AOI 7. The basis for the AOI-specific parameter list was previous analytical data presented in the Supplemental DOCC and the Supplemental RFI data from the February and March 1998 investigations. The AOI-specific parameter list included: PCE, TCE, trans- and cis-1,2-DCE, 1,1-DCA, 1,1-DCE, 1,1,1-TCA, and vinyl chloride. Samples were submitted to NET under proper chain-of-custody protocols. Three duplicate samples were taken (DUP-60, DUP-62, DUP-63), three rinseate blanks were taken (RB-37, RB-39, RB-40), and MS/MSD samples were taken.

To determine whether VOCs are present as a DNAPL and determine whether VOCs have migrated vertically to lower portions of the upper aquifer, well GM-27 was installed east of GM-23, below the upper clay till. The Hydropunch II™ technique

was used to collect groundwater samples between the upper clay till and the regional confining unit. These samples were analyzed for the AOI-specific parameter list and the results were used to determine the optimum location to set the well screen. To evaluate the presence of the upper clay till (and if present, whether it is potentially acting as a confining layer for DNAPL) and groundwater quality downgradient of AOI 7, well GM-28 was installed southwest of GM-27. Installation and development of these wells was presented in Section 2.3.1.2.

Groundwater samples were collected from GM-27 and GM-28 after they were developed. In addition to these wells, groundwater was also sampled from monitor wells HR-3, ME-6, HR-1, and GM-26 on August 24, 1998 and analyzed by NET for the AOI-specific parameter list. The biogeochemical parameters were also collected from GM-23, GM-27, and GM-28 on August 26, 1998 and analyzed by NET and Microseeps. This sampling included three duplicate samples (DUP-61, DUP-64, DUP-65), three rinseate blanks (RB-38, RB-41, RB-42), and MS/MSD samples. A total of ten trip blanks were submitted during the August 1998 sampling event.

3.4.2.2 Soil Results

Lithologic Characterization

Boring logs for the ten soil borings and two monitor wells installed during the first two phases of the AOI 7 investigation provided significant information regarding lithologic conditions within AOI 7 (Appendix D). This data indicates the presence of an upper clay till layer within the upper aquifer beneath AOI 7. The presence and extent of this upper clay till area was further evaluated using boring logs from monitor wells previously installed in and around AOI 7 and geotechnical boring logs associated with construction of the Moraine Engine plant. Using these logs, a geologic cross-section running north to south through AOI 7 and several running west to east were generated. The location of the cross-sections are presented on Figure 3-6 and the cross-sections are presented on Figures 3-7 and 3-8 (these cross-sections include lithologic and analytical data from a subsequent AOI 7 investigation discussed later).

Analytical Results

Borings OH-BH5 through OH-BH10, and GM-28, were advanced to the upper clay till, with total depths ranging from 31.5 ft to 38 ft bls. GM-27 was drilled through the upper clay till to the regional clay till to a total depth of 58 ft. Headspace readings from borings OH-BH5 through OH-BH8 and OH-BH10 were very low or 0 ppm in the

0 to 2 ft interval and generally increased with depth. Headspace readings from boring OH-BH9 were 0 ppm throughout the entire depth of the boring. Table 3-9 provides a summary of constituents detected in soil by laboratory analysis. Table 3-10 presents a summary of the dye test results.

In soil boring OH-BH5, PCE was detected in the 18 to 20 ft (135 ug/kg) and 24 to 26 ft (762J ug/kg). TCE was detected in the same intervals at concentrations of 6.1 ug/kg and 22.5 ug/kg, respectively. No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test for OH-BH5 was performed on saturated soil from the 36.5 to 37.5 ft interval. No evidence of DNAPL was observed.

In soil boring OH-BH6, PCE was detected in the 0 to 2 ft (554 ug/kg), 6 to 8 ft (38.9 ug/kg) and 22 to 24 ft (119J ug/kg) intervals. TCE was detected in the 0 to 2 ft (12.7 ug/kg) and 22 to 24 ft (5.8J ug/kg) intervals. No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test for OH-BH6 was performed on saturated soil from the 30 to 31.5 ft interval. A film appeared on the surface of the water inside the test jar, and several red dye particles were present, indicating the possible presence of DNAPL.

In soil boring OH-BH7, PCE was detected in the 0 to 2 ft (31.4 ug/kg), 18 to 20 ft (482 ug/kg) and 22 to 24 ft (325 ug/kg) intervals. TCE was detected in the 18 to 20 ft (5.1 ug/kg) interval. No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test for OH-BH7 was performed on saturated soil from the 30 to 30.5 ft interval. No evidence of DNAPL was observed.

In soil boring OH-BH8, PCE was detected in the 0 to 2 ft (16.0 ug/kg), 16 to 18 ft (70.0 ug/kg) and 26 to 28 ft (6,010 ug/kg) intervals. TCE was detected in the 26 to 28 ft (73.5 ug/kg) interval. Cis-1,2-DCE was detected in the 26 to 28 ft (36.3 ug/kg) interval. No other VOCs in the AOI-specific parameter list were detected. Hydrophobic dye tests for OH-BH8 were performed on soil from the 22 to 24 ft interval (immediately above a 3 ft thick interval of clay till) and the 36 to 38 ft interval (immediately above the upper clay till). No evidence of DNAPL was observed in either test.

In soil boring OH-BH9, PCE was detected in the 0 to 2 ft (280 ug/kg) and 28 to 30 ft (462J ug/kg) intervals. No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test for OH-BH9 was performed on saturated soil from the 36 to 38 ft interval. No evidence of DNAPL was observed.

In soil boring OH-BH10, PCE was detected in the 0 to 2 ft (548 ug/kg), 14 to 16 ft (235J ug/kg), and 26 to 28 ft (995 ug/kg) intervals. TCE was detected in the 0 to 2 ft (24.7 ug/kg) and 26 to 28 ft (20.0 ug/kg) intervals. No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test for OH-BH10 was performed on saturated soil from the 32 to 34 ft interval. No evidence of DNAPL was observed.

In the GM-27 soil boring, PCE was detected in the 0 to 2 ft (40.3 ug/kg), 18 to 20 ft (743 ug/kg), and 22 to 24 ft (1,510J ug/kg) intervals. TCE was detected in the 18 to 20 ft (6.9 ug/kg) and 22 to 24 ft (16.4 ug/kg) intervals. Cis-1,2-DCE was detected in the 22 to 24 ft (6.0 ug/kg) interval. No other VOCs in the AOI-specific parameter list were detected. Hydrophobic dye tests for the GM-27 boring were performed on saturated soil from immediately above the upper clay till (the 31.5 to 33.5 ft interval and the 33.5 to 34.5 ft interval) and between the upper clay till and the regional confining unit (the 38 to 39 ft interval and the 54 to 55 ft interval). The two dye tests collected above the upper clay till showed small red dye particles on the water inside the test jar, indicating the possible presence of DNAPL. The test from the 38 to 39 ft interval produced a colored sheen with red dye particles on the water surface, indicating the possible presence of DNAPL. The test from the 54 to 55 ft interval did not produce significant evidence of the presence of DNAPL.

In the GM-28 soil boring, PCE was detected in the 26 to 28 ft (27.0J ug/kg) interval. No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test for the GM-28 boring was performed on saturated soil from the 30 to 32 ft interval. No evidence for DNAPL was observed.

Soil sample DUP-60 was taken as a duplicate of the 0 to 2 ft sample from soil boring OH-BH6. PCE (500 ug/kg) and TCE (8.3 ug/kg) were detected. These constituents were also detected in the original sample. Soil sample DUP-62 was taken as a duplicate of the 28 to 30 ft sample from soil boring OH-BH9. PCE (619 ug/kg) was detected in DUP-62. This constituent was also detected in the original sample.

Rinseate blank RB-37 was taken prior to the 0 to 2 ft soil sample from OH-BH6. All constituents analyzed were below detection limits; therefore, it may be concluded that cross-contamination of samples by field equipment did not occur. Rinseate blank RB-39 was taken prior to the 28 to 30 ft soil sample from OH-BH9. All constituents analyzed were below detection limits; therefore, it may be concluded that cross-contamination of samples by field equipment did not occur.

Trip blanks TB-41, TB-42, TB-43, TB-44, TB-46, TB-48, TB-49 and TB-50 accompanied soil samples collected during the August 1998 investigation at AOI 7. All VOCs analyzed were below detection limits, indicating no cross contamination of VOCs occurred during sample collection and handling.

3.4.2.3 Groundwater Results

Hydropunch II™ Water Samples

The Hydropunch II™ technique was used to collect groundwater samples at the top of the upper clay till in soil borings OH-BH5 through OH-BH10, GM-27, and GM-28 during the August 1998 investigation. In addition, the Hydropunch II™ technique was used to collect groundwater samples within the shallow aquifer below the upper clay till during installation of GM-27 to set the well screen. Table 3-11 provides a summary of the constituents detected by laboratory analysis.

In soil boring OH-BH5, a Hydropunch II™ sample was taken from a depth of 37 ft bls. PCE (1,550 ug/L) and TCE (1,330 ug/L) were detected. Other VOCs detected were 1,1-DCA (18.5 ug/L), 1,1-DCE (84.1 ug/L), cis-1,2-DCE (1,280 ug/L), trans-1,2-DCE (7.6 ug/L), and vinyl chloride (436 ug/L).

In soil boring OH-BH6, a Hydropunch II™ sample was taken from a depth of 31.5 ft bls. PCE (28.5 ug/L) and TCE (52.4 ug/L) were detected. Other VOCs detected were 1,1-DCA (8.5 ug/L), 1,1-DCE (8.8 ug/L), cis-1,2-DCE (1,900 ug/L), trans-1,2-DCE (13.2 ug/L), and vinyl chloride (503 ug/L).

In soil boring OH-BH7, a Hydropunch II™ sample was attempted but the screen silted shut so the sample was taken from a depth of 30 ft bls using a bailer. PCE (2,950 ug/L) and TCE (728 ug/L) were detected. Other VOCs detected were 1,1-DCA (2.1 ug/L), cis-1,2-DCE (962 ug/L), trans-1,2-DCE (11.1 ug/L), 1,1,1-TCA (3.2 ug/L), and vinyl chloride (7.3 ug/L).

In soil boring OH-BH8, a Hydropunch II™ sample was taken from a depth of 38 ft bls. PCE (77.6 ug/L) and TCE (246 ug/L) were detected. Other VOCs detected were 1,1-DCA (20.6 ug/L), 1,1-DCE (3.6 ug/L), cis-1,2-DCE (226 ug/L), trans-1,2-DCE (7.0 ug/L), and vinyl chloride (2,680 ug/L).

In soil boring OH-BH9, a Hydropunch II™ sample was taken from a depth of 38 ft bls. PCE (520J ug/L) and TCE (6.6 ug/L) were detected. The only other VOC detected was 1,1,1-TCA (5.4 ug/L).

In soil boring OH-BH10, a Hydropunch II™ sample was taken from a depth of 34 ft bls. PCE (1,810 ug/L) and TCE (66.6 ug/L) were detected. Other VOCs detected were 1,1-DCA (2.5 ug/L), 1,1-DCE (1.3 ug/L), cis-1,2-DCE (57.0 ug/L), trans-1,2-DCE (1.4 ug/L), 1,1,1-TCA (6.2 ug/L), and vinyl chloride (3.7 ug/L).

In the Hydropunch II™ sample taken at a depth of 32 ft in the boring for monitoring well GM-27, PCE (484 ug/L) and TCE (75.6 ug/L) were detected. Other VOCs detected were 1,1-DCA (54.6 ug/L), 1,1-DCE (6.8 ug/L), cis-1,2-DCE (3,540 ug/L), trans-1,2-DCE (42.8 ug/L), 1,1,1-TCA (1.5 ug/L) and vinyl chloride (7,320 ug/L). Additional Hydropunch II™ samples were taken between the upper clay till and the regional clay till at depths of 39 ft bls, 50 ft bls, and 55 ft bls. The last sample, at 55 ft bls (at the top of the regional clay till), was taken via a temporary monitoring well since taking a Hydropunch II™ sample was not practical due to silting of the screen. The total VOC results from these additional Hydropunch II™ samples were compared to determine the optimum location to place the well screen. The highest total VOC concentrations occurred at the 39 ft interval (1,189.1 ug/L), immediately below the upper clay till; while the two deeper samples, collected at 50 ft bls (101.5 ug/L) and 55 ft bls (588.5 ug/L), showed lower total VOC concentrations; therefore the well screen was set between 40 ft bls and 50 ft bls.

In the Hydropunch II™ sample taken at a depth of 32 ft bls in the boring for monitoring well GM-28, PCE (242 ug/L) and TCE (444 ug/L) were detected. Other VOCs detected were 1,1-DCA (2.4 ug/L), cis-1,2-DCE (187 ug/L), trans-1,2-DCE (6.2 ug/L), and 1,1,1-TCA (10.5 ug/L).

Hydropunch II™ sample DUP-63 was taken as a duplicate of the Hydropunch II™ sample from boring OH-BH9. PCE (543 ug/L), TCE (7.1 ug/L), and 1,1,1-TCA (6.1 ug/L) were detected. These constituents were also detected in the original sample.

Rinseate blank RB-40 was taken prior to the Hydropunch II™ sample from boring OH-BH9. All constituents analyzed were below detection limits; therefore, it may be concluded that cross-contamination of samples by field equipment did not occur.

Monitor Well Sampling

Depth to water measurements prior to the August 1998 sampling of the five shallow aquifer monitoring wells were as follows: GM-27 had a depth-to-water of 22.41 ft (elevation of 708.18 ft msl), GM-28 had a depth-to-water of 21.54 ft (elevation of 707.65 ft msl), ME-6 had a depth-to-water of 22.23 ft (elevation of 706.11 ft msl), HR-1 had a depth-to-water of 26.65 ft (elevation of 706.06 ft msl), and HR-3 had a depth-to-water of 29.16 ft (elevation of 707.59 ft msl). Groundwater parameters (specific conductivity, pH, ORP, temperature, and DO), after they had stabilized to within 10% and before filling the sample containers, are provided on the groundwater sampling logs in Appendix D. Table 3-12 provides a summary of the constituents detected by laboratory analysis. Additionally, biogeochemical analytical results for GM-27, GM-28, and GM-23 are provided and discussed in Section 4.6.

In the groundwater sample collected from monitoring well GM-27 on August 24, 1998 using a bailer after its development, PCE (6.0 ug/L) and TCE (89.5 ug/L) were detected. Other VOCs detected were 1,1-DCA (1.7 ug/L), cis-1,2-DCE (48.5 ug/L), and vinyl chloride (6.9 ug/L). In the low-flow groundwater sample taken from monitoring well GM-27 on August 26, 1998 to support a bioattenuation evaluation, PCE (4.2 ug/L) and TCE (104 ug/L) were detected. Other VOCs detected were 1,1-DCA (2.0 ug/L), cis-1,2-DCE (54.9J ug/L) and vinyl chloride (8.5 ug/L).

In the groundwater sample collected from monitoring well GM-28 on August 17, 1998 using a bailer after its development, PCE (693 ug/L) and TCE (98.1J ug/L) were detected. Other VOCs detected were cis-1,2-DCE (38.2 ug/L), trans-1,2-DCE (1.3 ug/L), and 1,1,1-TCA (1.8 ug/L). In the low-flow groundwater sample taken from monitoring well GM-28 on August 26, 1998 to support a bioattenuation evaluation, PCE (500 ug/L) and TCE (475 ug/L) were detected. Other VOCs detected were 1,1-DCA (2.0 ug/L), cis-1,2-DCE (127 ug/L), trans-1,2-DCE (5.0 ug/L) and 1,1,1-TCA (10.0 ug/L).

In the low-flow groundwater sample taken from monitoring well GM-23 on August 26, 1998, PCE (8,800 ug/L) and TCE (1,190 ug/L) were detected. Other VOCs detected were 1,1-DCA (10.9 ug/L), 1,1-DCE (7.0 ug/L), cis-1,2-DCE (3,710 ug/L), trans-1,2-DCE (19.4 ug/L), 1,1,1-TCA (4.2 ug/L) and vinyl chloride (914 ug/L).

In the groundwater sample collected from monitoring well ME-6, PCE (114 ug/L) and TCE (312 ug/L) were detected. Other VOCs detected were 1,1-DCA (3.4 ug/L), cis-1,2-DCE (17.2 ug/L) and 1,1,1-TCA (26.1 ug/L).

In the groundwater sample collected from monitoring well HR-1, PCE (47.1 ug/L) and TCE (46.0 ug/L) were detected. Other VOCs detected were 1,1-DCA (1.5 ug/L), cis-1,2-DCE (9.4 ug/L) and trans-1,2-DCE (1.6 ug/L).

In the groundwater sample collected from monitoring well HR-3, PCE and TCE were not detected. 1,1-DCA (4.1 ug/L) and cis-1,2-DCE (4.6 ug/L) were detected.

Groundwater sample DUP-61 was collected as a duplicate of GM-28 sampled on August 17, 1998. PCE (770 ug/L), TCE (96.0 ug/L), cis-1,2-DCE (35.7 ug/L), trans-1,2-DCE (1.2 ug/L) and 1,1,1-TCA (1.6 ug/L) were detected in DUP-61. The same constituents were also detected in the original sample.

Groundwater sample DUP-64 was collected as a duplicate of HR-1. PCE (48.2 ug/L), TCE (47.3 ug/L), 1,1-DCA (1.6 ug/L), cis-1,2-DCE (9.3 ug/L) and trans-1,2-DCE (1.6 ug/L) were detected in DUP-64. The same constituents were also detected in the original sample.

Low-flow groundwater sample DUP-65 was collected as a duplicate of GM-27. PCE (4.7 ug/L), TCE (104 ug/L), 1,1-DCA (2.1 ug/L), cis-1,2-DCE (60.3 ug/L) and vinyl chloride (9.3 ug/L) were detected in DUP-65. The same constituents were also detected in the original sample.

Rinseate blank RB-38, RB-41, and RB-42 were collected prior to the groundwater samples from monitoring wells GM-28, HR-1, and GM-27, respectively. All constituents analyzed were below detection limits in RB-38, RB-41, and RB-42; therefore, it may be concluded that cross-contamination of samples by field equipment did not occur.

Trip blanks TB-41 through TB-52 accompanied groundwater samples taken to the laboratory. No VOCs were detected in any trip blanks, indicating no cross contamination of VOCs occurred during sample collection and handling.

3.4.2.4 Conclusions

After review of the analytical data from the August 1998, soil and groundwater sampling at AOI 7, and after review of additional facility information relating to this AOI, GM concluded that the objectives presented in Section 2.2.2.1 had not been completely addressed. The limits and topography of the upper clay till required further definition, the presence/absence of DNAPL required further evaluation, and

determination if a vadose zone source existed north of OH-BH9 was recommended. During evaluation of this data, additional information regarding historic site activities was uncovered. Specifically, an aerial photograph dated May 1979 was found in historic files at Delphi Thermal Moraine. The photograph shows the Oil House Building 7 in the foreground and the tank farm in the middle. After review of this photograph, GM concluded that the area north of the Oil House was used for temporary storage of equipment, boxes, and drums during the conversion of Frigidaire Plant 2 to the Moraine Engine Plant. A November 1979 aerial photograph showed that Building 7 had been demolished, and did not show evidence of the equipment, boxes, and drums seen in the May 1979 aerial photograph. These photographs were presented to the U.S. EPA in a letter report dated October 16, 1998 (Appendix A).

To meet the four objectives presented in Section 2.2.2.1 and to address additional areas observed in the May 1979 aerial photograph, additional soil and groundwater investigation was proposed for this AOI. The AOI 7 investigation results from August 1998 and the proposed scope of work for the additional investigation at AOI 7, was presented to the U.S. EPA in a letter report dated October 16, 1998.

3.4.3 Additional Investigation Conducted In November 1998

A conference call was held on October 30, 1998 between U.S. EPA, GM, and ARCADIS Geraghty & Miller to discuss the proposed scope of work for the additional investigation at AOI 7 presented in the letter report dated October 16, 1998. As a result of this call, the proposed investigation was modified and finalized. On October 30, 1998, GM received a letter from the U.S. EPA approving the additional investigation with the agreed upon modifications (Appendix A).

3.4.3.1 Investigative Summary

A judgmental sampling approach was used to install and sample thirteen soil borings (OH-BH11 through OH-BH20; OH-BH2A; OH-BH3A; GM-23A) between November 2, and 13, 1998. Soil boring locations are indicated on Figure 3-5. Boring locations were determined based on the historical May 1979 aerial photograph and based on the soil analytical results from the February and August 1998 investigations and to provide additional information on the presence or absence of the upper clay till.

Borings OH-BH11, OH-BH12, and OH-BH15 were installed west of the Oil House; borings OH-BH13 and OH-BH14 were installed east of the Oil House; and borings

OH-BH18, OH-BH19, and OH-BH20 were installed north of the Oil House. The purpose of these borings was to verify the presence of the upper clay till, assess DNAPL presence, and evaluate groundwater quality above the upper clay till. Borings OH-BH16 and OH-BH17 were installed on the Delphi Thermal Moraine facility and west of the railroad tracks. The purpose of these borings was to verify the presence of the upper clay till, assess DNAPL presence, evaluate groundwater quality above the upper clay till, and confirm/deny a source of PCE northwest of the Oil House area. Borings OH-BH2A and OH-BH-3A were installed immediately adjacent to OH-BH2 and OH-BH3, respectively, because the borings from the initial investigation stopped at the water table and the presence/absence of the upper clay till was not determined. The purpose of these borings was to verify the presence of the upper clay till, assess DNAPL presence, and evaluate groundwater quality above the upper clay till. Boring GM-23A was installed immediately adjacent to monitor well GM-23 to verify the presence of PCE in shallow and subsurface soil and to compare PCE results to the soil sample collected from the 3 ft to 5 ft interval during the 1994 investigation when the well was installed.

Continuous soil samples were collected using hollow-stem auger drilling and screened with an HNu (Section 2.3.2.2). To continue the evaluation of the presence of the upper clay till beneath AOI 7, 12 borings were advanced until the upper clay till was reached or advanced up to 15 ft below the water table. One exception was GM-23A, this boring was drilled to the water table. Another exception was OH-BH16 and OH-BH17. As discussed below, the upper clay till was not present in these locations and these borings were drilled to the regional confining unit. If the upper clay till was present, a groundwater sample was collected using Hydropunch II™ for laboratory analysis (Section 2.3.1.3). To assess if a DNAPL was present on the upper clay till (or the regional confining unit if the upper clay till was absent), a saturated soil sample was collected from the interval immediately above and extending into the upper clay till at each boring location. A hydrophobic dye test was conducted on these saturated soil samples, as described in Section 2.3.2.5. To assess the hydraulic conductivity in the vicinity of AOI 7, slug tests were performed on GM-23, GM-27 and GM-28 as discussed in Section 2.3.1.4. The slug test results are discussed in Section 4.0 and Appendix E.

The AOI-specific parameter list was used for laboratory analysis during the November 1998 investigation, but the analytical method was updated from 8240 to 8260. Samples were submitted to NET under proper chain-of-custody protocols. Four duplicate soil samples were taken (DUP-66, DUP-68, DUP-69, DUP-71), four rinseate blanks were taken (RB-44, RB-45, RB-46, RB-48), and MS/MSD samples were taken.

Two duplicate Hydropunch II™ samples were taken (DUP-67, DUP-70), two rinseate blanks were taken (RB-43, RB-47), and MS/MSD samples were taken. A total of 10 trip blanks were submitted during the November 1998 sampling event.

3.4.3.2 Soil Results

Lithologic Characterization

Boring logs for the thirteen soil borings installed during this third phase of the AOI 7 investigation were used to augment the characterization of lithology at AOI 7, discussed in Section 3.4.2.2. Using these logs, geologic cross-sections running north to south and west to east through AOI 7 were generated. The location of the cross-sections are presented on Figure 3-6 and the cross-sections are presented on Figures 3-7 and 3-8. A contour map of the top of the upper clay till was also generated (Figure 3-9). Additional discussion of the lateral extent of the upper clay till is presented in Section 4.0.

The lithologic data indicates that the upper clay till is present around AOI 7 at a depth ranging from approximately 25 ft to over 40 ft bls, and approximately 5 ft to 10 ft below the groundwater table. This upper clay till layer is approximately 6 ft to over 10 ft thick. The upper clay till zone was not detected in soil borings OH-BH16 or OH-BH-17 or monitor wells HR-3 and HR-13 on the Delphi Thermal Moraine facility indicating that it is likely absent west of AOI 7. To the east, the upper clay till was estimated from a historic boring log for production well 39, but could not be discerned in the log for production well 31, therefore, the presence of the upper clay till to the northeast could not be verified. Based on this information, the upper clay till layer appears to be a relatively narrow (possibly 300 to 600 feet wide) north-south trending deposit, likely an erosional remnant of a much larger area that was downcut by interglacial meltwater flow. The upper clay till appears to crest north of OH-BH18, then drop in elevation north to south across AOI 7 with a lower elevation channel running through the center of AOI 7 (starting beneath the former tank farm) and then trending to the southwest.

Analytical Results

Borings OH-BH11 through OH-BH15, borings OH-BH18 through OH-BH20, boring OH-BH2A, and boring OH-BH3A were advanced to the upper clay till, with total depths ranging from 27.75 ft bls to 41.75 ft bls. Borings OH-BH16 and OH-BH17 were advanced to the regional confining unit, with total depths of 61.75 ft bls and 57 ft

bls, respectively. Boring GM-23A was advanced to the water table with a total depth of 26 ft bls. Headspace readings were very low or 0 ppm in the 0 to 2 ft interval and in general increased with depth. Headspace readings from borings OH-BH14, OH-BH16 and OH-BH20 were 0 ppm throughout the entire depth of the boring. Table 3-13 provides a summary of constituents detected in soil by the laboratory analysis. Table 3-10 presents a summary of the dye test results. PCE and TCE soil concentrations just above the water table from the March, August, and November 1998 investigations have been contoured on Figure 3-10. All soil concentrations from AOI 7 are presented on Figure 3-11.

In soil boring OH-BH11, PCE was detected in the 0 to 2 ft (6.8 ug/kg), 18 to 20 ft (517 ug/kg) and 26 to 28 ft (4,880 ug/kg) intervals. TCE was detected in the 18 to 20 ft (10.0 ug/kg) and 26 to 28 ft (78.1 ug/kg) intervals. Cis-1,2-DCE was detected in the 26 to 28 ft (61.7 ug/kg) interval. No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test for soil boring OH-BH11 was performed on saturated soil from the 32 to 33.5 ft interval. No evidence of DNAPL was observed.

In soil boring OH-BH12, PCE was detected in the 0 to 2 ft (675 ug/kg), 12 to 14 ft (81.2 ug/kg) and 26 to 28 ft (120 ug/kg) intervals. TCE was detected in the same intervals at concentrations of 35.8 ug/kg, 13.8 ug/kg, and 25.3 ug/kg, respectively. Cis-1,2-DCE was detected in the 26 to 28 ft interval (6.3 ug/kg). No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test for soil boring OH-BH12 was performed on saturated soil from the 32 to 33.5 ft interval. A heavy sheen appeared on the surface of the water inside the test jar, and several red dye particles were present, indicating the possible presence of DNAPL.

In soil boring OH-BH13, PCE was detected in the 0 to 2 ft (17.6 ug/kg), 20 to 22 ft (333J ug/kg) and 24 to 25 ft (3,300 ug/kg) intervals. TCE was detected in the same intervals at concentrations of 10.0 ug/kg, 60.4J ug/kg, and 1,780 ug/kg, respectively. Cis-1,2-DCE (5.4 ug/kg) and 1,1,1-TCA (6.4J ug/kg) were detected in the 24 to 25 ft interval. No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test for soil boring OH-BH13 was performed on saturated soil from the 26 to 27 ft interval. No evidence of DNAPL was observed.

In soil boring OH-BH14, PCE was detected in the 22 to 24 ft (108 ug/kg) interval. TCE was detected in the 0 to 2 ft (5.2 ug/kg) and 22 to 24 ft (8.4 ug/kg) intervals. No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test for soil boring OH-BH14 was performed on saturated soil from the 32 to 32.5 ft

interval. Besides a few red dye particles present on the surface of the water inside the test jar, no evidence of DNAPL was observed.

In soil boring OH-BH15, PCE was detected in the 0 to 2 ft (118 ug/kg), 16 to 18 ft (95.1 ug/kg) and 24 to 26 ft (367 ug/kg) intervals. TCE was detected in the 0 to 2 ft (30.3 ug/kg) and 24 to 26 ft (9.7 ug/kg) intervals. No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test for soil boring OH-BH15 was performed on saturated soil from the 40 to 42 ft interval. A slight sheen and a few red dye particles appeared on the surface of the water inside the test jar, indicating the possible presence of DNAPL.

In soil boring OH-BH16, PCE was detected in the 28 to 30 ft (18.2 ug/kg) interval. No other VOCs in the AOI-specific parameter list were detected. Since the upper clay till was not observed in soil boring OH-BH16, the dye shake tests for this boring was performed on soil from the interval immediately above the regional confining unit. A hydrophobic dye test for soil boring OH-BH16 was performed on saturated soil from the 60 to 61.75 ft interval. No evidence of DNAPL was observed.

In soil boring OH-BH17, PCE was detected in the 28 to 30 ft (91.6 ug/kg) interval. No other VOCs in the AOI-specific parameter list were detected. Since the upper clay till was not observed in soil boring OH-BH17, the dye shake test was performed on soil from the interval immediately above the regional confining unit. A hydrophobic dye test for soil boring OH-BH17 was performed on saturated soil from the 56 to 57 ft interval. No evidence of DNAPL was observed.

In soil boring OH-BH18, PCE was detected in the 0 to 2 ft (202 ug/kg), 4 to 6 ft (140 ug/kg) and 30 to 31 ft (34.2J ug/kg) intervals. No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test for soil boring OH-BH18 was performed on saturated soil from the 34 to 35.5 ft interval. No evidence of DNAPL was observed.

In soil boring OH-BH19, PCE was detected in the 30 to 32 ft (11.1 ug/kg) interval. TCE was detected in the 0 to 2 ft (5.8 ug/kg) and 30 to 32 ft (7.8 ug/kg) intervals. No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test for soil boring OH-BH19 was performed on saturated soil from the 34 to 35 ft interval. No evidence of DNAPL was observed.

In soil boring OH-BH20, TCE was detected in the 0 to 2 ft (8.8J ug/kg) interval. No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test

for soil boring OH-BH20 was performed on saturated soil from the 36 to 38 ft interval. No evidence of DNAPL was observed.

In soil boring OH-BH2A, PCE was detected in the 12 to 14 ft (1,150J ug/kg) interval. TCE (53.9J ug/kg) was detected in the same interval. The presence or absence of the other analytes in this interval could not be verified due to unusable data (the surrogate recovery was less than 10%). A hydrophobic dye test for soil boring OH-BH2A was performed on saturated soil from the 36 to 37 ft interval. A heavy sheen and several red dye particles were observed on the surface of the water inside the test jar, indicating the possible presence of DNAPL.

In soil boring OH-BH3A, PCE was detected in the 20 to 22 ft (70.7 ug/kg) interval. TCE (14.2 ug/kg) was detected in the same interval. No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test for soil boring OH-BH3A was performed on saturated soil from the 28 to 30 ft interval. No evidence of DNAPL was observed.

In soil boring GM-23A, PCE was detected in the 2 to 4 ft (9,440 ug/kg), 4 to 5 ft (908J ug/kg) and 8 to 10 ft (772 ug/kg) intervals. TCE was detected in the 2 to 4 ft (6.7J ug/kg) interval. No other VOCs in the AOI-specific parameter list were detected. A hydrophobic dye test for soil boring GM-23A was not performed because this boring stopped at the water table.

Soil sample DUP-66 was taken as a duplicate of the 12 to 14 ft sample from soil boring OH-BH2A. PCE (2,540J ug/kg) was detected in DUP-66. This constituent was also detected in the original sample. The original sample also contained TCE; however, this constituent was not detected in the duplicate sample.

Soil sample DUP-68 was taken as a replicate of the 4 to 5 ft sample from soil boring GM-23A. PCE (1,000 ug/kg) was detected in DUP-68. This constituent was also detected in the original sample. TCE was detected at a concentration of 5.1 ug/kg; however, this constituent was not detected in the original sample.

Soil sample DUP-69 was taken as a replicate of the 20 to 22 ft sample from soil boring OH-BH13. PCE (48.2J ug/kg) and TCE (16.8J ug/kg) were detected in DUP-69. These constituents were also detected in the original sample.

Soil sample DUP-71 was taken as a replicate of the 0 to 2 ft sample from soil boring OH-BH17. TCE (6.8 ug/kg) was detected in DUP-71; however, this constituent was not detected in the original sample.

Rinseate blanks RB-44, RB-45, RB-46, and RB-48 were taken prior to the 0 to 2 ft soil sample from soil boring OH-BH11, the 0 to 2 ft soil sample from soil boring GM-23A, the 0 to 2 ft soil sample from soil boring OH-BH13, and the 0 to 2 ft soil sample from soil boring OH-BH17, respectively. All constituents analyzed in rinseate blanks RB-44, RB-45, RB-46, and RB-48 were below detection limits; therefore, it may be concluded that cross-contamination of samples by field equipment did not occur.

Trip blanks TB-53 through TB-62 accompanied soil samples collected during the November 1998 investigation at AOI 7. All VOCs analyzed were below detection limits, indicating that no cross contamination of VOCs occurred during sample collection and handling.

3.4.3.3 Groundwater Results

Hydropunch II™ Results

The Hydropunch II™ technique was used to collect groundwater samples at the top of the upper clay till in soil borings OH-BH11 through OH-BH15, OH-BH18 through OH-BH20, OH-BH2A and OH-BH3A during the November 1998 investigation. In addition, the Hydropunch II™ technique was used to collect groundwater samples at the top of the regional confining unit and approximately 10 to 15 ft above the regional confining unit (a corresponding depth to the Hydropunch samples collected where the upper clay till was present), in soil borings OH-BH16 and OH-BH17. Table 3-14 provides a summary of the constituents detected by laboratory analysis. The total VOCs concentrations in groundwater above the upper clay till from the August and November 1998 investigations have been contoured on Figure 3-12. PCE, TCE, and cis-1,2-DCE groundwater concentrations above the upper clay till from the August and November 1998 investigations have also been contoured on Figure 3-13.

In soil boring OH-BH11, a Hydropunch II™ sample was taken from a depth of 33 ft bls. PCE (2,060 ug/L) and TCE (1,680 ug/L) were detected. Other VOCs detected were 1,1-DCA (18.2 ug/L), 1,1-DCE (6.6 ug/L), cis-1,2-DCE (1,490 ug/L), trans-1,2-DCE (23.0 ug/L), 1,1,1-TCA (43.5 ug/L), and vinyl chloride (245 ug/L).

In soil boring OH-BH12, a Hydropunch II™ sample was taken from a depth of 33.5 ft bls. PCE (254 ug/L) and TCE (45.5 ug/L) were detected. Other VOCs detected were 1,1-DCA (29.3 ug/L), cis-1,2-DCE (131 ug/L), trans-1,2-DCE (3.2 ug/L), 1,1,1-TCA (2.1 ug/L), and vinyl chloride (113 ug/L).

In soil boring OH-BH13, a Hydropunch II™ sample was taken from a depth of 27 ft bls. PCE (136 ug/L) and TCE (3,500 ug/L) were detected. Other VOCs detected were 1,1-DCA (3.6 ug/L), 1,1-DCE (1.4 ug/L), cis-1,2-DCE (130 ug/L), trans-1,2-DCE (2.7 ug/L), and 1,1,1-TCA (12.0 ug/L).

In soil boring OH-BH14, a Hydropunch II™ sample was taken from a depth of 32 ft bls. PCE (114 ug/L) and TCE (39.0 ug/L) were detected. Other VOCs detected were 1,1-DCA (2.3 ug/L) and cis-1,2-DCE (33.9 ug/L).

In soil boring OH-BH15, a Hydropunch II™ sample was taken from a depth of 42 ft bls. PCE (65.4 ug/L) and TCE (981 ug/L) were detected. Other VOCs detected were cis-1,2-DCE (281 ug/L) and 1,1,1-TCA (18.3 ug/L).

In the Hydropunch II™ sample taken at the 33 ft depth for soil boring OH-BH16, all VOCs, were below detection limits. In the Hydropunch II™ sample at the 61 ft depth for soil boring OH-BH16, PCE (2.0 ug/L) and TCE (1.8 ug/L) were detected. Other VOCs detected were 1,1-DCA (25.0 ug/L), cis-1,2-DCE (12.0 ug/L), trans-1,2-DCE (1.4 ug/L), and 1,1,1-TCA (7.3 ug/L).

In the Hydropunch II™ sample taken at the 40 ft depth for soil boring OH-BH17, PCE (82.6 ug/L) and TCE (116 ug/L) were detected. Other VOCs detected were 1,1-DCA (11.1 ug/L), cis-1,2-DCE (2.7 ug/L), and 1,1,1-TCA (5.1 ug/L). In the Hydropunch II™ sample taken at the 57 ft depth for soil boring OH-BH17, PCE (10.0 ug/L) and TCE (24.6 ug/L) were detected. Other VOCs detected were 1,1-DCA (20.7 ug/L) and cis-1,2-DCE (12.3 ug/L).

In soil boring OH-BH18, a Hydropunch II™ sample was taken from a depth of 35.5 ft bls. PCE (712 ug/L) and TCE (15.1 ug/L) were detected. 1,1,1-TCA was also detected at a concentration of 88.8 ug/L.

In soil boring OH-BH19, a Hydropunch II™ sample was taken from a depth of 35 ft bls. PCE (27.3 ug/L) and TCE (10.1 ug/L) were detected. 1,1,1-TCA was also detected at a concentration of 6.3 ug/L.

In soil boring OH-BH20, a Hydropunch II™ sample was taken from a depth of 38 ft bls. All analyzed VOCs were below detection limits.

In soil boring OH-BH2A, a Hydropunch II™ sample was taken from a depth of 37 ft bls. PCE (1,180J ug/L) and TCE (1,260J ug/L) were detected. Other VOCs detected were 1,1-DCA (231 ug/L), cis-1,2-DCE (11,000 ug/L), and vinyl chloride (4,770J ug/L).

In soil boring OH-BH3A, a Hydropunch II™ sample was taken from a depth of 30 ft bls. PCE (238 ug/L) and TCE (1,560 ug/L) were detected. Other VOCs detected were 1,1-DCA (4.3 ug/L), cis-1,2-DCE (34.1 ug/L), 1,1,1-TCA (24.4 ug/L), and vinyl chloride (4.5 ug/L).

DUP-67 was taken as a duplicate of the Hydropunch II™ sample from soil boring OH-BH2A. PCE (1,470 ug/L), TCE (1,390 ug/L), 1,1-DCA (213 ug/L), cis-1,2-DCE (10,500 ug/L), and vinyl chloride (4,460 ug/L) were detected. These constituents were also detected in the original sample.

DUP-70 was taken as a duplicate of the Hydropunch II™ sample from soil boring OH-BH14. PCE (112 ug/L), TCE (42.4 ug/L), 1,1-DCA (2.3 ug/L), and cis-1,2-DCE (36.6 ug/L) were detected. These constituents were also detected in the original sample.

Rinseate blanks RB-43 and RB-47 were taken prior to the Hydropunch II™ samples from soil borings OH-BH2A and OH-BH16, respectively. All constituents analyzed were below detection limits; therefore, it may be concluded that cross-contamination of samples by field equipment did not occur.

Trip blanks TB-53 through TB-57 and TB-59 through TB-62 accompanied groundwater VOC samples taken to the laboratory. No VOCs were detected in any trip blanks, indicating no cross contamination of VOCs occurred during sample collection and handling.

Toluene Results

During analysis of OH-BH2A, NET found toluene to be present in the Hydropunch II™ sample and its duplicate DUP-67. Due to toluene carryover, the calibration performed on November 13, 1998 did not pass the linearity criteria of Method 8260 and the relative standard deviation (RSD) exceeded the 30% limit; however, toluene

was not a target analyte and the calibration was not rejected. The results for these samples were reported from a 100 times dilution. The presence of toluene in OH-BH2A (24,800 ug/L at 100 times dilution) and DUP-67 (24,300 ug/L at 100 times dilution) was confirmed through discussions with NET and the data validation process; however, it appears to be an anomaly compared to previous data collected at AOI 7. As a result, GM requested that NET evaluate the chromatograms from Hydropunch II™ samples and soil samples collected in the vicinity of OH-BH2A for both August and November 1998 data. Table 3-15 presents a summary of this qualitative evaluation. This evaluation indicates that toluene was not present in four of the nine August 1998 Hydropunch groundwater samples and in one of the six November 1998 Hydropunch samples. The maximum detected concentration of toluene in the August 1998 sampling event was estimated to be 17.1 ug/L (GM-27-32/HP), while the maximum concentration in the November 1998 sampling event was estimated to be 25.1 ug/L (OH-BH3A-30/HP).

Toluene was not present in seventeen of the eighteen August 1998 soil samples and in ten of the thirteen November 1998 soil samples. The only detected concentration of toluene in the August 1998 soil sampling event was estimated to be 29.3 ug/kg (OH-BH8-28/SL), while the maximum detected concentration of toluene in the November 1998 soil sampling event was estimated to be 13.9 ug/kg (GM-23A-4/SL). GM recommends expanding the AOI 7 parameter list to include toluene for any future sampling.

3.4.3.4 Conclusions

After review of the analytical data from the November 1998, soil and groundwater sampling at AOI 7, GM concludes that the objectives presented in Section 2.2.2.1 have been addressed. These objectives have been restated below, along with an explanation of how each objective was met.

1. *Determine whether a significant source of PCE, and its potential degradation products, exists in the vadose zone soil at AOI 7.*

   The PCE soil concentrations from GM-23A were lower than those detected in the 3 ft to 5 ft interval from GM-23 (PCE was detected at a concentration of 63,500 ug/kg in 1994); however, the highest PCE concentration in shallow soil was detected at GM-23A (9,440 ug/kg at the 2 ft to 4 ft interval) during the Supplemental RFI investigation. Based on this data, a localized source area is present in the vicinity of GM-23. The significance of this source is evaluated

further in the Supplemental Baseline Risk Assessment (Volume II). The highest PCE concentrations at the other borings were detected in the sample collected just above the water table, in the zone of groundwater fluctuation (smear zone) and are, therefore, likely associated with VOCs in groundwater.

2. *Determine whether PCE exists in the saturated zone, possibly as a DNAPL at AOI 7 and characterize its presence.*

   As concluded from the Hydropunch II™ groundwater results and hydrophobic dye shake tests, DNAPL is likely present in the vicinity of AOI 7. The presence of DNAPL is suspected near borings OH-BH2A, OH-BH6, OH-BH12, OH-BH15, and GM-27 (in the sample above the upper clay till).

3. *Determine the potential for the lithology in the vicinity of AOI 7 to affect migration of PCE, if PCE is present as a DNAPL.*

   As shown on Figure 3-9, the upper clay till is present beneath AOI 7. This till layer is likely affecting the migration of VOCs at the site, either as DNAPL or dissolved-phase constituents. If DNAPL is present, the low permeability upper clay till layer would minimize its vertical migration and cause it to move in a south to southwest direction along the contours of the upper clay till. This is verified by 1) comparing the VOCs detected at GM-23 to GM-27, where the highest concentrations occur above the upper clay till in the shallow aquifer, and 2) by a review of the VOC concentrations at AOI 7 (Figures 3-12 and 3-13) which trend south to southwest from the source areas located near the center of AOI 7.

4. *Determine if a vadose zone source of PCE or DNAPL in the saturated zone exists upgradient (or north) beyond OH-BH1.*

   After review of OH-BH9, OH-BH18, OH-BH19, and OH-BH20 soil and groundwater results, there is no vadose zone source of PCE nor is DNAPL present in the saturated zone at or north of OH-BH18.

After review of the AOI 7 data, GM concludes that a historic release of hazardous constituents has occurred. Furthermore, based on the elevated concentration of VOCs in groundwater, AOI 7 is likely the primary source of VOCs found across the site, as further discussed in Section 4.0.

Based on the fact that the AOI-specific objectives have been met, adequate data have been collected to support the Supplemental Baseline Risk Assessment, no additional investigation of AOI 7 is required to meet the Supplemental RFI objectives, although additional work will be recommended to support the interim measure/CMS.

4. Site-Wide Groundwater Conditions

During the Supplemental RFI, to accomplish the groundwater investigation objectives presented in Section 2.2.1, groundwater conditions were characterized on a site-wide basis. This involved sampling select wells upgradient from the site, on the three GM facilities, and down gradient from the site for VOCs and biogeochemical indicator parameters. To support this characterization, specific site-wide conditions were investigated and/or reevaluated. These conditions are addressed in this section, as follows: 1) geology of the clay-rich till intermediate layers within the upper aquifer (upper clay till), including lateral distribution and thickness, 2) historical and recent groundwater flow direction and its effect on the distribution of VOCs, 3) groundwater quality, including groundwater coming onto the Moraine site from upgradient sources, groundwater migrating off-site, and groundwater quality at select well locations within the site, and 4) evidence of intrinsic attenuation of the chlorinated VOCs present in groundwater. As with the AOI-specific investigations presented in Section 3.0, the focus of this groundwater investigation has been to determine if sufficient site-wide information has been collected to define VOC extent for purposes of assessing risks and to determine if an interim action/CMS is required.

4.1 Site-Wide Geology

The characterization of site-wide geology presented in the Delphi Thermal Moraine DOCC (Geraghty & Miller, Inc. 1991), Draft RFI Final Report (Geraghty & Miller, Inc. 1996), and Supplemental DOCC (Geraghty & Miller, Inc. 1997a), was reevaluated based on information collected as part of the Supplemental RFI. For the most part, the description of local geology given in the DOCCs and Draft RFI Final Report was accurate and not in need of revision. However, significant new information was developed in the area around AOI 7, where the distribution and thickness of a locally continuous upper clay till layer within the upper aquifer was identified and assessed (Section 3.4). Based on the potential significance of this geologic condition at affecting the movement of VOCs, either as DNAPLs or as dissolved-phase, the presence of this upper clay till layer at other areas of the Moraine site was evaluated.

To assess the southwestern trend in the upper clay till layer noted on Figure 3-9 information on the Delphi Thermal Moraine geology presented in the DOCC was reviewed (Geraghty & Miller, Inc. 1991). An upper clay till layer, similar to the one detected at AOI 7, was noted in the north-south cross-section (Plate 2) presented in the Delphi Thermal Moraine DOCC. The upper clay till on the Delphi Thermal Moraine facility is present southwest of AOI 7, at approximately 30 to 40 ft bls with a thickness

of 6 to 13 ft. It was estimated that this upper clay till on the Delphi Thermal Moraine facility extends approximately 1,400 feet from north of monitor well HR-5 to south of production well 42 (Plate 2). Additionally, the boring log for monitor well HR-1 indicates that several layers of clay till were noted above the regional clay till. While these layers at HR-1 are generally at a lower elevation than the upper clay till discussed above, it is conceivable that some connection may exist with the more laterally continuous upper clay till layer depicted at the Delphi Thermal Moraine facility in Plate 2 and at AOI 7 in Figure 3-9.

While investigating the southern extent of the upper clay till beneath AOI 7, a report with information for shallow soil borings installed at the GM Eastern Facilities was located and reviewed (Bowser-Morner, 1981). Based on this review, an upper till layer (occurring at a depth of 30 to 40 ft bls) was detected in the following three areas: (1) from the AOI 7 area at GM-28, south to a distance of between 600 ft to 800 ft along the western edge of Moraine Engine Plant 3; (2) along the eastern side of Moraine Engine Plant 3, extending from production well 39 to a distance south of approximately 1,900 ft, with one boring at the southern end being underneath the footprint of the Moraine Engine Plant 3; and (3) in a boring located just beyond the northwest corner of Moraine Assembly Plant 1 (northeast of AOI 7 across Springboro Road). This upper till layer is not detected in borings at the southern end of the Moraine Engine Plant, or across Springboro Road to the east (beyond the one boring discussed above), suggesting that the layer pinches out in these directions.

Based on the above assessment, it appears that the upper clay till layer may be present to the south (both east, beneath and west of Moraine Engine Plant 3) and southwest of AOI 7 extending beneath the Delphi Thermal Moraine Building 14. As such, this lower permeability formation could affect the migration of VOCs in the upper aquifer released from AOI 7 by limiting downward migration of separate phase VOCs and dissolved constituents in groundwater within the upper aquifer. This shallow, lower permeability lense could also influence the lateral movement of VOCs and limit the dispersion of VOCs contained in the 5 to 10 ft of groundwater between the upper clay till and the groundwater table surface.

4.2 Historical Groundwater Flow

Changes in site-wide historical groundwater pumping and resultant flow paths have likely had a significant impact on the spread of VOCs beneath the site. Historically, each of the three facilities has relied on production wells installed in the lower aquifer to provide water to support production activities. While these production wells are

screened in the lower aquifer, their pumping affects groundwater movement in the upper aquifer, though to a lesser degree.

Prior to 1978, pumping at the Delphi Thermal Moraine facility was high relative to pumping at the Dryden Road North Well Field (Dryden North). For instance, in 1974 Delphi Thermal Moraine was withdrawing approximately 12 million gallons per day (mgd) compared to Dryden North which was pumping approximately 3.7 mgd. This rate of groundwater use was modeled in 1983 during an investigation of Landfill L1 (Geraghty & Miller, Inc. 1983). This modeling effort determined that under these pumping conditions groundwater at the southern end of the facilities would likely flow north toward the plant pumping centers and a hydraulic divide would develop between Landfill L1 and Dryden North. As a result of the GM cone-of-depression, groundwater flow direction beneath areas local to Landfill L1, for example, were south to north, rather than the reverse seen today (flow divide predicted to be southwest of Landfill L1). By 1981, Delphi Thermal Moraine pumping had decreased to approximately 2 mgd, while Montgomery County pumping remained relatively constant or increased. Under these conditions, the model predicted that contaminants would likely move towards both pumping centers, with the predominant flow to the southwest (flow divide predicted to be directly beneath Landfill L1).

During the latter part of 1986, the three Montgomery County well fields (Dryden North, Dryden Road South Well Field, and Miami Shores Well Field) were shut down, and in January 1987, GM reduced groundwater pumping significantly by discontinuing use of the Delphi Thermal Moraine production wells (although pumping of wells on the GM Eastern Facilities continued). During this brief period in late 1986, between the time the County wells shutdown and the Delphi Thermal Moraine wells shutdown, a reversal in flow direction under the site would be considered likely as the GM facilities were the major pumping sources in the area.

Dryden South and Miami Shores were pumped intermittently during May to August 1987 at approximately 2 mgd, and during June to September 1988 Miami Shores was pumped continuously at approximately 10 mgd. During these time periods, groundwater beneath the GM site would be expected to migrate in a more western to southwestern direction under the influence of County pumping. However, during the remaining periods of the late 1980's when the production wells at the GM Eastern Facilities were the only wells pumping continuously, groundwater on the site would tend to have a more easterly component of flow. In March 1990, the County initiated a Pump-to-Waste program using DN-13 in the Dryden North well field. With the on-going groundwater extraction from DN-13 (started in 1990) and the initiation of

groundwater extraction from the upper aquifer from Interim Measures extraction well TW-2 in January 1996, site-wide groundwater flow established the patterns observed today (Figures 4-1 and 4-2 for the upper and lower aquifers, respectively).

The effect of the historic pumping from production wells at the site is that monitor wells currently positioned upgradient of some AOIs and SWMUs may have been hydraulically downgradient of these areas when the GM Moraine facilities were the major pumping center for the area. Further complicating the analysis is the fact that during the period of heavy GM pumping, use of specific plant production wells varied. It is likely this variation accounts for why some monitor wells contain VOCs which are not detected, or are present at low concentrations, within AOIs immediately upgradient of these wells under current groundwater flow conditions.

A secondary effect of the historic groundwater pumping is that it lowered the water table in the upper aquifer beneath the SWMUs and AOIs being evaluated. In response to the termination of pumping by the County in 1986 and at the Delphi Thermal Moraine facility in 1987, water levels have risen approximately 10 ft in the upper aquifer and 5 ft in the lower aquifer (Geraghty & Miller, Inc. 1996). This phenomena could mean that VOCs which may have been adsorbed to soils beneath a SWMU or AOI could now be below the water table, or within the capillary fringe, which provides more opportunity for flushing and desorption than would be expected from normal precipitation, especially considering that the majority of the site is covered with buildings or pavement.

Therefore, it is evident that the occurrence and movement of VOCs in groundwater at the site has been greatly influenced by historic pumping, both on-site and off-site. The variation in use of the various pumping centers, and the variation in use of the individual wells within the pumping centers, would cause VOCs in the groundwater to migrate in ways which are difficult to determine, which makes assigning monitor wells to specific SWMUs or AOIs inappropriate in most cases.

4.3 Current Groundwater Flow

As part of the site-wide assessment of current groundwater conditions, water-level elevations were measured to determine groundwater flow directions in the upper and lower aquifers and to determine vertical gradients between the two aquifers. A full round of water-level elevations was measured from 78 wells on or near the site on March 11 and 12, 1998. This included 45 monitoring wells in the upper aquifer, and

22 monitoring wells and 11 production wells in the lower aquifer. Water-level measurements made during the Supplemental RFI are presented in Table 4-1.

4.3.1 Upper Aquifer

The water-table surface on March 11 and 12, 1998 (Figure 4-1) shows that flow in the upper aquifer is generally from northeast to southwest over most of the site. A groundwater capture zone, centered around Capture Well TW-2 located in the southwest corner of Landfill L1, is evident at the southern end of the Delphi Thermal Moraine facility. Well TW-2, screened in the upper aquifer, has been operating since January 31, 1996 as part of the RFI Interim Measures.

The average hydraulic gradient of the water table, calculated from groundwater elevation measurements on March 11 and 12, 1998, was 0.0007 foot/foot (ft/ft). The groundwater flow velocity for the shallow aquifer was calculated using the following equation:

$$Vw = Ki/Ne$$

where

Vw = groundwater flow velocity (feet per day [ft/day])

K = hydraulic conductivity (ft/day)

i = hydraulic gradient (ft/ft)

Ne = effective porosity

Hydraulic characteristics of the water-table aquifer were determined by evaluation of data from pumping tests conducted in 1985 and in 1989. The median hydraulic conductivity value estimated from pumping test data was 1,650 ft/day, and effective porosity was assumed to be 0.3 to 0.5. Using average hydraulic gradients from March 11 and 12, 1998, groundwater flow velocities in the upper aquifer ranged from 2.36 ft/day to 3.93 ft/day. Assuming the most extreme condition (i.e., no retardation or retardation factor [R_d] equal to 0), the rate of VOC migration could equal the rate of groundwater flow. However, it is likely that some soil-VOC interaction is occurring, and that actual VOC migration rates are slower than that of groundwater flow. Most of the VOCs detected in the upper aquifer groundwater at the GM facilities are likely to have a R_d ranging from 2 to 10 (Walton 1985), so the rate of migration of the VOCs in

the upper aquifer may range from 0.24 ft/day to 2.0 ft/day. It should be noted that these rates of groundwater flow and VOC migration are based on current conditions, and likely are not representative of the rates associated with historic pumping conditions (discussed in Section 4.2).

During the Supplemental RFI, as part of the August 1998 investigation at AOI 7, slug tests were conducted on three monitor wells at AOI 7 (GM-23, GM-27 and GM-28) to assess groundwater flow conditions in this area of the site. These slug tests determined that hydraulic conductivity in the upper aquifer in this area is lower than the hydraulic conductivity calculated on a site-wide basis. Hydraulic conductivity of the portion of the aquifer above the upper clay till at AOI 7 was determined to be approximately 43 ft/day. Hydraulic conductivity of the portion of the aquifer below the upper clay till but above the regional clay till was determined to be approximately 54 ft/day. While the results of these slug tests are likely not as accurate as the pump tests conducted in 1985 and 1989, the data clearly indicate that the migration of groundwater and ultimately the movement of VOCs in the area of AOI 7 is likely to be slower than the velocities calculated on a site-wide basis. Additional information on the slug tests is presented in Appendix E.

4.3.2 Lower Aquifer

The potentiometric surface (lower aquifer) on March 11 and 12, 1998 (Figure 4-2) shows groundwater flow in the lower aquifer to be generally from northeast to southwest, with a groundwater capture zone centered around County Well DN-13 and active Moraine Assembly wells 12A, 31 and 39. No groundwater elevation data are available for production wells 31 and 39, therefore the cone of influence associated with pumping in this area is inferred on Figure 4-2. County Well DN-13 is located south of the Delphi Thermal facility in the Dryden Road North Wellfield. The Pump-to-Waste Program at the Dryden Road North Wellfield, a component of the RFI Interim Measures, was in operation during water-level elevation measurements on March 11 and 12, 1998.

The average hydraulic gradient of the potentiometric surface in the lower aquifer, calculated from groundwater elevation measurements on March 11 and 12, 1998, was 0.0008 ft/ft. Groundwater flow velocity in the lower aquifer ranged between 0.67 ft/day and 1.11 ft/day. This was calculated using the equation presented earlier ($Vw = Ki/Ne$), and lower aquifer groundwater elevation data collected on March 11 and 12, 1998. As discussed above, most of the VOCs detected in the upper aquifer groundwater at the GM facilities are likely to have a R_d ranging from 2 to 10 (Walton

1985), so the rate of migration of the VOCs in the lower aquifer may range from 0.07 ft/day to 0.56 ft/day. It should be noted that these rates of groundwater flow and VOC migration are based on current conditions, and likely are not representative of the rates associated with historic pumping conditions (discussed in Section 4.2).

4.3.3 Vertical Gradients

The water-level measurements collected on March 11 and 12, 1998 were used to determine the direction and magnitude of vertical gradients between the upper and lower aquifers (Table 4-2). The magnitude and direction of vertical gradients indicate whether the potential exists for groundwater to move from one aquifer to another through a confining unit, and which direction it will move. Additionally, water-level measurements collected in August 1998 were used to evaluate the vertical gradient across the upper clay till layer detected in the upper aquifer in the vicinity of AOI 7.

At the northern (upgradient) end of the site, vertical gradients were upward in shallow/deep monitoring well pairs HR- 9/HR-10 and HR-11/HR-12, 0.01 ft/ft and 0.10 ft/ft, respectively, during the Supplemental RFI; therefore, the potential exists for groundwater to migrate upward to the upper aquifer in this area. The vertical gradient at well pair HR-9/HR-10 was calculated based on a water-level measurement collected at HR-9 on March 16, 1998 due to a problem accessing this well on March 11 and 12, 1998.

Well pairs immediately downgradient (south) of the North Settling Lagoon (W-3-N/HR-15 and W-4-N/HR-14) showed downward vertical gradients, with the smaller vertical gradient being calculated in well pair W-3-N/HR-15. Well pairs in the vicinity of Landfill L1 (GM-8/GM-7R, GM-16/GM-15, GM-2/GM-1, GM-18/GM-13, GM-6/GM-3, GM17/GM-11 and 4S/GM-5) all showed downward vertical gradients, with the exception of well pair GM-6/GM-3. The upward vertical gradient at well pair GM-6/GM-3 is likely due to the proximity of this well pair to shallow aquifer Interim Measures extraction well TW-2.

Downgradient of the site, vertical gradients were downward in well pairs GM-10/GM-9 and GM-26/MT69; therefore, the potential exists for groundwater to migrate downward from the upper aquifer to the lower aquifer in this area. This downward vertical gradient is likely due to the effects of groundwater extraction in the lower aquifer as a result of DN-13 pumping.

At AOI 7, water-level measurements in upper aquifer well pair GM-23/GM-27 (above the upper clay till/beneath the upper clay till) were used to evaluate the vertical gradient in the upper aquifer. A slight downward vertical gradient of 0.14 ft/ft was present across the upper clay till.

4.4 Upper Aquifer Groundwater Quality

In accordance with the approved Supplemental DOCC (Geraghty & Miller, Inc. 1997a) and Supplemental RFI Work Plan, groundwater at the site was evaluated for VOCs as the only potential constituent of concern. In order to evaluate the presence of VOCs in groundwater, a total of 20 upper aquifer monitor wells were analyzed for Appendix IX VOCs and cis-1,2-DCE during March 1998. Analytical results for the upper aquifer monitor wells are presented on Tables 3-5 and 4-3, respectively. Select monitor wells (GM-23, GM-26 [installed in February 1998 as part of the Supplemental investigation], GM-27 and GM-28 [which were installed as part of the AOI 7 investigation discussed above], ME-6, HR-1 and HR-3 [which was not sampled in March 1998]) were sampled in August 1998 and analyzed for the AOI-specific list of eight VOCs. Analytical results for the August 1998 groundwater sampling event are presented on Table 3-12. Note that cis-1,2-DCE was not always previously analyzed or reported prior to the Supplemental RFI.

4.4.1 Upgradient Groundwater Quality

In March 1998, three upgradient upper aquifer monitor wells exhibited the presence of VOCs (total VOCs of 110.7 ug/L in HR-9, 8.2 ug/L in HR-11 and 19.6 ug/L in GM-24), while GM-25, which is side-gradient of the Moraine Assembly facility, did not contain detectable concentrations of VOCs. The specific VOCs and their concentrations are illustrated in Figure 4-3. VOC concentrations that are above their Safe Drinking Water Act (SDWA) Maximum Contaminant Level (MCL) are presented in color.

Two key observations are made relative to upgradient groundwater quality. First, the detected VOCs are consistent with historical values for upgradient groundwater quality as indicated in the original DOCC, the Draft RFI Final Report, and the Supplemental DOCC. This confirms that upgradient sources of VOCs, not related to GM operations, do exist in the local area. The highest concentrations of upgradient VOCs are DCA and DCE compounds, suggesting that the upgradient releases are relatively old and degradation of the chlorinated VOCs 1,1,1-TCA and TCE has occurred. Second, the types of VOCs detected upgradient are similar to those detected further downgradient

beneath the site, indicating that total VOC concentrations detected beneath the site may be affected by both upgradient (off-site) and on-site contributions.

4.4.2 Downgradient Groundwater Quality

Off-site downgradient wells (at the southern end of the site) in the upper aquifer generally exhibited lower concentrations of total VOCs in the March 1998 data when compared to previous Phase I and Phase II RFI data (Geraghty & Miller, Inc. 1996) as follows: the WSU-24 total VOC concentration of 17.2 ug/L is lower than the 26.1 ug/L reported during Phase II, the GM-10 concentration of 36.9 ug/L is lower than the 109.5 ug/L reported during Phase I, and GM-26 (installed during the Supplemental RFI adjacent to lower aquifer well MT-69) exhibited non-detectable concentrations of VOCs in March 1998, while the August 1998 sampling of GM-26 detected a low concentration of PCE (1.2 ug/L).

The decreasing concentrations in shallow monitor wells downgradient of the site is likely attributable to the effects of Interim Measures pumping at TW-2 which began in January 1996, pumping at DN-13, and on-going natural attenuation of the VOCs (discussed in Section 4.6). In regards to the low concentration of PCE detected in the August 1998 sampling at GM-26, this result could be due to a non-related source in the area downgradient of the site, as discussed in GM's comment response letter submitted to the U.S. EPA to address Agency comments on the Supplemental RFI Work Plan (dated November 5, 1997 and presented in Appendix A).

4.4.3 On-Site Groundwater Quality

The following sections discuss on-site groundwater quality in the upper aquifer.

4.4.3.1 March and August 1998 On-Site Groundwater Quality

To assess on-site groundwater quality in the upper aquifer, 13 monitoring wells were sampled in March 1998 for analysis of Appendix IX VOCs and cis-1,2-DCE. The locations of these 13 monitoring wells are presented on Figure 2-1. The analytical results for the March 1998 sampling event are presented on Table 3-5. Comparison of the March 1998 analytical results to historic RFI data, excluding cis-1,2-DCE, indicates that eight of the 13 wells (W-3-N, W-1-S, HR-17, EAST, GM-22, GM-8, GM-6 and GM-2) showed decreases in total VOCs. Four wells (HR-1, ME-6, ME-3 and GM-21) showed increased concentrations of total VOCs. The data for GM-23 have remained relatively constant through time.

To further evaluate on-site groundwater quality, specifically in relation to the presence of VOCs at AOI 7, six upper aquifer monitoring wells (GM-23, GM-27, GM-28, ME-6, HR-1 and HR-3 [not sampled during the March 1998 event]) were sampled in August 1998 for analysis of the focused list of eight VOCs. The locations of these monitoring wells are presented on Figure 2-1. Two groundwater sampling techniques, bailers and low-flow sampling, were used during this sampling event. Bailers were used to sample monitoring wells GM-27, GM-28, ME-6, HR-1 and HR-3, and low-flow sampling techniques were used to sample GM-23 and to collect additional parameters from GM-27 and GM-28 to support an evaluation of the level of bioattenuation occurring within AOI 7. The analytical results for the August 1998 sampling event are presented on Table 3-12. The concentration of VOCs for wells sampled in both March and August 1998 showed a decrease in total VOC concentrations compared to historical RFI data. Monitoring well HR-3, which was not sampled in March 1998, showed an increase in total VOCs to 8.7 ug/L, compared to non-detectable concentrations when this well was sampled in 1993 during Phase I of the RFI. Groundwater samples from newly installed monitoring wells GM-27 and GM-28 contained total VOC concentrations of 173.6 ug/L (beneath the upper clay till) and 1,119 ug/L (at the southern extent of AOI 7).

4.4.3.2 Effect of Source Area at AOI 7

The March and August 1998 groundwater quality data continues to indicate GM-23 contains the highest concentration of VOCs at the GM site. In August 1994 and June 1995, GM-23 exhibited total VOC concentrations (excluding cis-1,2-DCE which was not analyzed) of 11,840J ug/L and 15,700 ug/L, respectively. In March 1998, the concentration of total VOCs in GM-23 was 19,706 ug/L (15,836 ug/L without cis-1,2-DCE which is consistent with the June 1995 data). The August 1998 data for GM-23 indicates the concentration has decreased to 14,655.5 ug/L (10,955.5 without cis-1,2-DCE which is slightly lower than the August 1994 data). As a result of the Supplemental RFI investigations, AOI 7 has been identified as the major source of VOCs to groundwater. Given the magnitude of VOC releases observed in groundwater at AOI 7, this source location warranted evaluation relative to VOC transport via current and historical site-wide groundwater flow paths. Based on historical and current groundwater flow directions described in the previous section, on-site wells generally trending south of AOI 7, including GM-28, ME-6, ME-3, GM-22, EAST, GM-21 and GM-2, are potentially hydraulically downgradient of GM-23. In addition, historical flow could have had a southwesterly trend under the influence of County pumping (i.e., at Miami Shores), which makes impacts to HR-1, W-1-S and HR-17 from AOI 7 plausible.

Of the wells which are mentioned as downgradient from AOI 7 in the southerly direction, the following total VOC concentrations are noted from a review of previous RFI data and data provided in the Supplemental DOCC:

- ME-6, concentration of 273.6 ug/L in August 1993, increasing to 417.1 ug/L in September 1993, 413 ug/L in June 1995 (all reported without cis-1,2-DCE), then increasing to a maximum of 667.7 ug/L in March 1998 (cis-1,2-DCE of 15.2 ug/L), with a decrease to 472.7 ug/L in August 1998 (cis-1,2-DCE of 17.2 ug/L);

- ME-3, concentration of 83.6 ug/L in June 1993, to 63.8 ug/L in September 1993, increasing to 204.7 ug/L in June 1995 (all reported without cis-1,2-DCE), then increasing to 232.1 ug/L in March 1998 (cis-1,2-DCE of 36 ug/L);

- GM-22, concentration of 48.9 ug/L in August 1994, to 53.8 ug/L in June 1995 (all reported without cis-1,2-DCE), then decreasing to 12.5 ug/L in March 1998 (cis-1,2-DCE of 1.6 ug/L);

- EAST, concentration of 189.7 ug/L in January 1993, to 160.3 ug/L in October 1994 (all reported without cis-1,2-DCE), then to 175.7 ug/L in March 1998 (cis-1,2-DCE of 13.9 ug/L);

- GM-21, concentration of 398.2 ug/L in August 1994, to 267.4 ug/L in June 1995 (all reported without cis-1,2-DCE), then increasing to 506.1 ug/L in March 1998 (cis-1,2-DCE of 74.5 ug/L); and

- GM-2, concentration of 132.4 ug/L in January 1993, to 123.8 ug/L in June 1993, to 128.6 ug/L in both November 1993 and June 1994, to 128.6 in November 1994, to 141.1 ug/L in June 1995, to 111.1 ug/L in November 1995 (all reported without cis-1,2-DCE), then decreasing to 101.7 ug/L in March 1998 (cis-1,2-DCE of 10.5 ug/L).

These data indicate that VOC concentrations in monitor wells hydraulically south of AOI 7 tend to rise and fall over time. Because AOI 7 is the primary source of VOCs in groundwater, this phenomenon could be likely due to variations in historic pumping and operations at this AOI to cause releases which are moving through the aquifer.

The following total VOC trends are noted in monitor wells hydraulically downgradient of AOI 7 to the southwest using previous RFI data and data presented in the Supplemental DOCC:

- HR-1, concentration of 93.4 ug/L in January 1993 during Phase I of the RFI (reported without cis-1,2-DCE), then increasing to 138.6 ug/L in March 1998 (cis-1,2-DCE of 10.6 ug/L) and decreasing to 105.6 ug/L in August 1998 (cis-1,2-DCE of 9.4 ug/L);

- W-1-S, concentration of 69.8 ug/L in January 1993 during Phase I of the RFI (reported without cis-1,2-DCE), then decreasing to 48.3 ug/L in March 1998 (cis-1,2-DCE of 5 ug/L); and

- HR-17, concentration of 17.9 ug/L in January 1993 during Phase I of the RFI, to 28.7 ug/L in November 1994 during Phase II of the RFI (reported without cis-1,2-DCE), then decreasing to 13.1 ug/L in March 1998 (no cis-1,2-DCE present).

This data seems to indicate that at HR-1 a cycling of VOC concentrations similar to that noted in the monitor wells hydraulically south of AOI 7 is seen. While monitor wells W-1-S and HR-17, which are further southwest, are showing a persistent decreasing trend over time. VOCs from AOI 7 could be affecting these Delphi Thermal Moraine wells under the influence of the upper clay till and/or historic pumping from the county well fields (which include DN-13).

To further evaluate the relationship of AOI 7 to VOCs in downgradient monitor wells, concentrations of PCE and its daughter products TCE, cis-1,2-DCE and vinyl chloride were plotted on a distance-concentration graph (Figure 4-4). This graph illustrates the degradation of PCE within AOI 7 and as it migrates to downgradient well locations to the south. The "0" ft point on the distance for the X-axis was set at boring OH-BH19, which provided Hydropunch II™ groundwater data upgradient of AOI 7. This graph of PCE and its degradation products, shows that the highest VOC concentration for each of the four constituents is detected within AOI 7. Additionally, within AOI 7, elevated concentrations of cis-1,2,-DCE and vinyl chloride provide evidence that natural attenuation of PCE and TCE is occurring. As the plume of VOCs migrates beyond AOI 7 (past GM-28 at approximately 1,471 ft), to the south, concentrations of PCE, TCE, cis-1,2-DCE and vinyl chloride drop off dramatically, with slight rises in the concentration of TCE noted in monitor wells ME-6 (distance of 2,949 ft) and GM-21 (distance of 5,000 ft) in the north/south graph (Figure 4-4). However, as discussed above, these increases are likely associated with historic releases from AOI 7 as they do not persist in monitor wells immediately downgradient (ME-3 [distance of 3,167 ft] and GM-2 [distance of 5,357 ft], respectively).

This same exercise was done for 1,1,1-TCA and its breakdown product DCA (Figure 4-5). Again, the highest concentration for each of these constituents is present within AOI 7. The presence of 1,1-DCA within and downgradient of AOI 7 provides evidence that the 1,1,1-TCA is degrading under natural conditions. For these two compounds, concentrations decrease as groundwater flows south of AOI 7, then an increase in 1,1,1-TCA can be seen in ME-3 (distance of 3,167 ft), EAST (distance of 4,340 ft) and GM-21 (distance of 5,000 ft). The presence of this constituent in these wells may also be associated with slugs of VOCs moving from AOI 7 through the aquifer as the concentration of these constituents has cycled over time.

4.5 Lower Aquifer Groundwater Quality

In order to evaluate the presence of VOCs in groundwater, a total of six lower aquifer monitor wells were analyzed for Appendix IX VOCs and cis-1,2-DCE during March 1998. Analytical results for the lower aquifer monitor wells are presented on Table 4-3. The specific VOCs and their concentrations are illustrated in Figure 4-3a. VOC concentrations that are above their SDWA MCL are presented in color.

The upgradient lower aquifer well, HR-12, had a total VOC concentration of 7.6 ug/L, consisting of 1,1-DCA, cis-1,2-DCE and vinyl chloride. A duplicate sample of HR-12 (DUP-58) was collected during the March 1998 sampling event and the analysis of this duplicate sample reported identical results to those of the original sample.

On-site lower-aquifer monitor wells included HR-13 located southwest of AOI 7 and GM-1 located east of Landfill L1. The concentration of VOCs in well HR-13 (79 ug/L total, with 23.3 ug/L being cis-1,2-DCE) is consistent with data collected during Phase I of the Delphi Thermal Moraine RFI (51 ug/L total with cis-1,2-DCE not included in the analysis). The GM-1 total VOC concentration of 58.2 ug/L is similar to the 55.1 ug/L reported during Phase I of the RFI.

Downgradient lower aquifer wells exhibited similar or lower concentrations of total VOCs when compared to previous RFI data as follows: the GM-9 concentration of 11 ug/L (with 2 ug/L being cis-1,2-DCE) is lower than the 23.5 ug/L reported during Phase I of the RFI, the concentration in GM-20 has dropped to non-detectable levels which is lower than the 7.9 ug/L reported during Phase II of the RFI, and MT-69 continued to exhibit non-detectable concentrations of VOCs, consistent with the previous Phase II results.

4.6 Biogeochemical Data Review

The March and August 1998 Supplemental RFI groundwater sampling events included the collection of groundwater samples at select monitor wells for analysis of an expanded list of biogeochemical parameters (Table 1-1). The purpose of the biogeochemical analyses was to evaluate natural processes which are likely affecting the movement and on-going reduction of the VOCs in groundwater.

In order to evaluate natural attenuation on a site-wide scale, biogeochemical data was collected from several shallow wells along groundwater flow paths which transect several AOIs and SWMUs that have been identified at the site. The natural attenuation evaluation involves comparing changes in concentrations of individual "source" VOCs (i.e., PCE and 1,1,1-TCA) and the resulting degradation products along the groundwater flow paths. This information can be used with historical trend information and specific biogeochemical groundwater data to provide multiple lines of evidence that the changes in VOC concentrations (and mass) that are observed at the site are persistent and are related to specific geochemical groundwater environments.

Biogeochemical parameters and samples for VOC analysis were collected from twenty site monitoring wells in March 1998 as follows:

1. Upgradient/Background: HR-9, HR-11, and GM-24.
2. Side-gradient: GM-25.
3. On-Site:
    - W-3-N (North of Delphi Thermal Moraine);
    - GM-23 (AOI 7 Area);
    - HR-1, W-1S, and HR-17 (Southwest of AOI 7 on Delphi Thermal Moraine);
    - ME-6 and ME-3 (South of AOI 7 on Moraine Engine)
    - GM-22, EAST, GM-8, GM-6, GM-2, GM-21 (Southern end of Moraine Engine and Delphi Thermal Moraine facilities);

4. Downgradient Off-site: GM-10, GM-26, and WSU-24.

Additionally, GM-23, GM-27, and GM-28 which are located in the AOI 7 area were sampled for bioattenuation parameters and a focused list of eight VOCs in August 1998.

During both sampling events, the low-flow pump discharge was directed through a closed cell for the in-line monitoring of several field parameters, including DO, ORP, temperature, pH, and specific conductance (see groundwater sampling logs in Appendix D), as discussed in Section 2.3.1.3. Additionally, ferrous iron and hydrogen sulfide were analyzed at the wellhead using a HACH spectrophotometer due to the increased sensitivity of these constituents (sulfide and ferrous iron can be oxidized under atmospheric conditions and are therefore typically non-detect when analyzed by traditional laboratory methods). Biogeochemical parameters were analyzed by NET and/or Microseeps. Biogeochemical parameter results are presented on Tables 4-4 and 4-5. The major "classes" of biogeochemical parameters analyzed included the following:

- Electron Acceptors: total manganese and iron, nitrate, sulfate and carbon dioxide.
- Reduced by-products: ammonia and nitrite, dissolved manganese and iron, sulfide, ethene, ethane and methane.
- Miscellaneous Indicators: alkalinity, biochemical oxygen demand (BOD), chemical oxygen demand (COD), total organic carbon (TOC) and dissolved organic carbon (DOC).

4.6.1 Overview of Biodegradation of Chlorinated Aliphatic Hydrocarbons in Groundwater

The primary chlorinated VOCs present in groundwater at the site include PCE and its degradation products, including TCE, cis-1,2-DCE and vinyl chloride and to a lesser degree, 1,1,1-TCA and its degradation products, which include 1,1-DCA, chloroethane and 1,1-DCE. The transformation of these VOCs is most pronounced in anaerobic and reducing groundwater environments. Exceptions are vinyl chloride and chloroethane, which can be degraded at sufficient rates in aerobic groundwater environments.

The anaerobic degradation of the chlorinated VOCs proceeds via reductive dechlorination, a general term which refers to the sequential removal of a chloride ion (and replacement with a hydrogen ion). This process requires increasingly stronger

reducing environments to foster the reduction of the lesser-chlorinated VOCs (such as vinyl chloride) to the non-chlorinated and non toxic end products (such as ethene, ethane and carbon dioxide). The VOCs are generally degraded by co-metabolic, or secondary utilization processes. In cometabolism, microbes utilize a primary substrate as a carbon energy source and produce enzymes and other co-factors that fortuitously degrade another organic compound (i.e., the chlorinated VOCs). The bacteria receive no benefit by the VOC being present in this process. For PCE and 1,1,1-TCA degradation, reductive dechlorination will follow these sequences:

PCE → TCE → DCE → Vinyl Chloride → ethene→ ethane → carbon dioxide and water.

1,1,1-TCA → 1,1-DCA → Chloroethane → ethanol→ carbon dioxide and water.

TCA is also susceptible to abiotic (non biological) transformation, as follows:

1,1,1-TCA →acetic acid (80%)→ carbon dioxide and water.

1,1,1-TCA → 1,1-DCE (20%)→ Vinyl Chloride → ethene→ ethane → carbon dioxide.

By monitoring for these compounds along the groundwater flow paths at the site (along with other indicator parameters), it can be demonstrated that the complete degradation of source VOCs is occurring.

The more highly chlorinated compounds are most susceptible to reductive dechlorination because of their higher state of oxidation (McCarty 1994). Consequently, the later steps of this process, such as degradation of cis-1,2-DCE to vinyl chloride, and degradation of vinyl chloride to ethene, generally require more strongly reducing conditions in groundwater (typically in the range of -200 millivolts [mV]). Often a natural groundwater environment is not reducing enough (i.e. the ORP is not negative enough) to allow for complete degradation to occur and an accumulation of daughter products is observed (such as an accumulation of cis-1,2-DCE or vinyl chloride). As a result, ORP of the groundwater system is dependent on, and can influence, the specific reductive dechlorination processes (Wiedemeier 1998).

Bacteria need an electron acceptor in order to metabolize a carbon source. Oxygen is the most thermodynamically preferred electron acceptor for microbes, but in its absence, other alternate electron acceptors, can be utilized in anaerobic groundwater

environments. The general sequence of the utilization of these alternate electron acceptors is as follows (from most thermodynamically favorable to least):

Oxygen Reduction → Denitrification (Nitrate reduction) → Manganese and Iron Reduction → Sulfate Reduction → Methanogenesis (Carbon Dioxide Reduction).

Generally, stronger reducing conditions, and the depletion of electron acceptors, is needed to foster the latter processes in this sequence, such as sulfate reduction and methanogenesis. Generally, nitrate and manganese and iron reduction are most efficient in the ORP range of 0 to -100 mV, while sulfate reduction and methanogenesis are most efficient in the -100 to -300 mV range. ORP measurements above 0 mV indicate transitional to oxidizing conditions that are not favorable for most anaerobic reductive reactions, but are conducive to degradation by oxidation, which is applicable to petroleum-related hydrocarbons such as xylene and ethylbenzene and also to the lesser-chlorinated VOCs such as vinyl chloride.

At the site, the majority of the VOCs present in groundwater will be susceptible to anaerobic degradation processes. Aromatic hydrocarbons present in portions of the site (including benzene, toluene, ethylbenzene and xylenes [BTEX]) can be used as a carbon source to drive the co-metabolic degradation of the chlorinated VOCs. In the absence of an anthropogenic carbon source (such as BTEX), naturally occurring organic carbon present in the aquifer matrix can be used as a substrate for microbial degradation.

The following sections describe the geochemical conditions identified at the site, and use historical data to evaluate the effectiveness of natural attenuation for various portions of the site. VOC data collected in 1993, 1994, 1995 and 1998 is used in these discussions, as is the biogeochemical data collected in March and August 1998 (Tables 4-4 and 4-5).

4.6.2 Site Specific Evidence of Biodegradation

4.6.2.1 Background Groundwater Quality

Background, or incoming groundwater quality must be measured in order to determine if trends identified on site are significant. Generally, if concentrations of electron acceptors or reduced byproducts differ from background by more than two orders of magnitude, the effects are deemed significant. At the site, background groundwater quality was evaluated by collecting groundwater samples from upgradient wells HR-9,

HR-11, and GM-24 and from cross-gradient monitor well GM-25. The three upgradient wells show VOC impacts, consisting primarily of 1,1,1-TCA, 1,1-DCA and chloroform present in the upgradient portion of the site (total VOC concentration of 8 to 111 ug/L). Background groundwater is transitional to aerobic and oxidizing, with low DO (<0.21 mg/L) and moderate ORP (>+30 mV) measured in the north and north-northwest at HR-9 and HR-11, and elevated DO (5.15 mg/L) and moderate ORP (>+43 mV) measured to the northeast at GM-24. Electron acceptors are present in the incoming groundwater at concentrations which are capable of supporting biodegradation, including nitrate (8 to 13 mg/L), total iron (1 to 10 mg/L), sulfate (49 to 97 mg/L), and carbon dioxide (64 to 122 mg/L). TOC, an indicator of available substrate for bacteria, is fairly low in background groundwater, with concentrations between non detect and 3 mg/L. Methane levels are generally low, with the highest concentration being present at HR-9 (0.163 mg/L). Ethane and ethene levels are generally low, with the exception of a detection of ethane at HR-9 (22 ug/L).

At the cross-gradient monitor well GM-25, groundwater conditions appear to be reducing in nature (ORP of -198.9 mV and DO of 0.14 mg/L), which is unexpected considering that no VOCs were detected in this well and TOC is non-detect. Nitrate is non-detect in this cross-gradient groundwater, while total iron and sulfate are present at 18.9 mg/L and 80 mg/L, respectively.

Compared to this upgradient data, biogeochemical data collected from downgradient portions of the site shows depletion of individual electron acceptors and elevated levels of reduced byproducts in certain portions of the site. In general, the majority of the site shows only slightly reducing to transitional conditions: DO levels are for the most part below 1 mg/L, but ORP levels show oxidizing conditions (i.e. above 0 mV) in all but three wells (an area north of Landfill L1 and an area downgradient of the North Settling Lagoon). A transitional, or marginally reducing environment is conducive to the degradation of PCE and 1,1,1-TCA, but these environments will result in slow degradation of TCE, DCE and 1,1-DCA. Though it should be noted that site conditions could be enhanced to achieve better degradation rates. The following sections present an area by area discussion of the natural attenuation data and subsequent trends that have been identified for portions of the site.

4.6.2.2 AOI 7 Area

As discussed in Section 4.4.3.2, groundwater data at AOI 7 contains the highest concentrations of chlorinated VOCs detected at the site. These VOCs include PCE and its degradation products TCE, cis-1,2-DCE and vinyl chloride, as well as 1,1,1-TCA

and its degradation products 1,1-DCA and DCE. The presence of significant concentrations of these daughter products provides the first line of evidence that biodegradation of the chlorinated VOCs is occurring. This degradation from PCE and TCA to daughter products is also evident in the graphs of VOC concentrations versus distance presented in Figures 4-4 and 4-5, respectively.

The reducing environment appears to be transitional based on data collected from GM-23 in March 1998 and at GM-23, GM-27 and GM-28 in August 1998, as indicated by positive ORP readings (> 92 mV) and DO measured between 0.4 mg/L and 2.6 mg/L. There is evidence of electron acceptor utilization in the August 1998 data, with nitrate depleted at GM-27 and GM-28, and with the presence of nitrite, slightly lower levels of sulfate and elevated levels of carbon dioxide at GM-23 and GM-27 compared to GM-28 which is downgradient, beyond the area of highest VOC concentrations. The presence of dissolved manganese and iron in GM-27 (0.17 and 0.19 mg/L, respectively) and an increase in dissolved manganese in GM-28 also provide evidence of alternate electron acceptors being utilized. Finally, the elevated concentration of both ethene and ethane at GM-23 (in both sampling events), GM-27 and GM-28 provide evidence that the degradation process is proceeding beyond vinyl chloride, even though conditions do not appear to be highly reducing. TOC concentrations are low (2 to 8 mg/L), considering the amount of VOC mass present in the aquifer in this area, which may account for why more highly reducing conditions were not observed. Additional TOC in the aquifer could enhance the amount of degradation that is currently being observed.

4.6.2.3 Area North of Building 14

Wells completed upgradient (HR-9) and downgradient (W-3-N) of Landfill L3 and the North Settling Lagoon were monitored during the Supplemental RFI to assess biodegradation across this area north of the Delphi Thermal Moraine Building 14. The geochemical environment downgradient of this area (as represented by data in W-3-N) is one of the more anaerobic and reducing areas that have been identified at the site (DO of 0.17 mg/L; ORP of -87 mV). This more reducing environment would explain the favorable degradation trends that are observed in this area (PCE and TCE in W-3-N decreasing from 41.4 ug/L and 9.3 ug/L in January 1993, respectively, to 2.6 ug/L and non-detect, respectively). The presence of cis-1,2-DCE in W-3-N, which is consistent with historic data presented on Table B-6 of the Delphi Thermal Moraine DOCC (Geraghty & Miller, Inc., 1991), vinyl chloride, and low concentrations of ethane/ethene provide strong indication that PCE degradation is occurring. Additional evidence can be seen in that the electron acceptor nitrate is depleted in this area (non-

detect at W-3-N compared to 8.8 mg/L in HR-9) and dissolved iron concentrations are significantly greater than background (4.44 mg/L compared to non-detect).

4.6.2.4 Area West of Building 14

Biogeochemical parameters and VOCs were measured in three wells which are located on the Delphi Thermal Moraine facility, southwest of AOI 7 and west of Building 14: HR-1, W-1-S, and HR-17 (Figure 2-1). Total VOC concentrations are fairly low in this area, with totals ranging from 13.1 to 138.6 ug/L. VOCs consist of primarily PCE and TCE, with minor concentrations of the degradation product cis-1,2-DCE observed in HR-1 and W-1-S. Biogeochemical data collected from this area indicates the groundwater is in a transitional reducing state, with DO between 0.4 and 2 mg/L, and ORP greater than +47 mV. Nitrate is present throughout this area (13 mg/L), indicating the groundwater environment has not evolved to a more reduced state. The most elevated concentration of chloride detected on the site is observed at the downgradient well HR-17. Chloride is one of the final byproducts of reductive dechlorination, and its presence is likely an indication that dechlorination is occurring in upgradient portions of the site.

4.6.2.5 South of AOI 7 on Moraine Engine Facility

Biogeochemical data was collected from monitor wells ME-6 and ME-3, located west of Moraine Engine Plant 3 and GM-22 located south of Moraine Engine Plant 3. VOCs in this portion of the site consist primarily of PCE and its degradation products and lesser concentrations of 1,1,1-TCA and its degradation product 1,1-DCA. ME-6 is located in the upgradient portion of this area (and downgradient of AOI-7). The presence of dissolved iron, and elevated chloride level provide some indication that biodegradation is occurring upgradient of ME-6. The depletion of nitrate and the presence of dissolved manganese at ME-3, with slightly elevated methane and chloride concentrations, indicate that the reducing environment has evolved to some degree in this area and most likely natural attenuation is restricting the movement of VOC mass through this area. At GM-22, the low DO value, depletion of nitrate, and elevated chloride concentration provide indication that degradation of chlorinated VOCs is likely occurring. This biogeochemical indicator data is consistent with the concentration trend noted in this well (from 48.9 ug/L in August 1994 to 53.8 ug/L in June 1995 to a low of 12.5 ug/L in March 1998).

4.6.2.6 Southern End of Moraine Engine and Delphi Thermal Moraine Facilities

Monitor wells sampled at the southern end of the Moraine Engine and Delphi Thermal Moraine facilities included GM-21 (located east of Landfill L1), EAST (located north of Landfill L1), GM-2 (located east of Landfill L1), GM-8 and GM-6 (both located on the west side of Landfill L1).

Groundwater north of Landfill L1 shows reducing conditions at EAST (ORP of -80.8 and DO of 0.2 mg/L), while conditions at GM-21 and GM-2 which are east of Landfill L1 tend to be less reducing (ORPs of 137.5 mV and 126.7 mV). The presence of nitrite and dissolved manganese, reduced sulfate level, and elevated chloride level provide indication that degradation is occurring at the EAST monitor well. At GM-21 and GM-2, the biogeochemical parameters provide minor evidence that some degradation may be occurring, but the elevated concentration of TCE in GM-21 and the fact that no evidence of vinyl chloride or ethane/ethene production is noted in either GM-21 or GM-2, indicates this degradation is likely limited.

Groundwater along the western portion of Landfill L1 shows the most anaerobic and reducing state measured during the March 1998 event: ORP was identified at -145mV at GM-8, while DO concentrations are generally below 1 mg/L throughout this area. Vinyl chloride detected in this area and elevated ethene concentrations indicate that degradation is occurring to completion in this portion of the site. Many electron acceptors are reduced in this area, including nitrate, sulfate and carbon dioxide. Similarly, the presence of reduced products indicates that several reduction processes are ongoing: nitrite and ammonia are detected in this area (denitrification); elevated concentrations of dissolved manganese and iron (manganese and iron reduction); elevated concentrations of methane (methanogenesis); and elevated concentrations of chloride (general indicator of reductive dechlorination).

4.6.2.7 Downgradient Off-Site

Groundwater downgradient of the site, is transitional to aerobic. The increase in DO measurements, both the permanent gas analysis and the field measurement, indicate that groundwater conditions are becoming more aerobic as the VOC concentrations decrease downgradient towards GM-10, WSU-24 and GM-26. The increase in nitrate, and decreases in total manganese and iron and sulfate are also indicative of an aquifer which is returning to natural levels. This assertion is further supported by the decrease in TOC and chloride concentrations. This data indicates that the groundwater environment is recovering quickly as groundwater leaves the site.

4.7 Site-Wide Groundwater Conclusions

Based on the review of the site-wide groundwater data collected during the Supplemental RFI, the groundwater objectives stated in the approved Supplemental RFI Work Plan (presented in Section 2.2.1) have been met. Therefore, no additional groundwater investigative activities are required to support development of the Supplemental Baseline Risk Assessment and assess the need for interim measures focused on the source of VOCs in groundwater at the Site which is located at AOI 7.

5. Supplemental Baseline Risk Assessment

5.1 Background

The second volume of the Supplemental RFI Report presents the Supplemental Baseline Risk Assessment for the Moraine Engine and the Moraine Assembly (ENVIRON Corporation, 1999). This baseline risk assessment supplements the baseline risk assessment completed in 1996 as part of the RFI at the Delphi Thermal Moraine (ENVIRON Corporation, 1996).

The 1996 baseline risk assessment evaluated the potential risk to human health and the environment posed by releases of hazardous waste and constituents from the 14 SWMUs investigated in the RFI at Delphi Thermal Moraine, including SWMUs undergoing closure under Ohio EPA's RCRA program (i.e., the North and South Settling Lagoons). Potential exposures to constituents in soil/waste at the SWMUs via direct contact, airborne transport, and groundwater transport were evaluated to determine whether soil/waste at the SWMUs warrants corrective measures and to support identification of appropriate corrective measures alternatives by determining which potential exposure pathways, if any, pose a significant risk. The conceptual site model for the 1996 baseline risk assessment established the reasonably anticipated future land uses and groundwater uses at and around Delphi Thermal Moraine, the potential exposure pathways associated with constituents in soil/waste at the 14 SWMUs, and the potentially exposed populations on-site and off-site. The conceptual site model was reviewed extensively through written correspondence between U.S. EPA and Delphi Thermal Moraine before starting the risk assessment. Several key aspects of the technical methodology (e.g., groundwater modeling) and key assumptions (e.g., exposure factors) relating to the estimation of potential exposures were also reviewed with U.S. EPA. The baseline risk assessment for the SWMUs at Delphi Thermal Moraine was submitted to U.S. EPA in the draft RFI Final Report, Volume II (ENVIRON Corporation 1996).

The 1996 baseline risk assessment concluded that constituents in soil/waste at the SWMUs do not present a significant risk under reasonable maximum exposures via direct contact, airborne transport, or groundwater transport. With respect to the assessment of potential risk via groundwater transport, the 1996 baseline risk assessment was designed to evaluate potential threats to groundwater uses posed by constituents in soil/waste which may leach into groundwater at the SWMUs. It was not specifically designed to evaluate potential risk posed by concentrations of constituents already present in groundwater. This design was consistent with the

objective of determining whether soil/waste at a specific SWMU warrants corrective measures. However, as suggested by U.S. EPA's June 11, 1996 comments on the risk assessment, this design did not provide a clear approach for determining whether existing groundwater conditions warrant corrective measures (including the continuation of current interim measures to address the presence of VOCs in shallow groundwater at the downgradient boundary of Delphi Thermal Moraine).

GM's September 11, 1996 response to the June 11, 1996 U.S. EPA comments reiterated the conclusions of the 1996 baseline risk assessment, which was that soil/waste at the SWMUs does not warrant corrective measures. The response acknowledged that continuation of current interim measures was appropriate since constituent concentrations in site-wide groundwater were not specifically assessed in the 1996 risk assessment and, in many cases, are clearly not attributable to the SWMUs investigated in the RFI at Delphi Thermal. In response to U.S. EPA comments on assigning groundwater data to specific SWMUs, GM provided detailed explanations of the pitfalls associated with assigning constituent concentrations in groundwater to a SWMU where no evidence of a causal link exists. Along with these explanations, an alternate method for assessing the potential impact on groundwater from soil/waste at a SWMU was proposed. The proposed method was designed to minimize incorrect attribution of groundwater impact to soil/waste at a SWMU by using soil/waste characterization data rather than groundwater data (where justified) to estimate the potential for soil/waste to affect current or reasonably anticipated future groundwater uses. U.S. EPA's comments on the 1996 baseline risk assessment did not request modifications to other aspects of the risk assessment.

In a letter dated October 1, 1996, U.S. EPA withdrew its June 11, 1996 request for a revised RFI report (including revisions to the 1996 baseline risk assessment) in light of GM's plans to prepare a Supplemental RFI for Moraine Engine and Moraine Assembly. Because large parts of the two adjoining facilities are located upgradient of Delphi Thermal Moraine, one objective of the Supplemental RFI was to investigate areas at Moraine Engine and Moraine Assembly that may have affected, or may continue to affect, groundwater conditions at Delphi Thermal Moraine. Six such AOIs were investigated in the Supplemental RFI. Soil conditions at the AOIs were characterized to allow an assessment of potential exposures to constituents in soil at the AOIs via direct contact, airborne transport, and groundwater transport. The Supplemental RFI also included characterization of site-wide groundwater conditions and an extensive characterization of groundwater conditions at AOI 7 where initial groundwater monitoring data indicated potentially significant contamination.

As discussed in Sections 3.4 and 4.4 the extensive characterization of AOI 7 during the Supplemental RFI found evidence that DNAPL may be present in the shallow saturated zone underlying AOI 7 above an upper clay till layer. The constituents present in the shallow groundwater at AOI 7 consist primarily of PCE, TCE and their degradation products (i.e., 1,2-DCE and vinyl chloride). Because AOI 7 is upgradient of most of Moraine Engine and Delphi Thermal Moraine, the contamination in shallow groundwater above the upper clay till at AOI 7 is the primary source of VOCs in site-wide groundwater at these facilities. Furthermore, considering the composition and concentrations of VOCs in groundwater at AOI 7, the contamination in groundwater at AOI 7 is the primary contributor of the VOCs being addressed by the interim measures at the downgradient boundary of Delphi Thermal Moraine.

5.2 Purpose and Scope

The RFI at Delphi Thermal Moraine and the Supplemental RFI at Moraine Engine and Moraine Assembly provide a comprehensive characterization of site-wide groundwater conditions as well as soil/waste conditions at 14 SWMUs and six AOIs. The RFI and Supplemental RFI baseline risk assessments were conducted with the primary objective of addressing the following questions:

1. Do constituents in soil/waste at any of the SWMUs at Delphi Thermal Moraine pose an unacceptable risk which warrants corrective measures?

2. Do constituents in soil at any of the AOIs at Moraine Engine and Moraine Assembly pose an unacceptable risk which warrants corrective measures?

3. Do constituents in groundwater at any of the SWMUs or AOIs pose an unacceptable risk which warrants corrective measures?

As discussed above, the 1996 baseline risk assessment was designed to answer the first question. It concluded that constituents in soil/waste at the SWMUs do not present an unacceptable risk under reasonable maximum exposures via direct contact, airborne transport, or groundwater transport.

The supplemental baseline risk assessment, as described in Volume II, is designed to answer the second question. It evaluates potential exposures to constituents in soil at the AOIs using the same general approach and methods reviewed by U.S. EPA in the 1996 baseline risk assessment for the SWMUs at Delphi Thermal Moraine, except in

estimating groundwater source concentrations. Specifically, potential exposures to constituents in soil at the AOIs via direct contact, airborne transport, and groundwater transport are evaluated to determine whether soil at the AOIs warrants corrective measures. Because Moraine Engine and Moraine Assembly adjoin Delphi Thermal Moraine and the nature of operations at the three facilities is similar, the conceptual site model for the supplemental baseline risk assessment generally follows the conceptual site model used in 1996. That is, the potential exposure pathways associated with the AOIs at Moraine Engine and Moraine Assembly are evaluated under the same current and future land use and groundwater use scenarios established in the 1996 baseline risk assessment.

To address U.S. EPA comments on the 1996 baseline risk assessment, the supplemental baseline risk assessment evaluates potential exposures via groundwater transport of constituents in soil/waste at both the AOIs and SWMUs using the alternate method for estimating groundwater source concentrations as described in GM's September 11, 1996 response to comments. As discussed above and in the September 11, 1996 response, the alternate method was designed to minimize incorrect attribution of groundwater impact to soil/waste at a SWMU or AOI by using soil/waste characterization data rather than groundwater data (where justified) to estimate the potential for soil/waste to affect groundwater. Potential exposures at current and reasonably expected points of groundwater use are evaluated by combining potential contributions from both the AOIs at Moraine Engine and Moraine Assembly and the SWMUs at Delphi Thermal Moraine, to provide a comprehensive assessment of potential exposures to constituents in soil/waste via groundwater transport.

The supplemental baseline risk assessment is also designed to answer the third question. Because site-wide groundwater is primarily affected by contamination from the shallow groundwater at AOI 7, the supplemental baseline risk assessment is focused on evaluation of the effects of groundwater conditions at AOI 7 on site-wide groundwater. Specifically, potential exposures to constituents in groundwater at AOI 7 are evaluated to determine whether groundwater at AOI 7 warrants interim measures or corrective measures. This evaluation is done separately from the evaluation of potential exposures to constituents in soil at AOI 7, so that the need for interim measures or corrective measures to address each medium at AOI 7 can be determined separately. Unlike groundwater contamination across other areas of the site which cannot be causally linked to specific SWMUs or AOIs in those areas, the groundwater contamination at AOI 7 can be confidently attributed to AOI 7. Evaluation of potential exposures, if any, to existing constituents in site-wide groundwater not attributable to AOI 7 will be done as part of the assessment of the effectiveness of a proposed interim

measure to address the AOI 7 groundwater contamination. A work plan for this evaluation and the interim measure is being submitted separately to U.S. EPA.

5.3 Methodology

As mentioned above, the supplemental baseline risk assessment uses the same conceptual site model used in 1996. That is, the potential exposure pathways associated with the AOIs at Moraine Engine and Moraine Assembly are evaluated under the same current and future land use and groundwater use scenarios established in the 1996 baseline risk assessment. Potential exposures to constituents in soil at the AOIs are evaluated using the same general approach and methods reviewed by U.S. EPA in the 1996 baseline risk assessment for the SWMUs at Delphi Thermal Moraine, except in estimating groundwater source concentrations, as discussed above. *The basis for using the conceptual site model from the 1996 baseline risk assessment for Moraine Engine and Moraine Assembly is discussed in detail in Volume II of this Supplemental RFI Report and summarized below.*

In the 1996 baseline risk assessment, a comprehensive review of information on historical and current land use at and around Delphi Thermal was combined with considerations of local land use development patterns to establish reasonably anticipated future land use at Delphi Thermal. In particular, the likelihood of future residential and recreational land use at Delphi Thermal was evaluated. This evaluation was conducted according to USEPA guidance (55 FR 8666, March 8, 1990, p. 8710) which states that "the assumption of future residential land use is not a requirement" and "may not be justifiable if the probability that the site will support residential use in the future is small." USEPA guidance (1992B, 1991B) further states that "sites that are surrounded by operating industrial facilities can be assumed to remain as industrial areas unless there is an indication that this assumption is not appropriate."

Accordingly, a comprehensive review of information pertinent to future land use patterns around Delphi Thermal was conducted to evaluate the appropriateness of assuming continued industrial land use at the facility. The supplemental baseline risk assessment updated this review to include information on land use patterns to the east of Moraine Engine and Moraine Assembly to provide for a complete evaluation of the appropriateness of assuming continued industrial land use at these facilities. The evaluation of future land use at the three facilities considered the sources and types of information identified in USEPA guidance (USEPA 1995D), as follows:

- *Historical and Current Land Use*
  - *Current land use*
  - *Zoning maps*
  - *Historical and recent development patterns*
  - *Site location in relation to urban, residential, commercial, industrial, agricultural, and recreational areas*
- *Zoning and Future Land Use Plans*
  - *Zoning laws*
  - *Comprehensive community master plans*
- *Likelihood of Future Residential Use*
  - *Population growth patterns and projections*
  - *Accessibility of site to existing infrastructure*
- *Other Information Potentially Related to Land Use*

- *Federal/State land use designation*
- *Cultural factors*
- *Natural resources information*
- *Location of wellhead protection areas*
- *Environmental justice issues*
- *Location of on-site or nearby wetlands*
- *Proximity of site to a floodplain*

- *Proximity of site to critical habitats of endangered or threatened species*
- *Geologic and hydrogeologic information*

The following were the primary sources of information consulted in assessing the current and likely future land use at and surrounding the three facilities:

- *Comprehensive Plan for the City of Moraine*
- *City of Moraine Zoning Ordinance*
- *Official Zoning Map for the City of Moraine*
- *City Planner of Moraine*
- *City of Kettering Zoning Ordinance*
- *Official Zoning Map for the City of Kettering*
- *Kettering Demographic Trends Report*
- *City Planner of Kettering*

In addition, although the facilities are not located within the City of West Carrollton, the following information sources for the City of West Carrollton, which borders the City of Moraine to the south, were also consulted:

- *Comprehensive Plan for the City of West Carrollton*
- *Official Zoning Map for the City of West Carrollton*
- *Wellhead Protection Plan for the City of West Carrollton*
- *City Planner of West Carrollton*

The Comprehensive Plan for Moraine, Ohio, 1995-2015 (the Moraine Plan, BWSC 1994), the Comprehensive Plan for West Carrollton, Ohio 2010 (the West Carrollton Plan, West Carrollton 1994) and the City Planner of Kettering were particularly informative regarding the communities' plans for future growth and development. For

example, the City of Moraine adopted the Moraine Plan as a guide for long-range, future land use planning, following a comprehensive planning process which involved 20 public meetings and interviews with 20 key stakeholders from both public and private sectors in the Moraine area. The Moraine Plan sets forth the goals and policies developed during this planning process. Similarly, the West Carrollton Plan was the result of a "cooperative planning effort of the Mayor and City Council, the Planning Commission, all city departments, as well as the significant contribution of community leaders and concerned citizens" (West Carrollton 1994). As part of the development of the West Carrollton Plan, the City Planning Commission and City Council conducted numerous public meetings and hearings concerning the contents of the plan. Like the Moraine Plan, the West Carrollton Plan provides a long range guide for decisions on physical, economic and social development of West Carrollton, and includes general policy, guidelines, implementation plans, and recommendations for zoning changes. Finally, although it was determined that the City of Kettering does not have a comprehensive plan similar to those for the City of Moraine or the City of West Carrollton, the City Planner of Kettering indicated that approximately 90% of the land in Kettering is already developed and no major changes in zoning districts are anticipated (Aidt 1998).

The findings of this land use assessment relative to the reasonably anticipated future land use at Moraine Engine and Moraine Assembly are summarized below.

- ***Historical and Current Land Use***

  The Moraine Engine and Moraine Assembly facilities are located in an area of the City of Moraine (Moraine) that historically has been and currently is developed largely for industrial and commercial uses. The land occupied by the facilities has been under industrial use since 1916 and has been under GM ownership since the mid-1920s. Through the approximately 70 years of continuous operation, GM has modernized, modified, and expanded the operations at these facilities. As a result, GM has established a strong and consistent presence in Moraine, despite widespread changes in the automobile industry. GM expects that the current operations or similar operations will continue at this location.

  Land use surrounding Moraine Engine and Moraine Assembly is almost entirely industrial and commercial, with only a few small areas of residential use. This is in contrast to other parts of Moraine which have more varied land use. The land in West Carrollton adjoining Moraine to the south is solely in

manufacturing and commercial use and, as such, separates the industrialized area of Moraine from residential land use further south in West Carrollton. The land in the City of Kettering bordering Moraine to the east is largely in commercial and general business use and, as such, separates the industrialized area of Moraine from the western portion of Kettering which includes industrial, general business, as well as residential land use.

- ***Zoning and Future Land Use Plans***

According to the Moraine Plan, the City plans to maintain existing industries and businesses while expanding commercial/industrial development to promote new business growth in the area where the Moraine Engine and Moraine Assembly facilities are located. The goal of enhancing industrial/commercial growth in this area of the city, and elsewhere in Moraine, is consistent not only with Moraine's history of maintaining a favorable business environment but also with the importance of business growth to Moraine. Because the area where the facilities are located is already heavily developed for industrial and commercial use, the primary strategy for promoting further economic growth is redevelopment of underutilized properties. Such redevelopment may include industrial redevelopment of selected residential neighborhoods (including a mobile home park west of the Delphi Thermal facility) and construction of new commercial strips to service existing businesses and industries in the area. Consistent with these goals, the Moraine Plan envisions no expansion of residential land use in the area surrounding the GM facilities. Potential residential growth in Moraine is planned for areas which are several miles west of the facilities.

Similarly, the West Carrollton Plan projects that, given current land use in West Carrollton, the greatest portion of new development in the coming decades will likely occur west of the Great Miami River. Finally, approximately 90% of the land in Kettering is already developed and existing zoning districts are not expected to change significantly in the future (Aidt 1998).

In addition to evaluating the communities' long-term land use plans for the facilities and the surrounding areas, the likelihood of future residential land use at Moraine Engine and Moraine Assembly was assessed in terms of the (1) importance of the facilities to the local economy, (2) the suitability of the area for residential

development, (3) historical and predicted population trends in the area, (4) natural and cultural resources, (5) environmental justice, and (6) harmony with surrounding land uses.

As detailed in Section 3 of Volume II of this Supplemental RFI Report, the review of information pertinent to future land use patterns surrounding Delphi Thermal Moraine, Moraine Engine and Moraine Assembly confirms that the assumption of continued industrial land use at the three facilities is appropriate. As such, the potential for human exposure to the AOIs at Moraine Engine and Moraine Assembly is evaluated in the supplemental baseline risk assessment for the following current and reasonably anticipated future land uses:

- Industrial land use at Moraine Engine and Moraine Assembly; and
- Industrial/commercial, residential, and recreational land uses around the facilities.

The potentially exposed populations under these land uses are:

- On-facility and off-facility workers
- Off-facility residents

Groundwater in the lower aquifer in the region surrounding the three facilities is a drinking and industrial water source; but the groundwater in the upper aquifer underlying the facilities is not a drinking or industrial water source and is not reasonably expected to serve as either type of water source in the future. The groundwater in the upper aquifer, however, is a medium for potential transport of

constituents from the SWMUs at Delphi Thermal Moraine and the AOIs at Moraine Engine and Moraine Assembly to the lower aquifer and the Great Miami River. As such, the supplemental baseline risk assessment includes an assessment of the extent to which the hydraulic interconnections could result in migration of constituents to the lower aquifer or to the River in concentrations of significance to human health.

The potential for drinking water exposure to groundwater is evaluated in the supplemental baseline risk assessment using the same groundwater use scenarios evaluated in the 1996 baseline risk assessment. Specifically, potential exposure is evaluated for current or potential drinking water use of groundwater extracted from the following municipal well fields:

- West Carrollton: as West Carrollton's drinking water supply
- Miami Shores: as Greater Moraine Water System (GMWS) of Montgomery County's primary emergency drinking water supply
- Dryden Road South: as GMWS's secondary emergency drinking water supply

Although the Dryden Road North well field is not expected to serve as a drinking water supply or as an emergency drinking water supply, the groundwater quality at this well field is also evaluated.

Like the 1996 baseline risk assessment, the supplemental baseline risk assessment also evaluates the potential for exposures that may occur through current and potential nonpotable industrial use of groundwater extracted from industrial wells. Based on currently active production wells and potential operation of inactive production wells, potential exposures through nonpotable groundwater use is evaluated for the following on-site industrial wells:

- Delphi Thermal Moraine inactive production wells: as a potential industrial water supply
- Moraine Assembly active production wells: as an industrial water supply
- Moraine Engine active production wells: as an industrial water supply
- Moraine Engine inactive production well: as a potential industrial water supply

The significance of waste constituents potentially transported to the Great Miami River via groundwater flow from the upper aquifer is also evaluated, as in the 1996 baseline risk assessment.

Potential exposures are quantitatively evaluated for incidental ingestion of and dermal contact with soil and inhalation of soil constituents in vapor and particulates. Potential exposures via these pathways are quantified by the product of the concentration of waste constituents in an environmental medium at locations of potential exposure over an expected period of exposure and the intake of the environmental medium by a potentially exposed population. The product of these components is combined with toxicity values to estimate potential carcinogenic risk and noncarcinogenic effects. As in the 1996 baseline risk assessment, potential groundwater and surface water exposures are evaluated by comparison of exposure concentrations in groundwater and surface water at potential points of contact with MCLs under the Safe Drinking Water Act, or similar risk-based drinking water concentrations for constituents without MCLs.

Variability in the factors affecting exposure within a potentially exposed population is considered in estimating potential current and future exposures by quantifying both central tendency and high-end estimates of exposure, consistent with U.S. EPA guidance. In the supplemental baseline risk assessment, high-end estimates are calculated using conservative (i.e., screening-level) estimates of exposure concentrations and high-end exposure factors, while the central tendency estimates are calculated using typical exposure factors. The exposure factors used in the supplemental baseline risk assessment are the same as those used in the 1996 baseline risk assessment.

Current U.S. EPA-derived toxicity values are used when such values are available. However, many of the constituents included in the quantitative exposure assessment do not have U.S. EPA-derived toxicity values for evaluating cancer risk or noncancer effects via the inhalation route of exposure. U.S. EPA also has not established any toxicity values for evaluating risks or effects via the dermal route. To provide a quantitative analysis of the potential uncertainties in the estimates of risk (which use only U.S. EPA-derived toxicity values), estimates of cancer risk and noncancer effects are developed using route-to-route extrapolations, as in the 1996 baseline risk assessment

The results of the exposure assessment and toxicity assessment are combined to estimate potential cumulative cancer risk and noncancer effects for each of the

potential exposure pathways. The soil- and air-related cumulative cancer and noncancer risk estimates are compared with levels that U.S. EPA has established as protective of human health (i.e., site-related cumulative cancer risk range of 10^{-4} to 10^{-6} and hazard index of 1). Estimated groundwater concentrations at potential points of groundwater use and estimated surface water concentrations in the Great Miami River are compared with MCLs, or similar risk-based drinking water concentrations. MCLs or risk-based drinking water concentrations are appropriate for evaluating potential drinking water exposures and are conservative screening levels for evaluating potential non-drinking water exposures (e.g., nonpotable industrial groundwater use, surface water exposures in the Great Miami River). For active nonpotable industrial water supply wells where predicted constituent concentrations are higher than MCLs or risk-based drinking water concentrations, their predicted constituent concentrations are further assessed based on the actual exposure setting and water usage.

5.4 Conclusions

As discussed above, the 1996 baseline risk assessment concluded that constituents in soil/waste at the Delphi Thermal Moraine SWMUs do not present an unacceptable risk under reasonable maximum exposures via direct contact, airborne transport, or groundwater transport. The supplemental baseline risk assessment described in this report reevaluated whether soil/waste at any of the SWMUs at Delphi Thermal Moraine pose an unacceptable risk via groundwater transport. This reevaluation was performed to assess the combined effect of the SWMUs at Delphi Thermal with the AOIs at Moraine Engine and Moraine Assembly and to address U.S. EPA's June 11, 1996 comments. It also evaluated whether soil at any of the AOIs at Moraine Engine and Moraine Assembly pose an unacceptable risk via direct contact, airborne transport, and groundwater transport. Additionally, the supplemental baseline risk assessment evaluated whether constituents already in groundwater at the primary source area within AOI 7 pose an unacceptable risk to current and reasonably expected future groundwater uses.

The conclusions of the supplemental baseline risk assessment are as follows:

1. Constituents in soil at the Moraine Engine and Moraine Assembly AOIs do not pose an unacceptable risk via direct contact or airborne transport. Estimates of potential cumulative cancer risk and noncancer hazard index for potential exposures to constituents in soil at the AOIs via soil- and air-related pathways, assuming reasonable maximum exposures, are below levels U.S. EPA considers protective of human health. Based on the risk estimated in the baseline risk

assessment, including consideration of the risk estimates developed for the uncertainty analysis, no significant risk drivers were identified. As shown on Table 5-2 of Volume II, none of the high-end risk estimates exceed the low end of U.S. EPA's acceptable risk range. Even for the highest high-end risk estimates developed for the uncertainty analysis (see Table 5-5a in Volume II), the only risk estimate exceeding the low end of the acceptable risk range was for AOI 34 (with a high-end risk estimate of 2×10^{-6} for the ingestion pathway); this risk estimate is principally associated with the presence of arsenic at 85 mg/kg at AOI 34.

2. Constituents in soil/waste at the SWMUs and AOIs also do not pose an unacceptable risk via groundwater transport under the 10 groundwater use scenarios evaluated.

- Under current groundwater use conditions, without or with taking into account the current interim measures (Scenarios 1 and 6, respectively), potential leaching of constituents from soil/waste to groundwater is not predicted to cause concentrations at points of groundwater use to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs).

- In the event that the Miami Shores well field is used to supply water in an emergency without the need to also use the Dryden Road South well field (Scenarios 2, 3, 7, and 8), potential leaching of constituents from soil/waste to groundwater is not predicted to cause concentrations at points of groundwater use to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) with or without current interim measures.

- In the very unlikely event that the Miami Shores and Dryden Road South well fields are both needed to supply water in an emergency without current interim measures (Scenarios 4 and 5), potential leaching of constituents from soil/waste at the SWMUs (primarily Landfill L1 and the Waste Pile Staging Area) is predicted to cause concentrations at Dryden Road South to exceed MCLs for a few constituents. Specifically, PCE (0.01 mg/L in Scenario 4 and 0.009 mg/L in Scenario 5, compared to the MCL of 0.005 mg/L), TCE (0.02 mg/L in Scenario 4 and 0.01 mg/L in Scenario 5, compared to the MCL of 0.005 mg/L), chromium (0.2 mg/L in Scenario 4 and 0.13 mg/L in Scenario 5, compared to the MCL of 0.1 mg/L), lead (0.02 mg/L in Scenario 4, compared to the MCL of 0.015 mg/L), and nickel (0.1 mg/L in Scenario 4, compared to the Ohio MCL of 0.1 mg/L) are predicted to exceed MCLs. However, these results are expected to overstate potential reasonable maximum exposures because of the low likelihood that the

Dryden Road South well field would be used. Also, the predicted effects attributed to Landfill L1 actually may be from upgradient groundwater at AOI 7, and the predicted effects attributed to the Waste Pile Staging Area are not supported by on-site groundwater monitoring data. In the corresponding scenarios which account for the current interim measures (Scenarios 9 and 10), potential leaching of constituents from soil/waste at the SWMUs and AOIs is not predicted to cause concentrations at points of groundwater use to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs).

3. Constituents in groundwater at the primary source area within AOI 7 may affect groundwater quality at some points of current and reasonably expected future groundwater use, under the 10 groundwater use scenarios evaluated.

- The migration of constituents in groundwater from AOI 7 is not predicted to cause concentrations at current drinking water supplies (i.e., the West Carrollton well field) to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) under any of the 10 groundwater scenarios evaluated (with or without the current interim measures).

- The migration of constituents in groundwater from AOI 7 is not predicted to cause concentrations at the Miami Shores well field to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) if it is used as an emergency drinking water supply (with or without the current interim measures).

- The migration of constituents in groundwater from AOI 7 is not predicted to cause concentrations at the currently inactive Delphi Thermal Moraine industrial production wells to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) if they were placed into service under the pumping scenarios evaluated.

- The migration of PCE and TCE in groundwater from AOI 7 is predicted to cause concentrations in groundwater at the Moraine Engine and Moraine Assembly industrial production wells to exceed MCLs under several groundwater use scenarios (including those with the current interim measures). However, groundwater from these production wells is currently used as nonpotable process water and the predicted concentrations of PCE and TCE represent concentrations approximately 10,000 fold below Occupational Safety and Health Association (OSHA) Permissible Exposure Limits (PELs) to workers under current use.

- The migration of PCE and TCE in groundwater from AOI 7 is predicted to cause concentrations in groundwater to exceed MCLs at the Dryden Road North well field under groundwater use scenarios with the current interim measures and at the Dryden Road South well field for several groundwater use scenarios with and without the current interim measures. However, groundwater use at these well fields is very unlikely, and therefore, potential exposure to these constituents from these well fields are likely overstated.

No unacceptable human exposures have been determined to be currently occurring. However, constituents in groundwater at AOI 7 have been determined to have a potential to migrate to the extent that reasonably expected future uses of groundwater in the lower aquifer might be affected. As such, GM is implementing an IM to remediate the source area contamination at AOI 7.

6. Summary And Conclusions

Based on the results of the RFI and Supplemental RFI, GM concludes that constituents in soil/waste at the SWMUs and soil at the AOIs do not pose an unacceptable risk *under current and reasonably expected future site conditions. To ensure that these site conditions are not altered in the future in a way that could then result in potentially unacceptable risks, GM will evaluate the use of institutional controls as part of the CMS described below.* A separate assessment of risk posed by existing groundwater conditions in the primary source area AOI 7 indicates that further action is warranted for this area as discussed in Section 5.0 and summarized below.

Implementation of the Supplemental RFI, as presented in Volumes I and II, has accomplished the primary objectives of the Supplemental RFI (presented in Section 1.1) as required by the Administrative Order and the Amendment to the Administrative Order. Specific objectives for each media were presented in Sections 2.2.1 and 2.2.2 and are repeated below.

Soil

1. Determine if a release of hazardous constituents to soils had occurred from AOIs.

2. Evaluate nature and extent of any hazardous constituents released from AOIs, as required to support the Supplemental Baseline Risk Assessment.

Groundwater

1. Collect site-wide data to characterize groundwater with respect to flow direction and occurrence of Appendix IX VOC constituents and cis-1,2-dichloroethene (cis-1,2-DCE).

2. Collect data further downgradient of the site to characterize groundwater with respect to flow direction and occurrence of Appendix IX VOC constituents and cis-1,2-DCE.

3. Collect data to support the Supplemental Baseline Risk Assessment.

4. Evaluate site-wide intrinsic attenuation of VOCs.

Additionally, for each media evaluated, the Supplemental Baseline Risk Assessment estimated potential risk to human health and the environment posed by any hazardous constituents released from, or present within, the AOIs under investigation. The

primary objective of the Supplemental Baseline Risk Assessment was to address the following questions.

1. Do constituents in soil/waste at any of the SWMUs at Delphi Thermal pose an unacceptable risk which warrants corrective measures?

2. Do constituents in soil at any of the AOIs at the GM Eastern Facilities pose an unacceptable risk which warrants corrective measures?

3. Do constituents in groundwater at any of the SWMUs or AOIs pose an unacceptable risk which warrants corrective measures?

Presented below is a discussion of how each of these media-specific objectives were achieved during the Supplemental RFI and a conclusion regarding the need for additional investigative activities at the AOIs.

6.1 Soil

To accomplish the Supplemental RFI objectives at the six AOIs where soil was considered a medium of potential concern (AOIs 7, 13, 17, 34, 35, 36), a review of historical data was completed and Supplemental RFI soil sampling was conducted. Section 3.0 provides a detailed description of the investigative strategy, results, and investigative conclusions for each AOI under consideration. The soil sampling results provide information necessary to complete an evaluation of the presence of any suspected release, as well as, sufficient detail on the nature and extent of any release to support an evaluation of risks posed by the AOI in the Supplemental Baseline Risk Assessment. Based on the Supplemental RFI soil sampling results:

- A significant release of hazardous constituents has not occurred at AOIs 13, 17, 34, 35, and 36.

- A historic release of hazardous constituents in the vadose zone has occurred at AOI 7.

- Adequate data has been collected to characterize the AOIs and no additional activity is necessary to support the Supplemental Baseline Risk Assessment and the evaluation of the need for an interim measures/CMS.

As concluded in the Supplemental Baseline Risk Assessment, constituents in soil/waste at the SWMUs at Delphi Thermal and constituents in soil at the AOIs at the GM Eastern Facilities do not pose an unacceptable risk via direct contact or airborne transport. Estimates of potential cumulative cancer risk and noncancer hazard index for potential exposures to constituents in soil at the AOIs via soil- and air- related pathways, assuming reasonable maximum exposures, are below levels U.S. EPA considers protective of human health.

6.2 Groundwater

To accomplish the Supplemental RFI objectives for groundwater, site-wide sampling for VOCs, AOI-specific sampling, and bioattenuation indicator parameter sampling were conducted. In addition, water level measurements were collected and three shallow monitor wells were installed. Section 4.0 provides a detailed description of the site-wide geology, groundwater flow, groundwater quality, and biogeochemical data review. Based on the review of the site-wide groundwater data collected during the Supplemental RFI, the groundwater objectives have been met. Therefore, no additional groundwater investigative activities are required to support development of the Supplemental Baseline Risk Assessment and assess the need for an interim measures/CMS.

As concluded in the Supplemental Baseline Risk Assessment, constituents in soil/waste at the SWMUs and AOIs do not pose an unacceptable risk via groundwater transport under the 10 groundwater use scenarios evaluated.

- Under current groundwater use conditions, without or with taking into account the current interim measures (Scenarios 1 and 6, respectively), potential leaching of constituents from soil/waste to groundwater is not predicted to cause concentrations at points of groundwater use to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs).

- In the event that the Miami Shores well field is used to supply water in an emergency without the need to also use Dryden Road South well field (Scenarios 2, 3, 7, and 8), potential leaching of constituents from soil/waste to groundwater is not predicted to cause concentrations at points of groundwater use to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) with or without current interim measures.

- In the very unlikely event that the Miami Shores and Dryden Road South well fields are both needed to supply water in an emergency without current interim measures (Scenarios 4 and 5), potential leaching of constituents from soil/waste at the SWMUs (primarily Landfill L1 and the Waste Pile Staging Area) is predicted to cause concentrations at Dryden Road South to exceed MCLs for a few constituents. Specifically, PCE (0.01 mg/L in Scenario 4 and 0.009 mg/L in Scenario 5, compared to the MCL of 0.005 mg/L), TCE (0.02 mg/L in Scenario 4 and 0.01 mg/L in Scenario 5, compared to the MCL of 0.005 mg/L), chromium (0.2 mg/L in Scenario 4 and 0.13 mg/L in Scenario 5, compared to the MCL of 0.1 mg/L), lead (0.02 mg/L in Scenario 4, compared to the MCL of 0.015 mg/L), and nickel (0.1 mg/L in Scenario 4, compared to the Ohio MCL of 0.1 mg/L) are predicted to be above MCLs. However, these results are expected to overstate potential reasonable maximum exposures because of the low likelihood that the Dryden Road South well field would be used. Also the predicted effects attributed to Landfill L1 actually may be from upgradient groundwater at AOI 7, and the predicted effects attributed to the Waste Pile Staging Area are not supported by on-site groundwater monitoring data. In the corresponding scenarios which account for the current interim measures (Scenarios 9 and 10), potential leaching of constituents from soil/waste at the SWMUs and AOIs is not predicted to cause concentrations at points of groundwater use to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs).

Constituents in groundwater at AOI 7 may affect groundwater quality at some points of current and reasonably expected future groundwater use, under the 10 groundwater use scenarios.

- The migration of constituents in groundwater from AOI 7 is not predicted to cause concentrations at current drinking water supplies (i.e., the West Carrollton well field) to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) under any of the 10 groundwater scenarios evaluated (with or without current interim measures).

- The migration of constituents in groundwater from AOI 7 is not predicted to cause concentrations at the Miami Shores well field to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) if it is used as an emergency drinking water supply (with or without current interim measures).

- The migration of constituents in groundwater from AOI 7 is not predicted to cause concentrations at the currently inactive Delphi Thermal industrial production wells

to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) if they were placed into service under the pumping scenarios evaluated.

- The migration of PCE and TCE in groundwater from AOI 7 is predicted to cause concentrations in groundwater at the GM Eastern Facility's industrial production wells to exceed MCLs under several groundwater use scenarios (including those with the current interim measures). However, groundwater from these production wells is currently used as nonpotable process water and the predicted concentrations of PCE and TCE represent concentrations approximately 10,000 fold below OSHA PELs to workers under current use.

- The migration of PCE and TCE in groundwater from AOI 7 is predicted to cause concentrations in groundwater to exceed MCLs at the Dryden Road North well field under groundwater use scenarios with current interim measures and at the Dryden Road South well field for several groundwater use scenarios with and without current interim measures. However, groundwater use at these well fields is very unlikely, and, therefore, potential exposure to these constituents from these well fields are likely overstated.

Based on the RFI/Supplemental RFI findings, GM recommends the following short- and long-term goals.

Short-term Goal: Implementation of interim measures to address the VOCs present in shallow groundwater at AOI 7. This work is currently being implemented.

Long-term Goal: Remediation of groundwater as necessary to protect human health and the environment by implementing an aggressive and effective strategy at AOI 7 in conjunction with a site-wide monitoring plan, such that it becomes the site-wide remedy allowing initial interim measures implemented at the downgradient site boundary (i.e., groundwater extraction from TW-2 in the upper aquifer and DN-13 in the lower aquifer) to be shut-off after the remediation at AOI 7 is proven to be effective. This approach is consistent with the October 15, 1998 U.S. EPA correspondence to GM (Appendix A). Plans are currently being developed for a comprehensive monitoring program which will provide data necessary to assess the timing for shutting off the initial interim measures wells (TW-2 and DN-13), as well as providing for site-wide monitoring of SWMUs with in-place wastes (i.e., the landfills and lagoons) for some period thereafter. A draft Site-Wide Groundwater Monitoring Plan was submitted to the U.S. EPA on March 15, 2000 for their review.

Groundwater monitoring activities will be conducted across the site in the future per the Site-Wide Groundwater Monitoring Plan, with a portion of this plan focused on the Waste Pile/Staging Area, a SWMU located at the Delphi Thermal Moraine facility.

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Table 1-1. Summary of Supplemental RFI Sampling Program, General Motors Corporation, Moraine, Ohio

AOI	Soil Samples	# of Soil Samples*	Analyses	Groundwater Samples	# of Groundwater Samples*	Analyses
AOI 7 - Former Oil House Area (February 1998)	OH-BH1 to OH-BH4	11	TCL VOC 8240B TCL SVOC 8270B TCL PCB 8080A TAL Metals[1]	GM-23 and HR-11 (Low-flow)	2	App. IX VOC 8240B and cis-1,2-DCE App. IX SVOC 8270B App. IX PCB 8080A App. IX Total Metals 6020[2] App. IX Diss. Metals 6020[2] Biogeochemical Parameters[3]
AOI 7 - Former Oil House Area (August 1998)	OH-BH5 to OH-BH10 GM-27 borehole GM-28 borehole	21	TCL VOC 8240B short list[4]	OH-BH5 to OH-BH10 GM-27 and GM-28 (Hydropunch)	11	App. IX VOC 8240B short list[4]
				GM-27, GM-28, ME-6, HR-1, HR-3, and GM-26	6	App. IX VOC 8240B short list[4]
				GM-23, GM-27, and GM-28 (Low-flow)	3	App. IX VOC 8240B short list[4] Biogeochemical Parameters[3]
AOI 7 - Former Oil House Area (November 1998)	OH-BH11 to OH-BH20 OH-BH2A OH-BH3A GM-23A	31	TCL VOC 8260B short list[4]	OH-BH11 to OH-BH20 OH-BH2A OH-BH3A (Hydropunch)	14	App. IX VOC 8260 short list[4]
AOI 13 - Buildings 4, 6, and 13 (February 1998)	BDG-DP1 to BDG-DP19 (direct-push)	20	VOC and PCB Field Screening	GM-21, GM-22, and EAST (Low-flow)	3	App. IX VOC 8240B and cis-1,2-DCE App. IX SVOC 8270B App. IX PCB 8080A App. IX Total Metals 6020[2] App. IX Diss. Metals 6020[2] Biogeochemical Parameters[3]
	BDG-DP1	1	TCL PCB 8080A			
	BDG-DP13	1	TAL Metals[1]			
AOI 17 - Building 15 (February 1998)	BD15-DP1 to BD15-DP3	3	VOC and PCB Field Screening	GM-21 and GM-22 (Low-flow)	NA	App. IX VOC 8240B and cis-1,2-DCE App. IX SVOC 8270B App. IX PCB 8080A App. IX Total Metals 6020[2] App. IX Diss. Metals 6020[2] Biogeochemical Parameters[3]

Table 1-1. Summary of Supplemental RFI Sampling Program, General Motors Corporation, Moraine, Ohio

AOI	Soil Samples	# of Soil Samples*	Analyses	Groundwater Samples	# of Groundwater Samples*	Analyses
AOI 34 - Excavation Area 1 (August 1997)	EA1-BH01	2	TCL VOC 8240B TCL SVOC 8270B TCL PCB 8080A TAL Metals[1]	NA		
AOI 35 - Excavation Area 2 (August 1997)	EA2-BH01	2	TCL VOC 8240B TCL SVOC 8270B TCL PCB 8080A TAL Metals[1]	NA		
AOI 36 - Former Southwest ASTs (February 1998)	AST-BH1 to AST-BH2	4	TCL VOC 8240B TCL SVOC 8270B TCL PCB 8080A TAL Metals[1]	GM-2 and GM-21 (Low-flow)	1	App. IX VOC 8240B and cis-1,2-DCE App. IX SVOC 8270B App. IX PCB 8080A App. IX Total Metals 6020[2] App. IX Diss. Metals 6020[2] Biogeochemical Parameters[3]
AOI 36 - Former Southwest ASTs (June 1998)	Composite A to Composite G	7	Arsenic 7060A	NA		
Site-Wide Groundwater (March 1998)	NA			HR-9, GM-24, W-3-N, GM-25, HR-1, W-1-S, ME-6, ME-3, HR-17, GM-8, GM-6 WSU-24, GM-10, GM-26 (Low flow)	14	App. IX VOC 8240B and cis-1,2-DCE Biogeochemical Parameters[3]
				HR-12, HR-13, GM-1, GM-20D, GM-9, MT-69	6	App. IX VOC 8240B and cis-1,2-DCE

[1]List excluded aluminum, calcium, iron, magnesium, potassium, and sodium. Method numbers included 6010A for antimony, barium, beryllium, cadium, chromium, cobalt, manganese, nickel, silver, vanadium and zinc; Method 7060A for arsenic; Method 7421 for lead; Method 7471A for mercury; Method 7740 for selenium; Method 7841 for thallium.

[2]Appendix IX metals analyzed using Method 6020 except for mercury by Method 7470A, selenium by Method 7741A, tin by Method 6010A, and vanadium by Method 200.8.

[3] Biogeochemical parameters included Nitrogen - Ammonia 350.1, Total Fe & Mn 6010A, Diss. Fe & Mn 6010A, Sulfide 376.1, Sulfate 375.4, Chloride 325.3, Total Organic Carbon (TOC) SM5310B, Light Hydrocarbon Scan AM18G, Permanent Gases AM-15.01G, Nitrate Test Kit, Nitrite Test Kit and Ferrous Iron Test Kit.

[4] Short List of VOCs included 1,1-Dichloroethane, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Tetrachloroethene, 1,1,1-Trichloroethane, Trichloroethene and Vinyl Chloride.

*Number of samples does not include QA/QC samples. Refer to Appendix A for QA/QC data.

AOI - Area of Interest.
OH - Oil House.
EA - Excavation Area.
DP - Direct Push.
BD - Building.
BH - Borehole.
BDG - Building.
VOC- Volatile organic compounds.
SVOC - Semi-volatile organic compounds.
PCB - Polychlorinated biphenyls.
AST - Aboveground Storage Tank.
NA - Not applicable.

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Table 3-1. Analytical Results for Soil Samples, AOI - 34 Excavation Area 1 and AOI 35 - Excavation Area 2, General Motors Corporation, Moraine, Ohio.

		EA1-BH01			EA2-BH01	
Constituents	Units	Fill 8/28/97 6 - 8 ft bgs	Fill 8/28/97 Dup-39	Native 8/28/97 12-14 ft bgs	Fill 8/28/97 6 - 8 ft bgs	Native 8/28/97 22-24 ft bgs
VOCs	ug/Kg	ND	ND	ND	ND	ND
SVOCs						
Fluoranthene	ug/Kg	449	<330	<330	402	<330
Pyrene	ug/Kg	450	<330	<330	472	<330
PCBs	mg/Kg	ND	ND	ND	ND	ND
Metals						
Antimony	mg/Kg	<16	<16	<32	<33	<33
Arsenic	mg/Kg	46.5J	124J	3.18	3.16	3.24
Barium	mg/Kg	58.2J	66.9J	22J	53.8J	15J
Beryllium	mg/Kg	0.9	0.8	<2	<2	<2
Cadmium	mg/Kg	<3.9	<4.9	<9.6	<9.9	<9.9
Chromium	mg/Kg	12	15.1	<13	13	<13
Cobalt	mg/Kg	7.6	6.52	<6.4	<6.6	<6.6
Copper	mg/Kg	15.3	15.1	<6.4	<6.6	<6.6
Lead	mg/Kg	18	17.8	3.5	17.4	4.32
Manganese	mg/Kg	331	277	714	299	311
Mercury	mg/Kg	0.025	0.032	<0.01	0.012	<0.01
Nickel	mg/Kg	18.6	15.3	24	7.3	7.6
Selenium	mg/Kg	<1.63J	<1.64J	<1.66J	<1.61J	<1.64J
Silver	mg/Kg	<5.2	<1.3	<13	<13	<13
Thallium	mg/Kg	<0.5	<0.5	0.927	<0.5	0.683
Vanadium	mg/Kg	20.7J	24.9J	<16J	<16J	<17J
Zinc	mg/Kg	104J	141J	20J	49J	28J

EA - Excavation area.
ND - Not detected.
VOCs - Volatile organic compounds.
SVOCs - Semi-volatile organic compounds.
PCBs - Polychlorinated biphenyls.
< - Constituent not detected above laboratory detection limit shown.
mg/Kg - Milligram per kilogram.
ug/Kg - Microgram per kilogram.
ft bgs - Feet below ground surface.
DUP-39 = Duplicate of sample EA1-BH01(6-8).
J - Estimated Concentration.

Table 3-2. Field Screening Results for Soil Samples, AOI 13 - Buildings 4, 6, and 13 and AOI 17 - Building 15, General Motors Corporation, Moraine, Ohio.

Sample Date	Sample Identification	Sample Interval (feet)	PCB Test Kit Results (ppm)	HNu Reading (ppm)	Field GC Results (ppm)		
					TCE	PCE	1,1,1-TCA
AOI 13							
2/17/98	BDG-DP3	4-8	<0.5	0	<0.001	<0.001	<0.001
2/17/98	BDG-DP4	4-8	<0.5	0	<0.001	<0.001	<0.001
2/17/98	BDG-DP6	4-8	<0.5	0	0.011	0.002	<0.001
2/17/98	BDG-DP7	4-8	<0.5	0	<0.001	<0.001	<0.001
2/17/98	BDG-DP10	4-8	<0.5	0	<0.001	<0.001	<0.001
2/17/98	BDG-DP11	4-8	<0.5	0	0.002	0.001	<0.001
2/17/98	BDG-DP12	4-8	<0.5	0	0.001	0.001	<0.001
2/18/98	BDG-DP2	4-8	0.5 - 1.0	0	<0.001	<0.001	<0.001
2/18/98	BDG-DP5	4-8	<0.5	0	0.001	0.001	<0.001
2/18/98	BDG-DP8	4-8	<0.5	0	0.03	0.001	<0.001
2/18/98	BDG-DP8 (DUP)	4-8	<0.5	0	NA	NA	NA
2/18/98	BDG-DP9	4-8	<0.5	0	<0.001	0.048	<0.001
2/18/98	BDG-DP14	4-8	<0.5	0	0.066	0.004	0.002
2/18/98	BDG-DP14 (DUP)	4-8	NA	0	0.07	0.004	0.003
2/18/98	BDG-DP17	4-8	<0.5	0	0.002	0.002	<0.001
2/18/98	BDG-DP18	4-8	<0.5	0	<0.001	<0.001	<0.001
2/18/98	BDG-DP18 (DUP)	4-8	<0.5	0	NA	NA	NA
2/18/98	BDG-DP19	4-8	<0.5	0	<0.001	<0.001	<0.001
2/19/98	BDG-DP1	4-8	>25	0	<0.001	<0.001	<0.001
2/19/98	BDG-DP1 (DUP)	4-8	1.1 - 4	0	NA	NA	NA
2/19/98	BDG-DP13 (0-4)	0-4	<0.5	0	0.003	<0.001	<0.001
2/19/98	BDG-DP13 (4-8)	4-8	<0.5	0	0.002	<0.001	<0.001
2/19/98	BDG-DP15	4-8	<0.5	0	0.028	<0.001	<0.001
2/19/98	BDG-DP16 (0-4)	0-4	<0.5	0	0.008	<0.001	<0.001
2/19/98	BDG-DP16 (4-8)	4-8	<0.5	0	0.001	<0.001	<0.001

Table 3-2. Field Screening Results for Soil Samples, AOI 13 - Buildings 4, 6, and 13 and AOI 17 - Building 15, General Motors Corporation, Moraine, Ohio.

Sample Date	Sample Identification	Sample Interval (feet)	PCB Test Kit Results (ppm)	HNu Reading (ppm)	Field GC Results (ppm)		
					TCE	PCE	1,1,1-TCA
AOI 17							
2/19/98	BD15-DP1	4-8	<0.5	0	0.006	0.065	<0.001
2/19/98	BD15-DP2	4-8	<0.5	0	0.004	0.065	<0.001
2/19/98	BD15-DP2 (DUP)	4-8	NA	0	0.005	0.064	<0.001
2/19/98	BD15-DP3	4-8	<0.5	0	0.009	0.036	<0.001
2/19/98	BD15-DP3 (DUP)	4-8	<0.5	0	NA	NA	NA

A split of BDG-DP1 (4-8) was submitted to NET for analysis of TCL PCBs by Method 8080A.
A split of BDG-DP13 (0-4) was submitted to NET for analysis of TAL Metals by Method 6010A.
PCB Test Kit Results were obtained by using the D-TECH #TK-1002-1, PCB Soil Extraction Pac D-TECH #TK-1002S-1, and the test kit results were interpreted using the DETECHTOR #TK-1001M-1.
Field gas chromatograph results were obtained from Microseeps mobile laboratory.
NA - Not analyzed.
PCB - Polychlorinated biphenyls.
TCE - Trichloroethene.
PCE - Tetrachloroethene.
1,1,1-TCA - 1,1,1-Trichloroethane
ppm - Parts per million.

Table 3-3. Analytical Results for Soil Samples, AOI 13-Buildings 4, 6, and 13, General Motors Corporation, Moraine, Ohio

Constituents	Units	Sample Description		Soil Background Level
		BDG-DP1 2/19/98 4-8 ft bls	BDG-DP13 2/19/98 0-4 ft bls	
Metals				
Antimony	mg/Kg	NA	<7.2UJ	NB
Arsenic	mg/Kg	NA	6.19	28.5
Barium	mg/Kg	NA	103J	229
Beryllium	mg/Kg	NA	0.6	2.41
Cadmium	mg/Kg	NA	<1.1	12.6
Chromium	mg/Kg	NA	9.7	47.4
Cobalt	mg/Kg	NA	4.16	26
Copper	mg/Kg	NA	13.1	41
Lead	mg/Kg	NA	23.1	49.1
Manganese	mg/Kg	NA	611	1,600
Mercury	mg/Kg	NA	0.182J	0.69
Nickel	mg/Kg	NA	10.9	63.7
Selenium	mg/Kg	NA	0.643J	1.5
Silver	mg/Kg	NA	<1.4	0.76
Thallium	mg/Kg	NA	<0.60	NB
Vanadium	mg/Kg	NA	16.5	84.4
Zinc	mg/Kg	NA	82.3J	152
PCBs				
Aroclor 1016	mg/Kg	<0.56	NA	
Aroclor 1221	mg/Kg	<0.56	NA	
Aroclor 1232	mg/Kg	<0.56	NA	
Aroclor 1242	mg/Kg	<0.56	NA	
Aroclor 1248	mg/Kg	<0.56	NA	
Aroclor 1254	mg/Kg	7.86J	NA	
Aroclor 1260	mg/Kg	<0.56	NA	

Background levels from the RFI Final Report Volume II, Baseline Risk Assessment (ENVIRON Corporation 1996).
PCB - Polychlorinated biphenyl.
< - Constituent not detected above laboratory detection limit shown.
mg/Kg - Milligram per kilogram.
NA - Not analyzed.
NB - No background levels were calculated.
J - Estimated value.
UJ - Constituent was not detected above the reporting limit, detection limit is estimated.
ft bls - Feet below land surface.

Table 3-4. Analytical Results for Selected Groundwater Samples Collected in March 1998, General Motors Corporation, Moraine, Ohio.

Constituents	Units	EAST 3/5/98	GM-2 3/4/98	GM-21 3/10/98	GM-22 3/10/98	DUP-57 3/10/98	GM-23 3/9/98	HR-11 3/9/98
Semi-Volatile Organic Compounds	ug/l	ND	ND	ND	ND	ND	ND	ND
Polychlorinated Biphenyls	ug/l	ND	ND	ND	ND	ND	ND	ND
Metals								
Antimony	mg/l	0.0161	<0.0010	<0.0010	0.0012	0.0012	<0.0050	<0.0050
Antimony, Dissolved	mg/l	0.0078	NA	NA	<0.0010	0.001	NA	NA
Arsenic	mg/l	<0.025	<0.0050	<0.0050	<0.0050	<0.0050	<0.025	<0.025
Barium	mg/l	0.117	0.104	0.0808	0.149	0.161	0.161	0.172
Barium, Dissolved	mg/l	0.086	0.0973	0.0634J	0.106J	0.120J	0.0908	0.0944
Beryllium	mg/l	<0.0050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050
Cadmium	mg/l	<0.0050	<0.0010	<0.0010	0.0012	0.0021	<0.0050	<0.0050
Cadmium, Dissolved	mg/l	NA	NA	NA	<0.0010	<0.0010	NA	NA
Chromium	mg/l	0.066	0.0027U	0.0069	<0.0020	0.0027U	0.018	0.0160U
Chromium, Dissolved	mg/l	<0.0020	<0.0020	<0.0020	NA	<0.0020	<0.0020	<0.0020
Cobalt	mg/l	<0.025	<0.0050	0.0094	<0.0050	<0.0050	<0.025	<0.025
Cobalt, Dissolved	mg/l	NA	NA	<0.0050	NA	NA	NA	NA
Copper	mg/l	<0.025	<0.0050	<0.0050	<0.0050	<0.0050	<0.025	<0.025
Iron	mg/l	7.77	<0.10	1.65	0.680J	0.910J	15.0	10.5
Iron, Dissolved	mg/l	<0.10	NA	<0.10	<0.10	<0.10	<0.10	<0.10
Lead	mg/l	0.0077	<0.0010	0.0011	0.0021	0.003	0.0129	0.0074
Lead, Dissolved	mg/l	<0.0010	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/l	1.00	0.048	0.719	0.143J	0.183J	2.63	0.369
Manganese, Dissolved	mg/l	0.122	<0.010	0.181	0.097	0.096	0.242	0.072
Mercury	mg/l	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	mg/l	0.0560J	0.0056J	0.0100J	0.0589J	0.0624J	0.029	0.027
Nickel, Dissolved	mg/l	0.0062	<0.0050	<0.0050	0.043	0.048	<0.0050	0.0064
Selenium	mg/l	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	mg/l	<0.0020	<0.0005	<0.0005	<0.0005	<0.0005	<0.0020	<0.0020
Thallium	mg/l	<0.0050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050
Tin	mg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Vanadium	mg/l	<0.025	<0.0050	<0.0050	<0.0050	<0.0050	<0.025	<0.025
Zinc	mg/l	<0.25	<0.050	<0.050	<0.050	<0.050	<0.25	<0.25

NA	Not analyzed.
ND	Not detected.
mg/l	Milligrams per liter.
ug/l	Micrograms per liter.
J	Value is estimated.
U	Sample result has been qualified as a non-detect due to blank contamination.
DUP-57	Duplicate of GM-22.
<	Constituent not detected above laboratory detection limit shown.

Table 3-5. VOC Analytical Results for Groundwater Samples Collected from Upper Aquifer Wells, March 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Constituents	Units	HR-9 03/06/98	HR-11 03/09/98	GM-24 03/06/98	W-3-N 03/05/98	GM-23 03/09/98	GM-25 03/06/98	HR-1 03/05/98	W-1-S 03/05/98	ME-6 03/09/98	ME-3 03/09/98	HR-17 03/05/98
Volatile Organic Compounds												
1,1,1-Trichloroethane	ug/l	15.0	<1.0	1.1	<1.0	<200J	<1.0	1.5	<1.0	2.4	35.3	1.6J
1,1-Dichloroethane	ug/l	56.2	6.8	<1.0	<1.0	<200J	<1.0	2.1	<1.0	<1.0	13.5	<1.0J
1,1-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<200J	<1.0	<1.0	<1.0	<1.0	1.4	<1.0J
1,2-Dichloroethane	ug/l	1.8	<1.0	<1.0	<1.0	<200J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0J
Benzene	ug/l	<1.0	<1.0	<1.0	<1.0	<200J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0J
Bromodichloromethane	ug/l	<1.0	<1.0	3.4	<1.0	<200J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0J
Chloroethane	ug/l	<10	<10	<10	<10	<2000J	<10	<10	<10	<10	<10	<10
Chloroform	ug/l	<1.0	<1.0	15.1	<1.0	<200J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0J
Ethylbenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<200J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0J
Fluorotrichloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<200J	<1.0	3.2	3.7	<1.0	<1.0	<1.0J
Tetrachloroethene	ug/l	<1.0	<1.0	<1.0	2.6	11200J	<1.0	48.8	29.0	193	75.6	7.0J
Trichloroethene	ug/l	14.0	<1.0	<1.0	<1.0	3870J	<1.0	69.8	9.4	456	64.1	4.5J
Vinyl chloride	ug/l	<2.0	<2.0	<2.0	20.4	766J	<2.0	<2.0	<2.0	<2.0	6.2	<2.0J
Xylenes, total	ug/l	<1.0	<1.0	<1.0	<1.0	<200J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0J
cis-1,2-Dichloroethene	ug/l	20.9	1.4	<1.0	289	3870J	<1.0	10.6	5.0	15.2	36.0	<1.0J
trans-1,2-Dichloroethene	ug/l	2.8	<1.0	<1.0	3.6	<200J	<1.0	2.6	1.2	1.1	<1.0	<1.0J
Total VOCs	ug/l	**110.7**	**8.2**	**19.6**	**315.6**	**19,706**	**0**	**138.6**	**48.3**	**667.7**	**232.1**	**13.1**

ug/l - Micrograms per liter.

J - Value is estimated.

UJ - Constituent was not detected above the reporting limit. Detection limit is estimated.

DUP-56 - Duplicate of GM-8.

DUP-57 - Duplicate of GM-22.

< - Constituent not detected above laboratory detection limit shown.

Table 3-5. VOC Analytical Results for Groundwater Samples Collected from Upper Aquifer Wells, March 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Constituents	Units	EAST 03/05/98	GM-22 03/10/98	DUP-57 03/10/98	GM-21 03/10/98	GM-8 03/04/98	DUP-56 03/04/98	GM-6 03/04/98	GM-2 03/04/98	WSU-24 03/03/98	GM-10 03/03/98	GM-26 03/03/98
Volatile Organic Compounds												
1,1,1-Trichloroethane	ug/l	17.5	<1.0J	<1.0J	55.0	6.7	6.8	36.2	5.9J	1.7	2.3	<1.0
1,1-Dichloroethane	ug/l	6.4	1.3	1.3	7.6	49.3	52.6	35.3	1.7J	<1.0	1.5	<1.0
1,1-Dichloroethene	ug/l	1.3	<1.0J	<1.0J	4.5	1.0	1.1	<1.0	<1.0J	<1.0	<1.0	<1.0
1,2-Dichloroethane	ug/l	<1.0	<1.0J	<1.0J	<1.0J	<1.0	<1.0	<1.0	<1.0J	<1.0	<1.0	<1.0
Benzene	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	2.3	2.3	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Bromodichloromethane	ug/l	<1.0	<1.0J	<1.0J	<1.0J	<1.0	<1.0	<1.0	<1.0J	<1.0	<1.0	<1.0
Chloroethane	ug/l	<10	<10UJ	<10UJ	<10UJ	16.2	16.8	<10	<10UJ	<10	<10	<10
Chloroform	ug/l	<1.0	<1.0J	<1.0J	<1.0J	<1.0	<1.0	<1.0	<1.0J	<1.0	<1.0	<1.0
Ethylbenzene	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	28.9	27.6	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Fluorotrichloromethane	ug/l	<1.0	<1.0J	<1.0J	4.9	<1.0	<1.0	<1.0	<1.0J	<1.0	<1.0	<1.0
Tetrachloroethene	ug/l	66.2	5.1	5.0	<1.0J	20.0	19.7	94.0	8.5J	1.3	1.5	<1.0
Trichloroethene	ug/l	64.0	4.5	4.6	356	95.2	96.8	119	75.1J	14.2	28.0	<1.0
Vinyl chloride	ug/l	<2.0	<2.0J	<2.0J	<2.0J	10.1	10.7	2.3	<2.0J	<2.0	<2.0	<2.0
Xylenes, total	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	10.3	10.2	<1.0	<1.0UJ	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	ug/l	13.9	1.6	<1.0J	74.5	56.1	57.1	82.4	10.5J	<1.0	3.6	<1.0
trans-1,2-Dichloroethene	ug/l	6.4	<1.0J	<1.0J	3.6	10.1	10.6	2.4	<1.0J	<1.0	<1.0	<1.0
Total VOCs	ug/l	**175.7**	**12.5**	**10.9**	**506.1**	**306.2**	**312.3**	**371.6**	**101.7**	**17.2**	**36.9**	**0**

ug/l - Micrograms per liter.

J - Value is estimated.

UJ - Constituent was not detected above the reporting limit. Detection limit is estimated.

DUP-56 - Duplicate of GM-8.

DUP-57 - Duplicate of GM-22.

< - Constituent not detected above laboratory detection limit shown.

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Table 3-6. Analytical Results for Soil Samples, AOI 36-Former Southwest ASTs, February 1998, General Motors Corporation, Moraine, Ohio.

Constituents	Units	AST-BH1 2/19/98		AST-BH2 2/19/98		
		2 ft bls	22 ft bls	2 ft bls	24 ft bls	DUP-53
Volatile Organic Compounds						
Tetrachloroethene	ug/kg	<6.0	6	<6.1	<5.6	<5.5
Trichloroethene	ug/kg	<6.0	6.5	<6.1	<5.6	5.9
Semi-volatile Organic Compounds						
Bis(2-ethylhexyl)phthalate	ug/kg	<393	1,230	<403	<370	<360
Polychlorinated Biphenyls	mg/kg	ND	ND	ND	ND	ND
Metals						
Antimony	mg/kg	<19J	<17J	<19.8J	<15J	<16J
Arsenic	mg/kg	325	1.57	150	8.19J	0.639J
Barium	mg/kg	86J	11J	65.2J	11J	12J
Beryllium	mg/kg	0.8	<0.9	0.9	0.8	0.9
Cadmium	mg/kg	<1.2	<5.2	<1.2	<4.4	<4.9
Chromium	mg/kg	11	<6.9	11	<5.8	<6.5
Cobalt	mg/kg	7.9	<3.4	6.4	<2.9	<3.3
Copper	mg/kg	25.5	6.9	18.7	6.6	8.9
Lead	mg/kg	17.1	3.27	16.4	5.23	4.77
Manganese	mg/kg	619	123	494	152	192
Mercury	mg/kg	0.033J	<0.011J	0.032J	<0.011J	<0.011J
Nickel	mg/kg	17.4	4.3	13.1	4.4	5.3
Selenium	mg/kg	0.798J	<0.888J	0.808J	0.941J	<0.907J
Silver	mg/kg	<1.5	<6.9	<1.6	<5.8	<6.5
Thallium	mg/kg	<0.60	<0.54	<0.61	0.633	<0.55
Vanadium	mg/kg	20.1	<8.6	14.3	<7.3	<8.2
Zinc	mg/kg	67.9J	17.9J	63.6J	18.3J	20.5J

ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.
J - The reported value is estimated.
ND - Not detected.
DUP-53 - Duplicate of AST-BH2-24/SL.
< - Constituent not detected above laboratory detection limit shown.
ft bls - Feet below land surface.

Table 3-7. Analytical Results for Soil Samples Near AOI 36-Former Southwest ASTs, June 1998, General Motors Corporation, Moraine, Ohio.

Constituents	Units	Soil Area A Composite 6/10/98	Soil Area A DUP-59 6/10/98	Soil Area B Composite 6/10/98	Soil Area C Composite 6/10/98	Soil Area D Composite 6/11/98	Berm Area E Composite 6/10/98	Berm Area F Composite 6/10/98	Berm Area G Composite 6/10/98
Arsenic	mg/Kg	20.1J	41.6J	37.3	33.4	10	5.33	64.9	94.6

J - Value is estimated.
mg/Kg - Milligram per kilogram.
DUP-59 - Duplicate of composite sample A.
Soil Area A composite sample consists of A-GS1 through A-GS4.
Soil Area B composite sample consists of B-GS5 through B-GS8.
Soil Area C composite sample consists of C-GS9 through C-GS12.
Soil Area D composite sample consists of D-GS13 through D-GS16.
Berm Area E composite sample consists of E-GS17 through E-GS21.
Berm Area F composite sample consists of F-GS22 through F-GS26.
Berm Area G composite sample consists of G-GS27 through G-GS32.
Soil area samples were collected in the 0-2 foot interval within native soil and berm area samples were collected 1-1.5 feet into the berm.

Table 3-8. Analytical Results for Soil Samples, AOI 7-Former Oil House Area, February 1998, General Motors Corporation, Moraine, Ohio.

Constituents	Units	OH-BH1/SL 2/23/98				OH-BH2/SL 2/20/98			OH-BH3/SL 2/23/98		
		2 ft bls	8 ft bls	30 ft bls	DUP-55	3 ft bls	31 ft bls	DUP-54	2 ft bls	16 ft bls	26 ft bls
Volatile Organic Compounds											
Tetrachloroethene	ug/kg	53.7	125	505	377	56.4	7,690	9,290	41.4	29.3	247
Trichloroethene	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4	<5.2	521
Semi-volatile Organic Compounds											
Fluoranthene	ug/kg	<342	<344	<350	<347	4,570	<347	<346	<357	<346	<363
Phenanthrene	ug/kg	<342	<344	<350	<347	3,770	<347	<346	<357	<346	<363
Polychlorinated Biphenyls	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals											
Antimony	mg/kg	<17J	<17J	<17J	<20J	<18	<16	<17	<16J	<17J	<14J
Arsenic	mg/kg	2.76J	1.93J	1.53J	3.01J	2.09J	1.49	0.561J	10.4J	3.88J	2.51J
Barium	mg/kg	11	8.3	8.1	11	30.2J	11J	9.6J	30.2	14	16
Beryllium	mg/kg	1	<0.8	0.8	<1	1.1	0.9	0.9	1	0.9	0.9
Cadmium	mg/kg	<5.1	<5.1	<5.0	<6.1	<5.3	<4.8	<4.9	<4.9	<5.1	<4.3
Chromium	mg/kg	8.6	<6.9	<6.7	<8.2	<7.0	<6.4	<6.6	<6.5	<6.8	<5.7
Cobalt	mg/kg	<3.4	<3.4	<3.4	<4.1	<3.5	<3.3	<3.2	3.9	4.1	<2.9
Copper	mg/kg	3.9	7	5.5	7.4	6	7.4	7.5	12	13	7.5
Lead	mg/kg	3.67	2.72	3.55J	6.39J	5.47	4.11	4.14	9.39	4.36	4.8
Manganese	mg/kg	142	220	161J	2.88J	227	184	188	302	331	190
Mercury	mg/kg	<0.010	0.012	<0.011	<0.011	0.029	<0.011	<0.010	0.052	0.014	0.014
Nickel	mg/kg	25.2	5.8	4	6	4.3	5.9	4.9	8.5	14	6.6
Selenium	mg/kg	<1.66	<1.62	<0.881	<1.67	<1.57J	<1.67J	<0.780J	<0.805	<0.819	<0.860
Silver	mg/kg	<6.7	<6.9	<6.7	<8.2	<7.0	<6.4	<6.6	<6.5	<6.8	<5.7
Thallium	mg/kg	<0.52	<0.52	<0.53	<0.53	<0.53	<0.53	<0.52	<0.54	<0.52	<0.55
Vanadium	mg/kg	<8.5	<8.5	<8.4	<10	<8.8	<8.0	<8.2	<8.1	<8.5	<7.1
Zinc	mg/kg	16J	17.6J	16J	19J	26.2J	19J	18.6J	42.6J	227J	22.6J

ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.
J - The reported value is estimated.
ND - Not detected.
DUP-55 - Duplicate of OH-BH1-30/SL.
DUP-54 - Duplicate of OH-BH2-31/SL.
SL - Soil.
< - Constituent not detected above laboratory detection limit shown.
ft bls - Feet below land surface.

Table 3-8. Analytical Results for Soil Samples, AOI 7-Former Oil House Area, February 1998, General Motors Corporation, Moraine, Ohio.

Constituents	Units	OH-BH4/SL 2/23/98 2 ft bls	8 ft bls	24 ft bls
Volatile Organic Compounds				
Tetrachloroethene	ug/kg	123	113	474
Trichloroethene	ug/kg	20.6	<5.5	<55
Semi-volatile Organic Compounds				
Fluoranthene	ug/kg	<350	<363	<363
Phenanthrene	ug/kg	<350	<363	<363
Polychlorinated Biphenyls	mg/kg	ND	ND	ND
Metals				
Antimony	mg/kg	<17J	<18J	<18J
Arsenic	mg/kg	3.54J	3.91J	2.59J
Barium	mg/kg	13	7.7	24.3
Beryllium	mg/kg	0.8	<0.9	<0.9
Cadmium	mg/kg	<5.0	<5.3	<5.3
Chromium	mg/kg	<6.6	<7.0	<7.0
Cobalt	mg/kg	<3.3	<3.5	<3.5
Copper	mg/kg	6.1	6.8	7
Lead	mg/kg	6.06	4.36	4.56
Manganese	mg/kg	159	151	178
Mercury	mg/kg	0.013	<0.011	0.014
Nickel	mg/kg	5.6	5.6	5.4
Selenium	mg/kg	<0.863	<0.890	<0.786
Silver	mg/kg	<6.6	<7.0	<7.0
Thallium	mg/kg	<0.53	<0.55	<0.55
Vanadium	mg/kg	<8.3	<8.8	<8.7
Zinc	mg/kg	22J	26J	27.8J

ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.
J - The reported value is estimated.
ND - Not detected.
DUP-55 - Duplicate of OH-BH1-30/SL.
DUP-54 - Duplicate of OH-BH2-31/SL.
SL - Soil.
< - Constituent not detected above laboratory detection limit shown.
ft bls - Feet below land surface.

Table 3-9. Analytical Results for Soil Samples, AOI 7-Former Oil House Area, August 1998, General Motors Corporation, Moraine, Ohio.

Constituents	Units	OH-BH5/SL 8/14/98			OH-BH6/SL 8/12/98				OH-BH7/SL 8/10/98			OH-BH8/SL 8/18/98		
		2 ft bls	20 ft bls	26 ft bls	2 ft bls	DUP-60	8 ft bls	24 ft bls	2 ft bls	20 ft bls	24 ft bls	2 ft bls	18 ft bls	28 ft bls
Volatile Organic Compounds														
1,1-Dichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
cis-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	36.3
Tetrachloroethene	ug/kg	<5.0	135	762J	554	500	38.9	119J	31.4	482	325	16.0	70.0	6,010
1,1,1-Trichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Trichloroethene	ug/kg	<5.0	6.1	22.5	12.7	8.3	<5.0	5.8J	<5.0	5.1	<5.0	<5.0	<5.0	73.5
Vinyl Chloride	ug/kg	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Total VOCs	ug/kg	0.0	141.1	784.5	566.7	508.3	38.9	124.8	31.4	487.1	325	16.0	70.0	6,119.8

ug/kg - Micrograms per kilogram.
SL - Soil.
J - The reported value is estimated.
DUP-60 - Duplicate of OH-BH6-2/SL.
DUP-62 - Duplicate of OH-BH9-30/SL.
< - Constituent not detected above laboratory detection limit shown.
ft bls - Feet below land surface.

Table 3-9. Analytical Results for Soil Samples, AOI 7-Former Oil House Area, August 1998, General Motors Corporation, Moraine, Ohio.

Constituents	Units	OH-BH9/SL 8/19/98			OH-BH10/SL 8/18/98			GM-27/SL 8/4/98			GM-28/SL 8/5/98
		2 ft bls	30 ft bls	DUP-62	2 ft bls	16 ft bls	28 ft bls	2 ft bls	20 ft bls	24 ft bls	26 ft bls
Volatile Organic Compounds											
1,1-Dichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
cis-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	6.0	<5.0
Tetrachloroethene	ug/kg	280	462J	619	548	235J	995	40.3	743	1,510J	27.0J
1,1,1-Trichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Trichloroethene	ug/kg	<5.0	<5.0	<5.0	24.7	<5.0	20.0	<5.0	6.9	16.4	<5.0J
Vinyl Chloride	ug/kg	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0J	<10.0	<10.0	<10.0
Total VOCs	ug/kg	280	462	619	572.7	235	1,015	40.3	749.9	1,532.4	27.0

ug/kg - Micrograms per kilogram.
SL - Soil.
J - The reported value is estimated.
DUP-60 - Duplicate of OH-BH6-2/SL.
DUP-62 - Duplicate of OH-BH9-30/SL.
< - Constituent not detected above laboratory detection limit shown.
ft bls - Feet below land surface.

Table 3-10. Hydrophobic Dye Test Results, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

Boring	Depth Interval (ft bls)	Date	Appearance of Soil After Test	DNAPL Presence/Absence
GM-27	31.5 to 33.5	8/7/98	Sample taken from second attempted borehole. Separation of soil grain sizes. Possible red specs among soil particles floating on water surface.	Possible presence
GM-27	33.5 to 34.5	8/7/98	Sample very silty. Clear sheen containing red specs completely covers water surface.	Possible presence
GM-27	38 to 39	8/13/98	Separation of soil grain sizes. Slightly colored sheen with red specs observed on water surface. Slight odor noted.	Possible presence
GM-27	54 to 55	8/13/98	Very small spot of sheen observed on water surface with few red specs. Sample appeared clean otherwise.	No evidence
GM-28	30 to 32	8/5/98	Separation of soil grain sizes. No sheen, red specs or layers visible.	No evidence
OH-BH5	36.5 to 37.5	8/14/98	Separation of soil grain sizes. No sheen, red specs or layers visible.	No evidence
OH-BH6	30 to 31.5	8/12/98	Separation of soil grain sizes. 2 mm film on water surface containing soil particles and many red specs. Odor noted.	Possible presence
OH-BH7	30 to 30.5	8/10/98	Separation of soil grain sizes. No sheen, red specs or layers visible.	No evidence
OH-BH8	22 to 24	8/18/98	Separation of soil grain sizes. No sheen, red specs or layers visible.	No evidence
OH-BH8	36 to 38	8/18/98	Separation of soil grain sizes. No sheen, red specs or layers visible.	No evidence
OH-BH9	36 to 38	8/19/98	Separation of soil grain sizes. No sheen, red specs or layers visible.	No evidence
OH-BH10	32 to 34	8/18/98	Separation of soil grain sizes. No sheen, red specs or layers visible.	No evidence
OH-BH11	32 to 33.5	11/3/98	Separation of soil grain sizes. No sheen, red specs or layers visible.	No evidence
OH-BH12	32 to 33.5	11/6/98	Separation of soil grain sizes. Very heavy sheen observed on water surface with many red specs. Strong odor noted.	Possible presence
OH-BH13	26 to 27	11/10/98	Separation of soil grain sizes. No sheen, red specs or layers visible.	No evidence
OH-BH14	32 to 32.5	11/10/98	Separation of soil grain sizes. Some specs observed on water surface. No sheen noted.	No evidence
OH-BH15	40 to 42	11/5/98	Separation of soil grain sizes. Slight sheen and few specs observed on water surface.	Possible presence
OH-BH16	60 to 61.75	11/12/98	Separation of soil grain sizes. No sheen, red specs or layers visible.	No evidence
OH-BH17	56 to 57	11/13/98	Separation of soil grain sizes. No sheen, red specs or layers visible.	No evidence
OH-BH18	34 to 35.5	11/4/98	Separation of soil grain sizes. No sheen, red specs or layers visible.	No evidence
OH-BH19	34 to 35	11/9/98	Separation of soil grain sizes. No sheen, red specs or layers visible.	No evidence
OH-BH20	36 to 38	11/11/98	Separation of soil grain sizes. No sheen, red specs or layers visible.	No evidence
OH-BH2A	36 to 37	11/2/98	Separation of soil grain sizes. Heavy sheen and red specs in sheen observed on water surface.	Possible presence
OH-BH3A	28 to 30	11/6/98	Separation of soil grain sizes. No sheen, red specs or layers visible.	No evidence

ft - feet.
bls - below land surface.
mm - Millimeter.
OH - Oil House.
BH - borehole.
DNAPL - Dense nonaqueous phase liquid.

Table 3-11. Analytical Results for Groundwater Samples Collected Using a Hydropunch, AOI 7-Former Oil House Area, August 1998, General Motors Corporation, Moraine, Ohio.

Constituents	Units	OH-BH5/HP 37 ft bls 8/14/98	OH-BH6/HP 31.5 ft bls 8/12/98	OH-BH7/HP 30 ft bls 8/10/98	OH-BH8/HP 38 ft bls 8/18/98	OH-BH9/HP 38 ft bls 8/19/98	DUP-63 38 ft bls 8/19/98
Volatile Organic Compounds							
1,1-Dichloroethane	ug/L	18.5	8.5	2.1	20.6	<1.0	<1.0
1,1-Dichloroethene	ug/L	84.1	8.8	<2.0	3.6	<1.0	<1.0
trans-1,2-Dichloroethene	ug/L	7.6	13.2	11.1	7.0	<1.0	<1.0
cis-1,2-Dichloroethene	ug/L	1,280	1,900	962	226	<1.0	<1.0
Tetrachloroethene	ug/L	1,550	28.5	2,950	77.6	520J	543
1,1,1-Trichloroethane	ug/L	<2.0	<1.0	3.2	<2.0	5.4	6.1
Trichloroethene	ug/L	1,330	52.4	728	246	6.6	7.1
Vinyl Chloride	ug/L	436	503	7.3	2,680	<2.0	<2.0
Total VOCs	ug/L	4,706.2	2,514.4	4,663.7	3,260.8	532	556.2

ug/L - Micrograms per liter.
ft bls - Feet below land surface.
HP - Hydropunch.
J - The reported value is estimated.
DUP-63 - Duplicate of OH-BH9-38/HP.
< - Consituent not detected above laboratory detection limit shown.
TW - Temporary well.

Table 3-11. Analytical Results for Groundwater Samples Collected Using a Hydropunch, AOI 7-Former Oil House Area, August 1998, General Motors Corporation, Moraine, Ohio.

Constituents	Units	OH-BH10/HP 34 ft bls 8/18/98	GM-27/HP 32 ft bls 8/4/98	GM-27/HP 39 ft bls 8/13/98	GM-27/HP 50 ft bls 8/13/98	GM-27/TW 55 ft bls 8/19/98	GM-28/HP 32 ft bls 8/5/98
Volatile Organic Compounds							
1,1-Dichloroethane	ug/L	2.5	54.6	3.0	<2.0	<5.0	2.4
1,1-Dichloroethene	ug/L	1.3	6.8	<2.0	<2.0	<5.0	<2
trans-1,2-Dichloroethene	ug/L	1.4	42.8	6.8	<2.0	<5.0	6.2
cis-1,2-Dichloroethene	ug/L	57.0	3,540	821	17.4	395	187
Tetrachloroethene	ug/L	1,810	484	14.3	3.2	14	242
1,1,1-Trichloroethane	ug/L	6.2	1.5	<2.0	<2.0	<5.0	10.5
Trichloroethene	ug/L	66.6	75.6	113	80.9	69.5	444
Vinyl Chloride	ug/L	3.7	7,320	231	<4.0	110	<4.0
Total VOCs	ug/L	1,948.7	11,525.3	1,189.1	101.5	588.5	892.1

ug/L - Micrograms per liter.
ft bls - Feet below land surface.
HP - Hydropunch.
J - The reported value is estimated.
DUP-63 - Duplicate of OH-BH9-38/HP.
< - Consituent not detected above laboratory detection limit shown.
TW - Temporary well.

Table 3-12. Analytical Results for Groundwater Samples Collected in August 1998, General Motors Corporation, Moraine, Ohio.

Constituents	Units	GM-28/GW 8/17/98	DUP-61 8/17/98	GM-27/GW 8/24/98	ME-6/GW 8/24/98	HR-1/GW 8/24/98	DUP-64 8/24/98	HR-3/GW 8/24/98
Volatile Organic Compounds								
1,1-Dichloroethane	ug/L	<1.0	<1.0	1.7	3.4	1.5	1.6	4.1
1,1-Dichloroethene	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	ug/L	1.3	1.2	<1.0	<1.0	1.6	1.6	<1.0
cis-1,2-Dichloroethene	ug/L	38.2	35.7	48.5	17.2	9.4	9.3	4.6
Tetrachloroethene	ug/L	693	770	6.0	114	47.1	48.2	<1.0
1,1,1-Trichloroethane	ug/L	1.8	1.6	<1.0	26.1	<1.0	<1.0	<1.0
Trichloroethene	ug/L	98.1J	96.0	89.5	312	46.0	47.3	<1.0
Vinyl Chloride	ug/L	<2.0	<2.0	6.9	<2.0	<2.0	<2.0	<2.0
Total VOCs	ug/L	832.4	904.5	152.6	472.7	105.6	108.0	8.7

ug/L - Micrograms per liter.
GW - Groundwater.
LF - Low Flow Groundwater Sample taken as Part of Bioattenuation Study.
J - The reported value is estimated.
DUP-61 - Duplicate of GM-28/GW.
DUP-64 - Duplicate of HR-1/GW.
DUP-65 - Duplicate of GM-27/LF.
< - Constituent not detected above laboratory detection limit shown.

Table 3-12. Analytical Results for Groundwater Samples Collected in August 1998, General Motors Corporation, Moraine, Ohio.

Constituents	Units	GM-26/GW 8/24/98	GM-23/LF 8/26/98	GM-27/LF 8/26/98	DUP-65 8/26/98	GM-28/LF 8/26/98
Volatile Organic Compounds						
1,1-Dichloroethane	ug/L	<1.0	10.9	2.0	2.1	2.0
1,1-Dichloroethene	ug/L	<1.0	7.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	ug/L	<1.0	19.4	<1.0	<1.0	5.0
cis-1,2-Dichloroethene	ug/L	<1.0	3,710	54.9J	60.3	127
Tetrachloroethene	ug/L	1.2	8,800	4.2	4.7	500
1,1,1-Trichloroethane	ug/L	<1.0	4.2	<1.0	<1.0	10.0
Trichloroethene	ug/L	<1.0	1,190	104	104	475
Vinyl Chloride	ug/L	<2.0	914	8.5	9.3	<2.0
Total VOCs	ug/L	1.2	14,655.5	173.6	180.4	1,119

ug/L - Micrograms per liter.
GW - Groundwater.
LF - Low Flow Groundwater Sample taken as Part of Bioattenuation Study.
J - The reported value is estimated.
DUP-61 - Duplicate of GM-28/GW.
DUP-64 - Duplicate of HR-1/GW.
DUP-65 - Duplicate of GM-27/LF.
< - Constituent not detected above laboratory detection limit shown.

Table 3-13. Analytical Results for Soil Samples Collected in November 1998, AOI 7-Former Oil House Area, General Motors Corporation, Moraine, Ohio.

Constituents	Units	OH-BH2A/SL 11/2/98		OH-BH3A/SL 11/6/98	GM-23A/SL 11/5/98					OH-BH11/SL 11/3/98		
		14 ft bls	DUP-66	22 ft bls	2 ft bls	4 ft bls	5 ft bls	DUP-68	10 ft bls	2 ft bls	20 ft bls	28 ft bls
Volatile Organic Compounds												
1,1-Dichloroethane	ug/kg	R	<50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	ug/kg	R	<50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/kg	R	<50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
cis-1,2-Dichloroethene	ug/kg	R	<50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	61.7
Tetrachloroethene	ug/kg	1,150J	2,540J	70.7	<5.0	9,440	908J	1,000	772	6.8	517	4,880
1,1,1-Trichloroethane	ug/kg	R	<50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Trichloroethene	ug/kg	53.9J	<50	14.2	<5.0	6.7J	<5.0	5.1	<5.0	<5.0	10.0	78.1
Vinyl Chloride	ug/kg	R	<20	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total VOCs		1,203.9	2,540	84.9	0.0	9,446.7	908	1,005.1	772	6.8	527.0	5,019.8

ug/kg - Micrograms per kilogram.
SL - Soil.
< - Constituent not detected above laboratory detection limit shown.
J - The reported value is estimated.
R - The data is unusable and the presence or absence of the analyte cannot be verified.
DUP-66 - Duplicate of OH-BH2A-14/SL.
DUP-68 - Duplicate of GM-23A-5/SL.
DUP-69 - Duplicate of OH-BH13-22/SL.
DUP-71 - Duplicate of OH-BH17-2/SL.
ft bls - Feet below land surface.

Table 3-13. Analytical Results for Soil Samples Collected in November 1998, AOI 7-Former Oil House Area, General Motors Corporation, Moraine, Ohio.

Constituents	Units	OH-BH12/SL 11/6/98			OH-BH13/SL 11/10/98				OH-BH14/SL 11/10/98		OH-BH15/SL 11/4/98			OH-BH16/SL 11/12/98	
		2 ft bls	14 ft bls	28 ft bls	2 ft bls	22 ft bls	DUP-69	25 ft bls	2 ft bls	24 ft bls	2 ft bls	18 ft bls	26 ft bls	2 ft bls	30 ft bls
Volatile Organic Compounds															
1,1-Dichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
cis-1,2-Dichloroethene	ug/kg	<5.0	<5.0	6.3	<5.0	<5.0	<5.0	5.4	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Tetrachloroethene	ug/kg	675	81.2	120	17.6	333J	48.2J	3,300	<5.0	108	118	95.1	367	<5.0	18.2
1,1,1-Trichloroethane	ug/kg	<5.0	<5.0J	<5.0J	<5.0	<5.0	<5.0	6.4J	<5.0J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Trichloroethene	ug/kg	35.8	13.8	25.3	10.0	60.4J	16.8J	1,780	5.2	8.4	30.3	<5.0	9.7	<5.0	<5.0
Vinyl Chloride	ug/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total VOCs		710.8	95.0	151.6	27.6	393.4	65.0	5,091.8	5.2	116.4	148.3	95.1	376.7	0.0	18.2

ug/kg - Micrograms per kilogram.
SL - Soil.
< - Constituent not detected above laboratory detection limit shown.
J - The reported value is estimated.
R - The data is unusable and the presence or absence of the analyte cannot be verified.
DUP-66 - Duplicate of OH-BH2A-14/SL.
DUP-68 - Duplicate of GM-23A-5/SL.
DUP-69 - Duplicate of OH-BH13-22/SL.
DUP-71 - Duplicate of OH-BH17-2/SL.
ft bls - Feet below land surface.

Table 3-13. Analytical Results for Soil Samples Collected in November 1998, AOI 7-Former Oil House Area, General Motors Corporation, Moraine, Ohio.

Constituents	Units	OH-BH17/SL 11/13/98			OH-BH18/SL 11/4/98			OH-BH19/SL 11/9/98		OH-BH20/SL 11/11/98	
		2 ft bls	DUP-71	30 ft bls	2 ft bls	6 ft bls	31 ft bls	2 ft bls	32 ft bls	2 ft bls	35 ft bls
Volatile Organic Compounds											
1,1-Dichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/kg	<5.0J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
cis-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Tetrachloroethene	ug/kg	<5.0J	<5.0	91.6	202	140	34.2J	<5.0	11.1	<5.0	<5.0
1,1,1-Trichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Trichloroethene	ug/kg	<5.0J	6.8	<5.0	<5.0	<5.0	<5.0	5.8	7.8	8.8	<5.0
Vinyl Chloride	ug/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total VOCs		0.0	6.8	91.6	202	140	34.2	5.8	18.9	8.8	0.0

ug/kg - Micrograms per kilogram.
SL - Soil.
< - Constituent not detected above laboratory detection limit shown.
J - The reported value is estimated.
R - The data is unusable and the presence or absence of the analyte cannot be verified.
DUP-66 - Duplicate of OH-BH2A-14/SL.
DUP-68 - Duplicate of GM-23A-5/SL.
DUP-69 - Duplicate of OH-BH13-22/SL.
DUP-71 - Duplicate of OH-BH17-2/SL.
ft bls - Feet below land surface.

Table 3-14. Analytical Results for Groundwater Samples Collected Using a Hydropunch, AOI 7-Former Oil House Area, November 1998, General Motors Corporation, Moraine, Ohio.

Constituents	Units	OH-BH2A/HP 37 ft bls 11/3/98	OH-BH2A/HP DUP-67 11/3/98	OH-BH3A/HP 30 ft bls 11/6/98	OH-BH11/HP 33 ft bls 11/3/98	OH-BH12/HP 33.5 ft bls 11/6/98	OH-BH13/HP 27 ft bls 11/10/98	OH-BH14/HP 32 ft bls 11/11/98	OH-BH14/HP DUP-70 11/11/98
Volatile Organic Compounds									
1,1-Dichloroethane	ug/L	231	213	4.3	18.2	29.3	3.6	2.3	2.3
1,1-Dichloroethene	ug/L	<100	<100	<2	6.6	<1	1.4	<2.0	<2.0
trans-1,2-Dichloroethene	ug/L	<100	<100	<2	23.0	3.2	2.7	<2.0	<2.0
cis-1,2-Dichloroethene	ug/L	11,000	10,500	34.1	1,490	131	130	33.9	36.6
Tetrachloroethene	ug/L	1,180J	1,470	238	2,060	254	136	114	112
1,1,1-Trichloroethane	ug/L	<100	<100	24.4	43.5	2.1	12.0	<2.0	<2.0
Trichloroethene	ug/L	1,260J	1,390	1,560	1,680	45.5	3,500	39.0	42.4
Vinyl Chloride	ug/L	4,770J	4,460	4.5	245	113	<2	<4.0	<4.0
Total VOCs		18,441	18,033	1,865.3	5,566.3	578.1	3,785.7	189.2	193.3

ug/L - Micrograms per liter.
ft bls - Feet below land surface.
HP - Hydropunch.
< - Constitutent not detected above laboratory detection limit shown.
J - The reported value is estimated.
DUP-67 - Duplicate of OH-BH2A-37/HP.
DUP-70 - Duplicate of OH-BH14-32/HP.

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Table 3-14. Analytical Results for Groundwater Samples Collected Using a Hydropunch, AOI 7-Former Oil House Area, November 1998, General Motors Corporation, Moraine, Ohio.

Constituents	Units	OH-BH15/HP 42 ft bls 11/5/98	OH-BH16/HP 33 ft bls 11/12/98	OH-BH16/HP 61 ft bls 11/12/98	OH-BH17/HP 40 ft bls 11/13/98	OH-BH17/HP 57 ft bls 11/13/98	OH-BH18/HP 35.5 ft bls 11/4/98	OH-BH19/HP 35 ft bls 11/11/98	OH-BH20/HP 38 ft bls 11/11/98
Volatile Organic Compounds									
1,1-Dichloroethane	ug/L	<2.0	<10.0	25.0	11.1	20.7	<2	<2.0	<2.0
1,1-Dichloroethene	ug/L	<2.0	<10.0	<1.0	<1.0	<2.0	<2	<2.0	<2.0
trans-1,2-Dichloroethene	ug/L	<2.0	<10.0	1.4	<1.0	<2.0	<2	<2.0	<2.0
cis-1,2-Dichloroethene	ug/L	281	<10.0	12.0	2.7	12.3	<2	<2.0	<2.0
Tetrachloroethene	ug/L	65.4	<10.0	2.0	82.6	10.0	712	27.3	<2.0
1,1,1-Trichloroethane	ug/L	18.3	<10.0	7.3	5.1	<2.0	88.8	6.3	<2.0
Trichloroethene	ug/L	981	<10.0	1.8	116	24.6	15.1	10.1	<2.0
Vinyl Chloride	ug/L	<4.0	<20.0	<2.0	<2.0	<4.0	<4	<4.0	<4.0
Total VOCs		1,345.7	0.0	49.5	217.5	67.6	815.9	43.7	0.0

ug/L - Micrograms per liter.
ft bls - Feet below land surface.
HP - Hydropunch.
< - Constitutent not detected above laboratory detection limit shown.
J - The reported value is estimated.
DUP-67 - Duplicate of OH-BH2A-37/HP.
DUP-70 - Duplicate of OH-BH14-32/HP.

Table 3-15. Toluene Analytical Results, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

Sample ID	Units	Analysis Date	Toluene
Groundwater Sample			
OH-BH5-37/HP	ug/L	8/14/98	<2
OH-BH6-31.5/HP	ug/L	8/12/98	11.6
OH-BH7-30/HP	ug/L	8/13/98	4.1
OH-BH8-38/HP	ug/L	8/19/98	6
OH-BH10-34/HP	ug/L	8/19/98	1
GM-27-32/HP	ug/L	8/12/98	17.1
GM-23/LF	ug/L	8/28/98	<1
GM-27/LF	ug/L	8/28/98	<1
GM-28/LF	ug/L	8/28/98	<1
OH-BH11-33/HP	ug/L	11/16/98	10.1
OH-BH12-33.5/HP	ug/L	11/18/98	19.9
OH-BH13-27/HP	ug/L	11/18/98	3.6
OH-BH14-32/HP	ug/L	11/20/98	<2
OH-BH15-42/HP	ug/L	11/17/98	2.6
OH-BH2A-37/HP	ug/L	11/13/98	>444*
DUP-67	ug/L	11/13/98	>465*
OH-BH3A-30/HP	ug/L	11/18/98	25.1
Soil Sample			
OH-BH5-2/SL	ug/Kg	8/17/98	<5
OH-BH5-20/SL	ug/Kg	8/17/98	<5
OH-BH5-26/SL	ug/Kg	8/17/98	<5
OH-BH6-2/SL	ug/Kg	8/17/98	<5
OH-BH6-8/SL	ug/Kg	8/17/98	<5
OH-BH6-24/SL	ug/Kg	8/17/98	<5
OH-BH7-2/SL	ug/Kg	8/17/98	<5
OH-BH7-20/SL	ug/Kg	8/17/98	<5
OH-BH7-24/SL	ug/Kg	8/17/98	<5
OH-BH8-2/SL	ug/Kg	8/20/98	<5
OH-BH8-18/SL	ug/Kg	8/20/98	<5
OH-BH8-28/SL	ug/Kg	8/20/98	29.3
OH-BH10-2/SL	ug/Kg	8/21/98	<5
OH-BH10-16/SL	ug/Kg	8/21/98	<5
OH-BH10-28/SL	ug/Kg	8/21/98	<5
GM-27-2/SL	ug/Kg	8/9/98	<5
GM-27-20/SL	ug/Kg	8/9/98	<5
GM-27-24/SL	ug/Kg	8/9/98	<5
OH-BH11-2/SL	ug/Kg	11/5/98	6.2
OH-BH11-20/SL	ug/Kg	11/4/98	5.7
OH-BH11-28/SL	ug/Kg	11/4/98	<5

Table 3-15. Toluene Analytical Results, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

Sample ID	Units	Analysis Date	Toluene
Soil Sample (continued)			
OH-BH12-2/SL	ug/Kg	11/16/98	<5
OH-BH12-14/SL	ug/Kg	11/16/98	<5
OH-BH12-28/SL	ug/Kg	11/16/98	<5
OH-BH13-2/SL	ug/Kg	11/17/98	<5
OH-BH13-22/SL	ug/Kg	11/18/98	<5
OH-BH13-25/SL	ug/Kg	11/17/98	<5
GM-23A-2/SL	ug/Kg	11/13/98	<5
GM-23A-4/SL	ug/Kg	11/13/98	13.9
GM-23A-5/SL	ug/Kg	11/13/98	<5
GM-23A-10/SL	ug/Kg	11/13/98	<5

ug/L - Microgram per liter.
ug/Kg - Microgram per kilogram.
SL - Soil.
HP - Hydropunch.
LF - Low flow.
DUP-67 - Duplicate of OH-BH2A-37/HP.
* Due to carryover, the calibration performed by NET on 11/13/98 did not pass the linearity criteria of Method 8260, the RSD exceeded the 30% limit. Results were also reported from a 100x dilution. At this dilution, NET estimated the toluene concentrations to be >24,800 ug/L for OH-BH2A-37/HP and >24,300 ug/L for DUP-67.

Table 4-1. Water-Level Measurements During the Supplemental RFI, March 1998, General Motors Corporation, Moraine, Ohio.

Well	Measuring Point Elevation	Depth-to-Water (feet)	Water-Level Elevation
Shallow Aquifer Wells			
W-1-N	739.02	32.72	706.30
W-2-N	731.68	26.02	705.66
W-3-N	733.66	28.17	705.49
W-4-N	731.63	26.15	705.48
HR-1	732.71	28.77	703.94
HR-2	734.75	29.26	705.49
HR-3	736.75	31.29	705.46
HR-4	742.6	36.50	706.10
HR-5	734.27	29.21	705.06
HR-6	732.66	28.31	704.35
HR-7	731.73	26.55	705.18
HR-8	743.42	37.04	706.38
HR-9	743.51	36.58	706.93
HR-11	743.33	36.59	706.74
HR-16	727.01	23.48	703.53
HR-17	726.43	22.72	703.71
W-1-S	729.29	25.50	703.79
W-2-S	726.64	23.72	702.92
W-3-S	733.42	30.60	702.82
W-4-S	727.68	24.81	702.87
GM-2	735.81	33.01	702.80
4S	731.36	28.82	702.54
GM-6	730.27	28.13	702.14
GM-8	735.17	32.71	702.46
GM-10	723.9	21.99	701.91
GM-16	725.3	23.15	702.15
GM-17	723.84	21.62	702.22
GM-18	723.8	21.65	702.15
GM-19S	730.85	27.67	703.18
GM-26	722.29	20.70	701.59
EAST	730.98	27.42	703.56
WEST	731.08	27.62	703.46
WSU-24	725.1	22.35	702.75
TW-2 (1)	733.38	33.25	700.13
GM-21	724.2	20.49	703.71

Table 4-1. Water-Level Measurements During the Supplemental RFI, March 1998, General Motors Corporation, Moraine, Ohio.

Well	Measuring Point Elevation	Depth-to-Water (feet)	Water-Level Elevation
GM-22	728.28	24.57	703.71
GM-23	730.99	25.32	705.67
GM-24	747.29	40.06	707.23
GM-25	746.17	40.83	705.34
ME-1	728.06	24.17	703.89
ME-2	728.4	24.56	703.84
ME-3	728.09	24.28	703.81
ME-4	728.31	24.57	703.74
ME-5	728.29	24.87	703.42
ME-6	728.34	24.52	703.82
Deep Aquifer Wells			
GM-1	735.74	33.29	702.45
GM-3	730.44	28.58	701.86
GM-4	731.46	29.62	701.84
GM-5	731.29	29.20	702.09
GM-7R	735.61	33.22	702.39
GM-9	724.07	22.71	701.36
GM-11	723.71	22.61	701.10
GM-13	723.82	23.35	700.47
GM-14	723.5	23.15	700.35
GM-15	725.23	25.10	700.13
GM-19D	730.25	27.85	702.40
GM-20D	727.26	24.80	702.46
HR-10	742.81	35.87	706.94
HR-12	742.64	35.80	706.84
HR-13	735.03	29.58	705.45
HR-14	731.63	26.21	705.42
HR-15	733.74	28.44	705.30
M73C	716.55	16.13	700.43
MT68	746.45	41.80	704.65
MT69	722.71	21.34	701.37
MT576M	751.46	45.13	706.33
MT596M*	757.73	50.20	707.53

Table 4-1. Water-Level Measurements During the Supplemental RFI, March 1998, General Motors Corporation, Moraine, Ohio.

Well	Measuring Point Elevation	Depth-to-Water (feet)	Water-Level Elevation
Production and Fire Wells			
32	732.1	23.79	703.31
35	733.96	(29.54)	704.42
37	731.24	NA (bolted shut)	NA
42	731.62	27.92	703.70
44	734.62	28.57	706.05
45	731.03	28.50	702.53
46	733.34	30.67	702.67
A	739	32.63	706.38
12A	742.35	40.83	701.52
FW-1	740.9	34.42	706.48
FW-2	737.48	32.92	704.56
FW-3	739.26	NA	NA
FW-4	731.62	28.35	703.27

Measuring point is to top of the PVC Casing.
Water-level elevations are reported in feet above mean sea level (msl).
Depth-to-water elevations were measured on March 11 and 12, 1998 using an electronic water level indicator except for HR-9 which was collected on March 16, 1998.
Depth-to-water measurements are reported in feet below the measuring point.
1. TW-2 is an active recovery well.
NA - Not accessible.
( ) - Probable measurement error.
*Measuring point is top of cement housing.

Table 4-2. Vertical Gradients For Shallow/Deep Well Pairs, March 11-12 1998, General Motors Corporation, Moraine, Ohio

Shallow/Deep Wells Pairs	Vertical Gradient	
	Direction	Magnitude
Upgradient		
HR-9/HR-10	U[1]	0.01
HR-11/HR-12	U	0.10
On-Site		
W-3-N/HR-15	D	-0.19
W-4-N/HR-14	D	-0.06
HR-3/HR-13	D	-0.01
4S/GM-5	D	-0.45
GM-8/GM-7R	D	-0.07
GM-16/GM-15	D	-2.02
GM-2/GM-1	D	-0.35
GM-18/GM-13	D	-1.68
GM-17/GM-11	D	-1.12
GM-6/GM-3	U	2.72
Downgradient		
GM-10/GM-9	D	-0.55
GM-26/MT-69	D	-0.22

D Downward gradient (-).
U Upward gradient (+).
[1]Water-level measurement for HR-9 could not be collected on March 11-12, 1998 therefore, water-level measurements from March 16, 1998 sampling event was used to conduct this evaluation.

Table 4-3. VOC Analytical Results for Groundwater Samples Collected from Lower Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

Constituents	Units	HR-12 03/09/98	DUP-58 03/09/98	HR-13 03/10/98	GM-1 03/04/98	GM-20D 03/02/98	GM-9 03/03/98	MT-69 03/02/98
Volatile Organic Compounds								
1,1,1-Trichloroethane	ug/l	<1.0	<1.0	1.3	2.1	<1.0	<1.0	<1.0
1,1-Dichloroethane	ug/l	2.5	2.5	48.3	<1.0	<1.0	1.2	<1.0
Tetrachloroethene	ug/l	<1.0	<1.0	<1.0UJ	4.0	<1.0	<1.0	<1.0
Trichloroethene	ug/l	<1.0	<1.0	2.8	52.1	<1.0	7.7	<1.0
Vinyl chloride	ug/l	2.7	2.7	<2.0UJ	<2.0	<2.0	<2.0	<2.0
cis-1,2-Dichloroethene	ug/l	2.4	2.4	23.3	<1.0	<1.0	2.1	<1.0
trans-1,2-Dichloroethene	ug/l	<1.0	<1.0	3.3	<1.0	<1.0	<1.0	<1.0
Total VOCs		7.6	7.6	79	58.2	0	11	0

ug/l - Micrograms per liter.
UJ - Constituent was not detected. Detection limit is estimated.
ND - Not detected.
DUP-58 - Duplicate of HR-12.

Table 4-4. Bioattenuation Parameter Results in Upper Aquifer Monitor Wells March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	UPGRADIENT WELLS			SIDE-GRADIENT WELL	ON-SITE WELLS						
		HR-9 3/6/98	HR-11 3/9/98	GM-24 3/6/98	GM-25 3/6/98	W-3-N 3/5/98	GM-23 3/9/98	HR-1 3/5/98	ME-6 3/9/98	ME-3 3/9/98	W-1-S 3/5/98	HR-17 3/5/98
Inorganics & TOC												
Nitrate	mg/l	8.8	8.8	13.2	<4.4	<4.4	17.6	13.2	22.0	<4.4	13.2	13.2
Nitrite	mg/l	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033
Nitrogen, Ammonia	mg/l	<0.300	0.940	<0.300	<0.300	<0.300	<0.300	<0.300	<0.300	0.500	<0.300	<0.300
Manganese (Total)	mg/l	0.152	0.369	<0.01	0.310	0.089	2.63	<0.01	0.094	0.237	0.530	<0.01
Manganese (Dissolved)	mg/l	0.107	0.072	ns	0.058	0.083	0.242	ns	<0.01	0.050	0.011	ns
Iron (Total)	mg/l	1.37	10.5	<0.1	18.9	11.1	15.0	0.450	1.45	1.81	0.340	<0.1
Iron (Dissolved)	mg/l	<0.1	<0.1	ns	4.10	4.44	<0.1	<0.1	0.140	<0.1	<0.1	ns
Iron (Ferrous)	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sulfate	mg/l	49.0	97.0	61.0	80.0	110	77.0	80.0	165	166	105	69.0
Sulfide	mg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Organic Carbon	mg/l	1.00	3.00	<1	<1	2.00	8.00	2.00	<1	6.00	2.00	1.00
Chloride	mg/l	103	101	111	82.0	99.0	51.0	104	211	271	164	309
Permanent Gases												
Carbon Dioxide	mg/l	64.1	122.6	5.6	45.4	47.2	72.0	58.9	58.5	72.3	48.0	34.3
Oxygen	mg/l	1.81	1.37	8.15	1.23	3.68	1.24	1.95	2.38	1.12	2.11	4.00
Nitrogen	mg/l	26.4	21.4	18.5	23.4	24.5	19.4	20.1	16.2	16.8	23.5	18.9
Methane	mg/l	0.162931	0.012077	0.000463	0.001478	0.082004	0.079487	0.000380	0.000367	0.151422	0.000793	0.000529
Carbon Monoxide	mg/l	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Light Hydrocarbon Scan												
Ethane	ug/l	22.014	0.750	0.030	0.067	0.073	2.932	0.033	0.011	0.091	0.019	0.007
Ethene	ug/l	<0.005	<0.005	0.006	0.014	0.199	84.070	0.006	0.009	0.030	0.010	0.005
Field Parameters												
pH	S.U.	6.84	6.77	7.52	7.05	7.07	6.98	6.98	6.99	6.93	6.95	7.05
ORP	mV	30.90	121.70	42.50	-198.90	-87.30	92.70	47.40	118.60	119.40	79.30	104.10
Temperature	°C	15.88	16.04	17.18	18.38	15.16	17.77	20.65	22.53	23.46	15.87	14.01
Dissolved Oxygen	mg/L	0.20	0.21	5.15	0.14	0.17	0.42	0.40	1.23	0.27	0.44	2.07
Specific Conductance	umhos/cm	1,281	1,664	851	1,219	1,274	1,069	1,263	1,976	2,244	1,453	1,777

Table 4-4. Bioattenuation Parameter Results in Upper Aquifer Monitor Wells March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	ON-SITE WELLS								DOWNGRADIENT WELLS		
		EAST 3/5/98	GM-22 3/10/98	DUP-57 3/10/98	GM-21 3/10/98	GM-8 3/4/98	DUP-56 3/4/98	GM-6 3/4/98	GM-2 3/4/98	GM-10 3/3/98	GM-26 3/3/98	WSU-24 3/3/98
Inorganics & TOC												
Nitrate	mg/l	17.6	<4.4	<4.4	17.6	<4.4	<4.4	<4.4	22.0	22.0	17.6	22.0
Nitrite	mg/l	0.066	<0.033	<0.033	0.066	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033
Nitrogen, Ammonia	mg/l	<0.300	<0.300	<0.300	<0.300	1.69	1.77	<0.300	<0.300	<0.300	<0.300	<0.300
Manganese (Total)	mg/l	1.00	0.143	0.183	0.719	0.204	0.214	1.07	0.048	0.033	0.056	<0.01
Manganese (Dissolved)	mg/l	0.122	0.097	0.096	0.181	0.229	0.218	1.00	<0.01	0.010	0.032	ns
Iron (Total)	mg/l	7.77	0.680	0.910	1.65	1.01	1.08	1.32	<0.1	<0.1	0.500	<0.1
Iron (Dissolved)	mg/l	<0.1	<0.1	<0.1	<0.1	1.22	1.18	<0.1	ns	ns	<0.1	ns
Iron (Ferrous)	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	0.8	<0.2	<0.2	<0.2	<0.2	<0.2
Sulfate	mg/l	80.0	84.0	92.0	123	59.0	52.0	93.0	54.0	48.0	44.0	49.0
Sulfide	mg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Organic Carbon	mg/l	2.00	3.00	3.00	2.00	7.00	8.00	3.00	<1	<1	<1	<1
Chloride	mg/l	267	296	280	119	248	246	227	200	140	92.0	106
Permanent Gases												
Carbon Dioxide	mg/l	50.5	41.8	45.6	41.2	15.8	15.9	47.4	41.0	38.2	24.9	38.6
Oxygen	mg/l	1.77	1.10	1.55	1.57	1.10	1.37	1.57	3.12	2.54	5.14	8.12
Nitrogen	mg/l	22.2	19.1	23.2	22.4	19.7	20.9	20.5	21.1	18.4	19.6	18.2
Methane	mg/l	0.007093	0.110000	0.090000	0.003020	1.480000	1.550000	0.008337	0.000255	0.001694	0.001746	0.000241
Carbon Monoxide	mg/l	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Light Hydrocarbon Scan												
Ethane	ug/l	0.027	0.115	0.115	0.054	0.370	0.423	0.047	0.009	0.008	0.017	<0.005
Ethene	ug/l	0.019	0.066	0.075	0.016	12.233	14.483	0.091	0.005	0.008	<0.005	<0.005
Field Parameters												
pH	S.U.	6.96	7.12	7.12	7.13	7.70	7.70	7.00	7.01	7.16	7.32	7.10
ORP	mV	-80.80	150.40	150.40	137.50	-145.00	-145.00	57.60	126.70	143.70	142.10	157.00
Temperature	°C	18.46	18.76	18.76	15.54	17.53	17.53	18.49	14.63	15.69	12.63	14.44
Dissolved Oxygen	mg/L	0.20	0.25	0.25	0.38	0.16	0.16	0.88	1.38	0.90	2.84	3.63
Specific Conductance	umhos/cm	1,777	2,721	2,721	1,884	1,539	1,539	1,422	1,191	1,424	1,144	1,303

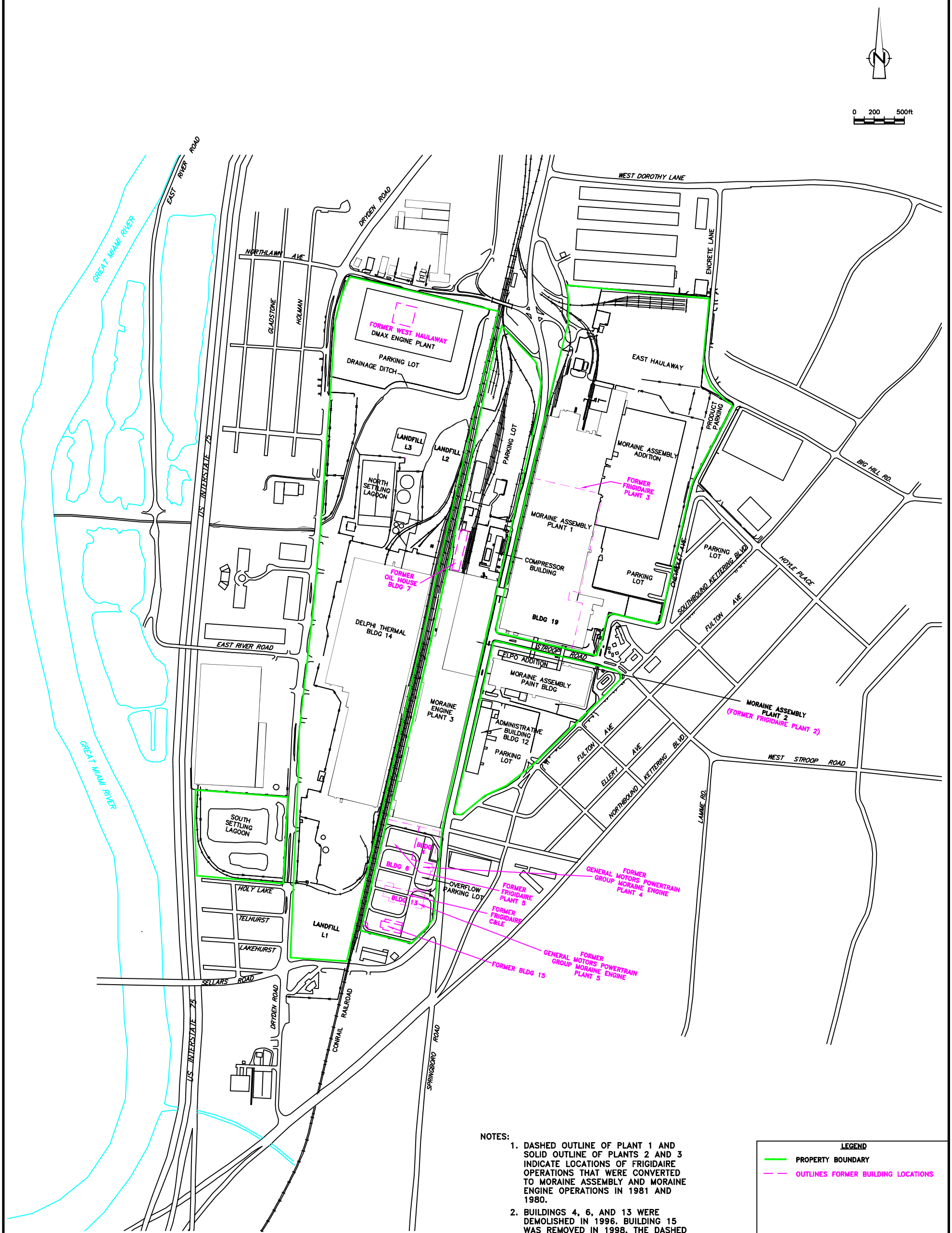
ns Not sampled.
mg/L Milligrams per liter.
ug/L Micrograms per liter.
S.U. Standard units.
mV Millivolts.
°C Degrees Celsius.
umhos/cm Micro-mohs/centimeter.

DUP-56 - Duplicate of GM-8.
DUP-57 - Duplicate of GM-22.
*HR-11 is upgradient and GM-23 is located within the suspected center of AOI-7 Former Oil House.
GM-22 is upgradient and, GM-21 and EAST are downgradient of AOI-13 Buildings 4, 6, and 13.
GM-22 is upgradient and GM-21 is downgradient of AOI-7 Building 15.
GM-21 is upgradient and GM-2 is downgradient of AOI-36 Former Southwest ASTs

Table 4-5. Bioattenuation Parameter Results in AOI 7 - Former Oil House Area, August 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	GM-23 8/26/98	GM-27 8/26/98	GM-28 8/26/98
Inorganics & TOC				
Nitrate	mg/l	22	<4.4	<4.4
Nitrite	mg/l	0.17	0.5	<0.033
Nitrogen, Ammonia	mg/l	<0.3	<0.3	<0.3
Manganese (Total)	mg/l	0.343	0.425	0.486
Manganese (Dissolved)	mg/l	0.197	0.17	0.269
Iron (Total)	mg/l	3.41	16	6.16
Iron (Dissolved)	mg/l	<0.10	0.19	<0.10
Iron (Ferrous)	mg/l	<0.2	<0.2	<0.2
Sulfate	mg/l	50	90	144
Sulfide	mg/l	<1	<2	<1
Total Organic Carbon	mg/l	9	2	6
Chloride	mg/l	69	118	163
Permanent Gases				
Carbon Dioxide	mg/l	58.32	63.42	31.50
Oxygen	mg/l	1.65	1.84	2.13
Nitrogen	mg/l	17.27	22.92	17.23
Methane	mg/l	0.063452	0.010517	0.004460
Carbon Monoxide	mg/l	<0.40	<0.40	<0.40
Light Hydrocarbon Scan				
Ethane	ug/l	5.136	4.599	0.990
Ethene	ug/l	75.038	4.700	0.696
Field Parameters				
pH	S.U.	6.57	6.80	7.02
ORP	mV	287.1	191.6	274.7
Temperature	°C	18.31	20.27	19.24
Dissolved Oxygen	mg/L	2.66	1.34	1.25
Specific Conductance	umhos/cm	952	1,271	1,336

mg/L	Milligrams per liter.
ug/L	Micrograms per liter.
S.U.	Standard units.
mV	Millivolts.
°C	Degrees Celsius.
umhos/cm	Micro-mohs/centimeter.



NOTES:

1. DASHED OUTLINE OF PLANT 1 AND SOLID OUTLINE OF PLANTS 2 AND 3 INDICATE LOCATIONS OF FRIGIDAIRE OPERATIONS THAT WERE CONVERTED TO MORAINE ASSEMBLY AND MORAINE ENGINE OPERATIONS IN 1981 AND 1980.
2. BUILDINGS 4, 6, AND 13 WERE DEMOLISHED IN 1996. BUILDING 15 WAS REMOVED IN 1998. THE DASHED OUTLINES OF THE BUILDINGS INDICATE THEIR FORMER LOCATIONS.

LEGEND

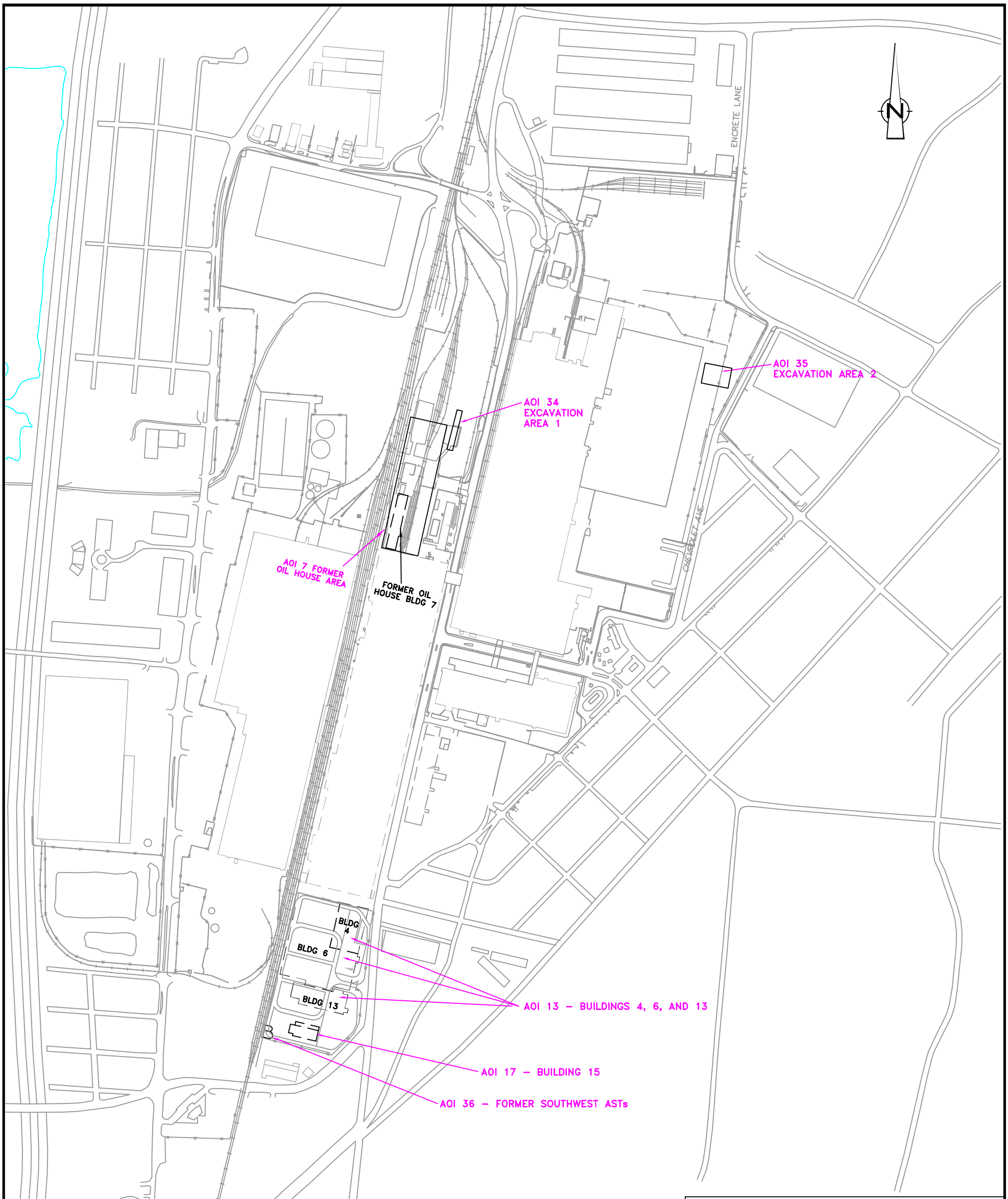
- PROPERTY BOUNDARY
- OUTLINES FORMER BUILDING LOCATIONS

ARCADIS GERAGHTY & MILLER

6397 Emerald Parkway
Suite 150, Dublin, OH 43016
Tel: 614/764-2310 Fax: 614/764-1270

SITE LAYOUT
MORAINE ENGINE, MORAINE ASSEMBLY AND DELPHI THERMAL FACILITIES
GENERAL MOTORS CORPORATION
MORAINE, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
27APR99	J. REID	HAR\CRA\RFI\CRA-SITE
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH	J. REID	N. GILLOTTI
PROJECT NUMBER		FIGURE NUMBER
0H000294.0001.0002		1-1



LEGEND

AOI — AREA OF INTEREST INVESTIGATED DURING THE SUPPLEMENTAL RFI

– – OUTLINES FORMER BUILDING LOCATIONS

ARCADIS GERAGHTY & MILLER

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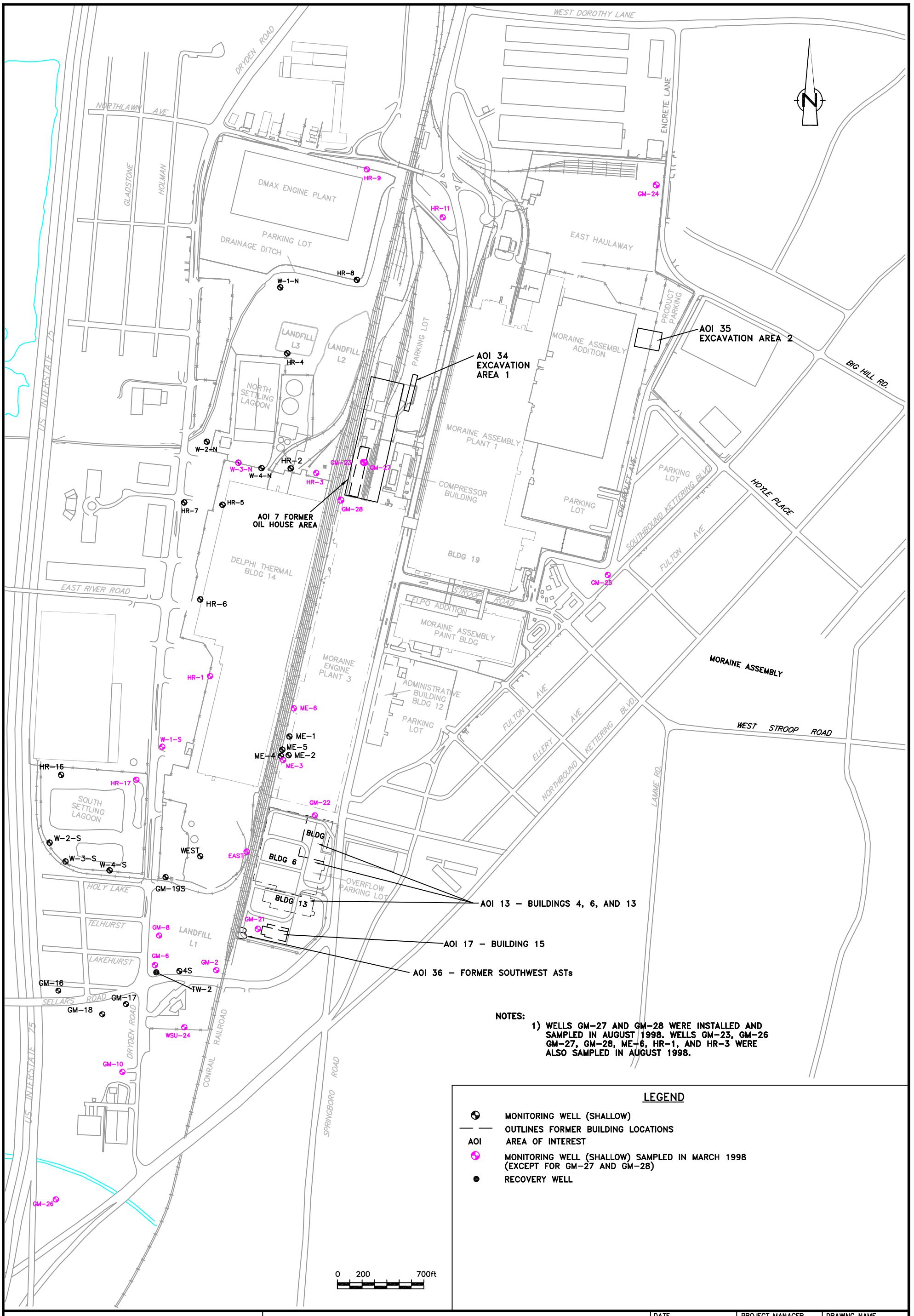
Suite 150, Dublin, OH 43016
Tel: 614/764-2310 Fax: 614/764-1270

AOI LOCATIONS
GMC EASTERN FACILITIES
GENERAL MOTORS CORPORATION
MORAINE, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
27APR99	J. REID	HAR\CRA\\OH294-01
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH		N. GILLOTTI
PROJECT NUMBER		FIGURE NUMBER
0H000294.0001.0002		1-2



NOTES:

1) WELLS GM-27 AND GM-28 WERE INSTALLED AND SAMPLED IN AUGUST 1998. WELLS GM-23, GM-26 GM-27, GM-28, ME-6, HR-1, AND HR-3 WERE ALSO SAMPLED IN AUGUST 1998.

LEGEND

- MONITORING WELL (SHALLOW)
- OUTLINES FORMER BUILDING LOCATIONS
- AOI — AREA OF INTEREST
- MONITORING WELL (SHALLOW) SAMPLED IN MARCH 1998 (EXCEPT FOR GM-27 AND GM-28)
- RECOVERY WELL

ARCADIS GERAGHTY&MILLER

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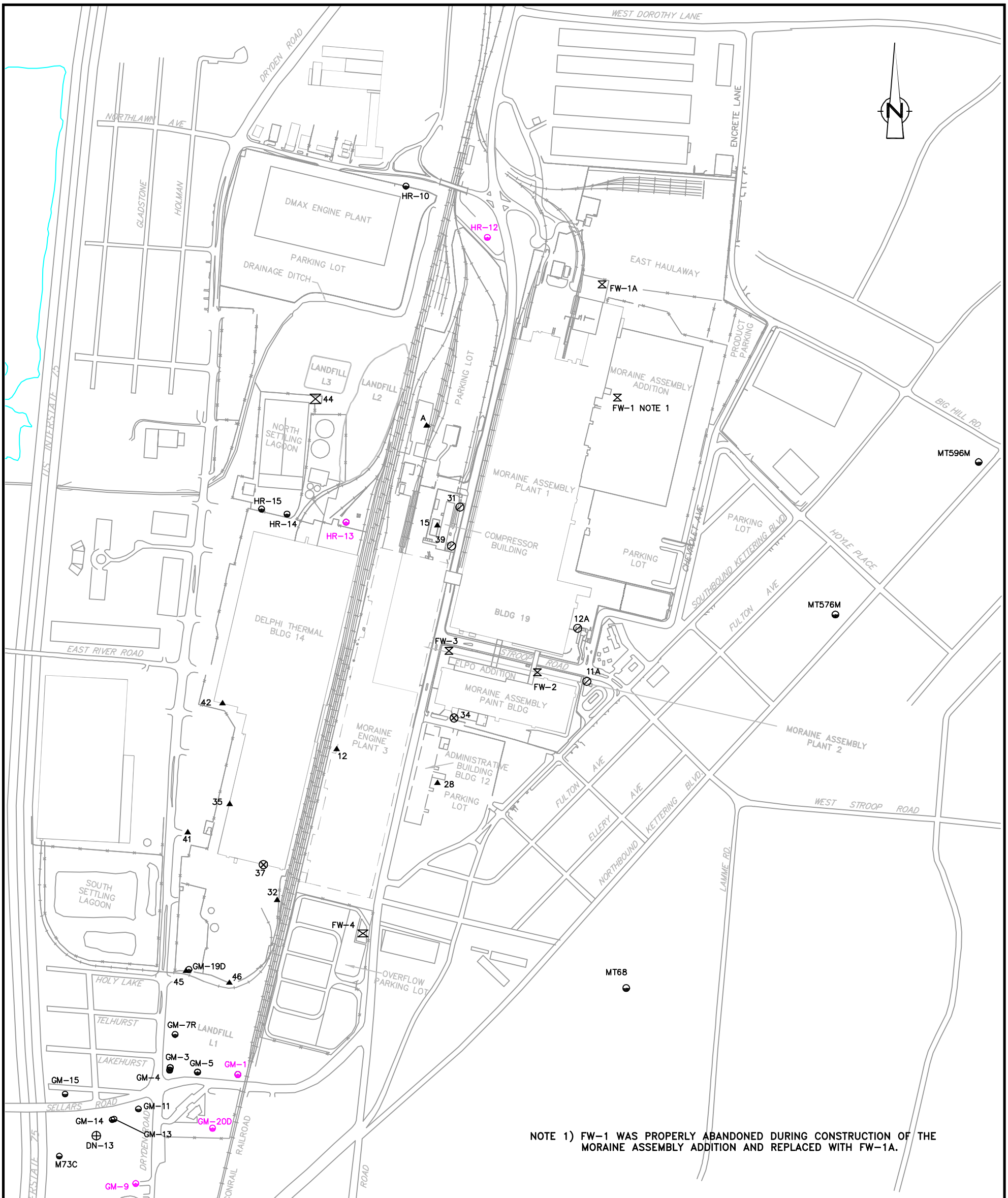
UPPER AQUIFER MONITORING WELL LOCATION MAP GENERAL MOTORS CORPORATION MORAINE, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
05MAY99	J. REID	\CRA\RFI\SHAL
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH		N. GILLOTTI
PROJECT NUMBER		FIGURE NUMBER
0H000294.0001.0002		2-1



NOTE 1) FW-1 WAS PROPERLY ABANDONED DURING CONSTRUCTION OF THE MORAINE ASSEMBLY ADDITION AND REPLACED WITH FW-1A.

LEGEND

- GM-9 — MONITORING WELL (DEEP)
- FIRE WELLS
- INACTIVE PRODUCTION WELLS
- ACTIVE PRODUCTION WELLS
- PUMP TO WASTE WELL
- SEALED WELL
- MONITORING WELL (DEEP) SAMPLED IN MARCH 1998

ARCADIS GERAGHTY & MILLER

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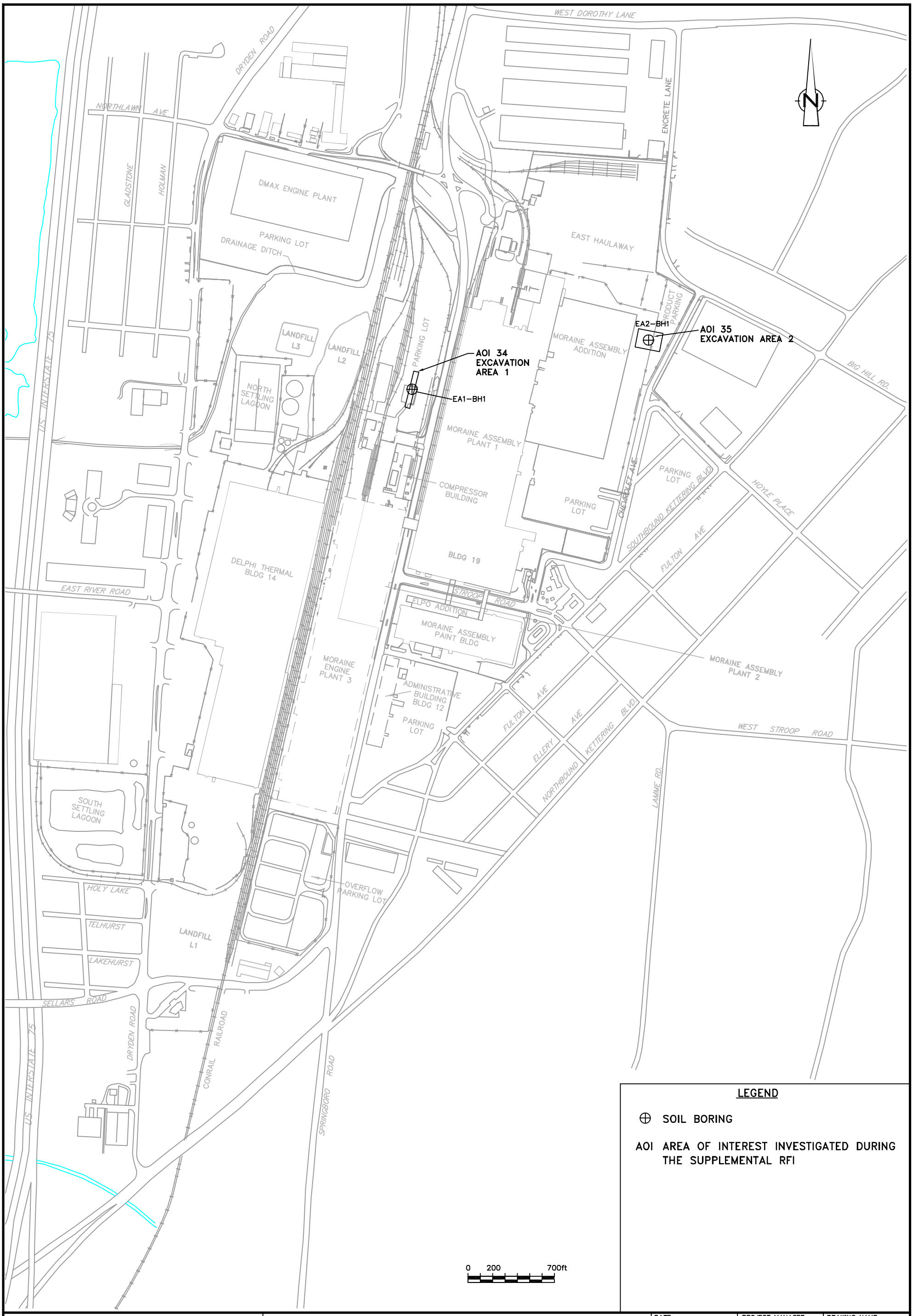
LOWER AQUIFER MONITORING WELL LOCATION MAP
GENERAL MOTORS CORPORATION
MORAINE, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
05MAY99	J. REID	\CRA\RFI\DEEP
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH		N. GILLOTTI
PROJECT NUMBER		FIGURE NUMBER
0H000294.0001.0002		2-2



LEGEND

⊕ SOIL BORING

AOI AREA OF INTEREST INVESTIGATED DURING THE SUPPLEMENTAL RFI

ARCADIS GERAGHTY & MILLER

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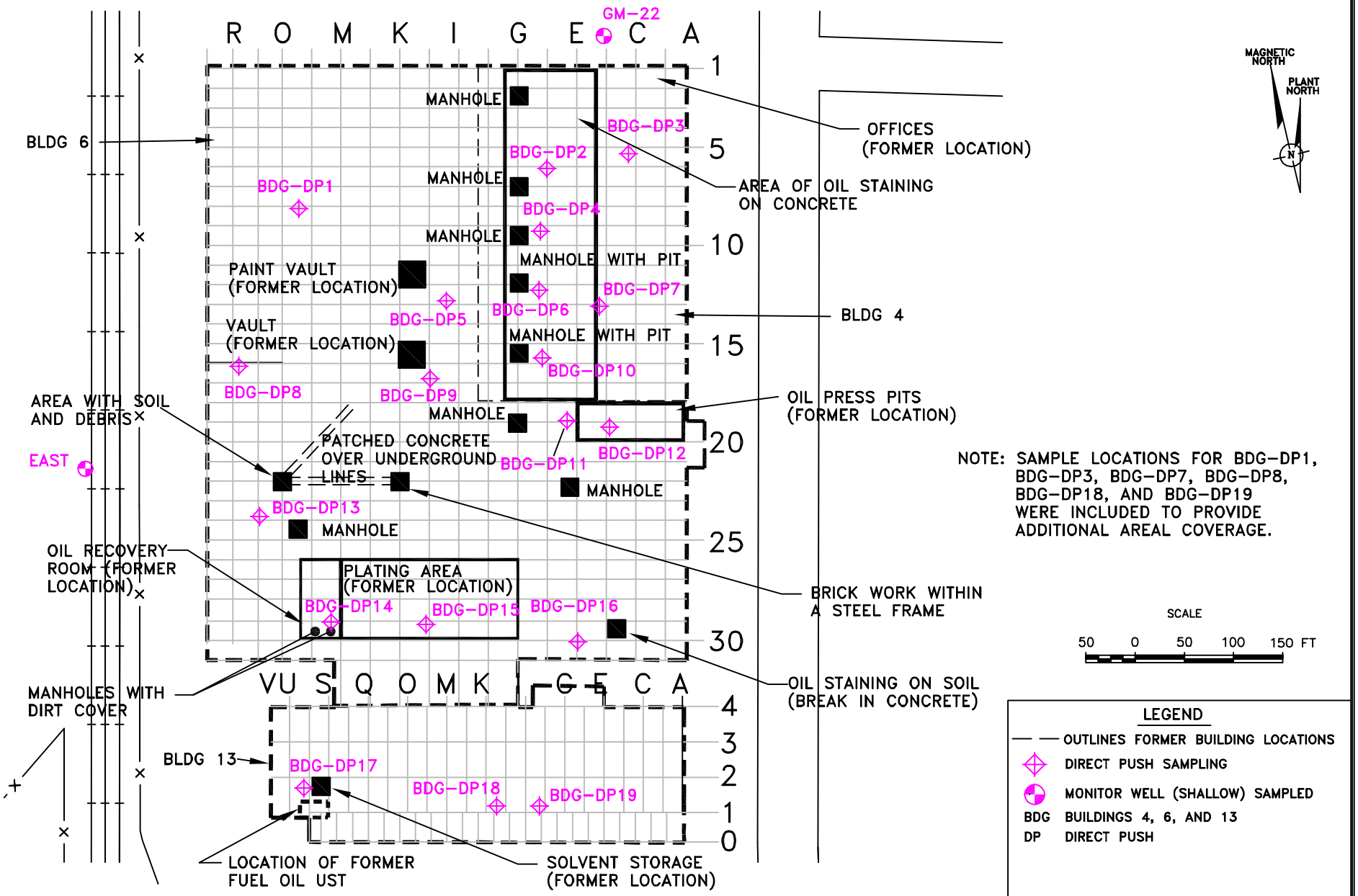
Suite 150, Dublin, OH 43016
Tel: 614/764-2310 Fax: 614/764-1270

BORING LOCATIONS FOR AOI 34-EXCAVATION AREA 1 AND AOI 35-EXCAVATION AREA 2 GENERAL MOTORS CORPORATION MORAINE, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
27APR99	J. REID	HAR\CRA\\OH294-04
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH		N. GILLOTTI
PROJECT NUMBER		FIGURE NUMBER
OH000294.0001.0002		3-1



NOTE: SAMPLE LOCATIONS FOR BDG-DP1, BDG-DP3, BDG-DP7, BDG-DP8, BDG-DP18, AND BDG-DP19 WERE INCLUDED TO PROVIDE ADDITIONAL AREAL COVERAGE.

SCALE

50 0 50 100 150 FT

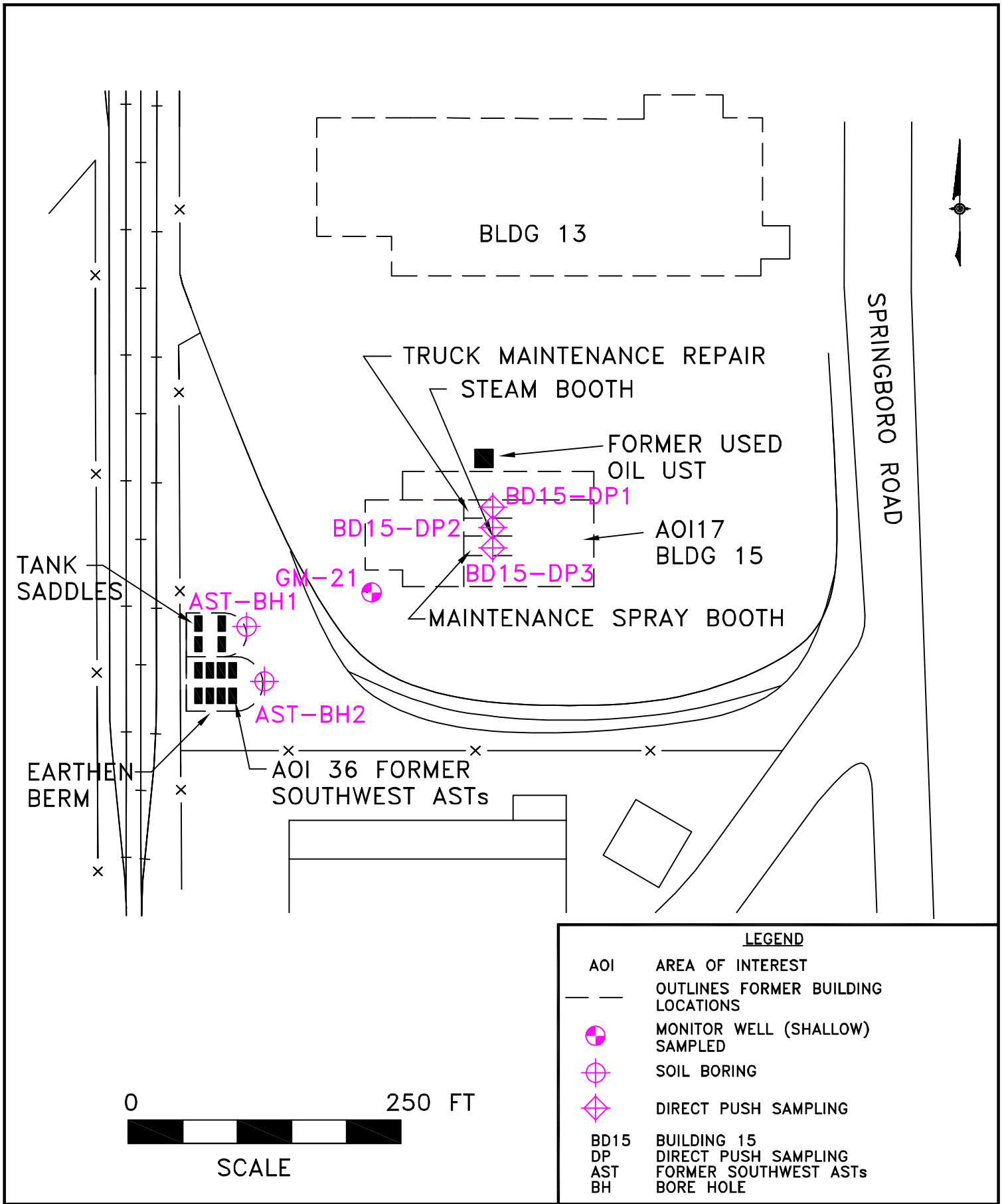
LEGEND

- OUTLINES FORMER BUILDING LOCATIONS
- DIRECT PUSH SAMPLING
- MONITOR WELL (SHALLOW) SAMPLED
- BDG BUILDINGS 4, 6, AND 13
- DP DIRECT PUSH

ARCADIS GERAGHTY & MILLER

DIRECT PUSH SOIL SAMPLE LOCATIONS
FOR AOI 13. BUILDINGS 4, 6, AND 13
GENERAL MOTORS CORPORATION
MORAINE, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
MAR99	N. GILLOTTI	NB\SUP\X3ARFI
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH	J. REID	B. FERGUSON
PROJECT NUMBER		FIGURE NUMBER
0H000294.0001.0002		3-2



ARCADIS GERAGHTY & MILLER
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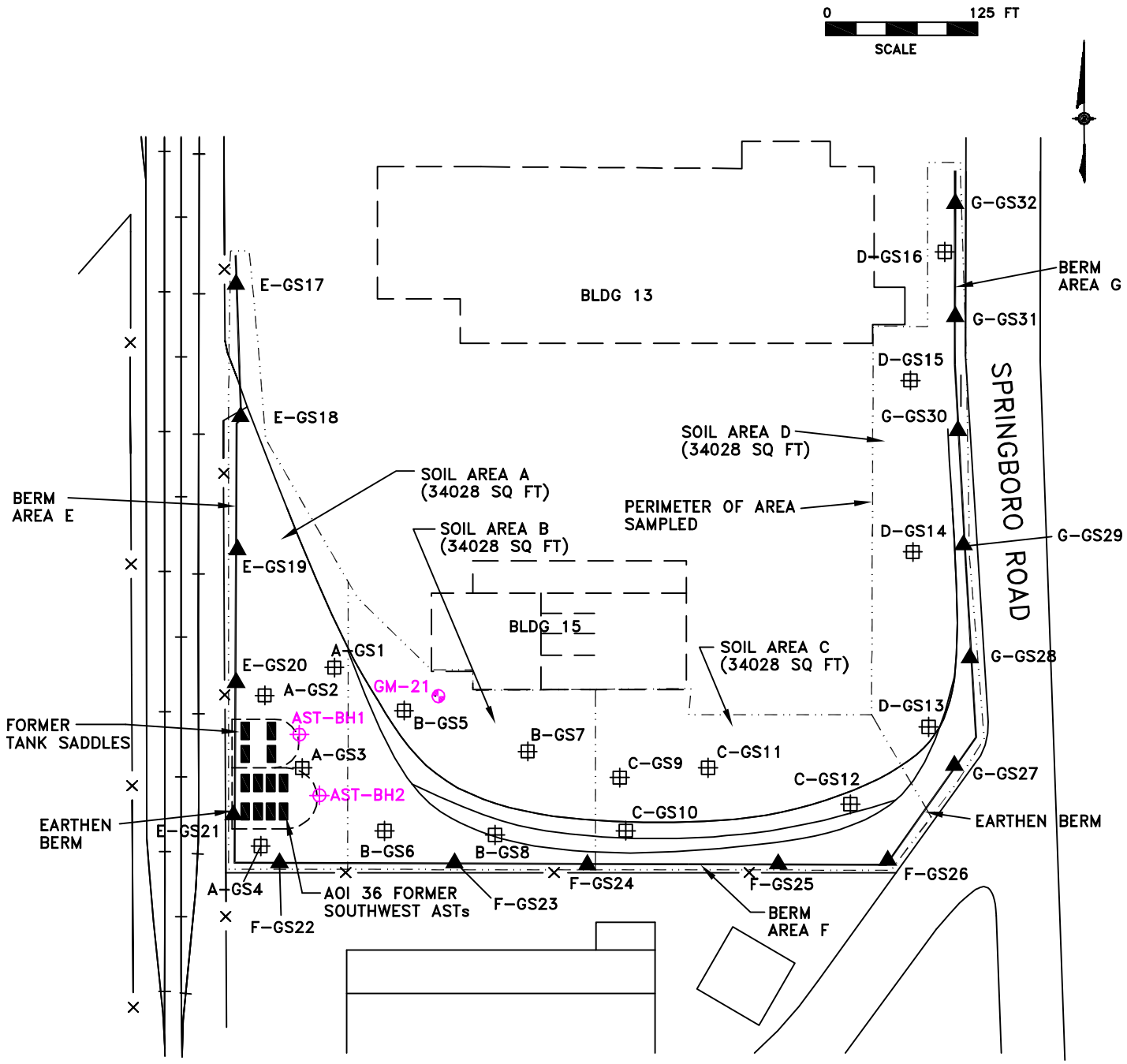
Suite 100, Dublin, OH 43016
Tel: 614/764-2310 Fax: 614/764-1270

DIRECT PUSH SOIL SAMPLING LOCATIONS
FOR AOI 17 – BUILDING 15 AND SOIL BORING
LOCATIONS FOR AOI 36 – FORMER SOUTHWEST ASTs
GENERAL MOTORS CORPORATION
MORAINE, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
MAR99	N. GILLOTTI	NB\SUP\AOI36RFI
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH		N. GILLOTTI
PROJECT NUMBER		FIGURE NUMBER
0H000294.0001.00002		3-3



SOIL AREA A COMPOSITE SAMPLE CONSISTED OF A-GS1 THROUGH A-GS4.
SOIL AREA B COMPOSITE SAMPLE CONSISTED OF B-GS5 THROUGH B-GS8.
SOIL AREA C COMPOSITE SAMPLE CONSISTED OF C-GS9 THROUGH C-GS12.
SOIL AREA D COMPOSITE SAMPLE CONSISTED OF D-GS13 THROUGH D-GS16.
BERM AREA E COMPOSITE SAMPLE CONSISTED OF E-GS17 THROUGH E-GS21.
BERM AREA F COMPOSITE SAMPLE CONSISTED OF F-GS22 THROUGH F-GS26
BERM AREA G COMPOSITE SAMPLE CONSISTED OF G-GS27 THROUGH G-GS32

LEGEND

AOI	AREA OF INTEREST
— —	OUTLINES FORMER BUILDING LOCATIONS
	MONITOR WELL (SHALLOW) SAMPLED
	SUPPLEMENTAL RFI SOIL BORING
	HAND AUGER SAMPLE LOCATION
▲	HAND AUGER BERM SAMPLE LOCATION
GS	GRAB SAMPLE
BH	BORE HOLE

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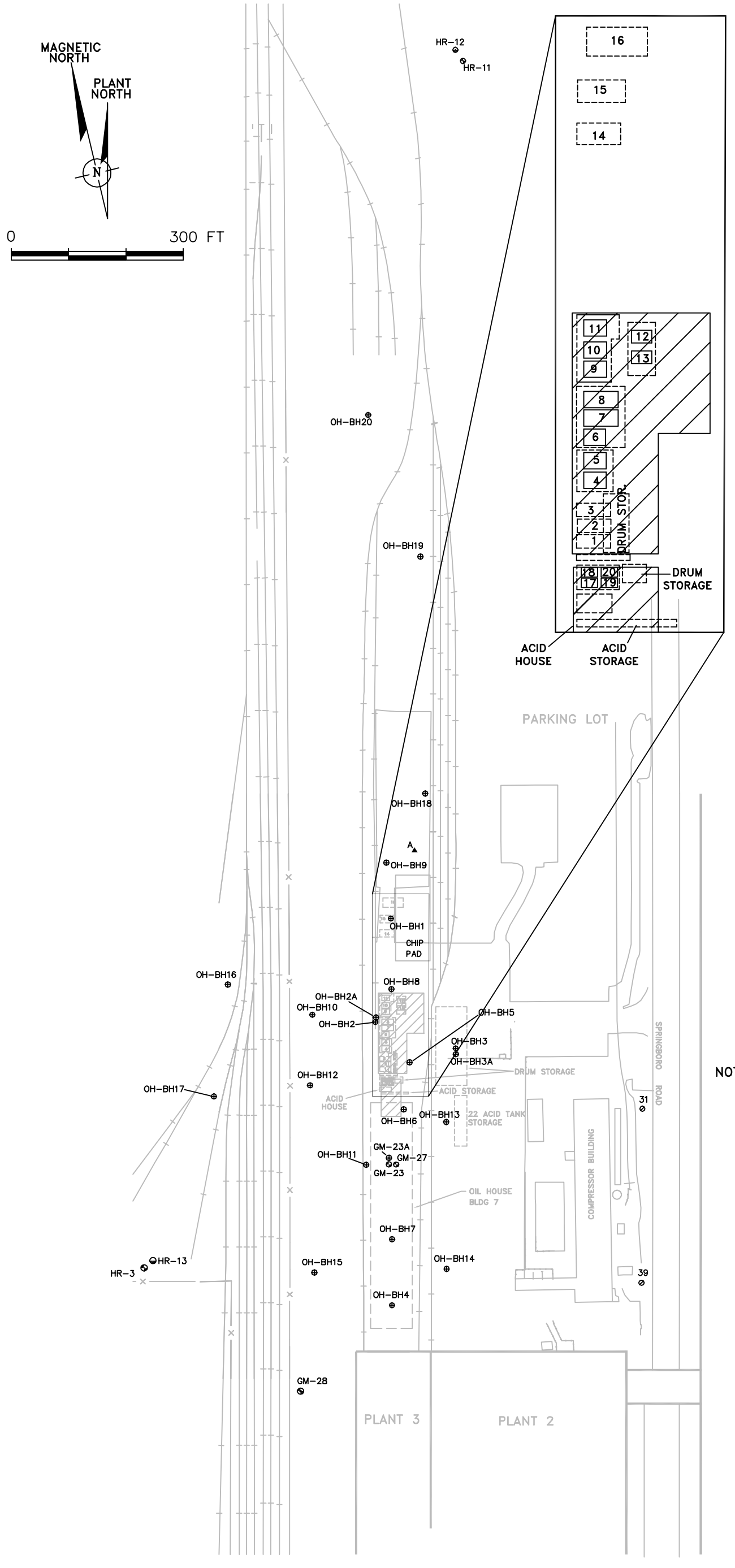
HAND AUGER SOIL SAMPLING LOCATIONS FOR AOI 36 – FORMER SOUTHWEST ASTs GENERAL MOTORS CORPORATION MORAINE, OHIO

DATE MAR99	PROJECT MANAGER J. REID	DRAWING NAME AOI36-B
DRAWN R. SMITH	LEAD DESIGN PROF. J. REID	CHECKED N. GILLOTTI
PROJECT NUMBER 0H000294.001.002		DRAWING NUMBER 3-4



HISTORIC TANK No.	CONTENTS	CAPACITY
1	OIL	15,000 GALLONS
2	OIL	15,000 GALLONS
3	OIL	15,000 GALLONS
4	THINNER	8,000 GALLONS
5	REDUCER	8,000 GALLONS
6	ALCOHOL	8,000 GALLONS
7	KEROSENE	10,000 GALLONS
8	PERCHLOROETHENE	10,000 GALLONS
9	PERCHLOROETHENE	10,000 GALLONS
10	ALCOHOL	10,000 GALLONS
11	ALCOHOL	10,000 GALLONS
12	XYLOL	10,000 GALLONS
13	THINNER	10,000 GALLONS
14	FREON 12	160,000 LBS
15	FREON 12	160,000 LBS
16	OIL	30,000 GALLONS
17	ACID-HNO_3	11,000 GALLONS
18	ACID-HCl	10,000 GALLONS
19	ACID-H_2SO_4	13,000 GALLONS
20	ACID-H_3PO_4	11,000 GALLONS
21	DRUMS-OIL	300 BBL
22	ACID	-----

NOTE:

BORINGS OH-BH1 THROUGH OH-BH4 WERE INSTALLED IN FEBRUARY 1998. BORINGS OH-BH5 THROUGH OH-BH10 AND WELLS GM-27 AND GM-28 WERE INSTALLED IN AUGUST 1998. BORINGS OH-BH11 THROUGH OH-BH20, OH-BH2A, OH-BH3A, AND GM-23A WERE INSTALLED IN NOVEMBER 1998.

LEGEND

- MONITOR WELL (SHALLOW)
- MONITOR WELL (DEEP)
- SOIL BORING
- ACTIVE PRODUCTION WELL
- INACTIVE PRODUCTION WELL
- OH — OIL HOUSE
- BH — BORE HOLE
- FORMER LOCATION OF OIL HOUSE STRUCTURES
- APPROXIMATE LOCATION OF CURRENT MORAINE ENGINE TANK FARM

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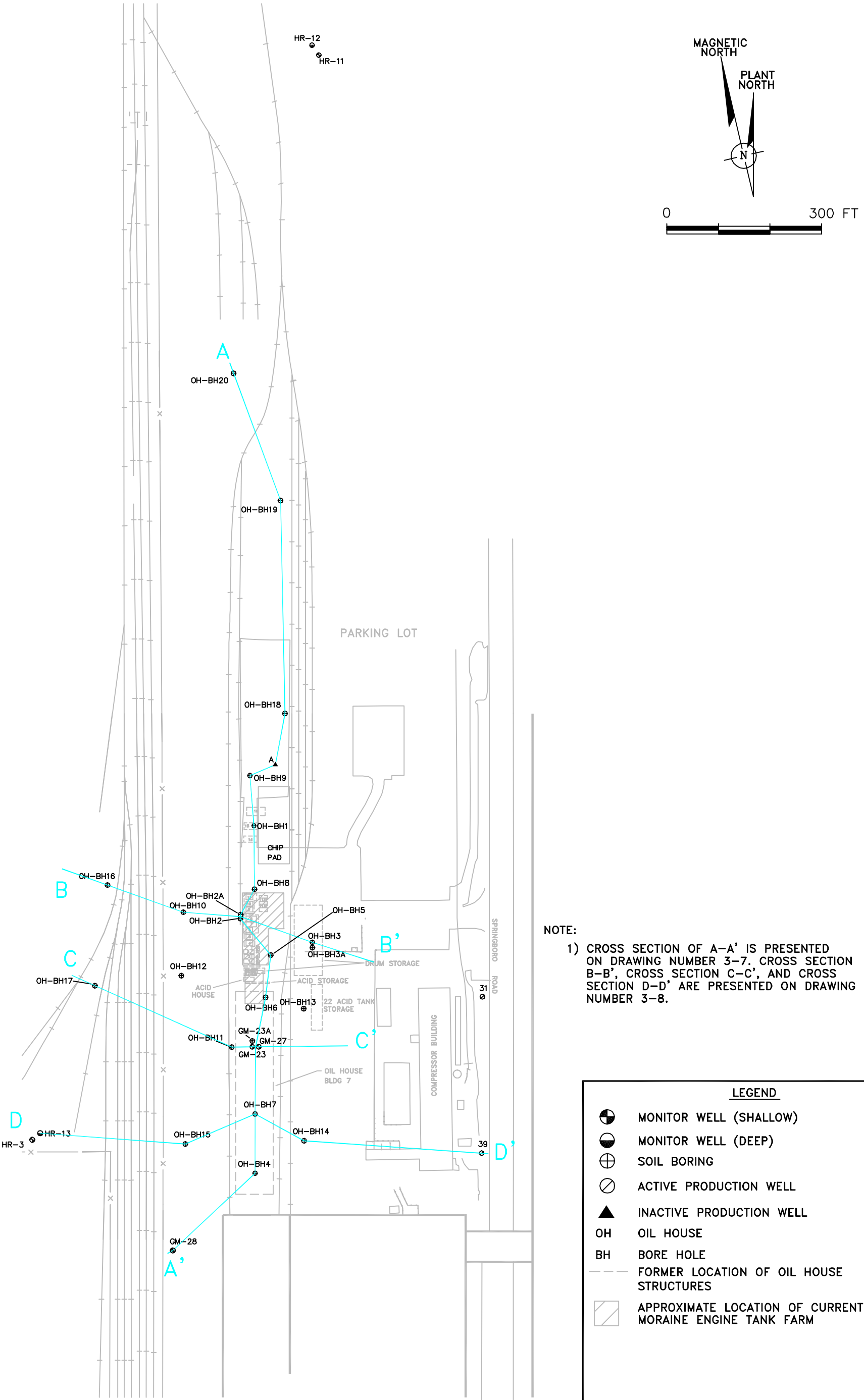
6397 Emerald Parkway
Suite 150, Dublin, OH 43016
Tel: 614/764-2310 Fax: 614/764-1270

SOIL BORING LOCATIONS FOR AOI 7 - FORMER OIL HOUSE AREA

GENERAL MOTORS CORPORATION
MORAINE, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
MAR99	J. REID	HARR\N-B\RFISUP1D
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH	J. REID	N. GILLOTTI
PROJECT NUMBER		DRAWING NUMBER
0H000294.0001.0002		3-5



NOTE:

1) CROSS SECTION OF A–A' IS PRESENTED ON DRAWING NUMBER 3–7. CROSS SECTION B–B', CROSS SECTION C–C', AND CROSS SECTION D–D' ARE PRESENTED ON DRAWING NUMBER 3–8.

LEGEND

- MONITOR WELL (SHALLOW)
- MONITOR WELL (DEEP)
- SOIL BORING
- ACTIVE PRODUCTION WELL
- INACTIVE PRODUCTION WELL
- OH — OIL HOUSE
- BH — BORE HOLE
- FORMER LOCATION OF OIL HOUSE STRUCTURES
- APPROXIMATE LOCATION OF CURRENT MORAINE ENGINE TANK FARM

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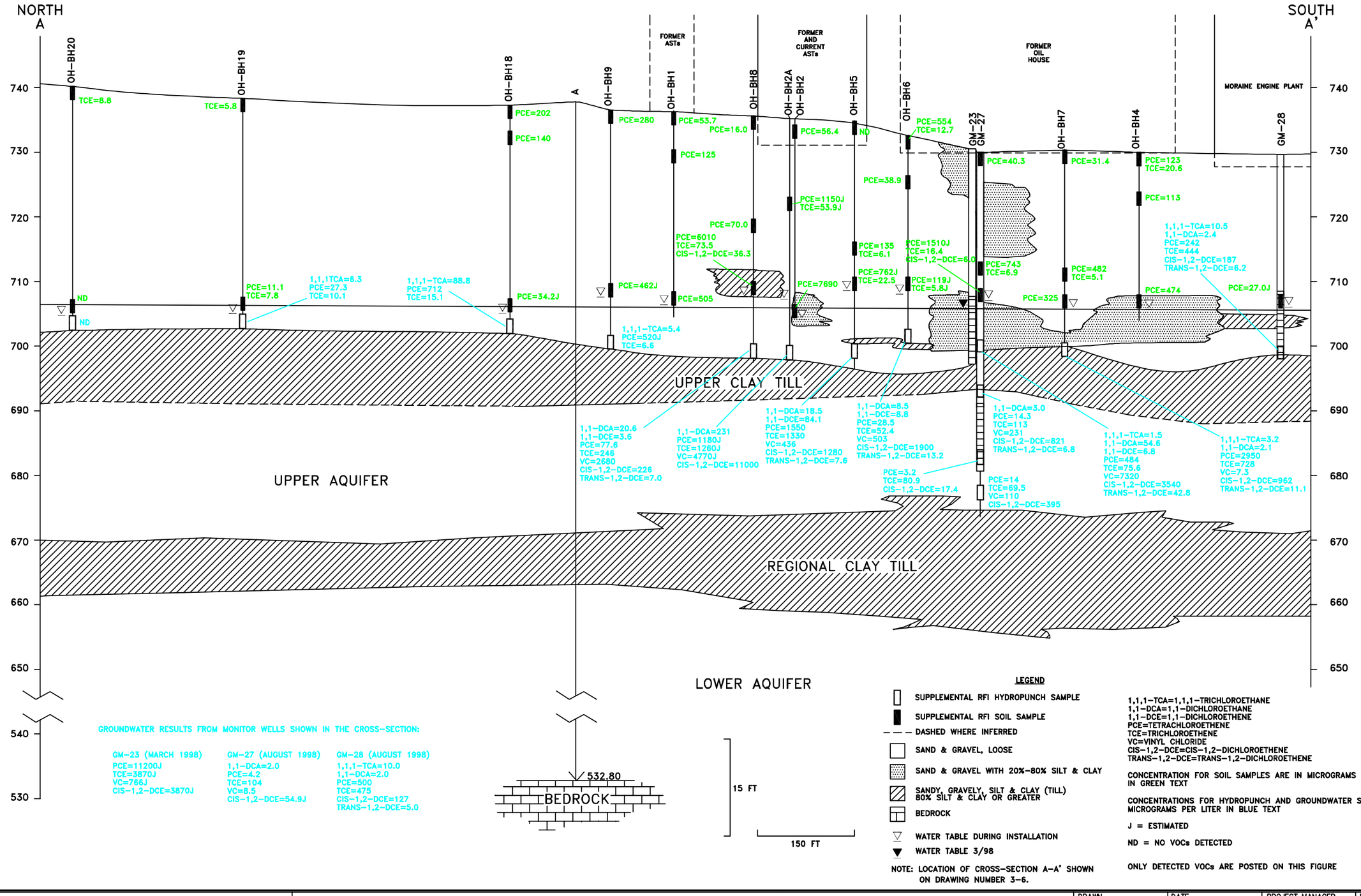
LINES OF CROSS SECTION FOR AOI 7 – FORMER OIL HOUSE AREA

GENERAL MOTORS CORPORATION
MORAINE, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
MAR99	J. REID	HARR\N-B\RFISUP1G
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH	J. REID	N. GILLOTTI
PROJECT NUMBER		DRAWING NUMBER
0H000294.0001.0002		3-6



GROUNDWATER RESULTS FROM MONITOR WELLS SHOWN IN THE CROSS-SECTION:

GM-23 (MARCH 1998)	GM-27 (AUGUST 1998)	GM-28 (AUGUST 1998)
PCE=11200J	1,1-DCA=2.0	1,1,1-TCA=10.0
TCE=3870J	PCE=4.2	1,1-DCA=2.0
VC=766J	TCE=104	PCE=500
CIS-1,2-DCE=3870J	VC=8.5	TCE=475
	CIS-1,2-DCE=54.9J	CIS-1,2-DCE=127
		TRANS-1,2-DCE=5.0

LEGEND

- SUPPLEMENTAL RFI HYDROPUNCH SAMPLE
- SUPPLEMENTAL RFI SOIL SAMPLE
- DASHED WHERE INFERRED
- SAND & GRAVEL, LOOSE
- SAND & GRAVEL WITH 20%-80% SILT & CLAY
- SANDY, GRAVELY, SILT & CLAY (TILL) 80% SILT & CLAY OR GREATER
- BEDROCK
- WATER TABLE DURING INSTALLATION
- WATER TABLE 3/98

NOTE: LOCATION OF CROSS-SECTION A-A' SHOWN ON DRAWING NUMBER 3-6.

1,1,1-TCA=1,1,1-TRICHLOROETHANE
1,1-DCA=1,1-DICHLOROETHANE
1,1-DCE=1,1-DICHLOROETHENE
PCE=TETRACHLOROETHENE
TCE=TRICHLOROETHENE
VC=VINYL CHLORIDE
CIS-1,2-DCE=CIS-1,2-DICHLOROETHENE
TRANS-1,2-DCE=TRANS-1,2-DICHLOROETHENE

CONCENTRATION FOR SOIL SAMPLES ARE IN MICROGRAMS PER KILOGRAM IN GREEN TEXT

CONCENTRATIONS FOR HYDROPUNCH AND GROUNDWATER SAMPLES ARE IN MICROGRAMS PER LITER IN BLUE TEXT

J = ESTIMATED

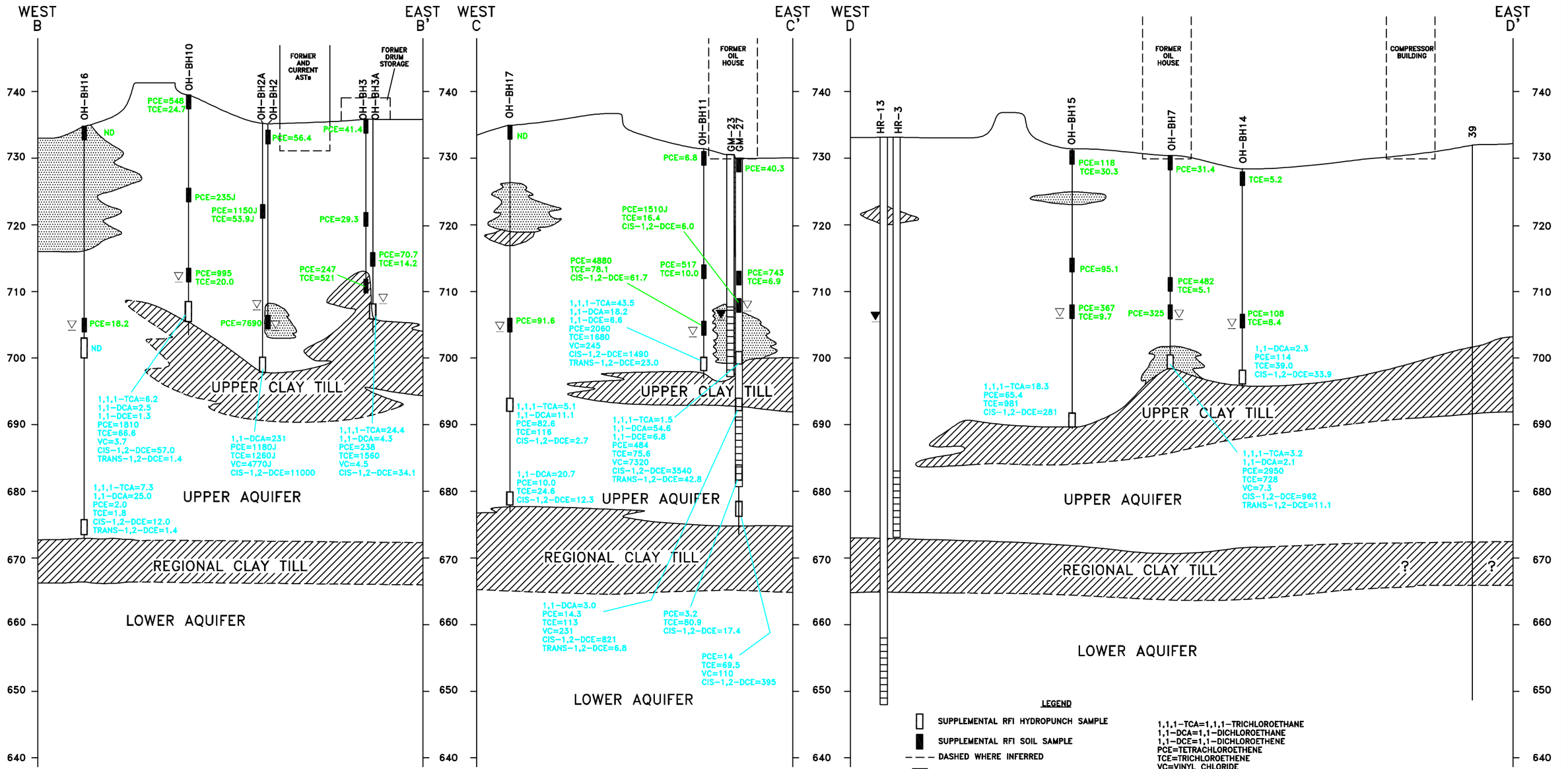
ND = NO VOCs DETECTED

ONLY DETECTED VOCs ARE POSTED ON THIS FIGURE

ARCADIS GERAGHTY&MILLER

CROSS SECTION A-A'
FOR AOI 7 - FORMER OIL HOUSE AREA
GENERAL MOTORS CORPORATION
MORAINE, OHIO

DRAWN	DATE	PROJECT MANAGER	DRAWING NAME
R. SMITH	27MAY99	J. REID	HAR\CRA\RFI\CS-01
		LEAD DESIGN PROF. J. REID	CHECKED N. GILLOTTI
		PROJECT NUMBER 0H0294.01.02	FIGURE NUMBER 3-7



GROUNDWATER RESULTS FROM MONITOR WELLS SHOWN IN THE CROSS-SECTIONS:

GM-23 (MARCH 1998)
PCE=11200J
TCE=3870J
VC=766J
CIS-1,2-DCE=3870J

GM-27 (AUGUST 1998)
1,1-DCA=2.0
PCE=4.2
TCE=104
VC=8.5
CIS-1,2-DCE=54.9J

GM-28 (AUGUST 1998)
1,1,1-TCA=10.0
1,1-DCA=2.0
PCE=500
TCE=475
CIS-1,2-DCE=127
TRANS-1,2-DCE=5.0

HR-3 (AUGUST 1998)
1,1-DCA=4.1
CIS-1,2-DCE=4.6

HR-13 (MARCH 1998)
1,1,1-TCA=1.3
1,1-DCA=48.3
TCE=2.8
CIS-1,2-DCE=23.3
TRANS-1,2-DCE=3.3

15 FT

150 FT

LEGEND

- SUPPLEMENTAL RFI HYDROPUNCH SAMPLE
- SUPPLEMENTAL RFI SOIL SAMPLE
- DASHED WHERE INFERRED
- SAND & GRAVEL, LOOSE
- SAND & GRAVEL WITH 20%-80% SILT & CLAY
- SANDY, GRAVELY, SILT & CLAY (TILL) 80% SILT & CLAY OR GREATER
- BEDROCK
- WATER TABLE DURING INSTALLATION
- WATER TABLE 3/98

NOTE: LOCATION OF CROSS-SECTION B-B', C-C', AND D-D' SHOWN ON DRAWING NUMBER 3-6.

1,1,1-TCA=1,1,1-TRICHLOROETHANE
1,1-DCA=1,1-DICHLOROETHANE
1,1-DCE=1,1-DICHLOROETHENE
PCE=TETRACHLOROETHENE
TCE=TRICHLOROETHENE
VC=VINYL CHLORIDE
CIS-1,2-DCE=CIS-1,2-DICHLOROETHENE
TRANS-1,2-DCE=TRANS-1,2-DICHLOROETHENE

CONCENTRATION FOR SOIL SAMPLES ARE IN MICROGRAMS PER KILOGRAM IN GREEN TEXT

CONCENTRATIONS FOR HYDROPUNCH AND GROUNDWATER SAMPLES ARE IN MICROGRAMS PER LITER IN BLUE TEXT

J = ESTIMATED

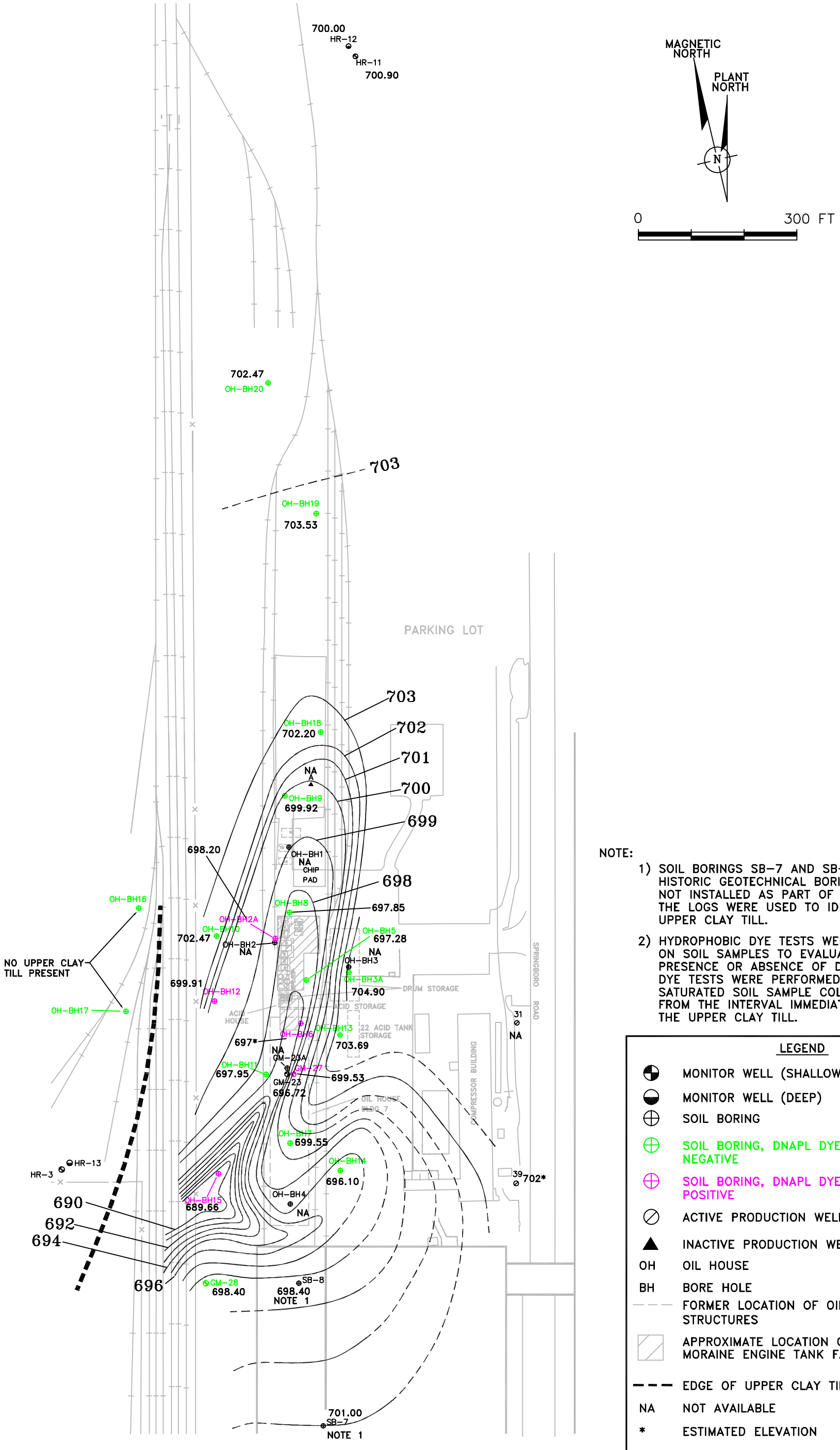
ND = NO VOCs DETECTED

ONLY DETECTED VOCs ARE POSTED ON THIS FIGURE

ARCADIS GERAGHTY & MILLER

CROSS SECTIONS B-B', C-C', AND D-D' FOR AOI 7 - FORMER OIL HOUSE AREA GENERAL MOTORS CORPORATION MORAINE, OHIO

DRAWN	DATE	PROJECT MANAGER	DRAWING NAME
R. SMITH	27MAY99	J. REID	HAR\CRA\RFI\CS-01
		LEAD DESIGN PROF. J. REID	CHECKED N. GILLOTTI
		PROJECT NUMBER 0H0294.01.02	FIGURE NUMBER 3-8



NOTE:

1) SOIL BORINGS SB-7 AND SB-8 WERE HISTORIC GEOTECHNICAL BORINGS AND NOT INSTALLED AS PART OF THE RFI THE LOGS WERE USED TO IDENTIFY THE UPPER CLAY TILL.
2) HYDROPHOBIC DYE TESTS WERE CONDUCTED ON SOIL SAMPLES TO EVALUATE THE PRESENCE OR ABSENCE OF DNAPL. THE DYE TESTS WERE PERFORMED ON A SATURATED SOIL SAMPLE COLLECTED FROM THE INTERVAL IMMEDIATELY ABOVE THE UPPER CLAY TILL.

LEGEND

- MONITOR WELL (SHALLOW)
- MONITOR WELL (DEEP)
- SOIL BORING
- SOIL BORING, DNAPL DYE TEST NEGATIVE
- SOIL BORING, DNAPL DYE TEST POSITIVE
- ACTIVE PRODUCTION WELL
- INACTIVE PRODUCTION WELL
- OH — OIL HOUSE
- BH — BORE HOLE
- FORMER LOCATION OF OIL HOUSE STRUCTURES
- APPROXIMATE LOCATION OF CURRENT MORAINE ENGINE TANK FARM
- EDGE OF UPPER CLAY TILL
- NA — NOT AVAILABLE
- * — ESTIMATED ELEVATION

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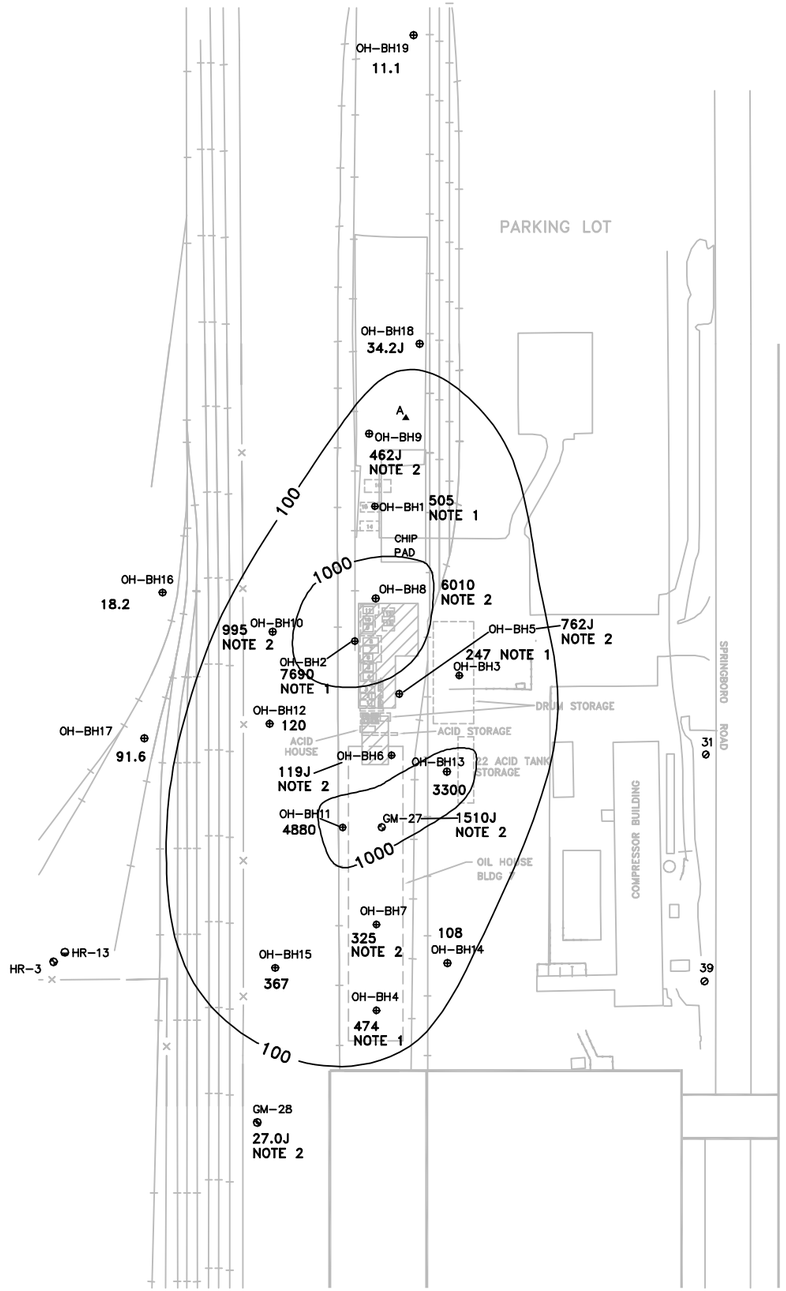
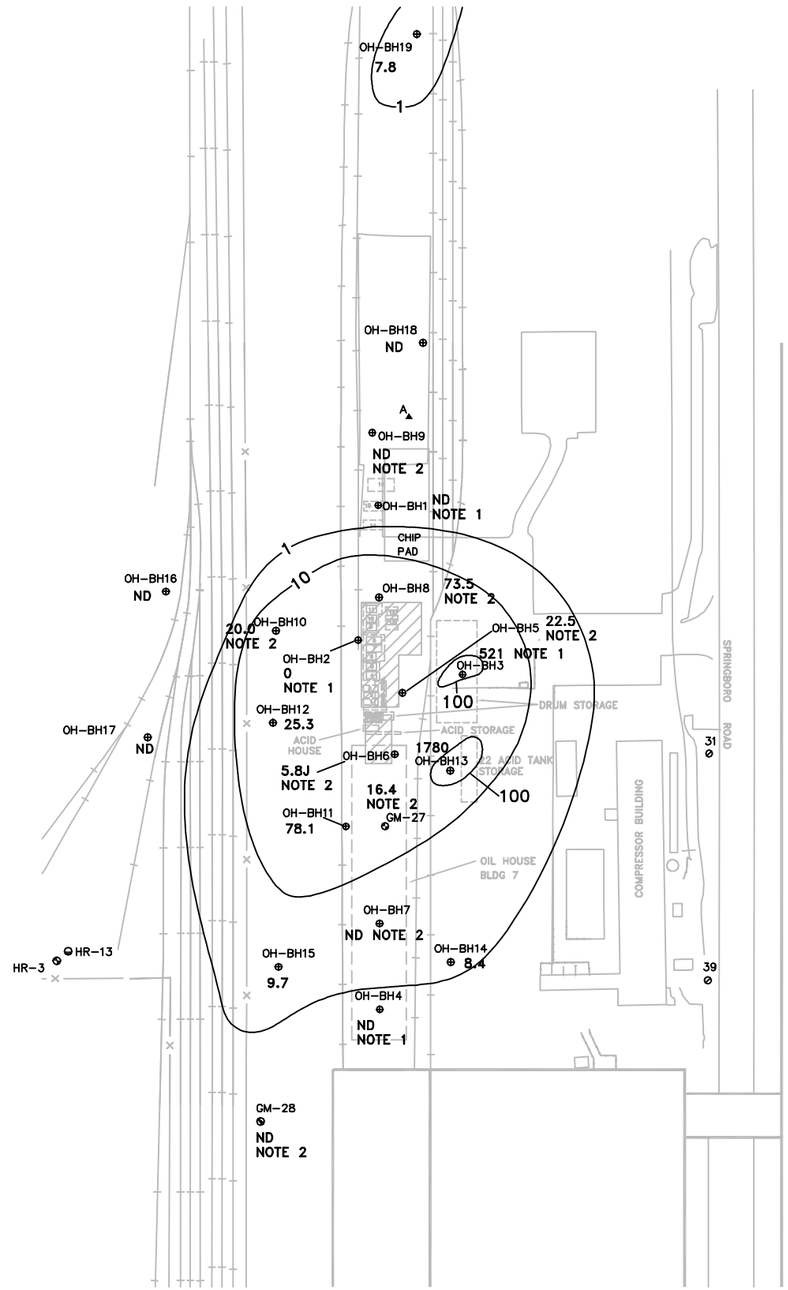
TOP OF UPPER CLAY TILL FOR AOI 7 – FORMER OIL HOUSE AREA

GENERAL MOTORS CORPORATION
MORAINE, OHIO

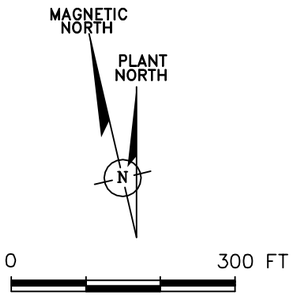
DATE	PROJECT MANAGER	DRAWING NAME
MAR99	J. REID	HARR\N-B\RFISUP1E
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH	J. REID	N. GILLOTTI
PROJECT NUMBER		DRAWING NUMBER
0H000294.0001.0002		3-9



PCE CONCENTRATIONS



TCE CONCENTRATIONS



PCE/TCE CONTOURS HAVE BEEN DEVELOPED TO REPRESENT SOIL CONCENTRATIONS ABOVE THE WATER TABLE DURING NOVEMBER 1998, UNLESS OTHERWISE NOTED.

NOTES

1) DATA FROM MARCH 1998 SUPPLEMENTAL RFI SOIL SAMPLING.
2) DATA FROM AUGUST 1998 SUPPLEMENTAL RFI SOIL SAMPLING.

LEGEND

- MONITOR WELL (SHALLOW)
- MONITOR WELL (DEEP)
- SOIL BORING
- ACTIVE PRODUCTION WELL
- INACTIVE PRODUCTION WELL
- OH — OIL HOUSE
- BH — BORE HOLE
- FORMER LOCATION OF OIL HOUSE STRUCTURES
- APPROXIMATE LOCATION OF CURRENT MORAINE ENGINE TANK FARM

TETRACHLOROETHENE (PCE) AND TRICHLOROETHENE (TCE) CONCENTRATIONS ARE REPRESENTED IN MICROGRAMS PER KILOGRAM

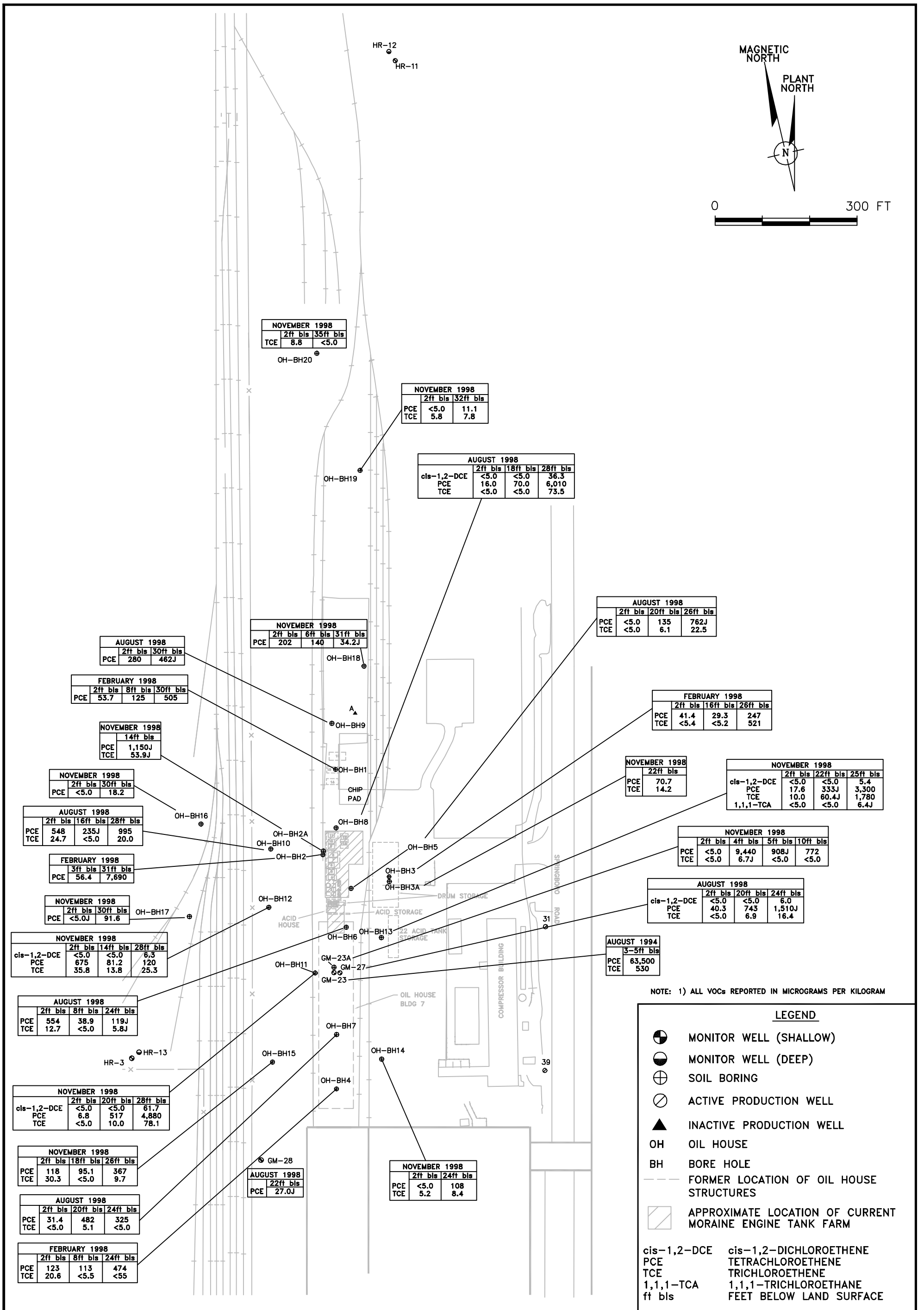
ND — NOT DETECTED

ARCADIS GERAGHTY & MILLER

PCE/TCE CONCENTRATIONS IN SOIL ABOVE WATER TABLE FOR AOI 7 – FORMER OIL HOUSE AREA

GENERAL MOTORS CORPORATION
MORAINE, OHIO

DRAWN	DATE	PROJECT MANAGER	DRAWING NAME
R. SMITH	27MAY99	J. REID	HAR\CRA\AOI7-03
		LEAD DESIGN PROF. J. REID	CHECKED N. GILLOTTI
		PROJECT NUMBER	FIGURE NUMBER
		OH0294.01.02	3-10



NOVEMBER 1998	2ft bls	35ft bls
TCE	8.8	<5.0

NOVEMBER 1998	2ft bls	32ft bls
PCE	<5.0	11.1
TCE	5.8	7.8

AUGUST 1998	2ft bls	18ft bls	28ft bls
cis-1,2-DCE	<5.0	<5.0	36.3
PCE	16.0	70.0	6,010
TCE	<5.0	<5.0	73.5

AUGUST 1998	2ft bls	20ft bls	26ft bls
PCE	<5.0	135	762J
TCE	<5.0	6.1	22.5

NOVEMBER 1998	2ft bls	6ft bls	31ft bls
PCE	202	140	34.2J

AUGUST 1998	2ft bls	30ft bls
PCE	280	462J

FEBRUARY 1998	2ft bls	8ft bls	30ft bls
PCE	53.7	125	505

FEBRUARY 1998	2ft bls	16ft bls	26ft bls
PCE	41.4	29.3	247
TCE	<5.4	<5.2	521

NOVEMBER 1998	14ft bls
PCE	1,150J
TCE	53.9J

NOVEMBER 1998	22ft bls
PCE	70.7
TCE	14.2

NOVEMBER 1998	2ft bls	22ft bls	25ft bls
cis-1,2-DCE	<5.0	<5.0	5.4
PCE	17.6	333J	3,300
TCE	10.0	60.4J	1,780
1,1,1-TCA	<5.0	<5.0	6.4J

NOVEMBER 1998	2ft bls	30ft bls
PCE	<5.0	18.2

AUGUST 1998	2ft bls	16ft bls	28ft bls
PCE	548	235J	995
TCE	24.7	<5.0	20.0

NOVEMBER 1998	2ft bls	4ft bls	5ft bls	10ft bls
PCE	<5.0	9,440	908J	772
TCE	<5.0	6.7J	<5.0	<5.0

FEBRUARY 1998	3ft bls	31ft bls
PCE	56.4	7,690

AUGUST 1998	2ft bls	20ft bls	24ft bls
cis-1,2-DCE	<5.0	<5.0	6.0
PCE	40.3	743	1,510J
TCE	<5.0	6.9	16.4

NOVEMBER 1998	2ft bls	30ft bls
PCE	<5.0J	91.6

NOVEMBER 1998	2ft bls	14ft bls	28ft bls
cis-1,2-DCE	<5.0	<5.0	6.3
PCE	675	81.2	120
TCE	35.8	13.8	25.3

AUGUST 1994	3-5ft bls
PCE	63,500
TCE	530

AUGUST 1998	2ft bls	8ft bls	24ft bls
PCE	554	38.9	119J
TCE	12.7	<5.0	5.8J

NOVEMBER 1998	2ft bls	20ft bls	28ft bls
cis-1,2-DCE	<5.0	<5.0	61.7
PCE	6.8	517	4,880
TCE	<5.0	10.0	78.1

NOVEMBER 1998	2ft bls	18ft bls	26ft bls
PCE	118	95.1	367
TCE	30.3	<5.0	9.7

AUGUST 1998	22ft bls
PCE	27.0J

NOVEMBER 1998	2ft bls	24ft bls
PCE	<5.0	108
TCE	5.2	8.4

AUGUST 1998	2ft bls	20ft bls	24ft bls
PCE	31.4	482	325
TCE	<5.0	5.1	<5.0

FEBRUARY 1998	2ft bls	8ft bls	24ft bls
PCE	123	113	474
TCE	20.6	<5.5	<55

NOTE: 1) ALL VOCs REPORTED IN MICROGRAMS PER KILOGRAM

LEGEND

- MONITOR WELL (SHALLOW)
- MONITOR WELL (DEEP)
- SOIL BORING
- ACTIVE PRODUCTION WELL
- INACTIVE PRODUCTION WELL
- OH — OIL HOUSE
- BH — BORE HOLE
- FORMER LOCATION OF OIL HOUSE STRUCTURES
- APPROXIMATE LOCATION OF CURRENT MORAINE ENGINE TANK FARM

cis-1,2-DCE	cis-1,2-DICHLOROETHENE
PCE	TETRACHLOROETHENE
TCE	TRICHLOROETHENE
1,1,1-TCA	1,1,1-TRICHLOROETHANE
ft bls	FEET BELOW LAND SURFACE

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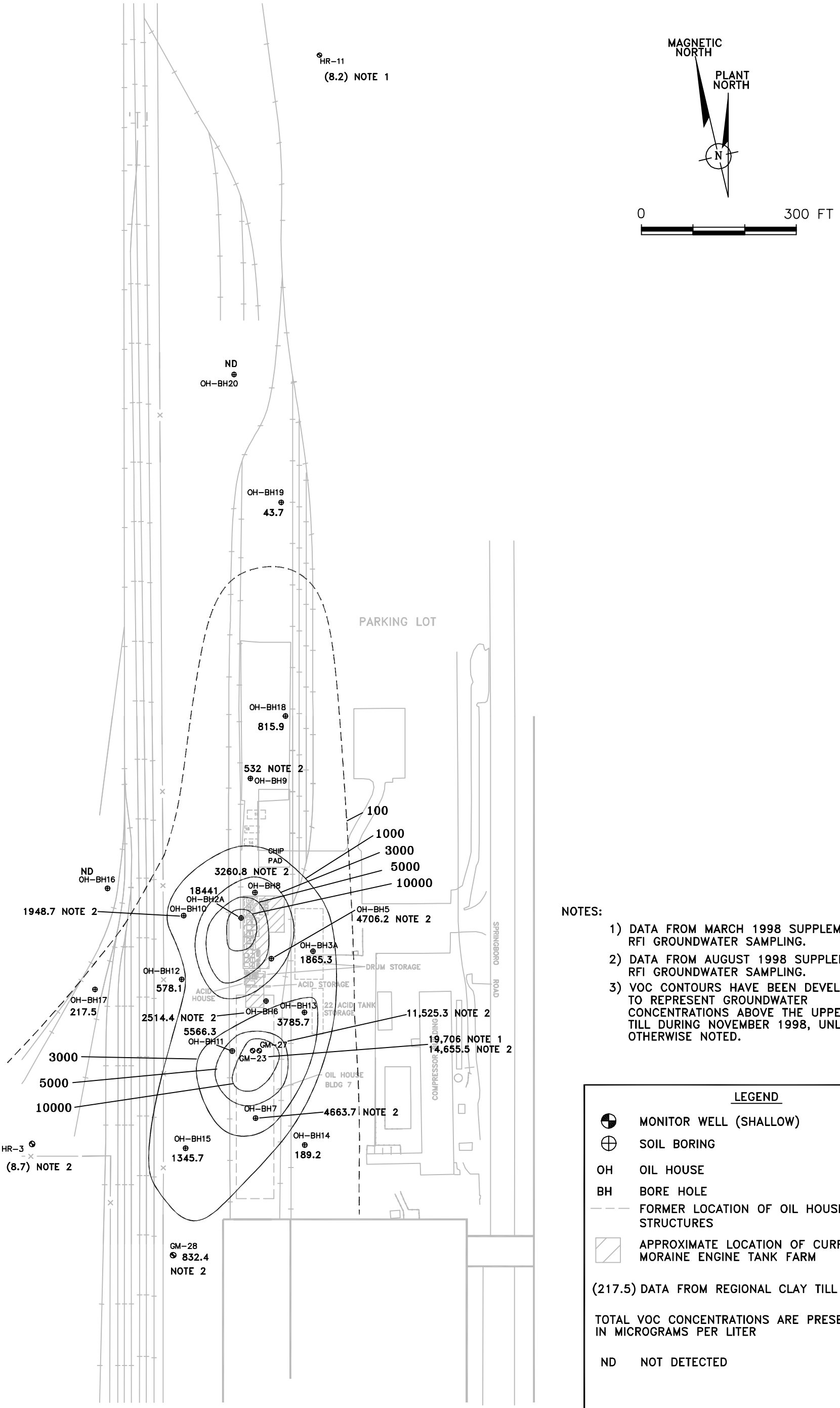
VOC CONCENTRATIONS IN SOIL
AOI 7 - FORMER OIL HOUSE AREA
GENERAL MOTORS CORPORATION
MORAINE, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
MAR99	J. REID	HAR\CRA\\OH294-03
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH	J. REID	N. GILLOTTI
PROJECT NUMBER		DRAWING NUMBER
0H000294.0001.0002		3-11



NOTES:

1) DATA FROM MARCH 1998 SUPPLEMENTAL RFI GROUNDWATER SAMPLING.
2) DATA FROM AUGUST 1998 SUPPLEMENTAL RFI GROUNDWATER SAMPLING.
3) VOC CONTOURS HAVE BEEN DEVELOPED TO REPRESENT GROUNDWATER CONCENTRATIONS ABOVE THE UPPER CLAY TILL DURING NOVEMBER 1998, UNLESS OTHERWISE NOTED.

LEGEND

- MONITOR WELL (SHALLOW)
- SOIL BORING
- OH OIL HOUSE
- BH BORE HOLE
- FORMER LOCATION OF OIL HOUSE STRUCTURES
- APPROXIMATE LOCATION OF CURRENT MORAINE ENGINE TANK FARM

(217.5) DATA FROM REGIONAL CLAY TILL

TOTAL VOC CONCENTRATIONS ARE PRESENTED IN MICROGRAMS PER LITER

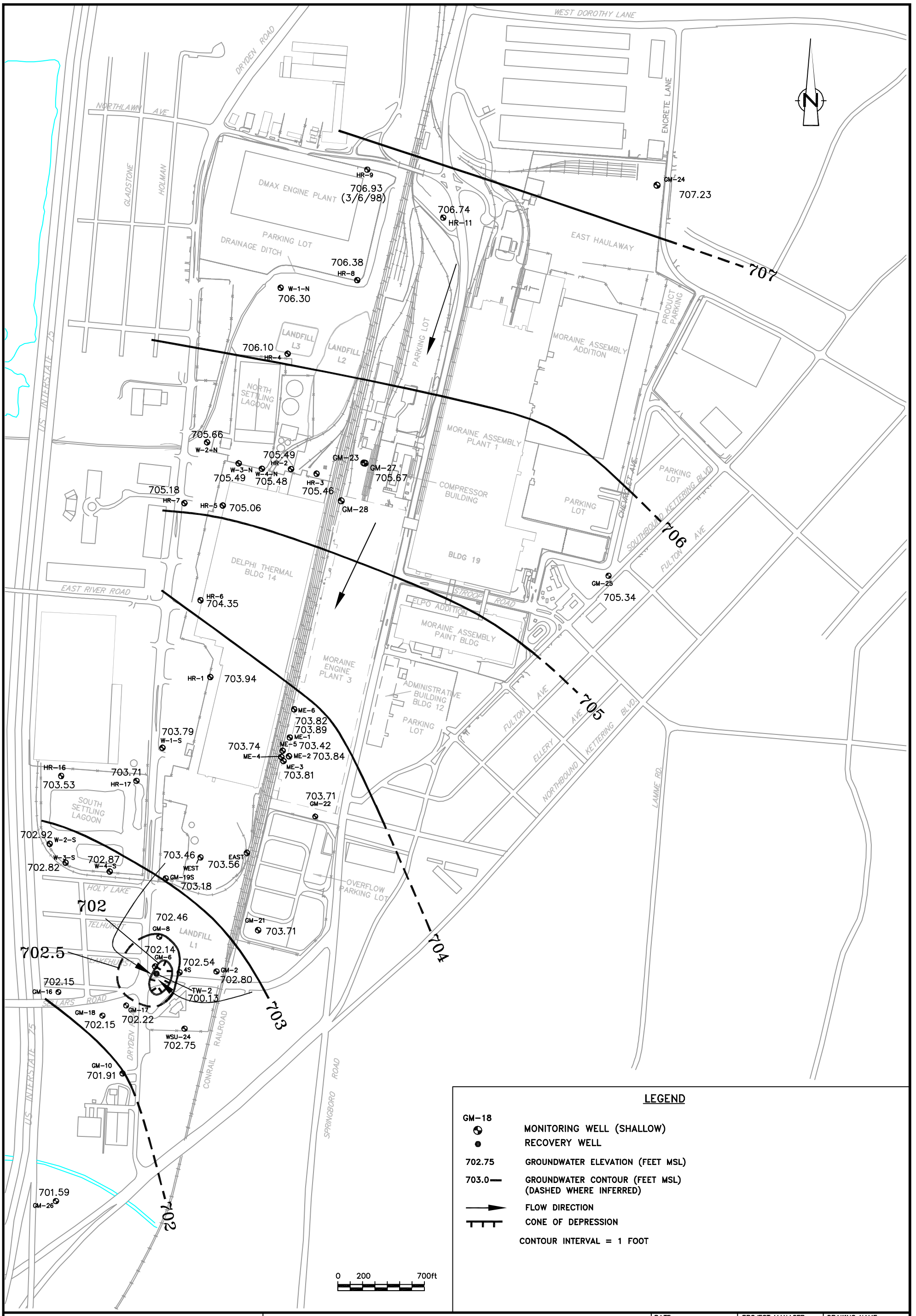
ND NOT DETECTED

ARCADIS GERAGHTY & MILLER
6397 Emerald Parkway
Suite 150, Dublin, OH 43016
Tel: 614/764-2310 Fax: 614/764-1270

TOTAL VOC CONCENTRATIONS IN SHALLOW GROUNDWATER FOR AOI 7 – FORMER OIL HOUSE AREA

GENERAL MOTORS CORPORATION
MORAINE, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
MAR99	J. REID	HARR\N-B\RFISUP1F
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH	J. REID	N. GILLOTTI
PROJECT NUMBER		DRAWING NUMBER
0H000294.0001.0002		3-12



LEGEND

GM-18	MONITORING WELL (SHALLOW)
	RECOVERY WELL
702.75	GROUNDWATER ELEVATION (FEET MSL)
703.0	GROUNDWATER CONTOUR (FEET MSL) (DASHED WHERE INFERRED)
	FLOW DIRECTION
	CONE OF DEPRESSION

CONTOUR INTERVAL = 1 FOOT

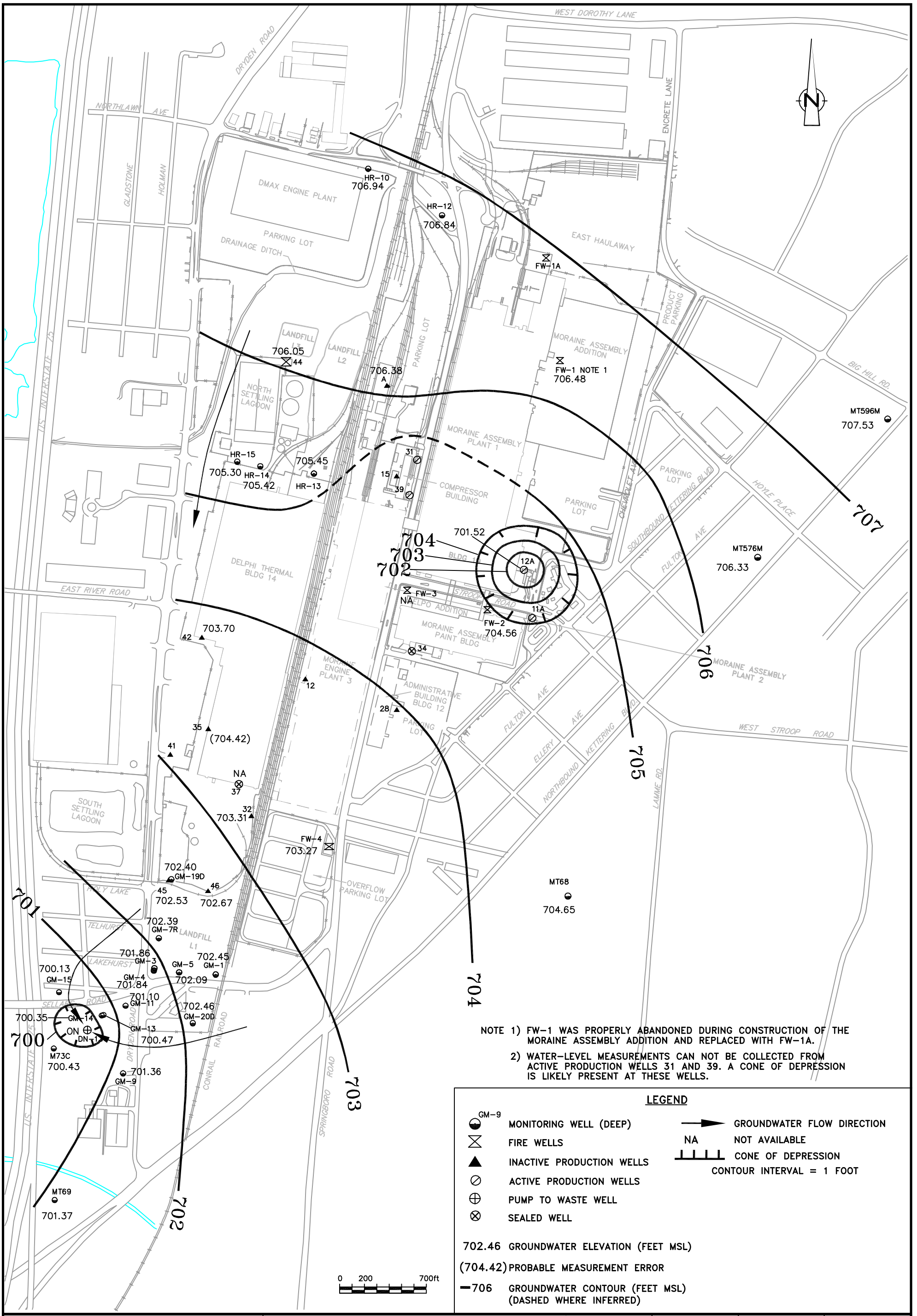
ARCADIS GERAGHTY&MILLER

6397 Emerald Parkway
Suite 150, Dublin, OH 43016
Tel: 614/764-2310 Fax: 614/764-1270

WATER TABLE SURFACE ON MARCH 11 AND 12, 1998

GENERAL MOTORS CORPORATION,
MORAINE, OHIO

DATE 05MAY99	PROJECT MANAGER J. REID	DRAWING NAME \CRA\RFI\SHAL
DRAWN R. SMITH	LEAD DESIGN PROF.	CHECKED N. GILLOTTI
PROJECT NUMBER 0H000294.0001.0002		FIGURE NUMBER 4-1



NOTE 1) FW-1 WAS PROPERLY ABANDONED DURING CONSTRUCTION OF THE MORAINE ASSEMBLY ADDITION AND REPLACED WITH FW-1A.

2) WATER-LEVEL MEASUREMENTS CAN NOT BE COLLECTED FROM ACTIVE PRODUCTION WELLS 31 AND 39. A CONE OF DEPRESSION IS LIKELY PRESENT AT THESE WELLS.

LEGEND

- GM-9 — MONITORING WELL (DEEP)
- FIRE WELLS
- INACTIVE PRODUCTION WELLS
- ACTIVE PRODUCTION WELLS
- PUMP TO WASTE WELL
- SEALED WELL
- GROUNDWATER FLOW DIRECTION
- NA — NOT AVAILABLE
- CONE OF DEPRESSION
- CONTOUR INTERVAL = 1 FOOT
- 702.46 — GROUNDWATER ELEVATION (FEET MSL)
- (704.42) — PROBABLE MEASUREMENT ERROR
- 706 — GROUNDWATER CONTOUR (FEET MSL) (DASHED WHERE INFERRED)

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Suite 150, Dublin, OH 43016
Tel: 614/764-2310 Fax: 614/764-1270

POTENTIOMETRIC SURFACE ON MARCH 11 AND 12, 1998 GENERAL MOTORS CORPORATION MORAINE, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
05MAY99	J. REID	\CRA\RFI\DEEP
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH		N. GILLOTTI
PROJECT NUMBER		FIGURE NUMBER
0H000294.0001.0002		4-2

MARCH 1998	
1,1-DCA	6.8
cis-1,2-DCE	1.4

MARCH 1998	
1,1,1-TCA	15
1,1-DCA	56.2
1,2-DCA	1.8
TCE	14
cis-1,2-DCE	20.9
T-1,2-DCE	2.8

MARCH 1998	
1,1,1-TCA	1.1
BrDICHLMTHN	3.4
CHLOROFORM	15.1

	MAR-98	AUG-98
1,1,1-TCA	<200J	4.2
1,1-DCA	<200J	10.9
1,1-DCE	<200J	7
PCE	11200J	8800
TCE	3870J	1190
cis-1,2-DCE	3870J	3710
T-1,2-DCE	<200J	19.4
VC	766J	914

AUGUST 1998	
1,1-DCA	2
PCE	4.2
TCE	104
cis-1,2-DCE	54.9J
VC	8.5

MARCH 1998	
PCE	2.6
cis-1,2-DCE	289
T-1,2-DCE	3.6
VC	20.4

AUGUST 1998	
1,1-DCA	4.1
cis-1,2-DCE	4.6

AUGUST 1998	
1,1,1-TCA	10
1,1-DCA	2
PCE	500
TCE	475
cis-1,2-DCE	127
T-1,2-DCE	5

	MAR-98	AUG-98
1,1,1-TCA	1.5	ND
1,1-DCA	2.1	1.5
FTCA	3.2	ND
PCE	48.8	47.1
TCE	69.8	46
cis-1,2-DCE	10.6	9.4
T-1,2-DCE	2.6	1.6

MARCH 1998	
ALL VOCs	ND

MARCH 1998	
FTCA	3.7
PCE	29
TCE	9.4
cis-1,2-DCE	5
T-1,2-DCE	1.2

	MAR-98	AUG-98
1,1,1-TCA	2.4	26.1
1,1-DCA	ND	3.4
PCE	193	114
TCE	456	312
cis-1,2-DCE	15.2	17.2
T-1,2-DCE	1.1	<1.0

MARCH 1998	
1,1,1-TCA	1.6J
PCE	7J
TCE	4.5J

MARCH 1998	
1,1-DCA	1.3
PCE	5.1
TCE	4.5
cis-1,2-DCE	1.6

MARCH 1998	
1,1,1-TCA	35.3
1,1-DCA	13.5
1,1-DCE	1.4
PCE	75.6
TCE	64.1
cis-1,2-DCE	36
VC	6.2

MARCH 1998	
1,1,1-TCA	17.5
1,1-DCA	6.4
1,1-DCE	1.3
PCE	66.2
TCE	64
cis-1,2-DCE	13.9
T-1,2-DCE	6.4

MARCH 1998	
1,1,1-TCA	55
1,1-DCA	7.6
1,1-DCE	4.5
FTCA	4.9
TCE	356
cis-1,2-DCE	74.5
T-1,2-DCE	3.6

MARCH 1998	
1,1,1-TCA	6.7
1,1-DCA	49.3
1,1-DCE	1.0
PCE	20
TCE	95.2
cis-1,2-DCE	56.1
T-1,2-DCE	10
VC	10.1
BENZENE	2.3
CHA	16.2
ETHYLBENZENE	28.9
XYLENE	10.3

MARCH 1998	
1,1,1-TCA	5.9J
1,1-DCA	1.7J
PCE	8.5J
TCE	75.1J
cis-1,2-DCE	10.5J

MARCH 1998	
1,1,1-TCA	36.2
1,1-DCA	35.3
PCE	94
TCE	119
cis-1,2-DCE	82.4
T-1,2-DCE	2.4
VC	2.3

MARCH 1998	
1,1,1-TCA	1.7
PCE	1.3
TCE	14.2

MARCH 1998	
1,1,1-TCA	2.3
1,1-DCA	1.5
PCE	1.5
TCE	28
cis-1,2-DCE	3.6

	MAR-98	AUG-98
PCE	<1.0	1.2

LEGEND

- MONITOR WELL (SHALLOW)
- RECOVERY WELL
- MONITOR WELL (SHALLOW) SAMPLED IN MARCH OR AUGUST 1998

1,1,1-TCA	1,1,1-TRICHLOROETHANE
1,1-DCA	1,1-DICHLOROETHANE
1,1-DCE	1,1-DICHLOROETHENE
1,2-DCA	1,2-DICHLOROETHANE
PCE	TETRACHLOROETHENE
TCE	TRICHLOROETHENE
cis-1,2-DCE	cis-1,2-DICHLOROETHENE
T-1,2-DCE	trans-1,2-DICHLOROETHENE
FTCA	FLUOROTRICHLOROMETHANE
VC	VINYL CHLORIDE
BrDICHLMTHN	BROMODICHLOROMETHANE
CHLOROFORM	CHLOROFORM
CHA	CHLOROETHANE
ND	NON DETECT
9.4	EXCEEDS THE MAXIMUM CONTAMINANT LEVEL

ALL VOC CONCENTRATIONS REPORTED IN MICROGRAMS PER LITER (ug/L)

* WELL SCREENED ABOVE THE UPPER CLAY TILL

NOTES:

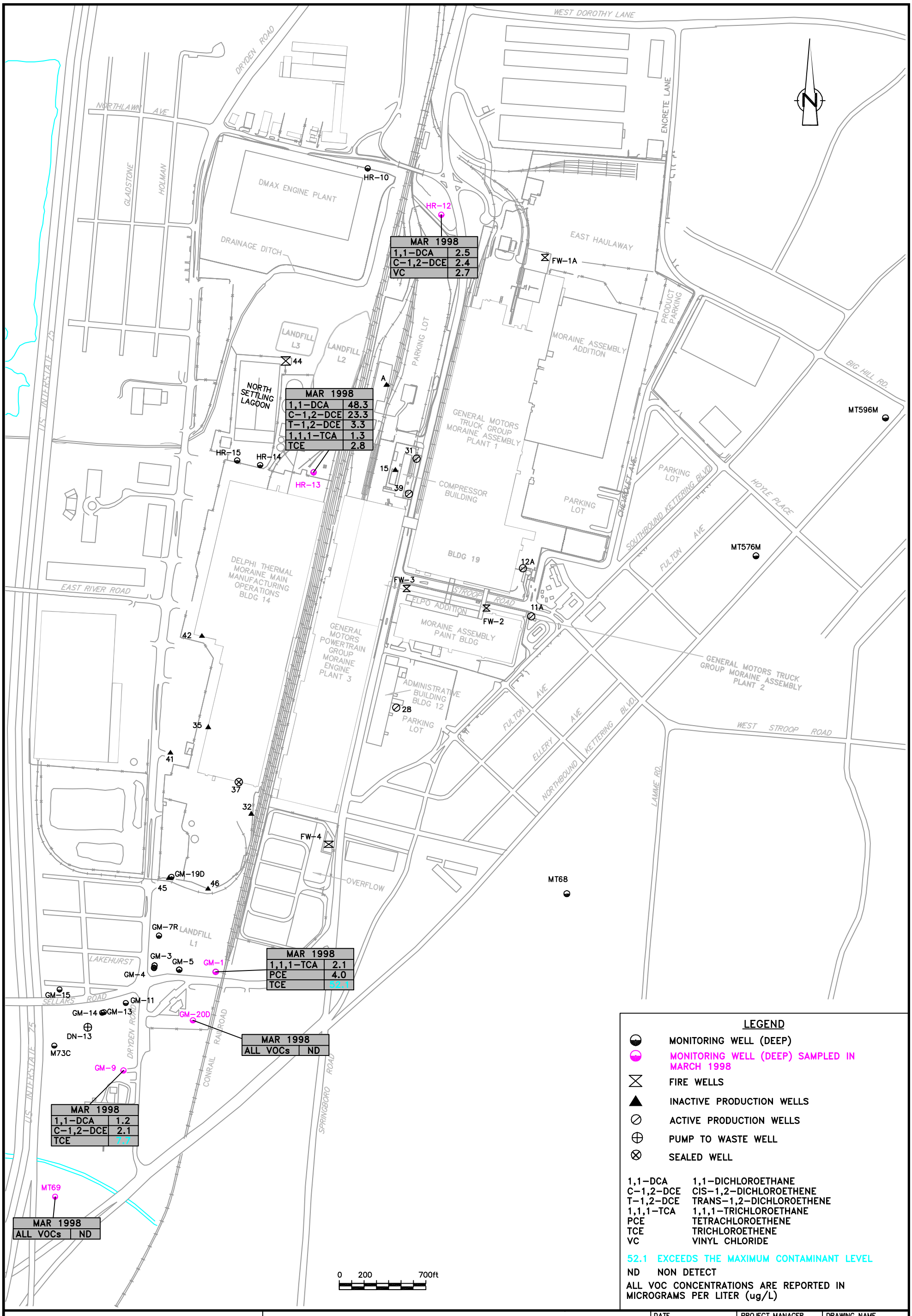
1) WELLS GM-23, GM-26, GM-27, GM-28, ME-6, HR-1, AND HR-3 WERE SAMPLED IN AUGUST 1998.

0 200 700ft

ARCADIS GERAGHTY&MILLER
6397 Emerald Parkway
Suite 150, Dublin, OH 43016
Tel: 614/764-2310 Fax: 614/764-1270

VOC CONCENTRATIONS IN UPPER AQUIFER MONITORING WELLS SUPPLEMENTAL RFI GENERAL MOTORS CORPORATION, MORAINE, OHIO

DATE 13MAR00	PROJECT MANAGER N. GILLOTTI	DRAWING NAME \CRA\EPAFIGS\EPA-03
DRAWN R. SMITH	LEAD DESIGN PROF.	CHECKED N. GILLOTTI
PROJECT NUMBER 0H000294.0002.0001		FIGURE NUMBER 4-3



LEGEND

- MONITORING WELL (DEEP)
- MONITORING WELL (DEEP) SAMPLED IN MARCH 1998
- FIRE WELLS
- INACTIVE PRODUCTION WELLS
- ACTIVE PRODUCTION WELLS
- PUMP TO WASTE WELL
- SEALED WELL

1,1-DCA	1,1-DICHLOROETHANE
C-1,2-DCE	CIS-1,2-DICHLOROETHENE
T-1,2-DCE	TRANS-1,2-DICHLOROETHENE
1,1,1-TCA	1,1,1-TRICHLOROETHANE
PCE	TETRACHLOROETHENE
TCE	TRICHLOROETHENE
VC	VINYL CHLORIDE

52.1 EXCEEDS THE MAXIMUM CONTAMINANT LEVEL

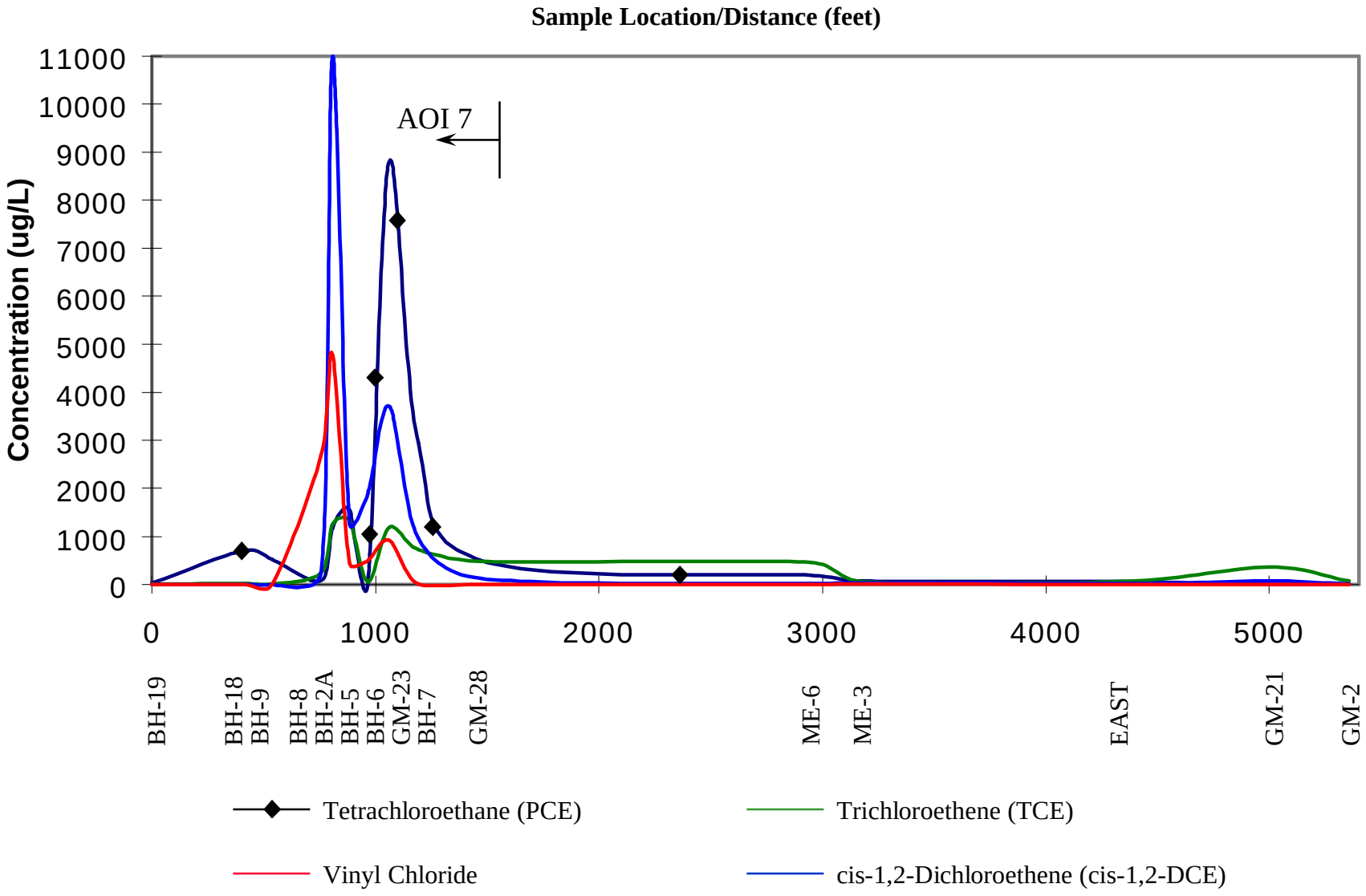
ND NON DETECT

ALL VOC CONCENTRATIONS ARE REPORTED IN MICROGRAMS PER LITER (ug/L)

ARCADIS GERAGHTY & MILLER
6397 Emerald Parkway
Suite 150, Dublin, OH 43016
Tel: 614/764-2310 Fax: 614/764-1270

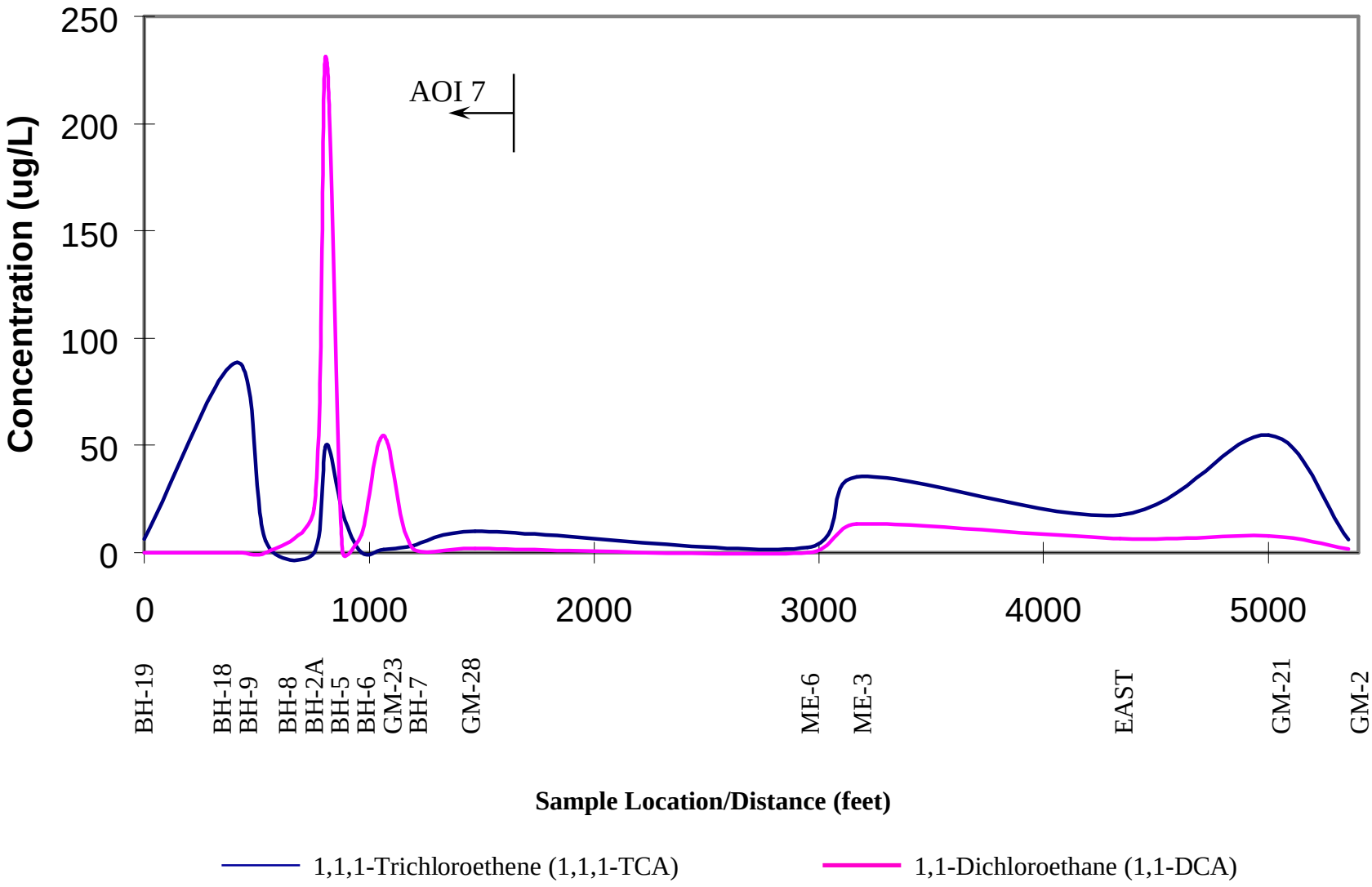
VOC CONCENTRATIONS IN LOWER AQUIFER MONITORING WELLS SUPPLEMENTAL RFI, GENERAL MOTORS CORPORATION, MORAINE, OHIO

DATE 13MAR00	PROJECT MANAGER N. GILLOTTI	DRAWING NAME CRA\EPAFIGS\EPA-04
DRAWN R. SMITH	LEAD DESIGN PROF.	CHECKED N. GILLOTTI
PROJECT NUMBER 0H000294.0002.0001		FIGURE NUMBER 4-3A



ARCADIS Geraghty & Miller

Figure 4-4. PCE/TCE/cis-1,2-DCE/VC North South Groundwater Concentration Graph, General Motors Corporation, Moraine, Ohio.



ARCADIS Geraghty & Miller

Figure 4-5. TCA/DCA North South Groundwater Concentration Graph, General Motors Corporation, Moraine, Ohio.

Appendix A

Supplemental RFI Agency Correspondence

AOI 34 - Excavation Area 1
and AOI 35 - Excavation Area 2

August 6, 1997

Mr. William Buller
U.S. EPA Region 5
Enforcement and Compliance Assurance Branch, HRE-8J
77 West Jackson Boulevard
Chicago, IL 60604-3590

RE: General Motors Truck Group Moraine Assembly Plant Expansion Project

Dear Mr. Buller:

The Moraine Truck Group Assembly Plant is in the early phase of an expansion project which will allow it to produce a new vehicle. While the primary purpose of this letter is to discuss the impact of this project on AOI 34 and AOI 35, I have included a general overview for informational purposes. Following is a description of the major components of this project. I have included a modified figure from the Supplemental RFI Work Plan which locates each of these areas.

Area A: This is a 80,000 ft.^{2} expansion to the existing Paint Building. It will house a new phosphate system and paint system. It is currently under construction and is projected to be completed in July, 1998. This expansion caused the abandonment of Production Well 12 (Supplemental DOCC, Page 1-13). The location of replacement Well 12A is shown on the attached figure.

Area B: This is a 60,000 ft.^{2} expansion at the north end of Plant 1. It is currently under construction and is projected to be completed in December 1997. Once completed, it will house the Tire and Wheel Operations.

Area C: This is a 700,000 ft.^{2} expansion to Plant 1, which when completed, will house assembly operations. This expansion will place a building in the immediate proximity of AOI 35. It is scheduled to start in March, 1998 and be completed in October, 2000.

Area D: To replace the parking lot lost due to the 700,000 ft.^{2} assembly addition, a new asphalt parking lot will be constructed in the area shown. Construction is scheduled to start in October, 1997 and to be completed in November, 1997.

Area E: As part of the expansion project, the Trim Assembly Operations will be relocated in Plant 2. To support these operations, a new parking lot will be constructed in the area shown. This lot will be constructed on top of AOI 34. Construction is scheduled to start in September, 1997 and be completed in November, 1997.

Area F: To accommodate logistic needs, the West Haulaway will be expanded as shown on the figure. The expansion of the West Haulaway is scheduled to start in September, 1997 and be completed in December, 1997.

As discussed in earlier phone conversations, GM has conducted the survey of AOI 34 and AOI 35 to determine the historical location of these excavation areas. The survey confirms that the assembly building will be constructed in the immediate proximity of AOI 35 and a asphalt parking lot on top of AOI 34. As a result, the proposed RFI sampling in these areas needs to be accelerated. General Motors request that the Agency expedite their review of this portion of the Supplemental RFI Work Plan (Sections 3.2.4 and 3.2.5) so that agreement can be reached on the RFI sampling at these locations. GM would like to conduct the initial borings at these locations in late August, 1997. This will allow for additional sampling to confirm a release, if any, and to evaluate the nature and extent of any such release as necessary to support the Supplemental Baseline Risk Assessment. Once the Agency has reviewed both this information and the pertinent sections of the Supplemental DOCC and Supplemental RFI Workplan, I would suggest a conference call before August 20, 1997 to discuss sampling in these areas. I will call you so we can establish a date and time for this call.

Sincerely,

Norman J Sawdey

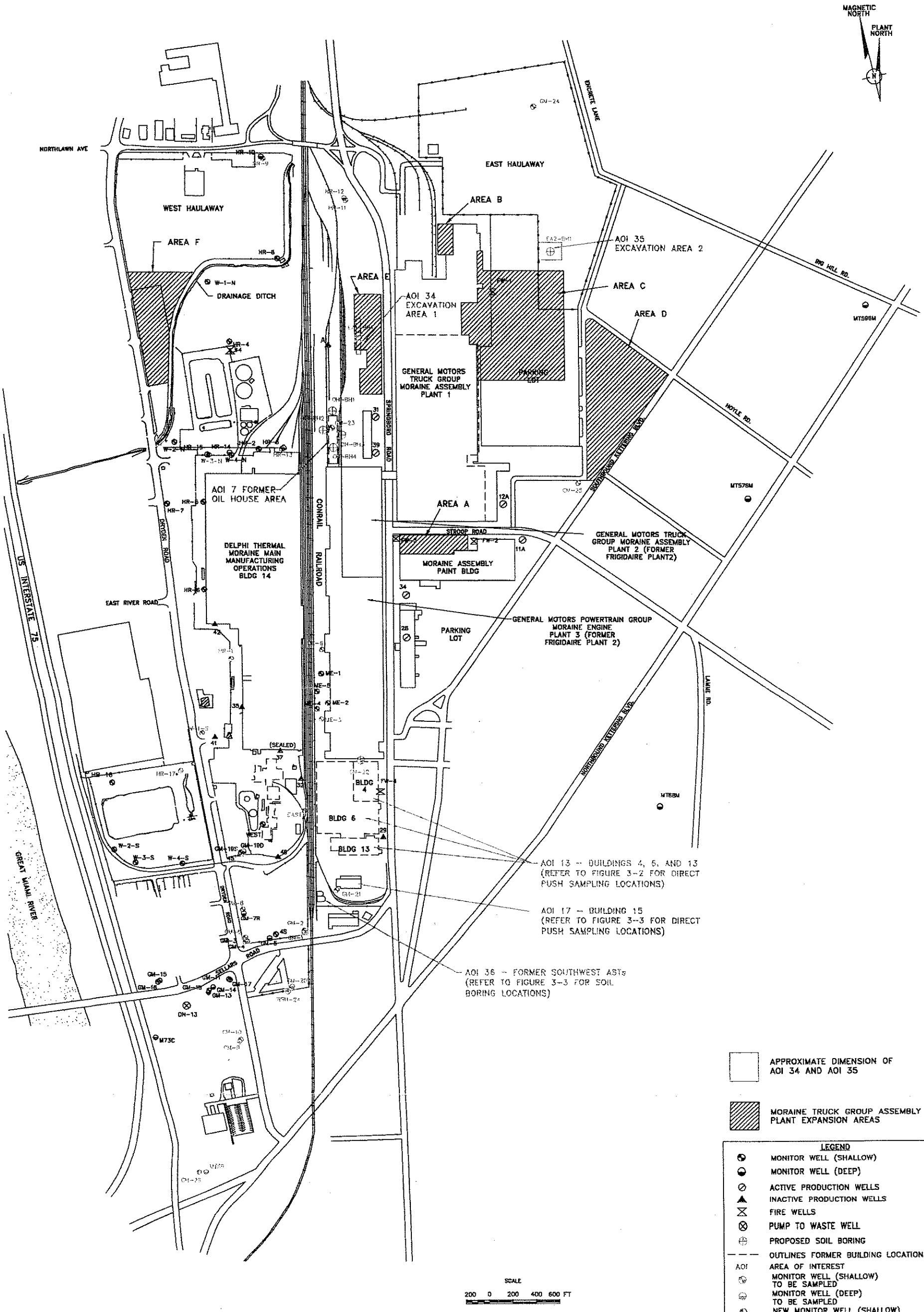
Norman J. Sawdey

Enclosure

c: C. Cotton, OEPA

/NJS07287

DWG DA	PR97	PRJCT NO.: OH0293.001	FILE NO.: NB\SUPPLRFI	DRAWING: RFI	CHECKED: J.R.	APPROVED: J.R.	DRAFTER:



NOTE: WATER LEVEL MEASUREMENTS WILL BE TAKEN FROM ALL WELLS INDICATED ON THIS FIGURE.

GERAGHTY & MILLER, INC.
Environmental Services

MONITOR WELL, AOI, AND PROPOSED SOIL BORING LOCATION MAP

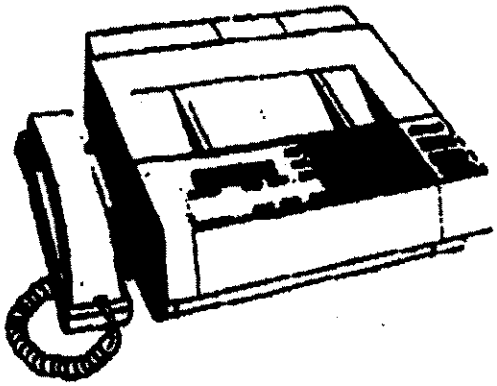
SUPPLEMENTAL RFI WORK PLAN

GENERAL MOTORS CORPORATION
MORAINE, OHIO

FIGURE
1-2

Waste, Pesticides & Toxics Division
Enforcement & Compliance Assurance Branch
U.S. Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Mailcode HRE-8J
Chicago, Illinois 60604

FACSIMILE REQUEST



To: Norm Sawdey
Office/Phone (513) 455-4423
Facsimile Number (513) 455-4750
Verification Number

From: Bill Buller
Office/Phone (312) 886-4568
Date: 8/19/97 Number of Pages: 1

Additional Comments:

Your sampling plan concerning AOC 34 & 35 are acceptable.
2 recommendations: ① When eventually excavating soil it should be properly handled & disposed ② When performing geotech sampling, PID/Hnu testing is recommended.

SENT FROM FACSIMILE NO.
(312) 353-4788

WBuller

DELPHI
Harrison Thermal Systems

November 5, 1997

Federal Express

Mr. William Buller
U.S. EPA Region 5
Enforcement and Compliance Assurance Branch, HRE-8J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

RE: Summary of Investigation and Findings at AOI 34 and AOI 35, Supplemental RFI, General Motors Corporation, Moraine, Ohio

Dear Mr. Buller:

General Motors Corporation (GMC) is providing the United States Environmental Protection Agency (U.S. EPA) with three copies of the report entitled "Summary of Investigation and Findings at AOI 34 and AOI 35, Supplemental RFI, for the General Motors Powertrain Group Moraine Engine Plant (Moraine Engine) and General Motors Truck Group Moraine Assembly Plant (Moraine Assembly)". The investigative field work for AOI 34 - Excavation Area 1 and AOI 35 - Excavation Area 2 was performed in August 1997 per the scope of work presented in the U.S. EPA-approved Sections 3.2.4 and 3.2.5 of the Supplemental RFI Work Plan.

If you have any questions regarding this document please call me at 937-455-4423.

Sincerely,

James L. Reid for

Norman Sawdey

Enclosure

cc: C. Cotton, OEPA

3600 Dryden Road Moraine, Ohio 45439-1410 USA

SUMMARY OF INVESTIGATION AND FINDINGS AT AOI 34 AND AOI 35 SUPPLEMENTAL RFI GENERAL MOTORS POWERTRAIN GROUP MORAINE ENGINE PLANT AND GENERAL MOTORS TRUCK GROUP MORAINE ASSEMBLY PLANT MORAINE, OHIO

November 1997

Prepared for

Remediation Group
General Motors Corporation
Detroit, Michigan

Prepared by

Geraghty & Miller, Inc.
4700 Lakehurst Court, Suite 100
Dublin, Ohio 43016
(614) 764-2310

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BACKGROUND 2
- AOI 34 2
- AOI 35 2

METHODOLOGY 3
- SURVEYING 3
- DRILLING AND SOIL SAMPLING 4
- SAMPLE ANALYSES AND VALIDATION 5

RESULTS 5
- SOIL CHARACTERIZATION 5
  - AOI 34 5
  - AOI 35 6
- DATA VALIDATION 7
- ANALYTICAL RESULTS 7
  - AOI 34 7
  - AOI 35 8

PRELIMINARY EVALUATION OF DATA 9

REFERENCES 11

TABLES

1. Summary of Laboratory Results, AOI 34-Excavation Area 1 and AOI 35-Excavation Area 2, General Motors Corporation, Moraine, Ohio.

FIGURES

1. Soil Boring Location Map for AOIs 34 and 35, General Motors Corporation, Moraine, Ohio.

ATTACHMENTS

A. Soil Boring Logs.

B. Soil Sampling Logs.

SUMMARY OF INVESTIGATION AND FINDINGS AT AOI 34 AND AOI 35 SUPPLEMENTAL RFI GENERAL MOTORS POWERTRAIN GROUP MORAINE ENGINE PLANT AND GENERAL MOTORS TRUCK GROUP MORAINE ASSEMBLY PLANT MORAINE, OHIO

INTRODUCTION

This report provides a summary of the findings from a subsurface investigation conducted under Resource Conservation and Recovery Act (RCRA) Corrective Action. Areas of interest (AOIs) were identified in the Supplemental Description of Current Conditions (DOCC) for the General Motors Powertrain Group Moraine Engine Plant (Moraine Engine) and General Motors Truck Group Moraine Assembly Plant (Moraine Assembly) located in Moraine, Ohio (Geraghty & Miller, Inc. 1997a). Excavation Area 1 and Excavation Area 2 were identified as AOI 34 and AOI 35, respectively, in the Supplemental DOCC as requiring further action. The scope of work to investigate these AOIs is presented in the Supplemental RCRA Facility Investigation (RFI) Work Plan (Geraghty & Miller, Inc. 1997b). The Supplemental DOCC and Supplemental RFI Work Plan were submitted to the United States Environmental Protection Agency (U.S. EPA) in July 1997 and are pending U.S. EPA approval.

Due to expansion plans at the Moraine Assembly facility in the vicinity of these AOIs investigative work at these two AOI's was performed in August 1997. Prior to investigating these AOI's, Mr. Norman Sawdey of General Motors Corporation (GMC) provided Mr. William Buller of the U.S. EPA with details regarding the expansion project in a letter dated August 6, 1997 and requested that U.S. EPA expedite their review of Sections 3.2.4 and 3.2.5 of the Supplemental RFI Work Plan in order to reach an agreement on the RFI sampling at these AOIs. On August 19, 1997, Mr. William Buller of U.S. EPA sent Mr. Norman Sawdey a facsimile approving the sampling plan concerning AOIs 34 and 35.

The following sections provide a discussion of background information, methodologies, results, and conclusions with respect to each AOI.

BACKGROUND

The following provides a brief description of AOI 34 and AOI 35, as presented in the Supplemental DOCC.

AOI 34

This AOI is located north of the Moraine Engine Plant 3 and west of Springboro Road, and was identified from a 1956 aerial photograph. The excavation area was approximately 300 ft long by 40 ft wide, with the southern end containing a depression that was possibly filled with liquid. This area is currently covered with grass. No information is available regarding the types of materials which may have been handled in this area and their potential for releasing hazardous constituents. The location of AOI 34 is illustrated on Figure 1. Upon evaluating this information, no specific basis exists for further action to investigate AOI 34. However, GMC proposed installing and sampling a soil boring in the AOI to assess the potential presence of contamination.

AOI 35

This AOI is located northeast of the Moraine Assembly Plant 1 and east of Springboro Road, and was identified from a 1956 aerial photograph. The excavation area is approximately 200 ft long by 150 ft wide. This area is currently covered by a parking lot. No information is available regarding the types of materials which may have been handled in this area and their potential for releasing hazardous constituents. The location of AOI 35 is presented on Figure 1. Upon evaluating this information, no specific basis exists for further

action to investigate AOI 35. However, GMC proposed installing and sampling a soil boring in the AOI to assess the potential presence of contamination.

METHODOLOGY

The following provides a discussion of investigation methodology in terms of surveying the excavation area locations, drilling and soil sampling, and data analyses and validation.

SURVEYING

Prior to the subsurface investigation, a site walk over was conducted on July 30, 1997 by Mr. James Reid of Geraghty & Miller, Mr. Vince Festa of the Moraine Engine facility, and Messrs. Dave Kloppenburg and Ed Beckley of the Moraine Assembly facility. The purpose of this site walk over was to identify and survey the suspected locations of AOI 34 and AOI 35. Using the 1956 aerial photographs, the locations of these AOI's were determined by scaling distances from the excavation areas to recognizable landmarks (such as Moraine Assembly Plant 1 and Moraine Assembly Plant 2). McDougal Associates of Miamisburg, Ohio conducted the surveying on July 30, 1997.

Following surveying of these AOIs, GMC identified a topographic map dated March 1968 showing the location and depth of each AOI. Based on this topographic map, it was determined that the surveyed boring location for AOI 34 was in the correct location. However, it was determined that the boring location for AOI 35 proposed based on scaling off of the 1956 aerial photograph, needed to be moved approximately 100 feet south and east of the originally surveyed location to be positioned in the deepest portion of the excavation depicted on the 1968 topographic map. Geraghty & Miller is confident that this procedure correctly spotted appropriate boring locations for the AOIs because (1) the 1968 topographic map provided reference points used to measure the location of the excavation areas more

accurately than the reference points obtained from the 1956 aerial photograph, and (2) soil samples indicated the presence of fill material and drilling was difficult while in the excavation area depths shown on the 1968 topographic map. Figure 1 provides a revised location of boring EA2-BH01 and AOI 35.

DRILLING AND SOIL SAMPLING

To characterize AOIs 34 and 35, one soil boring was installed at each AOI on August 28, 1997. Each soil boring (located to approximate the center of the excavation area) was advanced using 2 1/4-inch hollow stem augers. During drilling, continuous soil samples were collected using a stainless-steel split spoon and described in the field by a Geraghty & Miller geologist. The boring was advanced until native soil was encountered. Belasco Drilling Services, Inc. of Columbus, Ohio conducted the drilling activities.

Headspace readings were measured using a photo-ionization detector (HNu) for each soil sample collected. One soil sample from within the fill was selected for laboratory analyses based on having the highest HNu headspace reading. A second soil sample was collected from immediately below the base of the fill and submitted to the National Environmental Testing, Inc. (NET) laboratory of Dayton, Ohio for analysis. During the investigation, one rinseate blank (equipment blank) sample, one duplicate sample, and one trip blank sample were collected for quality assurance/quality control (QA/QC) purposes. Attachment A contains the soil boring logs and Attachment B contains the soil sampling logs.

Soil sampling equipment such as augers and split spoons were decontaminated prior to sampling. Water used for decontamination of sampling equipment and augers was contained in 55 gallon drums. Cuttings generated during drilling were contained in 55 gallon drums. Containerized cuttings generated during this investigation were sampled and characterized as appropriate for disposal. Results of analysis indicate the material does not exhibit the characteristic of toxicity, ignitability, corrosivity, or reactivity and can be classified a

nonhazardous waste. Additionally this characterization indicates contaminants present will not leach from the fill.

SAMPLE ANALYSES AND VALIDATION

Samples were delivered by Geraghty & Miller directly to NET for analyses under proper chain of custody protocols. These samples were analyzed for Target Compound List (TCL) Volatile Organic Compounds (VOCs) and Semi-volatile Organic Compounds (SVOCs), Polychlorinated Biphenyls (PCBs), and Target Analyte List (TAL) metals (excluding the six essential nutrients: aluminum, calcium, iron, magnesium, potassium, and sodium). The trip blank TB-30 was analyzed for TCL VOCs only. Upon receipt of the analytical data, all data were validated and reviewed in accordance with the RFI Quality Assurance Project Plan (QAPjP) and RFI Data Management Plan included in Appendices B and D of the Supplemental RFI Work Plan, respectively (Geraghty & Miller, Inc., 1997b).

RESULTS

The following provides a discussion of soil characterization, data validation and analytical results for AOIs 34 and 35.

SOIL CHARACTERIZATION

AOI 34

Boring EA1-BH01 was advanced to a total depth of 14 feet below ground surface (bgs). A boring log is provided in Attachment A. Fill consisting of varying percentages of clay, sand, and gravel was found to a depth of approximately 10 feet bgs. Headspace readings from fill samples ranged from 10 parts per million (ppm) (0 to 2 feet bgs) to 115 ppm (6 to 8

feet bgs). The sample of fill material from 6 to 8 feet was selected for laboratory analyses based on the highest headspace reading. DUP-39 is the duplicate sample that corresponds to EA1-BH01 (6-8). Sampling logs are provided in Attachment B.

Native soil, which consists mainly of sand and gravel of varying percentages, was found at a depth of approximately 10 feet bgs. Determination of native soil was based on the lack of clay in the soil. This depth of fill is consistent with the depth of the excavation area shown on the 1968 topographic map. Split-spoon refusal occurred at 8 inches into the 10 to 12 feet bgs interval, and the sample volume recovered was inadequate for laboratory analyses. As a result, soil collected at a depth of 12 to 14 feet bgs was submitted to the laboratory for analyses of native soil below the fill. Headspace readings within the native soil ranged from 5.8 ppm (10 to 12 feet bgs) to 9.0 ppm (12 to 14 feet bgs).

AOI 35

Boring EA2-BH01 was advanced to a total depth of 24 feet bgs. A boring log is provided in Attachment A. Drilling and sampling at this location was difficult because auger refusal occurred at a depth of 3 feet bgs due to the presence of subsurface materials. The boring was then moved 3 feet to the north and drilling resumed. Split-spoon refusal occurred at a depth of 10 to 12 feet bgs due to the presence of subsurface materials, resulting in no sample recovery. Similarly, no samples were recovered at depths of 14 to 16 feet bgs and 18 to 20 feet bgs because no material was recovered within the split-spoon.

Fill consisting of varying percentages of clay, sand, and gravel was found to a depth of approximately 20 feet bgs. Asphalt was noted to a depth of approximately 12.25 feet bgs. Headspace readings from fill samples at AOI 35 ranged from 4.0 ppm (8 to 10 feet bgs and 16 to 18 feet bgs) to 68 ppm (6 to 8 feet bgs). The fill sample from 6 to 8 feet was selected for laboratory analyses based on the highest headspace reading. Sampling logs are provided in Attachment B.

Native soil, which consists mainly of sand and gravel of varying percentages, was found at a depth of approximately 20 feet bgs. Ease of drilling at a depth from approximately 20 feet to 24 feet bgs may also be indicative of a change from fill to native soil. This determination of native soil is consistent with depth of the excavation area shown on the 1968 topographic map. Sample recovery was poor at a depth of 20 to 22 feet bgs, and soil volume was inadequate for laboratory analyses. As a result, soil collected at a depth of 22 to 24 feet bgs was submitted to the laboratory for analyses of native soil below the fill. Headspace readings ranged from 1.0 ppm (20 to 22 feet bgs) to 3.2 ppm (22 to 24 feet bgs).

DATA VALIDATION

Selenium data (reported as less than the method detection limit) are qualified with a J as estimated concentrations because the results were outside the QC criteria. All barium and zinc concentrations are also outside of QC criteria with respect to the duplicate sample, matrix spike (MS), and matrix spike duplicate (MSD) and have been qualified with a J as estimated concentrations. Arsenic concentrations in samples EA1-BH01(6-8) and DUP-39 were qualified with a J as estimated because concentrations exceed QC criteria with respect to the duplicate sample. Vanadium concentrations in all samples are qualified with a J as estimated concentrations because the MS and MSD exceed QC criteria.

ANALYTICAL RESULTS

Table 1 provides a summary of constituents detected by the laboratory analysis.

AOI 34

No VOCs were detected in fill sample EA1-BH01(6-8) or native soil sample EA1-BH01(12-14). Fluoranthene and pyrene were detected in the fill at concentrations of 449 micrograms per kilogram (ug/kg) and 450 ug/kg, respectively, but were not detected in

the duplicate sample (DUP-39). No SVOCs were detected in native soil. No PCBs were detected in either the fill or native soil samples. No dilution was required for VOC, SVOC, or PCB samples and the reporting limits were those listed in the Supplemental RFI QAPjP (Geraghty & Miller, Inc. 1997b). Of the TAL metals analyzed, arsenic, barium, beryllium, chromium, cobalt, copper, lead, manganese, mercury, nickel, vanadium, and zinc were detected in the fill sample. In the native soil sample, TAL metals detected include: arsenic, barium, lead, manganese, nickel, thallium, and zinc.

AOI 35

No VOCs were detected in fill sample EA2-BH01(6-8) or native soil sample EA2-BH01(22-24). Fluoranthene and pyrene were detected in the fill at concentrations of 402 ug/kg and 472 ug/kg, respectively. No SVOCs were detected in native soil. No PCBs were detected in either the fill or native soil samples. No dilution was required for VOC, SVOC, or PCB samples and the reporting limits were those listed in the Supplemental RFI QAPjP (Geraghty & Miller, Inc. 1997b). Of the TAL metals analyzed, arsenic, barium, chromium, lead, manganese, mercury, nickel, and zinc were detected in the fill sample. In the native soil sample, TAL metals detected include: arsenic, barium, lead, manganese, nickel, thallium, and zinc.

QA/QC Samples

No SVOCs, PCBs, or metals were detected in rinseate blank sample RB-26. VOCs detected in rinseate blank RB-26 include chloroform, ethylbenzene, and xylenes at concentrations of 2.0 micrograms per liter (ug/L), 1.2 ug/L, and 6.3 ug/L, respectively. However, these constituents were not detected in any soil samples, therefore there is no indication of possible cross contamination due to decontamination or sampling procedures. No VOCs were detected in trip blank TB-30, indicating no cross contamination of VOCs occurred during sample collection and handling.

PRELIMINARY EVALUATION OF DATA

Based on an evaluation of the type of fill materials encountered during the advancement of borings, there is no evidence that industrial waste materials were placed in these excavation AOIs.

To determine if additional sampling at these AOIs would be needed, the concentrations of detected SVOC constituents (fluoranthene and pyrene) present in the fill material at AOIs 34 and 35 were compared to maximum soil concentrations evaluated in the Baseline Risk Assessment during the Delphi Thermal Moraine RFI (Table 2-4 of the RFI Baseline Risk Assessment [ENVIRON Corporation 1996]). The highest concentrations of fluoranthene and pyrene evaluated in the risk assessment during the Delphi Thermal Moraine RFI, 86,000 ug/kg and 83,000 ug/kg, respectively, were found in soil at the Waste Pile Staging Area. According to the RFI Baseline Risk Assessment, these concentrations did not contribute a significant risk. The concentrations of fluoranthene and pyrene detected in fill samples are two orders of magnitude lower than the maximum concentrations found during the Delphi Thermal Moraine RFI. Because the potential exposures to workers at AOIs 34 and 35 would be similar to those at the Waste Pile Staging Area, the concentrations of fluoranthene and pyrene in the fill samples also would not contribute significant risk. Additionally, fluoranthene and pyrene were not detected in native soil which indicates they have not migrated from the fill to native soil.

Detected inorganic constituents for AOI 34 and AOI 35 were compared to background concentrations found in Table 2-1 of the RFI Baseline Risk Assessment (ENVIRON Corporation 1996). Detected inorganic constituents did not exceed background concentrations, with the exception of arsenic in fill material from AOI 34. The estimated background concentration of arsenic is 28.5 mg/kg, while the concentrations of arsenic in fill samples EA1-BH01(6-8) and DUP-36 are 47J mg/kg and 124J mg/kg, respectively. Because potential exposures to workers at AOI 34 would be similar to those at the Waste Pile Staging

Area at Delphi Thermal Moraine, the soil arsenic concentration at AOI 34 estimated from the duplicate pair can be evaluated by comparison with the soil arsenic concentrations evaluated in the Baseline Risk Assessment for the Waste Pile Staging Area (ENVIRON Corporation 1996). This comparison shows that potential worker exposures to the soil arsenic concentrations at AOI 34 would be expected to result in an insignificant incremental risk above background (in this case, less than 10^{-6}). Additionally, arsenic was detected at a concentration of 3 mg/kg in the native soil sample EA1-BH01 (12-14), which is well below the background concentration for arsenic, and indicates arsenic has not migrated from the fill to native soil.

Investigative activities conducted at AOIs 34 and 35 have provided sufficient detail to meet the RFI objectives.

1. The lateral extent of each AOI has been adequately characterized by review of the 1968 topographic map. The vertical extent of each AOI has been clearly delineated by a distinct change in soil characteristics detected during the advancement of the soil borings (see the soil boring logs in Attachment A).

2. An evaluation of the analytical results for the fill material and subsurface native soil provides no evidence of any significant release of hazardous constituents at these AOIs, by comparison with the constituent concentrations evaluated in the Baseline Risk Assessment for Delphi Thermal. The sampling results provide adequate characterization to support the supplemental Baseline Risk Assessment.

Based on this preliminary evaluation of the data, no additional investigative activity is required at these AOIs.

REFERENCES

ENVIRON Corporation, 1996. RCRA Facility Investigation Final Report Volume II (Baseline Risk Assessment), Delphi Harrison Thermal Systems, General Motors Corporation, Moraine, Ohio. February 1996.

Geraghty & Miller, Inc. 1997a. Supplemental DOCC for General Motors Powertrain Group Moraine Engine Plant and General Motors Truck Group Moraine Assembly Plant, Moraine, Ohio. July 1997. Draft Report.

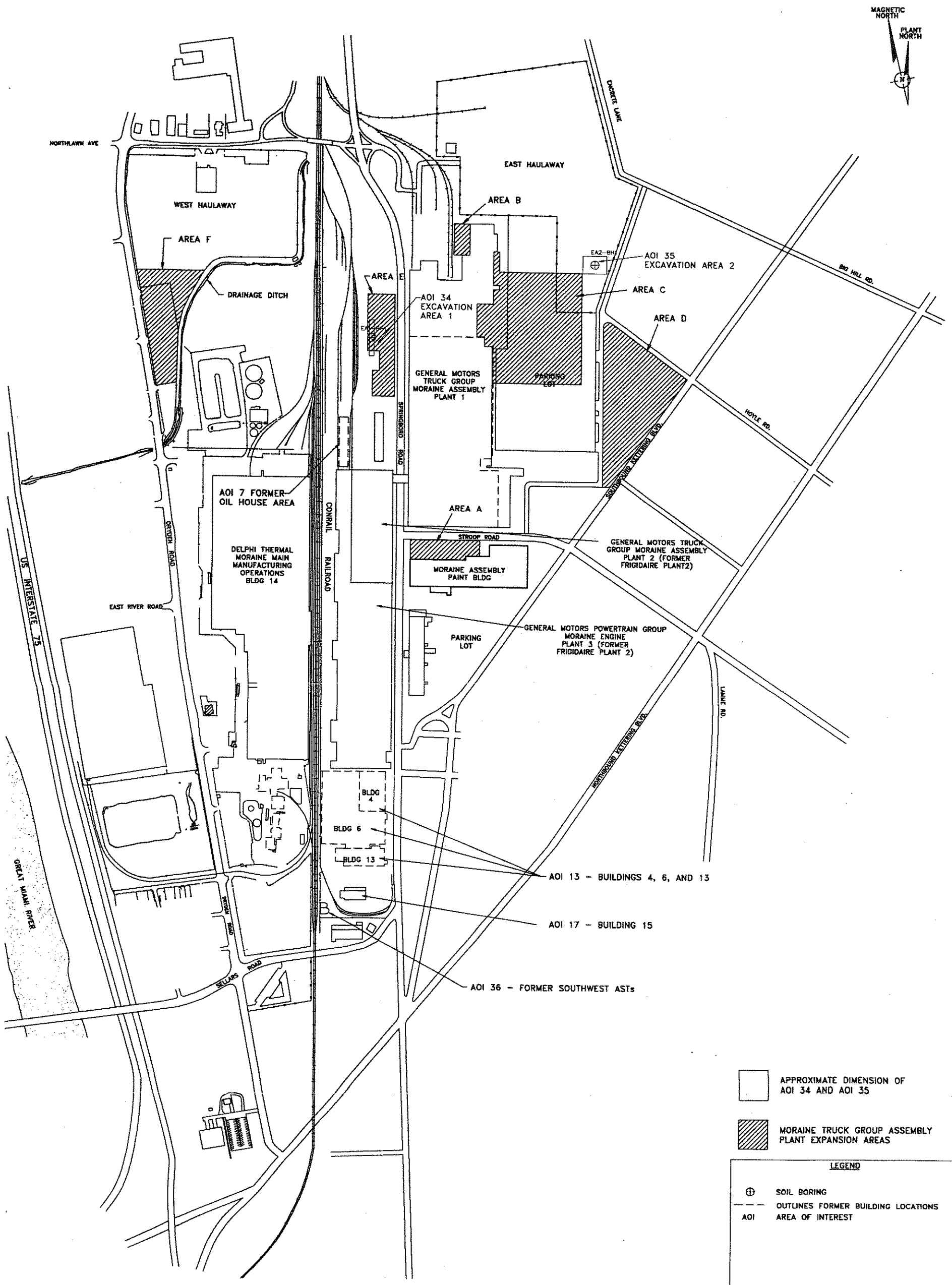
Geraghty & Miller, Inc. 1997b. Supplemental RFI Work Plan for General Motors Powertrain Group Moraine Engine Plant and General Motors Truck Group Moraine Assembly Plant, Moraine, Ohio. July 1997. Draft Report.

Table 1. Summary of Laboratory Results, AOI - 34 Excavation Area 1 and AOI 35 - Excavation Area 2, General Motors Corporation, Moraine, Ohio

Constituent	Units	EA-1 (AOI 34) Fill 6 - 8 ft bgs	EA-1 (AOI 34) Native 12-14 ft bgs	EA -2 (AOI 35) Fill 6 - 8 ft bgs	EA -2 (AOI 35) Native 22-24 ft bgs	QA/QC Samples Dup-39	QA/QC Samples RB-26	QA/QC Samples TB-30
VOCs	ug/Kg	ND	ND	ND	ND	ND	ND	ND
Chloroform							2	
Ethylbenzene							1.2	
Xylenes							6.3	
SVOCs								NA
Fluoranthene	ug/Kg	449	<330	402	<330	<330	<10	
Pyrene	ug/Kg	450	<330	472	<330	<330	<10	
Metals								NA
Antimony	mg/Kg	<16	<32	<33	<33	<16	<0.10	
Arsenic	mg/Kg	46.5J	3.18	3.16	3.24	124J	<0.005	
Barium	mg/Kg	58.2J	22J	53.8J	15J	66.9J	<0.020	
Beryllium	mg/Kg	0.9	<2	<2	<2	0.8	<0.005	
Cadmium	mg/Kg	<3.9	<9.6	<9.9	<9.9	<4.9	<0.030	
Chromium	mg/Kg	12	<13	13	<13	15.1	<0.040	
Cobalt	mg/Kg	7.6	<6.4	<6.6	<6.6	6.52	<0.020	
Copper	mg/Kg	15.3	<6.4	<6.6	<6.6	15.1	<0.020	
Lead	mg/Kg	18	3.5	17.4	4.32	17.8	<0.00050	
Manganese	mg/Kg	331	714	299	311	277	<0.010	
Mercury	mg/Kg	0.025	<0.01	0.012	<0.01	0.032	<0.0002	
Nickel	mg/Kg	18.6	24	7.3	7.6	15.3	<0.010	
Selenium	mg/Kg	<1.63J	<1.66J	<1.61J	<1.64J	<1.64J	<0.0050	
Silver	mg/Kg	<5.2	<13	<13	<13	<1.3	<0.040	
Thallium	mg/Kg	<0.5	0.927	<0.5	0.683	<0.5	<0.0100	
Vanadium	mg/Kg	20.7J	<16J	<16J	<17J	24.9J	<0.050	
Zinc	mg/Kg	104J	20J	49J	28J	141J	<0.050	
PCBs (7 Aroclors)	mg/Kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20	NA

VOCs - Volatile organic compounds.
SVOCs - Semi-volatile organic compounds.
ND - VOCs not detected above their respective laboratory detection limit, unless presented on the table.
< - Constituent not detected above laboratory detection limit shown.
mg/Kg - Milligram per kilogram.
ug/Kg - Microgram per kilogram.
ft bgs - Feet below ground surface.
DUP-39 = Duplicate of sample EA1-BH01(6-8).
J - Estimated Concentration.
QA/QC - Quality assurance/quality control.
RB-26 - Rinseate blank; metal results reported in milligrams per liter (mg/L); VOCs, SVOCs, PCBs reported in micrograms per liter (ug/L).
TB-30 - Trip blank, results reported in ug/L.
NA - Not Applicable.

DWG DATE: 29OCT97 | PRJCT NO.: OH0294.001 | FILE NO.: NB\SUPPLRFI | DRAWING: RFISUPP2 | CHECKED: J.R. | APPROVED: J.R. | DRAFTER: RTS



GERAGHTY & MILLER, INC.
Environmental Services

SOIL BORING LOCATION MAP FOR AOIs 34 AND 35

GENERAL MOTORS CORPORATION
MORAINE, OHIO

FIGURE
1

ATTACHMENT A

SOIL BORING LOGS

Geraghty & Miller, Inc.
Environmental Services

Log of Boring: EA1-BH01

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0						*No recovery – moved location 1 foot to east and started again.
	6-11-14-17	1.0	10.0			**FILL:** 0-2 ft; silt and gravel, trace of clay, dry, hard, dark brown, roots, gravelly, limestone at bottom of spoon.
	6-16-10-13	1.5	68.0			**FILL:** 2-4 ft; sand and gravel, dark brown, trace clay dry, loose, fine to coarse gravel, sub-round to sub-angular, poorly sorted.
5	17-15-6-13	1.33	68.0			**FILL:** 4-6 ft; clay, sandy (20%); dry, brown, slightly plastic, hard.
	6-10-10-6	1.58	115.0			**FILL:** 6-8 ft; sand and gravel, brown, dry, fine to coarse, poorly sorted, sub-round, color change at 7', darker brown.
	10-22 24-34	1.33	50.0			**FILL:** 8-9 ft; clay, brown, very sandy (~50%) and gravelly, dry.
10						**FILL:** 9-10 ft; sand and gravel, some clay, dry, brown, fine to coarse gravel, poorly sorted, sub-round.
	47-50/2	0.25	5.8			***SAND (with gravel):*** 10-12 ft; brown, dry, medium gray, moderately sorted, with 20-30% gravel, loose, sub-round. (Poor Recovery)
	9-10-40-48	1.0	9.0			***SAND & GRAVEL:*** 12-14 ft; fine to coarse gravel, loose, dry, poorly sorted, sub-round, brown, native soil.
15						BOTTOM OF HOLE 14.0 ft.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drillers
Driller: Cord/Conrad
Drilling Method: Hollow-Stem Auger
Drilling Fluid: None
Remarks:

Geologist: S. Clouse
Total Depth: 14.0
Surface Elev.:
Datum:
West Coor.:

Begin Drilling: 08/28/97
End Drilling: 08/28/97
Converted to Well: No
Well Name:
South Coor.:

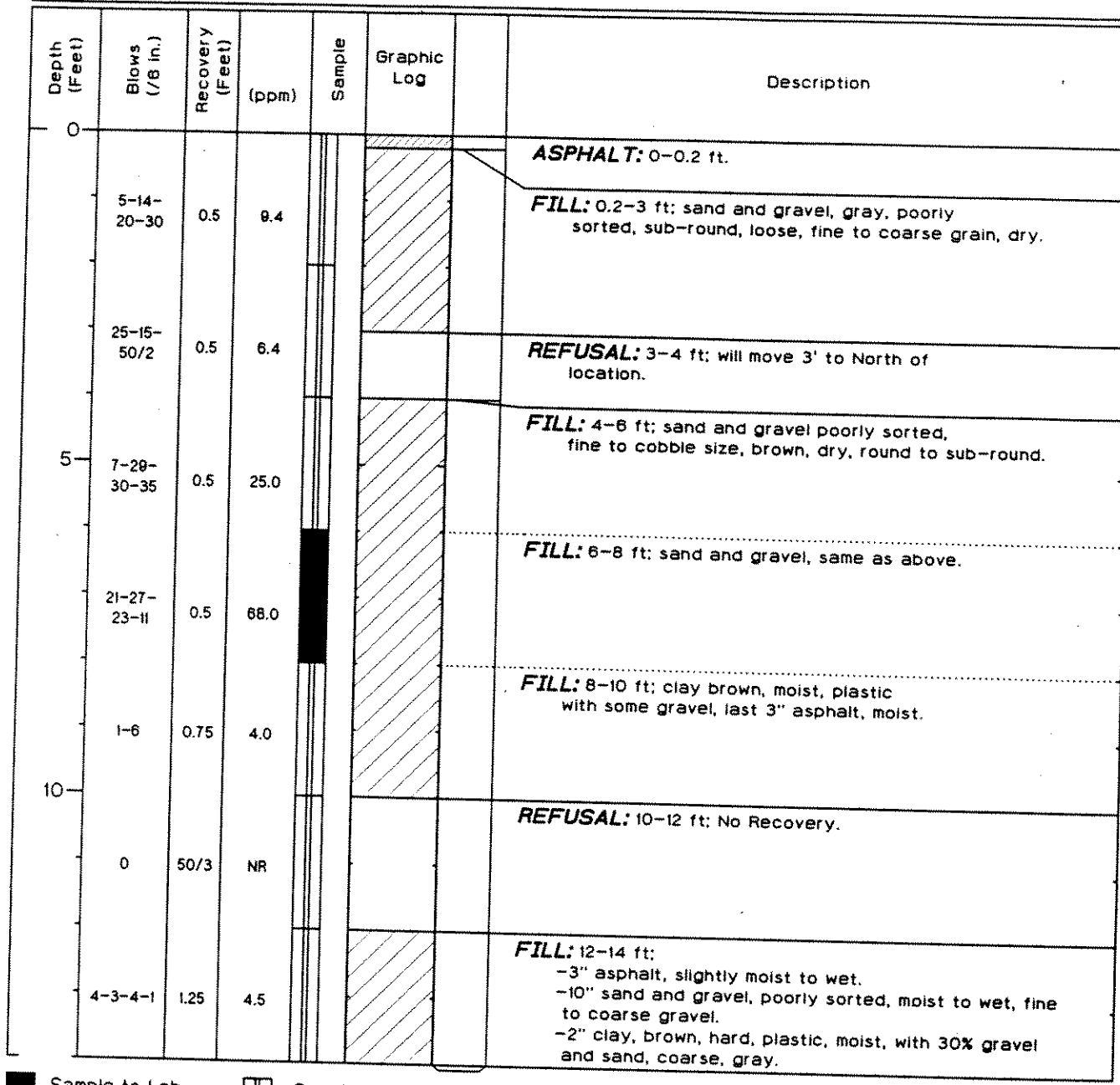
OH0294.001.002

Disk: GM (1); File: EA1-BH01; (rev: 10/28/97)

Geraghty & Miller, Inc.
Environmental Services

Log of Boring: EA2-BH01

GENERAL MOTORS — Moraine, Ohio



■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drillers
Driller: Cord/Conrad
Drilling Method: Hollow-Stem Auger
Drilling Fluid: None
Remarks:

Geologist: S. Clouse
Total Depth: 24.0
Surface Elev.:
Datum:
West Coor.:

Begin Drilling: 08/28/97
End Drilling: 08/28/97
Converted to Well: No
Well Name:
South Coor.:

OH0294.001.002

Disk: GM (1); File: EA2-BH01; (rev: 10/28/97)

Geraghty & Miller, Inc.
Environmental Services

Log of Boring: EA2-BH01

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
14	10-9-12-8	0	NR			***NO RECOVERY:*** 14-16 ft.
	24-7-13-13	0.17	4.0			***FILL:*** 16-18 ft; sand and gravel, gray, dry, loose, sub-round to sub-angular, poorly sorted, fine to coarse, gray.
19	15-20-30-15	0	NR			***NO RECOVERY:*** 18-20 ft.
	26-6-19-9	0.42	1.0			***SAND & GRAVEL:*** 20-22 ft; looks like native soil, fine to coarse grain, dry, brown, loose, sub-round, poorly sorted. (Drilling Easier).
	15-32-50/4	1.0	3.2			***SAND & GRAVEL:*** 22-24 ft; same as above.
24						BOTTOM OF HOLE 24.0 ft.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drillers
Driller: Cord/Conrad
Drilling Method: Hollow-Stem Auger
Drilling Fluid: None
Remarks:

Geologist: S. Clouse
Total Depth: 24.0
Surface Elev.:
Datum:
West Coor.:

Begin Drilling: 08/28/97
End Drilling: 08/28/97
Converted to Well: No
Well Name:
South Coor.:

OH0294.001.002

Disk: GM (1); File: EA2-BH01; (rev: 10/28/97)

ATTACHMENT B

SOIL SAMPLING LOGS

SOIL/SEDIMENT SAMPLING LOG

Project/No. GM-Moraine/OH0294.001.002 Page 1 of 1

Sample No. EA1-BH01 (6-8) Coded/ Replicate No. DUP-39 Date 8/28/97

Weather Sunny 70's°F Time Sampling Began 1005 Time Sampling Completed 1015

Sampling Method and Material Spilt-spoon sampler with hollow stem auger

Grab x Composite ____

From	To	Soil/Sediment Description
6	8	Sand and gravel, brown, dry, fine to coarse grain, poorly sorted, subrounded (fill)

Other (OVA; HNU; etc.) 115 ppm

Constituents Sampled	Container Description From Lab x or G&M ___	Preservative
TCL VOCs	4 oz glass jar	Cool
SVOCs, PCBs, TAL Metals	16 oz glass jar	Cool

Remarks

Sampling Personnel S. Clouse

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SOIL/SEDIMENT SAMPLING LOG

Project/No. GM-Moraine/OH0294.001.002 Page 1 of 1

Sample No. EA1-BH01 (12-14) Coded/ Replicate No. NA Date 8/28/97

Weather Sunny 70's°F Time Sampling Began 1025 Time Sampling Completed 1035

Sampling Method and Material Spilt-spoon sampler with hollow stem auger

Grab x Composite ____

From	To	Soil/Sediment Description
12	14	Sand and gravel, fine to coarse grain, loose, dry poorly sorted, subrounded, brown (native soil)

Other (OVA; HNU; etc.) 9.0 ppm

Constituents Sampled	Container Description From Lab x or G&M ___	Preservative
TCL VOCs	4 oz glass jar	Cool
SVOCs, PCBs, TAL Metals	16 oz glass jar	Cool

Remarks Collected rinseate blank (RB-26) at 13:50, after sampling this interval.

Sampling Personnel S. Clouse

I:\GM\OTORR\AOI\04_35\BA113-14.DOC

SOIL/SEDIMENT SAMPLING LOG

Project/No. GM-Moraine/OH0294.001.002 Page 1 of 1

Sample No. EA2-BH01 (6-8) Coded/ Replicate No. NA Date 8/28/97

Weather Sunny 70's°F Time Sampling Began 1455 Time Sampling Completed 1505

Sampling Method and Material Split-spoon sampler with hollow stem auger

Grab x Composite ____

From	To	Soil/Sediment Description
6	8	Sand and gravel, brown, dry, loose, fine to cobble size and subrounded (fill)

Other (OVA; HNU; etc.) 68 ppm

Constituents Sampled	Container Description From Lab x or G&M ___	Preservative
TCL VOCs	4 oz glass jar	Cool
SVOCs, PCBs, TAL Metals	16 oz glass jar	Cool

Remarks Took rinseate blank (RB-26) at 13:50, prior to sampling this interval

Sampling Personnel S. Clouse

I:\GM\OTOREU\AOD\4_35\BH01-4B.DOC

SOIL/SEDIMENT SAMPLING LOG

Project/No. GM-Moraine/OH0294.001.002 Page 1 of 1

Sample No. EA2-BH01 (22-24) Coded/ Replicate No. NA Date 8/28/97

Weather Sunny 70's°F Time Sampling Began 1605 Time Sampling Completed 1615

Sampling Method and Material Spilt-spoon sampler with hollow stem auger

Grab x Composite ____

From	To	Soil/Sediment Description
22	24	Sand and gravel, fine to coarse grain, brown, dry, loose, subrounded, poorly sorted.

Other (OVA; HNU; etc.) 3.2 ppm

Constituents Sampled	Container Description From Lab x or G&M ____	Preservative
TCL VOCs	4 oz glass jar	Cool
SVOCs, PCBs, TAL Metals	16 oz glass jar	Cool

Remarks

Sampling Personnel S. Clouse

I:\GM\OTOREVA\OH294_35\BA223-24.DOC

ARCADIS GERAGHTY & MILLER

Supplemental RFI Work Plan

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Norman Sawdey
General Motors Corporation
Delphi/Harrison Thermal systems
3600 Dryden Road
Moraine, Ohio 45439-1410

DRE-9J

Re: Supplemental RCRA Facility Investigation Workplan
GMC Delphi/Harrsion OHD 000 817 577
GMC Moraine Engine Plant OHD 980 569 388
GMC Moraine Assembly Plant OHD 041 063 074
Administrative Order
Docket No. V-W-R-002-91

Dear Mr. Sawdey:

The United States Environmental Protection Agency (U.S. EPA) has reviewed the Supplemental RCRA Facility Investigation Workplan and support documents dated July, 1997. These documents address the two additional facilities incorporated into the Administrative Order referenced above and as amended March 21, 1997. U.S. EPA has determined that certain revisions are needed prior to approval of the Supplemental RFI Workplan. General Motors shall submit a revised RFI report which addresses the comments in Attachment I within thirty (30) days of receipt of this letter. To reduce the volume of paper, it is suggested that the revisions be submitted as a supplement to the July 1997 reports rather than inserting revised text into the report.

If you have any questions please call me at (312) 886-4568.

Sincerely,

William Buller

William Buller, Project Coordinator
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
MI/WI Section

cc: Chris Cotton, OEPA (with attachment)
Pinake Banerjee, PRC (TTIEMC)

ATTACHMENT I

RFI WORK PLAN

GENERAL COMMENTS

1. The RFI work plan states that the purpose of the supplemental RFI is to collect data in support of the supplemental baseline risk assessment; however, the administrative order issued by EPA requires GMC to define the nature and extent of contamination. Supplemental RFI activities should be implemented to determine the full horizontal and vertical extent of contamination in subsurface soil and groundwater. Specific comments on the following pages provide examples where the RFI work plan does not present sufficient sampling to meet this objective. The RFI work plan should be checked for deficiencies related to this issue and amended to address this issue.

2. The RFI work plan describes a judgmental sampling technique that will be utilized during the RFI; however, no information about the methods or schedules of supplemental soil sampling activities is provided. Additionally, field activities should be somewhat flexible to include additional soil boring during the same field sampling effort, if appropriate, to provide the additional data without the additional cost of remobilization. GMC should submit an addendum to the RFI work plan that clearly defines decision parameters related to sampling activities and that establishes time frames for completing supplemental sampling activities.

3. The RFI work plan refers to supplemental soil sampling activities if contaminated soil is detected; however, no supplemental groundwater assessment activities related to the detection of contaminants in soil samples collected from the water table interval are included in the work plan. If contaminated soil samples are collected from the water table interval, groundwater samples should also be collected to determine if groundwater contamination is present. A supplemental groundwater assessment plan should be added to the work plan to determine the impact of soil contamination on groundwater.

4. The RFI work plan does not present an approach to assess the historical release of contaminants to groundwater. Whether or not contamination is detected in areas of interest (AOI) from soil boring

or direct-push sampling, groundwater samples should be collected both immediately upgradient and downgradient of AOIs. Samples can be collected using a direct-push sampling method and sent to the off-site laboratory for analysis. Data from these analyses can be compared to soil sampling data and used in groundwater modeling and risk assessment. This approach is consistent with the groundwater modeling and risk assessment approach used in the draft final RFI report for the Delphi Thermal Division.

5. GMC proposes to collect soil samples and analyze for PCBs only if a screening level of 25 mg/kg is exceeded. GMC cites the EPA document "Guidance on Remedial Actions for Superfund Sites with PCB Contamination" (EPA 1990) as a basis for its screening level. However, EPA (1990) recommends soil action level of 10 to 25 mg/kg instead of the 25 mg/kg proposed by GMC. GMC did not provide any justification supporting its high end screening level value. Numerous chemicals, in addition to PCBs, could potentially contribute to risks to human health and the environment at the GMC site. Because of the additive effects, Tetra Tech recommends that the PCB screening be set at 10 mg/kg. The RFI work plan should be modified to set the PCB screening level at 10 mg/kg.

SPECIFIC COMMENTS

1. Section 3.2.2, Page 3-4, Paragraph 0. The RFI work plan states that soil samples will be collected from AOI 13 at 19 locations to depths up to 6 to 8 feet (ft) below ground surface (bgs); however, no sampling procedures are described to determine the vertical extent of soil contamination during boring activities. The judgmental sampling approach should include the advancement of borings to deeper than 8 ft bgs if field observations and screening methods indicate the presence of contamination.

2. Section 3.2.2, Page 3-4, Paragraph 0, and Section 3.2.3, page 3-5, Paragraphs 3 and 4. The work plan states that soil samples will be screened in the field with immunoassay test kits; however, no specific information concerning the immunoassay test kits is provided. Also, the work plan does not present a method to confirm immunoassay test results for quality assurance purposes. Information on detection limits, recovery limits, and quality assurance/quality control (QA/QC) information for immunoassay field screening results should be provided. To verify the accuracy of the immunoassay test, 10 percent of the soil samples shown to contain polychlorinated biphenyls (PCB) should be submitted for confirmatory laboratory analysis. The RFI work plan should be amended to specify the immunoassay test kits and to discuss detection limits, recovery limits, and QA/QC information for the immunoassay kit results.

3. Section 3.2.2, Page 3-4, Paragraph 1, and Section 3.2.3, Page 3-5, paragraph 4. The RFI work plan states that if screening levels are exceeded, soils will be sampled with the objective of confirming a release and evaluating the nature and extent of the release as required to support the supplemental baseline risk assessment; however, no procedures or schedules for the supplemental soil sampling is provided. Because supplemental RFI implementation at this AOI will utilize immunoassay and gas chromatograph (GC) field screening methods, the existence and concentrations of PCBs and volatile organic compounds (VOC) in the soil samples will be determined relatively quickly, thus enabling the implementation of supplemental sampling within the same sampling event. The RFI work plan should be amended to state that additional soil sampling activities should be implemented (if required) upon the receipt of field screening results and to specify associated procedures and schedules.

4. Section 3.2.2, Page 3-4, Paragraph 1. If soil contamination is present, its vertical extent should be determined to identify possible sources of groundwater contamination. Supplemental soil borings, if required, should be continuously sampled until the water table is reached.

DESCRIPTION OF CURRENT CONDITIONS

GENERAL COMMENT

1. The supplemental DOCC lists 36 AOIs. All solid waste management units (SWMU) identified by EPA in 1991 during the preliminary assessment/visual site inspections (PA/VSI) are included as AOIs. However, many more AOIs are listed in the supplemental DOCC than were identified during the PA/VSI. Although GMC has performed an extensive background search to identify AOIs, it appears that during the course of the RFI, as further information is collected, additional contaminant source areas could potentially be identified. GMC should continue to collect information regarding past and current on-sit activities and inform EPA if additional source areas are identified.

QUALITY ASSURANCE PROJECT PLAN

GENERAL COMMENTS

1. Analytical methods for several parameters listed in the QAPP differ from the QAPP prepared by National Environmental Testing, Inc. (NET), the designated laboratory. For example, analytical methods listed for ammonia nitrogen, sulfide, and sulfate listed in Table 3.1 in the QAPP and Table 3-1 in the RFI work plan are not consistent with methods listed in Table 5.1 of the NET QAPP. Such discrepancies should be resolved prior to sample analysis.

2. The analytical method to be used for cis-1,2-dichloroethene is not listed in the QAPP. Table 3-1 in the RFI work plan lists SW-8240B as the preferred analytical method. The analytical method to be used for cis-1,2-dichloroethene should be listed in the QAPP.

DELPHI
Harrison Thermal Systems

November 5, 1997

Federal Express

Mr. William Buller
U.S. EPA Region 5
Enforcement and Compliance Assurance Branch, HRE-8J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

RE: Response to Comments on the Supplemental RFI Work Plan and Supplemental Description of Current Conditions for the General Motors Corporation, Moraine, Ohio Facilities

Dear Mr. Buller:

General Motors Corporation (GMC) is providing the United States Environmental Protection Agency (U.S. EPA) with three copies of responses to comments on the Supplemental RFI Work Plan and Supplemental Description of Current Conditions for the General Motors Powertrain Group Moraine Engine Plant and General Motors Truck Group Moraine Assembly Plant, Moraine, Ohio. U.S. EPA comments were received by GMC on October 7, 1997.

GMC is interested in arranging a meeting if you have additional comments on these responses that require further discussion. GMC is available to meet in Chicago, or if you are interested, a meeting could be held at the site in Moraine, Ohio. A meeting at the site would allow the opportunity for a site walk. Please contact me after the U.S. EPA has completed their preliminary review of the comment responses to discuss the appropriateness of scheduling a meeting. In the meantime, if you have any questions regarding these responses to comments please call me at 937-455-4423.

Sincerely,

James J. Reid /for
Norman Sawdey

Enclosures

cc: C. Cotton, OEPA

3600 Dryden Road Moraine, Ohio 45439-1410 USA

RESPONSES TO U.S. EPA COMMENTS DATED OCTOBER 7, 1997 FOR GENERAL MOTORS POWERTRAIN GROUP MORAINE ENGINE PLANT AND GENERAL MOTORS TRUCK GROUP MORAINE ASSEMBLY PLANT MORAINE, OHIO

SUPPLEMENTAL RFI WORK PLAN

RESPONSE TO GENERAL COMMENT 1

General Motors Corporation (GMC) believes that for each Area of Interest (AOI), the proposed investigation will determine if a release of hazardous constituents has occurred from an AOI. Additionally, if a release has occurred, then the proposed investigation should provide sufficient sampling to determine the nature and extent of contamination in soil and groundwater. The investigation presented in the Supplemental Work Plan is consistent with the Administrative Order (Order) and consistent with the approach presented in the RFI Work Plan Section 1.3, dated November 1992 (approved by the U.S. EPA in a letter dated September 22, 1992), the Interim RFI Report dated July 1993, the Phase II Work Plan dated September 1994, and the Draft RFI Final Report Volume I Methodologies and Results (Section 1.1) and Volume II Baseline Risk Assessment, dated February 1996.

The following paragraphs summarize how the planned field activities for each AOI relate to assessing if a release has occurred and for determining nature and extent of contamination in soil. (Refer to the response to General Comment 3 for the groundwater discussion.) If no significant release of hazardous constituents is confirmed at an AOI after the proposed sampling and analysis, then sampling will be completed. If a significant release is confirmed, the data will be evaluated to assess if the horizontal and vertical nature and extent of contamination has been adequately delineated. If, based on a risk-based evaluation of soil data at an AOI and groundwater data from existing wells, it is determined that additional soil

sampling would be necessary, GMC will implement a second phase of investigation, as shown on the attached revised schedule of Supplemental RFI activities (Task No. 14 on Figure 1-9).

AOI 7 - Former Oil House Area

A judgmental sampling approach will be used to install and sample soil borings (advanced to the water table) to further evaluate if a release has occurred from this AOI. The proposed boring locations were selected to provide data in areas where GMC believes there is the greatest potential that past releases occurred and should provide the delineation of nature and extent necessary to meet the project objectives. Additionally, the four borings provide coverage of the known areal extent of the AOI. The results of soil sampling from the borings will be evaluated (Task No. 14 on Figure 1-9) to determine if a second phase of investigation is warranted.

AOI 13 - Buildings 4, 6, and 13 and AOI 17 - Building 15

At these AOIs, which cover a relatively large area and where GMC is less certain of the potential for historical releases across these building footprints, field screening has been recommended to determine if a release has occurred, and if a release is detected, to focus the investigation of the nature and extent of contamination using soil boring and sampling techniques during one continuous phase. Judgmental sampling and the collection of soil samples with the direct-push sampling methodology will be used for screening purposes to determine if a release has occurred. Samples will be collected (Task No. 7 on Figure 1-9) from 13 locations at AOI 13 that were selected based on knowledge of past operations and visual observations. Six additional locations were identified to provide areal coverage. A judgmental sampling approach was also used for AOI 17 to identify three sampling locations within the three former maintenance areas in the building.

The decision to install a soil boring(s), which will be advanced to the water table, will be based on the following screening criteria for volatile organic compounds (VOCs) (greater than 1 milligrams per kilogram [mg/kg] for any individual VOC using a field gas chromatograph), polychlorinated biphenyls (PCBs) (greater than or equal to 25 mg/kg using an immunoassay test kit), and metals (compare analytical results to RFI background levels). Samples with visual evidence of metals staining will be submitted to the laboratory for metals analysis because a field screening test is not available. If the screening criteria are exceeded, then soil borings will be installed and sampled around the identified area(s) of contamination with the objective of confirming the release and evaluating the nature and extent of the release (Task No. 10 on Figure 1-9).

The results of soil sampling from the borings will be evaluated (Task No. 14 on Figure 1-9) to determine if a second phase of investigation is warranted.

AOI 34 - Excavation Area 1 and AOI 35 - Excavation Area 2

The scope of work proposed for these two AOIs was designed to first confirm if there was a release of hazardous constituents. GMC submitted a letter to the U.S. EPA on August 6, 1997 requesting approval to proceed with the RFI sampling proposed for these two AOIs in the Supplemental Work Plan, due to a plant expansion project in proximity to these AOIs. Based on receipt of U.S. EPA approval to proceed (received via facsimile from Mr. William Buller of U.S. EPA on August 19, 1997), GMC collected the proposed fill and native soil samples at each AOI. Based on the analysis of these samples it was determined that no significant release of hazardous constituents has occurred at these AOIs. Therefore, GMC believes that no further characterization under this RFI will be required. GMC will submit a report summarizing the findings of this focused investigation to the U.S. EPA under separate cover.

AOI 36 - Former Southwest AST

A judgmental sampling approach will be used to install and sample two soil borings to characterize this area and determine if a release to soil has occurred. Due to the small areal extent of this AOI and the fact that soil borings will be advanced to the water table, the proposed level of planned field activities should provide the delineation required to meet the project objectives.

RESPONSE TO GENERAL COMMENT 2

It is GMC's intent that the current scope of work presented in Section 3.0 of the Supplemental RFI Work Plan will be implemented in one continuous phase. This is shown in Task No. 6 through No. 14 for Planned Investigation Activities on the attached revised version of the schedule of Supplemental RFI activities (Figure 1-9). Additionally, if gross contamination is observed during these planned field activities, a field decision to collect additional samples or install additional soil borings will be made at that time. This decision will be made with the U.S. EPA and/or their oversight contractor. The revised schedule includes approximately one additional week of field time to accommodate such field contingencies. This approach is consistent with the Delphi Thermal RFI.

Once the planned field activities are implemented, data will be validated and an evaluation will be conducted in the context of the baseline risk assessment, similar to the Delphi Thermal RFI. The decision to conduct a second phase of investigation will be determined from the risk-based evaluation (Tasks No. 14 and 22 on Figure 1-9). The revised version of the schedule of Supplemental RFI activities indicates the phased approach for any additional investigation (Task No. 15 through No. 19 on Figure 1-9), if required.

RESPONSE TO GENERAL COMMENT 3

As described below, GMC believes the Supplemental RFI Work Plan provides an appropriate phased approach to evaluating groundwater. GMC will collect groundwater quality data to better characterize the potential effects on groundwater from soil at AOI's 7, 13, 17, and 36. Groundwater quality data is not required at AOIs 34 and 35, since the completed investigation determined that no significant release of hazardous constituents has occurred. The wells listed on Table 1 will be sampled during the Supplemental RFI as described in Section 3.1 of the Supplemental RFI Work Plan. As shown in Table 1, each of these AOIs has wells that would provide data on upgradient and downgradient groundwater quality.

The groundwater data collected during the Supplemental RFI can be used to better characterize, from a risk perspective, the potential effects on groundwater from soil contamination at an AOI; however, there are difficulties and limitations associated with this data usage. As discussed in GMC's September 11, 1996 responses to U.S. EPA's comments on the Draft RFI Final Report for Delphi Thermal, the use of groundwater data to determine whether a specific AOI may significantly affect groundwater quality is often complicated by several factors (e.g., upgradient groundwater quality and/or presence of constituents in groundwater that were not managed at the AOI). Because of GMC's experience with such complexities in the risk assessment at Delphi Thermal, GMC believes that soil data at an AOI should be used as the primary means for estimating the AOI's potential effect on groundwater quality at potential points of groundwater use. As discussed in the risk assessment for Delphi Thermal and in GMC's September 11, 1996 responses to U.S. EPA's comments, GMC has used and plans to use conservative assumptions in evaluating soil data from an AOI to assess potential effects on groundwater use. Where soil data suggest that an AOI may have a potentially significant effect on groundwater use, groundwater quality data can be used to determine the extent to which the conservative evaluation of soil data may have overstated an AOI's effect.

After reviewing this comment, and to be consistent with the Delphi Thermal RFI, GMC recommends modifying the parameter list for the wells on Table 1 to add Appendix IX semi-volatile organic compounds (SVOCs), PCBs, and total and dissolved metals. This will ensure groundwater data around these four AOIs are consistent with the soil data being collected and evaluated in the baseline risk assessment. Table 3-1 of the Supplemental RFI Work Plan and Table 3.1 of the RFI QAPjP have been revised accordingly and are attached to this response document.

If GMC determines, based on a risk-based evaluation of soil data at an AOI and groundwater data from existing wells, that additional groundwater sampling would be appropriate, GMC will implement a second phase of groundwater investigation, as shown on the attached revised schedule (Task No. 15 through No. 19 on Figure 1-9).

RESPONSE TO GENERAL COMMENT 4

As discussed in the response to General Comment 3, groundwater samples will be taken from existing wells in proximity to the AOIs whether or not constituents are detected in soil borings within an AOI. However, due to the transient nature of groundwater, and the potential for multiple sources to impact groundwater beneath an AOI, it is impracticable for GMC to assess the historical release of contaminants to groundwater using the procedure requested by the U.S. EPA. The Supplemental RFI Work Plan has taken the same approach presented in the approved Delphi Thermal RFI Work Plan for assessing the AOIs identified as requiring further evaluation.

This approach involves evaluating groundwater quality data from wells in proximity to the AOIs (refer to the attached Table 1), as well as evaluating groundwater quality data on a site-wide basis to assess historical releases from the GMC facilities (refer to Section 3.1 in the Supplemental RFI Work Plan). This groundwater quality data, combined with soil data to be collected at each AOI and evaluated for its potential to leach to groundwater, will provide

sufficient data to conduct the groundwater modeling and risk assessment utilizing the approach presented in the Draft Final RFI Report. If evaluation of the soil data from an AOI shows that the AOI is expected to have insignificant effects on groundwater use, then collection and consideration of additional groundwater quality upgradient and downgradient of the AOI would not be useful in determining the AOI's effect on groundwater. The difficulties and limitations associated with using groundwater at each AOI were discussed in the response to General Comment 3.

In response to U.S. EPA's suggestion to sample groundwater using a direct-push method, GMC feels that this method is impractical at this site based on 1) knowledge of site conditions (geology and depth to water), 2) the soil data collected from the AOI must first be analyzed in the laboratory and the results evaluated using groundwater modeling to determine whether the existing soil concentrations indicate that the AOI may have significant effects on groundwater use, and 3) direct-push methods may be incapable of obtaining groundwater samples that would be more representative than the upgradient and downgradient groundwater samples already specified to be collected.

RESPONSE TO GENERAL COMMENT 5

GMC based the selected PCB screening level of 25 mg/kg for this sampling program on U.S. EPA's recommended PCB screening range of 10 to 25 mg/kg, as well as on the design and reported performance of the PCB screening test kits to be used. According to the methodology information (SW846, Method 4020), PCB immunoassay test kits are designed to minimize the rate of false negative test responses (i.e., a result indicating a concentration less than a specified standard when in fact, the actual concentration is greater than this standard). This biased test design results in a substantial false positive rate (i.e., a result indicating a concentration greater than a specified standard when in fact, the actual concentration is less than this standard) that must be considered in developing a sampling program in which field decisions will be based on these test results. The false positive rates

reported in SW846 for Method 4020 range from approximately 20 percent to greater than 90 percent depending on the manufacturer of the test kit and the specified test standard or standard range.

Based on this information, GMC believes that a screening level of 25 mg/kg is appropriate given the design of this sampling program: (1) the immunoassay test kits will provide positive results for soil concentrations greater than 25 mg/kg; (2) the immunoassay test kits will provide false positive results for greater than at least 20 percent of the soil concentrations in the range of 10 to 25 mg/kg, and for lower concentrations; and (3) a split sample of all samples exhibiting a positive test-kit result above 25 mg/kg will be analyzed using a quantitative analytical method (i.e., SW846 Method 8080). This duplicate sample analysis procedure will be done to support an evaluation of PCB concentrations in the baseline risk assessment. Using this approach, GMC will actually be selecting samples with concentrations that fall into the recommended screening range of 10 to 25 mg/kg for quantitative analysis due to the propensity for these tests to provide false positive results.

In contrast, if a test kit screening standard level of 10 mg/kg is used, a substantial number of field samples will be identified as exceeding 10 mg/kg when in fact the actual concentrations are below this lower limit of the recommended screening range. Therefore, the use of the lower test standard may result in many incorrect field decisions regarding the need for additional sampling to delineate these locations believed to exceed the screening level, when in fact the actual concentrations are less than 10 mg/kg. Further, since GMC intends to have all samples exhibiting a positive test-kit result greater than 25 mg/kg quantified in an analytical laboratory, the lower screening level will result in the laboratory analysis of many more samples than otherwise would be necessary to evaluate the actual concentrations exceeding the recommended screening range of 10 to 25 mg/kg. The effect of these false positives will be to needlessly increase the level of effort for the delineation activities, as well as increase the overall cost of the sampling program.

In summary, considering the nature of the test kit design, GMC believes that 25 mg/kg is an appropriate and practical screening level for evaluating the need for quantitative PCB analysis and further delineation sampling.

RESPONSE TO SPECIFIC COMMENT 1

As presented in the response to General Comment 1, it is GMC's intention to conduct additional soil sampling at depths greater than 8 feet below ground surface (bgs), using hollow-stem auger drilling techniques around areas, if the shallow soil screening (using direct-push sampling and on-site screening with immunoassay kits and field gas chromatograph or visual evidence of metals based on contamination confirmed with laboratory analysis) indicate that a potential release may have occurred. The screening of shallow soil using the direct-push sampling system (Task No. 7 on Figure 1-9) was recommended at AOIs 13 and 17 to locate areas where historic operations in this relatively large area may have released hazardous constituents. Direct-push sampling provides a technique for collecting a large amount of data in a timely and cost-effective manner. However, due to the nature of subsurface geology there is significant uncertainty as to whether this direct-push sampling technology will be able to collect samples at depths greater than 8 feet. Therefore, in areas where the need for additional soil sampling at depth is indicated by the field screening and/or laboratory analysis for metals, GMC intends to conduct this effort using hollow-stem auger drilling techniques and collecting samples at 0 - 2 feet and above the water table (a third sample may be collected based on visual evidence of contamination or field screening with an HNu). These planned activities are shown as Task No. 10 on Figure 1-9.

RESPONSE TO SPECIFIC COMMENT 2

GMC is providing the following information regarding the use of immunoassay test kits when field screening soil for PCBs at AOIs 13 and 17. Soil samples will be screened in the field for PCBs using a D TECH model TK-1002-1 PCB test kit. This immunoassay PCB

test kit can provide semi-quantitative results of PCB concentrations in soil with detection limits ranging from 0.5 to 25 mg/kg, depending on the aroclor present. The manufacturer's detection limits are based on ideal soil conditions (i.e., no matrix interference, ambient temperatures between 7° to 38° C, soil with minimal clay content). However, it should be noted that, as discussed in the response to General Comment 5, these test kits are biased toward false positive results to compensate for non-ideal field conditions and provide a conservative screening tool for selecting areas which require additional investigation.

Results of the test kit will be interpreted using a portable instrument (DTECHTOR) to obtain a semi-quantitative result. The following summarizes the manufacturer's quality assurance/quality control (QA/QC) items to be followed when using the PCB test kit.

- Personnel performing field screening of soil using the PCB test kit will become familiar with and follow the instructions provided by the manufacturer.
- Conditions, temperature, and expiration dates will be monitored during storage and during testing.
- Investigators will confirm that all samples analyzed are homogeneous and representative of the site.
- A reference will be run with each test to serve as a positive control to ensure the performance of the test and verify that test procedures were properly followed.

In addition, operators name, time, date, sample location, raw data, calculations, and final results for each sample will be recorded on a soil sampling log. Duplicate analyses using the PCB test kit will be performed on one of every 20 samples, as recommended by the manufacturer. Additionally, as discussed in the response to General Comment 5, GMC intends to submit split soil samples for laboratory confirmation of PCBs (to support an evaluation of PCBs in the baseline risk assessment) for all sampling intervals which exceed the 25 mg/kg action level, or a minimum of 10 percent of the test kit samples.

RESPONSE TO SPECIFIC COMMENT 3

As presented in GMC's response to General Comments 1 and 2, it has been GMC's intent all along to complete the field screening and supplemental soil sampling at AOIs 13 and 17 in one continuous field program. The locations for the supplemental borings will be determined in the field based on the results of the screening analysis (field gas chromatograph, immunoassay kits, visual evidence of metals contamination confirmed with laboratory analysis). The schedule presented on Figure 1-9 of the Supplemental RFI Work Plan has been revised to more clearly present the proposed program for completing the field screening and additional soil sampling at AOIs 13 and 17.

Time has also been added to the schedule for AOIs 7 and 36 field programs to accommodate some additional characterization during this same phase of field work, if gross contamination is observed. The revised Figure 1-9 is attached to this response document.

RESPONSE TO SPECIFIC COMMENT 4

GMC will advance soil borings at AOIs 13 and 17 using hollow-stem augering, if required, and these borings will be continuously sampled and field screened with an HNu until the water table is reached. Samples will be selected from each boring for laboratory analysis at 0 - 2 feet and above the water table (a third sample may be collected based on visual evidence of contamination or field screening with an HNu).

SUPPLEMENTAL DOCC

RESPONSE TO GENERAL COMMENT 1

As U.S. EPA described, GMC has comprehensively collected information regarding past and current on-site activities. If GMC discovers any additional source areas during implementation of the Supplemental RFI, GMC will inform U.S. EPA.

SUPPLEMENTAL RFI WORK PLAN APPENDIX B
RFI QUALITY ASSURANCE PROJECT PLAN

RESPONSE TO GENERAL COMMENT 1

Table 3.1 in the RFI Quality Assurance Project Plan (QAPjP) and Table 3-1 in the Supplemental RFI Work Plan have been modified to be consistent with the laboratory analytical methods presented by NET Environmental Testing, Inc. (NET) in their QAPjP. The methods presented by NET (Table 5.1 of the NET QAPjP) are defined in the Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992. These analytical methods will provide the necessary data quality for use in the biogeochemical screening proposed for groundwater. Replacement pages for Table 3.1 in the RFI QAPjP and Table 3-1 in the Supplemental RFI Work Plan incorporating these change are attached to this response document.

RESPONSE TO GENERAL COMMENT 2

The analytical method for cis-1,2 dichloroethene was inadvertently not listed on Table 3.1 of the RFI QAPjP. Table 3.1 of the RFI QAPjP has been revised to include Method 8240B for the analyses of cis-1,2 dichloroethene, consistent with the Supplemental RFI Work

Plan, NET's QAPjP, and the method employed during the Delphi Thermal RFI. The revised Table 3.1, incorporating this change is attached to this response document.

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Table 1. Monitor Wells Assigned to Areas of Interest, Supplemental RFI Work Plan, General Motors Corporation, Moraine, Ohio.

Area of Interest	Upgradient Monitor Well	Downgradient Monitor Well
AOI 7 - Former Oil House	HR-11	GM-23 [1]
AOI 13 - Buildings 4, 6, and 13	GM-22	GM-21, EAST
AOI 17 - Building 15	GM-22	GM-21
AOI 36 - Former Southwest ASTs	GM-21	GM-2

[1] - GM-23 is located within the suspected center of AOI 7.

I:\GMOTORS\COMMENTS\TABLE1.DOC

Table 3-1. Field and Laboratory Analytical Procedures for Groundwater, Supplemental RFI Work Plan, General Motors Corporation, Moraine, Ohio.

Parameters	Method Number	Procedure
Appendix IX VOCs and cis 1,2-DCE	Method 8240B	Laboratory[3]
Appendix IX SVOCs	*Method 8270B*	*Laboratory[3]*
Appendix IX PCBs	*Method 8080A*	*Laboratory[3]*
Appendix IX Total Metals	*Method 6020[5]*	*Laboratory[3]*
Appendix IX Dissolved Metals	*Method 6020[5]*	*Laboratory[3]*
Dissolved Oxygen	[1]	Field
Reduction/Oxidation Potential	[1]	Field
pH	[1]	Field
Specific Conductance	[1]	Field
Nitrate	Method SM4500	Field
Nitrite	Method SM4500	Field
Nitrogen, Ammonia	SM4500NH_3-H	Laboratory[3]
Manganese (Total)	Method 6010A	Laboratory[3]
Manganese (Dissolved)	Method 6010A	Laboratory[3]
Iron (Total)	Method 6010A	Laboratory[3]
Iron (Dissolved)	Method 6010A	Laboratory[3]
Iron (Ferrous)	Method 315B	Field
Sulfate	SM4500SO_4-E	Laboratory[3]
Sulfide	SM4500-S_2E	Laboratory[3]
Total Organic Carbon	SM5310B	Laboratory[3]
Chlorides	SM4500CL-C	Laboratory[3]
Light Hydrocarbon Scan (Ethane, Ethene)	Method AM15.01G[2]	Laboratory[4]
Permanent Gases (Carbon Dioxide, Oxygen, Nitrogen, Methane and Carbon Monoxide)	Method AM18G[2]	Laboratory[4]

Footnotes appear on Page 2.

Table 3-1. Field and Laboratory Analytical Procedures for Groundwater, Supplemental RFI Work Plan, General Motors Corporation, Moraine, Ohio. (continued)

Method	Refers to U.S. Environmental Protection Agency SW 846.
SM	Standard Methods for the Evaluation of Water and Wastewater, 18th Edition, 1992.
(1)	Field parameters to be collected using a down-well or a flow-through meter.
(2)	Method numbers are laboratory-specific and developed for monitoring natural attenuation projects.
(3)	National Environmental Testing, Inc. - Dayton Division.
(4)	Microseeps, Pittsburgh, Pennsylvania.
(5)	*Appendix IX metals will be analyzed using Method 6020 except mercury by Method 7470A; selenium by Method 7741A; tin by Method 6010A; and vanadium by Method 200.8.*
cis 1,2-DCE	cis 1,2-Dichloroethene.
VOCs	Volatile organic compounds.
SVOCs	*Semi-volatile organic compounds.*
PCBs	*Polychlorinated biphenyls.*

I:\GM\MOTORS\WORK\PLN\TABLE3-1.DOC

TABLE 3.1
SUMMARY OF RFI INVESTIGATIVE AND QC SAMPLES

MATRIX	FIELD PARAMETERS	LAB PARAMETERS	INVESTIGATIVE SAMPLES	RINSEATE BLANKS	DUPLICATE SAMPLES	MS/MSD	TOTAL SAMPLES[3]
Surface Water	pH, Scon, Temp, HNU	App IX VOCs (8240)	2	1	1	1	4
		App IX SVOCs (8270/3510/3520)	2	1	1	1	4
		App IX Pesticides/PCBs (8080/3510/3520)	2	1	1	1	4
		App IX Herbicides (8150)	2	1	1	1	4
		App IX Metals (6010[2])	2	1	1	1	4
		App IX Cyanide (9010)	2	1	1	1	4
Sediment	HNU	TCL VOCs (8240)	2	0	1	1	3
		TCL SVOCs (8270/3540)	2	0	1	1	3
		TCL PCB/Pesticides (8080/3540)	2	0	1	1	3
		TAL Metals (6010[1])	2	0	1	1	3
		TAL Cyanide (9010 modified)	2	0	1	1	3
Waste (L1, L2, L3)	HNU	TCL VOCs (8240)	11	0	2	1	13
		TCL SVOCs (8270/3540)	11	0	2	1	13
		TCL PCB/Pesticides (8080/3540)	11	0	2	1	13
		TAL Metals (6010[1])	11	0	2	1	13
		TAL Cyanide (9010 modified)	11	0	2	1	13
Bkg Soil	HNU	TAL Metals (6010[1])	24	0	3	1	27
Soil (West Tank Farm and South Tank Farm)	HNU	TCL VOC (8240)	6	0	1	1	7
		TCL PCB (8080/3540)	6	0	1	1	7
		TAL Metals (6010[1])	6	0	1	1	7
Soil (T8)	HNU	TCL VOCs (8240)	2	0	1	*	3
Soil (T4 and T12)	HNU	TCL VOCs (8240)	2	0	1	*	3
		TAL Metals (6010[1])	2	0	1	*	3

TABLE 3.1
SUMMARY OF RFI INVESTIGATIVE AND QC SAMPLES

MATRIX	FIELD PARAMETERS	LAB PARAMETERS	INVESTIGATIVE SAMPLES	RINSEATE BLANKS	DUPLICATE SAMPLES	MS/MSD	TOTAL SAMPLES[3]
Soil (T5/T6)	HNU	TCL VOCs (8240)	2	0	1	*	3
		TCL SVOCs (8270/3540)	2	0	1	*	3
		TCL PCB (8080/3540)	2	0	1	*	3
		TAL Metals (6010[1])	2	0	1	*	3
Soil (T11)	HNU	TCL VOCs (8240)	6	0	1	*	7
		TCL SVOCs (8270/3540)	6	0	1	*	7
		TCL PCB/Pesticides (8080/3540)	6	0	1	*	7
		TAL Metals (6010[1])	6	0	1	*	7
		TAL Cyanide (9010 modified)					
Soil (Stage Area and Waste Pile)	HNU	TCL VOCs (8240)	6	0	1	1	7
		TCL SVOCs (8270/3540)	6	0	1	1	7
		TCL PCB/Pesticides (8080/3540)	6	0	1	1	7
		TAL Metals (6010[1])	6	0	1	1	7
Ground Water	pH, Scon, Temp, HNU	App IX VOCs (8240)	33	4	4	2	41
		App IX SVOCs (8270/3510/3520)	33	4	4	2	41
		App IX Pesticides/PCBs (8080/3510/3520)	33	4	4	2	41
		App IX Herbicides (8150)	33	4	4	2	41
		App IX Total Metals (6010[2])	33	4	4	2	41
		App IX Dissolved Metals (6010[2])	33	4	4	2	41
		App IX Cyanide (9010)					
Ground Water W-1-S, HR-1	pH, Scon, Temp, HNU	App IX VOC (8240)	2	**	**	**	2
		App IX PCB (8080/3510/3520)	2	**	**	**	2
		App IX Total Metals (6010[2])	2	**	**	**	2
		App IX Dissolved Metals (6010[2])	2	**	**	**	2
Ground Water HR-6	pH, Scon, Temp, HNU	App IX VOCs (8240)	1	**	**	**	1
		App IX Total Metals (6010[2])	1	**	**	**	1
		App IX Dissolved Metals (6010[2])	1				1

TABLE 3.1
SUMMARY OF RFI INVESTIGATIVE AND QC SAMPLES

MATRIX	FIELD PARAMETERS	LAB PARAMETERS	INVESTIGATIVE SAMPLES	RINSEATE BLANKS	DUPLICATE SAMPLES	MS/MSD	TOTAL SAMPLES[3]
Soil	None	Bulk Density (ASTM D698)	6	0	1	0	7
		Porosity (ASTM D4404)	6	0	1	0	7
		Particle Size Distribution (ASTM D422)	6	0	1	0	7
		Moisture Content (D2216)	6	0	1	0	7
		TOC (Walkey - Black 9060)	6	0	1	0	7
		CEC (9081)	6	0	1	0	7
Groundwater for the Supplemental RFI	*pH, Scon, Temp, Hnu*	*App IX VOCs (8240B) and cis-1,2-Dichloroethene (8240B)*	26	3	3	2	34
		App IX SVOCs (8270B)	6	1	1	1	9
		App IX PCBs (8080A)	6	1	1	1	9
		App IX Total Metals (6020[5])	6	1	1	1	9
		App IX Dissolved Metals (6020[5])	6	1	1	1	9
	DO, Redox, pH, Scon, Nitrate, Nitrite, Iron (Ferrous)	*Nitrate/Nitrite (SM4500)* *Nitrogen Ammonia (SM4500NH3-H)* *Manganese Total and Dissolved (6010A)* *Iron Total and Dissolved (6010A)* *Sulfate (SM4500S04-E)* *Sulfide (SM4500-S2E)* *TOC (SM5310B)* *Chlorides (SM4500CL-C)* *Light Hydrocarbon Scan (AM15.01G)* *Permanent Gases (AM18G)*	*20*	*2*	*2*	*0*	*24*
Soil (AOI 7 - Former Oil House Area)	*HNU*	*TCL VOCs (8240B)* *TCL SVOCs (8270B/3540B)* *TCL PCBs (8080A)* *TAL Metals (6010A)[1,4]*	*12 (minimum of 8)*	*2*	*2*	*1*	*16*

TABLE 3.1
SUMMARY OF RFI INVESTIGATIVE AND QC SAMPLES

MATRIX	FIELD PARAMETERS	LAB PARAMETERS	INVESTIGATIVE SAMPLES	RINSEATE BLANKS	DUPLICATE SAMPLES	MS/MSD	TOTAL SAMPLES[2]
Soil (AOI 13 - Buildings 4, 6, and 13)	*HNU, Field GC for VOCs and immunoassay test kits for PCBs for 19 sample locations*	*TCL VOCs (8240B)* *TCL SVOCs (8270B/3540B)* *TCL PCBs (8080A)* *TAL Metals (6010A)[1,4]*	*(actual number will be based on field screening results)*				
Soil (AOI 17 - Building 15)	*HNU, Field GC for VOCs and immunoassay test kits for PCBs for 3 sample locations*	*TCL VOCs (8240B)* *TCL SVOCs (8270B/3540B)* *TCL PCBs(8080A)* *TAL Metals (6010A)[1,4]*	*(actual number will be based on field screening results)*				
Soil (AOI - 34 Excavation Area 1)	*HNU*	*TCL VOCs (8240B)* *TCL SVOCs (8270B/3540B)* *TCL PCBs (8080A)* *TAL Metals (6010A)[1,4]*	*2*	*1*	*1*	*	*4*
Soil (AOI 35 - Excavation Area 2)	*HNU*	*TCL VOCs (8240B)* *TCL SVOCs (8270B/3540B)* *TCL PCBs (8080A)* *TAL Metals (6010A)[1,4]*	*2*	***	***	*	*2*
Soil (AOI 36 - Former Southwest ASTs)	*HNU*	*TCL VOCs (8240B)* *TCL SVOCs (8270B/3540B)* *TCL PCBs (8080A)* *TAL Metals (6010A)[1,4]*	*6 (minimum of 4)*	*1*	*1*	*	*8*

NOTES:

[1] Additional methods referenced for metal analysis on solid or semi-solid samples: 7041/3050 (antimony); 7060/3050 (arsenic); 7131/3050 (cadmium); 7421/3050 (lead); 7740/3050 (selenium); EPA method 272.2 (silver); and 7841/3050 (thallium). Mercury is analyzed using Method 7470 only. For further detail, see Table 5.2 of the QAPP (Appendix B).

[2] Additional methods referenced for metal analysis on liquid samples: 7041/3020 (antimony); 7060/3020 (arsenic); 7131/3020 (cadmium); 7421/3020 (lead); 7740/3020

TABLE 3.1
SUMMARY OF RFI INVESTIGATIVE AND QC SAMPLES

(selenium); EPA method 272.2 (silver); and 7841/3020 (thallium). Mercury is analyzed by Method 7470 only. For further detail, see Table 5.1 of the QAPP (Appendix B).

[3] MS/MSD samples for organic analysis will be collected with extra sample volume. Triple the normal sample volumes will be collected for VOCs and triple the normal sample volumes will be collected for semivolatiles and pesticide/PCBs. The number of samples to be collected for MS/MSD are not included in the matrix total.

[4] List excludes aluminum, calcium, iron, magnesium, potassium, and sodium.

[5] *Appendix IX metals will be analyzed uisng Method 6020 except for mercury by Method 7470A; selenium by Method 7741A; tin by Method 6010A; and vanadium by Method 200.8.*

* All MS/MSD for soil samples will be performed at the West Tank Farm/South Tank Farm, Storage Area/Waste Pile, *the Former Oil House Area, and Buildings 4, 6, and 13.*

**All rinseate blanks, duplicates, and MS/MSD for ground-water sampling are included above.
Assumption: One rinseate blank and one duplicate sample per 10 or fewer investigative samples.
All numbers are best estimate at this time.
One trip blank shall be shipped with each shipment cooler of aqueous VOC samples. The number of trip blanks is excluded from the matrix total.

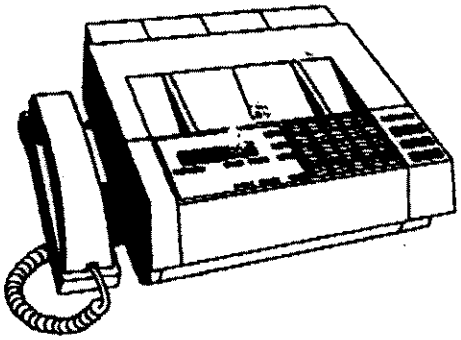
****During the AOI 34 and AOI 35 investigation, one rinseate blank and one duplicate sample will be collected as listed for AOI 34. This meets the one rinseate blank and one duplicate sample per 10 or fewer investigative samples criteria per day assuming they are investigated on the same day.*

VOCs	=	Volatile Organic Compounds
SVOCs	=	Semivolatile Organic Compounds
PCBs	=	Polychlorinated Biphenyls
APP IX	=	Appendix IX
TCL/TAL	=	Target Compound List/Target Analyte List

[illegible]

Waste Pesticides & Toxics Division
Enforcement & Compliance Assurance Branch
U.S. Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Mailcode: DRE-9J
Chicago, Illinois 60604

FACSIMILE REQUEST



To: J Reid
Office/Phone: (614) 799-4706
Facsimile Number: (614) 764-1270
Verification Number:

From: MBulk
Office/Phone: (312) 886-4568
Date: 12/22/97 **Number of Pages:** 3
Additional Comments:

J. This letter was mailed on 19th, you should receive it in a few days

FACSIMILE NUMBER:
312/353-4342

DEC 19 1997

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

DRE-9J

Mr. Norman Sawdey
General Motors Corporation
Delphi/Harrison Thermal Systems
3600 Dryden Road
Moraine, Ohio 45439-1410

Re: Supplemental RCRA Facility Investigation Workplan
GMC Delphi/Harrison OHD 000 817 577
GMC Moraine Engine Plant OHD 980 569 388
GMC Moraine Assembly Plant OHD 041 063 074
Administrative Order
Docket No. V-W-R-002-91

Dear Mr. Sawdey:

The United States Environmental Protection Agency (U.S. EPA) hereby approves the Supplemental RCRA Facility Investigation Workplan for General Motors Powertrain Group Moraine Engine Plant and General Motors Truck Group Moraine Assembly Plant, Moraine, Ohio, dated July, 1997, with the following modifications (items 1-3):

(1) Gross contamination as referred to in the Workplan, shall be established by soil staining or are other evidence of waste material, as identified during visual inspection of soil samples and excavations.

(2) If a 25 mg/kg screening level for PCBs is applied, at least ten percent, or three of the samples (whichever is higher) of the samples that record a screening value between 10 and 25 mg/kg shall be analyzed for the full suite of analytes.

(3) The draft Supplemental RCRA Facility Investigation report shall be submitted to U.S. EPA by November 9, 1998.

General Motors shall notify U.S. EPA of the beginning of field activities at least 14 days in advance of such initiation. To closely coordinate critical decisions, U.S. EPA requests that General Motors include in the monthly progress reports, the raw data generated during the report period.

If you have any questions please call me at (312) 886-4568.

Sincerely,

William Buller, Project Coordinator
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
MI/WI Section

cc: Chris Cotton, OEPA (with attachment)
Pinake Banerjee, PRC (TTIEMC)

ARCADIS GERAGHTY & MILLER

ARCADIS Geraghty & Miller, Inc.
4700 Lakehurst Court
Suite 100
Dublin
Ohio 43016
Tel 614 764 2310
Fax 614 764 1270

ENVIRONMENTAL

Mr. William Buller
U.S. EPA Region 5
Enforcement and Compliance Assurance Branch, HRE-8J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Subject
Supplemental RFI Work Plan, General Motors Corporation, Moraine, Ohio Facilities

Dear Mr. Buller:

On behalf of General Motors Corporation (GMC) ARCADIS Geraghty & Miller, Inc. is providing this letter to follow up on the United States Environmental Protection Agency (U.S. EPA) letter to Mr. Norm Sawdey of GMC dated December 19, 1997, received by Mr. James Reid of ARCADIS Geraghty & Miller via facsimile on December 22, 1997. As we discussed in telephone calls on December 29, 1997 and January 5, 1998, GMC had questions with two issues in the U.S. EPA letter. At your request, I discussed these issues with Mr. Pinake Banerjee of Tetra Tech on January 2, 1998. This letter summarizes GMC's understanding of the agreement reached with U.S. EPA regarding these two issues.

Dublin,
6 January 1998

Contact
James J. Reid

Extension
614 799 4706

The first issue relates to Item 2 in the U.S. EPA letter where it is indicated that select field screening samples for polychlorinated biphenyls (PCBs) with readings between 10 milligram per kilogram (mg/kg) and 25 mg/kg would be submitted for laboratory analysis of a full suite of analytes. The purpose of using field test kits for PCB screening was to determine where borings would be installed for sampling for laboratory analysis of the suite of compounds presented in the Supplemental RFI Work Plan. As presented in the Supplemental RFI Work Plan, and discussed in the December 15, 1997 conference call with U.S. EPA, samples collected during the screening phase with PCB test kit readings above 25 mg/kg would be sent off for laboratory confirmation analysis for PCBs only. Additionally, based on the discussion during the December 15, 1997 conference call, it was decided that a minimum of 10 percent of the samples between 10 mg/kg and 25 mg/kg would be submitted for laboratory analysis for PCBs only. Based upon: (1) the laboratory results showing greater than 25 mg/kg PCBs in the screening samples; (2) field screening for volatile organic compounds (VOCs); and (3) visual screening, borings would then be advanced to the water table and sampled for analysis of the suite of analytes presented in the Supplemental RFI Work Plan to delineate the nature and extent of a possible release. Mr. Banerjee indicated that it is appropriate to analyze the 10 percent of samples with field screening levels of PCBs between 10 mg/kg and 25 mg/kg for PCBs only, consistent with the analysis proposed in the Supplemental RFI Work Plan for screening samples greater than 25 mg/kg.

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Prepared at Request of Counsel

The second issue which required clarification was U.S. EPA's request that raw data be provided with the monthly progress reports. During the December 15th conference call, U.S. EPA and GMC representatives discussed the use of preliminary data from laboratory confirmation samples of PCB field testing results for determining where GMC would place soil borings at the AOIs. Based on the telephone discussions with you and Mr. Banerjee, GMC will provide the U.S. EPA with a summary of the field screening data and preliminary laboratory data to be used to determine appropriate boring locations so that U.S. EPA can effectively evaluate GMC's proposed boring locations. However, the monthly progress report schedule may not be appropriate for transmitting this data in a timely manner to ensure field decisions are made quickly enough so that the investigation schedule is maintained. Therefore, GMC will provide this information to the Agency as a separate document. For all other laboratory data, GMC will follow data reporting procedures used during the RFI at the Delphi Thermal facility, which required presentation of the data in the Supplemental RFI Report.

An 11-inch by 17-inch copy of the Final Schedule of Supplemental RFI Activities showing the November 9, 1998 delivery of the Supplemental RFI Report is attached for your use. As we discussed in a telephone conversation on December 18, 1997, this schedule is appropriate if a second phase of investigation is not required. If, however, a second phase of investigation is necessary, a modification to the November 9, 1998 scheduled date may be required. GMC will work closely with U.S. EPA to ensure that, if needed, necessary supplemental data is obtained expeditiously.

On behalf of GMC, ARCADIS Geraghty & Miller respectfully requests that U.S. EPA confirm in writing its concurrence with this agreement reached between U.S. EPA and GMC, regarding modifications presented in the December 19, 1997 U.S. EPA letter approving the Supplemental RFI Work Plan.

Sincerely,

ARCADIS Geraghty & Miller, Inc.

James J. Reid, P.E.
Project Manager

Copies
C. Cotton, OEPA
P. Banerjee, Tetra Tech
N. Sawdey, GMC
J. Caufield, GMC
S. Song, ENVIRON

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

Received
JAN 16 1998
Norman Sawdey

JAN 13 1998

REPLY TO THE ATTENTION OF

DRE-9J

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Norman Sawdey
General Motors Corporation
Delphi/Harrison Thermal systems
3600 Dryden Road
Moraine, Ohio 45439-1410

Re: Supplemental RCRA Facility Investigation Workplan
GMC Delphi/Harrison OHD 000 817 577
GMC Moraine Engine Plant OHD 980 569 388
GMC Moraine Assembly Plant OHD 041 063 074
Administrative Order
Docket No. V-W-R-002-91

Dear Mr. Sawdey:

This letter is to provide clarification on my December 19, 1997, letter to you in which the Supplemental RCRA Facility Investigation (RFI) Workplan was approved by the United States Environmental Protection Agency (U.S. EPA) with modifications.

The samples referred to in item 2 of the modifications need only be analyzed for polychlorinated biphenyls (PCBs) rather than a full suite of analysis.

James Reid's letter of January 6, 1998, proposed that field screening data and the preliminary laboratory data to be used to determine appropriate boring locations be submitted in timely manner as a separate document, rather than in including this information in monthly progress reports. This submittal procedure is satisfactory with U.S. EPA.

If a second phase of the Supplemental RFI is required, U.S. EPA will evaluate the need to extend the November 9, 1998, due date for submittal of the Supplemental RFI report. You will be notified in writing if the due date is extended.

Recycled/Recyclable-Printed with Vegetable Oil Based Inks on 100% Recycled Paper (40% Postconsumer)

If you have any questions please call me at (312) 886-4568.

Sincerely,

William Buller

William Buller, Project Coordinator
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
MI/WI Section

cc: Chris Cotton, OEPA (with attachment)
Pinaki Banerjee, TTIEMC

AOI 13 - Buildings 4, 6, and 13
and AOI 17 - Building 15

DELPHI
Harrison Thermal Systems

March 3, 1998

FACSIMILE AND FEDEX

Mr. William Buller
U.S. EPA Region 5
Enforcement and Compliance Assurance Branch, HRE-8J
77 West Jackson Boulevard
Chicago, IL 60604-3590

RE: Field Screening Results, Supplemental RFI, General Motors Corporation, Moraine, Ohio

Dear Mr. Buller:

Pursuant to the Supplemental RFI Work Plan, field screening activities were conducted for Areas of Interest (AOIs) 13 and 17 on February 17 through 19, 1998 at the General Motors Powertrain Group Moraine Engine Plant in Moraine, Ohio. Oversight of field activities was conducted by Tetra Tech. The enclosed Tables 1 and 2 present the field screening and analytical results, respectively. Soil samples were collected using direct push methodology at nineteen locations at AOI 13 and three locations at AOI 17. Sample depth was 8 feet. Continuous headspace readings were taken using a photo-ionization detector (HNu) and all readings were 0 parts per million (ppm).

All volatile organic compound (VOC) results from the on-site field gas chromatograph were below the 1 milligram per kilogram (mg/kg) screening criteria (Table 1). There were only three positive test kit results for polychlorinated biphenyls (PCBs), as shown on Table 1. A positive test kit result occurred at BDG-DP2 (0.5 - 1.0 mg/kg) and the other two occurred at BDG-DP1. The initial test kit result at BDG-DP1 was greater than 25 ppm and a duplicate test kit result was 1.1 - 4 ppm. Per the Supplemental RFI Work Plan, a split of this sample (BDG-DP1) was submitted to National Environmental Testing, Inc. (NET) for confirmation. Based on the analytical results (Table 2), only Aroclor 1254 was detected at 6.99 mg/kg, which is well below the RFI screening criteria of 25 mg/kg. This result is also below the United States Environmental Protection Agency (U.S. EPA) soil PCB action level of 10 to 25 mg/kg, presented in U.S. EPA's comments on the Supplemental RFI Work Plan and received by GMC on October 7, 1997. One sample (BDG-DP13) was collected based on visual evidence of staining and submitted to NET for metals analysis. As shown on Table 2, metals results were below soil background levels from the RFI Final Report Volume II, Baseline Risk Assessment.

Based on these field screening results, General Motors believes no further soil sampling or corrective measures to address constituents in soil are required at AOIs 13 and 17. As previously discussed with U.S. EPA, General Motors plans in the near future to pave AOIs 13 and 17 as part of

the expansion projects. Therefore, General Motors requests U.S. EPA agreement as expeditiously as possible that no further soil sampling or corrective measures to address constituents in soil are required at AOIs 13 and 17.

I will call you on Thursday, March 5, 1998 to discuss this letter.

Sincerely,

Norman J. Sawdey

Attachments

cc: P. Banerjee, Tetra Tech

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Table 1. Field Screening Results for AOIs 13 and 17, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Sample Date	Sample Identification	Sample Interval (feet)	PCB Test Kit Results (ppm)	HNu Reading (ppm)	Field GC Results (ppm)		
					TCE	PCE	1,1,1-TCA
AOI 13							
2/17/98	BDG-DP3	4-8	<0.5	0	<0.001	<0.001	<0.001
2/17/98	BDG-DP4	4-8	<0.5	0	<0.001	<0.001	<0.001
2/17/98	BDG-DP6	4-8	<0.5	0	0.011	0.002	<0.001
2/17/98	BDG-DP7	4-8	<0.5	0	<0.001	<0.001	<0.001
2/17/98	BDG-DP10	4-8	<0.5	0	<0.001	<0.001	<0.001
2/17/98	BDG-DP11	4-8	<0.5	0	0.002	0.001	<0.001
2/17/98	BDG-DP12	4-8	<0.5	0	0.001	0.001	<0.001
2/18/98	BDG-DP2	4-8	0.5 - 1.0	0	<0.001	<0.001	<0.001
2/18/98	BDG-DP5	4-8	<0.5	0	0.001	0.001	<0.001
2/18/98	BDG-DP8	4-8	<0.5	0	0.03	0.001	<0.001
2/18/98	BDG-DP8 (DUP)	4-8	<0.5	0	NA	NA	NA
2/18/98	BDG-DP9	4-8	<0.5	0	<0.001	0.048	<0.001
2/18/98	BDG-DP14	4-8	<0.5	0	0.066	0.004	0.002
2/18/98	BDG-DP14 (DUP)	4-8	NA	0	0.07	0.004	0.003
2/18/98	BDG-DP17	4-8	<0.5	0	0.002	0.002	<0.001
2/18/98	BDG-DP18	4-8	<0.5	0	<0.001	<0.001	<0.001
2/18/98	BDG-DP18 (DUP)	4-8	<0.5	0	NA	NA	NA
2/18/98	BDG-DP19	4-8	<0.5	0	<0.001	<0.001	<0.001
2/19/98	BDG-DP1	4-8	>25	0	<0.001	<0.001	<0.001
2/19/98	BDG-DP1 (DUP)	4-8	1.1 - 4	0	NA	NA	NA
2/19/98	BDG-DP13 (0-4)	0-4	<0.5	0	0.003	<0.001	<0.001
2/19/98	BDG-DP13 (4-8)	4-8	<0.5	0	0.002	<0.001	<0.001
2/19/98	BDG-DP15	4-8	<0.5	0	0.028	<0.001	<0.001
2/19/98	BDG-DP16 (0-4)	0-4	<0.5	0	0.008	<0.001	<0.001
2/19/98	BDG-DP16 (4-8)	4-8	<0.5	0	0.001	<0.001	<0.001
AOI 17							
2/19/98	BD15-DP1	4-8	<0.5	0	0.006	0.065	<0.001
2/19/98	BD15-DP2	4-8	<0.5	0	0.004	0.065	<0.001
2/19/98	BD15-DP2 (DUP)	4-8	NA	0	0.005	0.064	<0.001
2/19/98	BD15-DP3	4-8	<0.5	0	0.009	0.036	<0.001
2/19/98	BD15-DP3 (DUP)	4-8	<0.5	0	NA	NA	NA

Table 1. Field Screening Results for AOIs 13 and 17, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Notes:
A split of BDG-DP1 (4-8) was submitted to NET for analysis of TCL PCBs by Method 8080A.
A split of BDG-DP13 (0-4) was submitted to NET for analysis of TAL Metals by Method 6010A.
PCB Test Kit Results were obtained by using the D-TECH #TK-1002-1, PCB Soil Extraction Pac D-TECH #TK-1002S-1, and the test kit results were interpreted using the DETECHTOR #TK-1001M-1.
Field GC Results were obtained from Microseeps mobile laboratory.
NA - Not analyzed.

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Table 2. Confirmation Sample Laboratory Results, Supplemental RFI, General Motors Corporation, Moraine, Ohio

Constituent	Units	Sample Description		Soil Background Level
		BDG-DP1 4-8 feet	BDG-DP13 0-4 feet	
Metals				
Antimony	mg/Kg	NA	<7.2	NB
Arsenic	mg/Kg	NA	6.19	28.5
Barium	mg/Kg	NA	103	229
Beryllium	mg/Kg	NA	0.6	2.41
Cadmium	mg/Kg	NA	<1.1	12.6
Chromium	mg/Kg	NA	9.7	47.4
Cobalt	mg/Kg	NA	4.16	26
Copper	mg/Kg	NA	13.1	41
Lead	mg/Kg	NA	23.1	49.1
Manganese	mg/Kg	NA	611	1,600
Mercury	mg/Kg	NA	0.182	0.69
Nickel	mg/Kg	NA	10.9	63.7
Selenium	mg/Kg	NA	0.643	1.5
Silver	mg/Kg	NA	<1.4	0.76
Thallium	mg/Kg	NA	<0.60	NB
Vanadium	mg/Kg	NA	16.5	84.4
Zinc	mg/Kg	NA	82.3	152
PCBs				
Aroclor 1016	mg/Kg	<0.56	NA	
Aroclor 1221	mg/Kg	<0.56	NA	
Aroclor 1232	mg/Kg	<0.56	NA	
Aroclor 1242	mg/Kg	<0.56	NA	
Aroclor 1248	mg/Kg	<0.56	NA	
Aroclor 1254	mg/Kg	6.99	NA	
Aroclor 1260	mg/Kg	<0.56	NA	

Notes:
Background levels from the RFI Final Report Volume II, Baseline Risk Assessment.
PCB - Polychlorinated biphenyl.
< - Constituent not detected above laboratory detection limit shown.
mg/Kg - Milligram per kilogram.
NA - Not analyzed.
NB - No background levels were calculated.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

MAR 05 1998

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

DRE-9J

Mr. Norman Sawdey
General Motors Corporation
Delphi/Harrison Thermal systems
3600 Dryden Road
Moraine, Ohio 45439-1410

Re: Supplemental RCRA Facility Investigation
GMC Delphi/Harrsion OHD 000 817 577
GMC Moraine Engine Plant OHD 980 569 388
GMC Moraine Assembly Plant OHD 041 063 074
Administrative Order
Docket No. V-W-R-002-91

Dear Mr. Sawdey:

The U.S. EPA is in receipt of your March 3, 1998 letter. The letter presented the soil screening results for AOIs (Areas of Interest) 13 and 17, and requested the Agency's concurrence that no further soil sampling or corrective measures for these two areas are required. Your letter also indicated your intent to pave these areas in the near future.

In accordance with the Supplemental RFI (RCRA Facility Investigation) Work Plan, based on the soil testing results for AOIs 13 and 17, no further sampling is required. However, until all data developed in the RFI has been received, validated and thoroughly evaluated, U.S. EPA reserves the right to require additional sampling/testing at AOIs 13 and 17, as well as corrective measures, if needed.

If you have any questions please call me at (312) 886-4568.

Sincerely,

William Buller

William Buller, Project Coordinator
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
MI/WI Section

Recycled/Recyclable-Printed with Vegetable Oil Based Inks on 100% Recycled Paper (40% Postconsumer)

cc: Chris Cotton, OEPA (with attachment)
Pinaki Banerjee, TTIEMC

AOI 36 - Former Southwest ASTs

DELPHI
Harrison Thermal Systems

May 29, 1998

FACSIMILE AND FEDEX

Mr. William Buller
U.S. EPA Region 5
Enforcement and Compliance Assurance Branch, HRE-8J
77 West Jackson Boulevard
Chicago, IL 60604-3590

RE: Supplemental RFI, General Motors Corporation, Moraine, Ohio

Dear Mr. Buller:

Per our telephone conversation on May 28, 1998, I am providing the United States Environmental Protection Agency (U.S. EPA) with the attached information regarding proposed additional sampling of shallow soil at the southern end of the General Motors Powertrain Group Moraine Engine Plant (Engine Plant). As we discussed, the results of shallow soil analysis at Area of Interest (AOI) 36 - Former Southwest ASTs during sampling associated with the Supplemental RCRA Facility Investigation (RFI) indicated the presence of arsenic above the site-specific background levels determined during the initial phase of the RFI. While a preliminary evaluation of the data indicates that the level of arsenic does not pose a significant potential risk to workers, under exposure assumptions developed for the Risk Assessment conducted during the initial phases of the RFI at the Delphi Harrison Thermal System (Delphi Thermal) Moraine facility, General Motors Corporation (GMC) intends to conduct the additional sampling to further quantify and evaluate the presence of arsenic in this area.

GMC appreciates you prompt attention to this matter. I will call you on Monday, June 1, 1998 to discuss this letter.

Sincerely,

W. John Ridd
Senior Environmental Project Engineer

Attachments
cc: E. Schuessler, Tetra Tech

GMOTORS\GMCRFI\epa529b.doc

ADDITIONAL ARSENIC SAMPLING PLAN
SUPPLEMENTAL RFI
GENERAL MOTORS CORPORATION
MORAINE, OHIO

INTRODUCTION

A preliminary review of the soil characterization for AOI 36-Former Southwest ASTs, conducted per the approved Supplemental RFI Work Plan, (see attached Table 1) shows that the concentrations of arsenic in the two shallow soil samples are above background levels. No concentrations of other metals exceed the site-specific background levels determined during the RFI for Delphi Harrison Thermal Systems (Delphi Thermal) and reported in the baseline risk assessment for Delphi Thermal. The concentrations of arsenic in the deeper soil samples also do not exceed the site-specific background levels. The concentrations of organic constituents detected are expected to pose no significant risk under the site-specific exposure scenarios that will be used in evaluating AOI 36 in the upcoming supplemental baseline risk assessment. In fact, the concentrations of the organic constituents are lower than U.S.EPA's generic Soil Screening Levels.

Because the arsenic concentrations in the shallow soil samples are above background levels, and there is uncertainty regarding the cause for the presence of these concentrations at the sampled locations, additional sampling is appropriate to further characterize arsenic concentrations in the shallow soil at the area around AOI 36. A preliminary evaluation of potential risk associated with these arsenic concentrations was conducted using the same exposure assumptions used in the Delphi Thermal baseline risk assessment for evaluating potential worker exposures at the Solid Waste Management Unit identified as "Fill Area" at Delphi Thermal. The exposure scenarios used for evaluating the Fill Area are expected to be appropriate for evaluating AOI 36 in the upcoming supplemental risk assessment. The size of the Fill Area is also similar to the size of the unpaved area around AOI 36 as shown on Figure 1. Based on this preliminary evaluation, the potential risk to workers from the arsenic concentrations in the shallow soil samples are expected to be less than 10^{-5} when the supplemental risk assessment is conducted for all the constituents and Areas of Interest (AOIs) at the General Motors Truck Group and Engine facilities.

Although the preliminary evaluation of the arsenic concentrations in the shallow soil samples do not indicate significant potential risk to workers, additional characterization of arsenic concentrations in the area around AOI 36 would be appropriate to reduce uncertainty in quantifying the concentrations of arsenic that workers may encounter in the area over the long-term. Therefore, General Motors Corporation (GMC)proposes to conduct additional sampling in the unpaved area around AOI 36 to provide data for establishing an exposure concentration for

arsenic that would be used in the upcoming supplemental baseline risk assessment. The sampling plan is described below.

SAMPLING PLAN

Attached is a figure detailing the area at the south end of the Engine Plant showing where additional sampling will be conducted to evaluate the presence of arsenic detected in shallow soil in the vicinity of AOI-36. Since the source of the arsenic may not be associated with materials which were likely stored in the Southwest ASTs, the sampling plan has been developed to obtain arsenic data for the area around AOI-36 which historically has been unpaved. To further refine the evaluation of the data to be collected, this area has been divided into Areas A and B. The surface area for Area A is approximately 77,611 square feet (sq ft) and for Area B is approximately 50,552 sq ft. The following briefly describes the sampling plan.

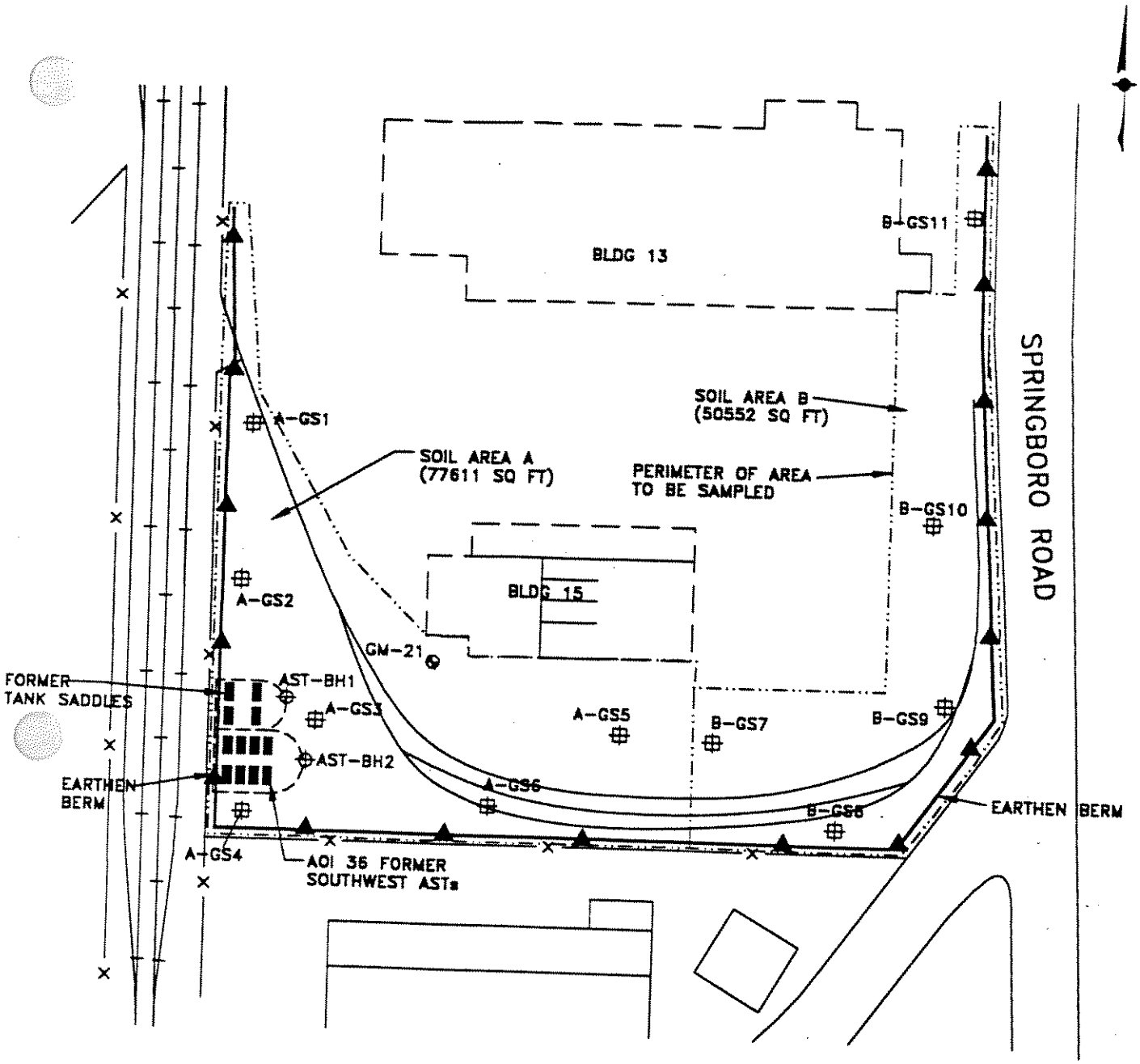
Soil samples from the 0 to 2 foot (ft) and 2 to 4 ft intervals will be collected at approximately six locations in Area A and five locations in Area B. Samples will be collected using either a manual hand auger, or powered auger. The shallow soil samples will be split, with half retained as a discrete sample and half combined into one representative composite sample for each Area. The two shallow interval composite samples will be analyzed for arsenic by National Environmental Testing, Inc. (NET).

The shallow discrete samples, and deeper discrete samples will be retained and the need to analyze these samples will be determined based on an evaluation of the analytical results of the composite sample. Based on the preliminary risk assessment discussed above, which determined that the arsenic concentration of 325 milligrams per kilogram (mg/kg) is not expected to pose significant risk, if the concentration of arsenic determined by the composite sample analysis is greater than 325 mg/kg the discrete samples collected in the 0-2 ft interval in that Area will be analyzed for arsenic. Pending the results of this discrete sample analysis, a determination will be made regarding whether the soil sample from the deeper horizon in the Area should be analyzed.

As part of the construction of a parking lot in this southern area of the Engine Plant, a landscaping berm (requested by the City of Moraine) has been created along the eastern, southern and western boundaries of Areas A and B (Figure 1). This berm was constructed using a mixture of top soil from Areas A and B and fill material brought onto the site. Additional soil samples will be collected to evaluate the presence of arsenic in the berm. The berm will be divided into two sections, consistent with boundaries of Areas A and B above. Soil samples from the mid-depth of the berm will be collected from approximately eight locations within each berm section. The samples will be split with a portion retained as a discrete sample and a portion combined into a composite sample. The composite samples will be analyzed for arsenic by NET.

The discrete berm samples will be retained and the need to analyze these samples will be determined based on an evaluation of the analytical results of the composite sample. If the concentration of arsenic determined by the composite sample analysis for a particular section of the berm is greater than 325 milligrams per kilogram (mg/kg), the discrete samples from that section of the berm will be analyzed for arsenic to evaluate the distribution within the berm.

All soil sampling, analytical and data validation protocols detailed within the approved Supplemental RFI Work Plan and associated support documents will be adhered to during the implementation of this additional sampling.



OIL AREA A COMPOSITE SAMPLE WILL
ONSIST OF AST-GS1 THROUGH AST-GS6.

OIL AREA B COMPOSITE SAMPLE WILL
ONSIST OF AST-GS7 THROUGH AST-GS11.

0 250 FT

SCALE

LEGEND

AOI	AREA OF INTEREST
— —	OUTLINES FORMER BUILDING LOCATIONS
⊙	MONITOR WELL (SHALLOW)
⊕	PHASE III RFI SOIL BORING
⊞	APPROXIMATE SAMPLE POINTS
▲	APPROXIMATE BERM SAMPLE LOCATION
GS	GRAB SAMPLE
BH	BORE HOLE

S GERAGHTY & MILLER

HAND AUGER SOIL SAMPLING
LOCATIONS FOR AOI 36 - FORMER
SOUTHWEST ASTs
GENERAL MOTORS CORPORATION
MORAINE, OHIO

DATE 2/MAY/98	PROJECT MANAGER J. REID	DRAWING NAME AOI36-S
DRAWN R. SMITH	LEAD DESIGN PROF. J. REID	CHECKED R. ELLIOTT
PROJECT NUMBER 0H000294.001.002		DRAWING NUMBER 1

Table 1. AOI-36 Former Southwest ASTs, Soil Analytical Results, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

	Units	AST-BH1		AST-BH2	
		2 ft	22 ft	2 ft	24 ft
Volatile Organic Compounds					
Tetrachloroethene	ug/kg	<6.0	6	<6.1	<5.6
Trichloroethene	ug/kg	<6.0	6.5	<6.1	<5.6
Semi-volatile Organic Compounds					
Bis(2-ethylhexyl)phthalate	ug/kg	<393	1,230	<403	<370
Fluoranthene	ug/kg	<393	<354	<403	<370
Phenanthrene	ug/kg	<393	<354	<403	<370
Metals					
Antimony	mg/kg	<19	<17	<19.8	<15
Arsenic	mg/kg	**325**	1.57	**150**	8.19
Barium	mg/kg	86	11	65.2	11
Beryllium	mg/kg	0.8	<0.9	0.9	0.8
Cadmium	mg/kg	<1.2	<5.2	<1.2	<4.4
Chromium	mg/kg	11	<6.9	11	<5.8
Cobalt	mg/kg	7.9	<3.4	6.4	<2.9
Copper	mg/kg	25.5	6.9	18.7	6.6
Lead	mg/kg	17.1	3.27	16.4	5.23
Manganese	mg/kg	619	123	494	152
Mercury	mg/kg	0.033	<0.011	0.032	<0.011
Nickel	mg/kg	17.4	4.3	13.1	4.4
Selenium	mg/kg	0.798	<0.888	0.808	0.941
Silver	mg/kg	<1.5	<6.9	<1.6	<5.8
Thallium	mg/kg	<0.60	<0.54	<0.61	0.633
Vanadium	mg/kg	20.1	<8.6	14.3	<7.3
Zinc	mg/kg	67.9	17.9	63.6	18.3

Results presented in this table are considered preliminary because the data has not been validated. This table presents VOC and SVOC data above the method detection limit. PCBs were not detected in these samples. Metal analytical results that are bold exceed RFI background concentrations.
ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.
ND - Not detected.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. John Ridd
Senior Environmental Project Engineer
General Motors Corporation
Delphi/Harrison Thermal systems
3600 Dryden Road
Moraine, Ohio 45439-1410

DRE-9J

Re: Supplemental RCRA Facility Investigation
GMC Delphi/Harrsion OHD 000 817 577
GMC Moraine Engine Plant OHD 980 569 388
GMC Moraine Assembly Plant OHD 041 063 074
Administrative Order
Docket No. V-W-R-002-91

Dear Mr. Ridd:

The United States Environmental Protection Agency (U.S. EPA) hereby approves the May 29, 1998 AOI 36 Sampling Plan as revised June 9, 1998.

To clarify, 1 composite soil sample of the 0-2 foot depth interval and 1 composite berm sample from area A,B,C, and D shall be analyzed for arsenic. Discrete soil and/or berm samples shall be analyzed for arsenic for those areas which have arsenic concentrations in composite samples exceeding 325 mg/kg. If arsenic concentrations of the 0-2 foot discrete soil sample exceed 325 mg/kg, the corresponding discrete sample of the 2-4 foot interval shall be analyzed for arsenic.

Due to the unique circumstances of the GMC site, the sampling plan including composite sample analysis was deemed acceptable. Approval of the plan shall not be construed as a general approval by U.S. EPA of such sampling plan.

If you have any questions please call me at (312) 886-4568.

Sincerely,

William Buller, Project Coordinator
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
MI/WI Section

DELPHI
Harrison Thermal Systems

June 24, 1998

FACSIMILE AND FEDEX

Mr. William Buller
U.S. EPA Region 5
Enforcement and Compliance Assurance Branch, HRE-8J
77 West Jackson Boulevard
Chicago, IL 60604-3590

RE: Additional Arsenic Sampling Near AOI 36, Supplemental RFI, General Motors Corporation, Moraine, Ohio

Dear Mr. Buller:

Enclosed are the preliminary arsenic analytical results from the additional sampling of unpaved shallow soils at the southern end of the General Motors Powertrain Group Moraine Engine Plant (Engine Plant) in the vicinity of AOI 36 - Former Southwest ASTs. The results are presented on Table 1 and are well below the 325 milligrams per kilogram (mg/kg) screening level recommended in the Additional Arsenic Sampling Plan, dated May 29, 1998.

The May 29, 1998 Additional Arsenic Sampling Plan was discussed in our telephone conversations on June 9 and 10, 1998. Based on these discussions it was decided that the area at the southern end of the Engine Plant to be investigated would be divided into four equal areas, rather than the two areas originally proposed. Based on verbal U.S. EPA approval received during our June 10, 1998 conversation, soil sampling was conducted on June 10 and 11, 1998 by ARCADIS Geraghty & Miller. The U.S. EPA approval letter, submitted via facsimile on June 11, 1998, was received by General Motors on June 12, 1998, when I returned to the office.

In accordance with the sampling plan as approved by the U.S. EPA, one composite sample was analyzed from each of the four equal soil areas (A through D), as shown on Figure 1. Four discrete samples were collected from each of the four areas to make up these composite samples. These discrete samples were collected over a two-day period (June 10 and 11, 1998) and were composited by the laboratory per ARCADIS Geraghty & Miller's instructions.

As described in the May 29, 1998 sampling plan, a landscaping berm was created along the outer edges of the unpaved soil area in conjunction with initial site grading for the parking lot. This berm consists predominantly of topsoil from the unpaved areas. According to the May 29, 1998 sampling plan, the berm was to be divided into a western half and eastern half, with eight discrete samples to be collected in each, and composited into one sample for each half. However, when the

sampling team arrived on site on June 10th, they determined that the majority of the topsoil had been moved to the western and eastern berms, leaving only a limited quantity of berm material present along the southern property boundary. On the basis of field observations and conversations with construction personnel on how the shallow soil had been moved to form the berm, a field decision was made to divide the berm into three areas (western side E, southern side F, and eastern side G) for compositing (see Figure 1).

Note that it is our understanding of the U.S. EPA approval letter, which we received after the work was completed, that the U.S. EPA believed we had intended to divide the berm to coincide with the revised four-area sampling strategy. However, during the June 9 and 10, 1998 telephone conversations, the discussions were directed toward the "area" samples. Therefore, it was General Motors' understanding that the berm would still be divided into two sections, per the original plan, with one composite sample prepared for each section. Considering the geometry of the revised areas, this would have resulted in unequal berm segments with the A and D segments comprised of six samples per composite and the B and C segments with only two samples per composite. Further, considering the area comprising the footprint of the berm and layout of berm sampling locations, it is important to note that the sample density and number of composites per unit area in the two or three-composite approach is still much greater than that approved for the "area" samples.

The attached Table 1 presents the soil area and berm composite sample results collected from the 0-2 foot interval. These results are all well below 325 mg/kg. Figure 1 indicates soil areas, berm areas, and actual sampling locations. Based on these preliminary results, General Motors believes that these arsenic concentrations do not pose a risk to workers and that sufficient data has been collected to quantify arsenic concentrations that workers may encounter in the area over the long-term. General Motors also believes that no further sampling is required to address arsenic concentrations in the vicinity of AOI 36 - Former Southwest ASTs.

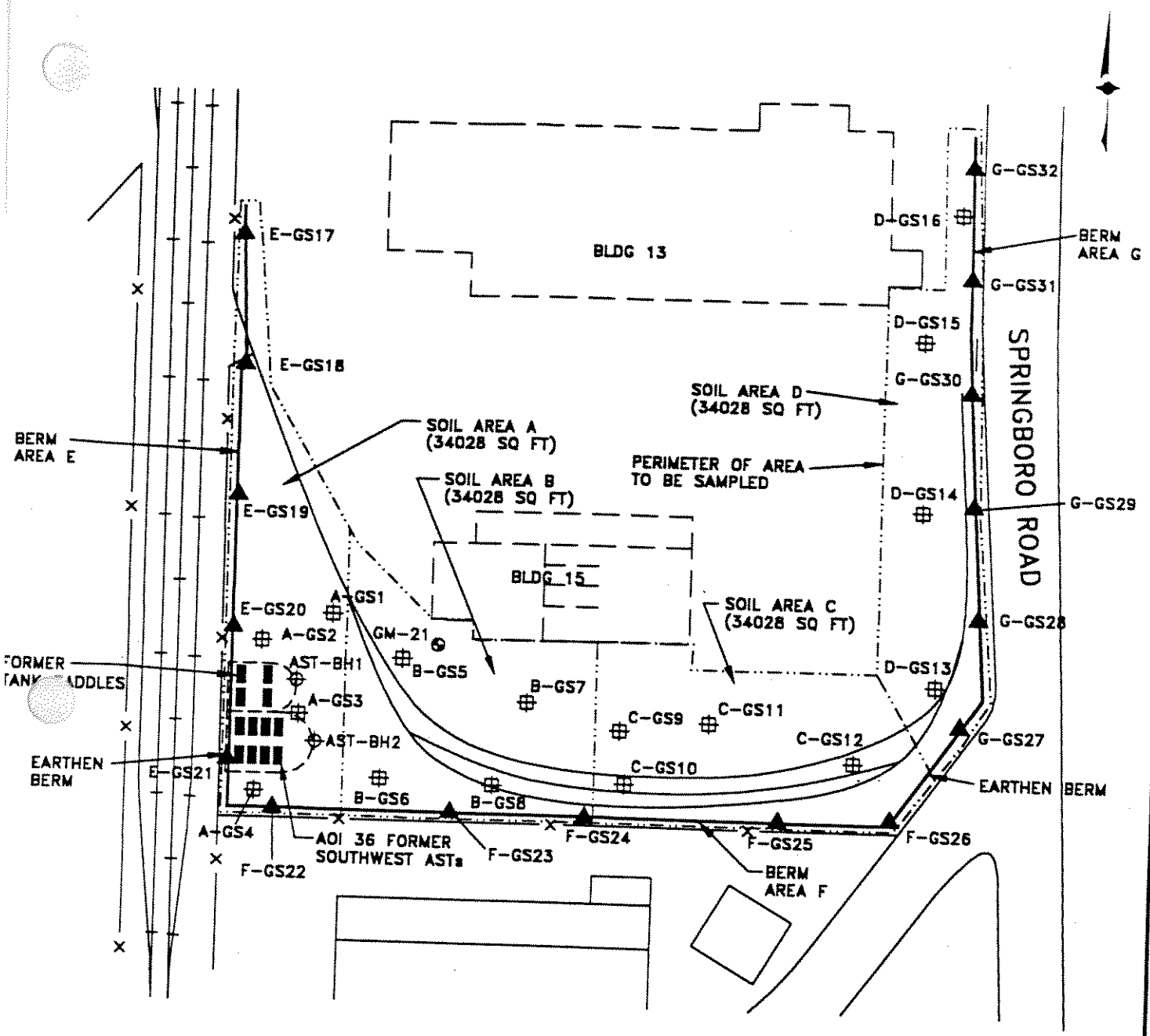
We apologize for any misunderstanding regarding the berm sampling and appreciate your consideration of our revised sampling plan as it was implemented. Again, we appreciate your continued cooperation to expedite these sampling activities to allow us to not impede the schedule of the plant expansion activities. I will call you on June 26 to discuss this letter.

Sincerely,

Nancy A. Gillotti for

W. John Ridd
Senior Environmental Project Engineer

Attachments
cc: E. Schuessler, Tetra Tech



LEGEND

AOI	AREA OF INTEREST
— —	OUTLINES FORMER BUILDING LOCATIONS
⊙	MONITOR WELL (SHALLOW)
⊕	SUPPLEMENTAL RFI SOIL BORING
⊞	APPROXIMATE SAMPLE POINTS
▲	APPROXIMATE BERM SAMPLE LOCATION
GS	GRAB SAMPLE
BH	BORE HOLE

0 125 FT
SCALE

GERAGHTY & MILLER

HAND AUGER SOIL SAMPLING LOCATIONS FOR AOI 36 – FORMER SOUTHWEST ASTs
GENERAL MOTORS CORPORATION
MORAINE, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
2/24/98	J. REID	AOI36-2
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH	J. REID	R. ELLIOTT
PROJECT NUMBER		DRAWING NUMBER
OH000294.001.002		1

Table 1. Preliminary Laboratory Results near AOI - 36 Former Southwest ASTs, General Motors Corporation, Moraine, Ohio.

Constituent	Units	Soil Area A Composite	Soil Area B Composite	Soil Area C Composite	Soil Area D Composite	Berm Area E Composite	Berm Area F Composite	Berm Area G Composite	QA/QC Samples		
									Dup-59	RB-35	RB-36
Metals											
Arsenic	mg/Kg	20.1	37.3	33.4	10	5.33	64.9	94.6	41.6	<0.005	<0.005

< - Constituent not detected above laboratory detection limit shown.
mg/Kg - Milligram per kilogram.
RB-35 = Rinseate blank for hand auger.
RB-36 = Rinseate blank for power auger.
DUP-59 = Duplicate of composite sample A.
QA/QC - Quality assurance/quality control.
Results presented in this table are considered preliminary because the data has not been validated.
Soil Area A composite sample consists of A-GS1 through A-GS4.
Soil Area B composite sample consists of B-GS5 through B-GS8.
Soil Area C composite sample consists of C-GS9 through C-GS12.
Soil Area D composite sample consists of D-GS13 through D-GS16.
Berm Area E composite sample consists of E-GS17 through E-GS21.
Berm Area F composite sample consists of F-GS22 through F-GS26.
Berm Area G composite sample consists of G-GS27 through G-GS32.
Soil area samples were collected in the 0-2 foot interval within native soil and berm area samples were collected 1-1.5 feet into the berm.

AOI 7 - Former Oil House Area

DELPHI
Harrison Thermal Systems

July 16, 1998

Federal Express

U.S. EPA Region V
RCRA Enforcement Branch, HRE-8J
77 West Jackson Blvd.
Chicago, IL 60604-3590
Attn: Mr. William Buller

Dear Mr. Buller:

General Motors Corporation (GMC) completed a review of the Supplemental RFI soil and groundwater results to evaluate the need for additional investigative activities, as shown in Line 14 of the project schedule for the approved Supplemental RFI Work Plan. The attached Preliminary AOI Evaluation and Recommendations Report presents a summary of this review. The report provides U.S. EPA with data from the Supplemental RFI investigation, not previously submitted, including preliminary soil data for AOI 7 - Former Oil House and the validated groundwater data, excluding the bioattenuation results. As presented in the attached report, GMC believes that no further investigative activity is necessary for AOIs 13, 17, 34, 35, and 36; however, additional investigation is recommended for AOI 7.

The attached report also contains a sampling plan to install additional soil borings and monitor wells at AOI 7. Within the proposed scope of work for AOI 7 are two new procedures that have not been implemented during this RFI program. Therefore, two Standard Operating Procedures will be developed and submitted to U.S. EPA as an addendum to the Supplemental RFI Sampling and Analysis Plan prior to initiating field activities. To accommodate the additional investigation at AOI 7, the Supplemental RFI project schedule has been revised and is included in the attached report as Figure 4.

GMC appreciates your timely review of the attached sampling plan so that the additional AOI 7 investigation work can be implemented in early August, 1998. Please call me so that we can arrange a convenient time to discuss this proposed scope of work.

Sincerely,

W. John Ridd
Senior Environmental Project Engineer

Attachments
cc: E. Schuessler, Tetra Tech

Preliminary AOI Evaluation And Recommendations Report Supplemental RFI

General Motors Corporation
Moraine, Ohio

ARCADIS
GERAGHTY & MILLER

16 July 1998

PREPARED FOR

Remediation Group
General Motors Corporation

PRELIMINARY AOI EVALUATION AND RECOMMENDATIONS REPORT SUPPLEMENTAL RFI GENERAL MOTORS CORPORATION MORAINE, OHIO

INTRODUCTION

This report evaluates the need for additional investigations at the General Motors Corporation (GMC) Truck Group Moraine Assembly Plant (Moraine Assembly) and, the General Motors Powertrain Group Moraine Engine Plant (Moraine Engine). This evaluation is being completed as presented in the Supplemental Resource Conservation and Recovery Act Facility Investigation (RFI) Work Plan schedule which was approved by the U.S. Environmental Protection Agency (U.S. EPA) in a letter dated January 13, 1998, which was received by GMC on January 16, 1998. To expedite this project, the evaluation of soil data associated with the Areas of Interest (AOIs) are based on non-validated data. The groundwater results from the Supplemental RFI discussed in this report have been validated.

As presented in the Supplemental RFI Work Plan, six AOIs were recommended for further investigation after reviewing 36 AOIs in the Supplemental Description of Current Conditions (DOCC) (Geraghty & Miller, Inc. 1997a): AOI 7 - Former Oil House Area; AOI 13 - Buildings 4, 6, and 13; AOI 17 - Building 15; AOI 34 - Excavation Area 1; AOI 35 - Excavation Area 2; and AOI 36 - Former Southwest Above Ground Storage Tanks (ASTs). Locations of these AOIs are indicated on Figure 1.

AOI SOIL EVALUATION

The following sections provide an evaluation of the data associated with each AOI and an assessment of whether additional investigation is warranted. Evaluation summaries for five AOIs (13, 17, 34, 35, and 36) have previously been submitted to the U.S. EPA, and additional soil data to address arsenic have already been collected and submitted to U.S. EPA for AOI 36. As discussed in the following sections, GMC believes that no further investigative activity is necessary for these five AOIs. With respect to AOI 7, however, additional investigation is recommended, as discussed below.

AOI 34 - EXCAVATION AREA 1 AND AOI 35 - EXCAVATION AREA 2

Excavation Area 1 and Excavation Area 2 were identified as AOI 34 and AOI 35, respectively, in the Supplemental DOCC as requiring further investigation. Due to expansion plans at the Moraine Assembly facility in the vicinity of these AOIs, investigative work at these two AOIs was performed in August 1997. Prior to investigating these AOIs, Mr. Norman Sawdey of GMC provided Mr. William Buller of the U.S. EPA with details regarding the expansion project in a letter dated August 6, 1997 and requested that U.S. EPA expedite its review of Sections 3.2.4 and 3.2.5 of the Supplemental RFI Work Plan (Geraghty & Miller, Inc. 1997b) in order to reach an agreement on the RFI sampling at these AOIs. On August 19,

1997, Mr. William Buller of U.S. EPA sent Mr. Norman Sawdey a facsimile approving the sampling plan concerning AOIs 34 and 35.

The scope of work and results of investigations conducted at AOIs 34 and 35 per the approved Supplemental RFI Work Plan were presented to the U.S. EPA on November 5, 1997 in a report entitled Summary of Investigation and Findings at AOI 34 and AOI 35 (Geraghty & Miller, Inc. 1997c). These AOI investigations provide sufficient detail to meet the RFI objectives as follows:

1. The lateral extent of each AOI has been adequately characterized by review of the 1968 topographic map. The vertical extent of each AOI has been clearly delineated by a distinct change in soil characteristics detected during the advancement of the soil borings (see the soil boring logs in Appendix A provided in the November 1997 report [Geraghty & Miller, Inc. 1997c]).

2. An evaluation of the constituent concentrations for the fill material and subsurface native soil provides no evidence of any significant release of hazardous constituents at these AOIs, since the concentrations are lower than constituent concentrations evaluated in the Delphi Thermal Moraine Baseline Risk Assessment (ENVIRON Corporation 1996). The sampling results provide adequate characterization to evaluate these AOIs in the Supplemental Baseline Risk Assessment.

Based on this evaluation of the data, no additional investigation is needed at these AOIs.

AOI 13 - BUILDINGS 4, 6, AND 13 AND AOI 17 - BUILDING 15

Field screening activities were conducted at these two AOIs on February 17 through 19, 1998 per the scope of work presented in the approved Supplemental RFI Work Plan. The screening results for soil from these two AOIs determined the following: (1) all volatile organic compound (VOC) results from the on-site field gas chromatograph were below the 1 milligram per kilogram (mg/kg) screening criterion, (2) no polychlorinated biphenyls (PCBs) were detected above the U.S. EPA action level of 10 to 25 mg/kg presented in U.S. EPA's October 7, 1997 comments on the Supplemental RFI Work Plan, and (3) for the one sample collected in the only area which exhibited visual evidence of staining, the metals results were below the site-specific soil background levels established in Delphi Thermal Moraine Baseline Risk Assessment (ENVIRON Corporation 1996). These data were presented to U.S. EPA in a letter from GMC dated March 3, 1998 (submitted via facsimile and Fedex) to accommodate GMC's need to pave the area at the southern end of the Engine Plant, encompassing AOIs 13 and 17, as part of the on-going expansion projects.

Based on the fact that concentrations of VOCs, PCBs and metals were below decision criteria, presented in the approved Supplemental RFI Work Plan, no additional investigation is needed.

AOI 36 - FORMER SOUTHWEST ABOVE GROUND STORAGE TANKS

A preliminary review of the soil characterization for AOI 36-Former Southwest ASTs was conducted per the approved Supplemental RFI Work Plan and presented to the U.S. EPA in a letter from GMC dated May 29, 1998. The concentrations of organic constituents detected in soil are expected to pose no significant risk under the site-specific exposure scenarios that will be used in evaluating AOI 36 in the upcoming Supplemental Baseline Risk Assessment. In fact, the concentrations of the organic constituents are lower than U.S. EPA's generic Soil Screening Levels. A review of the metals data shows that the concentrations of arsenic in the two shallow soil samples are above background levels. No concentrations of other metals exceed the site-specific background levels determined during the RFI for Delphi Thermal Moraine and reported in the Delphi Thermal Moraine Baseline Risk Assessment (ENVIRON Corporation 1996). The concentrations of arsenic in the deeper soil samples also do not exceed the site-specific background levels. Because the arsenic concentrations in the shallow soil samples are above background levels, and there is uncertainty regarding the source of these concentrations at the sampled locations, additional sampling was determined to be appropriate to further characterize arsenic concentrations in the shallow soil at the area around AOI 36. GMC submitted a work plan for additional arsenic sampling to U.S. EPA on May 29, 1998.

After receiving verbal U.S. EPA approval of the additional sampling work plan on June 10, 1998, the additional sampling was conducted on June 10 and 11, 1998. The results of the additional sampling were submitted to U.S. EPA in a letter from GMC issued via facsimile and Fedex on June 24, 1998. The additional sampling data indicates that for all seven composite samples (four area and three berm composite samples) the concentration of arsenic is well below the 325 mg/kg screening criteria presented in the additional sampling work plan, and, therefore, no additional investigation of the soils in this area is needed.

AOI 7 - FORMER OIL HOUSE

A preliminary review of the soil characterization data for AOI 7 - Former Oil House (Table 1), shows that the concentrations of tetrachloroethene (PCE) in the soil samples collected per the approved Supplemental RFI Work Plan generally increased with depth from ground surface. The highest concentrations of PCE in each soil boring were at the water table. At borings OH-BH1, OH-BH3, and OH-BH4, the concentrations at the water table were about 5 to 10 times higher than those in the shallower samples. At boring OH-BH2, the concentration at the water table was more than 130 times higher than those in the shallower samples. The concentrations of PCE in the shallow soil samples (0 to 2 feet) among OH-BH1 through OH-BH4 ranged from 0.041 mg/kg to 0.123 mg/kg. These concentrations are more than 500 times lower than the concentration of PCE in shallow soil (3 to 5 feet) measured during installation of monitoring well GM-23 in 1994 (63.5 mg/kg, presented in Appendix A-8 of the Supplemental DOCC). Trichloroethene (TCE) was also detected (0.53 mg/kg) at this interval in the GM-23 soil boring. The concentration of PCE measured in groundwater at monitoring well GM-23 during the Supplemental RFI (11,200 micrograms per liter [ug/L]) was consistent with the concentration measured in 1994 (8,570 ug/L, presented in Table 2-6 of the Supplemental DOCC).

Four other organic constituents were detected at low frequencies and low concentrations in soil samples at borings OH-BH1 through OH-BH4 and during installation of GM-23. The presence of TCE in one of the four soil samples (OH-BH3) collected at the water table during the Supplemental RFI may be related to the presence of PCE in groundwater in the vicinity of this location. The concentrations of the other organic constituents detected (i.e., the three semivolatile organic compounds [SVOCs]) are expected to pose no significant risk under the site-specific exposure scenarios that will be used in evaluating AOI 7 in the upcoming Supplemental Baseline Risk Assessment. The concentrations of metals in soil samples at borings OH-BH1 through OH-BH4 were all within the site-specific background levels determined during the RFI for Delphi Thermal and reported in the baseline risk assessment for Delphi Thermal. The three VOCs other than PCE (i.e., cis-1,2-DCE, TCE, and vinyl chloride) detected in the groundwater sample collected from GM-23 during the Supplemental RFI may be related to the presence of PCE in soil and groundwater in the vicinity of this monitoring well.

Based on the PCE data from the soil and groundwater samples collected at AOI 7, in particular, the higher PCE concentrations at the water table, no apparent source for the presence of PCE and its potential degradation products in soil and groundwater at well GM-23 was identified. Therefore, additional investigation is appropriate to further characterize the presence of PCE and its potential degradation products in the vadose zone soil and in groundwater at AOI 7. The primary purpose of the additional investigation is to develop better information, as practical, for estimating the "source term" in assessing the groundwater pathway for AOI 7 in the upcoming baseline risk assessment. Specific objectives of this additional investigation are as follows:

1. Determine whether a significant source of PCE, and its potential degradation products, exists in the vadose zone soil at AOI 7,
2. Determine whether PCE exists in the saturated zone, possibly as a dense nonaqueous phase liquid (DNAPL) at AOI 7 and characterize its presence.
3. Determine the potential for the lithology in the vicinity of AOI 7 to affect migration of PCE, if PCE is present as a DNAPL, and
4. Determine if a vadose zone source of PCE or DNAPL in the saturated zone exists upgradient (or north) beyond OH-BH1.

Also, additional investigation of the presence of PCE and its potential degradation products in the vadose zone soil would allow a more refined estimate of the concentrations that workers may encounter under the potential exposure scenarios for AOI 7 (i.e., routine activities and occasional excavation) that will be assessed in the upcoming Supplemental Baseline Risk Assessment. The proposed AOI 7 sampling plan, consistent with these objectives, is described later in this report.

SITE-WIDE GROUNDWATER QUALITY

In accordance with the approved Supplemental RFI Work Plan, 26 upper and lower aquifer monitor wells were sampled. Samples from all 26 wells were analyzed for Appendix IX VOCs. In addition, 6 of the 26 wells were analyzed for Appendix IX SVOCs, PCBs, and total and dissolved metals. The groundwater data collected during the Supplemental RFI can be used to better characterize, from a risk perspective, the

potential effects on groundwater from soil contamination at an AOI; however, there are difficulties and limitations associated with this data usage. As discussed in GMC's September 11, 1996 responses to U.S. EPA's comments on the Draft RFI Final Report for Delphi Thermal and in GMC's November 5, 1997 responses to U.S. EPA comments on the draft Supplemental RFI Work Plan, the use of groundwater data to determine whether a specific AOI may significantly affect groundwater quality is often complicated by several factors (e.g., upgradient groundwater quality and/or presence of constituents in groundwater that were not managed at the AOI). Because of GMC's experience with such complexities in the risk assessment at Delphi Thermal, GMC believes that soil data at an AOI should be used as the primary means for estimating the AOI's potential effect on groundwater quality at potential points of groundwater use. As discussed in the baseline risk assessment for Delphi Thermal and in GMC's September 11, 1996 responses to U.S. EPA's comments, GMC has used and plans to use conservative assumptions in evaluating soil data from an AOI to assess potential effects on groundwater use. Where soil data suggest that an AOI may have a potentially significant effect on groundwater use, groundwater quality data can be used to determine the extent to which the conservative evaluation of soil data may have overstated an AOI's effect.

Therefore, consistent with GMC's November 5, 1997 responses to U.S. EPA comments on the draft Supplemental RFI Work Plan, six select upper aquifer monitor wells (Table 2) were analyzed for Appendix IX SVOCs, PCBs, and total and dissolved metals, in addition to Appendix IX VOCs. This data was collected to ensure groundwater data around these AOIs could be evaluated in comparison with the soil data collected at the AOIs. These data indicate that no SVOCs or PCBs were present above their respective laboratory method detection limit (MDL). Data for dissolved metals concentrations indicate that antimony, barium, manganese, and nickel were detected in some of the select wells (Table 2). In the Delphi Thermal Baseline Risk Assessment (ENVIRON Corporation 1996), Safe Drinking Water Act Maximum Contaminant Levels (MCLs) or risk-based drinking water concentrations were used to evaluate groundwater quality at potential points of groundwater exposure (e.g. well fields). For the purpose of providing a conservative preliminary screening of the data collected during the Supplemental RFI, these drinking water criteria were applied at each of the six selected monitoring wells. This evaluation indicates that no dissolved metal concentrations are likely to pose a potentially significant risk. In regards to dissolved antimony, the concentration in the EAST well (0.0078 mg/L) is only slightly above the MCL (0.006 mg/L), but is well below the antimony concentrations detected in monitoring wells upgradient of the facilities in the Delphi Thermal RFI (i.e., 0.0553 mg/L at HR-9 and 0.0519 mg/L at HR-12).

In order to evaluate the presence of VOCs in groundwater, a total of 26 monitor wells (20 upper aquifer and six lower aquifer monitor wells) were analyzed for Appendix IX VOCs and cis-1,2-dichloroethene (cis-1,2-DCE). It should be noted when comparing current data to previous data collected during the first two phases of RFI groundwater sampling (Phase I in January 1993 and Phase II in October 1994 [Geraghty & Miller, Inc. 1996]) or previous groundwater sampling conducted on the Moraine Engine and/or Moraine Assembly plants (Geraghty & Miller, Inc. 1997a), that cis-1,2-DCE was not previously analyzed or reported. Analytical results for the upper aquifer and lower aquifer monitor wells are presented on Tables 3 and 4, respectively.

Two upgradient upper aquifer wells exhibited the presence of VOCs (total VOCs of 8.2 ug/L in HR-11 and 19.6 ug/L in GM-24), while GM-25, which is side-gradient of the Moraine Assembly facility, did not

contain detectable concentrations of VOCs. Downgradient wells (at the southern end of the site or off-site) in the upper aquifer exhibited lower concentrations of total VOCs when compared to previous RFI data (collected during the Delphi Thermal RFI) as follows: the GM-2 total VOC concentration of 101.7 ug/L is lower than the 132.4 ug/L reported during Phase I, the WSU-24 total VOC concentration of 17.2 ug/L is lower than the 26.1 ug/L reported during Phase II, the GM-10 concentration of 36.9 ug/L is lower than the 109.5 ug/L reported during Phase I, and GM-26 (installed during the Supplemental RFI adjacent to lower aquifer well MT-69) exhibited non-detectable concentrations of VOCs.

The highest concentration of VOCs in on-site wells is in upper aquifer well GM-23, located in the vicinity of AOI 7, as discussed above. This is consistent with previous data. Additional investigation is recommended at this AOI, to meet the objectives presented in the previous section. In regards to the other eleven on-site upper aquifer wells sampled during the Supplemental RFI, seven wells (W-3-N, W-1-S, ME-3, HR-17, GM-22, GM-8, and GM-6) showed decreasing concentrations compared to the most recent data, one well (EAST) remained relatively constant, and three wells (HR-1, ME-6, and GM-21) showed increased VOC concentrations. For those wells where VOC concentrations have decreased or remained the same as compared to the Delphi Thermal RFI, site-related contributions to groundwater quality are not expected to exceed MCLs or risk-based drinking water concentrations under current and reasonably expected future use conditions both in the absence or presence of interim measures. Additionally, based on process knowledge, presented in the Delphi Thermal DOCC and the Supplemental DOCC, and soil data from SWMUs/AOIs in proximity to the three wells where VOC concentrations have increased, GMC believes the increased VOC concentrations may be related to migration of a historic upgradient release, suspected to have originated in the northern half of the site. This will be further evaluated after completion of the additional investigation described in the next section.

In regards to VOC concentrations in the lower aquifer, one well upgradient (HR-12), one well (HR-13) on the Delphi Thermal property, west of AOI 7 - Former Oil House, and four wells downgradient of the facility were evaluated. Upgradient well HR-12 contained 1,1-dichloroethane, cis-1,2-DCE and vinyl chloride at a total concentration of 7.6 ug/L. The concentration of VOCs in well HR-13 (79 ug/L total, with 23.3 ug/L being cis-1,2-DCE) are consistent with data collected during Phase I of the Delphi Thermal RFI (51 ug/L total with cis-1,2-DCE not included in the analysis). Downgradient wells exhibited similar or lower concentrations of total VOCs when compared to previous RFI data as follows: the GM-1 total VOC concentration of 58.2 ug/L is similar to the 55.1 ug/L reported during Phase I, the GM-9 concentration of 11 ug/L is lower than the 23.5 ug/L reported during Phase I (especially considering that cis-1,2-DCE was not previously analyzed), the concentration of VOCs in GM-20 has dropped to non-detectable levels which is lower than the 7.9 ug/L reported during Phase II of the RFI, and MT-69 continued to exhibit non-detectable concentrations of VOCs, consistent with the previous Phase II results.

AOI 7 - FORMER OIL HOUSE SAMPLING PLAN

INTRODUCTION

A judgmental sampling approach to further evaluate the source area, as required to support the Supplemental Baseline Risk Assessment, will be used at AOI 7. This work will include the installation of

additional soil borings and monitor wells. Additional soil borings will be installed with soil samples collected at a shallow depth and immediately above the water table (at a minimum), and the Hydropunch II ™ technique will be used to collect groundwater samples at the top of the first encountered clay-rich aquitard (upper clay till) and in the lower portion of the upper aquifer to support well screen placement during monitor well installation. Saturated soil samples will also be collected to perform a hydrophobic dye soil-water shake field test. One monitor well will be installed at or above the regional confining till that separates the upper and lower aquifer to evaluate groundwater quality within the AOI (GM-27). An additional downgradient well (GM-28) will be installed at the upper clay till, if present. If it is not present, GM-28 will be installed at or above the regional confining till. The upper clay till and regional confining till are indicated on the former oil house cross section shown on Figure 2. Table 5 presents a summary of this additional scope of work and includes the objectives for data collection. Figure 3 presents the proposed soil boring and monitor well locations. All field work will be conducted per the approved Supplemental RFI Work Plan and Standard Operating Procedures located in Appendix C of the Supplemental RFI Work Plan.

An AOI-specific parameter list will be used for laboratory analysis during the additional investigation at AOI 7. The basis for the AOI-specific parameter list is previous analytical data presented in the Supplemental DOCC and the Supplemental RFI data presented in Tables 1, 2 and 3. Consistent with the objectives listed above, the additional investigation is focused on evaluating the source of VOCs; therefore, the AOI-specific parameter list will include all VOCs detected in soil and groundwater at AOI 7. All samples will be analyzed for PCE, TCE, trans- and cis-1,2-DCE, 1,1-dichloroethene (1,1-DCE), and vinyl chloride, in accordance with the Supplemental RFI Quality Assurance Project Plan (Appendix B of the Supplemental RFI Work Plan). Trans-1,2-DCE and 1,1-DCE were not detected in soil or groundwater at AOI 7, but are included in this list because they are possible degradation products of PCE and have been detected elsewhere at the site.

SOIL BORING INSTALLATION

Six soil borings will be installed and sampled in proposed locations shown on Figure 3. Boring locations were determined based on the historical layout of the area and the soil analytical results from the initial phase of the Supplemental RFI. Boring OH-BH5 will be located between borings OH-BH2 and OH-BH3 and immediately east of the current Moraine Engine Tank Farm, in order to evaluate the potential source of VOCs in shallow and deep soil associated with what is believed to be the historic tank farm unloading area. Boring OH-BH6 will be located between the former oil house building and former oil house tank farm, in order to delineate and further investigate VOCs reported during installation of GM-23. Boring OH-BH7 will be located between boring OH-BH4 and GM-23, in order to delineate and further investigate VOCs reported during installation of GM-23. Boring OH-BH8 will be located immediately north of the existing Moraine Engine Tank Farm, in order to evaluate the potential source of VOCs in shallow and deep soil associated with the former oil house tank farm. Boring OH-BH9 will be located north of OH-BH1 and the new chip pad currently being constructed as part of the expansion project, in order to evaluate the lateral extent of VOCs in shallow and deep soil north of the former oil house ASTs. Boring OH-BH10 will be located west of OH-BH2, in order to evaluate the lateral extent of VOCs in shallow and deep soil west of the former oil house tank farm.

The borings will be sampled continuously for lithologic description and field screening. Soil samples will be collected at depths of 0 to 2 feet and above the water table (approximately 25 feet below land surface) from each boring using a hollow-stem auger. In addition, visual screening will be conducted and continuous headspace readings will be collected during drilling. One additional sample from each soil boring may be selected from the sample with the highest HNu headspace reading and/or visual evidence of contamination and submitted to the laboratory. If all HNu readings are background levels and there is no visual evidence of contamination, then the soil samples collected from 0 to 2 feet and above the water table will be the only samples submitted to the laboratory for analysis. The samples will be submitted for analysis of the AOI-specific VOCs presented above. This data will be used to further evaluate the source area, as required to support the Supplemental Baseline Risk Assessment.

In addition to soil sampling described above, other techniques will be implemented at each soil boring location to evaluate the presence of the upper clay till and DNAPL. These techniques include advancing borings further into the water table for lithologic characterization, collecting and analyzing groundwater samples using the Hydropunch II ™ and performing a hydrophobic dye soil-water shake field test on a saturated soil sample.

To evaluate the presence of the upper clay till (suspected to be approximately 5 to 10 feet below the water table) beneath AOI 7, each of the six soil borings will be advanced up to 15 feet below the water table. If the upper clay till is present, a groundwater sample will be collected using Hydropunch II ™ technique at each boring location for laboratory analysis. The Hydropunch II ™ technique will be used to collect the water samples. The Hydropunch II ™ is an enclosed device that is four feet long and will be attached to the hollow-stem auger. The auger will drive the Hydropunch II ™ into the upper clay till and then pull back to expose a stainless steel well screen used to collect the water sample. These samples will be submitted to the laboratory for analysis of the AOI-specific list of VOCs. If the upper clay till is not present, the boring will be abandoned and no groundwater sample will be collected from the boring.

An additional technique to assess if a DNAPL is present on this upper clay till will involve collecting a saturated soil sample from the sample interval immediately above the upper clay till at each soil boring location. A visual field test will be used to detect the presence of DNAPL in these saturated soil samples (Cohen, R. M., et. al. 1992; U.S. EPA 1992). This technique includes placing the saturated soil sample in a polyethylene Ziplock ® bag and adding a sufficient quantity of distilled water such that once the bag is sealed, there is enough airspace to hand mix the soil-water mixture. Approximately 2 milligrams of Sudan IV, a hydrophobic red dye, will then be added to the bag to facilitate visual identification. The contents of the bag will be mixed for 30 seconds by vigorously shaking by hand. If DNAPL is present, it will turn red and be visible as a separate phase as a result of the dye. If the upper clay till is not present, the boring will be abandoned and no saturated soil sample will be collected from the boring.

MONITOR WELL INSTALLATION

Additional groundwater sampling will be conducted to define the vertical and horizontal extent of VOCs, to the degree necessary to evaluate potential risk. Elevated concentrations of VOCs were detected in well GM-23, screened at approximately 20 to 30 feet below land surface, above the upper clay till. To ascertain whether VOCs are present as a DNAPL, and determine whether VOCs have migrated vertically to lower portions of the upper aquifer, well GM-27 will be installed east of GM-23 (approximately 15 feet). This well will be drilled using the hollow-stem auger method with continuous split-spoon sampling to the upper clay till (20 to 30 feet below land surface). Soil samples will be collected at 0 to 2 feet and above the water table for analysis of the AOI-specific list of VOCs to delineate the VOCs detected in soils at GM-23. Continuous headspace readings will be taken and a third soil sample may be collected at the highest headspace reading or visual evidence of contamination and analyzed for the AOI-specific list of VOCs. If all headspace readings are background levels or there is no visual evidence of contamination, only two samples will be collected. The Hydropunch II ™ technique (described above) will be used to collect a groundwater sample above the upper clay till, if present, to evaluate the presence of VOCs at that horizon. The groundwater samples will be analyzed for the AOI-specific list of VOCs. Saturated soil samples will be collected from the sample interval immediately above the upper clay till and the regional confining unit and a hydrophobic dye soil-water shake test (described above) will be performed. A telescoping well casing will be installed into the upper clay till to prevent vertical migration of VOCs from above the upper clay till. The hole will be cased off in the upper clay till before advancing through the upper clay till. Beyond this depth, the hollow-stem auger method will be used to drill to the base of the upper aquifer (approximately 60 feet). Hydropunch II ™ groundwater samples will be collected and analyzed for the AOI-specific list of VOCs at approximately every 10 to 15 feet to assist in placement of the deep well screen. The well will be screened slightly into and above the regional clay confining unit, unless groundwater data collected using the Hydropunch II ™, indicates a more appropriate location for screening the well. A groundwater sample from GM-27 will be collected and analyzed for the AOI-specific list of VOCs.

To evaluate the presence of the upper clay till (and, if present, whether it is potentially acting as a confining layer for DNAPL) and groundwater quality downgradient of AOI 7, well GM-28 will be installed southwest of GM-27 (Figure 3). During drilling, continuous headspace readings will be taken and a soil sample may be collected based on the headspace readings or visual evidence of contamination and analyzed for the AOI-specific list of VOCs, unless visual evidence or HNu readings suggest the parameter list should be expanded. If all headspace readings are background levels or there is no visual evidence of contamination, a soil sample will not be collected because the location of GM-28 is not within the limits of the AOI. Well GM-28 will be drilled using hollow-stem auger technique to the upper clay till. If the upper clay till is not encountered during drilling, the well will be screened slightly into and above the regional clay confining unit. The Hydropunch II ™ technique will be used to either collect a groundwater sample above the upper clay till (if present) to verify the presence of VOCs at that horizon or at 10 to 15 foot intervals (if the upper clay till is not present) above the regional clay confining unit to support placement of the well screen, as described for GM-27. Samples will be analyzed for the AOI-specific list of VOCs. Saturated soil sample(s) will be collected from the sample interval immediately above the upper clay till (if present) and/or the regional confining unit and a hydrophobic dye soil-water shake test will be performed. A groundwater

sample from GM-28 will be collected and analyzed for the AOI-specific list of VOCs (or the same parameter list analyzed for the soil samples).

SUPPLEMENTAL RFI REVISED SCHEDULE

To accommodate the additional investigation at AOI 7, the Supplemental RFI project schedule has been revised as indicated in the approved Supplemental RFI Work Plan. These revisions are indicated in Figure 4.

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Table 1. AOI-7 Former Oil House Area Preliminary Soil Analytical Results, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

	Units	OH-BH1			OH-BH2		OH-BH3			OH-BH4		
		2ft	8 ft	30 ft	3 ft	31 ft	2 ft	16 ft	26 ft	2 ft	8 ft	24 ft
Volatile Organic Compounds												
Tetrachloroethene	ug/kg	53.7	125	505	56.4	7,690	41.4	29.3	247	123	113	474
Trichloroethene	ug/kg	ND	ND	ND	ND	ND	ND	ND	521	20.6	ND	ND
Semi-volatile Organic Compounds												
Bis(2-ethylhexyl)phthalate	ug/kg	650	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ug/kg	ND	ND	ND	4,570	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ug/kg	ND	ND	ND	3,770	ND	ND	ND	ND	ND	ND	ND
Metals												
Antimony	mg/kg	<17	<17	<17	<18	<16	<16	<17	<14	<17	<18	<18
Arsenic	mg/kg	2.76	1.93	1.53	2.09	1.49	10.4	3.88	2.51	3.54	3.91	2.59
Barium	mg/kg	11	8.3	8.1	30.2	11	30.2	14	16	13	7.7	24.3
Beryllium	mg/kg	1	<0.8	0.8	1.1	0.9	1	0.9	0.9	0.8	<0.9	<0.9
Cadmium	mg/kg	<5.1	<5.1	<5.0	<5.3	<4.8	<4.9	<5.1	<4.3	<5.0	<5.3	<5.3
Chromium	mg/kg	8.6	<6.9	<6.7	<7.0	<6.4	<6.5	<6.8	<5.7	<6.6	<7.0	<7.0
Cobalt	mg/kg	<3.4	<3.4	<3.4	<3.5	<3.3	3.9	4.1	<2.9	<3.3	<3.5	<3.5
Copper	mg/kg	3.9	7	5.5	6	7.4	12	13	7.5	6.1	6.8	7
Lead	mg/kg	3.67	2.72	3.55	5.47	4.11	9.39	4.36	4.8	6.06	4.36	4.56
Manganese	mg/kg	142	220	161	227	184	302	331	190	159	151	178
Mercury	mg/kg	<0.010	0.012	<0.011	0.029	<0.011	0.052	0.014	0.014	0.013	<0.011	0.014
Nickel	mg/kg	25.2	5.8	4	4.3	5.9	8.5	14	6.6	5.6	5.6	5.4
Selenium	mg/kg	<1.66	<1.62	<0.881	<1.57	<1.67	<0.805	<0.819	<0.860	<0.863	<0.890	<0.786
Silver	mg/kg	<6.7	<6.9	<6.7	<7.0	<6.4	<6.5	<6.8	<5.7	<6.6	<7.0	<7.0
Thallium	mg/kg	<0.52	<0.52	<0.53	<0.53	<0.53	<0.54	<0.52	<0.55	<0.53	<0.55	<0.55
Vanadium	mg/kg	<8.5	<8.5	<8.4	<8.8	<8.0	<8.1	<8.5	<7.1	<8.3	<8.8	<8.7
Zinc	mg/kg	16	17.6	16	26.2	19	42.6	227	22.6	22	26	27.8

This table presents VOC and SVOC data above the method detection limit. PCBs were not detected in these samples.
ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.
ND - Not detected.

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Table 2. Analytical Results for Selected Groundwater Samples Collected in March 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	EAST 03/05/98	GM-2 03/04/98	GM-21 03/10/98	GM-22 03/10/98	GM-22 DUP 03/10/98	GM-23 03/09/98	HR-11 03/09/98
Semivolatile Organic Compounds								
1,2,4,5-Tetrachlorobenzene	ug/l	<20	<20	<20	<20	<20	<20	<20
1,2,4-Trichlorobenzene	ug/l	<10	<10	<10	<10	<10	<10	<10
1,3,5-Trinitrobenzene	ug/l	<30	<30	<30	<30	<30	<30	<30
1,4-Napthoquinone	ug/l	<100	<100	<100	<100	<100	<100	<100
1-Naphthylamine	ug/l	<30	<30	<30	<30	<30	<30	<30
2,2'-Dichlorodiisopropyl ether	ug/l	<10	<10	<10	<10	<10	<10	<10
2,3,4,6-Tetrachlorophenol	ug/l	<20	<20	<20	<20	<20	<20	<20
2,4,5-Trichlorophenol	ug/l	<10	<10	<10	<10	<10	<10	<10
2,4,6-Trichlorophenol	ug/l	<10	<10	<10	<10	<10	<10	<10
2,4-Dichlorophenol	ug/l	<10	<10	<10	<10	<10	<10	<10
2,4-Dimethylphenol	ug/l	<10	<10	<10	<10	<10	<10	<10
2,4-Dinitrophenol	ug/l	<10	<10	<10	<10	<10	<10	<10
2,4-Dinitrotoluene	ug/l	<10	<10	<10	<10	<10	<10	<10
2,6-Dichlorophenol	ug/l	<10	<10	<10	<10	<10	<10	<10
2,6-Dinitrotoluene	ug/l	<10	<10	<10	<10	<10	<10	<10
2-Acetylaminofluorene (2-AAF)	ug/l	<20	<20	<20	<20	<20	<20	<20
2-Chloronaphthalene	ug/l	<10	<10	<10	<10	<10	<10	<10
2-Chlorophenol	ug/l	<10	<10	<10	<10	<10	<10	<10
2-Methylnaphthalene	ug/l	<10	<10	<10	<10	<10	<10	<10
2-Naphthylamine	ug/l	<30	<30	<30	<30	<30	<30	<30
2-Picoline	ug/l	<20	<20	<20	<20	<20	<20	<20
3,3'-Dichlorobenzidine	ug/l	<50	<50	<50	<50	<50	<50	<50
3,3'-Dimethylbenzidine	ug/l	<20	<20	<20	<20	<20	<20	<20
3-Methylcholanthrene	ug/l	<30	<30	<30	<30	<30	<30	<30
4,6-Dinitro-2-methylphenol	ug/l	<10	<10	<10	<10	<10	<10	<10
4-Aminobiphenyl	ug/l	<20	<20	<20	<20	<20	<20	<20
4-Bromophenyl phenyl ether	ug/l	<10	<10	<10	<10	<10	<10	<10
4-Chloro-3-methyl phenol	ug/l	<10	<10	<10	<10	<10	<10	<10
4-Chlorophenyl phenyl ether	ug/l	<10	<10	<10	<10	<10	<10	<10
4-Nitroquinoline 1-oxide	ug/l	<30	<30	R	R	R	R	R
5-Nitro-o-toluidine	ug/l	<20	<20	<20	<20	<20	<20	<20
7,12-Dimethylbenz(a)anthracene	ug/l	<20	<20	<20	<20	<20	<20	<20
Acenaphthene	ug/l	<10	<10	<10	<10	<10	<10	<10
Acenaphthylene	ug/l	<10	<10	<10	<10	<10	<10	<10
Acetophenone	ug/l	<20	<20	<20	<20	<20	<20	<20
Aniline	ug/l	<10	<10	<10	<10	<10	<10	<10
Anthracene	ug/l	<10	<10	<10	<10	<10	<10	<10

Table 2. Analytical Results for Selected Groundwater Samples Collected in March 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	EAST 03/05/98	GM-2 03/04/98	GM-21 03/10/98	GM-22 03/10/98	GM-22 DUP 03/10/98	GM-23 03/09/98	HR-11 03/09/98
Semivolatile Organic Compounds (continued)								
Aramite	ug/l	<15UJ	<15UJ	<15	<15	<15	<15	<15
Benzo(a)anthracene	ug/l	<10	<10	<10	<10	<10	<10	<10
Benzo(a)pyrene	ug/l	<10	<10	<10	<10	<10	<10	<10
Benzo(b)fluoranthene	ug/l	<10	<10	<10	<10	<10	<10	<10
Benzo(ghi)perylene	ug/l	<10	<10	<10	<10	<10	<10	<10
Benzo(k)fluoranthene	ug/l	<10	<10	<10	<10	<10	<10	<10
Benzyl alcohol	ug/l	<10	<10	<10	<10	<10	<10	<10
Bis(2-chloroethoxy)methane	ug/l	<10	<10	<10	<10	<10	<10	<10
Bis(2-chloroethyl)ether	ug/l	<10	<10	<10	<10	<10	<10	<10
Bis(2-ethylhexyl)phthalate	ug/l	<10	<10	<10	<10	<10	<10	<10
Butyl benzyl phthalate	ug/l	<10	<10	<10	<10	<10	<10	<10
Chlorobenzilate	ug/l	<50	<50	<50	<50	<50	<50	<50
Chrysene	ug/l	<10	<10	<10	<10	<10	<10	<10
Di-n-butyl phthalate	ug/l	<10	<10	<10	<10	<10	<10	<10
Di-n-octyl phthalate	ug/l	<10	<10	<10	<10	<10	<10	<10
Diallate	ug/l	<30	<30	<30	<30	<30	<30	<30
Dibenzo(a,h)anthracene	ug/l	<10	<10	<10	<10	<10	<10	<10
Dibenzofuran	ug/l	<10	<10	<10	<10	<10	<10	<10
Diethyl phthalate	ug/l	<10	<10	<10	<10	<10	<10	<10
Dimethoate	ug/l	<100	<100	<100	<100	<100	<100	<100
Dimethyl phthalate	ug/l	<10	<10	<10	<10	<10	<10	<10
Diphenylamine	ug/l	<20	<20	<20	<20	<20	<20	<20
Disulfoton	ug/l	<20	<20	<20	<20	<20	<20	<20
Ethyl methanesulfonate	ug/l	<20	<20	<20	<20	<20	<20	<20
Famphur	ug/l	<10UJ	<10UJ	<10	<10	<10	<10	<10
Fluoranthene	ug/l	<10	<10	<10	<10	<10	<10	<10
Fluorene	ug/l	<10	<10	<10	<10	<10	<10	<10
Hexachlorobenzene	ug/l	<10	<10	<10	<10	<10	<10	<10
Hexachlorobutadiene	ug/l	<10	<10	<10	<10	<10	<10	<10
Hexachlorocyclopentadiene	ug/l	<20	<20	<20	<20	<20	<20	<20
Hexachloroethane	ug/l	<10	<10	<10	<10	<10	<10	<10
Hexachlorophene	ug/l	R	R	R	R	R	R	R
Hexachloropropene	ug/l	<30	<30	<30	<30	<30	<30	<30
Indeno(1,2,3-cd)pyrene	ug/l	<10	<10	<10	<10	<10	<10	<10
Isodrin	ug/l	<30	<30	<30	<30	<30	<30	<30
Isophorone	ug/l	<10	<10	<10	<10	<10	<10	<10
Isosafrole	ug/l	<20	<20	<20	<20	<20	<20	<20
Kepone	ug/l	R	R	<250	<250	<250	<250	<250

Table 2. Analytical Results for Selected Groundwater Samples Collected in March 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	EAST 03/05/98	GM-2 03/04/98	GM-21 03/10/98	GM-22 03/10/98	GM-22 DUP 03/10/98	GM-23 03/09/98	HR-11 03/09/98
Semivolatile Organic Compounds (continued)								
Methapyrilene	ug/l	<100UJ	<100UJ	<100	<100	<100	<100	<100
Methyl methanesulfonate	ug/l	<20	<20	<20	<20	<20	<20	<20
Methyl parathion	ug/l	<20	<20	<20UJ	<20UJ	<20UJ	<20UJ	<20UJ
N-Nitrosodi-n-butylamine	ug/l	<20	<20	<20	<20	<20	<20	<20
N-Nitrosodiethylamine	ug/l	<30	<30	<30	<30	<30	<30	<30
N-Nitrosodimethylamine	ug/l	<10	<10	<10	<10	<10	<10	<10
N-Nitrosodiphenylamine	ug/l	<10	<10	<10	<10	<10	<10	<10
N-Nitrosodipropylamine	ug/l	<10	<10	<10	<10	<10	<10	<10
N-Nitrosomethylethylamine	ug/l	<20	<20	<20	<20	<20	<20	<20
N-Nitrosomorpholine	ug/l	<20	<20	<20	<20	<20	<20	<20
N-Nitrosopiperidine	ug/l	<20	<20	<20	<20	<20	<20	<20
N-Nitrosopyrrolidine	ug/l	<20	<20	<20	<20	<20	<20	<20
Naphthalene	ug/l	<10	<10	<10	<10	<10	<10	<10
Nitrobenzene	ug/l	<10	<10	<10	<10	<10	<10	<10
Parathion	ug/l	<20	<20	<20	<20	<20	<20	<20
Pentachlorobenzene	ug/l	<20	<20	<20	<20	<20	<20	<20
Pentachloronitrobenzene	ug/l	<20	<20	<20	<20	<20	<20	<20
Pentachlorophenol	ug/l	<10	<10	<10	<10	<10	<10	<10
Phenacetin	ug/l	<20	<20	<20	<20	<20	<20	<20
Phenanthrene	ug/l	<10	<10	<10	<10	<10	<10	<10
Phenol	ug/l	<10	<10	<10	<10	<10	<10	<10
Phorate	ug/l	<20	<20	<20	<20	<20	<20	<20
Pronamide	ug/l	<20	<20	<20	<20	<20	<20	<20
Pyrene	ug/l	<10	<10	<10	<10	<10	<10	<10
Pyridine	ug/l	<10	<10	<10	<10	<10	<10	<10
Safrole	ug/l	<20	<20	<20	<20	<20	<20	<20
Sulfotepp	ug/l	<20	<20	<20	<20	<20	<20	<20
Thionazin	ug/l	<20	<20	<20	<20	<20	<20	<20
Triethyl phosphorothioate	ug/l	<20	<20	<20	<20	<20	<20	<20
a,a-Dimethyl-phenethylamine	ug/l	<50	<50	<50	<50	<50	<50	<50
m-Dichlorobenzene	ug/l	<10	<10	<10	<10	<10	<10	<10
m-Dinitrobenzene	ug/l	<20	<20	<20	<20	<20	<20	<20
m-Nitroaniline	ug/l	<15	<15	<15	<15	<15	<15	<15
meta & para-Methylphenol	ug/l	<10	<10	<10	<10	<10	<10	<10
o-Dichlorobenzene	ug/l	<10	<10	<10	<10	<10	<10	<10
o-Nitroaniline	ug/l	<15	<15	<15	<15	<15	<15	<15
o-Nitrophenol	ug/l	<10	<10	<10	<10	<10	<10	<10
o-Toluidine	ug/l	<20	<20	<20	<20	<20	<20	<20

Table 2. Analytical Results for Selected Groundwater Samples Collected in March 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	EAST 03/05/98	GM-2 03/04/98	GM-21 03/10/98	GM-22 03/10/98	GM-22 DUP 03/10/98	GM-23 03/09/98	HR-11 03/09/98
Semivolatile Organic Compounds (continued)								
ortho-Methylphenol	ug/l	<10	<10	<10	<10	<10	<10	<10
p-(Dimethylamino)azobenzene	ug/l	<50	<50	<50	<50	<50	<50	<50
p-Chloroaniline	ug/l	<10	<10	<10	<10	<10	<10	<10
p-Dichlorobenzene	ug/l	<10	<10	<10	<10	<10	<10	<10
p-Nitroaniline	ug/l	<15	<15	<15	<15	<15	<15	<15
p-Nitrophenol	ug/l	<10	<10	<10	<10	<10	<10	<10
p-Phenylenediamine	ug/l	<30UJ	<30UJ	<30	<30	<30	<30	<30
Polychlorinated Biphenyls								
Aroclor 1016	ug/l	<0.20	<0.21	<0.22	<0.20	<0.20	<0.22	<0.22
Aroclor 1221	ug/l	<0.20	<0.21	<0.22	<0.20	<0.20	<0.22	<0.22
Aroclor 1232	ug/l	<0.20	<0.21	<0.22	<0.20	<0.20	<0.22	<0.22
Aroclor 1242	ug/l	<0.20	<0.21	<0.22	<0.20	<0.20	<0.22	<0.22
Aroclor 1248	ug/l	<0.20	<0.21	<0.22	<0.20	<0.20	<0.22	<0.22
Aroclor 1254	ug/l	<0.20	<0.21	<0.22	<0.20	<0.20	<0.22	<0.22
Aroclor 1260	ug/l	<0.20	<0.21	<0.22	<0.20	<0.20	<0.22	<0.22
Metals								
Antimony	mg/l	0.0161	<0.0010	<0.0010	0.0012	0.0012	<0.0050	<0.0050
Antimony, Dissolved	mg/l	0.0078	na	na	<0.0010	0.0010	na	na
Arsenic	mg/l	<0.025	<0.0050	<0.0050	<0.0050	<0.0050	<0.025	<0.025
Barium	mg/l	0.117	0.104	0.0808	0.149	0.161	0.161	0.172
Barium, Dissolved	mg/l	0.0860	0.0973	0.0634J	0.106J	0.120J	0.0908	0.0944
Beryllium	mg/l	<0.0050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050
Cadmium	mg/l	<0.0050	<0.0010	<0.0010	0.0012	0.0021	<0.0050	<0.0050
Cadmium, Dissolved	mg/l	na	na	na	<0.0010	<0.0010	na	na
Chromium	mg/l	0.0660	0.0027U	0.0069	<0.0020	0.0027U	0.0180	0.0160U
Chromium, Dissolved	mg/l	<0.0020	<0.0020	<0.0020	na	<0.0020	<0.0020	<0.0020
Cobalt	mg/l	<0.025	<0.0050	0.0094	<0.0050	<0.0050	<0.025	<0.025
Cobalt, Dissolved	mg/l	na	na	<0.0050	na	na	na	na
Copper	mg/l	<0.025	<0.0050	<0.0050	<0.0050	<0.0050	<0.025	<0.025
Iron	mg/l	7.77	<0.10	1.65	0.680J	0.910J	15.0	10.5
Iron, Dissolved	mg/l	<0.10	na	<0.10	<0.10	<0.10	<0.10	<0.10
Lead	mg/l	0.0077	<0.0010	0.0011	0.0021	0.0030	0.0129	0.0074
Lead, Dissolved	mg/l	<0.0010	na	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Manganese	mg/l	1.00	0.0480	0.719	0.143J	0.183J	2.63	0.369
Manganese, Dissolved	mg/l	0.122	<0.010	0.181	0.0970	0.0960	0.242	0.0720
Mercury	mg/l	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	mg/l	0.0560J	0.0056J	0.0100J	0.0589J	0.0624J	0.0290	0.0270
Nickel, Dissolved	mg/l	0.0062	<0.0050	<0.0050	0.0430	0.0480	<0.0050	0.0064

Table 2. Analytical Results for Selected Groundwater Samples Collected in March 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	EAST 03/05/98	GM-2 03/04/98	GM-21 03/10/98	GM-22 03/10/98	GM-22 DUP 03/10/98	GM-23 03/09/98	HR-11 03/09/98
Metals (continued)								
Selenium	mg/l	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	mg/l	<0.0020	<0.0005	<0.0005	<0.0005	<0.0005	<0.0020	<0.0020
Thallium	mg/l	<0.0050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050
Tin	mg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Vanadium	mg/l	<0.025	<0.0050	<0.0050	<0.0050	<0.0050	<0.025	<0.025
Zinc	mg/l	<0.25	<0.050	<0.050	<0.050	<0.050	<0.25	<0.25

na Not analyzed.
mg/l Milligrams per liter.
ug/l Micrograms per liter.
J Value is estimated.
UJ Constituent was not detected above the reporting limit. Detection limit is estimated.
R Value is unuseable.
U Sample result has been qualified as a non-detect due to blank contamination.

Table 3. VOC Analytical Results for Groundwater Samples Collected from Upper Aquifer Wells in March 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	HR-9 03/06/98	HR-11 03/09/98	GM-24 03/06/98	W-3-N 03/05/98	GM-23 03/09/98	GM-25 03/06/98	HR-1 03/05/98	W-1-S 03/05/98	ME-6 03/09/98	ME-3 03/09/98	HR-17 03/05/98
Volatile Organic Compounds												
1,1,1,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
1,1,1-Trichloroethane	ug/l	15.0	<1.0	1.1	<1.0	<200UJ	<1.0	1.5	<1.0	2.4	35.3	1.6J
1,1,2,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
1,1,2-Trichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
1,1-Dichloroethane	ug/l	56.2	6.8	<1.0	<1.0	<200UJ	<1.0	2.1	<1.0	<1.0	13.5	<1.0UJ
1,1-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	1.4	<1.0UJ
1,2,3-Trichloropropane	ug/l	<5.0	<5.0	<5.0	<5.0	<1000UJ	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ
1,2-Dibromo-3-chloropropane	ug/l	<5.0	<5.0UJ	<5.0	<5.0	<1000UJ	<5.0	<5.0	<5.0	<5.0UJ	<5.0UJ	<5.0UJ
1,2-Dibromoethane	ug/l	<5.0	<5.0	<5.0	<5.0	<1000UJ	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ
1,2-Dichloroethane	ug/l	1.8	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
1,2-Dichloropropane	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
2-Hexanone	ug/l	<10	<10UJ	<10	<10	<2000UJ	<10	<10	<10	<10UJ	<10UJ	<10UJ
Acetone	ug/l	<20	<20UJ	<20	<20	<4000UJ	<20	<20	<20	<20UJ	<20UJ	<20UJ
Acrolein	ug/l	<50	<50UJ	<50	<50UJ	R	<50	<50UJ	<50UJ	<50UJ	<50UJ	<50UJ
Acrylonitrile	ug/l	<50	<50	<50	<50	<10000UJ	<50	<50	<50	<50	<50	<50UJ
Allyl chloride	ug/l	<5.0	<5.0	<5.0	<5.0	<1000UJ	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ
Benzene	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
Bromodichloromethane	ug/l	<1.0	<1.0	3.4	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
Bromoform	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
Bromomethane	ug/l	<5.0	<5.0	<5.0	<5.0	<1000UJ	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ
Carbon disulfide	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
Carbon tetrachloride	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
Chlorobenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
Chloroethane	ug/l	<10	<10	<10	<10	<2000UJ	<10	<10	<10	<10	<10	<10UJ
Chloroform	ug/l	<1.0	<1.0	15.1	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
Chloromethane	ug/l	<10	<10	<10	<10	<2000UJ	<10	<10	<10	<10	<10	<10UJ
Chloroprene	ug/l	<5.0	<5.0	<5.0	<5.0	<1000UJ	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ
Dibromochloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
Dibromomethane	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
Dichlorodifluoromethane	ug/l	<10	<10	<10	<10	<2000UJ	<10	<10	<10	<10	<10	<10UJ
Ethyl benzene	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
Ethyl methacrylate	ug/l	<5.0	<5.0	<5.0	<5.0	<1000UJ	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ
Fluorotrichloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	3.2	3.7	<1.0	<1.0	<1.0UJ
Iodomethane	ug/l	<5.0	<5.0	<5.0	<5.0	<1000UJ	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ
Methacrylonitrile	ug/l	<5.0	<5.0	<5.0	<5.0	<1000UJ	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ
Methyl ethyl ketone (MEK)	ug/l	R	R	R	R	R	R	R	R	R	R	R
Methyl isobutyl ketone (MIBK)	ug/l	<10	<10	<10	<10	<2000UJ	<10	<10	<10	<10	10	10UJ
Methyl methacrylate	ug/l	<5.0	<5.0	<5.0	<5.0	<1000UJ	<5.0	<5.0	<5.0	<5.0	5.0	5.0UJ
Methylene chloride	ug/l	<10	<10	<10	<10	<2000UJ	<10	<10	<10	<10	<10	10UJ
Pentachloroethane	ug/l	<5.0	<5.0	<5.0	<5.0	<1000UJ	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ
Propionitrile	ug/l	<50	<50UJ	<50	<50	R	<50	<50	<50	<50UJ	<50UJ	<50UJ

Table 3. VOC Analytical Results for Groundwater Samples Collected from Upper Aquifer Wells in March 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	HR-9 03/06/98	HR-11 03/09/98	GM-24 03/06/98	W-3-N 03/05/98	GM-23 03/09/98	GM-25 03/06/98	HR-1 03/05/98	W-1-S 03/05/98	ME-6 03/09/98	ME-3 03/09/98	HR-17 03/05/98
Volatile Organic Compounds												
Styrene	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
Tetrachloroethene	ug/l	<1.0	<1.0	<1.0	2.6	11200J	<1.0	48.8	29.0	193	75.6	7.0J
Toluene	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
Trichloroethene	ug/l	14.0	<1.0	<1.0	<1.0	3870J	<1.0	69.8	9.4	456	64.1	4.5J
Vinyl acetate	ug/l	<10	<10	<10	<10	<2000UJ	<10	<10	<10	<10	<10	<10UJ
Vinyl chloride	ug/l	<2.0	<2.0	<2.0	20.4	766J	<2.0	<2.0	<2.0	<2.0	6.2	<2.0UJ
Xylenes, Total	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
cis-1,2-Dichloroethene	ug/l	20.9	1.4	<1.0	289	3870J	<1.0	10.6	5.0	15.2	36.0	<1.0UJ
cis-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
t-1,4-Dichloro-2-butene	ug/l	<5.0	<5.0	<5.0	<5.0	<1000UJ	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ
trans-1,2-Dichloroethene	ug/l	2.8	<1.0	<1.0	3.6	<200UJ	<1.0	2.6	1.2	1.1	<1.0	<1.0UJ
trans-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0	<1.0	<200UJ	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ
Total VOCs		**110.7**	**8.2**	**19.6**	**315.6**	**19,706**	**ND**	**138.6**	**48.3**	**667.7**	**232.1**	**13.1**

ug/l Micrograms per liter.
J Value is estimated.
UJ Constituent was not detected. Detection limit is estimated.
R Result is unuseable.
ND Not detected.

Table 3. VOC Analytical Results for Groundwater Samples Collected from Upper Aquifer Wells in March 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	EAST 03/05/98	GM-22 03/10/98	GM-22 DUP 03/10/98	GM-21 03/10/98	GM-8 03/04/98	GM-8 DUP 03/04/98	GM-6 03/04/98	GM-2 03/04/98	WSU-24 03/03/98	GM-10 03/03/98	GM-26 03/03/98
Volatile Organic Compounds												
1,1,1,2-Tetrachloroethane	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	ug/l	17.5	<1.0UJ	<1.0UJ	55.0	6.7	6.8	36.2	5.9J	1.7	2.3	<1.0
1,1,2,2-Tetrachloroethane	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
1,1-Dichloroethane	ug/l	6.4	1.3	1.3	7.6	49.3	52.6	35.3	1.7J	<1.0	1.5	<1.0
1,1-Dichloroethene	ug/l	1.3	<1.0UJ	<1.0UJ	4.5	1.0	1.1	<1.0	<1.0UJ	<1.0	<1.0	<1.0
1,2,3-Trichloropropane	ug/l	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
1,2-Dibromo-3-chloropropane	ug/l	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
1,2-Dibromoethane	ug/l	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
1,2-Dichloroethane	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
1,2-Dichloropropane	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
2-Hexanone	ug/l	<10	<10UJ	<10UJ	<10UJ	<10	<10	<10	<10UJ	<10	<10	<10
Acetone	ug/l	<20	<20UJ	<20UJ	<20UJ	<20	<20	<20	<20UJ	<20	<20	<20
Acrolein	ug/l	<50UJ	R	R	R	<50	<50	<50	<50UJ	<50	<50	<50
Acrylonitrile	ug/l	<50	<50UJ	<50UJ	<50UJ	<50	<50	<50	<50UJ	<50	<50	<50
Allyl chloride	ug/l	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Benzene	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	2.3	2.3	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Bromodichloromethane	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Bromoform	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Bromomethane	ug/l	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Carbon disulfide	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Carbon tetrachloride	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Chlorobenzene	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Chloroethane	ug/l	<10	<10UJ	<10UJ	<10UJ	16.2	16.8	<10	<10UJ	<10	<10	<10
Chloroform	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Chloromethane	ug/l	<10	<10UJ	<10UJ	<10UJ	<10	<10	<10	<10UJ	<10	<10	<10
Chloroprene	ug/l	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Dibromochloromethane	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Dibromomethane	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Dichlorodifluoromethane	ug/l	<10	<10UJ	<10UJ	<10UJ	<10	<10	<10	<10UJ	<10	<10	<10
Ethyl benzene	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	28.9	27.6	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Ethyl methacrylate	ug/l	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Fluorotrichloromethane	ug/l	<1.0	<1.0UJ	<1.0UJ	4.9	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Iodomethane	ug/l	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Methacrylonitrile	ug/l	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Methyl ethyl ketone (MEK)	ug/l	R	R	R	R	R	R	R	R	R	R	R
Methyl isobutyl ketone (MIBK)	ug/l	<10	<10UJ	<10UJ	<10UJ	<10	<10	<10	<10UJ	<10	<10	<10
Methyl methacrylate	ug/l	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Methylene chloride	ug/l	<10	<10UJ	<10UJ	<10UJ	<10	<10	<10	<10UJ	<10	<10	<10
Pentachloroethane	ug/l	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Propionitrile	ug/l	<50	R	R	R	<50	<50	<50	<50UJ	<50	<50	<50

Table 3. VOC Analytical Results for Groundwater Samples Collected from Upper Aquifer Wells in March 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	EAST 03/05/98	GM-22 03/10/98	GM-22 DUP 03/10/98	GM-21 03/10/98	GM-8 03/04/98	GM-8 DUP 03/04/98	GM-6 03/04/98	GM-2 03/04/98	WSU-24 03/03/98	GM-10 03/03/98	GM-26 03/03/98
Volatile Organic Compounds												
Styrene	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Tetrachloroethene	ug/l	66.2	5.1	5.0	<1.0UJ	20.0	19.7	94.0	8.5J	1.3	1.5	<1.0
Toluene	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Trichloroethene	ug/l	64.0	4.5	4.6	356	95.2	96.8	119	75.1J	14.2	28.0	<1.0
Vinyl acetate	ug/l	<10	<10UJ	<10UJ	<10UJ	<10	<10	<10	<10UJ	<10	<10	<10
Vinyl chloride	ug/l	<2.0	<2.0UJ	<2.0UJ	<2.0UJ	10.1	10.7	2.3	<2.0UJ	<2.0	<2.0	<2.0
Xylenes, Total	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	10.3	10.2	<1.0	<1.0UJ	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	ug/l	13.9	1.6	<1.0UJ	74.5	56.1	57.1	82.4	10.5J	<1.0	3.6	<1.0
cis-1,3-Dichloropropene	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
t-1,4-Dichloro-2-butene	ug/l	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/l	6.4	<1.0UJ	<1.0UJ	3.6	10.1	10.6	2.4	<1.0UJ	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	ug/l	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Total VOCs		**175.7**	**12.5**	**10.9**	**506.1**	**306.2**	**312.3**	**371.6**	**101.7**	**17.2**	**36.9**	**ND**

ug/l Micrograms per liter.
J Value is estimated.
UJ Constituent was not detected. Detection lim
R Result is unuseable.
ND Not detected.

Table . OC Analytical Results for Groundwater Samples Collected from Lower Aquife. ells in March 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	HR-12 03/09/98	HR-12 DUP 03/09/98	HR-13 03/10/98	GM-1 03/04/98	GM-20D 03/02/98	GM-9 03/03/98	MT-69 03/02/98
Volatile Organic Compounds								
1,1,1,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	ug/l	<1.0	<1.0	1.3	2.1	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	ug/l	2.5	2.5	48.3	<1.0	<1.0	1.2	<1.0
1,1-Dichloroethene	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
1,2,3-Trichloropropane	ug/l	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0	<5.0
1,2-Dibromo-3-chloropropane	ug/l	<5.0UJ	<5.0UJ	<5.0UJ	<5.0	<5.0	<5.0	<5.0
1,2-Dibromoethane	ug/l	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0	<5.0
1,2-Dichloroethane	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
2-Hexanone	ug/l	<10UJ	<10UJ	<10UJ	<10	<10	<10	<10
Acetone	ug/l	<20UJ	<20UJ	<20UJ	<20	<20	<20	<20
Acrolein	ug/l	R	R	R	<50	<50	<50	<50
Acrylonitrile	ug/l	<50	<50	<50UJ	<50	<50	<50	<50
Allyl chloride	ug/l	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0	<5.0
Benzene	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
Bromodichloromethane	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
Bromoform	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
Bromomethane	ug/l	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0	<5.0
Carbon disulfide	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
Carbon tetrachloride	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
Chloroethane	ug/l	<10	<10	<10UJ	<10	<10	<10	<10
Chloroform	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
Chloromethane	ug/l	<10	<10	<10UJ	<10	<10	<10	<10
Chloroprene	ug/l	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0	<5.0
Dibromochloromethane	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
Dibromomethane	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
Dichlorodifluoromethane	ug/l	<10	<10	<10UJ	<10	<10	<10	<10
Ethyl benzene	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
Ethyl methacrylate	ug/l	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0	<5.0
Fluorotrichloromethane	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
Iodomethane	ug/l	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0	<5.0
Methacrylonitrile	ug/l	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0	<5.0
Methyl ethyl ketone (MEK)	ug/l	R	R	R	R	R	R	R
Methyl isobutyl ketone (MIBK)	ug/l	<10UJ	<10UJ	<10UJ	<10	<10	<10	<10
Methyl methacrylate	ug/l	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0	<5.0
Methylene chloride	ug/l	<10	<10	<10UJ	<10	<10	<10	<10
Pentachloroethane	ug/l	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0	<5.0
Propionitrile	ug/l	R	R	R	<50	<50	<50	<50
Styrene	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0

Table VOC Analytical Results for Groundwater Samples Collected from Lower Aquifer Wells in March 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	HR-12 03/09/98	HR-12 DUP 03/09/98	HR-13 03/10/98	GM-1 03/04/98	GM-20D 03/02/98	GM-9 03/03/98	MT-69 03/02/98
Volatile Organic Compounds								
Tetrachloroethene	ug/l	<1.0	<1.0	<1.0UJ	4.0	<1.0	<1.0	<1.0
Toluene	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
Trichloroethene	ug/l	<1.0	<1.0	2.8	52.1	<1.0	7.7	<1.0
Vinyl acetate	ug/l	<10	<10	<10UJ	<10	<10	<10	<10
Vinyl chloride	ug/l	2.7	2.7	<2.0UJ	<2.0	<2.0	<2.0	<2.0
Xylenes, Total	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	ug/l	2.4	2.4	23.3	<1.0	<1.0	2.1	<1.0
cis-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
t-1,4-Dichloro-2-butene	ug/l	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/l	<1.0	<1.0	3.3	<1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0	<1.0
Total VOCs		**7.6**	**7.6**	**79**	**58.2**	**ND**	**11**	**ND**

ug/l Micrograms per liter.
J Value is estimated.
UJ Constituent was not detected. Detection limit is estimated.
R Result is unuseable.
ND Not detected.

Table 5. Proposed Additional Scope of Work for AOI 7 - Former Oil House, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Sample Identification	Proposed Scope of Work	Objectives
GM-27	Install shallow monitor well pair with GM-23 using hollow-stem auger and telescoping drilling techniques. Set at the top of the regional confining unit (approximately 60 feet deep) while sealing off the upper clay till during well installation. Collect soil samples at 0-2 feet and above the water table for analysis of the AOI-specific list of VOCs. Continuous headspace readings will be taken and a third soil sample may be collected at the highest headspace reading or visual evidence of contamination and analyzed for the AOI-specific list of VOCs. If all headspace readings are background levels or there is no visual evidence of contamination, then the two soil samples will be collected. Advance boring into groundwater to determine if upper clay till is present and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample(s) (immediately above the upper clay till, if present, and/or the regional confining unit) to perform the hydrophobic dye soil-water shake field test. Collect additional groundwater samples using the Hydropunch II ™ after casing off the upper clay till while advancing the boring to above the regional confining unit. Develop and sample well and analyze for the AOI-specific list of VOCs.	Evaluate groundwater quality in lower portion of upper aquifer at the regional confining unit. Evaluate significance of upper clay till to act as a confining unit. Assess DNAPL presence. Use Hydropunch II ™ results to determine well screen location.
GM-28	Install shallow monitor well downgradient of AOI 7 using a hollow-stem auger drilling techniques. Set at the top of the upper clay till. If the upper clay till is not present, install the monitor well at the top of the regional confining unit. Continuous headspace readings will be taken and a sample may be collected based on the headspace readings or visual evidence of contamination and analyzed for the AOI-specific list of VOCs, unless visual evidence or HNu readings suggest the parameter list should be	Evaluate downgradient extent of VOCs. Verify presence/absence of upper clay till. Assess DNAPL presence. Use Hydropunch II ™ results to determine well screen location.

Table 5. Proposed Additional Scope of Work for AOI 7 - Former Oil House, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Sample Identification	Proposed Scope of Work	Objectives
GM-28 (continued)	expanded. If all headspace readings are background levels or there is no visual evidence of contamination, no soil samples will be collected. Advance boring into groundwater to determine if upper clay till is present and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample(s) (immediately above the upper clay till, if present, and/or the regional confining unit) to perform the hydrophobic dye soil-water shake field test. If the upper clay till is not present collect additional groundwater samples using the Hydropunch II ™ while advancing the boring to above the regional confining unit. Develop and sample well and analyze for the AOI-specific list of VOCs (or the same parameter list analyzed for the soil samples).	
OH-BH5	Install a soil boring using hollow-stem auger drilling techniques. Locate boring between OH-BH2 and OH-BH3. Collect soil samples at 0-2 feet and above the water table for analysis of the AOI-specific list of VOCs. Continuous headspace readings will be taken and a third sample may be collected at the highest headspace reading or visual evidence of contamination and analyzed for the AOI-specific list of VOCs. If all headspace readings are background levels or there is no visual evidence of contamination, then only two samples will be collected. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till and analyze sample for the AOI-specific list of VOCs. Collect a saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Evaluate potential source of VOCs in shallow and deep soil associated with historic tank farm unloading area and screen groundwater quality to define source area and support risk assessment. Verify presence/absence of upper clay till. Assess DNAPL presence.

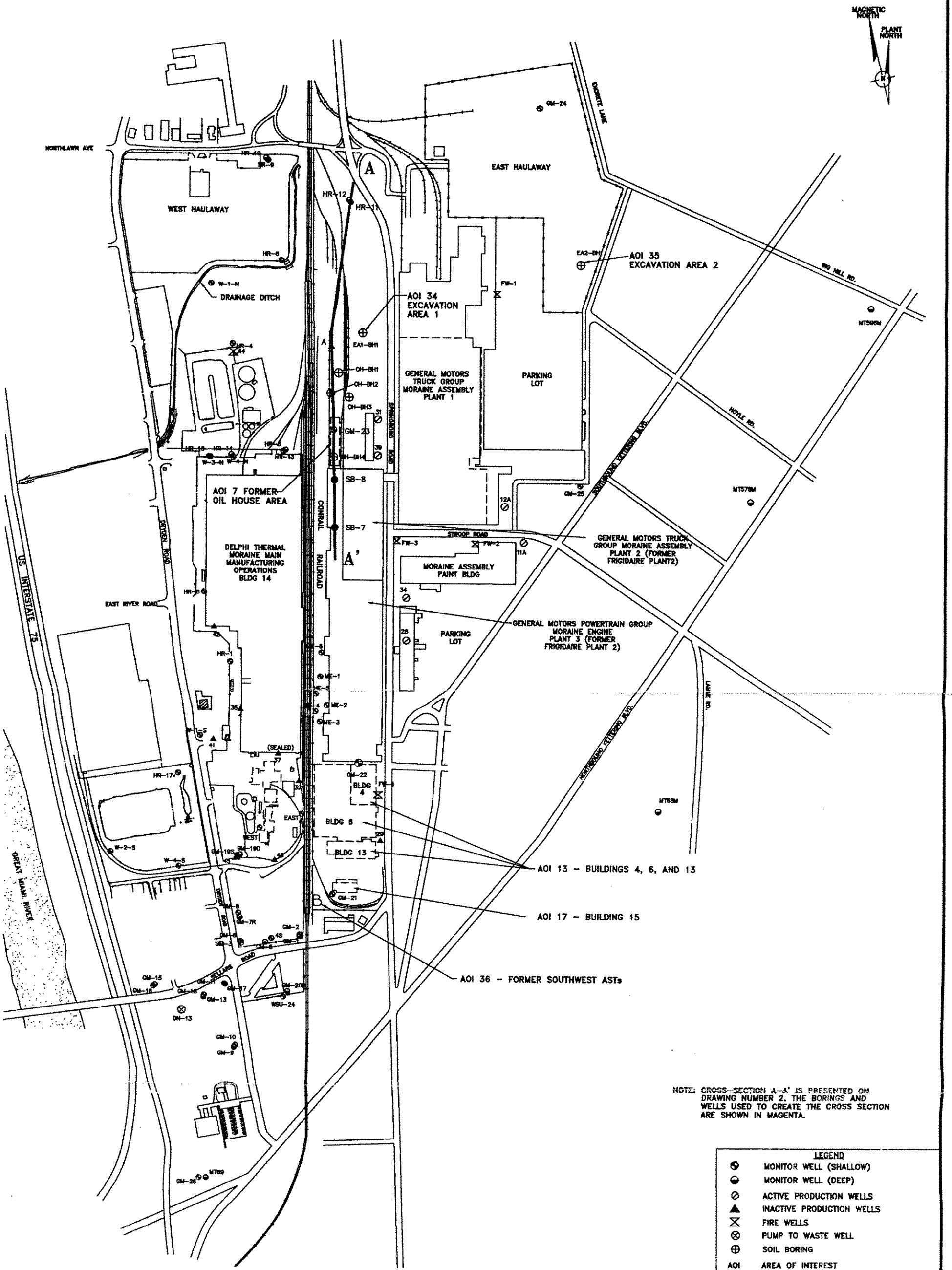
Table 5. Proposed Additional Scope of Work for AOI 7 - Former Oil House, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Sample Identification	Proposed Scope of Work	Objectives
OH-BH6	Install a soil boring using hollow-stem auger drilling techniques. Locate boring between the former oil house building and the former oil house tank farm. Take continuous headspace readings and collect soil samples as described for OH-BH5. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till (if present) and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Evaluate potential source of VOCs in shallow and deep soil associated with the former oil house building and the former tank farm, further investigate VOCs reported during installation of GM-23 and screen groundwater quality to define source area and support risk assessment. Verify presence/absence of upper clay till. Assess DNAPL presence.
OH-BH7	Install a soil boring using hollow-stem auger drilling techniques. Locate boring between OH-BH4 and GM-23. Take continuous headspace readings and collect soil samples as described for OH-BH5. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till (if present) and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Evaluate potential source of VOCs in shallow and deep soil associated with the former oil house building, further investigate VOCs reported during installation of GM-23 and screen groundwater quality to define source area and support risk assessment. Verify presence/absence of upper clay till. Assess DNAPL presence.
OH-BH8	Install a soil boring using hollow-stem auger drilling techniques. Locate boring immediately north of the existing tank farm. Take continuous headspace readings and collect soil samples as described for OH-BH5. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till (if present) and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper	Evaluate presence of VOCs in shallow and deep soil north of the existing tank farm and screen groundwater quality to define source area and support risk assessment. Verify presence/absence of upper clay till. Assess DNAPL presence.

Table 5. Proposed Additional Scope of Work for AOI 7 - Former Oil House, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Sample Identification	Proposed Scope of Work	Objectives
OH-BH8 (continued)	clay till is present.	
OH-BH9	Install a soil boring using hollow-stem auger drilling techniques. Locate boring north of OH-BH1. Take continuous headspace readings and collect soil samples as described for OH-BH5. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till (if present) and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Evaluate presence of VOCs in shallow and deep soil north of OH-BH1 and screen groundwater quality to define source area and support risk assessment. Verify presence/absence of upper clay till. Assess DNAPL presence.
OH-BH10	Install a soil boring using hollow-stem auger drilling techniques. Locate boring west of OH-BH2. Take continuous headspace readings and collect soil samples as described for OH-BH5. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till (if present) and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Evaluate presence of VOCs in shallow and deep soil west of the former oil house tank farm and screen groundwater quality to define source area and support risk assessment. Verify presence/absence of upper clay till. Assess DNAPL presence.

AOI Area of Interest
DNAPL Dense Non-aqueous Phase Liquid
VOCs Volatile Organic Compounds
AOI-specific list of VOCs includes: tetrachloroethene, trichloroethene, trans- and cis-1,2-dichloroethene, and vinyl chloride.



NOTE: CROSS-SECTION A-A' IS PRESENTED ON DRAWING NUMBER 2. THE BORINGS AND WELLS USED TO CREATE THE CROSS SECTION ARE SHOWN IN MAGENTA.

LEGEND

- MONITOR WELL (SHALLOW)
- MONITOR WELL (DEEP)
- ACTIVE PRODUCTION WELLS
- INACTIVE PRODUCTION WELLS
- FIRE WELLS
- PUMP TO WASTE WELL
- SOIL BORING
- AOI — AREA OF INTEREST

ARCADIS GERAGHTY & MILLER

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Suite 100, Dublin, OH 43016
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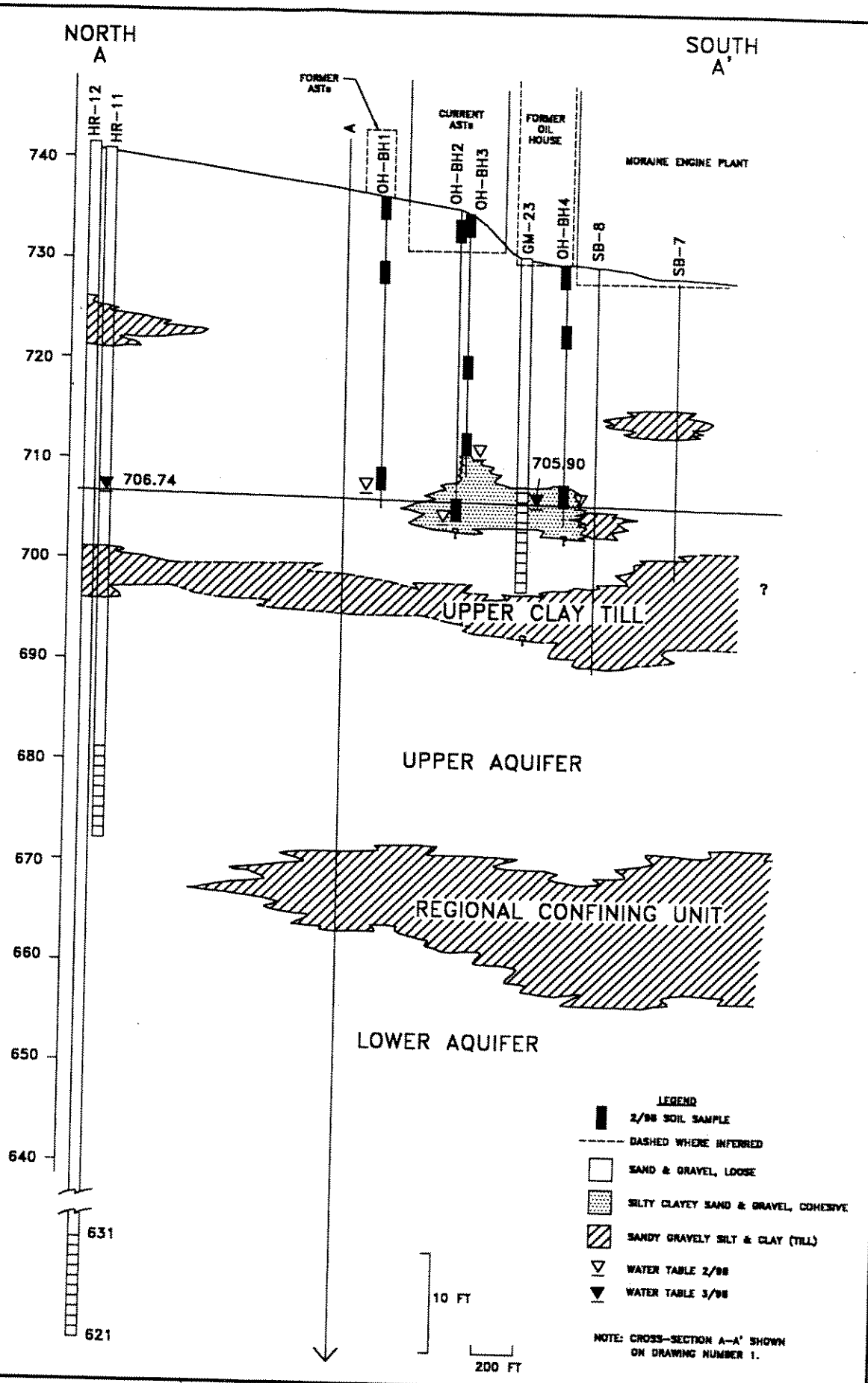
AOI LOCATIONS AND LINE OF CROSS SECTION A-A'

GENERAL MOTORS CORPORATION MORAINE, OHIO

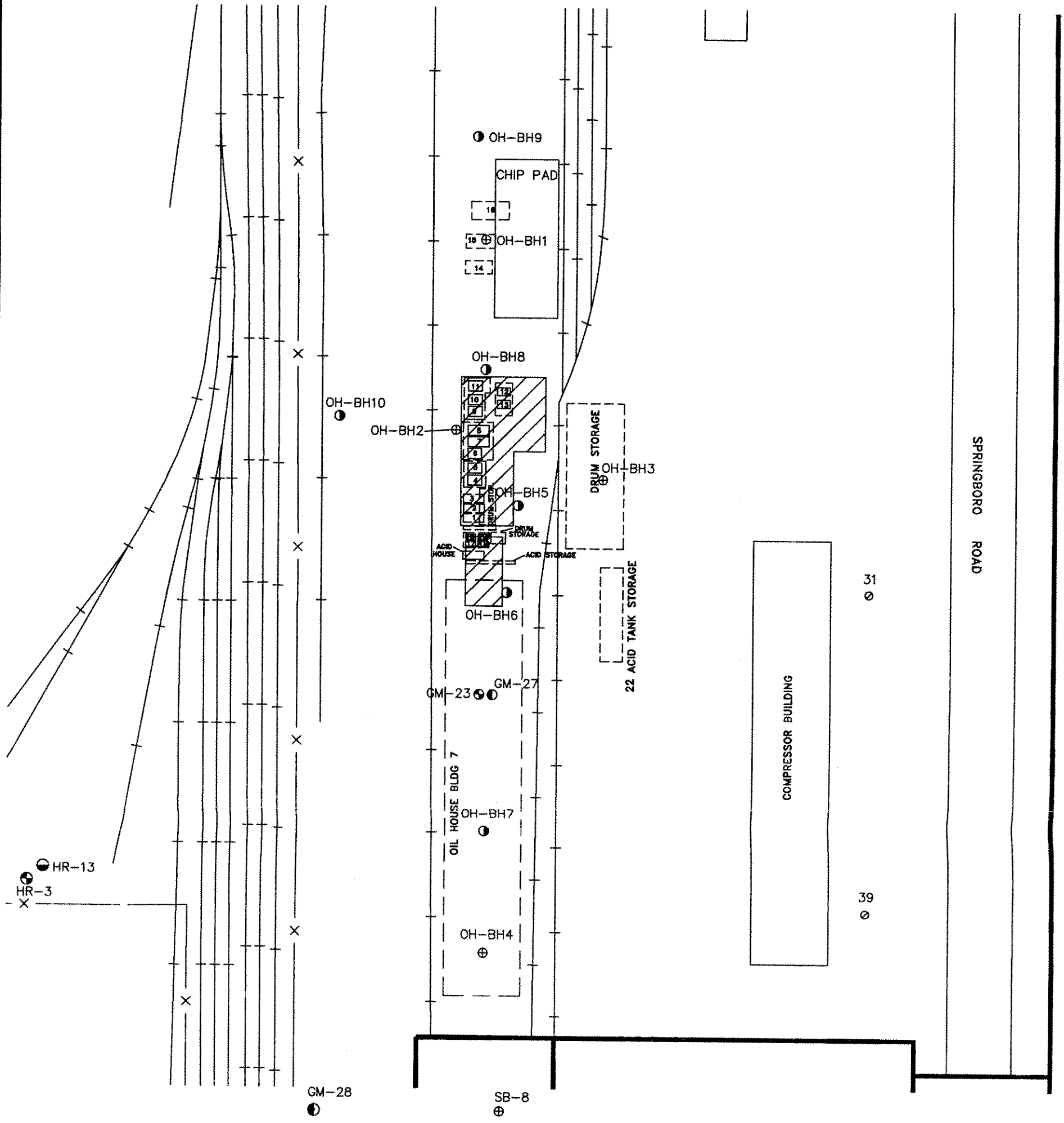
DATE 12JUN98	PROJECT MANAGER R.ASTLE	DRAWING NAME HARR\N-B\RFTSUPP2
DRAWN R. SMITH	LEAD DESIGN PROF.	CHECKED R. ASTLE
PROJECT NUMBER 0H000294.001.002		DRAWING NUMBER 1

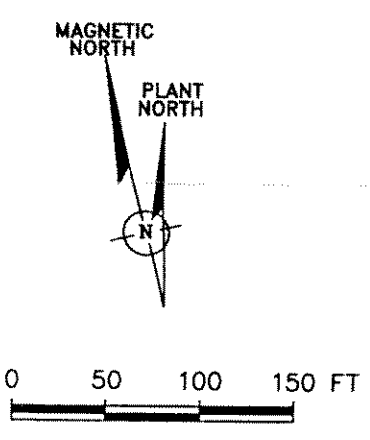


ARCADIS GERAGHTY & MILLER

CROSS-SECTION A-A'
GENERAL MOTORS CORPORATION
MORAINE, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
3/4/2000	R. BILLOTE	CS-AA-GM
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH		R. ASTLE
PROJECT NUMBER		DRAWING NUMBER
OH000294.0001.0002		2





HISTORIC TANK No.	CONTENTS	CAPACITY
1	OIL	15,000 GALLONS
2	OIL	15,000 GALLONS
3	OIL	15,000 GALLONS
4	THINNER	8,000 GALLONS
5	REDUCER	8,000 GALLONS
6	ALCOHOL	8,000 GALLONS
7	KEROSENE	10,000 GALLONS
8	PERCHLOROETHENE	10,000 GALLONS
9	PERCHLOROETHENE	10,000 GALLONS
10	ALCOHOL	10,000 GALLONS
11	ALCOHOL	10,000 GALLONS
12	XYLOL	10,000 GALLONS
13	THINNER	10,000 GALLONS
14	FREON 12	160,000 LBS
15	FREON 12	160,000 LBS
16	OIL	30,000 GALLONS
17	ACID--HNO_3	11,000 GALLONS
18	ACID--HCl	10,000 GALLONS
19	ACID--H_2SO_4	13,000 GALLONS
20	ACID--H_3PO_4	11,000 GALLONS
21	DRUMS-OIL	300 BBL
22	ACID	-----

LEGEND

- MONITOR WELL (SHALLOW)
- MONITOR WELL (DEEP)
- SOIL BORING
- ACTIVE PRODUCTION WELL
- PROPOSED MONITOR WELL (SHALLOW)
- PROPOSED SOIL BORING
- OH — OIL HOUSE
- BH — BORE HOLE
- — — FORMER LOCATION OF OIL HOUSE STRUCTURES
- APPROXIMATE LOCATION OF CURRENT MORAINE ENGINE TANK FARM (AOI 20)

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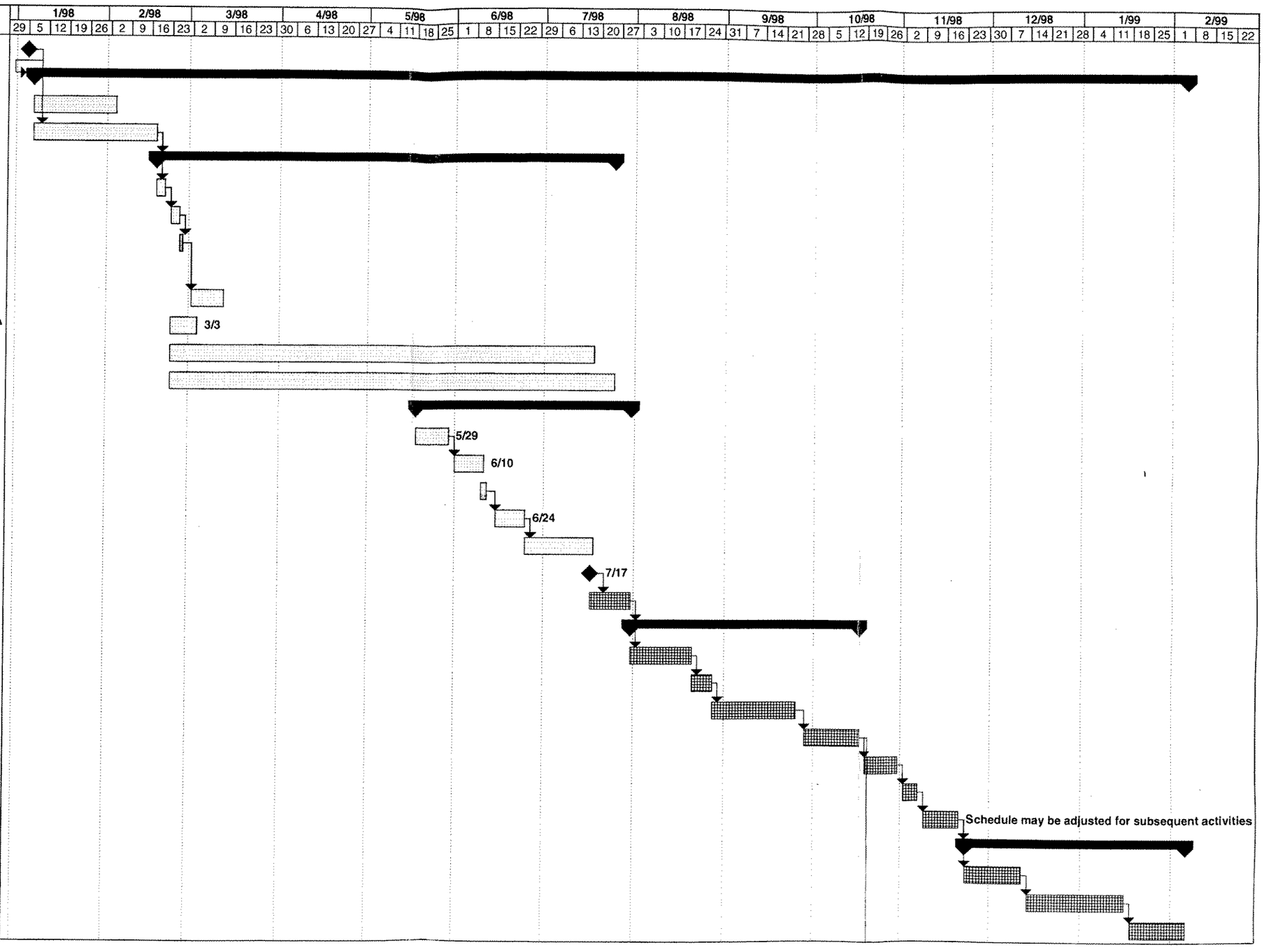
PROPOSED SOIL BORING AND MONITOR WELL LOCATIONS FOR AOI 7 - FORMER OIL HOUSE AREA

GENERAL MOTORS CORPORATION
MORAINE, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
12JUN98	R.ASTLE	HARR\N-B\RFISUP1B
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH		R. ASTLE
PROJECT NUMBER		DRAWING NUMBER
0H000294.0001.0002		3

Figure 4. Revised Schedule of Supplemental RFI Activities for Additional Investigation, Supplemental RFI, General Motors Corporation, Moraine, Ohio

No.	Task Name
1	**USEPA Approval of Supplemental RFI WP**
2	**Implement Field Program**
3	Obtain Well Access Agreements
4	Bid Subcontract Work/Mobilize
5	**Planned Investigation Activities**
6	AOI 13 & 17 Screening (On-site analysis)
7	AOI 7/AOI 36 Investigation
8	Monitor Well (GM-26) Installation
9	AOI 13 &17 Auger Drilling Investigation (NR)
10	Groundwater Sampling
11	Submit Screening Results for AOIs 13 & 17 to USEPA
12	Laboratory Analysis
13	Validation (Field/Lab Samples)
14	**Eval if Added Field Activities are Required**
15	Submit AOI 36 Evaluation to USEPA
16	USEPA Review/Approval of AOI 36 Sampling
17	AOI 36 Soil Sampling
18	AOI 36 Lab Analysis/Submit Soil Results to USEPA
19	Develop Preliminary AOI Evaluation Report*
20	Submit AOI Evaluation Report to USEPA*
21	USEPA Review/Approval*
22	**Additional Investigation Activities at AOI 7**
23	Drilling (borings and wells) and Soil Sampling
24	Groundwater Sampling
25	Laboratory Analysis
26	Validation
27	Eval if Added Field Activities are Required
28	Submit Preliminary Evaluation Report to USEPA
29	USEPA Review/Approval
30	**Additional Investigation Activities, If Required**
31	Drilling (borings and/or wells) and/or Sampling
32	Laboratory Analysis
33	Validation



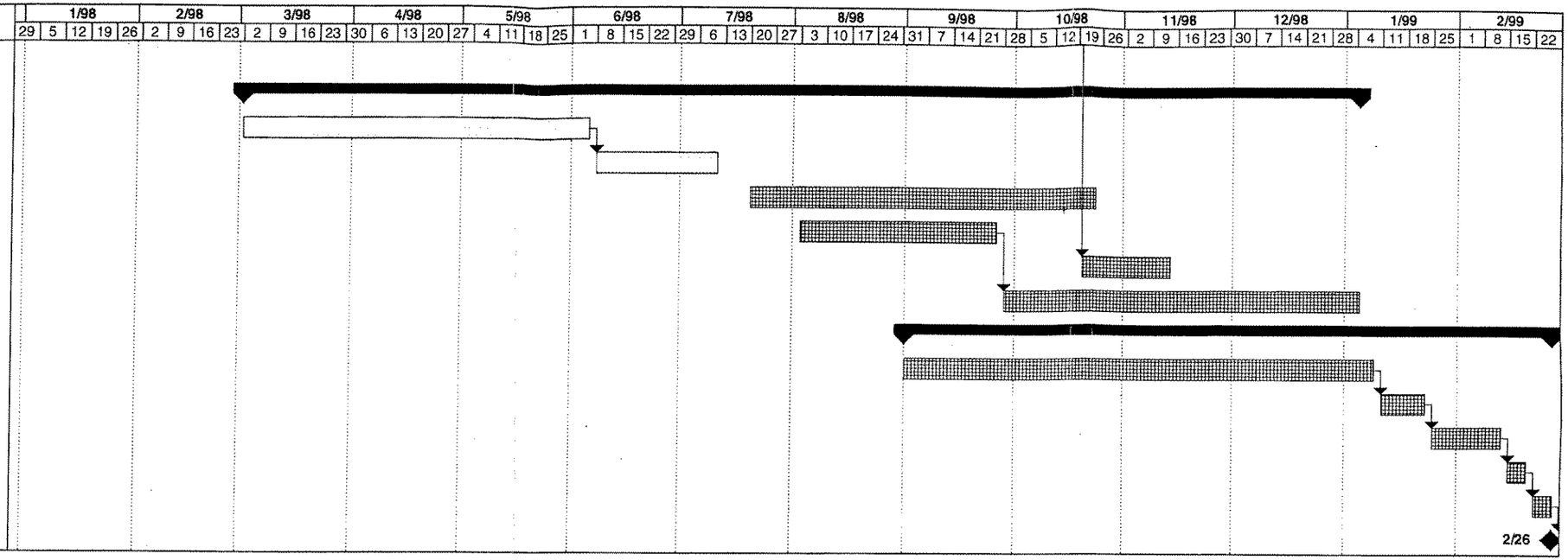
Project:
Date: Thu 7/16/98

Completed Task | Milestone | Summary | Planned Task

* These tasks have been rescheduled to accomodate the additional field program as indicated on the schedule included with the approved Supplemental RFI Work Plan. NR - Not Required.

Figure 4. Revised Schedule of Supplemental RFI Activities for Additional Investigation, Supplemental RFI, General Motors Corporation, Moraine, Ohio

No.	Task Name
34	
35	**Risk Assessment**
36	Exposure Assessment
37	Preliminary Risk Calculations
38	Exposure Assessment
39	Risk Calculations (AOIs 13, 17, 34, 35, 36)
40	Risk Calculations (AOI 7, Groundwater) *
41	Develop Draft Supplemental Risk Assessment *
42	**Reporting**
43	Develop Internal Draft Supplemental RFI Rpt *
44	GMC Draft Review *
45	Develop Final Supplemental RFI Rpt *
46	GMC Final Review *
47	Finalize Supplemental RFI Rpt *
48	**Supplemental RFI Addendum to USEPA ***



Project:
Date: Thu 7/16/98

Completed Task | Milestone | Summary | Planned Task

* These tasks have been rescheduled to accomodate the additional field program as indicated on the schedule included with the approved Supplemental RFI Work Plan. NR - Not Required.

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ENVIRONMENTAL

MEMO

To
Bill Buller, U.S. EPA
Ed Schuessler, Tetra Tech

Copies
John Ridd, GMC
Mark Nielsen, ENVIRON
Larry Graves

From
J. Reid/Nancy Gillotti

Date
6 August 1998

Subject
Additional Investigation at AOI 7 - Former Oil House Area, Supplemental RFI, General Motors Corporation, Moraine, Ohio

ARCADIS Geraghty & Miller Project No
OH000294.0001.00002

The following is a summary of the discussions held during the July 30, 1998 conference call between the U.S. EPA, General Motors Corporation, ENVIRON, and ARCADIS Geraghty & Miller. This memorandum has been revised to incorporate added detail and supersedes the memorandum issued July 31, 1998.

1. The AOI-specific parameter list was discussed and it was agreed that in addition to the six VOCs (PCE, TCE, trans- and cis-1,2-DCE, 1,1-DCE and vinyl chloride) presented in the AOI Evaluation and Recommendations Report, two more VOCs (1,1-DCA and 1,1,1-TCA) would be added to the list.

2. The next discussion focused on soil borings OH-BH5 through OH-BH10, the presence/absence of the upper clay till, and whether to collect a groundwater sample from each boring using the Hydropunch technique if the upper clay till is not present. It was agreed that proposed wells GM-27 and GM-28 would be installed first, so that the presence/absence of the upper clay till can be evaluated. Next, proposed soil borings OH-BH6 and OH-BH7 will be drilled and if the upper clay till is encountered, a groundwater sample will be collected above the upper clay till using the Hydropunch technique as described in the AOI Evaluation and Recommendations Report. If the upper clay till is not present, drilling will continue until the regional confining unit is encountered and groundwater samples will be collected using the Hydropunch technique, approximately every 10 feet between the water table and the regional confining unit. The proposed scope of work for soil borings OH-BH5 and OH-BH8 through OH-BH10 will be determined following the installation of monitoring wells GM-27 and GM-28 and soil borings OH-BH6 and OH-BH7, and will be based on an evaluation of subsurface conditions encountered and analytical results for samples collected from these four locations.

3. U.S. EPA has proposed installation of an additional downgradient shallow aquifer well located between GM-28 and ME-6. In order to determine if this additional well is necessary, it was agreed that all groundwater samples collected from GM-27, GM-28, OH-BH6, and OH-BH7 would be analyzed on a rush turnaround basis from the laboratory. When available, this data will be discussed with U.S. EPA and Tetra Tech on a conference call prior to demobilizing the drillers. A decision will be made at that time whether to install a shallow monitor well between GM-28 and ME-6, based on a comparison of groundwater data from GM-28 relative to data previously collected at GM-23 and ME-6.

4. The Supplemental RFI project schedule was discussed and it was agreed that discussion on the final schedule will be deferred until the field program at AOI 7 is complete.

5. U.S EPA raised the issue that a deep aquifer monitoring well might be required downgradient of AOI 7. It was agreed that any further discussion regarding investigation of the deep aquifer would be deferred until completion of (1) the shallow aquifer investigation, and (2) an evaluation of the extensive historic geologic, hydrogeologic and groundwater quality data developed to date regarding the deep aquifer at the Site.

ARCADIS Geraghty & Miller
4700 Lakehurst Court, Suite 100
Dublin, Ohio 43016-2251

Fax Cover Sheet

DATE: August 19, 1998

PROJ NO: OH000294.0001.00002

TO:	William Buller U.S. EPA	**PHONE:** **FAX:**	312-886-4568 312-353-4788
	Ed Schuessler Tetra Tech	**PHONE:** **FAX:**	312-856-8700 312-938-0118
CC:	John Ridd GMC	**PHONE:** **FAX:**	937-455-4408 937-455-4036
	Jean Caufield GMC	**PHONE:** **FAX:**	313-556-0845 313-556-0803
FROM:	J. Reid/Nancy Gillotti ARCADIS Geraghty & Miller	**PHONE:** **FAX:**	614-764-2310 614-764-1270

RE: Status of Additional Investigation at AOI 7 - Former Oil House Area, Supplemental RFI, General Motors Corporation, Moraine, Ohio

Number of pages including cover sheet: 5

The attached Tables 1 and 2 provide a summary of the field program at AOI 7, specifically, soil descriptions, hydropunch analytical results, and dye shake test results for OH-BH5, OH-BH6, OH-BH7, GM-27, and GM-28. A conference call between the U.S. EPA, General Motors, and ARCADIS Geraghty & Miller has been scheduled to discuss the information presented in these tables. The call will be held on Thursday August 20th at 10:30 AM Central Time and 11:30 AM Eastern Time, the dial in number is **719-457-2704** and the confirmation number is **524783**.

Please note that hydropunch analytical results are not yet available for OH-BH6. This information will be faxed to you as soon as it is received from NET.

If transmission is interrupted or received incomplete, please call (614)764-2310.

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Table 1. Summary of Additional Investigation at AOI 7 - Former Oil House Area, Supplemental RFI, General Motors Corporation, Moraine, Ohio

Boring/Monitor Well Identification						
Interval Feet (bls)	OH-BH5 14-Aug-98	HNu (ppm)	OH-BH6 12-Aug-98	HNu (ppm)	OH-BH7 10-Aug-98	HNu (ppm)
0-2	y-brn, S 50% f-m, G 40%, St/C 10%, mst	0.0**	blk, S 70% f-c, G 20%, St/C 10%, mst	4.5**	y-brn gry, S 50% f-c, G 40%, St/C 10%, mst	0.5**
2-4	y-brn, S 50% f-m, G 40%, St/C 10%, mst	0.0	y-brn, S 70% f-m, G 20%, St/C 10%, mst	1.5	gry y-brn w/ sl orng stng, S 70% f-m, G 20%, St/C 10%, mst	0.0
4-6	y-brn, S 60% f-m, G 30%, St/C 10%, mst	0.5	y-brn, S 60% f-m, G 30%, St/C 10%, mst	1.5	gry y-brn, S 70% f-m, G 20%, St/C 10%, mst	0.5
6-8	y-brn, S 70% f-c, G 20%, St/C 10%, mst	1.0	y-brn, S 70% f-c, G 20%, St/C 10%, mst	4.5**	y-brn, S 60% f-m, G 30%, St/C 10%, mst	1.0
8-10	y-brn, S 70% f-c, G 20%, St/C 10%, mst	1.5	y-brn gry, S 60% f-m, G 30%, St/C 10%, mst	4.5	y-brn w/gry, S 60% f-m, G 30%, St/C 10%, mst	2.0
10-12	y-brn, S 70% f-m, G 20%, St/C 10%, v-mst	2.0	y-brn, S 70% f-c, G 20%, St/C 10%, v-mst	2.0	y-brn, S 40% f-m, G 50%, St/C 10%, mst	7.0
12-14	y-brn, S 60% f-m, G 30%, St/C 10%, mst	2.0	y-brn, S 70% f-m, G 20%, St/C 10%, mst	4.0	y-brn, S 70% f-c, G 20%, St/C 10%, mst	3.0
14-16	y-brn, S 60% f-c, G 30%, St/C 10%, mst	1.0	y-brn, S 75% f-c, G 15%, St/C 10%, mst	2.5	y-brn w/gry, S 60% f-m, G 30%, St/C 10%, mst	8.0
16-18	y-brn, S 60% f-c, G 30%, St/C 10%, mst	1.0	y-brn gry, S 70% f-c, G 20%, St/C 10%, mst	3.0	y-brn w/gry, S 60% f-c, G 30%, St/C 10%, mst	8.0
18-20	y-brn, S 60% f-c, G 30%, St/C 10%, mst	3.0**	y-brn gry, S 75% f-c, G 15%, St/C 10%, mst	3.5	y-brn w/gry, S 70% f-c, G 20%, St/C 10%, mst	19.0**
20-22	y-brn, S 60% f-c, G 30%, St/C 10%, mst	3.0	y-brn gry, S 60% f-c, G 30%, St/C 10%, mst	4.5	y-brn, S 70% f-c, G 20%, St/C 10%, v mst	10.0
22-24	y-brn, S 60% f-c, G 30%, St/C 10%, mst	2.0	y-brn, S 75% f-m, G 15%, St/C 10%, mst	7.0**	y-brn, S 75% m-c, G 15%, St/C 10%, v mst-wet	2.0**
24-26	y-brn, S 70% f-c, G 20%, St/C 10%, v mst	3.0**	y-brn, S 80% f-c, G 10%, St/C 10%, wet	1.5	y-brn, S 40% f-c, G 50%, St/C 10%,wet	0.0
26-28	y-brn, S 70% f-c, G 20%, St/C 10%, wet	0.5	y-brn, S 70% f-c, G 20%, St/C 10%, wet	0.5	y-brn, S 75% f-m, G 10%, St/C 15%, wet	8.0
28-30	y-brn, S 60% f-c, G 30%, St/C 10%, wet	0.5	y-brn, S 85% f-m, G 5%, St/C 10%, wet	22.0	y-brn, S 70% f-m, G 10%, St/C 20%, wet	1.0
30-32	y-brn, S 25% m-c, S 50%, G 15%, St/C 10%, wet	0.5	**30-31.5'** dk gry-blk, S 85% f-m, G 5%, St/C 10%, wet	NM	**30-30.5'** y-brn, S 80% f-m, St/C 20%, wet	4.0
	Bottom 4" - gry-blk, fine S	7.5	**31.5-32'** dk gry w/ blk-orng stng, TILL, St/C 90%, S f 5%, G 5%, v mst EOB		**30.5-31.5'** dk gry, TILL, St/C 80%, G 20%, mst EOB	0.0
32-34	y-brn, S 80% f-m, G 10%, St/C 10%, wet	8.0				
34-36	y-brn gry, S 75% f-c, G 10%, St/C 15%, wet	4.5				
36-38	**36-37.5'** gry, S 80% f-c, G 5%, St/C 15%, wet	13.0				
	37.5-38' gry, TILL St/C 80% , G 10%, S 10%, mst EOB	4.0				
Hydropunch Sample Result (Total VOCs)	**37.0'** 4,708.2 ug/L		**31.5'** na		**30'** 4,663.7 ug/L	
Dye Test Results	**36.5-37.5'** Negative		**30.5-31.5'** Possible		**30-30.5'** Negative	

Soil Description : G - gravel, S - sand, St - silt, C - clay; c - coarse, m - medium, f - fine
Color: blk - black, brn - brown, y - yellow, gry - gray, orng - orange
Moisture: mst - moist, v - very, sl - slightly, dk - dark
Other: stng - staining, w/ - with, EOB - end of boring

** Soil sample submitted for laboratory analysis of select volatile organic compounds
NM - Not measured
bls - Below land surface
ug/L - Micrograms per liter
ppm - Parts per million
na - Not available

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Table 1. Summary of Additional Investigation at AOI 7 - Former Oil House Area, Supplemental RFI, General Motors Corporation, Moraine, Ohio

Boring/Monitor Well Identification				
Interval Feet (bls)	GM-27 04-Aug-98	HNu (ppm)	GM-28 05-Aug-98	HNu (ppm)
0-2	dk y-brn, S 60% f-c, G 30%, St/C 10%, sl mst	1.0**	blk gry brn, S 60% f-c, G 30%, St/C 10%, sl mst	0.0
2-4	dk y-brn gry,S 70% f-c, G 20%, St/C 10%, sl mst	3.0	dk y-brn, S 50% f-m, G 40%, St/C 10%, mst	0.0
4-6	dk brn, S 40% f-m, G 30%, St/C 30%, mst	2.0	y-brn, S 60% f-m, G 30%, St/C 10%, sl mst	0.0
6-8	y-brn, S 50% f-m, G 25%, St/C 25%, mst	2.0	y-brn gry, S 40% f-m, G 50%, St/C 10%, mst	0.0
8-10	y-brn, S 60% f-m, G 20%, St/C 20%, mst	2.0	y-brn, S 60% f-m, G 30%, St/C 10%, sl mst	0.0
10-12	y-brn, S 60% f-m, G 20%, St/C 20%, mst	17.0	y-brn, S 60% f-m, G 30%, St/C 10%, sl mst	0.0
12-14	No Recovery	NM	y-brn, S 60% f-m, G 30%, St/C 10%, sl mst	0.0
14-16	y-brn, S 60% f-m, G 20%, St/C 20%, mst	3.5	y-brn, S 60% f-m, G 30%, St/C 10%, sl mst	0.0
16-18	y-brn gry, S 50% f-m, G 40%, St/C 10%, sl mst	9.0	y-brn, S 70% f-c, G 20%, St/C 10%,mst	0.0
18-20	y-brn, S 60% f-m, G 30%, St/C 10%, mst	19.0**	y-brn, S 70% f-c, G 20%, St/C 10%, mst	0.0
20-22	y-brn, S 70% f-m, G 15%, St/C 15%, mst	15.5	y-brn, S 70% f-m, G 20%, St/C 10%, mst	0.5**
22-24	y-brn, S 70% f-m, G 10%, St/C 20%, v mst	6.5**	y-brn, S 70% f-c, G 20%, St/C 10%, v mst-wet	<0.5
24-26	y-brn, S 90% f, trace G and St/C, v mst-wet	12.0	y-brn, S 60% f-c, G 30%, St/C 10%, wet	0.0
26-28	y-brn, S 60% f-m, G 15%, St/C 25%, wet	9.0	y-brn, S 70% f-c, G 20%, St/C 10%, wet	0.0
28-30	dk y-brn, S 50% f-m, G 30%, St/C 20%, wet	12.5	y-brn, S 80% f-c, G 10%, St/C 10%, wet	0.5
30-32	**30-31.5'** dk y-brn, S 70% f-m, G 20%, St/C 10%, wet **31.5-32'** dk gry, TILL, St/C 80%, S 10%, G 10%, mst EOB	9.0	**30-31.5'** y-brn, S 80% f-c, G 10%, St/C 10%, wet **31.5-32'** dk gry, TILL, St/C 90%, G 5%, S 5%, mst EOB	1.0
32-34	(See page 3 of 3 for continuation of GM-27)			
34-36				
36-38				
Hydropunch Sample Result (Total VOCs)	**32'** 11,525.3 ug/L		**32'** 895.1 ug/L	
Dye Test Results	**31.5-33.5'** Possible		**30-32'** Negative	

Soil Description : G - gravel, S - sand, St - silt, C - clay; c - coarse, m - medium, f - fine
Color: blk - black, brn - brown, y - yellow, gry - gray, omg - orange
Moisture: mst - moist, v - very, sl - slightly, dk - dark
Other: stng - staining, w/ - with, EOB - end of boring

** Soil sample submitted for laboratory analysis of select volatile organic compounds

NM - Not measured

bls - Below land surface

ug/L - Micrograms per liter

ppm - parts per million

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Table 1. Summary of Additional Investigation at AOI 7 - Former Oil House Area, Supplemental RFI, General Motors Corporation, Moraine, Ohio

Boring/Monitor Well Identification		
Interval Feet (bls)	* GM-27 13-Aug-98	HNu (ppm)
34-36	gry, TILL St/C 85%, G 10%, S 5%, dry	0.0
36-38	gry, TILL St/C 80%, G 15%, S 5%, wet	0.0
38-40	y-brn, S 80% f-c, G 10%, St/C 10%, wet	<0.5
40-42	y-brn, S 75% f-c, G 15%, St/C 10%, wet	0.0
42-44	y-brn, S 70% f-c, G 20%, St/C 10%, wet	0.0
44-46	y-brn, S 70% f-c, G 20%, St/C 10%, wet	0.0
46-48	y-brn, S 70% f-c, G 20%, St/C 10%, wet	0.0
48-50	y-brn, S 75% f-c, G 15%, St/C 10%, wet	<0.5
50-52	y-brn, S 90% f-c, St/C 10%, wet	0.0
52-54	y-brn, S 90% f-c, St/C 10%, wet	0.0
54-56	y-brn, S 80% f-c, G 10%, St/C 10%, wet	0.0
56-58	gry, TILL St/C 80%, G 15%, S 5%, mst EOB	0.0
Hydropunch Sample Result (Total VOCs)	39' 1,191.1ug/L 50' 101.5 ug/L	
Dye Test Results	33.5-34.5' Possible 38-39' Possible 54-55' Possible	

* GM-27 was drilled from the upper clay till to the regional clay till at an adjacent location. The till was identified at the 34-36 foot interval.

Soil Description : G - gravel, S - sand, St - silt, C - clay; c - coarse, m - medium, f - fine
Color: blk - black, brn - brown, y - yellow, gry - gray, orng - orange
Moisture: mst - moist, v - very, sl - slightly, dk - dark
Other: stng - staining, w/ - with, EOB - end of boring

** Soil sample submitted for laboratory analysis of select volatile organic compounds

NM - Not measured
bls - Below land surface

ug/L - Micrograms per liter
ppm - parts per million

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Table 2. Preliminary Analytical Results for Groundwater Samples Collected Using a Hydropunch in August 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH5 37 ft bls 08/14/98	OH-BH6 31.5 ft bls 08/12/98	OH-BH7 30 ft bls 08/10/98	GM-27 32 ft bls 08/04/98	GM-27 39 ft bls 08/13/98	GM-27 50 ft bls 08/13/98	GM-28 32 ft bls 08/05/98
Volatile Organic Compounds								
1,1-Dichloroethane	ug/l	18.5	na	2.1	54.6	3.0	<2.0	2.4
1,1-Dichloroethene	ug/l	84.1	na	<2.0	6.8	2.0	<2.0	<2
trans-1,2-Dichloroethene	ug/l	7.6	na	11.1	42.8	6.8	<2.0	6.2
cis-1,2-Dichloroethene	ug/l	1,280	na	962	3,540	821	17.4	187
Tetrachloroethene	ug/l	1,550	na	2,950	484	14.3	3.2	242
1,1,1-Trichloroethane	ug/l	2.0	na	3.2	1.5	<2.0	<2.0	10.5
Trichloroethene	ug/l	1,330	na	728	75.6	113	80.9	444
Vinyl chloride	ug/l	436	na	7.3	7,320	231	<4.0	3.0
Total VOCs	ug/l	4,708.2		4,663.7	11,525.3	1,191.1	101.5	895.1

ug/l Micrograms per liter.
ft bls Feet below land surface.
na Not available.

DRAFT

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ENVIRONMENTAL

MEMO

To:
Bill Buller, U.S. EPA
Ed Schuessler, Tetra Tech

Copies:
John Ridd, GMC

From:
J. Reid/Nancy Gillotti

Date:
11 September 1998

Subject:
Additional Investigation at AOI 7 - Former Oil House Area, Supplemental RFI, General Motors Corporation, Moraine, Ohio

ARCADIS Geraghty & Miller Project No.:
OH000294.0001.00002

The following is a summary of the discussions held during the August 20, 1998 conference call between the U.S. EPA, Tetra Tech, General Motors Corporation, and ARCADIS Geraghty & Miller.

1. The GM-27 well screen location and GM-27 groundwater samples collected using a hydropunch were discussed. It was agreed that, based on the hydropunch results, VOC concentration patterns, and the fact that the portion of the upper aquifer below the upper clay till is only 15 feet thick, the well screen would be set at 40 to 50 feet below land surface (immediately below the upper clay till where the highest total VOC concentration was detected using hydropunch sampling). In addition, to ensure an adequate seal of the well penetrating through the upper clay till, a 2 foot sand pack would be installed at the 38 to 40 foot interval and bentonite would be used through the remaining thickness of the upper clay till (34 to 38 foot interval), with bentonite also installed to grade per the monitor well construction details in the approved RFI Work Plan.

2. The next discussion focused on the OH-BH7 hydropunch sample result collected at 30 feet below land surface (immediately above the upper clay till). Due to the difficulty with collecting this groundwater sample using the hydropunch technique, the sample was collected using a bailer. Therefore, the sample results may be lower than if the sample was collected using the hydropunch technique. It was agreed that sufficient data had already been collected to support the baseline risk assessment and the evaluation of remedial technologies and it was not necessary to collect additional data at OH-BH7.

3. A comparison of groundwater quality data from the GM-28 hydropunch result to the ME-6 data collected in March 1998 showed that these wells have similar groundwater quality. Based on this

similarity, the U.S. EPA concurred with GMC that an additional well would not be required between GM-28 and ME-6. GMC will, however, collect a groundwater sample from ME-6 during this additional investigation coincident with GM-28 sampling.

4. U.S. EPA initiated a discussion regarding the lower portion of the upper aquifer and the possibility of a data gap if only one well (GM-27) was installed in this zone. Based on the fact that the VOCs present at GM-27 are at concentrations significantly below the VOC concentrations detected above the upper clay till (GM-23 and GM-27 hydropunch result), and the VOCs present at GM-27 are primarily daughter products of PCE degradation, it was noted this likely represented conditions beyond the primary source area (suspected to be the groundwater zone within AOI 7 above the upper clay till). Since this portion of the upper aquifer below the upper clay till does not represent the primary source area, VOC data collected from this zone of the upper aquifer would not be used to support the baseline risk assessment. Further, remediation at AOI 7 would likely be focused on source area remediation and control, and additional data beneath the upper clay till is not necessary to support an evaluation of potential remedial strategies. To provide additional data in the lower portion of the upper aquifer, monitor wells HR-1 and HR-3, screened at the regional confining unit, would be resampled for analysis of the AOI-specific list of VOCs. Bill Buller and Ed Schuessler indicated they would discuss this topic further outside of the conference call and contact John Ridd if they had any changes to the AOI 7 field program to address this issue.

5. U.S. EPA initiated a discussion regarding the downgradient, off-site wells MT69 and GM-26. The well construction details for MT69 presented in the GMC RFI comment response letter submitted to the U.S. EPA on September 11, 1996 were discussed. Additionally, U.S. EPA's request in their June 11, 1996 comment letter on the Draft RFI Report (February 1996) for adding monitoring wells to assess downgradient, off-site groundwater quality was discussed. To address the U.S. EPA's concern of monitoring downgradient, off-site groundwater conditions, the Supplemental RFI Work Plan covered installation of GM-26, a shallow monitor well paired with MT69. VOCs were not detected in GM-26 during the March 1998 sampling event. It was agreed that GM-26 would be resampled for analysis of the AOI-specific list of VOCs during the AOI 7 field program.

6. The Supplemental RFI project schedule was discussed and it was agreed that the revised schedule, presented as Figure 4 in the Preliminary AOI Evaluation and Recommendations Report, is approved. Concurrent with completion of the Supplemental RFI project schedule, GMC will continue to evaluate the potential effectiveness of implementing remediation to achieve stabilization of the primary source area at AOI 7.

Because no further discussion was initiated by the U.S. EPA or Tetra Tech regarding item 4 in this memo, the AOI 7 field program presented in the Preliminary AOI Evaluation and Recommendations Report and as modified per the July 30, 1998 conference call, has been completed. The attached revised Table 1 provides a summary of preliminary data from the field program at AOI 7, specifically, soil descriptions, hydropunch analytical results, and dye shake test results. This table now includes OH-BH8, OH-BH9, and OH-BH10, which were not available at the time of the conference call.

Table 1. Summary of Additional Investigation at AOI 7 - Former Oil House Area, Supplemental RFI, General Motors Corporation, Moraine, Ohio

	Boring/Monitor Well Identification					
Interval Feet (bls)	OH-BH5 14-Aug-98	HNu (ppm)	OH-BH6 12-Aug-98	HNu (ppm)	OH-BH7 10-Aug-98	HNu (ppm)
0-2	y-brn, S 50% f-m, G 40%, St/C 10%, mst	0.0**	blk, S 70% f-c, G 20%, St/C 10%, mst	4.5**	y-brn gry, S 50% f-c, G 40%, St/C 10%, mst	0.5**
2-4	y-brn, S 50% f-m, G 40%, St/C 10%, mst	0.0	y-brn, S 70% f-m, G 20%, St/C 10%, mst	1.5	gry y-brn w/ sl orng stng, S 70% f-m, G 20%, St/C 10%, mst	0.0
4-6	y-brn, S 60% f-m, G 30%, St/C 10%, mst	0.5	y-brn, S 60% f-m, G 30%, St/C 10%, mst	1.5	gry y-brn, S 70% f-m, G 20%, St/C 10%, mst	0.5
6-8	y-brn, S 70% f-c, G 20%, St/C 10%, mst	1.0	y-brn, S 70% f-c, G 20%, St/C 10%, mst	4.5**	y-brn, S 60% f-m, G 30%, St/C 10%, mst	1.0
8-10	y-brn, S 70% f-c, G 20%, St/C 10%, mst	1.5	y-brn gry, S 60% f-m, G 30%, St/C 10%, mst	4.5	y-brn w/gry, S 60% f-m, G 30%, St/C 10%, mst	2.0
10-12	y-brn, S 70% f-m, G 20%, St/C 10%, v-mst	2.0	y-brn, S 70% f-c, G 20%, St/C 10%, v-mst	2.0	y-brn, S 40% f-m, G 50%, St/C 10%, mst	7.0
12-14	y-brn, S 60% f-m, G 30%, St/C 10%, mst	2.0	y-brn, S 70% f-m, G 20%, St/C 10%, mst	4.0	y-brn, S 70% f-c, G 20%, St/C 10%, mst	3.0
14-16	y-brn, S 60% f-c, G 30%, St/C 10%, mst	1.0	y-brn, S 75% f-c, G 15%, St/C 10%, mst	2.5	y-brn w/gry, S 60% f-m, G 30%, St/C 10%, mst	8.0
16-18	y-brn, S 60% f-c, G 30%, St/C 10%, mst	1.0	y-brn gry, S 70% f-c, G 20%, St/C 10%, mst	3.0	y-brn w/gry, S 60% f-c, G 30%, St/C 10%, mst	8.0
18-20	y-brn, S 60% f-c, G 30%, St/C 10%, mst	3.0**	y-brn gry, S 75% f-c, G 15%, St/C 10%, mst	3.5	y-brn w/gry, S 70% f-c, G 20%, St/C 10%, mst	19.0**
20-22	y-brn, S 60% f-c, G 30%, St/C 10%, mst	3.0	y-brn gry, S 60% f-c, G 30%, St/C 10%, mst	4.5	y-brn, S 70% f-c, G 20%, St/C 10%, v mst	10.0
22-24	y-brn, S 60% f-c, G 30%, St/C 10%, mst	2.0	y-brn, S 75% f-m, G 15%, St/C 10%, mst	7.0**	y-brn, S 75% m-c, G 15%, St/C 10%, v mst-wet	2.0**
24-26	y-brn, S 70% f-c, G 20%, St/C 10%, v mst	3.0**	y-brn, S 80% f-c, G 10%, St/C 10%, wet	1.5	y-brn, S 40% f-c, G 50%, St/C 10%,wet	0.0
26-28	y-brn, S 70% f-c, G 20%, St/C 10%, wet	0.5	y-brn, S 70% f-c, G 20%, St/C 10%, wet	0.5	y-brn, S 75% f-m, G 10%, St/C 15%, wet	8.0
28-30	y-brn, S 60% f-c, G 30%, St/C 10%, wet	0.5	y-brn, S 85% f-m, G 5%, St/C 10%, wet	22.0	y-brn, S 70% f-m, G 10%, St/C 20%, wet	1.0
30-32	y-brn, S 25% m-c, S 50%, G 15%, St/C 10%, wet	0.5	**30-31.5'** dk gry-blk, S 85% f-m, G 5%, St/C 10%, wet	NM	**30-30.5'** y-brn, S 80% f-m, St/C 20%, wet	4.0
	Bottom 4" - gry-blk, fine S	7.5	**31.5-32'** dk gry w/ blk-orng stng, TILL, St/C 90%, S f 5%, G 5%, v mst EOB		**30.5-31.5'** dk gry, TILL, St/C 80%, G 20%, mst EOB	0.0
32-34	y-brn, S 80% f-m, G 10%, St/C 10%, wet	8.0				
34-36	y-brn gry, S 75% f-c, G 10%, St/C 15%, wet	4.5				
36-38	**36-37.5'** gry, S 80% f-c, G 5%, St/C 15%, wet	13.0				
	37.5-38' gry, TILL St/C 80%, G 10%, S 10%, mst EOB	4.0				
Hydropunch Sample Result (Total VOCs)	**37'** 4,708.2 ug/L		**31.5'** 2,514.4 ug/L		**30'** 4,663.7 ug/L	
Dye Test Results	**36.5-37.5'** Negative		**30.5-31.5'** Possible		**30-30.5'** Negative	

Soil Description : G - gravel, S - sand, St - silt, C - clay; c - coarse, m - medium, f - fine
Color: blk - black, brn - brown, y - yellow, gry - gray, orng - orange
Moisture: mst - moist, v - very, sl - slightly, dk - dark
Other: stng - staining, w/ - with, EOB - end of boring

** Soil sample submitted for laboratory analysis of select volatile organic compounds
NM - Not measured
bls - Below land surface
ug/L - Micrograms per liter
ppm - Parts per million

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Table 1. Summary of Additional Investigation at AOI 7 - Former Oil House Area, Supplemental RFI, General Motors Corporation, Moraine, Ohio

Interval Feet (bls)	Boring/Monitor Well Identification GM-27 04-Aug-98	HNu (ppm)	GM-28 05-Aug-98	HNu (ppm)
0-2	dk y-brn, S 60% f-c, G 30%, St/C 10%, sl mst	1.0**	blk gry brn, S 60% f-c, G 30%, St/C 10%, sl mst	0.0
2-4	dk y-brn gry,S 70% f-c, G 20%, St/C 10%, sl mst	3.0	dk y-brn, S 50% f-m, G 40%, St/C 10%, mst	0.0
4-6	dk brn, S 40% f-m, G 30%, St/C 30%, mst	2.0	y-brn, S 60% f-m, G 30%, St/C 10%, sl mst	0.0
6-8	y-brn, S 50% f-m, G 25%, St/C 25%, mst	2.0	y-brn gry, S 40% f-m, G 50%, St/C 10%, mst	0.0
8-10	y-brn, S 60% f-m, G 20%, St/C 20%, mst	2.0	y-brn, S 60% f-m, G 30%, St/C 10%, sl mst	0.0
10-12	y-brn, S 60% f-m, G 20%, St/C 20%, mst	17.0	y-brn, S 60% f-m, G 30%, St/C 10%, sl mst	0.0
12-14	No Recovery	NM	y-brn, S 60% f-m, G 30%, St/C 10%, sl mst	0.0
14-16	y-brn, S 60% f-m, G 20%, St/C 20%, mst	3.5	y-brn, S 60% f-m, G 30%, St/C 10%, sl mst	0.0
16-18	y-brn gry, S 50% f-m, G 40%, St/C 10%, sl mst	9.0	y-brn, S 70% f-c, G 20%, St/C 10%,mst	0.0
18-20	y-brn, S 60% f-m, G 30%, St/C 10%, mst	19.0**	y-brn, S 70% f-c, G 20%, St/C 10%, mst	0.0
20-22	y-brn, S 70% f-m, G 15%, St/C 15%, mst	15.5	y-brn, S 70% f-m, G 20%, St/C 10%, mst	0.5**
22-24	y-brn, S 70% f-m, G 10%, St/C 20%, v mst	6.5**	y-brn, S 70% f-c, G 20%, St/C 10%, v mst-wet	<0.5
24-26	y-brn, S 90% f, trace G and St/C, v mst-wet	12.0	y-brn, S 60% f-c, G 30%, St/C 10%, wet	0.0
26-28	y-brn, S 60% f-m, G 15%, St/C 25%, wet	9.0	y-brn, S 70% f-c, G 20%, St/C 10%, wet	0.0
28-30	dk y-brn, S 50% f-m, G 30%, St/C 20%, wet	12.5	y-brn, S 80% f-c, G 10%, St/C 10%, wet	0.5
30-32	**30-31.5'** dk y-brn, S 70% f-m, G 20%, St/C 10%, wet **31.5-32'** dk gry, TILL, St/C 80%, S 10%, G 10%, mst EOB	9.0	**30-31.5'** y-brn, S 80% f-c, G 10%, St/C 10%, wet **31.5-32'** dk gry, TILL, St/C 90%, G 5%, S 5%, mst EOB	1.0
32-34	(See page 3 of 4 for continuation of GM-27)			
34-36				
36-38				
Hydropunch Sample Result (Total VOCs)	**32'** 11,525.3 ug/L		**32'** 895.1 ug/L	
Dye Test Results	**31.5-33.5'** Possible		**30-32'** Negative	

Soil Description : G - gravel, S - sand, St - silt, C - clay; c - coarse, m - medium, f - fine
Color: blk - black, brn - brown, y - yellow, gry - gray, orng - orange
Moisture: mst - moist, v - very, sl - slightly, dk - dark
Other: stng - staining, w/ - with, EOB - end of boring

** Soil sample submitted for laboratory analysis of select volatile organic compounds

NM - Not measured

bls - Below land surface

ug/L - Micrograms per liter

ppm - parts per million

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Table 1. Summary of Additional Investigation at AOI 7 - Former Oil House Area, Supplemental RFI, General Motors Corporation, Moraine, Ohio

Boring/Monitor Well Identification		
Interval Feet (bls)	* GM-27 13-Aug-98	HNu (ppm)
34-36	gry, TILL St/C 85%, G 10%, S 5%, dry	0.0
36-38	gry, TILL St/C 80%, G 15%, S 5%, wet	0.0
38-40	y-brn, S 80% f-c, G 10%, St/C 10%, wet	<0.5
40-42	y-brn, S 75% f-c, G 15%, St/C 10%, wet	0.0
42-44	y-brn, S 70% f-c, G 20%, St/C 10%, wet	0.0
44-46	y-brn, S 70% f-c, G 20%, St/C 10%, wet	0.0
46-48	y-brn, S 70% f-c, G 20%, St/C 10%, wet	0.0
48-50	y-brn, S 75% f-c, G 15%, St/C 10%, wet	<0.5
50-52	y-brn, S 90% f-c, St/C 10%, wet	0.0
52-54	y-brn, S 90% f-c, St/C 10%, wet	0.0
54-56	y-brn, S 80% f-c, G 10%, St/C 10%, wet	0.0
56-58	gry, TILL St/C 80%, G 15%, S 5%, mst EOB	0.0
Hydropunch Sample Result (Total VOCs)	39' 1,191.1ug/L 50' 101.5 ug/L 55' 588.5 ug/L	
Dye Test Results	33.5-34.5' Possible 38-39' Possible 54-55' Possible	

* GM-27 was drilled from the upper clay till to the regional clay till at an adjacent location. The till was identified at the 34-36 foot interval.

Soil Description : G - gravel, S - sand, St - silt, C - clay; c - coarse, m - medium, f - fine
Color: blk - black, brn - brown, y - yellow, gry - gray, orng - orange
Moisture: mst - moist, v - very, sl - slightly, dk - dark
Other: stng - staining, w/ - with, EOB - end of boring

** Soil sample submitted for laboratory analysis of select volatile organic compounds

NM - Not measured
bls - Below land surface

ug/L - Micrograms per liter
ppm - parts per million

DRAFT

Table 1. Summary of Additional Investigation at AOI 7 - Former Oil House Area, Supplemental RFI, General Motors Corporation, Moraine, Ohio

	Boring/Monitor Well Identification					
Interval Feet (bls)	OH-BH8 18-Aug-98	HNu (ppm)	OH-BH9 19-Aug-98	HNu (ppm)	OH-BH10 18-Aug-98	HNu (ppm)
0-2	y-brn, S 70% f-m, G 20%, St/C 10%, mst	0.5**	y-brn, S 60% f-m, G 30%, St/C 10%, sl mst	0.0**	lt brn-lt gry, S 40% f-m, G 50%, St/C 10%, sl mst	2.0**
2-4	y-brn w/blk stng, S 70% f-m, G 15%, St/C 15%, mst	4.5	y-brn, S 70% f-c, G 20%, St/C 10%, sl mst	0.0	y-brn, S 60% f-m, G 30%, St/C 10%, sl mst	4.0
4-6	y-brn-lt gry, S 60% f-m, G 30%, St/C 10%, mst	6.0	y-brn, S 70% f-m, G 20%, St/C 10%, sl mst	0.0	y-brn & lt gry, S 50% f-m, G 40%, St/C 10%, sl mst	2.5
6-8	y-brn, S 60% f-m, G 25%, St/C 15%, mst	1.0	y-brn & lt gry, S 70% f-c, G 20%, St/C 10%, sl mst	0.0	y-brn, S 50% f-m, G 40%, St/C 10%, sl mst	10.0
8-10	y-brn, S 60% f-m, G 30%, St/C 10%, mst	11.0	y-brn & lt gry, S 70% f-m, G 20%, St/C 10%, sl mst	0.0	y-brn-lt gry, S 50% f-m, G 40%, St/C 10%, sl mst	5.0
10-12	y-brn, S 65% f-m, G 20%, St/C 15%, mst	2.0	y-brn & lt gry, S 50% f-m, G 40%, St/C 10%, sl mst	0.0	y-brn- lt gry, S 60% f-m, G 30%, St/C 10%, sl mst	9.5
12-14	y-brn w/ blk stng, S 50% f-m, G 40%, St/C 10%, mst	12.0	y-brn, S 60% f-m, G 30%, St/C 10%, sl mst	0.0	y-brn, S 60% f-m, G 30%, St/C 10%, sl mst	3.0
14-16	y-brn, S 70% f-m, G 20%, St/C 10%, mst	11.0	y-brn, S 60% f-c, G 30%, St/C 10%, sl mst	0.0	y-brn, S 70% f-m, G 20%, St/C 10%, sl mst	14.0**
16-18	y-brn, S 70% f-m, G 20%, St/C 10%, mst	13.0**	y-brn, S 80% f-m, G 10%, St/C 10%, mst	0.0	y-brn, S 60% f-m, G 30%, St/C 10%, mst	3.5
18-20	y-brn, S 75% f-m, G 15%, St/C 10%, mst	10.0	y-brn & lt gry, S 60% f-m, G 30%, St/C 10%, sl mst	0.0	y-brn w/blk stng, S 70% f-m, G 20%, St/C 10%, sl mst	12.5
20-22	y-brn-lt gry, S 60% f-m, G 30%, St/C 10%, mst	9.5	y-brn, S 60% f-c, G 30%, St/C 10%, mst	0.0	y-brn-lt gry, S 50% f-c, G 40%, St/C 10%, mst	3.0
22-24	y-brn w/orng stng, S 40% f-m, G 50%, St/C 10%, mst	11.5	y-brn & lt gry, S 60% f-c, G 30%, St/C 10%, sl mst	0.0	y-brn, S 60% f-c, G 30%, St/C 10%, mst-v mst	2.5
24-26	**24-25'**: y-brn, TILL, St/C 80%, G 15%, S 5% f, mst **25-26'**: dk gray, TILL, St/C 80%, G 15%, S 5% f, mst	1.0 0.0	y-brn & lt gry, S 70% f-m, G 20%, St/C 10%, mst	0.0	y-brn, S 60% f-m, G 30%, St/C 10%, mst-v mst	4.5
26-28	**26-26.5'**: y-brn, St/C 75%, S 15% f-m, G 10%, sl mst **26.5-27.8'**: y-brn-gray, TILL, St/C 80%, G 15%, S 5% f, sl mst **27.8-28'**: y-brn, S 30% f-m, G 40%, St/C 30%, mst	0.5** 1.0 0.5	y-brn w/ orng stng, S 70% f-c, G 20%, St/C 10%, mst	0.0	y-brn, S 60% f-m, G 30%, St/C 10%, mst	17.0**
28-30	y-brn, S 70% f-c, G 20%, St/C 10%, wet	2.0	y-brn, S 70% f-c, G 20%, St/C 10%, v mst	0.0**	y-brn, S 70% f-c, G 20%, St/C 10%, wet	3.5
30-32	y-brn, S 80% f-c, G 10%, St/C 10%, wet	9.5	y-brn, S 70% f-c, G 20%, St/C 10%, wet	0.0	y-brn, S 70% f-c, G 20%, St/C 10%, wet	2.5
32-34	y-brn, S 70% f-m, G 20%, St/C 10%, wet	5.0	y-brn, S 75% f-c, G 15%, St/C 10%, wet	0.0	y-brn, S 85% f-m, G 5%, St/C 10%, wet	3.5
34-36	y-brn w/ blk stng, S 60% f-c, G 30%, St/C 10%, wet	4.0	y-brn, S 80% f-m, G 10%, St/C 10%, wet	0.0	**34-35'** y-brn, TILL, St/C 80%, G 15%, S 5% f, sl mst EOB	0.0
36-38	**36-37.8'** gry w/ blk stng, S 60% f-c, G 30%, St/C 10%, wet **37.8-38'** y-brn, TILL St/C 80%, G 15%, S 5% f, sl mst EOB	1.0 3.0	**36-37.7'** y-brn, S 80% f-m, G 10%, St/C 10%, wet **37.7-38'** y-brn, TILL, St/C 80%, S 5% f, G 15%, sl mst EOB	0.0 0.0		
Hydropunch Sample Result (Total VOCs)	**38'** 3,260.8 ug/L		**38'** 532.0 ug/L		**34'** 1,948.7 ug/L	
Dye Test Results	**36-38'** Negative		**36-38'** Negative		**32-34'** Negative	

Soil Description : G - gravel, S - sand, St - silt, C - clay; c - coarse, m - medium, f - fine
Color: blk - black, brn - brown, y - yellow, gry - gray, orng - orange
Moisture: mst - moist, v - very, sl - slightly, dk - dark
Other: stng - staining, w/ - with, EOB - end of boring

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bls - Below land surface
ug/L - Micrograms per liter
ppm - Parts per million

** Soil sample submitted for laboratory analysis of select volatile organic compounds

DRAFT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

REPLY TO THE ATTENTION OF:

DE-9J

Mr. John Ridd
Senior Environmental Project Engineer
General Motors Corporation (GMC)
Delphi/Harrison Thermal Systems
3600 Dryden Road
Moraine, Ohio 45439-1410

Re: Supplemental RCRA Facility Investigation
GMC Delphi/Harrsion OHD 000 817 577
GMC Moraine Engine Plant OHD 980 569 388
GMC Moraine Assembly Plant OHD 041 063 074
RCRA Administrative Order
Docket No. V-W-R-002-91

Dear Mr. Ridd:

The Supplemental RCRA Facility Investigation (RFI) for the two facilities adjacent to Harrison GMC plant, the GMC Moraine Engine Plant and the GMC Assembly Plant, is nearing completion. Several investigative focal points in the Supplemental RFI, designated as Areas of Interest (AOI), were investigated. GM has shared the data developed in the Supplemental RFI with the United States Environmental Protection Agency (U.S. EPA) and the State of Ohio as the data has been obtained. This data indicates that AOI 7 has relatively high contaminant concentrations in comparison to the other AOIs at the facilities.

In our August 20, 1998 conference call, General Motors informally proposed to perform Interim Measures (IM) to address the contamination at AOI 7. U.S. EPA concludes that an IM for AOI 7 would not conflict with the Administrative Order and would expedite the remediation of the Moraine manufacturing complex. U.S. EPA concurs with the IM proposal for AOI 7. U.S. EPA notes however, that this concurrence does not in any way waive any requirements of the above referenced RCRA Administrative Order. Although we have had several telephone conversations subsequent to the August telephone conference, the purpose of this letter is to provide further clarification and direction on this matter.

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A description and basic design of the proposed AOI 7 IM should be included in the Supplemental RFI report, or concurrently presented as a separate document. Comparison of the proposed remedial technology for AOI 7 to a few optional technologies is suggested. U.S. EPA recommends that the Supplemental RFI report provide a general overview of the contaminant occurrence at the entire manufacturing complex including illustrations depicting the contaminants distribution. A discussion on how the IMs currently in operation and the proposed IM for AOI 7 mitigates the contamination is also recommended.

U.S. EPA requests that General Motors state its intent to proceed with an IM for AOI 7 in writing, within 15 days of receipt of this letter. In accordance with your July 16, 1998, Preliminary AOI Evaluation report, the Supplemental RFI report and the basic design for the proposed IM shall be submitted by February 26, 1999.

To provide further clarification, the following discussion of the U.S. EPA's basic corrective action process is provided. Upon approval of a RFI report and subsequent approval of a Corrective Measures Study (CMS) report, U.S. EPA develops a Statement of Basis (SOB) document for the Facility which is presented to the public for comment. Following closure of the public comment period for the SOB, U.S. EPA issues a Final Decision document for the Facility which specifies the remedial activities that constitute the final remedy. The Final Decision, in consideration of the public comments, may incorporate additional or different remedial actions than those proposed in the Statement of Basis. The general information for the RFI report as outlined above corresponds to information generally presented in a CMS report, and if adequately addressing the subject matter may ultimately serve as a CMS report.

U.S. EPA, will extend the due date for submittal of documents if General Motors demonstrates the need for additional time. If you wish to discuss this matter further, please call me at (312) 886-4568.

Sincerely,

William Buller, Project Coordinator
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
MI/WI Section

cc: Chris Cotton, OEPA
Ed Schuessler, TTIEMC

DELPHI
Harrison Thermal Systems

October 16, 1998

FACSIMILE AND FEDERAL EXPRESS

Mr. William Buller
U.S. EPA Region 5
Enforcement and Compliance Assurance Branch, HRE-8J
77 West Jackson Boulevard
Chicago, IL 60604-3590

RE: Additional Investigation at AOI 7, Supplemental RFI, General Motors Corporation, Moraine, Ohio

Dear Mr. Buller:

Enclosed is a set of the preliminary Hydropunch, groundwater, and soil analytical results (Tables 1, 2, and 3, respectively) from the August 1998 sampling of AOI 7 - Former Oil House Area at the northern end of the General Motors Powertrain Group Moraine Engine Plant (Engine Plant). Table 4 contains the soil analytical results for borings OH-BH1 through OH-BH4 from the initial phase of sampling conducted in February 1998 (data previously provided to U.S. EPA). After review of these data, and additional facility information relating to this AOI, General Motors Corporation (GMC) concludes that the objectives presented in the Preliminary AOI Evaluation and Recommendations Report, dated July 16, 1998 (page 4) have not been completely addressed.

During evaluation of this Oil House investigation data, additional information regarding historic site activities was uncovered. Specifically, an aerial photograph dated May 1979 was found in historic files at Delphi Harrison Thermal Systems. The photograph shows the Oil House Building 7 in the foreground and the tank farm in the middle. After review of this photograph, GMC concludes that the area north of the Oil House was used for temporary storage of equipment, boxes, and drums during the conversion of Frigidaire Plant 2. As stated in the Supplemental Description of Current Conditions (DOCC), GMC announced the shut down of all Frigidaire operations in January 1979. During 1980 and 1981, the majority of the former Frigidaire Plant 2 was converted to the Moraine Engine facility. During the aerial photograph survey conducted to prepare the Supplemental DOCC, a November 1979 aerial photograph was reviewed but was not included in the report due to poor quality. This showed that Building 7 had been demolished, but did not show evidence of the equipment, boxes, and drums seen in the May 1979 aerial photograph. Copies of both of the photographs are included as Attachment 1.

To meet the four objectives in the Preliminary AOI Evaluation and Recommendation Report (July 1998), 13 additional soil borings are proposed at AOI 7, as discussed below. The 13 proposed boring locations are shown on Figure 1 and have been located based on the review of current data as well as

the May 1979 photograph. Table 5 presents a summary of the scope of work and how data collected from each boring will be used to meet these four project objectives.

1. *Determine whether a significant source of tetrachloroethene (PCE), and its potential degradation products, exists in the vadose zone soil at AOI 7.*
   Based on the very low volatile organic compound (VOC) soil concentrations from GM-27, which was intended to verify conditions at GM-23, additional soil data is needed to determine if a significant source of PCE exists in the vadose zone west of GM-23 in order to meet Objective 1. Further, additional soil data is needed immediately adjacent to GM-23 to verify the high VOC concentrations reported for a soil sample collected at GM-23 prior to the Supplemental RFI.

2. *Determine whether PCE exists in the saturated zone, possibly as a dense nonaqueous phase liquid (DNAPL) at AOI 7 and characterize its presence.*
   It is GMC's intent to continue conducting the hydrophobic dye soil-water shake tests and visual inspection of saturated soil samples from the proposed boring locations.

3. *Determine the potential for the lithology in the vicinity of AOI 7 to affect migration of PCE, if PCE is present as a DNAPL.*
   Additional data is needed in order to further define the presence of the upper clay till in the vicinity of AOI 7 to meet Objective 3. As a result, additional borings are proposed to the west, north, and east of AOI 7.

4. *Determine if a vadose zone source of PCE or DNAPL in the saturated zone exists upgradient (or north) beyond OH-BH1.*
   After review of OH-BH9 and OH-BH10 groundwater results and a review of the newly discovered May 1979 aerial photograph, GMC concludes that additional borings to the north of OH-BH9 and northwest of OH-BH10 would be necessary to meet Objective 4.

The proposed soil borings will be installed following the same methodology used for Borings OH-BH5 through OH-BH10, as described on pages 7 and 8 of the Preliminary AOI Evaluation and Recommendations Report, dated July 16, 1998. The AOI-specific parameter list will be followed; therefore, samples will be analyzed for 1,1-dichloroethane, 1,1-dichloroethene, trans- and cis-1,2-dichloroethene, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene, and vinyl chloride. In order to expedite this additional investigation, National Environmental Testing, Inc. has requested that the AOI-specific parameter list be analyzed using Method 8260 rather than Method 8240. Switching methods will allow the laboratory to complete these analyses in a timely manner. GMC requests that all future RFI analysis (including the groundwater recovery and treatment system interim measures at TW-2 and monthly sampling at DN-13) follow Method 8260 for VOCs and will provide all necessary changed pages to the RFI Quality Assurance Project Plan under separate cover before initiating this work.

In addition to the soil boring installation, slug tests are also proposed for monitor wells GM-23, GM-27, and GM-28. Slug testing is a useful technique for obtaining order-of-magnitude approximations of hydraulic conductivity in the immediate vicinity of the monitor well. The data will be used to evaluate the potential migration of VOCs detected at AOI 7. The method will consist of instantaneously displacing a known equivalent volume of water in a well with a solid object (a "slug") and recording the change in water level with time as the water level recovers to static conditions. Slug tests have not been performed during the RFI program, therefore, a new Standard Operating Procedure (SOP) has been prepared. Please insert the attached SOP #27 (Attachment 2) into Appendix C RFI Sampling and Analysis Plan after SOP #26, page 43n.

GMC appreciates your prompt attention to review this proposed scope of work so that field work may begin in early November 1998. This further investigation will require a modification to the final schedule which can be discussed after finalization of the proposed field program.

Sincerely,

W. John Ridd
Senior Environmental Project Engineer

Attachments
cc: E. Schuessler, Tetra Tech
C. Cotton, Ohio EPA

Table 1. Preliminary Analytical Results for Groundwater Samples Collected Using a Hydropunch in August 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Compounds	Units	OH-BH5/HP 37 ft bls 8/14/98	OH-BH6/HP 31.5 ft bls 8/12/98	OH-BH7/HP 30 ft bls 8/10/98	OH-BH8/HP 38 ft bls 8/18/98	OH-BH9/HP 38 ft bls 8/19/98	OH-BH10/HP 34 ft bls 8/18/98
Volatile Organic Compounds							
1,1-Dichloroethane	ug/L	18.5	8.5	2.1	20.6	<1.0	2.5
1,1-Dichloroethene	ug/L	84.1	8.8	<2.0	3.6	<1.0	1.3
trans-1,2-Dichloroethene	ug/L	7.6	13.2	11.1	7.0	<1.0	1.4
cis-1,2-Dichloroethene	ug/L	1,280	1,900	962	226	<1.0	57.0
Tetrachloroethene	ug/L	1,550	28.5	2,950	77.6	520	1,810
1,1,1-Trichloroethane	ug/L	2.0	<1.0	3.2	<2.0	5.4	6.2
Trichloroethene	ug/L	1,330	52.4	728	246	6.6	66.6
Vinyl Chloride	ug/L	436	503	7.3	2,680	<2.0	3.7
Total VOCs	ug/L	4,708.2	2,514.4	4,663.7	3,260.8	532.0	1,948.7

ug/L - Micrograms per liter.
ft bls - Feet below land surface.
HP - Hydropunch.

Table 1. Preliminary Analytical Results for Groundwater Samples Collected Using a Hydropunch in August 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Compounds	Units	GM-27/HP 32 ft bls 8/4/98	GM-27/HP 39 ft bls 8/13/98	GM-27/HP 50 ft bls 8/13/98	GM-27/HP 55 ft bls 8/19/98	GM-28/HP 32 ft bls 8/5/98
Volatile Organic Compounds						
1,1-Dichloroethane	ug/L	54.6	3.0	<2.0	<5.0	2.4
1,1-Dichloroethene	ug/L	6.8	2.0	<2.0	<5.0	<2
trans-1,2-Dichloroethene	ug/L	42.8	6.8	<2.0	<5.0	6.2
cis-1,2-Dichloroethene	ug/L	3,540	821	17.4	395	187
Tetrachloroethene	ug/L	484	14.3	3.2	14	242
1,1,1-Trichloroethane	ug/L	1.5	<2.0	<2.0	<5.0	10.5
Trichloroethene	ug/L	75.6	113	80.9	69.5	444
Vinyl Chloride	ug/L	7,320	231	<4.0	110	3.0
Total VOCs	ug/L	11,525.3	1,191.1	101.5	588.5	895.1

ug/L - Micrograms per liter.
ft bls - Feet below land surface.
HP - Hydropunch.

Table 2. Preliminary Analytical Results for Groundwater Samples Collected in August 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Compounds	Units	GM-27/GW 8/24/98	GM-28/GM 8/17/98	GM-23/GW 8/26/98	ME-6/GW 8/24/98	HR-1/GW 8/24/98	HR-3/GW 8/24/98	GM-26/GW 8/24/98
Volatile Organic Compounds								
1,1-Dichloroethane	ug/L	1.7	<1.0	10.9	3.4	1.5	4.1	<1.0
1,1-Dichloroethene	ug/L	<1.0	<1.0	7.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	ug/L	<1.0	1.3	19.4	<1.0	1.6	<1.0	<1.0
cis-1,2-Dichloroethene	ug/L	48.5	38.2	3,710	17.2	9.4	4.6	<1.0
Tetrachloroethene	ug/L	6.0	693	8,800	114	47.1	<1.0	1.2
1,1,1-Trichloroethane	ug/L	<1.0	1.8	4.2	26.1	<1.0	<1.0	<1.0
Trichloroethene	ug/L	89.5	98.1	1,190	312	46.0	<1.0	<1.0
Vinyl Chloride	ug/L	6.9	<2.0	914	<2.0	<2.0	<2.0	<2.0
Total VOCs	ug/L	152.6	832.4	14,655.5	472.7	105.6	8.7	1.2

ug/L - Micrograms per liter.
GW - Groundwater.

Table 3. Preliminary Analytical Results for Soil Samples Collected in August 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Compounds	Units	OH-BH5/SL 8/14/98			OH-BH6/SL 8/12/98			OH-BH7/SL 8/10/98		
		2 ft	20 ft	26 ft	2 ft	8 ft	24 ft	2 ft	20 ft	24 ft
Volatile Organic Compounds										
1,1-Dichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<25	<25
1,1-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<25	<25
trans-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<25	<25
cis-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<25	<25
Tetrachloroethene	ug/kg	<5.0	135	762	494	38.9	119	31.4	482	325
1,1,1-Trichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<25	<25
Trichloroethene	ug/kg	<5.0	6.1	22.5	12.7	<5.0	5.8	<5.0	<25	<25
Vinyl Chloride	ug/kg	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<50	<50
Total VOCs	ug/kg	0.0	141.1	784.5	506.7	38.9	124.8	31.4	482	325

ug/kg - Micrograms per kilogram.
SL - Soil.

Table 3. Preliminary Analytical Results for Soil Samples Collected in August 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Compounds	Units	OH-BH8/SL 8/18/98			OH-BH9/SL 8/19/98		OH-BH10/SL 8/18/98		
		2 ft	18 ft	28 ft	2 ft	30 ft	2 ft	16 ft	28 ft
Volatile Organic Compounds									
1,1-Dichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
cis-1,2-Dichloroethene	ug/kg	<5.0	<5.0	36.3	<5.0	<5.0	<5.0	<5.0	<5.0
Tetrachloroethene	ug/kg	16.0	70.0	6,010	280	462	548	235	995
1,1,1-Trichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Trichloroethene	ug/kg	<5.0	<5.0	73.5	<5.0	<5.0	24.7	<5.0	20
Vinyl Chloride	ug/kg	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Total VOCs	ug/kg	16.0	70.0	6,119.8	280	462	572.7	235	1,015.0

ug/kg - Micrograms per kilogram.
SL - Soil.

Table 3. Preliminary Analytical Results for Soil Samples Collected in August 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Compounds	Units	GM-27/SL 8/4/98			GM-28/SL 8/5/98
		2 ft	20 ft	24 ft	22 ft
Volatile Organic Compounds					
1,1-Dichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0
cis-1,2-Dichloroethene	ug/kg	<5.0	<5.0	6.0	<5.0
Tetrachloroethene	ug/kg	40.3	743	1,514	27.0
1,1,1-Trichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0
Trichloroethene	ug/kg	<5.0	6.9	16.4	<5.0
Vinyl Chloride	ug/kg	<10.0	<10.0	<10.0	<10.0
Total VOCs	ug/kg	40.3	749.9	1,536.4	27.0

ug/kg - Micrograms per kilogram.
SL - Soil.

Table 4. AOI-7 Former Oil House Area Preliminary Soil Analytical Results Collected in February 1998, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

	Units	OH-BH1			OH-BH2		OH-BH3			OH-BH4		
		2ft	8 ft	30 ft	3 ft	31 ft	2 ft	16 ft	26 ft	2 ft	8 ft	24 ft
Volatile Organic Compounds												
Tetrachloroethene	ug/kg	53.7	125	505	56.4	7,690	41.4	29.3	247	123	113	474
Trichloroethene	ug/kg	ND	ND	ND	ND	ND	ND	ND	521	20.6	ND	ND
Semi-volatile Organic Compounds												
Bis(2-ethylhexyl)phthalate	ug/kg	650	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ug/kg	ND	ND	ND	4,570	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ug/kg	ND	ND	ND	3,770	ND	ND	ND	ND	ND	ND	ND
Metals												
Antimony	mg/kg	<17	<17	<17	<18	<16	<16	<17	<14	<17	<18	<18
Arsenic	mg/kg	2.76	1.93	1.53	2.09	1.49	10.4	3.88	2.51	3.54	3.91	2.59
Barium	mg/kg	11	8.3	8.1	30.2	11	30.2	14	16	13	7.7	24.3
Beryllium	mg/kg	1	<0.8	0.8	1.1	0.9	1	0.9	0.9	0.8	<0.9	<0.9
Cadmium	mg/kg	<5.1	<5.1	<5.0	<5.3	<4.8	<4.9	<5.1	<4.3	<5.0	<5.3	<5.3
Chromium	mg/kg	8.6	<6.9	<6.7	<7.0	<6.4	<6.5	<6.8	<5.7	<6.6	<7.0	<7.0
Cobalt	mg/kg	<3.4	<3.4	<3.4	<3.5	<3.3	3.9	4.1	<2.9	<3.3	<3.5	<3.5
Copper	mg/kg	3.9	7	5.5	6	7.4	12	13	7.5	6.1	6.8	7
Lead	mg/kg	3.67	2.72	3.55	5.47	4.11	9.39	4.36	4.8	6.06	4.36	4.56
Manganese	mg/kg	142	220	161	227	184	302	331	190	159	151	178
Mercury	mg/kg	<0.010	0.012	<0.011	0.029	<0.011	0.052	0.014	0.014	0.013	<0.011	0.014
Nickel	mg/kg	25.2	5.8	4	4.3	5.9	8.5	14	6.6	5.6	5.6	5.4
Selenium	mg/kg	<1.66	<1.62	<0.881	<1.57	<1.67	<0.805	<0.819	<0.860	<0.863	<0.890	<0.786
Silver	mg/kg	<6.7	<6.9	<6.7	<7.0	<6.4	<6.5	<6.8	<5.7	<6.6	<7.0	<7.0
Thallium	mg/kg	<0.52	<0.52	<0.53	<0.53	<0.53	<0.54	<0.52	<0.55	<0.53	<0.55	<0.55
Vanadium	mg/kg	<8.5	<8.5	<8.4	<8.8	<8.0	<8.1	<8.5	<7.1	<8.3	<8.8	<8.7
Zinc	mg/kg	16	17.6	16	26.2	19	42.6	227	22.6	22	26	27.8

This table presents VOC and SVOC data above the method detection limit. PCBs were not detected in these samples.
ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.
ND - Not detected.

I:\gmotors\gmcrfi\aoi7\october\tab4.xls

Table 5. Proposed Additional Scope of Work for AOI 7 - Former Oil House, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Sample Identification	Proposed Scope of Work	Objectives
GM-23A	Install a soil boring immediately adjacent to GM-23, using hollow-stem auger drilling techniques. Advance soil boring 10 feet below land surface and collect a soil sample at the 3 to 5 foot interval and the 8 to 10 foot interval. Continuous headspace readings will be taken. Analyze samples for the AOI-specific list of VOCs.	Verify presence of PCE in shallow and subsurface soil. Compare PCE results to the soil sample collected from the 3 to 5 foot interval at GM-23 (63.5 mg/kg). Data collected to meet Objective 1.
OH-BH2A	Install a soil boring immediately adjacent to OH-BH2, using hollow-stem auger techniques. Continuous headspace readings will be taken and a soil sample collected only if headspace readings are greater than 19 ppm (the highest headspace reading in the unsaturated zone during previous AOI 7 investigations) or if there is visual evidence of contamination. If a soil sample is collected, it will be analyzed for the AOI-specific list of VOCs. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till and analyze sample for the AOI-specific list of VOCs. Collect a saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Verify presence/absence of upper clay till. Assess DNAPL presence. Evaluate groundwater quality above the upper clay till. Data collected to meet Objectives 2 and 3.
OH-BH3A	Install a soil boring immediately adjacent to OH-BH3, using hollow-stem auger techniques. Continuous headspace readings will be taken and a soil sample collected only if headspace readings are greater than 19 ppm (the highest headspace reading in the unsaturated zone during previous AOI 7 investigations) or if there is visual evidence of contamination. If a soil sample is collected, it will be analyzed for the AOI-specific list of VOCs. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till and analyze sample for the	Verify presence/absence of upper clay till. Assess DNAPL presence. Evaluate groundwater quality above the upper clay till. Data collected to meet Objectives 2 and 3.

Table 5. Proposed Additional Scope of Work for AOI 7 - Former Oil House, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

Sample Identification	Proposed Scope of Work	Objectives
OH-BH3A (continued)	AOI-specific list of VOCs. Collect a saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	
OH-BH11	Install a soil boring west of GM-23, using hollow-stem auger drilling techniques. Collect soil samples at 0-2 feet and above the water table for analysis of the AOI-specific list of VOCs. Continuous headspace readings will be taken and a third sample may be collected at the highest headspace reading and visual evidence of contamination and analyzed for the AOI-specific list of VOCs. If all headspace readings are background levels or there is no visual evidence of contamination, then only two samples will be collected. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till and analyze sample for the AOI-specific list of VOCs. Collect a saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Verify presence/absence of upper clay till. Assess DNAPL presence. Evaluate groundwater quality above the upper clay till. Data collected to meet Objectives 1, 2, and 3.
OH-BH12	Install a soil boring west of the Oil House Building 7 and OH-BH6, using hollow-stem auger drilling techniques. Take continuous headspace readings and collect soil samples as described for OH-BH11. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till (if present) and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Verify presence/absence of upper clay till. Assess DNAPL presence. Evaluate groundwater quality above the upper clay till. Data collected to meet Objectives 1, 2, and 3.

Table 5. Proposed Additional Scope of Work for AOI 7 - Former Oil House, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

OH-BH13	Install a soil boring east of the Oil House Building 7 and OH-BH6, using hollow-stem auger drilling techniques. Take continuous headspace readings and collect soil samples as described for OH-BH11. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till (if present) and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Verify presence/absence of upper clay till. Assess DNAPL presence. Evaluate groundwater quality above the upper clay till. Data collected to meet Objectives 1, 2, and 3.
OH-BH14	Install a soil boring east of the Oil House Building 7, OH-BH7, and OH-BH4, using hollow-stem auger drilling techniques. Take continuous headspace readings and collect soil samples as described for OH-BH11. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till (if present) and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Verify presence/absence of upper clay till. Assess DNAPL presence. Evaluate groundwater quality above the upper clay till. Data collected to meet Objectives 1, 2, and 3.
OH-BH15	Install a soil boring west of the Oil House Building 7, OH-BH7, and OH-BH4, using hollow-stem auger drilling techniques. Take continuous headspace readings and collect soil samples as described for OH-BH11. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till (if present) and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Verify presence/absence of upper clay till. Assess DNAPL presence. Evaluate groundwater quality above the upper clay till. Data collected to meet Objectives 1, 2, and 3.

Table 5. Proposed Additional Scope of Work for AOI 7 - Former Oil House, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

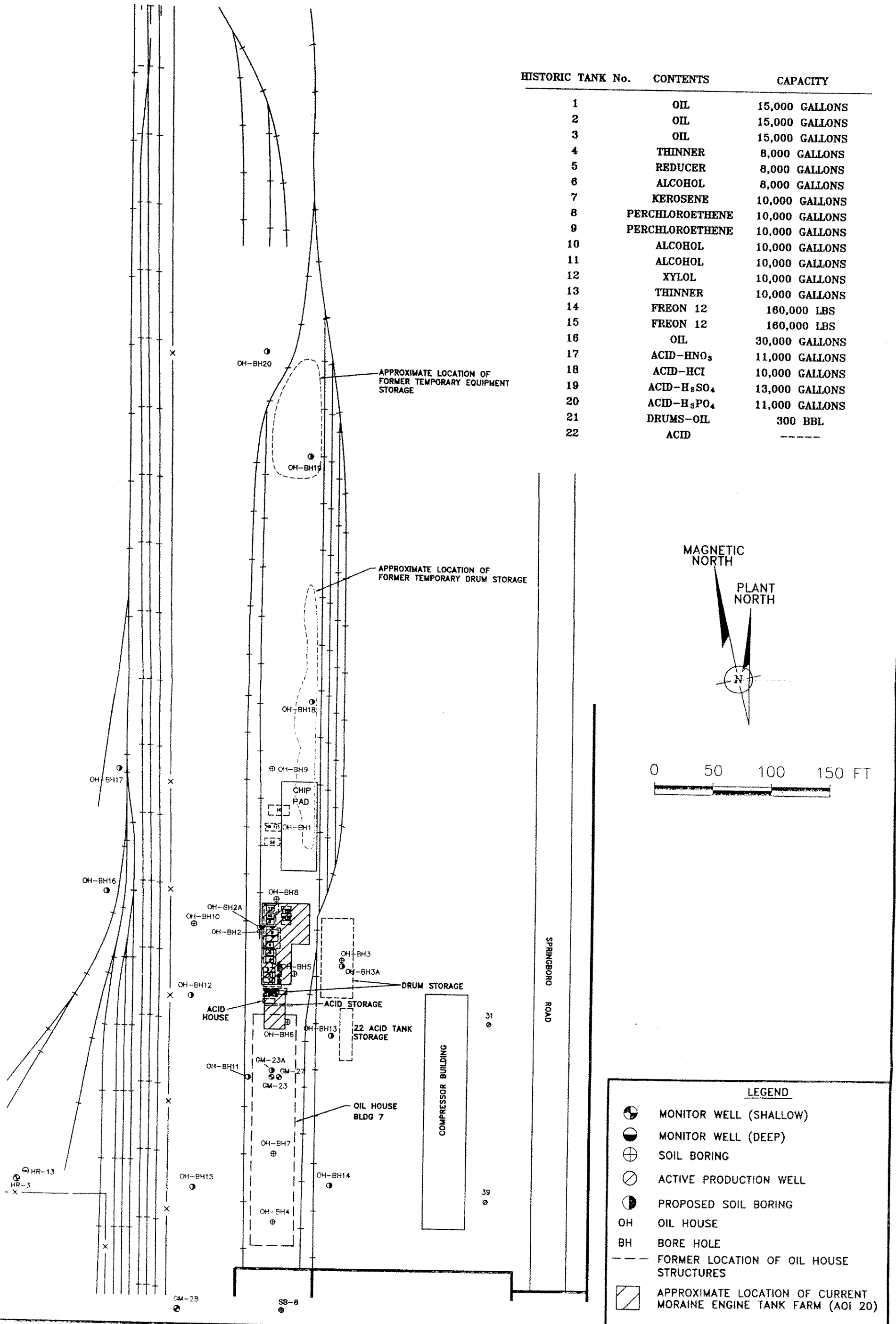
OH-BH16	Install a soil boring west of the railroad tracks and OH-BH1 and east of Landfill L2, using hollow-stem auger drilling techniques. Take continuous headspace readings and collect soil samples as described for OH-BH11. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till (if present) and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Verify presence/absence of upper clay till. Assess DNAPL presence. Confirm/deny source of PCE northwest of the Oil House area. Evaluate groundwater quality above the upper clay till. Data collected to meet Objectives 3 and 4.
OH-BH17	Install a soil boring west of the railroad tracks and OH-BH18 and east of Landfill L2, using hollow-stem auger drilling techniques. Take continuous headspace readings and collect soil samples as described for OH-BH11. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till (if present) and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Verify presence/absence of upper clay till. Assess DNAPL presence. Confirm/deny source of PCE northwest of the Oil House area. Evaluate groundwater quality above the upper clay till. Data collected to meet Objectives 3 and 4.
OH-BH18	Install a soil boring north of OH-BH9, using hollow-stem auger drilling techniques. Take continuous headspace readings and collect soil samples as described for OH-BH11. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till (if present) and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Verify presence/absence of upper clay till. Assess DNAPL presence. Confirm/deny source of PCE north of Oil House area. Evaluate groundwater quality above the upper clay till. Data collected to meet Objectives 3 and 4.

Table 5. Proposed Additional Scope of Work for AOI 7 - Former Oil House, Supplemental RFI, General Motors Corporation, Moraine, Ohio.

OH-BH19	Install a soil boring, north of OH-BH18, using hollow-stem auger drilling techniques. Take continuous headspace readings and collect soil samples as described for OH-BH11. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till (if present) and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Verify presence/absence of upper clay till. Assess DNAPL presence. Confirm/deny source of PCE north of Oil House area. Evaluate groundwater quality above the upper clay till. Data collected to meet Objectives 3 and 4.
OH-BH20	Install a soil boring, northwest of OH-BH19 at the General Motors property boundary, using hollow-stem auger drilling techniques. Take continuous headspace readings and collect soil samples as described for OH-BH11. Advance boring into groundwater a maximum of 15 feet to determine if upper clay till is present, and, if present, use Hydropunch II ™ to collect discrete groundwater sample beneath the water table and above the upper clay till (if present) and analyze sample for the AOI-specific list of VOCs. Collect saturated soil sample to perform the hydrophobic dye soil-water shake field test, if upper clay till is present.	Verify presence/absence of upper clay till. Assess DNAPL presence. Confirm/deny source of PCE north of Oil House area. Evaluate groundwater quality above the upper clay till. Data collected to meet Objectives 3 and 4.

AOI Area of Interest
DNAPL Dense Non-aqueous Phase Liquid
VOCs Volatile Organic Compounds
AOI-specific list of VOCs includes: tetrachloroethene, trichloroethene, trans- and cis-1,2-dichloroethene, 1,1-dichloroethene, 1,1-dichloroethane, 1,1,1-trichloroethane and vinyl chloride.

HISTORIC TANK No.	CONTENTS	CAPACITY
1	OIL	15,000 GALLONS
2	OIL	15,000 GALLONS
3	OIL	15,000 GALLONS
4	THINNER	8,000 GALLONS
5	REDUCER	8,000 GALLONS
6	ALCOHOL	8,000 GALLONS
7	KEROSENE	10,000 GALLONS
8	PERCHLOROETHENE	10,000 GALLONS
9	PERCHLOROETHENE	10,000 GALLONS
10	ALCOHOL	10,000 GALLONS
11	ALCOHOL	10,000 GALLONS
12	XYLOL	10,000 GALLONS
13	THINNER	10,000 GALLONS
14	FREON 12	160,000 LBS
15	FREON 12	160,000 LBS
16	OIL	30,000 GALLONS
17	ACID–HNO_3	11,000 GALLONS
18	ACID–HCl	10,000 GALLONS
19	ACID–H_2SO_4	13,000 GALLONS
20	ACID–H_3PO_4	11,000 GALLONS
21	DRUMS–OIL	300 BBL
22	ACID	------



ENVIRODYNE GERAGHTY & MILLER
1700 Lakehurst Court
Suite 100, Dublin, OH 43016
Tel: 614/764-2310 Fax: 614/764-1270

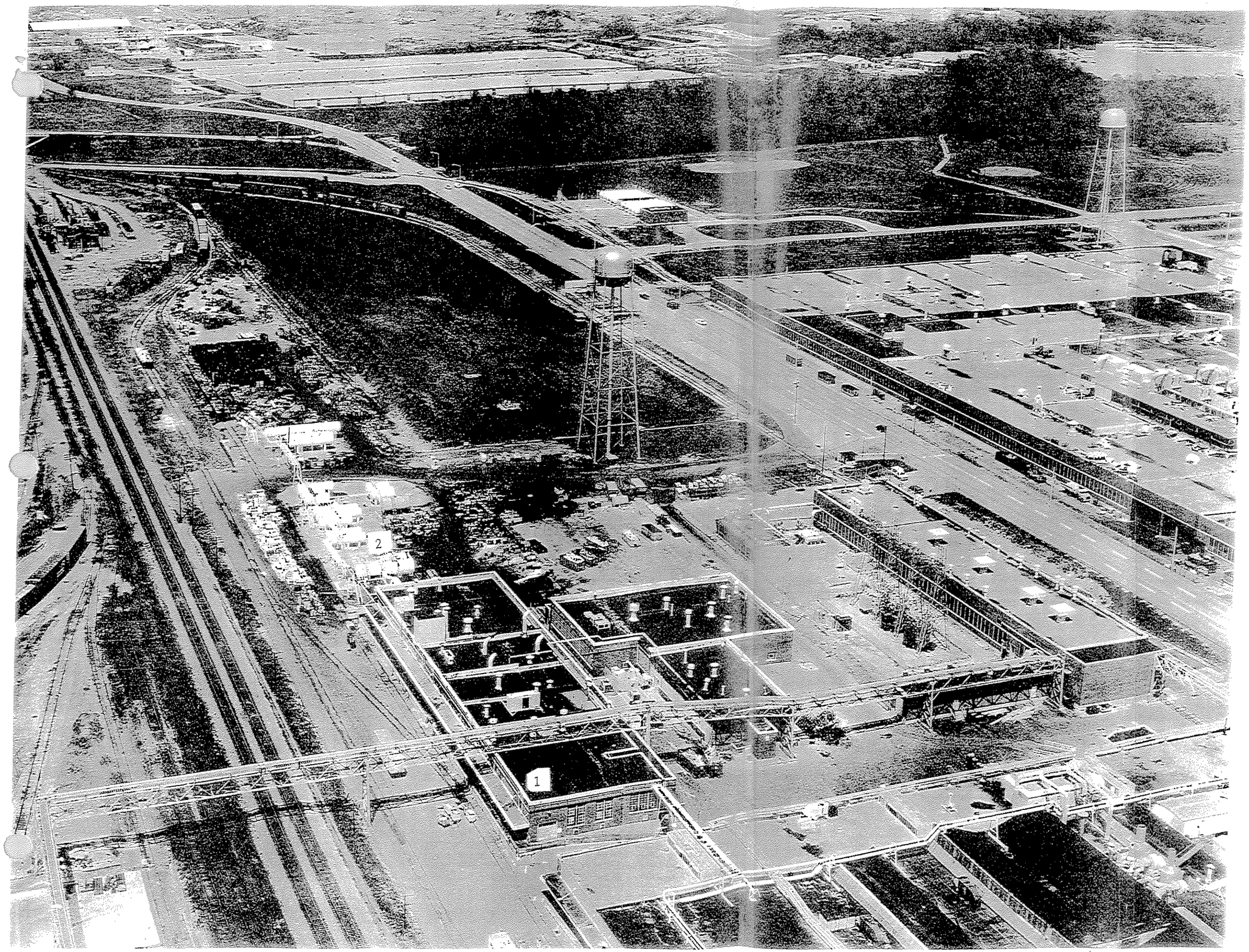
PROPOSED SOIL BORING LOCATIONS FOR AOI 7 – FORMER OIL HOUSE AREA

GENERAL MOTORS CORPORATION
MORAINE, OHIO

DATE 12JUN98	PROJECT MANAGER R.ASTLE	DRAWING NAME HARR\N-B\RFISUP1C
DRAWN R. SMITH	LEAD DESIGN PROF.	CHECKED R. ASTLE
PROJECT NUMBER OH000294.0001.0002		DRAWING NUMBER 1

Attachment 1

1979 Aerial Photographs



May 1979

1. Oil House Building 7
2. Oil House Tank Farm

Not to scale

November 1979

1. Former Oil House Building 7
2. Oil House Tank Farm

Not to scale

Attachment 2

Standard Operating Procedure
#27

SOP #27 - SLUG TEST COMPLETION

EQUIPMENT:

_____ *Water-level meter*
_____ *Stopwatch*
_____ *Caution tape and posts*
_____ *Plastic sheeting*
_____ *Ziploc bags (1-gallon size)*
_____ *PPE (gloves, safety glasses)*
_____ *Paperwork*
_____ *Pens and Markers*
_____ *Slug and rope*
_____ *Pressure transducer and data recorder*

PROCEDURES:

At Field Office:

1. *Acquire necessary equipment.*

At Sampling Location:

1. *Don appropriate PPE.*
2. *Establish exclusion zone with barricade tape.*
3. *Place plastic sheeting near work area.*
4. *Open well of interest; note condition of well.*
5. *Measure and record the static water level and depth to the bottom of the well. Record this data on the appropriate field data form.*
6. *If a transducer and analog or digital recorder are to be used to measure water-level changes, calibrate the transducer at two different depths in the well. Calibration depths should be widely separated. Leave the transducer at the lower calibration point.*

Falling-Head Slug Test :

1. *Switch on the data recorder, or set the water-level meter probe near the level at which water is expected to rise.*
2. *Rapidly lower the slug into the water.*

3. Record fall in water level versus time. If a transducer and recording device are used, record depth at predetermined intervals (as frequently as equipment permits) for the first 2 minutes or longer, based on aquifer conditions. If using a water-level indicator and stopwatch, record depth-time data at the fastest rate possible for the first 5 minutes of well recovery. Subsequent recording intervals may be adjusted to suit the rate of well recovery.

4. Continue recording depth-time data until the well has recovered to nearly static water level condition. When using data recorders, it is advisable to check and record the reading every few minutes to ensure that data are being properly recorded.

5. Record the time of test completion on the field data forms. If a data recorder with random access memory (RAM) or erasable programmable read only memory (EPROM) was used, record the file name used.

6. Decontaminate all equipment according to SOP #10. Clean up the site, and close and lock the well before leaving (optional if Rising-Head Slug Test not completed concurrently).

Note: Both rising- and falling-head slug tests may be carried out in the same operation by first measuring the rate of water-level fall immediately after slug insertion, then measuring the rate of water-level rise after slug withdrawal. Be sure that the well has recovered to the static water level before conducting the rising-head test.

Rising-Head Slug Test :

1. Lower the slug into the water until it is fully submerged. Allow the well to re-equilibrate to static water level. If a transducer is used, ensure that the sensor is below the anticipated level that the water will fall when the slug is removed (optional if Rising-Head Slug Test not completed concurrently).

2. Turn on the data recorder, if used, or verify the static water level has been reestablished with a water-level meter.

3. *Withdrawal the slug quickly, but avoid surging. Record the time of withdrawal to the second. Start the stop watch, if used, at the instant the slug is withdrawn.*

4. *Record the rise in water level vs. time. If a transducer and recording device are used, record depth at predetermined intervals (as frequently as equipment permits) for the first 2 minutes or longer, based on aquifer conditions. If using a water-level indicator and stopwatch, record depth-time data at the fastest rate possible for the first 5 minutes of well recovery. Subsequent recording intervals may be adjusted to suit the rate of well recovery.*

5. *Continue recording depth-time data until the well has recovered to nearly the static water level. When using data recorders, it is advisable to check and record readings every few minutes to ensure that data are being properly recorded.*

6. *Record the time of test completion in the field data forms. If a data recorder with RAM or EPROM memory was used, record the file name used.*

7. *Decontaminate all equipment according to SOP #10. Clean up the site, and close and lock the well before leaving.*

Restrictions/Limitations:

In wells in which the static water level and water levels induced during testing are above the top of the screened interval, both the rising-head and falling-head tests should be conducted to provide a check of results.

Falling-head slug tests are invalid in wells in which the static water level is at or below the top of the screened interval.

Data Interpretation:

Field data from slug tests will be reduced and evaluated using commercially available software packages (i.e. Aqtesolv) to determine hydraulic conductivity of the unconsolidated aquifer in proximity to the well being tested.

BY FACSIMILE

Mr. John Ridd
Senior Environmental Project Engineer
General Motors Corporation (GMC)
Delphi/Harrison Thermal Systems
3600 Dryden Road
Moraine, Ohio 45439-1410

DE-9J

Re: Supplemental RCRA Facility Investigation
GMC Delphi/Harrsion OHD 000 817 577
GMC Moraine Engine Plant OHD 980 569 388
GMC Moraine Assembly Plant OHD 041 063 074
RCRA Administrative Order
Docket No. V-W-R-002-91

Dear Mr. Ridd:

The United States Environmental Protection Agency (U.S. EPA) is in receipt of your October 16, 1998 letter. The letter proposes to perform additional field investigative work at Area of Interest (AOI) 7 so as to better characterize the contamination at this area. U.S. EPA hereby approves the additional field investigation as prescribed in you October 16, 1998, letter, with the following modifications (items 1-4) as stated below.

(1) The elevation of the top of the upper clay layer shall be established at each borehole of the AOI 7 investigation, so that appropriate maps of the clay layer can be developed.

(2) The soil boring adjacent to GM-23 shall be advanced to the top of the water table if the sample headspace reading is above background levels.

(3) In some cases laboratory analysis revealed relatively high concentrations in samples which had low headspace readings, indicating that headspace readings are no always reliable. Consequently at soil boring OH-BH2A AND OH-BH3A, an additional soil sample shall be collected at the point of highest head spacing reading.

(4) If groundwater samples can not be collected by the Hydropunch

II sampler, groundwater samples shall be collected by installing temporary wells.

Since GMC has proposed to do additional field work at AOI 7, the due date for the Supplemental RCRA Facility Investigation (RFI) report submittal as previously specified will be reevaluated and established at a future date. Since the additional data to be developed in the expanded investigation is critical to the decision concerning implementation of an Interim Measure (IM) for AOI 7, a committal statement by GMC on this matter is also deferred. If GMC intends to proceed with a IM for AOI 7, a statement in writing as to such intent shall be provided concurrently with the submittal of the Supplemental RFI. A general description of the IM and a schedule for implementation shall also be included.

If you have any questions, please call me at (312) 886-4568.

Sincerely,

William Buller, Project Coordinator
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
MI/WI Section

cc: Chris Cotton, OEPA
Ed Schuessler, TTIEMC

bcc: Tom Turner, ORC

ARCADIS GERAGHTY & MILLER

Supplemental RFI
Revised Project Schedule

DELPHI
Harrison Thermal Systems

December 18, 1998

Federal Express

U.S. EPA Region V
Enforcement and Compliance Assurance Branch, DE-9J
Waste, Pesticides and Toxics Division
77 West Jackson Blvd.
Chicago, IL 60604-3590
Attn: Mr. William Buller

Dear Mr. Buller:

The Supplemental RFI revised project schedule presented as Figure 4 in the Preliminary AOI Evaluation and Recommendations Report, dated July 16, 1998 has been updated to reflect the additional investigation at AOI 7 conducted in November 1998. Three copies of this updated project schedule are attached to this letter.

If you have any questions, please call me at 937-455-4408.

Sincerely,

James X Ridd /for

W. John Ridd
Senior Environmental Project Engineer

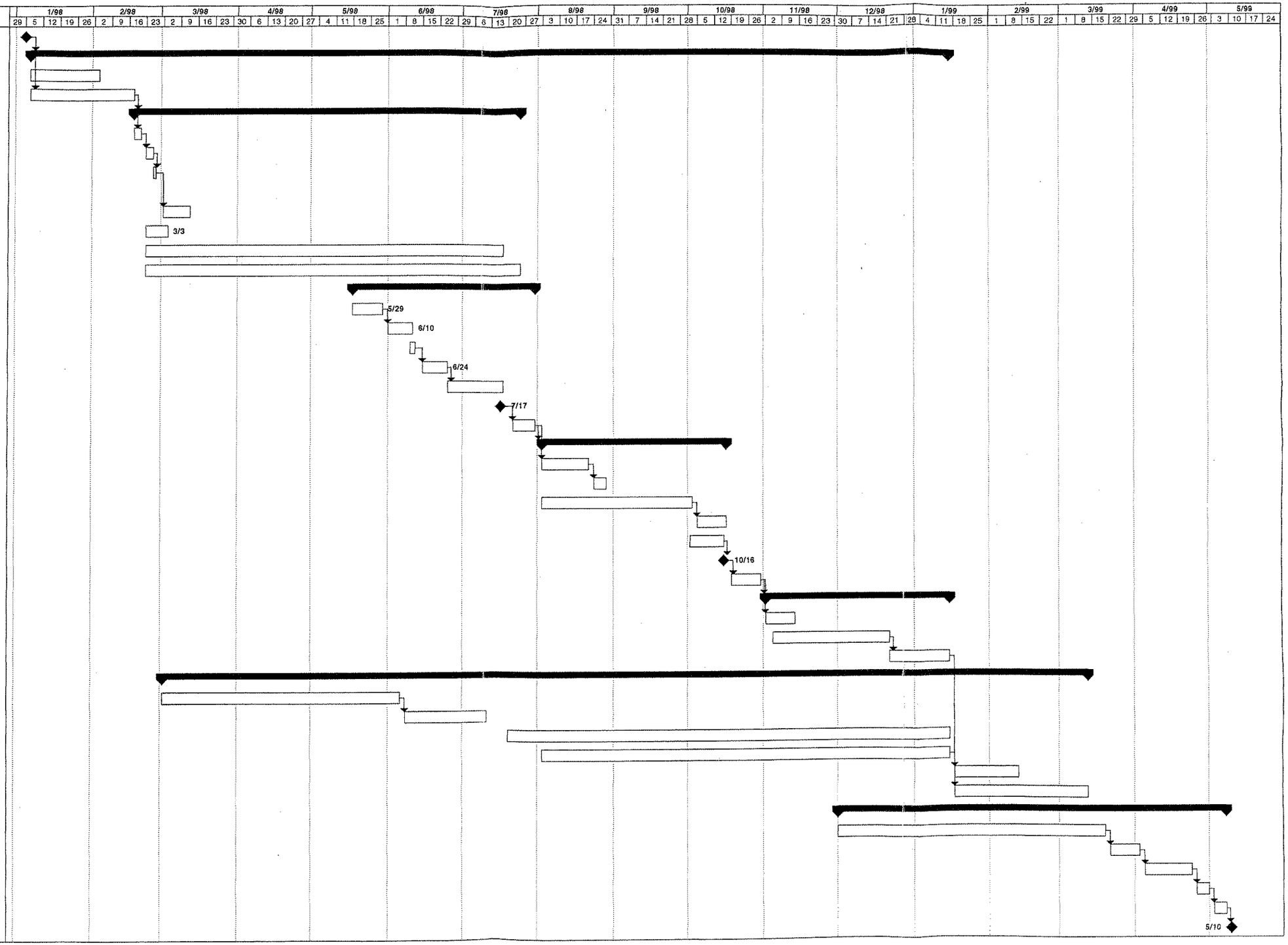
Enclosures

cc: C. Cotton, Ohio EPA

3600 Dryden Road Moraine, Ohio 45439-1410 USA

Figure 1. Revised Project Schedule for the Supplemental RFI, General Motors Corporation, Moraine, Ohio.

No.	Task Name
1	**USEPA Approval of Supplemental RFI WP**
2	**Implement Field Program**
3	Obtain Well Access Agreements
4	Bid Subcontract Work/Mobilize
5	**Planned Investigation Activities**
6	AOI 13 & 17 Screening (On-site analysis)
7	AOI 7/AOI 36 Investigation
8	Monitor Well (GM-26) Installation
9	AOI 13 &17 Auger Drilling Investigation (NR)
10	Groundwater Sampling
11	Submit Screening Results for AOIs 13 & 17 to USEPA
12	Laboratory Analysis
13	Validation (Field/Lab Samples)
14	**Eval if Added Field Activities are Required**
15	Submit AOI 36 Evaluation to USEPA
16	USEPA Review/Approval of AOI 36 Sampling
17	AOI 36 Soil Sampling
18	AOI 36 Lab Analysis/Submit Soil Results to USEPA
19	Develop Preliminary AOI Evaluation Report
20	Submit AOI Evaluation Report to USEPA
21	USEPA Review/Approval
22	**Additional Investigation Activities at AOI 7**
23	Drilling (borings and wells) and Sampling
24	Groundwater Sampling
25	Laboratory Analysis
26	Validation
27	Eval if Added Field Activities are Required
28	Submit Sampling Plan to USEPA
29	USEPA Review/Approval
30	**Additional Investigation Activities at AOI 7**
31	Drilling (borings) and Soil Sampling
32	Laboratory Analysis
33	Validation
34	**Risk Assessment**
35	Exposure Assessment
36	Preliminary Risk Calculations
37	Exposure Assessment
38	Risk Calculations (AOIs 13, 17, 34, 35, 36)
39	Risk Calculations (AOI 7)
40	Develop Draft Supplemental Risk Assessment
41	**Reporting**
42	Develop Internal Draft Supplemental RFI Rpt
43	GMC Draft Review
44	Develop Final Supplemental RFI Rpt
45	GMC Final Review
46	Finalize Supplemental RFI Rpt
47	**Supplemental RFI Addendum to USEPA**



Project: GMC RFI
Date: Fri 12/18/98

Project Task | Milestone | Summary

NR Not Required

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:
DE-9J

4 January 1999

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

John Ridd
Senior Environmental Project Engineer
General Motors Corporation (GMC)
Delphi/Harrison Thermal Systems
3600 Dryden Road
Moraine, Ohio 45439-1410

Re: Supplemental RCRA Facility Investigation
GMC Delphi/Harrison, U.S. EPA ID. No.: OHD 000 817 577
GMC Moraine Engine Plant, U.S. EPA ID. No.: OHD 980 569 388
GMC Moraine Assembly Plant, U.S. EPA ID. No.: OHD 041 063 074

Dear Mr. Ridd:

The United States Environmental Protection Agency (U.S. EPA), is in receipt of your December 18, 1998, letter which enclosed the revised schedule for the Supplemental RCRA Facility Investigation (RFI). The revised schedule is hereby approved, the Supplemental RFI report shall be submitted to U.S. EPA by May 10, 1999.

Also, please be informed that after December 30, 1998, Ms. Diane Sharrow will serve as U.S. EPA's project coordinator for the above referenced Facilities. I am retiring as of January 2, 1999. Ms. Sharrow can be reached at (312) 886-6199.

Sincerely,

William Buller, Project Coordinator
Michigan/Wisconsin Section
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division

cc: Chris Cotton, OEPA
Ed Schuessler, TTIEMC
Tom Turner, ORC

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DELPHI
Harrison Thermal Systems

May 4, 1999

Federal Express

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MAY - - 1999
ARCADIS Geraghty & Miller

USEPA Region V
Enforcement and Compliance Assurance Branch, DE-9J
Waste, Pesticides and Toxics Division
77 West Jackson Blvd.
Chicago, IL 60604-3590
Attn: Ms. Diane Sharrow

Re: Revised Schedule for Supplemental RFI Report
General Motors Powertrain Group, Moraine Engine Plant and
General Motors Truck Group, Moraine Assembly Plant
Moraine, Ohio

Dear Ms. Sharrow:

This letter is written to confirm our conversation on April 30, 1999 regarding the schedule for submittal of the Supplemental RFI Report for the General Motors facilities in Moraine, Ohio. As we discussed, we have recently acquired new information regarding projected process water use scenarios at this site. In order to evaluate the effect of this information on predicted downgradient groundwater quality, we have incorporated this information into the site-specific groundwater model and are currently re-running the associated risk calculations. Accordingly, this has resulted in a delay in the finalization of the Supplemental RFI Report. Per our conversation, we understand that U.S. EPA has agreed to an extension to June 10, 1999, for submittal of the Supplemental RFI Report. Enclosed are three copies of a revised project schedule reflecting this change.

General Motors appreciates your consideration in granting of this extension. If you have any questions, please call me on (937) 455-4408.

Sincerely,

W. John Ridd

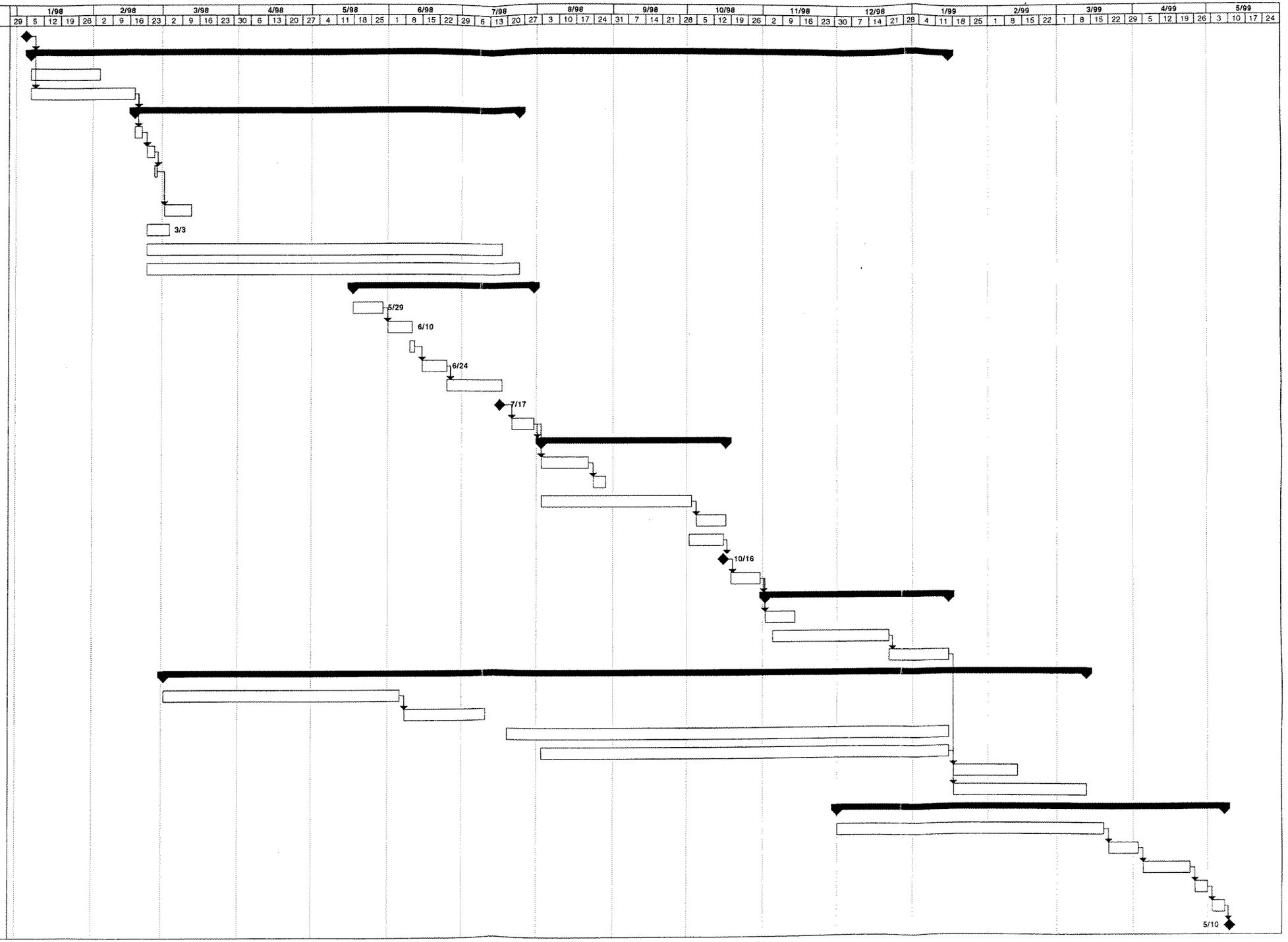
W. John Ridd

c: Chris Cotton, OEPA

3600 Dryden Road Moraine, Ohio 45439-1410 USA

Figure 1. Revised Project Schedule for the Supplemental RFI, General Motors Corporation, Moraine, Ohio.

No.	Task Name
1	**USEPA Approval of Supplemental RFI WP**
2	**Implement Field Program**
3	Obtain Well Access Agreements
4	Bid Subcontract Work/Mobilize
5	**Planned Investigation Activities**
6	AOI 13 & 17 Screening (On-site analysis)
7	AOI 7/AOI 36 Investigation
8	Monitor Well (GM-26) Installation
9	AOI 13 &17 Auger Drilling Investigation (NR)
10	Groundwater Sampling
11	Submit Screening Results for AOIs 13 & 17 to USEPA
12	Laboratory Analysis
13	Validation (Field/Lab Samples)
14	**Eval if Added Field Activities are Required**
15	Submit AOI 36 Evaluation to USEPA
16	USEPA Review/Approval of AOI 36 Sampling
17	AOI 36 Soil Sampling
18	AOI 36 Lab Analysis/Submit Soil Results to USEPA
19	Develop Preliminary AOI Evaluation Report
20	Submit AOI Evaluation Report to USEPA
21	USEPA Review/Approval
22	**Additional Investigation Activities at AOI 7**
23	Drilling (borings and wells) and Sampling
24	Groundwater Sampling
25	Laboratory Analysis
26	Validation
27	Eval if Added Field Activities are Required
28	Submit Sampling Plan to USEPA
29	USEPA Review/Approval
30	**Additional Investigation Activities at AOI 7**
31	Drilling (borings) and Soil Sampling
32	Laboratory Analysis
33	Validation
34	**Risk Assessment**
35	Exposure Assessment
36	Preliminary Risk Calculations
37	Exposure Assessment
38	Risk Calculations (AOIs 13, 17, 34, 35, 36)
39	Risk Calculations (AOI 7)
40	Develop Draft Supplemental Risk Assessment
41	**Reporting**
42	Develop Internal Draft Supplemental RFI Rpt
43	GMC Draft Review
44	Develop Final Supplemental RFI Rpt
45	GMC Final Review
46	Finalize Supplemental RFI Rpt
47	**Supplemental RFI Addendum to USEPA**



Project: GMC RFI
Date: Fri 12/18/98

Project Task Milestone Summary

NR Not Required

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:
DE-9J

4 January 1999

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

John Ridd
Senior Environmental Project Engineer
General Motors Corporation (GMC)
Delphi/Harrison Thermal Systems
3600 Dryden Road
Moraine, Ohio 45439-1410

Re: Supplemental RCRA Facility Investigation
GMC Delphi/Harrison, U.S. EPA ID. No.: OHD 000 817 577
GMC Moraine Engine Plant, U.S. EPA ID. No.: OHD 980 569 388
GMC Moraine Assembly Plant, U.S. EPA ID. No.: OHD 041 063 074

Dear Mr. Ridd:

The United States Environmental Protection Agency (U.S. EPA), is in receipt of your December 18, 1998, letter which enclosed the revised schedule for the Supplemental RCRA Facility Investigation (RFI). The revised schedule is hereby approved, the Supplemental RFI report shall be submitted to U.S. EPA by May 10, 1999.

Also, please be informed that after December 30, 1998, Ms. Diane Sharrow will serve as U.S. EPA's project coordinator for the above referenced Facilities. I am retiring as of January 2, 1999. Ms. Sharrow can be reached at (312) 886-6199.

Sincerely,

William Bulder, Project Coordinator
Michigan/Wisconsin Section
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division

cc: Chris Cotton, OEPA
Ed Schuessler, TTIEMC
Tom Turner, ORC

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W. John Ridd

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3600 Dryden Road Moraine, Ohio 45439-1410 USA

Figure 1. Revised Project Schedule for the Supplemental RFI, General Motors Corporation, Moraine, Ohio.

No.	Task Name
1	**USEPA Approval of Supplemental RFI WP**
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12	Laboratory Analysis
13	Validation (Field/Lab Samples)
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17	AOI 36 Soil Sampling
18	AOI 36 Lab Analysis/Submit Soil Results to USEPA
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35	Exposure Assessment
36	Preliminary Risk Calculations
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44	Develop Final Supplemental RFI Rpt
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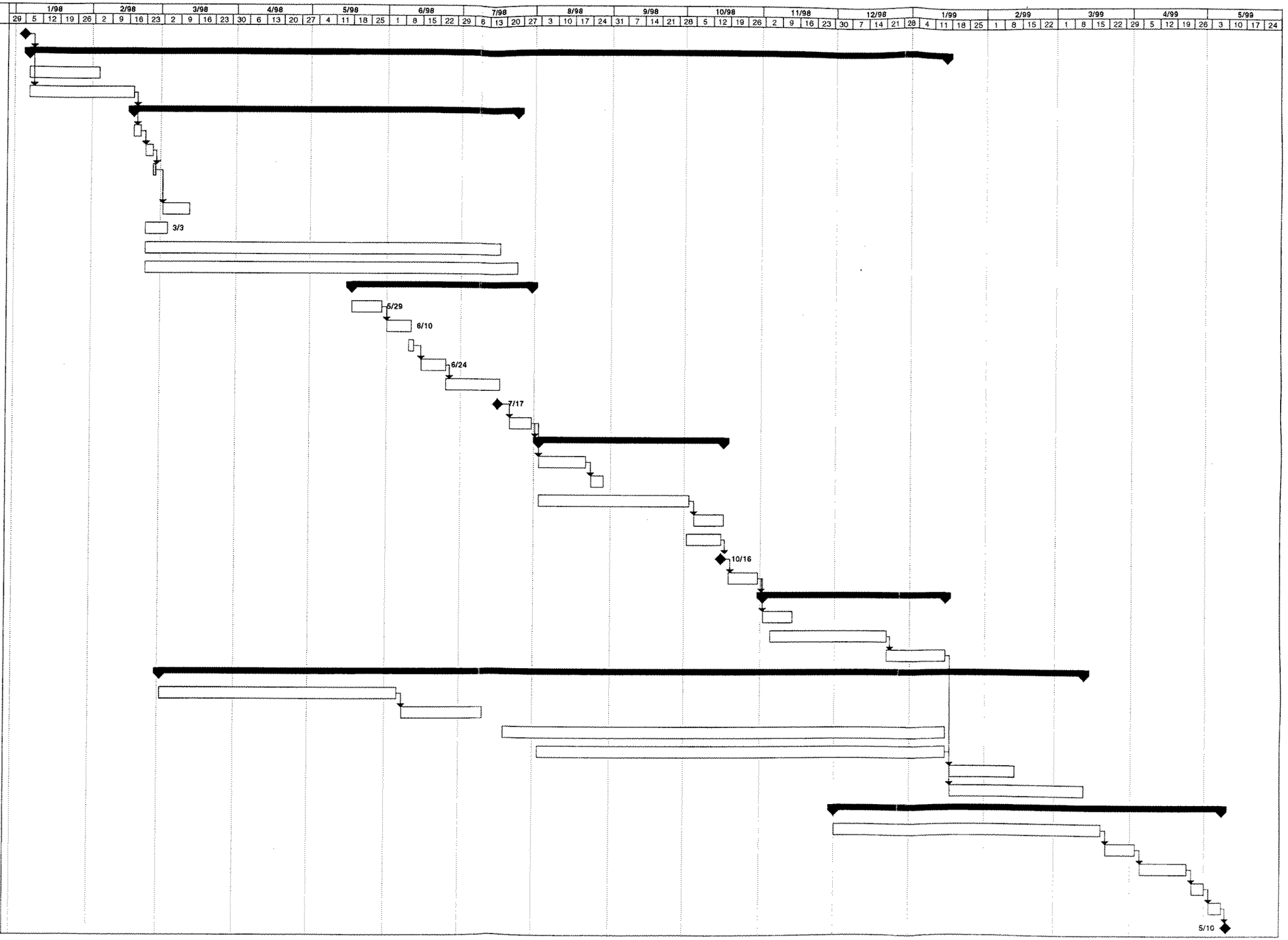
47	**Supplemental RFI Addendum to USEPA**



Project: GMC RFI
Date: Fri 12/18/98

Project Task Milestone Summary

NR Not Required

Appendix B

Supplemental RFI Laboratory
Analytical Results

Table B-1. Identification of Replicate Samples Submitted for Laboratory Analysis, Supplemental RFI, General Motors Corporation, Moraine, Ohio

Replicate Sample	Original Sample	Sample Medium	Date Taken
DUP-39	EA1-BH01(6-8)	Soil	8/28/97
DUP-53	AST-BH2-24/SL	Soil	2/19/98
DUP-54	OH-BH2-31/SL	Soil	2/20/98
DUP-55	OH-BH1-30/SL	Soil	2/23/98
DUP-56	GM-8-030498/GW	Groundwater	3/4/98
DUP-57	GM-22-031098/GW	Groundwater	3/10/98
DUP-58	HR-12-030998/GW	Groundwater	3/9/98
DUP-59	Composite A	Soil	6/10/98
DUP-60	OH-BH6-2/SL	Soil	8/12/98
DUP-61	GM-28	Groundwater	8/17/98
DUP-62	OH-BH9-30/SL	Soil	8/19/98
DUP-63	OH-BH9-38/HP	Groundwater	8/19/98
DUP-64	HR1-08-24-98/GW	Groundwater	8/24/98
DUP-65	GM-27/LF	Groundwater	8/26/98
DUP-66	OH-BH2A-14/SL	Soil	11/2/98
DUP-67	OH-BH2A-37/HP	Groundwater	11/3/98
DUP-68	GM-23A-5/SL	Soil	11/5/98
DUP-69	OH-BH13-22/SL	Soil	11/10/98
DUP-70	OH-BH14-32/HP	Groundwater	11/11/98
DUP-71	OH-BH17-2/SL	Soil	11/13/98

DUP - Duplicate.
OH - Oil House.
BH - Borehole.
SL - Soil.
HP - Hydropunch.
LF - Low Flow.
GW - Groundwater.
EA - Excavation Area.
AST - Aboveground Storage Tank.

Table B-2. SVOCs, PCBs, and Metals Analytical Results for Selected Upper Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUNDS	UNITS	EAST 03/05/98	GM-2 03/04/98	GM-21 03/10/98	GM-22 03/10/98	DUP-57 03/10/98	GM-23 03/09/98	HR-11 03/09/98	RB-33 03/10/98
Semi-Volatile Organic Compounds									
1,2,4,5-Tetrachlorobenzene	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
1,2,4-Trichlorobenzene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
1,3,5-Trinitrobenzene	ug/l	<30	<30	<30	<30	<30	<30	<30	<30
1,4-Napthoquinone	ug/l	<100	<100	<100	<100	<100	<100	<100	<100
1-Naphthylamine	ug/l	<30	<30	<30	<30	<30	<30	<30	<30
2,2'-Dichlorodiisopropyl ether	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
2,3,4,6-Tetrachlorophenol	ug/l	<20	<20	<20	<20	<20	<20	<20	R
2,4,5-Trichlorophenol	ug/l	<10	<10	<10	<10	<10	<10	<10	R
2,4,6-Trichlorophenol	ug/l	<10	<10	<10	<10	<10	<10	<10	R
2,4-Dichlorophenol	ug/l	<10	<10	<10	<10	<10	<10	<10	R
2,4-Dimethylphenol	ug/l	<10	<10	<10	<10	<10	<10	<10	R
2,4-Dinitrophenol	ug/l	<10	<10	<10	<10	<10	<10	<10	R
2,4-Dinitrotoluene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
2,6-Dichlorophenol	ug/l	<10	<10	<10	<10	<10	<10	<10	R
2,6-Dinitrotoluene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
2-Acetylaminofluorene (2-AAF)	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
2-Chloronaphthalene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
2-Chlorophenol	ug/l	<10	<10	<10	<10	<10	<10	<10	R
2-Methylnaphthalene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
2-Naphthylamine	ug/l	<30	<30	<30	<30	<30	<30	<30	<30
2-Picoline	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
3,3'-Dichlorobenzidine	ug/l	<50	<50	<50	<50	<50	<50	<50	<50
3,3'-Dimethylbenzidine	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
3-Methylcholanthrene	ug/l	<30	<30	<30	<30	<30	<30	<30	<30
4,6-Dinitro-2-methylphenol	ug/l	<10	<10	<10	<10	<10	<10	<10	R
4-Aminobiphenyl	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
4-Bromophenyl phenyl ether	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
4-Chloro-3-methyl phenol	ug/l	<10	<10	<10	<10	<10	<10	<10	R
4-Chlorophenyl phenyl ether	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
4-Nitroquinoline 1-oxide	ug/l	<30	<30	R	R	R	R	R	R
5-Nitro-o-toluidine	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
7,12-Dimethylbenz(a)anthracene	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Acenaphthene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Acenaphthylene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Acetophenone	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Aniline	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Anthracene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10

Table B-2. SVOCs, PCBs, and Metals Analytical Results for Selected Upper Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUNDS	UNITS	EAST 03/05/98	GM-2 03/04/98	GM-21 03/10/98	GM-22 03/10/98	DUP-57 03/10/98	GM-23 03/09/98	HR-11 03/09/98	RB-33 03/10/98
Semi-Volatile Organic Compounds (continued)									
Aramite	ug/l	<15UJ	<15UJ	<15	<15	<15	<15	<15	<15
Benzo(a)anthracene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Benzo(a)pyrene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Benzo(b)fluoranthene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Benzo(ghi)perylene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Benzo(k)fluoranthene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Benzyl alcohol	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Bis(2-chloroethoxy)methane	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Bis(2-chloroethyl)ether	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Bis(2-ethylhexyl)phthalate	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Butyl benzyl phthalate	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Chlorobenzilate	ug/l	<50	<50	<50	<50	<50	<50	<50	<50
Chrysene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Di-n-butyl phthalate	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Di-n-octyl phthalate	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Diallate	ug/l	<30	<30	<30	<30	<30	<30	<30	<30
Dibenzo(a,h)anthracene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Dibenzofuran	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Diethyl phthalate	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Dimethoate	ug/l	<100	<100	<100	<100	<100	<100	<100	<100
Dimethyl phthalate	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Diphenylamine	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Disulfoton	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Ethyl methanesulfonate	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Famphur	ug/l	<10UJ	<10UJ	<10	<10	<10	<10	<10	<10
Fluoranthene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Fluorene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Hexachlorobenzene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Hexachlorobutadiene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Hexachlorocyclopentadiene	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Hexachloroethane	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Hexachlorophene	ug/l	R	R	R	R	R	R	R	<500
Hexachloropropene	ug/l	<30	<30	<30	<30	<30	<30	<30	R
Indeno(1,2,3-cd)pyrene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Isodrin	ug/l	<30	<30	<30	<30	<30	<30	<30	<30
Isophorone	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Isosafrole	ug/l	<20	<20	<20	<20	<20	<20	<20	<20

Table B-2. SVOCs, PCBs, and Metals Analytical Results for Selected Upper Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

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Semi-Volatile Organic Compounds (continued)									
Kepone	ug/l	R	R	<250	<250	<250	<250	<250	<250
Methapyrilene	ug/l	<100UJ	<100UJ	<100	<100	<100	<100	<100	<100
Methyl methanesulfonate	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Methyl parathion	ug/l	<20	<20	<20UJ	<20UJ	<20UJ	<20UJ	<20UJ	<20UJ
N-Nitrosodi-n-butylamine	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
N-Nitrosodiethylamine	ug/l	<30	<30	<30	<30	<30	<30	<30	<30
N-Nitrosodimethylamine	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
N-Nitrosodiphenylamine	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
N-Nitrosodipropylamine	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
N-Nitrosomethylethylamine	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
N-Nitrosomorpholine	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
N-Nitrosopiperidine	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
N-Nitrosopyrrolidine	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Naphthalene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Nitrobenzene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Parathion	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Pentachlorobenzene	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Pentachloronitrobenzene	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Pentachlorophenol	ug/l	<10	<10	<10	<10	<10	<10	<10	R
Phenacetin	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Phenanthrene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Phenol	ug/l	<10	<10	<10	<10	<10	<10	<10	R
Phorate	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Pronamide	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Pyrene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Pyridine	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
Safrole	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Sulfotepp	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Thionazin	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
Triethyl phosphorothioate	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
a,a-Dimethyl-phenethylamine	ug/l	<50	<50	<50	<50	<50	<50	<50	<50
m-Dichlorobenzene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
m-Dinitrobenzene	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
m-Nitroaniline	ug/l	<15	<15	<15	<15	<15	<15	<15	<15
meta & para-Methylphenol	ug/l	<10	<10	<10	<10	<10	<10	<10	R
o-Dichlorobenzene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
o-Nitroaniline	ug/l	<15	<15	<15	<15	<15	<15	<15	<15

Table B-2. SVOCs, PCBs, and Metals Analytical Results for Selected Upper Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUNDS	UNITS	EAST 03/05/98	GM-2 03/04/98	GM-21 03/10/98	GM-22 03/10/98	DUP-57 03/10/98	GM-23 03/09/98	HR-11 03/09/98	RB-33 03/10/98
Semi-Volatile Organic Compounds (continued)									
o-Nitrophenol	ug/l	<10	<10	<10	<10	<10	<10	<10	R
o-Toluidine	ug/l	<20	<20	<20	<20	<20	<20	<20	<20
ortho-Methylphenol	ug/l	<10	<10	<10	<10	<10	<10	<10	R
p-(Dimethylamino)azobenzene	ug/l	<50	<50	<50	<50	<50	<50	<50	<50
p-Chloroaniline	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
p-Dichlorobenzene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10
p-Nitroaniline	ug/l	<15	<15	<15	<15	<15	<15	<15	<15
p-Nitrophenol	ug/l	<10	<10	<10	<10	<10	<10	<10	R
p-Phenylenediamine	ug/l	<30UJ	<30UJ	<30	<30	<30	<30	<30	<30
Polychlorinated Biphenyls									
Aroclor 1016	ug/l	<0.200	<0.210	<0.220	<0.200	<0.200	<0.220	<0.220	<0.200
Aroclor 1221	ug/l	<0.200	<0.210	<0.220	<0.200	<0.200	<0.220	<0.220	<0.200
Aroclor 1232	ug/l	<0.200	<0.210	<0.220	<0.200	<0.200	<0.220	<0.220	<0.200
Aroclor 1242	ug/l	<0.200	<0.210	<0.220	<0.200	<0.200	<0.220	<0.220	<0.200
Aroclor 1248	ug/l	<0.200	<0.210	<0.220	<0.200	<0.200	<0.220	<0.220	<0.200
Aroclor 1254	ug/l	<0.200	<0.210	<0.220	<0.200	<0.200	<0.220	<0.220	<0.200
Aroclor 1260	ug/l	<0.200	<0.210	<0.220	<0.200	<0.200	<0.220	<0.220	<0.200
Metals									
Antimony, Dissolved	mg/l	0.0078	--	--	<0.001	<0.001	--	--	--
Antimony	mg/l	0.0161	<0.001	<0.001	0.0012	0.0012	<0.005	<0.005	<0.001
Arsenic	mg/l	<0.025	<0.005	<0.005	<0.005	<0.005	<0.025	<0.025	<0.005
Barium, Dissolved	mg/l	0.086	0.0973	0.0634J	0.106J	0.120J	0.0908	0.0944	--
Barium	mg/l	0.117	0.104	0.0808	0.149	0.161	0.161	0.172	<0.005
Beryllium	mg/l	<0.005	<0.001	<0.001	<0.001	<0.001	<0.005	<0.005	<0.001
Cadmium, Dissolved	mg/l	--	--	--	<0.001	<0.001	--	--	--
Cadmium	mg/l	<0.005	<0.001	<0.001	0.0012	0.0021	<0.005	<0.005	<0.001
Chromium, Dissolved	mg/l	<0.002	<0.002	<0.002	--	<0.0020	<0.002	<0.002	<0.002
Chromium	mg/l	0.066	0.0027U	0.0069	<0.002	0.0027U	0.018	0.016U	0.0032
Cobalt, Dissolved	mg/l	--	--	<0.005	--	--	--	--	--
Cobalt	mg/l	<0.025	<0.005	0.0094	<0.005	<0.005	<0.025	<0.025	<0.005
Copper	mg/l	<0.025	<0.005	<0.005	<0.005	<0.005	<0.025	<0.025	<0.005
Iron, Dissolved	mg/l	<0.100	--	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Iron	mg/l	7.77	<0.100	1.65	0.68J	0.91J	15	10.5	<0.100
Lead, Dissolved	mg/l	<0.001	--	<0.001	<0.001	<0.001	<0.001	<0.001	--
Lead	mg/l	0.0077	<0.001	0.0011	0.0021	0.003	0.0129	0.0074	<0.001
Manganese, Dissolved	mg/l	0.122	<0.010	0.181	0.097	0.096	0.242	0.072	<0.010
Manganese	mg/l	1.00	0.048	0.719	0.143J	0.183J	2.63	0.369	<0.010
Mercury	mg/l	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

Table B-2. SVOCs, PCBs, and Metals Analytical Results for Selected Upper Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUNDS	UNITS	EAST 03/05/98	GM-2 03/04/98	GM-21 03/10/98	GM-22 03/10/98	DUP-57 03/10/98	GM-23 03/09/98	HR-11 03/09/98	RB-33 03/10/98
Metals (continued)									
Nickel, Dissolved	mg/l	0.0062	<0.005	<0.005	0.0430	0.0480	<0.005	0.0064	--
Nickel	mg/l	0.056J	0.0056J	0.0100J	0.0589J	0.0624J	0.029	0.027	<0.005UJ
Selenium	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Silver	mg/l	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.002	<0.0005
Thallium	mg/l	<0.005	<0.001	<0.001	<0.001	<0.001	<0.005	<0.005	<0.001
Tin	mg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Vanadium	mg/l	<0.025	<0.005	<0.005	<0.005	<0.005	<0.025	<0.025	<0.005
Zinc	mg/l	<0.250	<0.050	<0.050	<0.050	<0.050	<0.250	<0.250	<0.050

ug/l - Micrograms per liter.
mg/l - Milligrams per liter.
DUP-57 - Duplicate of GM-22.
RB - Rinseate blank.
TB - Trip blank.
-- - Not analyzed.
R - Value is unusable.
UJ - Constituent was not detected above the reporting limit. Detection limit is estimated.
J - Value is estimated.
< - Constituent not detected above laboratory detection limit shown.
U - Value is not detected.

Table B-3. VOCs Analytical Results for Upper Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	EAST 03/05/98	GM-10 03/03/98	GM-2 03/04/98	GM-21 03/10/98	GM-22 03/10/98	DUP-57 03/10/98	GM-23 03/09/98	GM-24 03/06/98	GM-25 03/06/98
Volatile Organic Compounds										
1,1,1,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
1,1,1-Trichloroethane	ug/l	17.5	2.3	5.9J	55.0	<1.0UJ	<1.0UJ	<200UJ	1.1	<1.0
1,1,2,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
1,1,2-Trichloroethane	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
1,1-Dichloroethane	ug/l	6.4	1.5	1.7J	7.6	1.3	1.3	<200UJ	<1.0	<1.0
1,1-Dichloroethene	ug/l	1.3	<1.0	<1.0UJ	4.5	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
1,2,3-Trichloropropane	ug/l	<5.0	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0UJ	<1000UJ	<5.0	<5.0
1,2-Dibromo-3-chloropropane	ug/l	<5.0	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0UJ	<1000UJ	<5.0	<5.0
1,2-Dibromoethane	ug/l	<5.0	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0UJ	<1000UJ	<5.0	<5.0
1,2-Dichloroethane	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
1,2-Dichloropropane	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
2-Hexanone	ug/l	<10	<10	<10UJ	<10UJ	<10UJ	<10UJ	<2000UJ	<10	<10
Acetone	ug/l	<20	<20	<20UJ	<20UJ	<20UJ	<20UJ	<4000UJ	<20	<20
Acrolein	ug/l	<50UJ	<50	<50UJ	<50UJ	R	R	R	<50	<50
Acrylonitrile	ug/l	<50	<50	<50UJ	<50UJ	<50UJ	<50UJ	<10000UJ	<50	<50
Allyl chloride	ug/l	<5.0	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0UJ	<1000UJ	<5.0	<5.0
Benzene	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
Bromodichloromethane	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	3.4	<1.0
Bromoform	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
Bromomethane	ug/l	<5.0	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0UJ	<1000UJ	<5.0	<5.0
Carbon disulfide	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
Carbon tetrachloride	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
Chlorobenzene	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
Chloroethane	ug/l	<10	<10	<10UJ	<10UJ	<10UJ	<10UJ	<2000UJ	<10	<10
Chloroform	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	15.1	<1.0
Chloromethane	ug/l	<10	<10	<10UJ	<10UJ	<10UJ	<10UJ	<2000UJ	<10	<10
Chloroprene	ug/l	<5.0	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0UJ	<1000UJ	<5.0	<5.0
Dibromochloromethane	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
Dibromomethane	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
Dichlorodifluoromethane	ug/l	<10	<10	<10UJ	<10UJ	<10UJ	<10UJ	<2000UJ	<10	<10
Ethyl benzene	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
Ethyl methacrylate	ug/l	<5.0	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0UJ	<1000UJ	<5.0	<5.0
Fluorotrichloromethane	ug/l	<1.0	<1.0	<1.0UJ	4.9	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
Iodomethane	ug/l	<5.0	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0UJ	<1000UJ	<5.0	<5.0
Methacrylonitrile	ug/l	<5.0	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0UJ	<1000UJ	<5.0	<5.0
Methyl ethyl ketone (MEK)	ug/l	R	R	R	R	R	R	R	R	R
Methyl isobutyl ketone (MIBK)	ug/l	<10	<10	<10UJ	<10UJ	<10UJ	<10UJ	<2000UJ	<10	<10

Table B-3. VOCs Analytical Results for Upper Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	EAST 03/05/98	GM-10 03/03/98	GM-2 03/04/98	GM-21 03/10/98	GM-22 03/10/98	DUP-57 03/10/98	GM-23 03/09/98	GM-24 03/06/98	GM-25 03/06/98
Volatile Organic Compounds (continued)										
Methyl methacrylate	ug/l	<5.0	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0UJ	<1000UJ	<5.0	<5.0
Methylene chloride	ug/l	<10	<10	<10UJ	<10UJ	<10UJ	<10UJ	<2000UJ	<10	<10
Pentachloroethane	ug/l	<5.0	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0UJ	<1000UJ	<5.0	<5.0
Propionitrile	ug/l	<50	<50	<50UJ	R	R	R	R	<50	<50
Styrene	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
Tetrachloroethene	ug/l	66.2	1.5	8.5J	<1.0UJ	5.1	5.0	11200J	<1.0	<1.0
Toluene	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
Trichloroethene	ug/l	64.0	28.0	75.1J	356	4.5	4.6	3870J	<1.0	<1.0
Vinyl acetate	ug/l	<10	<10	<10UJ	<10UJ	<10UJ	<10UJ	<2000UJ	<10	<10
Vinyl chloride	ug/l	<2.0	<2.0	<2.0UJ	<2.0UJ	<2.0UJ	<2.0UJ	766J	<2.0	<2.0
Xylenes, Total	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
cis-1,2-Dichloroethene	ug/l	13.9	3.6	10.5J	74.5	1.6	<1.0UJ	3870J	<1.0	<1.0
cis-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
t-1,4-Dichloro-2-butene	ug/l	<5.0	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0UJ	<1000UJ	<5.0	<5.0
trans-1,2-Dichloroethene	ug/l	6.4	<1.0	<1.0UJ	3.6	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0
trans-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0UJ	<1.0UJ	<1.0UJ	<1.0UJ	<200UJ	<1.0	<1.0

Table B-3. VOCs Analytical Results for Upper Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	GM-26 03/03/98	GM-6 03/04/98	GM-8 03/04/98	DUP-56 03/04/98	HR-1 03/05/98	HR-11 03/09/98	HR-17 03/05/98	HR-9 03/06/98	ME-3 03/09/98
Volatile Organic Compounds (continued)										
1,1,1,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0
1,1,1-Trichloroethane	ug/l	<1.0	36.2	6.7	6.8	1.5	<1.0	1.6J	15.0	35.3
1,1,2,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0
1,1,2-Trichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0
1,1-Dichloroethane	ug/l	<1.0	35.3	49.3	52.6	2.1	6.8	<1.0UJ	56.2	13.5
1,1-Dichloroethene	ug/l	<1.0	<1.0	1.0	1.1	<1.0	<1.0	<1.0UJ	<1.0	1.4
1,2,3-Trichloropropane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0
1,2-Dibromo-3-chloropropane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0UJ	<5.0	<5.0UJ
1,2-Dibromoethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0
1,2-Dichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	1.8	<1.0
1,2-Dichloropropane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0
2-Hexanone	ug/l	<10	<10	<10	<10	<10	<10UJ	<10UJ	<10	<10UJ
Acetone	ug/l	<20	<20	<20	<20	<20	<20UJ	<20UJ	<20	<20UJ
Acrolein	ug/l	<50	<50	<50	<50	<50UJ	<50UJ	<50UJ	<50	<50UJ
Acrylonitrile	ug/l	<50	<50	<50	<50	<50	<50	<50UJ	<50	<50
Allyl chloride	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0
Benzene	ug/l	<1.0	<1.0	2.3	2.3	<1.0	<1.0	<1.0UJ	<1.0	<1.0
Bromodichloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0
Bromoform	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0
Bromomethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0
Carbon disulfide	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0
Carbon tetrachloride	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0
Chlorobenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0
Chloroethane	ug/l	<10	<10	16.2	16.8	<10	<10	<10UJ	<10	<10
Chloroform	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0
Chloromethane	ug/l	<10	<10	<10	<10	<10	<10	<10UJ	<10	<10
Chloroprene	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0
Dibromochloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0
Dibromomethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0
Dichlorodifluoromethane	ug/l	<10	<10	<10	<10	<10	<10	<10UJ	<10	<10
Ethyl benzene	ug/l	<1.0	<1.0	28.9	27.6	<1.0	<1.0	<1.0UJ	<1.0	<1.0
Ethyl methacrylate	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0
Fluorotrichloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	3.2	<1.0	<1.0UJ	<1.0	<1.0
Iodomethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0
Methacrylonitrile	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0
Methyl ethyl ketone (MEK)	ug/l	R	R	R	R	R	R	R	R	R
Methyl isobutyl ketone (MIBK)	ug/l	<10	<10	<10	<10	<10	<10	<10UJ	<10	<10

Table B-3. VOCs Analytical Results for Upper Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	GM-26 03/03/98	GM-6 03/04/98	GM-8 03/04/98	DUP-56 03/04/98	HR-1 03/05/98	HR-11 03/09/98	HR-17 03/05/98	HR-9 03/06/98	ME-3 03/09/98
Volatile Organic Compounds (continued)										
Methyl methacrylate	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0
Methylene chloride	ug/l	<10	<10	<10	<10	<10	<10	<10UJ	<10	<10
Pentachloroethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0
Propionitrile	ug/l	<50	<50	<50	<50	<50	<50UJ	<50UJ	<50	<50UJ
Styrene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0
Tetrachloroethene	ug/l	<1.0	94.0	20.0	19.7	48.8	<1.0	7.0J	<1.0	75.6
Toluene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0
Trichloroethene	ug/l	<1.0	119	95.2	96.8	69.8	<1.0	4.5J	14.0	64.1
Vinyl acetate	ug/l	<10	<10	<10	<10	<10	<10	<10UJ	<10	<10
Vinyl chloride	ug/l	<2.0	2.3	10.1	10.7	<2.0	<2.0	<2.0UJ	<2.0	6.2
Xylenes, Total	ug/l	<1.0	<1.0	10.3	10.2	<1.0	<1.0	<1.0UJ	<1.0	<1.0
cis-1,2-Dichloroethene	ug/l	<1.0	82.4	56.1	57.1	10.6	1.4	<1.0UJ	20.9	36.0
cis-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0
t-1,4-Dichloro-2-butene	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0
trans-1,2-Dichloroethene	ug/l	<1.0	2.4	10	10.6	2.6	<1.0	<1.0UJ	2.8	<1.0
trans-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0

Table B-3. VOCs Analytical Results for Upper Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	ME-6 03/09/98	W-1-S 03/05/98	W-3-N 03/05/98	WSU-24 03/03/98	RB-32 03/04/98	RB-33 03/10/98	TB-36 03/03/98	TB-37 03/04/98	TB-38 03/05/98
Volatile Organic Compounds (continued)										
1,1,1,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	ug/l	2.4	<1.0	<1.0	1.7	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,3-Trichloropropane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-Dibromo-3-chloropropane	ug/l	<5.0UJ	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-Dibromoethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-Dichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Hexanone	ug/l	<10UJ	<10	<10	<10	<10	<10	<10	<10	<10
Acetone	ug/l	<20UJ	<20	<20	<20	<20	<20	<20	<20	<20
Acrolein	ug/l	<50UJ	<50UJ	<50UJ	<50	<50	<50	<50	<50	<50UJ
Acrylonitrile	ug/l	<50	<50	<50	<50	<50	<50	<50	<50	<50
Allyl chloride	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromodichloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromoform	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromomethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Carbon disulfide	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon tetrachloride	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroethane	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chloroform	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	4.6	<1.0	<1.0	<1.0
Chloromethane	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chloroprene	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dibromochloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromomethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dichlorodifluoromethane	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ethyl benzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethyl methacrylate	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Fluorotrichloromethane	ug/l	<1.0	3.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Iodomethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Methacrylonitrile	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Methyl ethyl ketone (MEK)	ug/l	R	R	R	R	<10	<10	R	R	R
Methyl isobutyl ketone (MIBK)	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10

Table B-3. VOCs Analytical Results for Upper Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	ME-6 03/09/98	W-1-S 03/05/98	W-3-N 03/05/98	WSU-24 03/03/98	RB-32 03/04/98	RB-33 03/10/98	TB-36 03/03/98	TB-37 03/04/98	TB-38 03/05/98
Volatile Organic Compounds (continued)										
Methyl methacrylate	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Methylene chloride	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Pentachloroethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Propionitrile	ug/l	<50UJ	<50	<50	<50	<50	<50	<50	<50	<50
Styrene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	ug/l	193	29.0	2.6	1.3	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene	ug/l	456	9.4	<1.0	14.2	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl acetate	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Vinyl chloride	ug/l	<2.0	<2.0	20.4	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Xylenes, Total	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	ug/l	15.2	5.0	289	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
t-1,4-Dichloro-2-butene	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/l	1.1	1.2	3.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Table B-3. VOCs Analytical Results for Upper Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	TB-39 03/06/98	TB-40 03/09/98	TB-40A 03/10/98	TB-41 03/10/98
Volatile Organic Compounds (continued)					
1,1,1,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0
1,2,3-Trichloropropane	ug/l	<5.0	<5.0	<5.0	<5.0
1,2-Dibromo-3-chloropropane	ug/l	<5.0	<5.0UJ	<5.0	<5.0
1,2-Dibromoethane	ug/l	<5.0	<5.0	<5.0	<5.0
1,2-Dichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	ug/l	<1.0	<1.0	<1.0	<1.0
2-Hexanone	ug/l	<10	<10UJ	<10	<10
Acetone	ug/l	<20	<20UJ	<20	<20
Acrolein	ug/l	<50	<50UJ	<50	<50
Acrylonitrile	ug/l	<50	<50	<50	<50
Allyl chloride	ug/l	<5.0	<5.0	<5.0	<5.0
Benzene	ug/l	<1.0	<1.0	<1.0	<1.0
Bromodichloromethane	ug/l	<1.0	<1.0	<1.0	<1.0
Bromoform	ug/l	<1.0	<1.0	<1.0	<1.0
Bromomethane	ug/l	<5.0	<5.0	<5.0	<5.0
Carbon disulfide	ug/l	<1.0	<1.0	<1.0	<1.0
Carbon tetrachloride	ug/l	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	ug/l	<1.0	<1.0	<1.0	<1.0
Chloroethane	ug/l	<10	<10	<10	<10
Chloroform	ug/l	<1.0	<1.0	<1.0	<1.0
Chloromethane	ug/l	<10	<10	<10	<10
Chloroprene	ug/l	<5.0	<5.0	<5.0	<5.0
Dibromochloromethane	ug/l	<1.0	<1.0	<1.0	<1.0
Dibromomethane	ug/l	<1.0	<1.0	<1.0	<1.0
Dichlorodifluoromethane	ug/l	<10	<10	<10	<10
Ethyl benzene	ug/l	<1.0	<1.0	<1.0	<1.0
Ethyl methacrylate	ug/l	<5.0	<5.0	<5.0	<5.0
Fluorotrichloromethane	ug/l	<1.0	<1.0	<1.0	<1.0
Iodomethane	ug/l	<5.0	<5.0	<5.0	<5.0
Methacrylonitrile	ug/l	<5.0	<5.0	<5.0	<5.0
Methyl ethyl ketone (MEK)	ug/l	<10	R	<10	<10
Methyl isobutyl ketone (MIBK)	ug/l	<10	<10	<10	<10

Table B-3. VOCs Analytical Results for Upper Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	TB-39 03/06/98	TB-40 03/09/98	TB-40A 03/10/98	TB-41 03/10/98
Volatile Organic Compounds (continued)					
Methyl methacrylate	ug/l	<5.0	<5.0	<5.0	<5.0
Methylene chloride	ug/l	<10	<10	<10	<10
Pentachloroethane	ug/l	<5.0	<5.0	<5.0	<5.0
Propionitrile	ug/l	<50	<50UJ	<50	<50
Styrene	ug/l	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	ug/l	<1.0	<1.0	<1.0	<1.0
Toluene	ug/l	<1.0	<1.0	<1.0	<1.0
Trichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0
Vinyl acetate	ug/l	<10	<10	<10	<10
Vinyl chloride	ug/l	<2.0	<2.0	<2.0	<2.0
Xylenes, Total	ug/l	<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0
cis-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0	<1.0
t-1,4-Dichloro-2-butene	ug/l	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0	<1.0

ug/l - Micrograms per liter.
DUP-56 - Duplicate of GM-8.
DUP-57 - Duplicate of GM-22.
RB - Rinseate blank.
TB - Trip blank.
R - Value is unusable.
UJ - Constituent was not detected above the reporting limit. Detection limit is estimated.
< - Constituent not detected above laboratory detection limit shown.
J - Value is estimated.

Table B-4. VOC's Results from Upper Aquifer Wells, August 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	GM-23/LF 08/26/98	GM-26 08/24/98	GM-27 08/24/98	GM-27/LF 08/26/98	DUP-65 08/26/98	GM-28 08/17/98	DUP-61 08/17/98	GM-28/LF 08/26/98
Volatile Organic Compound									
1,1,1-Trichloroethane	ug/l	4.2	<1.0	<1.0	<1.0	<1.0	1.8	1.6	10.0
1,1-Dichloroethane	ug/l	10.9	<1.0	1.7	2.0	2.1	<1.0	<1.0	2.0
1,1-Dichloroethene	ug/l	7.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	ug/l	8800	1.2	6.0	4.2	4.7	693	770	500
Trichloroethene	ug/l	1190	<1.0	89.5	104	104	98.1J	96.0	475
Vinyl chloride	ug/l	914	<2.0	6.9	8.5	9.3	<2.0	<2.0	<2.0
cis-1,2-Dichloroethene	ug/l	3710	<1.0	48.5	54.9J	60.3	38.2	35.7	127
trans-1,2-Dichloroethene	ug/l	19.4	<1.0	<1.0	<1.0	<1.0	1.3	1.2	5.0

Table B-4. VOCs Results from Upper Aquifer Wells, August 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	HR-1 08/24/98	DUP-64 08/24/98	HR-3 08/24/98	ME-6 08/24/98	RB-41 08/24/98	RB-42 08/26/98	RB-38 08/17/98	TB-47 08/17/98	TB-51 08/24/98	TB-52 08/26/98
Volatile Organic Compound											
1,1,1-Trichloroethane	ug/l	<1.0	<1.0	<1.0	26.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	ug/l	1.5	1.6	4.1	3.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	ug/l	47.1	48.2	<1.0	114	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene	ug/l	46.0	47.3	<1.0	312	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl chloride	ug/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
cis-1,2-Dichloroethene	ug/l	9.4	9.3	4.6	17.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	ug/l	1.6	1.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

ug/l - Micrograms per liter.
DUP-61 - Duplicate of GM-28.
DUP-64 - Duplicate of HR-1.
DUP-65 - Duplicate of GM-27/LF.
J - Value is estimated.
LF - Low flow groundwater sample taken as part of the bioattenuation study.
< - Constituent not detected above laboratory detection limit shown.

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Table B-5. VOCs Analytical Results for Lower Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	GM-1 03/04/98	GM-20D 03/02/98	GM-9 03/03/98	HR-12 03/09/98	DUP-58 03/09/98	HR-13 03/10/98	MT-69 03/02/98	RB-34 03/09/98	TB-35 03/02/98
Volatile Organic Compound										
1,1,1,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	ug/l	2.1	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
1,1-Dichloroethane	ug/l	<1.0	<1.0	1.2	2.5	2.5	48.3	<1.0	<1.0	<1.0
1,1-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
1,2,3-Trichloropropane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
1,2-Dibromo-3-chloropropane	ug/l	<5.0	<5.0	<5.0	<5.0UJ	<5.0UJ	<5.0UJ	<5.0	<5.0UJ	<5.0
1,2-Dibromoethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
1,2-Dichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
1,2-Dichloropropane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
2-Hexanone	ug/l	<10	<10	<10	<10UJ	<10UJ	<10UJ	<10	<10UJ	<10
Acetone	ug/l	<20	<20	<20	<20UJ	<20UJ	<20UJ	<20	<20UJ	<20
Acrolein	ug/l	<50	<50	<50	R	R	R	<50	R	<50
Acrylonitrile	ug/l	<50	<50	<50	<50	<50	<50UJ	<50	<50	<50
Allyl chloride	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Benzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Bromodichloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Bromoform	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Bromomethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Carbon disulfide	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Carbon tetrachloride	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Chlorobenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Chloroethane	ug/l	<10	<10	<10	<10	<10	<10UJ	<10	<10	<10
Chloroform	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	1.1	<1.0
Chloromethane	ug/l	<10	<10	<10	<10	<10	<10UJ	<10	<10	<10
Chloroprene	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Dibromochloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Dibromomethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Dichlorodifluoromethane	ug/l	<10	<10	<10	<10	<10	<10UJ	<10	<10	<10
Ethyl benzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Ethyl methacrylate	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Fluorotrichloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Iodomethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Methacrylonitrile	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Methyl ethyl ketone (MEK)	ug/l	R	R	R	R	R	R	R	R	<10
Methyl isobutyl ketone (MIBK)	ug/l	<10	<10	<10	<10UJ	<10UJ	<10UJ	<10	<10UJ	<10

Table B-5. VOCs Analytical Results for Lower Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	GM-1 03/04/98	GM-20D 03/02/98	GM-9 03/03/98	HR-12 03/09/98	DUP-58 03/09/98	HR-13 03/10/98	MT-69 03/02/98	RB-34 03/09/98	TB-35 03/02/98
Volatile Organic Compound (continued)										
Methyl methacrylate	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Methylene chloride	ug/l	<10	<10	<10	<10	<10	<10UJ	<10	<10	<10
Pentachloroethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
Propionitrile	ug/l	<50	<50	<50	R	R	R	<50	R	<50
Styrene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Tetrachloroethene	ug/l	4.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Toluene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
Trichloroethene	ug/l	52.1	<1.0	7.7	<1.0	<1.0	2.8	<1.0	<1.0	<1.0
Vinyl acetate	ug/l	<10	<10	<10	<10	<10	<10UJ	<10	<10	<10
Vinyl chloride	ug/l	<2.0	<2.0	<2.0	2.7	2.7	<2.0UJ	<2.0	<2.0	<2.0
Xylenes, Total	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	ug/l	<1.0	<1.0	2.1	2.4	2.4	23.3	<1.0	<1.0	<1.0
cis-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0
t-1,4-Dichloro-2-butene	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0UJ	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	3.3	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0UJ	<1.0	<1.0	<1.0

Table B-5. VOC's Analytical Results for Lower Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	TB-36 03/03/98	TB-37 03/04/98	TB-40 03/09/98	TB-40A 03/10/98	TB-41 03/10/98
Volatile Organic Compound						
1,1,1,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,3-Trichloropropane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-Dibromo-3-chloropropane	ug/l	<5.0	<5.0	<5.0UJ	<5.0	<5.0
1,2-Dibromoethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-Dichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
2-Hexanone	ug/l	<10	<10	<10UJ	<10	<10
Acetone	ug/l	<20	<20	<20UJ	<20	<20
Acrolein	ug/l	<50	<50	<50UJ	<50	<50
Acrylonitrile	ug/l	<50	<50	<50	<50	<50
Allyl chloride	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Benzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Bromodichloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Bromoform	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Bromomethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Carbon disulfide	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon tetrachloride	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroethane	ug/l	<10	<10	<10	<10	<10
Chloroform	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Chloromethane	ug/l	<10	<10	<10	<10	<10
Chloroprene	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Dibromochloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromomethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Dichlorodifluoromethane	ug/l	<10	<10	<10	<10	<10
Ethyl benzene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Ethyl methacrylate	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Fluorotrichloromethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Iodomethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Methacrylonitrile	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Methyl ethyl ketone (MEK)	ug/l	R	R	R	<10	<10
Methyl isobutyl ketone (MIBK)	ug/l	<10	<10	<10	<10	<10

Table B-5. VOCs Analytical Results for Lower Aquifer Wells, March 1998, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	TB-36 03/03/98	TB-37 03/04/98	TB-40 03/09/98	TB-40A 03/10/98	TB-41 03/10/98
Volatile Organic Compound (continued)						
Methyl methacrylate	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Methylene chloride	ug/l	<10	<10	<10	<10	<10
Pentachloroethane	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
Propionitrile	ug/l	<50	<50	<50UJ	<50	<50
Styrene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl acetate	ug/l	<10	<10	<10	<10	<10
Vinyl chloride	ug/l	<2.0	<2.0	<2.0	<2.0	<2.0
Xylenes, Total	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
t-1,4-Dichloro-2-butene	ug/l	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0

ug/l - Micrograms per liter.
DUP-58 - Duplicate of HR-12.
RB - Rinseate blank.
TB - Trip blank.
R - Value is unusable.
UJ - Constituent was not detected above the reporting limit. Detection limit is estimated.
< - Constituent not detected above laboratory detection limit shown.

Table B-6. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 34 - Excavation Area 1 and AOI 35 - Excavation Area 2, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	EA1-BH01(6-8)SL 08/28/97	DUP-39 08/28/97	EA1-BH01(12-14)SL 08/28/97	EA2-BH01(6-8)SL 08/28/97	EA2-BH01(22-24)SL 08/28/97	RB-26 08/28/97	TB-30 08/28/98
Volatile Organic Compounds								
1,1,1-Trichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
1,1,2-Trichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
1,1-Dichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
1,1-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
1,2-Dichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
1,2-Dichloroethene, Total	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
1,2-Dichloropropane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
2-Hexanone	ug/kg	<50	<50	<50	<50	<50	<10.0	<10.0
4-Methyl-2-pentanone	ug/kg	<50	<50	<50	<50	<50	<10.0	<10.0
Acetone	ug/kg	<100	<100	<100	<100	<100	<20.0	<20.0
Benzene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
Bromodichloromethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
Bromoform	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
Bromomethane	ug/kg	<25	<25	<25	<25	<25	<5.0	<5.0
Carbon disulfide	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
Carbon tetrachloride	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
Chlorobenzene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
Chloroethane	ug/kg	<50	<50	<50	<50	<50	<10.0	<10.0
Chloroform	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	2.0	<1.0
Chloromethane	ug/kg	<25	<25	<25	<25	<25	<10.0	<10.0
Dibromochloromethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
Ethylbenzene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	1.2	<1.0
Methyl ethyl ketone	ug/kg	<50	<50	<50	<50	<50	<10.0	<10.0
Methylene chloride	ug/kg	<50	<50	<50	<50	<50	<10.0	<10.0
Styrene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
Tetrachloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
Toluene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
Trichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
Vinyl chloride	ug/kg	<10	<10	<10	<10	<10	<5.0	<5.0
Xylenes	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	6.3	<2.0
cis-1,3-Dichloropropene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
trans-1,3-Dichloropropene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<1.0	<1.0
Semi-Volatile Organic Compounds								
1,2,4-Trichlorobenzene	ug/kg	<330	<330	<330	<330	<330	<10	--
1,2-Dichlorobenzene	ug/kg	<330	<330	<330	<330	<330	<10	--
1,3-Dichlorobenzene	ug/kg	<330	<330	<330	<330	<330	<10	--

Table B-6. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 34 - Excavation Area 1 and AOI 35 - Excavation Area 2, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	EA1-BH01(6-8)SL 08/28/97	DUP-39 08/28/97	EA1-BH01(12-14)SL 08/28/97	EA2-BH01(6-8)SL 08/28/97	EA2-BH01(22-24)SL 08/28/97	RB-26 08/28/97	TB-30 08/28/98
Semi-Volatile Organic Compounds (continued)								
1,4-Dichlorobenzene	ug/kg	<330	<330	<330	<330	<330	<10	--
2,4,5-Trichlorophenol	ug/kg	<330	<330	<330	<330	<330	<10	--
2,4,6-Trichlorophenol	ug/kg	<330	<330	<330	<330	<330	<10	--
2,4-Dichlorophenol	ug/kg	<330	<330	<330	<330	<330	<10	--
2,4-Dimethylphenol	ug/kg	<330	<330	<330	<330	<330	<10	--
2,4-Dinitrophenol	ug/kg	<330	<330	<330	<330	<330	<10	--
2,4-Dinitrotoluene	ug/kg	<330	<330	<330	<330	<330	<10	--
2,6-Dinitrotoluene	ug/kg	<330	<330	<330	<330	<330	<10	--
2-Chloronaphthalene	ug/kg	<330	<330	<330	<330	<330	<10	--
2-Chlorophenol	ug/kg	<330	<330	<330	<330	<330	<10	--
2-Methyl naphthalene	ug/kg	<330	<330	<330	<330	<330	<10	--
2-Methyl-4,6-dinitrophenol	ug/kg	<330	<330	<330	<330	<330	<10	--
2-Methylphenol	ug/kg	<330	<330	<330	<330	<330	<10	--
2-Nitroaniline	ug/kg	<495	<495	<495	<495	<495	<15	--
2-Nitrophenol	ug/kg	<330	<330	<330	<330	<330	<10	--
3,3'-Dichlorobenzidine	ug/kg	<1650	<1650	<1650	<1650	<1650	<50	--
3-Nitroaniline	ug/kg	<495	<495	<495	<495	<495	<15	--
4-Bromophenyl phenyl ether	ug/kg	<330	<330	<330	<330	<330	<10	--
4-Chloro-3-methylphenol	ug/kg	<330	<330	<330	<330	<330	<10	--
4-Chloroaniline	ug/kg	<330	<330	<330	<330	<330	<10	--
4-Chlorophenylphenyl ether	ug/kg	<330	<330	<330	<330	<330	<10	--
4-Methylphenol	ug/kg	<330	<330	<330	<330	<330	<10	--
4-Nitroaniline	ug/kg	<495	<495	<495	<495	<495	<15	--
4-Nitrophenol	ug/kg	<330	<330	<330	<330	<330	<10	--
Acenaphthene	ug/kg	<330	<330	<330	<330	<330	<10	--
Acenaphthylene	ug/kg	<330	<330	<330	<330	<330	<10	--
Anthracene	ug/kg	<330	<330	<330	<330	<330	<10	--
Benzo(a)anthracene	ug/kg	<330	<330	<330	<330	<330	<10	--
Benzo(a)pyrene	ug/kg	<330	<330	<330	<330	<330	<10	--
Benzo(b)fluoranthene	ug/kg	<330	<330	<330	<330	<330	<10	--
Benzo(ghi)perylene	ug/kg	<330	<330	<330	<330	<330	<10	--
Benzo(k)fluoranthene	ug/kg	<330	<330	<330	<330	<330	<10	--
Benzyl butyl phthalate	ug/kg	<330	<330	<330	<330	<330	<10	--
Bis(2-chloroethoxy)methane	ug/kg	<330	<330	<330	<330	<330	<10	--
Bis(2-chloroethyl)ether	ug/kg	<330	<330	<330	<330	<330	<10	--
Bis(2-ethylhexyl)phthalate	ug/kg	<330	<330	<330	<330	<330	<10	--
Bis(2chloroisopropyl)ether	ug/kg	<330	<330	<330	<330	<330	<10	--

Table B-6. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 34 - Excavation Area 1 and AOI 35 - Excavation Area 2, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	EA1-BH01(6-8)SL 08/28/97	DUP-39 08/28/97	EA1-BH01(12-14)SL 08/28/97	EA2-BH01(6-8)SL 08/28/97	EA2-BH01(22-24)SL 08/28/97	RB-26 08/28/97	TB-30 08/28/98
Semi-Volatile Organic Compounds (continued)								
Carbazole	ug/kg	<330	<330	<330	<330	<330	<10	--
Chrysene	ug/kg	<330	<330	<330	<330	<330	<10	--
Di-n-butylphthalate	ug/kg	<330	<330	<330	<330	<330	<10	--
Di-n-octylphthalate	ug/kg	<330	<330	<330	<330	<330	<10	--
Dibenzo(a,h)anthracene	ug/kg	<330	<330	<330	<330	<330	<10	--
Dibenzofuran	ug/kg	<330	<330	<330	<330	<330	<10	--
Diethyl phthalate	ug/kg	<330	<330	<330	<330	<330	<10	--
Dimethyl phthalate	ug/kg	<330	<330	<330	<330	<330	<10	--
Fluoranthene	ug/kg	449	<330	<330	402	<330	<10	--
Fluorene	ug/kg	<330	<330	<330	<330	<330	<10	--
Hexachloro-1,3-butadiene	ug/kg	<330	<330	<330	<330	<330	<10	--
Hexachlorobenzene	ug/kg	<330	<330	<330	<330	<330	<10	--
Hexachlorocyclopentadiene	ug/kg	<660	<660	<660	<660	<660	<20	--
Hexachloroethane	ug/kg	<330	<330	<330	<330	<330	<10	--
Indeno(1,2,3-cd)pyrene	ug/kg	<330	<330	<330	<330	<330	<10	--
Isophorone	ug/kg	<330	<330	<330	<330	<330	<10	--
N-Nitrosodi-n-propylamine	ug/kg	<330	<330	<330	<330	<330	<10	--
N-Nitrosodiphenylamine	ug/kg	<330	<330	<330	<330	<330	<10	--
Naphthalene	ug/kg	<330	<330	<330	<330	<330	<10	--
Nitrobenzene	ug/kg	<330	<330	<330	<330	<330	<10	--
Pentachlorophenol	ug/kg	<330	<330	<330	<330	<330	<10	--
Phenanthrene	ug/kg	<330	<330	<330	<330	<330	<10	--
Phenol	ug/kg	<330	<330	<330	<330	<330	<10	--
Pyrene	ug/kg	450	<330	<330	472	<330	<10	--
Polychlorinated Biphenyls								
Aroclor 1016	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500	<0.200	--
Aroclor 1221	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500	<0.200	--
Aroclor 1232	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500	<0.200	--
Aroclor 1242	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500	<0.200	--
Aroclor 1248	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500	<0.200	--
Aroclor 1254	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500	<0.200	--
Aroclor 1260	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500	<0.200	--
Metals								
Antimony	mg/kg	<16	<16	<32	<33	<33	<0.100	--
Arsenic	mg/kg	46.5J	124J	3.18	3.16	3.24	<0.005	--
Barium	mg/kg	58.2J	66.9J	22J	53.8J	15J	<0.020	--
Beryllium	mg/kg	0.9	0.8	<2.0	<2.0	<2.0	<0.005	--

Table B-6. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 34 - Excavation Area 1 and AOI 35 - Excavation Area 2, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	EA1-BH01(6-8)SL 08/28/97	DUP-39 08/28/97	EA1-BH01(12-14)SL 08/28/97	EA2-BH01(6-8)SL 08/28/97	EA2-BH01(22-24)SL 08/28/97	RB-26 08/28/97	TB-30 08/28/98
Metals (continued)								
Cadmium	mg/kg	<3.9	<4.9	<9.6	<9.9	<9.9	<0.030	--
Chromium	mg/kg	12	15.1	<13	13	<13	<0.040	--
Cobalt	mg/kg	7.6	6.52	<6.4	<6.6	<6.6	<0.020	--
Copper	mg/kg	15.3	15.1	<6.4	<6.6	<6.6	<0.020	--
Lead	mg/kg	18	17.8	3.50	17.4	4.32	<0.005	--
Manganese	mg/kg	331	277	714	299	311	<0.010	--
Mercury	mg/kg	0.025	0.032	<0.010	0.012	<0.010	<0.0002	--
Nickel	mg/kg	18.6	15.3	24	7.3	7.6	<0.010	--
Selenium	mg/kg	<1.63UJ	<1.64UJ	<1.66UJ	<1.61UJ	<1.64UJ	<0.005	--
Silver	mg/kg	<5.2	<1.3	<13	<13	<13	<0.040	--
Thallium	mg/kg	<0.500	<0.500	0.927	<0.500	0.683	<0.010	--
Vanadium	mg/kg	20.7J	24.9J	<16UJ	<16UJ	<17UJ	<0.050	--
Zinc	mg/kg	104J	141J	20J	49J	28J	<0.050	--

ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.
SL - Soil.
DUP-39 - Duplicate of EA1-BH01(6-8)/SL.
J - Value is estimated.
UJ - Constituent was not detected above the reporting limit. Detection limit is estimated.
RB-26 - Rinseate blank, metals results reported in milligrams per liter; VOC, SVOC and PCB results reported in micrograms per liter.
TB-30 - Trip blank, results reported in micrograms per liter.
< - Constituents not detected above laboratory detection limit shown.

Table B-7. PCBs and Metals Analytical Results for Soil, AOI 13 - Buildings 4, 6, and 13, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	BDG-DP1-8/SL 02/19/98	BDG-DP13-4/SL 02/19/98	RB-28 02/19/98	TB-32 02/19/98
Volatile Organic Compounds					
1,1,1-Trichloroethane	ug/l	--	--	<1.0	<1.0
1,1,2,2-Tetrachloroethane	ug/l	--	--	<1.0	<1.0
1,1,2-Trichloroethane	ug/l	--	--	<1.0	<1.0
1,1-Dichloroethane	ug/l	--	--	<1.0	<1.0
1,1-Dichloroethene	ug/l	--	--	<1.0	<1.0
1,2-Dichloroethane	ug/l	--	--	<1.0	<1.0
1,2-Dichloroethene, Total	ug/l	--	--	<1.0	<1.0
1,2-Dichloropropane	ug/l	--	--	<1.0	<1.0
2-Hexanone	ug/l	--	--	<10.0	<10.0
4-Methyl-2-Pentanone	ug/l	--	--	<10.0	<10.0
Acetone	ug/l	--	--	<20	<20UJ
Benzene	ug/l	--	--	<1.0	<1.0
Bromodichloromethane	ug/l	--	--	<1.0	<1.0
Bromoform	ug/l	--	--	<1.0	<1.0
Bromomethane	ug/l	--	--	<5.0	<5.0
Carbon disulfide	ug/l	--	--	<1.0	<1.0
Carbon tetrachloride	ug/l	--	--	<1.0	<1.0
Chlorobenzene	ug/l	--	--	<1.0	<1.0
Chloroethane	ug/l	--	--	<10.0	<10.0
Chloroform	ug/l	--	--	<1.0	<1.0
Chloromethane	ug/l	--	--	<10.0	<10.0
Dibromochloromethane	ug/l	--	--	<1.0	<1.0
Ethylbenzene	ug/l	--	--	<1.0	<1.0
Methyl ethyl ketone	ug/l	--	--	R	R
Methylene chloride	ug/l	--	--	<10.0	<10.0
Styrene	ug/l	--	--	<1.0	<1.0
Tetrachloroethene	ug/l	--	--	<1.0	<1.0
Toluene	ug/l	--	--	<1.0	<1.0
Trichloroethene	ug/l	--	--	<1.0	<1.0
Vinyl chloride	ug/l	--	--	<2.0	<2.0
Xylenes	ug/l	--	--	<1.0	<1.0
cis-1,3-Dichloropropene	ug/l	--	--	<1.0	<1.0
trans-1,3-Dichloropropene	ug/l	--	--	<1.0	<1.0

Table B-7. PCBs and Metals Analytical Results for Soil, AOI 13 - Buildings 4, 6, and 13, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	BDG-DP1-8/SL 02/19/98	BDG-DP13-4/SL 02/19/98	RB-28 02/19/98	TB-32 02/19/98
Polychlorinated Biphenyls					
Aroclor 1016	mg/kg	<0.560	--	<0.200	--
Aroclor 1221	mg/kg	<0.560	--	<0.200	--
Aroclor 1232	mg/kg	<0.560	--	<0.200	--
Aroclor 1242	mg/kg	<0.560	--	<0.200	--
Aroclor 1248	mg/kg	<0.560	--	<0.200	--
Aroclor 1254	mg/kg	7.86J	--	<0.200	--
Aroclor 1260	mg/kg	<0.560	--	<0.200	--
Metals					
Antimony	mg/kg	--	<7.2UJ	<0.100	--
Arsenic	mg/kg	--	6.19	<0.005	--
Barium	mg/kg	--	103J	<0.020	--
Beryllium	mg/kg	--	0.6	<0.005	--
Cadmium	mg/kg	--	<1.1	<0.030	--
Chromium	mg/kg	--	9.7	<0.040	--
Cobalt	mg/kg	--	4.16	<0.020	--
Copper	mg/kg	--	13.1	<0.020	--
Lead	mg/kg	--	23.1	<0.005	--
Manganese	mg/kg	--	611	<0.010	--
Mercury	mg/kg	--	0.182J	<0.0002	--
Nickel	mg/kg	--	10.9	<0.010	--
Selenium	mg/kg	--	0.643J	<0.005	--
Silver	mg/kg	--	<1.4	<0.040	--
Thallium	mg/kg	--	<0.600	<0.010	--
Vanadium	mg/kg	--	16.5	<0.050	--
Zinc	mg/kg	--	82.3	<0.050	--

ug/l - Micrograms per liter.
mg/kg - Milligrams per kilogram.
SL - Soil.
TB - Trip blank; results presented in micrograms per liter.
RB - Rinseate blank; VOC and PCB results presented in micrograms per liter, metals results presented in milligrams per liter.
R - Value is unusable.
-- - Not analyzed.
J - Value is estimated.
UJ - Constituent was not detected above the reporting limit. Detection limit is estimated.
< - Constituent not detected above laboratory detection limit shown.

Table B-8. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 36 - Former Southwest ASTs, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	AST-BH1-2/SL 02/19/98	AST-BH1-22/SL 02/19/98	AST-BH2-2/SL 02/14/98	AST-BH2-24/SL 02/14/98	DUP-53 02/17/98	RB-29 02/19/98	TB-32 02/19/98
Volatile Organic Compound								
1,1,1-Trichloroethane	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
1,1,2,2-Tetrachloroethane	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
1,1,2-Trichloroethane	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
1,1-Dichloroethane	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
1,1-Dichloroethene	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
1,2-Dichloroethane	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
1,2-Dichloroethene, Total	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
1,2-Dichloropropane	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
2-Hexanone	ug/kg	<59.5	<53.6	<61.1	<56	<54.5	<10	<10
4-Methyl-2-pentanone	ug/kg	<59.5	<53.6	<61.1	<56	<54.5	<10	<10
Acetone	ug/kg	<119	<107	<122	<112	<109	<20	<20UJ
Benzene	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
Bromodichloromethane	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
Bromoform	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
Bromomethane	ug/kg	<29.8	<26.8	<30.6	<28	<27.3	<5.0	<5.0
Carbon disulfide	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
Carbon tetrachloride	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
Chlorobenzene	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
Chloroethane	ug/kg	<59.5	<53.6	<61.1	<56	<54.5	<10	<10
Chloroform	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
Chloromethane	ug/kg	<59.5	<53.6	<61.1	<56	<54.5	<10	<10
Dibromochloromethane	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
Ethylbenzene	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
Methyl ethyl ketone	ug/kg	R	R	R	R	R	R	R
Methylene chloride	ug/kg	<59.5	<53.6	<61.1	<56	<54.5	<10	<10
Styrene	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
Tetrachloroethene	ug/kg	<6.0	6.0	<6.1	<5.6	<5.5	<1.0	<1.0
Toluene	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
Trichloroethene	ug/kg	<6.0	6.5	<6.1	<5.6	5.9	<1.0	<1.0
Vinyl chloride	ug/kg	<11.9	<10.7	<12.2	<11.2	<10.9	<2.0	<2.0
Xylenes	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
cis-1,3-Dichloropropene	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
trans-1,3-Dichloropropene	ug/kg	<6.0	<5.4	<6.1	<5.6	<5.5	<1.0	<1.0
Semi-Volatile Organic Compound								
1,2,4-Trichlorobenzene	ug/kg	<393	<354	<403	<370	<360	<10	--
1,2-Dichlorobenzene	ug/kg	<393	<354	<403	<370	<360	<10	--
1,3-Dichlorobenzene	ug/kg	<393	<354	<403	<370	<360	<10	--

Table B-8. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 36 - Former Southwest ASTs, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	AST-BH1-2/SL 02/19/98	AST-BH1-22/SL 02/19/98	AST-BH2-2/SL 02/14/98	AST-BH2-24/SL 02/14/98	DUP-53 02/17/98	RB-29 02/19/98	TB-32 02/19/98
Semi-Volatile Organic Compound (continued)								
1,4-Dichlorobenzene	ug/kg	<393	<354	<403	<370	<360	<10	--
2,4,5-Trichlorophenol	ug/kg	<393	<354	<403	<370	<360	<10	--
2,4,6-Trichlorophenol	ug/kg	<393	<354	<403	<370	<360	<10	--
2,4-Dichlorophenol	ug/kg	<393	<354	<403	<370	<360	<10	--
2,4-Dimethylphenol	ug/kg	<393	<354	<403	<370	<360	<10	--
2,4-Dinitrophenol	ug/kg	<393UJ	<354UJ	<403UJ	<370UJ	<360UJ	<10UJ	--
2,4-Dinitrotoluene	ug/kg	<393	<354	<403	<370	<360	<10	--
2,6-Dinitrotoluene	ug/kg	<393	<354	<403	<370	<360	<10	--
2-Chloronaphthalene	ug/kg	<393	<354	<403	<370	<360	<10	--
2-Chlorophenol	ug/kg	<393	<354	<403	<370	<360	<10	--
2-Methyl naphthalene	ug/kg	<393	<354	<403	<370	<360	<10	--
2-Methyl-4,6-dinitrophenol	ug/kg	<393	<354	<403	<370	<360	<10	--
2-Methylphenol	ug/kg	<393	<354	<403	<370	<360	<10	--
2-Nitroaniline	ug/kg	<393	<354	<403	<370	<360	<10	--
2-Nitrophenol	ug/kg	<589	<531	<605	<554	<540	<15	--
3,3'-Dichlorobenzidine	ug/kg	<393	<354	<403	<370	<360	<10	--
3-Nitroaniline	ug/kg	<786	<708	<807	<739	<720	<50	--
4-Bromophenyl phenyl ether	ug/kg	<589	<531	<605	<554	<540	<15	--
4-Chloro-3-methylphenol	ug/kg	<393	<354	<403	<370	<360	<10	--
4-Chloroaniline	ug/kg	<393	<354	<403	<370	<360	<10	--
4-Chlorophenylphenyl ether	ug/kg	<393	<354	<403	<370	<360	<10	--
4-Methylphenol	ug/kg	<393	<354	<403	<370	<360	<10	--
4-Nitroaniline	ug/kg	<393	<354	<403	<370	<360	<10	--
4-Nitrophenol	ug/kg	<589	<531	<605	<554	<540	<15	--
Acenaphthene	ug/kg	<393	<354	<403	<370	<360	<10	--
Acenaphthylene	ug/kg	<393	<354	<403	<370	<360	<10	--
Anthracene	ug/kg	<393	<354	<403	<370	<360	<10	--
Benzo(a)anthracene	ug/kg	<393	<354	<403	<370	<360	<10	--
Benzo(a)pyrene	ug/kg	<393	<354	<403	<370	<360	<10	--
Benzo(b)fluoranthene	ug/kg	<393	<354UJ	<403UJ	<370	<360	<10	--
Benzo(ghi)perylene	ug/kg	<393	<354UJ	<403UJ	<370	<360	<10	--
Benzo(k)fluoranthene	ug/kg	<393	<354UJ	<403UJ	<370	<360	<10	--
Benzyl butyl phthalate	ug/kg	<393	<354UJ	<403UJ	<370	<360	<10	--
Bis(2-chloroethoxy)methane	ug/kg	<393	<354	<403	<370	<360	<10	--
Bis(2-chloroethyl)ether	ug/kg	<393	<354	<403	<370	<360	<10	--
Bis(2-chloroisopropyl)ether	ug/kg	<393	<354	<403	<370	<360	<10	--
Bis(2-ethylhexyl)phthalate	ug/kg	<393	1230	<403	<370	<360	<10	--

Table B-8. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 36 - Former Southwest ASTs, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	AST-BH1-2/SL 02/19/98	AST-BH1-22/SL 02/19/98	AST-BH2-2/SL 02/14/98	AST-BH2-24/SL 02/14/98	DUP-53 02/17/98	RB-29 02/19/98	TB-32 02/19/98
Semi-Volatile Organic Compound (continued)								
Carbazole	ug/kg	<393	<354	<403	<370	<360	<10	--
Chrysene	ug/kg	<393	<354	<403	<370	<360	<10	--
Di-n-butylphthalate	ug/kg	<393	<354	<403	<370	<360	<10	--
Di-n-octylphthalate	ug/kg	<393	<354UJ	<403UJ	<370	<360	<10	--
Dibenzo(a,h)anthracene	ug/kg	<393	<354UJ	<403UJ	<370	<360	<10	--
Dibenzofuran	ug/kg	<393	<354	<403	<370	<360	<10	--
Diethyl phthalate	ug/kg	<393	<354	<403	<370	<360	<10	--
Dimethyl phthalate	ug/kg	<393	<354	<403	<370	<360	<10	--
Fluoranthene	ug/kg	<393	<354	<403	<370	<360	<10	--
Fluorene	ug/kg	<393	<354	<403	<370	<360	<10	--
Hexachloro-1,3-butadiene	ug/kg	<393	<354	<403	<370	<360	<10	--
Hexachlorobenzene	ug/kg	<393	<354	<403	<370	<360	<10	--
Hexachlorocyclopentadiene	ug/kg	<786	<708	<807	<739	<720	<20	--
Hexachloroethane	ug/kg	<393	<354	<403	<370	<360	<10	--
Indeno(1,2,3-cd)pyrene	ug/kg	<393	<354UJ	<403UJ	<370	<360	<10	--
Isophorone	ug/kg	<393	<354	<403	<370	<360	<10	--
N-Nitrosodi-n-propylamine	ug/kg	<393	<354	<403	<370	<360	<10	--
N-Nitrosodiphenylamine	ug/kg	<393	<354	<403	<370	<360	<10	--
Naphthalene	ug/kg	<393	<354	<403	<370	<360	<10	--
Nitrobenzene	ug/kg	<393	<354	<403	<370	<360	<10	--
Pentachlorophenol	ug/kg	<393	<354	<403	<370	<360	<10	--
Phenanthrene	ug/kg	<393	<354	<403	<370	<360	<10	--
Phenol	ug/kg	<393	<354	<403	<370	<360	<10	--
Pyrene	ug/kg	<393	<354	<403	<370	<360	<10	--
Polychlorinated Biphenyls								
Aroclor 1016	mg/kg	<0.600	<0.540	<0.610	<0.560	<0.550	<0.230	--
Aroclor 1221	mg/kg	<0.600	<0.540	<0.610	<0.560	<0.550	<0.230	--
Aroclor 1232	mg/kg	<0.600	<0.540	<0.610	<0.560	<0.550	<0.230	--
Aroclor 1242	mg/kg	<0.600	<0.540	<0.610	<0.560	<0.550	<0.230	--
Aroclor 1248	mg/kg	<0.600	<0.540	<0.610	<0.560	<0.550	<0.230	--
Aroclor 1254	mg/kg	<0.600	<0.540	<0.610	<0.560	<0.550	<0.230	--
Aroclor 1260	mg/kg	<0.600	<0.540	<0.610	<0.560	<0.550	<0.230	--
Metals								
Antimony	mg/kg	<19UJ	<17UJ	<19.8UJ	<15UJ	<16UJ	<0.100	--
Arsenic	mg/kg	325	1.57	150	8.19J	0.639J	0.0053	--
Barium	mg/kg	86J	11J	65.2J	11J	12J	<0.020	--

Table B-8. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 36 - Former Southwest ASTs, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	AST-BH1-2/SL 02/19/98	AST-BH1-22/SL 02/19/98	AST-BH2-2/SL 02/14/98	AST-BH2-24/SL 02/14/98	DUP-53 02/17/98	RB-29 02/19/98	TB-32 02/19/98
Metals (continued)								
Beryllium	mg/kg	0.8	<0.9	0.9	0.8	0.9	<0.005	--
Cadmium	mg/kg	<1.2	<5.2	<1.2	<4.4	<4.9	<0.030	--
Chromium	mg/kg	11	<6.9	11	<5.8	<6.5	<0.040	--
Cobalt	mg/kg	7.90	<3.4	6.4	<2.9	<3.3	<0.020	--
Copper	mg/kg	25.5	6.9	18.7	6.6	8.9	<0.020	--
Lead	mg/kg	17.1	3.27	16.4	5.23	4.77	<0.005	--
Manganese	mg/kg	619	123	494	152	192	0.04	--
Mercury	mg/kg	0.033J	<0.011UJ	0.032J	<0.011UJ	<0.011UJ	<0.0002	--
Nickel	mg/kg	17.4	4.3	13.1	4.4	5.3	<0.010	--
Selenium	mg/kg	0.798J	<0.888UJ	0.808J	0.941J	<0.907UJ	<0.005	--
Silver	mg/kg	<1.5	<6.9	<1.6	<5.8	<6.5	<0.040	--
Thallium	mg/kg	<0.600	<0.540	<0.610	0.633	<0.550	<0.010	--
Vanadium	mg/kg	20.1	<8.6	14.3	<7.3	<8.2	<0.050	--
Zinc	mg/kg	67.9J	17.9J	63.6J	18.3J	20.5J	<0.050	--

ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.
SL - Soil.
DUP-53 - Duplicate of AST-BH2-24/SL.
J - Value is estimated.
UJ - Constituent was not detected above the reporting limit. Detection limit is estimated.
R - Value is unusable.
RB - Rinseate blank, metals results reported in milligrams per liter; VOC, SVOC and PCB results reported in micrograms per liter.
TB - Trip blank, VOC results reported in micrograms per liter.
< - Constituent not detected above laboratory detection limit shown.
-- - Not analyzed.

Table B-9. Arsenic Analytical Results for Soil, AOI 36 - Former Southwest ASTs, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	COMPOSITE "A" 06/10/98	DUP-59 06/10/98	COMPOSITE "B" 06/11/98	COMPOSITE "C" 06/11/98	COMPOSITE "D" 06/11/98	COMPOSITE "E" 06/10/98
Metals							
Arsenic	mg/kg	20.1J	41.6J	37.3	33.4	10.0	5.33

Table B-9. Arsenic Analytical Results for Soil, AOI 36 - Former Southwest ASTs, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	COMPOSITE "F" 06/10/98	COMPOSITE "G" 06/10/98	RB-35 06/10/98	RB-36 06/10/98
Metals					
Arsenic	mg/kg	64.9	94.6	<0.0050	<0.0050

mg/kg - Milligrams per kilogram.
J - Value is estimated.
RB - Rinseate blank; results are presented in milligrams per liter.
< - Constituent not detected above laboratory detection limit shown.

Table B-10. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH1-2/SL 02/23/98	OH-BH1-8/SL 02/23/98	OH-BH1-30/SL 02/23/98	DUP-55 02/23/98	OH-BH2-3/SL 02/20/98	OH-BH2-31/SL 02/20/98	DUP-54 02/20/98	OH-BH3-2/SL 02/23/98
Volatile Organic Compound									
1,1,1-Trichloroethane	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
1,1,2,2-Tetrachloroethane	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
1,1,2-Trichloroethane	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
1,1-Dichloroethane	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
1,1-Dichloroethene	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
1,2-Dichloroethane	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
1,2-Dichloroethene, Total	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
1,2-Dichloropropane	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
2-Hexanone	ug/kg	<51.9	<52.1	<530	<530	<53.2	<5260	<5240	<54.1
4-Methyl-2-pentanone	ug/kg	<51.9	<52.1	<530	<530	<53.2	<5260	<5240	<54.1
Acetone	ug/kg	<104	<104	<1100	<1000	<106	<10500UJ	<10500UJ	<108
Benzene	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
Bromodichloromethane	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
Bromoform	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
Bromomethane	ug/kg	<25.9	<26	<260	<260	<26.6	<2630	<2620	<27
Carbon disulfide	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
Carbon tetrachloride	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
Chlorobenzene	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
Chloroethane	ug/kg	<51.9	<52.1	<530	<530	<53.2	<5260	<5240	<54.1
Chloroform	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
Chloromethane	ug/kg	<51.9	<52.1	<530	<530	<53.2	<5260	<5240	<54.1
Dibromochloromethane	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
Ethylbenzene	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
Methyl ethyl ketone	ug/kg	R	R	R	R	R	R	R	R
Methylene chloride	ug/kg	<51.9	<52	<530	<530	<53.2	<5260	<5240	<54.1
Styrene	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
Tetrachloroethene	ug/kg	53.7	125	505	377	56.4	7690	9290	41.4
Toluene	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
Trichloroethene	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
Vinyl chloride	ug/kg	<10.4	<10.4	<110	<100	<10.6	<1050	<1050	<11
Xylenes	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
cis-1,3-Dichloropropene	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
trans-1,3-Dichloropropene	ug/kg	<5.2	<5.2	<53	<53	<5.3	<530	<520	<5.4
Semi-Volatile Organic Compound									
1,2,4-Trichlorobenzene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
1,2-Dichlorobenzene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
1,3-Dichlorobenzene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357

Table B-10. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH1-2/SL 02/23/98	OH-BH1-8/SL 02/23/98	OH-BH1-30/SL 02/23/98	DUP-55 02/23/98	OH-BH2-3/SL 02/20/98	OH-BH2-31/SL 02/20/98	DUP-54 02/20/98	OH-BH3-2/SL 02/23/98
Semi-Volatile Organic Compound (continued)									
1,4-Dichlorobenzene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
2,4,5-Trichlorophenol	ug/kg	<342	<344	<350	<347	<3500	<347	<346	<357
2,4,6-Trichlorophenol	ug/kg	<342	<344	<350	<347	<3500	<347	<346	<357
2,4-Dichlorophenol	ug/kg	<342	<344	<350	<347	<3500	<347	<346	<357
2,4-Dimethylphenol	ug/kg	<342	<344	<350	<347	<3500	<347	<346	<357
2,4-Dinitrophenol	ug/kg	<342	<344	<350	<347	<3500UJ	<347UJ	<346UJ	<357
2,4-Dinitrotoluene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
2,6-Dinitrotoluene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
2-Chloronaphthalene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
2-Chlorophenol	ug/kg	<342	<344	<350	<347	<3500	<347	<346	<357
2-Methyl naphthalene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
2-Methyl-4,6-dinitrophenol	ug/kg	<342	<344	<350	<347	<3500UJ	<347UJ	<346UJ	<357
2-Methylphenol	ug/kg	<342	<344	<350	<347	<3500	<347	<346	<357
2-Nitroaniline	ug/kg	<513	<516	<525	<521	<5270	<521	<518	<535
2-Nitrophenol	ug/kg	<342	<344	<350	<347	<3500	<347	<346	<357
3,3'-Dichlorobenzidine	ug/kg	<685	<688	<701	<695	<7020	<695	<691	<714
3-Nitroaniline	ug/kg	<513	<516	<525	<521	<5270	<521	<518	<535
4-Bromophenyl phenyl ether	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
4-Chloro-3-methylphenol	ug/kg	<342	<344	<350	<347	<3500	<347	<346	<357
4-Chloroaniline	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
4-Chlorophenylphenyl ether	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
4-Methylphenol	ug/kg	<342	<344	<350	<347	<3500	<347	<346	<357
4-Nitroaniline	ug/kg	<513	<516	<525	<521	<5270	<521	<518	<535
4-Nitrophenol	ug/kg	<342	<344	<350	<347	<3500	<347	<346	<357
Acenaphthene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Acenaphthylene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Anthracene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Benzo(a)anthracene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Benzo(a)pyrene	ug/kg	<342UJ	<344	<350	<347	<3510	<347	<346	<357
Benzo(b)fluoranthene	ug/kg	<342UJ	<344	<350	<347	<3510	<347	<346	<357
Benzo(ghi)perylene	ug/kg	<342UJ	<344	<350	<347	<3510	<347	<346	<357
Benzo(k)fluoranthene	ug/kg	<342UJ	<344	<350	<347	<3510	<347	<346	<357
Benzyl butyl phthalate	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Bis(2-chloroethoxy)methane	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Bis(2-chloroethyl)ether	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Bis(2-chloroisopropyl)ether	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Bis(2-ethylhexyl)phthalate	ug/kg	<550	<344	<350	<347	<3510	<347	<346	<357

Table B-10. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH1-2/SL 02/23/98	OH-BH1-8/SL 02/23/98	OH-BH1-30/SL 02/23/98	DUP-55 02/23/98	OH-BH2-3/SL 02/20/98	OH-BH2-31/SL 02/20/98	DUP-54 02/20/98	OH-BH3-2/SL 02/23/98
Semi-Volatile Organic Compound (continued)									
Bis(2chloroisopropyl)ether	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Carbazole	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Chrysene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Di-n-butylphthalate	ug/kg	<342UJ	<344	<350	<347	<3510	<347	<346	<357
Di-n-octylphthalate	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Dibenzo(a,h)anthracene	ug/kg	<342UJ	<344	<350	<347	<3510UJ	<347UJ	<346UJ	<357
Dibenzofuran	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Diethyl phthalate	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Dimethyl phthalate	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Fluoranthene	ug/kg	<342	<344	<350	<347	4570	<347	<346	<357
Fluorene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Hexachloro-1,3-butadiene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Hexachlorobenzene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Hexachlorocyclopentadiene	ug/kg	<685	<688	<701	<695	<7020UJ	<695UJ	<691UJ	<714
Hexachloroethane	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Indeno(1,2,3-cd)pyrene	ug/kg	<342UJ	<344	<350	<347	<3510	<347	<346	<357
Isophorone	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
N-Nitrosodi-n-propylamine	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
N-Nitrosodiphenylamine	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Naphthalene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Nitrobenzene	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Pentachlorophenol	ug/kg	<342	<344	<350	<347	<3510	<347	<346	<357
Phenanthrene	ug/kg	<342	<344	<350	<347	<3500	<347	<346	<357
Phenol	ug/kg	<342	<344	<350	<347	3770	<347	<346	<357
Pyrene	ug/kg	<342	<344	<350	<347	<3500	<347	<346	<357
Polychlorinated Biphenyls						<3510	<347	<346	<357
Aroclor 1016	mg/kg	<0.520	<0.520	<0.530	<0.530	<0.530	<0.530	<0.520	<0.540
Aroclor 1221	mg/kg	<0.520	<0.520	<0.530	<0.530	<0.530	<0.530	<0.520	<0.540
Aroclor 1232	mg/kg	<0.520	<0.520	<0.530	<0.530	<0.530	<0.530	<0.520	<0.540
Aroclor 1242	mg/kg	<0.520	<0.520	<0.530	<0.530	<0.530	<0.530	<0.520	<0.540
Aroclor 1248	mg/kg	<0.520	<0.520	<0.530	<0.530	<0.530	<0.530	<0.520	<0.540
Aroclor 1254	mg/kg	<0.520	<0.520	<0.530	<0.530	<0.530	<0.530	<0.520	<0.540
Aroclor 1260	mg/kg	<0.520	<0.520	<0.530	<0.530	<0.530	<0.530	<0.520	<0.540
Metals									
Antimony	mg/kg	<17UJ	<17UJ	<17UJ	<20UJ	<18	<16	<17	<16UJ
Arsenic	mg/kg	2.76J	1.93J	1.53J	3.01J	2.09J	1.49	0.561J	10.4J
Barium	mg/kg	11	8.3	8.1	11	30.2J	11J	9.6J	30.2

Table B-10. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH1-2/SL 02/23/98	OH-BH1-8/SL 02/23/98	OH-BH1-30/SL 02/23/98	DUP-55 02/23/98	OH-BH2-3/SL 02/20/98	OH-BH2-31/SL 02/20/98	DUP-54 02/20/98	OH-BH3-2/SL 02/23/98
Metals (continued)									
Beryllium	mg/kg	1.0	<0.800	0.8	<1.0	1.1	0.9	0.9	1
Cadmium	mg/kg	<5.1	<5.1	<5.0	<6.1	<5.3	<4.8	<4.9	<4.9
Chromium	mg/kg	8.6	<6.9	<6.7	<8.2	<7.0	<6.4	<6.6	<6.5
Cobalt	mg/kg	<3.4	<3.4	<3.4	<4.1	<3.5	<3.3	<3.2	3.9
Copper	mg/kg	3.9	7	5.5	7.4	6.0	7.4	7.5	12
Lead	mg/kg	3.67	2.72	3.55J	6.39J	5.47	4.11	4.14	9.39
Manganese	mg/kg	142	220	161J	288J	227	184	188	302
Mercury	mg/kg	<0.010	0.012	<0.011	<0.011	0.029	<0.011	<0.010	0.052
Nickel	mg/kg	25.2	5.8	4.0	6	4.3	5.9	4.9	8.5
Selenium	mg/kg	<1.66	<1.62	<0.881	<1.67	<1.57UJ	<1.67UJ	<0.780UJ	<0.805
Silver	mg/kg	<6.7	<6.9	<6.7	<8.2	<7.0	<6.4	<6.6	<6.5
Thallium	mg/kg	<0.520	<0.520	<0.530	<0.530	<0.530	<0.530	<0.520	<0.540
Vanadium	mg/kg	<8.5	<8.5	<8.4	<10	<8.8	<8.0	<8.2	<8.1
Zinc	mg/kg	16J	17.6J	16J	19J	26.2J	19J	18.6J	42.6J

Table B-10. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH3-16/SL 02/23/98	OH-BH3-26/SL 02/23/98	OH-BH4-2/SL 02/23/98	OH-BH4-8/SL 02/23/98	OH-BH4-24/SL 02/23/98	RB-30 02/23/98	RB-31 02/23/98	TB-33 02/20/98	TB-34 02/23/98
Volatile Organic Compound										
1,1,1-Trichloroethane	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
1,2-Dichloroethene, Total	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
2-Hexanone	ug/kg	<52.4	<550	<53	<54.9	<550	<10	<10	<10	<10
4-Methyl-2-pentanone	ug/kg	<52.4	<550	<53	<55	<550	<10	<10	<10	<10
Acetone	ug/kg	<105	<1100	<106	<110	<1100	<20UJ	<20UJ	<20	<20UJ
Benzene	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
Bromodichloromethane	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
Bromoform	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
Bromomethane	ug/kg	<26	<280	<26.5	<27.5	<280	<5.0	<5.0	<5.0	<5.0
Carbon disulfide	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
Carbon tetrachloride	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
Chloroethane	ug/kg	<52.4	<550	<53	<55	<550	<10	<10	<10	<10
Chloroform	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
Chloromethane	ug/kg	<52	<550	<53	<54.9	<550	<10	<10	<10	<10
Dibromochloromethane	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
Methyl ethyl ketone	ug/kg	R	R	R	R	R	R	R	R	R
Methylene chloride	ug/kg	<52.4	<550	<53	<54.9	<550	<10	<10	<10	<10
Styrene	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	ug/kg	29.3	247	123	113	474	<1.0	<1.0	<1.0	<1.0
Toluene	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
Trichloroethene	ug/kg	<5.2	521	20.6	<5.5	<55	<1.0	<1.0	<1.0	<1.0
Vinyl chloride	ug/kg	<11	<110	<10.6	<11	<110	<2.0	<2.0	<2.0	<2.0
Xylenes	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
cis-1,3-Dichloropropene	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	ug/kg	<5.2	<55	<5.3	<5.5	<55	<1.0	<1.0	<1.0	<1.0
Semi-Volatile Organic Compound										
1,2,4-Trichlorobenzene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
1,2-Dichlorobenzene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
1,3-Dichlorobenzene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--

Table B-10. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH3-16/SL 02/23/98	OH-BH3-26/SL 02/23/98	OH-BH4-2/SL 02/23/98	OH-BH4-8/SL 02/23/98	OH-BH4-24/SL 02/23/98	RB-30 02/23/98	RB-31 02/23/98	TB-33 02/20/98	TB-34 02/23/98
Semi-Volatile Organic Compound (continued)										
1,4-Dichlorobenzene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
2,4,5-Trichlorophenol	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
2,4,6-Trichlorophenol	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
2,4-Dichlorophenol	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
2,4-Dimethylphenol	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
2,4-Dinitrophenol	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
2,4-Dinitrotoluene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
2,6-Dinitrotoluene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
2-Chloronaphthalene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
2-Chlorophenol	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
2-Methyl naphthalene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
2-Methyl-4,6-dinitrophenol	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
2-Methylphenol	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
2-Nitroaniline	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
2-Nitrophenol	ug/kg	<518	<544	<524	<544	<544	<15	<15	--	--
3,3'-Dichlorobenzidine	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
3-Nitroaniline	ug/kg	<691	<725	<699	<725	<725	<50	<50	--	--
4-Bromophenyl phenyl ether	ug/kg	<518	<544	<524	<544	<544	<15	<15	--	--
4-Chloro-3-methylphenol	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
4-Chloroaniline	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
4-Chlorophenylphenyl ether	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
4-Methylphenol	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
4-Nitroaniline	ug/kg	<518	<544	<524	<544	<544	<15	<15	--	--
4-Nitrophenol	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Acenaphthene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Acenaphthylene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Anthracene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Benzo(a)anthracene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Benzo(a)pyrene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Benzo(b)fluoranthene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Benzo(ghi)perylene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Benzo(k)fluoranthene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Benzyl butyl phthalate	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Bis(2-chloroethoxy)methane	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Bis(2-chloroethyl)ether	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Bis(2-chloroisopropyl)ether	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Bis(2-ethylhexyl)phthalate	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--

Table B-10. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH3-16/SL 02/23/98	OH-BH3-26/SL 02/23/98	OH-BH4-2/SL 02/23/98	OH-BH4-8/SL 02/23/98	OH-BH4-24/SL 02/23/98	RB-30 02/23/98	RB-31 02/23/98	TB-33 02/20/98	TB-34 02/23/98
Semi-Volatile Organic Compound (continued)										
Bis(2chloroisopropyl)ether	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Carbazole	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Chrysene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Di-n-butylphthalate	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Di-n-octylphthalate	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Dibenzo(a,h)anthracene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Dibenzofuran	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Diethyl phthalate	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Dimethyl phthalate	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Fluoranthene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Fluorene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Hexachloro-1,3-butadiene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Hexachlorobenzene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Hexachlorocyclopentadiene	ug/kg	<691	<725	<699	<725	<725	<20	<20	--	--
Hexachloroethane	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Indeno(1,2,3-cd)pyrene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Isophorone	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
N-Nitrosodi-n-propylamine	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
N-Nitrosodiphenylamine	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Naphthalene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Nitrobenzene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Pentachlorophenol	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Phenanthrene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Phenol	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Pyrene	ug/kg	<346	<363	<350	<363	<363	<10	<10	--	--
Polychlorinated Biphenyls										
Aroclor 1016	mg/kg	<0.520	<0.550	<0.530	<0.550UJ	<0.550	<0.210	<0.220	--	--
Aroclor 1221	mg/kg	<0.520	<0.550	<0.530	<0.550UJ	<0.550	<0.210	<0.220	--	--
Aroclor 1232	mg/kg	<0.520	<0.550	<0.530	<0.550UJ	<0.550	<0.210	<0.220	--	--
Aroclor 1242	mg/kg	<0.520	<0.550	<0.530	<0.550UJ	<0.550	<0.210	<0.220	--	--
Aroclor 1248	mg/kg	<0.520	<0.550	<0.530	<0.550UJ	<0.550	<0.210	<0.220	--	--
Aroclor 1254	mg/kg	<0.520	<0.550	<0.530	<0.550UJ	<0.550	<0.210	<0.220	--	--
Aroclor 1260	mg/kg	<0.520	<0.550	<0.530	<0.550UJ	<0.550	<0.210	<0.220	--	--
Metals										
Antimony	mg/kg	<17UJ	<14UJ	<17UJ	<18UJ	<18UJ	<0.100	<0.100	--	--
Arsenic	mg/kg	3.88J	2.51J	3.54J	3.91J	2.59J	<0.005	<0.005	--	--
Barium	mg/kg	14	16	13	7.7	24.3	<0.020	<0.020	--	--

Table B-10. VOCs, SVOCs, PCBs, and Metals Analytical Results for Soil, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH3-16/SL 02/23/98	OH-BH3-26/SL 02/23/98	OH-BH4-2/SL 02/23/98	OH-BH4-8/SL 02/23/98	OH-BH4-24/SL 02/23/98	RB-30 02/23/98	RB-31 02/23/98	TB-33 02/20/98	TB-34 02/23/98
Metals (continued)										
Beryllium	mg/kg	0.9	0.9	0.8	<0.900	<0.900	<0.005	<0.005	--	--
Cadmium	mg/kg	<5.1	<4.3	<5.0	<5.3	<5.3	<0.030	<0.030	--	--
Chromium	mg/kg	<6.8	<5.7	<6.6	<7.0	<7.0	<0.040	<0.040	--	--
Cobalt	mg/kg	4.1	<2.9	<3.3	<3.5	<3.5	<0.020	<0.020	--	--
Copper	mg/kg	13	7.5	6.1	6.8	7	<0.020	<0.020	--	--
Lead	mg/kg	4.36	4.80	6.06	4.36	4.56	<0.005	<0.005	--	--
Manganese	mg/kg	331	190	159	151	178	0.038	<0.010	--	--
Mercury	mg/kg	0.014	0.014	0.013	<0.011	0.014	<0.0002	<0.0002	--	--
Nickel	mg/kg	14	6.6	5.6	5.6	5.4	<0.010	<0.010	--	--
Selenium	mg/kg	<0.819	<0.860	<0.863	<0.890	<0.786	<0.005	<0.005	--	--
Silver	mg/kg	<6.8	<5.7	<6.6	<7.0	<7.0	<0.040	<0.040	--	--
Thallium	mg/kg	<0.520	<0.550	<0.530	<0.550	<0.550	<0.010	<0.010	--	--
Vanadium	mg/kg	<8.5	<7.1	<8.3	<8.8	<8.7	<0.050	<0.050	--	--
Zinc	mg/kg	227J	22.6J	22.0J	26.0J	27.8J	<0.050	<0.050	--	--

ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.
DUP-54 - Duplicate of OH-BH2-31/SL.
DUP-55 - Duplicate of OH-BH1-30/SL.
J - Value is estimated.
R - Value is unusable.
UJ - Constituent was not detected above the reporting limit. Detection limit is estimated.
RB - Rinseate blank, metals results reported in milligrams per liter; VOC, SVOC and PCB results reported in micrograms per liter.
TB - Trip blank, results reported in micrograms per liter.
< - Constituent not detected above laboratory detection limit shown.
-- - Not analyzed.

Table B-11. VOC Analytical Results for Additional Soil Investigation, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	GM-27-2/SL 08/04/98	GM-27-20/SL 08/04/98	GM-27-24/SL 08/04/98	GM-28-26/SL 08/05/98	GM-23A-2/SL 11/05/98	GM-23A-4/SL 11/05/98	GM-23A-5/SL 11/05/98	DUP-68 11/05/98
1,1,1-Trichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Tetrachloroethene	ug/kg	40.3	743	1510J	27.0J	<5.0	9440	908J	1000
Trichloroethene	ug/kg	<5.0	6.9	16.4	<5.0UJ	<5.0	6.7J	<5.0	5.1
Vinyl chloride	ug/kg	<10.0UJ	<10.0	<10.0	<10.0	<2.0	<2.0	<2.0	<2.0
cis-1,2-Dichloroethene	ug/kg	<5.0	<5.0	6.0	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table B-11. VOC Analytical Results for Additional Soil Investigation, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	GM-23A-10/SL 11/05/98	OH-BH2A-14/SL 11/02/98	DUP-66 11/02/98	OH-BH3A-22/SL 11/06/98	OH-BH5-2/SL 08/14/98	OH-BH5-20/SL 08/14/98	OH-BH5-26/SL 08/14/98	OH-BH6-2/SL 08/12/98
1,1,1-Trichloroethane	ug/kg	<5.0	R	<50	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethane	ug/kg	<5.0	R	<50	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	ug/kg	<5.0	R	<50	<5.0	<5.0	<5.0	<5.0	<5.0
Tetrachloroethene	ug/kg	772	1150J	2540J	70.7	<5.0	135	762J	554
Trichloroethene	ug/kg	<5.0	53.9J	<50	14.2	<5.0	6.1	22.5	12.7
Vinyl chloride	ug/kg	<2.0	R	<20	<2.0	<10.0	<10.0	<10.0	<10.0
cis-1,2-Dichloroethene	ug/kg	<5.0	R	<50	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/kg	<5.0	R	<50	<5.0	<5.0	<5.0	<5.0	<5.0

Table B-11. VOC Analytical Results for Additional Soil Investigation, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	DUP-60 08/12/98	OH-BH6-8/SL 08/12/98	OH-BH6-24/SL 08/12/98	OH-BH7-2/SL 08/10/98	OH-BH7-20/SL 08/10/98	OH-BH7-24/SL 08/10/98	OH-BH8-2/SL 08/18/98	OH-BH8-18/SL 08/18/98
1,1,1-Trichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Tetrachloroethene	ug/kg	500	38.9	119J	31.4	482	325	16.0	70.0
Trichloroethene	ug/kg	8.3	<5.0	5.8J	<5.0	5.1	<5.0	<5.0	<5.0
Vinyl chloride	ug/kg	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
cis-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table B-11. VOC Analytical Results for Additional Soil Investigation, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH8-28/SL 08/18/98	OH-BH9-2/SL 08/19/98	OH-BH9-30/SL 08/19/98	DUP-62 08/19/98	OH-BH10-2/SL 08/18/98	OH-BH10-16/SL 08/18/98	OH-BH10-28/SL 08/18/98	OH-BH11-2/SL 11/03/98
1,1,1-Trichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Tetrachloroethene	ug/kg	6010	280	462J	619	548	235J	995	6.8
Trichloroethene	ug/kg	73.5	<5.0	<5.0	<5.0	24.7	<5.0	20.0	<5.0
Vinyl chloride	ug/kg	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<2.0
cis-1,2-Dichloroethene	ug/kg	36.3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table B-11. VOC Analytical Results for Additional Soil Investigation, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH11-20/SL 11/03/98	OH-BH11-28/SL 11/03/98	OH-BH12-2/SL 11/06/98	OH-BH12-14/SL 11/06/98	OH-BH12-28/SL 11/06/98	OH-BH13-2/SL 11/10/98	OH-BH13-22/SL 11/10/98	DUP-69 11/10/98
1,1,1-Trichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0J	<5.0J	<5.0	<5.0	<5.0
1,1-Dichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Tetrachloroethene	ug/kg	517	4880	675	81.2	120	17.6	333J	48.2J
Trichloroethene	ug/kg	10.0	78.1	35.8	13.8	25.3	10.0	60.4J	16.8J
Vinyl chloride	ug/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
cis-1,2-Dichloroethene	ug/kg	<5.0	61.7	<5.0	<5.0	6.3	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table B-11. VOC Analytical Results for Additional Soil Investigation, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH13-25/SL 11/10/98	OH-BH14-2/SL 11/10/98	OH-BH14-24/SL 11/10/98	OH-BH15-2/SL 11/04/98	OH-BH15-18/SL 11/04/98	OH-BH15-26/SL 11/04/98	OH-BH16-2/SL 11/12/98	OH-BH16-30/SL 11/12/98
1,1,1-Trichloroethane	ug/kg	6.4J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Tetrachloroethene	ug/kg	3300	<5.0	108	118	95.1	367	<5.0	18.2
Trichloroethene	ug/kg	1780	5.2	8.4	30.3	<5.0	9.7	<5.0	<5.0
Vinyl chloride	ug/kg	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
cis-1,2-Dichloroethene	ug/kg	5.4	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table B-11. VOC Analytical Results for Additional Soil Investigation, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH17-2/SL 11/13/98	DUP-71 11/13/98	OH-BH17-30/SL 11/13/98	OH-BH18-2/SL 11/04/98	OH-BH18-6/SL 11/04/98	OH-BH18-31/SL 11/04/98	OH-BH19-2/SL 11/09/98	OH-BH19-32/SL 11/09/98
1,1,1-Trichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethane	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Tetrachloroethene	ug/kg	<5.0J	<5.0	91.6	202	140	34.2J	<5.0	11.1
Trichloroethene	ug/kg	<5.0J	6.8	<5.0	<5.0	<5.0	<5.0	5.8	7.8
Vinyl chloride	ug/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
cis-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	ug/kg	<5.0J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table B-11. VOC Analytical Results for Additional Soil Investigation, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH20-2/SL 11/11/98	OH-BH20-35/SL 11/11/98	RB-37 08/12/98	RB-39 08/19/98	RB-44 11/03/98	RB-45 11/05/98	RB-46 11/10/98	RB-48 11/13/98	TB-41A 08/04/98
1,1,1-Trichloroethane	ug/kg	<5.0	<5.0	<1.0	<1.0	<1	<1.0	<1	<1.0	<1.0
1,1-Dichloroethane	ug/kg	<5.0	<5.0	<1.0	<1.0	<1	<1.0	<1	<1.0	<1.0
1,1-Dichloroethene	ug/kg	<5.0	<5.0	<1.0	<1.0	<1	<1.0	<1	<1.0	<1.0
Tetrachloroethene	ug/kg	<5.0	<5.0	<1.0	<1.0	<1	<1.0	<1	<1.0	<1.0
Trichloroethene	ug/kg	8.8	<5.0	<1.0	<1.0	<1	<1.0	<1	<1.0	<1.0
Vinyl chloride	ug/kg	<2.0	<2.0	<2.0	<2.0	<2	<2.0	<2	<2.0	<2.0
cis-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<1.0	<1.0	<1	<1.0	<1	<1.0	<1.0
trans-1,2-Dichloroethene	ug/kg	<5.0	<5.0	<1.0	<1.0	<1	<1.0	<1	<1.0	<1.0

Table B-11. VOC Analytical Results for Additional Soil Investigation, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	TB-42 08/05/98	TB-43 08/11/98	TB-44 08/12/98	TB-46 08/14/98	TB-48 08/18/98	TB-49 08/18/98	TB-50 08/19/98	TB-53 11/02/98	TB-54 11/03/98	TB-55 11/04/98
1,1,1-Trichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1	<1	<1.0
1,1-Dichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1	<1	<1.0
1,1-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1	<1	<1.0
Tetrachloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1	<1	<1.0
Trichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1	<1	<1.0
Vinyl chloride	ug/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	<2.0
cis-1,2-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1	<1	<1.0
trans-1,2-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1	<1	<1.0

Table B-11. VOC Analytical Results for Additional Soil Investigation, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	TB-56 11/05/98	TB-57 11/06/98	TB-58 11/09/98	TB-59 11/10/98	TB-60 11/11/98	TB-61 11/12/98	TB-62 11/13/98
1,1,1-Trichloroethane	ug/l	<1	<1	<1	<1	<1.0	<1.0	<1.0
1,1-Dichloroethane	ug/l	<1	<1	<1	<1	<1.0	<1.0	<1.0
1,1-Dichloroethene	ug/l	<1	<1	<1	<1	<1.0	<1.0	<1.0
Tetrachloroethene	ug/l	<1	<1	<1	<1	<1.0	<1.0	<1.0
Trichloroethene	ug/l	<1	<1	<1	<1	<1.0	<1.0	<1.0
Vinyl chloride	ug/l	<2	<2	<2	<2	<2.0	<2.0	<2.0
cis-1,2-Dichloroethene	ug/l	<1	<1	<1	<1	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	ug/l	<1	<1	<1	<1	<1.0	<1.0	<1.0

ug/kg - Micrograms per kilogram.

ug/L - Micrograms per liter.

DUP-60 - Duplicate of OH-BH6-2/SL.

DUP-62 - Duplicate of OH-BH9-30/SL.

DUP-66 - Duplicate of OH-BH2A-14/SL.

DUP-68 - Duplicate of GM-23A-5/SL.

DUP-69 - Duplicate of OH-BH13-22/SL.

DUP-71 - Duplicate of OH-BH17-2/SL.

J - Value is estimated.

R - Value is unusable.

UJ - Constituent was not detected above the reporting limit. Detection limit is estimated.

SL - Soil.

RB - Rinseate blank, results are reported in micrograms per liter.

TB - Trip blank, results are reported in micrograms per liter.

< - Constituent not detected above laboratory detection limit shown.

Table B-12. VOC Analytical Results for Groundwater Samples Collected Using a Hydropunch, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	GM-27-32/HP 08/04/98	GM-27-39/HP 08/13/98	GM-27-50/HP 08/13/98	GM-27-55/TW 08/19/98	GM-28-32/HP 08/05/98	OH-BH-2A-37/HP 11/03/98	DUP-67 11/03/98	OH-BH-3A-30/HP 11/06/98
1,1,1-Trichloroethane	ug/l	1.5	<2.0	<2.0	<5.0	10.5	<100	<100	24.4
1,1-Dichloroethane	ug/l	54.6	3.0	<2.0	<5.0	2.4	231	213	4.3
1,1-Dichloroethene	ug/l	6.8	<2.0	<2.0	<5.0	<2	<100	<100	<2
Tetrachloroethene	ug/l	484	14.3	3.2	14	242	1180J	1470	238
Trichloroethene	ug/l	75.6	113	80.9	69.5	444	1260J	1390	1560
Vinyl chloride	ug/l	7320	231	<4.0	110	<4.0	4470J	4460	4.5
cis-1,2-Dichloroethene	ug/l	3540	821	17.4	395	187	11000	10500	34.1
trans-1,2-Dichloroethene	ug/l	42.8	6.8	<2.0	<5.0	6.2	<100	<100	<2

Table B-12. VOC Analytical Results for Groundwater Samples Collected Using a Hydropunch, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH5-37/HP 08/14/98	OH-BH6-31.5/HP 08/12/98	OH-BH7-30/HP 08/11/98	OH-BH8-38/HP 08/18/98	OH-BH9-38/HP 08/19/98	DUP-63 08/19/98	OH-BH10-34/HP 08/19/98	OH-BH-11-33/HP 11/03/98
1,1,1-Trichloroethane	ug/l	<2.0	<1.0	3.2	<2.0	5.4	6.1	6.2	43.5
1,1-Dichloroethane	ug/l	18.5	8.5	2.1	20.6	<1.0	<1.0	2.5	18.2
1,1-Dichloroethene	ug/l	84.1	8.8	<2.0	3.6	<1.0	<1.0	1.3	6.6
Tetrachloroethene	ug/l	1550	28.5	2950	77.6	520J	543	1810	2060
Trichloroethene	ug/l	1330	52.4	728	246	6.6	7.1	66.6	1680
Vinyl chloride	ug/l	436	503	7.3	2680	<2.0	<2.0	3.7	245
cis-1,2-Dichloroethene	ug/l	1280	1900	962	226	<1.0	<1.0	57.0	1490
trans-1,2-Dichloroethene	ug/l	7.6	13.2	11.1	7.0	<1.0	<1.0	1.4	23.0

Table B-12. VOC Analytical Results for Groundwater Samples Collected Using a Hydropunch, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH12-33.5/HP 11/06/98	OH-BH13-27/HP 11/10/98	OH-BH14-32/HP 11/11/98	DUP-70 11/11/98	OH-BH15-42/HP 11/05/98	OH-BH16-33/HP 11/12/98	OH-BH16-61/HP 11/12/98	OH-BH17-40/HP 11/13/98
1,1,1-Trichloroethane	ug/l	2.1	12.0	<2.0	<2.0	18.3	<10.0	7.3	5.1
1,1-Dichloroethane	ug/l	29.3	3.6	2.3	2.3	<2.0	<10.0	25.0	11.1
1,1-Dichloroethene	ug/l	<1	1.4	<2.0	<2.0	<2.0	<10.0	<1.0	<1.0
Tetrachloroethene	ug/l	254	136	114	112	65.4	<10.0	2.0	82.6
Trichloroethene	ug/l	45.5	3500	39.0	42.4	981	<10.0	1.8	116
Vinyl chloride	ug/l	113	<2	<4.0	<4.0	<4.0	<20.0	<2.0	<2.0
cis-1,2-Dichloroethene	ug/l	131	130	33.9	36.6	281	<10.0	12.0	2.7
trans-1,2-Dichloroethene	ug/l	3.2	2.7	<2.0	<2.0	<2.0	<10.0	1.4	<1.0

Table B-12. VOC Analytical Results for Groundwater Samples Collected Using a Hydropunch, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	OH-BH17-57/HP 11/13/98	OH-BH18-35.5/HP 11/04/98	OH-BH19-35/HP 11/11/98	OH-BH20-38/HP 11/11/98	RB-40 08/19/98	RB-43 11/02/98	RB-47 11/12/98	TB-41A 08/04/98	TB-42 08/12/98
1,1,1-Trichloroethane	ug/l	<2.0	88.8	6.3	<2.0	<1.0	<1	<1.0	<1.0	<1.0
1,1-Dichloroethane	ug/l	20.7	<2	<2.0	<2.0	<1.0	<1	<1.0	<1.0	<1.0
1,1-Dichloroethene	ug/l	<2.0	<2	<2.0	<2.0	<1.0	<1	<1.0	<1.0	<1.0
Tetrachloroethene	ug/l	10.0	712	27.3	<2.0	<1.0	<1	<1.0	<1.0	<1.0
Trichloroethene	ug/l	24.6	15.1	10.1	<2.0	<1.0	<1	<1.0	<1.0	<1.0
Vinyl chloride	ug/l	<4.0	<4	<4.0	<4.0	<2.0	<2	<2.0	<2.0	<2.0
cis-1,2-Dichloroethene	ug/l	12.3	<2	<2.0	<2.0	<1.0	<1	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	ug/l	<2.0	<2	<2.0	<2.0	<1.0	<1	<1.0	<1.0	<1.0

Table B-12. VOC Analytical Results for Groundwater Samples Collected Using a Hydropunch, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	TB-43 08/12/98	TB-44 08/12/98	TB-45 08/13/98	TB-46 08/14/98	TB-48 08/18/98	TB-49 08/18/98	TB-50 08/19/98	TB-53 11/02/98	TB-54 11/03/98	TB-55 11/04/98
1,1,1-Trichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1	<1	<1.0
1,1-Dichloroethane	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1	<1	<1.0
1,1-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1	<1	<1.0
Tetrachloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1	<1	<1.0
Trichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1	<1	<1.0
Vinyl chloride	ug/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	<2.0
cis-1,2-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1	<1	<1.0
trans-1,2-Dichloroethene	ug/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1	<1	<1.0

Table B-12. VOC Analytical Results for Groundwater Samples Collected Using a Hydropunch, AOI 7 - Former Oil House Area, General Motors Corporation, Moraine, Ohio.

COMPOUND	UNITS	TB-56 11/05/98	TB-57 11/06/98	TB-59 11/10/98	TB-60 11/11/98	TB-61 11/12/98	TB-62 11/13/98
1,1,1-Trichloroethane	ug/l	<1	<1	<1	<1.0	<1.0	<1.0
1,1-Dichloroethane	ug/l	<1	<1	<1	<1.0	<1.0	<1.0
1,1-Dichloroethene	ug/l	<1	<1	<1	<1.0	<1.0	<1.0
Tetrachloroethene	ug/l	<1	<1	<1	<1.0	<1.0	<1.0
Trichloroethene	ug/l	<1	<1	<1	<1.0	<1.0	<1.0
Vinyl chloride	ug/l	<2	<2	<2	<2.0	<2.0	<2.0
cis-1,2-Dichloroethene	ug/l	<1	<1	<1	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	ug/l	<1	<1	<1	<1.0	<1.0	<1.0

ug/l - Micrograms per liter.

DUP-63 - Duplicate of OH-BH9-38/HP.

DUP-67 - Duplicate of OH-BH2A-37HP.

DUP-70 - Duplicate of OH-BH14-32/HP.

J - Value is estimated.

HP - Hydropunch.

RB - Rinseate blank.

TB - Trip blank.

TW - Temporary well.

< - Constituents not detected above laboratory detection limit shown.

Appendix C

Supplemental RFI Data Quality Objectives

ARCADIS GERAGHTY & MILLER

Appendix C - Supplemental RFI Data Quality Objectives

General Motors Powertrain Group
Moraine Engine Plant & General Motors Truck Group Moraine Assembly Plant
Moraine, Ohio

PREPARED FOR

General Motors Corporation
May 1999

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1. Data Quality Objectives

1.1 Introduction

In accordance with the Supplemental RCRA Facility Investigation (RFI) Work Plan (Geraghty & Miller, Inc. 1997), which includes the Quality Assurance Project Plan (QAPjP) in Appendix B and the Data Management Plan in Appendix D, laboratory and field data collected during the Supplemental RFI field activities were evaluated by ARCADIS Geraghty & Miller to determine precision, accuracy, representativeness, completeness, and comparability. Field data and subsequent laboratory data measurements collected during the Supplemental RFI will be discussed in terms of the above Data Quality Objectives (DQOs).

1.2 Review Of Field Measurements

The standard operating procedures (SOPs) outlined in the Supplemental RFI Sampling Plan (Appendix C of the Supplemental RFI Work Plan [Geraghty & Miller, Inc. 1997]) were developed to provide precise and accurate field measurements. The field sampling records were reviewed by ARCADIS Geraghty & Miller to determine whether the protocols detailed in the Supplemental RFI Work Plan were followed during the Supplemental RFI field activities. The following sections describe the precision, accuracy, representativeness, completeness, and comparability DQO review results for the field data.

1.2.1 Precision of Field Measurements

Measurements of data precision are necessary to demonstrate the reproducibility of the data. The precision of field measurements including pH, specific conductivity, depth to water, and photo-ionization (HNu) headspace readings, were assessed qualitatively to verify that replicate field measurements were collected at a frequency of 20 percent or one per five measurements. Duplicate samples were also collected and analyzed at a rate of 10 percent or one per ten or fewer investigative samples to quantitatively assess the overall precision of field and laboratory procedures.

A round of water-level measurements was collected on March 11-12, 1998 from 81 on- and off-site wells. The percentage of field measurements for depth-to-water measurements was duplicated at a frequency of 100 percent, since all depth-to-water measurements were confirmed in the field. During groundwater sampling, the rate of precision of duplicate field measurements for depth to water, pH, and specific

conductivity measurements was determined to be 100 percent, since all depth-to-water measurements were confirmed in the field and a flow-thru cell was used to obtain continuous pH and specific conductivity measurements. During soil sampling, the rate of precision of duplicate field measurements for HNu headspace readings was determined to be 100 percent since all readings were confirmed in the field. All samples collected during the Supplemental RFI conform to the precision requirements for field and laboratory replication.

1.2.2 Accuracy of Field Measurements

Accuracy is the relationship of the reported data to the "true" value. The accuracy of field measurements of pH and specific conductivity were assessed by daily calibrations and post-calibration verifications using standard solutions. In accordance with the Supplemental RFI Work Plan, all pH quality assurance/quality control (QA/QC) measurements must be within ± 0.1 standard units of the standard solution values used during calibration. All specific conductivity QA/QC measurements must be within ± 10 micro-mhos (umhos) of the standard solution values used during calibration. Both pH and specific conductivity QA/QC measurements were to be performed twice per day or every 4 hours during sampling. The accuracy of the HNu meter was to be assessed through hourly calibration checks where readings were to be found within ± 20 percent of the isobutylene calibrant gas concentration. If the accuracy of the HNu meter could not be assessed through hourly calibration checks due to strict adherence to RFI SOPs for sampling, calibration checks were to be performed immediately upon reaching each sample location. In addition, calibration checks per ten or fewer investigative samples was to be conducted on the field gas chromatograph (GC).

The frequency of calibration checks for pH, specific conductivity, and the field GC met the requirements stated in the Supplemental RFI Work Plan. Calibration standards of 7.0 and 10.0 standard units were used for calibrating the pH meter. The deviation between these two standards and the calibration readings were all within the control limits stated in the Supplemental RFI Work Plan. All of the specific conductivity calibration readings using the 1,000-umhos standard solution were found to be well within the required control limits.

Several of the frequency intervals for the HNu calibration could not be made within a 1 hour period because soil samples were being collected in strict accordance with the SOP for soil sampling from a split-spoon sampler. However, each of the following calibration checks performed after the missed frequency interval were found to be within the required control limits. In those instances where hourly calibration checks

could not be made, the HNu was calibrated immediately upon reaching the next sample location.

1.2.3 Representativeness of Field Data

All field data obtained during the Supplemental RFI were evaluated to determine if the data were representative of actual site conditions. Considerations for evaluating the representativeness of the data include sample locations, sampling methods, and the appropriateness of the analytical method to the type of sample obtained. The sampling strategy outlined in the Supplemental RFI Work Plan was designed to provide data representative of site conditions in the Areas of Interest (AOIs) that were investigated. Consideration was given to past waste disposal practices, physical setting, and existing analytical data during development of this strategy. The procedures used to obtain the planned analytical data, as documented in the Supplemental RFI Work Plan, have provided representative data.

The representativeness of all data was qualitatively assessed by ARCADIS Geraghty & Miller to determine if the data were consistent with known or anticipated hydrogeologic or chemical conditions and accepted principles. Field measurements were also checked for completeness of procedures and documentation of procedures and results. In both cases, data collected during the Supplemental RFI were deemed representative of actual site conditions.

1.2.4 Completeness of Field Data

To determine the completeness of field measurements, field documentation was compared to the DQOs presented in Table 5-1 of the QAPjP (Appendix B of the Supplemental RFI Work Plan [Geraghty & Miller, Inc. 1997]). Field documentation (sampling logs) is included in Appendix C of this Supplemental RFI Report. The completeness of the collected data will be defined as the number of satisfactory field measurements (pH, specific conductivity, depth to water, HNu screening) recorded compared to the number of measurements intended to be collected under the Supplemental RFI Work Plan. The completeness comparison should yield a result of at least 90 percent. The following section summarizes the results of this comparison.

pH measurements for all aqueous samples were found to be 100 percent complete. pH calibration checks using 7.0 and 10.0 standard unit solutions were found to be 100 percent complete. Specific conductivity measurements for all aqueous samples were found to be 100 percent complete. Specific conductivity calibration was found to be

100 percent complete using a 1,000 umhos standard solution for calibration. Depth-to-water measurements were found to be 98 percent complete. HNu measurements for headspace screening of soil samples were found to be 100 percent complete. HNu calibration checks within ±20 percent were found to be 90 percent complete. Field GC calibration checks were found to be 90 percent complete.

1.2.5 Comparability of Field Data

Comparability was achieved by utilizing standardized sampling and analysis methods and data reporting format. Soil and groundwater samples were all obtained following the standardized sampling procedures stated in the Supplemental RFI Work Plan. All field measurements, calibrations, and calibration measurements (including depth to water, pH, specific conductivity, and HNu readings) were performed and recorded in a standardized format in accordance with the Supplemental RFI Work Plan. Paper copies of all field records collected during Supplemental RFI field activities were prepared and kept in files for review and management by ARCADIS Geraghty & Miller.

1.3 Review Of Laboratory Data

The investigative groundwater, soil, and associated QC samples collected by ARCADIS Geraghty & Miller personnel during the Supplemental RFI field activities were analyzed by TestAmerica, Inc. (formerly National Environmental Testing, Inc. [NET] Dayton Division), in Dayton, Ohio. The analytical sample data provided by the laboratory were validated by ARCADIS Geraghty & Miller personnel to determine the quality of the reported Level III data. The reporting requirements for Level III data are based upon quality control criteria from the U.S. Environmental Protection Agency (EPA) document *Data Quality Objectives for Remedial Response Activities* (U.S. EPA, 1987) and quality control criteria from the U.S. EPA document *Test Methods for Examining Solid Waste, SW-846* (U.S. EPA 1986 with revisions). In addition, the U.S. EPA documents *Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses,* February 1994 (U.S. EPA 1994a) and *Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses,* December 1994 (U.S. EPA 1994b) were used as guidance for assigning data qualifier codes to the analytical results. The samples analyzed during this project include aqueous (groundwater) and non-aqueous (soil) matrices.

Reporting Level III data validation of the organic and inorganic sample data consists of the review of sample extraction and analysis holding times; results of method blanks,

equipment blanks, trip blanks, field duplicates, surrogate spike recoveries (organic data only), and matrix spike (MS)/MS duplicate (MSD) recoveries, including the relative percent difference (RPD) between the MS and MSD data. In addition, the tuning, initial calibration and continuing calibration, and internal standard data are reviewed to ensure proper volatile and semivolatile analysis instrument response. The inorganic data review includes the following criteria: initial and continuing calibration, initial and continuing blank results, inductively coupled plasma (ICP) interference check sample percent recovery, ICP serial dilution, and furnace atomic absorption (AA) metal post-digestion spike recovery data. A detailed discussion of these criteria is provided in the U.S. EPA data validation documents referenced above. Completeness of the laboratory data reported by NET was determined by ARCADIS Geraghty & Miller and is summarized in Section 1.3.4. As with the review of the field data, the two qualitative criteria representativeness and comparability, help ensure that the samples collected are representative of the site conditions and were collected in accordance with SOPs. A detailed discussion of these criteria is provided below.

The majority of the Supplemental RFI data was determined to be quantitative and acceptable for use. However, data validation qualifiers were assigned to the sample data because of various quality control deficiencies. The affected data were either qualified as estimated and flagged with a "J" if detected or a "UJ" if nondetected, and/or as nondetected and flagged with a "U". In several instances, sample data were qualified as unusable and flagged with an "R" (rejected).

1.3.1 Precision of Laboratory Data

Precision of the Supplemental RFI data was assessed by reviewing replicate MS data and comparing field duplicate sample data. For a detailed discussion of general laboratory precision reporting, refer to Section 14.0 of the QAPjP in Appendix B of the Supplemental RFI Work Plan (Geraghty & Miller, Inc. 1997). DQO precision results were reviewed by an ARCADIS Geraghty & Miller data validator. Results that were not qualified as estimated and flagged with a "J" or "UJ" met precision DQO requirements as determined by laboratory control checks. DQO precision results are included in the corresponding laboratory data package.

1.3.2 Accuracy of Laboratory Data

Accuracy of the Supplemental RFI data was determined during data validation by evaluating the recoveries of MS/MSDs, laboratory control samples, and surrogates. For a detailed discussion on general laboratory accuracy reporting, refer to Section

14.0 of the QAPjP in Appendix B, of the Supplemental RFI Work Plan (Geraghty & Miller, Inc. 1997). DQO results for accuracy were reviewed by a qualified ARCADIS Geraghty & Miller data validator. Data that were not qualified as estimated and flagged with a "J" or "UJ" or qualified as unusable and flagged "R" met accuracy DQO requirements as determined by laboratory control checks. DQO results for accuracy during the Supplemental RFI are included in the corresponding laboratory data package.

1.3.3 Representativeness of Laboratory Data

Representativeness of the sample data was qualitatively assessed by comparing the Supplemental RFI data to existing site data to ensure that the data are consistent with known hydrogeologic or chemical conditions at the site. Documentation establishing the integrity of the samples collected was also reviewed. In all cases, the required protocols were followed to preserve the representativeness of the samples.

1.3.4 Completeness of Analytical Data

Completeness was evaluated by determining the proportion of valid analytical data acquired to the stated project objectives specified in the Supplemental RFI Work Plan (Geraghty & Miller, Inc., 1997). Percent completeness was calculated per sample matrix and per parameter for the analytical data collected during the Supplemental RFI. Completeness per sample matrix was calculated by determining the proportion of valid analytical results for a given matrix, not including data qualified as unusable and flagged "R" relative to the total number of analytical results for that matrix. Completeness per parameter was calculated by determining the proportion of valid analytical results for a given parameter, not including data qualified as unusable and flagged "R" relative to the total number of analytical results for that parameter. The two different levels of completeness were calculated to ensure that this DQO was thoroughly assessed. Quality control samples (equipment blanks and trip blanks) were not included in this assessment. As specified in Section 5.0 of the QAPjP, Appendix B of the Supplemental RFI Work Plan (Geraghty & Miller, Inc. 1997), percent completeness should be equal to or greater than 90 percent.

Completeness for aqueous, solid, and combined matrices (all samples added together) samples were 98.1 percent, 99.3 percent, and 98.7 percent, respectively. Completeness for the volatile organic compound (VOC) parameters in aqueous, solid, and combined matrices were 97.7 percent, 98.0 percent, and 97.8 percent, respectively. Completeness for semi-volatile organic compound (SVOC) parameters in aqueous, solid, and

combined matrices were 98.3 percent, 100 percent, and 99.4 percent, respectively. Completeness for polychlorinated biphenyls (PCBs) in aqueous, solid, and combined matrices were 100 percent. Completeness for metals in aqueous, solid, and combined matrices were 100 percent. Completeness for all parameters was greater than 97 percent. Completeness results for sample matrix and parameter analyzed for during the Supplemental RFI are summarized in Table C-1.

1.3.5 Comparability of RFI Laboratory Data

Comparability was achieved by utilizing approved and standardized sampling and analytical methods in association with a standardized reporting format that was strictly adhered to by NET. DQO results for comparability were reviewed by a qualified ARCADIS Geraghty & Miller data validator. Results that were not qualified as estimated and flagged with a "J" or "UJ" met comparability DQO requirements as determined by laboratory control checks. The QA/QC guidelines and analytical techniques followed by NET that are associated with the DQO for comparability are included in the laboratory data package.

1.3.6 Practical Quantitation Limits Evaluation

Several Supplemental RFI samples and associated parameters had reported practical quantitation limits (PQLs) that were outside of the QAPjP-specified limits. These sample data were affected by one or more of the following criteria: physical or chemical matrix interference, presence of high target compound concentrations, presence of high non-target compound concentrations, excessive sample foaming, elevated groundwater sample sediment content, extraction efficiency, and "cleanup" of sample extracts. Sample dilution and clean up procedures used by NET to correct these deficiencies resulted in elevated PQLs. Additionally, NET diluted several samples based on the sample or sample extract appearances. This dilution procedure also resulted in higher detection limits for these samples.

Although several sample PQLs were outside of the QAPjP-specified limits, guidance documents and the referenced methods allow for sample analysis and data validation professional judgment. Based on ARCADIS Geraghty & Miller's review of the Supplemental RFI data, NET has followed appropriate technical analytical procedures. Therefore, sample data with PQLs outside of the specified QAPjP limit are considered valid and acceptable for use.

1.3.7 Evaluation of Additional Criteria

Several Supplemental RFI samples had VOC concentrations which exceeded the instrument upper calibration ranges. In instances where compound concentrations were reported above the calibration range these data were qualified as estimated and flagged "J." Several metal sample data were qualified as nondetected and flagged "<" because of contamination in the associated QC blank sample. The metal concentrations detected in these samples did not exceed 5 times the blank results. The VOC data for several samples were qualified as estimated and flagged "J" because of elevated sample pH after analysis or elevated cooler temperature recorded by NET upon sample receipt.

2. References

Geraghty & Miller, Inc. 1997. Supplemental RFI Work Plan for General Motors Powertrain Group, Moraine Engine Plant and General Motors Truck Group Moraine Assembly Plant, Moraine, Ohio. July 1997.

U.S. Environmental Protection Agency (USEPA) 1987. Data Quality Objectives for Remedial Response Activities. EPA/540/G-87/004. March 1987.

U.S. Environmental Protection Agency (USEPA). 1986. Test Methods for Examining Solid Waste, SW-846. November 1986 with revision updates.

U.S. Environmental Protection Agency (USEPA). 1994a. Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses. February 1994.

U.S. Environmental Protection Agency (USEPA). 1994b. Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses. December 1994.

Table C-1 Supplemental RFI Percent Completeness per Sample Matrix and Parameter Analyzed, General Motors Corporation, Moraine, Ohio.

Matrix	Completeness
AQUEOUS (Groundwater/Hydropunch)	98.1%
Volatile Organic Compounds	97.7%
Semivolatile Organic Compounds	98.3%
PCBs	100.0%
Metals	100.0%
SOLID	99.3%
Volatile Organic Compounds	98.0%
Semivolatile Organic Compounds	100.0%
PCBs	100.0%
Metals	100.0%
COMBINED (Aqueous and Solids Added Together)	98.7%
Volatile Organic Compounds	97.8%
Semivolatile Organic Compounds	99.4%
PCBs	100.0%
Metals	100.0%

Appendix D

Supplemental RFI Boring Logs,
Soil/Groundwater Sampling Logs,
and Well Construction Logs

Groundwater Sampling Logs
March 1998

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/2/98
Site/Well No.	MT-69	Replicate No.	-	Code No.	
Weather	Overcast, high 40's	Sampling Time:	Begin 13:00	End	15:00

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	117.94
Depth to Water (ft bmp)	21.30
Water-Level Elevation (ft)	
Water Column in Well (ft)	96.64
Casing Diameter/Type	6"
Gallons in Well	142.1 x 3 = 426
Gallons Pumped/Bailed Prior to Sampling	430
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin 13:00 end 14:25
Pumping Rate (gpm)	5
Evacuation Method	2" submersible pump, normal

Field Parameters

Color	Very Light Brown
Odor	None
Appearance	Slightly Turbid
pH (s.u.)	7.99
Conductivity (mS/cm)	
(µmhos/cm)	429
Turbidity (NTU)	N/A
Temperature (°C)	8.8
Dissolved Oxygen (mg/L)	
Salinity (%)	
Sampling Method	Disposable bailer after 3 well vols.
Remarks	HNU = 0 ppm

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Milligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/2/98
Site/Well No.	GM-20D	Replicate No.	-	Code No.	
Weather	Overcast, high 40's	Sampling Time:	Begin 15:30	End	16:30

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	100.18
Depth to Water (ft bmp)	24.74
Water-Level Elevation (ft)	
Water Column in Well (ft)	75.44
Casing Diameter/Type	2"
Gallons in Well	49.04 x 3 = 147
Gallons Pumped/Bailed Prior to Sampling	150
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin 15:30 end 16:10
Pumping Rate (gpm)	5
Evacuation Method	2" submersible pump, normal

Field Parameters

Color	Colorless
Odor	None
Appearance	Clear
pH (s.u.)	6.89
Conductivity (mS/cm)	
(µmhos/cm)	562
Turbidity (NTU)	N/A
Temperature (°C)	12.1
Dissolved Oxygen (mg/L)	
Salinity (%)	
Sampling Method	disposable bailer after 3 well vols.
Remarks	16:15=Sample time; HNU = 0 ppm

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Milligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/3/98
Site/Well No.	GM-9	Replicate No.	-	Code No.	
Weather	Cloudy, low 30's	Sampling Time:	Begin 8:30	End	9:00

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	99.90
Depth to Water (ft bmp)	22.73
Water-Level Elevation (ft)	
Water Column in Well (ft)	77.17
Casing Diameter/Type	2"
Gallons in Well	12.34 x 3 = 37
Gallons Pumped/Bailed Prior to Sampling	40
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin 8:40 end 8:50
Pumping Rate (gpm)	4
Evacuation Method	2" submersible pump, normal

Field Parameters

Color	Light Brown
Odor	None
Appearance	Slightly Turbid
pH (s.u.)	7.61
Conductivity (mS/cm)	
(µmhos/cm)	973
Turbidity (NTU)	N/A
Temperature (°C)	10.6
Dissolved Oxygen (mg/L)	
Salinity (%)	
Sampling Method	Tubing after 3 well vols.
Remarks	HNU = 0 ppm

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Milligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/3/98
Site/Well No.	GM-10	Replicate No.		Code No.	
Weather	Overcast, flurries, 30's	Sampling Time:	Begin 9:20	End	12:30

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	49.88
Depth to Water (ft bmp)	21.99
Water-Level Elevation (ft)	
Water Column in Well (ft)	27.87
Casing Diameter/Type	2"
Gallons in Well	4.46 x 3 = 13.40
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Colorless
Odor	None
Appearance	Clear
pH (s.u.)	7.16
Conductivity (mS/cm)	
(µmhos/cm)	1090
Turbidity (NTU)	N/A
Temperature (°C)	15.69
Dissolved Oxygen (mg/L)	0.96
Salinity (%)	
Sampling Method	Flow-thru cell
Remarks	21.99=DTW when finished @11:41 Sample time = 11:20; ORP = 143.8 mV; HNU = 0 ppm; Nitrate = 22 mg/l; Nitrite = 0 mg/l; Ferrous Iron = 0 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & ManganeseTot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well GM-10 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/3/98	10:25	13.85	1376.00	1.55	7.14	138.30
3/3/98	10:33	15.32	1379.00	1.21	7.15	142.10
3/3/98	10:57	15.48	1400.00	1.06	7.15	144.30
3/3/98	11:02	15.59	1409.00	1.01	7.15	144.00
3/3/98	11:09	15.69	1424.00	0.96	7.16	143.70

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/3/98
Site/Well No.	GM-26	Replicate No.		Code No.	
Weather	Overcast 40's	Sampling Time:	Begin 13:30	End	15:30

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	~62.50
Depth to Water (ft bmp)	21.74
Water-Level Elevation (ft)	
Water Column in Well (ft)	41.78
Casing Diameter/Type	2"
Gallons in Well	6.68 x 3 =20.05
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Very light brown
Odor	None
Appearance	Slightly turbid
pH (s.u.)	7.33
Conductivity (mS/cm)	
(µmhos/cm)	888
Turbidity (NTU)	N/A
Temperature (°C)	12.63
Dissolved Oxygen (mg/L)	2.84
Salinity (%)	
Sampling Method	Flow-thru cell
Remarks	21.74=DTW Final; Sample time = 14:35; ORP = 142.1 mV; HNU = 0 ppm; Nitrate = 17.6 mg/l; Nitrite = .033 mg/l; Ferrous iron = 0 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss.(6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well GM-26 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/3/98	13:58	11.12	1,138.00	2.91	7.34	145.90
3/3/98	13:59	12.13	1,137.00	2.90	7.34	146.20
3/3/98	14:20	12.69	1,133.00	2.82	7.32	143.70
3/3/98	14:28	12.98	1,141.00	2.83	7.32	142.30
3/3/98	14:30	12.63	1,144.00	2.84	7.32	142.10

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/3/98
Site/Well No.	WSU-24	Replicate No.		Code No.	
Weather	Overcast, high 30's	Sampling Time:	Begin 15:50	End	17:10

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	66.12
Depth to Water (ft bmp)	22.34
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	2"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Clear
Odor	None
Appearance	Clear
pH (s.u.)	7.10
Conductivity (mS/cm)	
(µmhos/cm)	998
Turbidity (NTU)	N/A
Temperature (°C)	14.43
Dissolved Oxygen (mg/L)	3.64
Salinity (%)	
Sampling Method	Flow-thru cell
Remarks	22.34=DTW Final; Sample time = 16:30; ORP = 157.0 mV; HNU = 0 ppm; Nitrate = 22 mg/l; Nitrite = 0 mg/l; Ferrous Iron = 0 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vials	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Milligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well WSU-24 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/3/98	16:09	13.39	1,270.00	4.25	7.21	155.40
3/3/98	16:19	14.27	1,301.00	3.61	7.11	156.40
3/3/98	16:24	14.44	1,302.00	3.64	7.10	156.80
3/3/98	16:28	14.44	1,303.00	3.63	7.10	157.00

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/4/98
Site/Well No.	GM-1	Replicate No.	-	Code No.	
Weather	Overcast, snowing, high-30's	Sampling Time:	Begin 15:45	End	16:30

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	102.12
Depth to Water (ft bmp)	33.33
Water-Level Elevation (ft)	
Water Column in Well (ft)	68.79
Casing Diameter/Type	2"
Gallons in Well	11.00 x 3 = 33
Gallons Pumped/Bailed Prior to Sampling	100
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, normal

Field Parameters

Color	Colorless
Odor	None
Appearance	Clear
pH (s.u.)	6.87
Conductivity (mS/cm)	
(µmhos/cm)	949
Turbidity (NTU)	N/A
Temperature (°C)	14.81
Dissolved Oxygen (mg/L)	1.15
Salinity (%)	
Sampling Method	Tubing after 3 well vols.
Remarks	Sample time = 16:15; ORP = 90.3 mV; HNU = 0 ppm.

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Milligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/4/98
Site/Well No.	GM-2	Replicate No.	-	Code No.	
Weather	Overcast, snowing, high-30's	Sampling Time:	Begin 16:30	End	17:55

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	56.65
Depth to Water (ft bmp)	33.02
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	2"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Colorless
Odor	None
Appearance	Clear
pH (s.u.)	7.01
Conductivity (mS/cm)	
(µmhos/cm)	1190
Turbidity (NTU)	N/A
Temperature (°C)	14.69
Dissolved Oxygen (mg/L)	1.38
Salinity (%)	
Sampling Method	Flow-thru cell
Remarks	33.02 = DTW Final, ORP = 126.7 mV; HNU = 0 ppm; Nitrate = 22.0 mg/l; Nitrite = 0 mg/l; Ferrous Iron = 0 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
App IX SVOC's (8270B)	1l amber glass	1	Cool
App IX PCB's (8080A)	1l amber glass	1	Cool
App IX Total Metals (6020)	1l plastic	1	Cool, HNO_3
App IX Diss. Metals (6020)	1l plastic	1	Cool, HNO_3
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B) and	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nepheiometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Milligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well GM-2 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/4/98	16:36	12.65	1,071.00	10.39	4.97	202.30
3/4/98	16:47	14.17	1,183.00	1.62	7.00	138.80
3/4/98	16:54	14.64	1,188.00	1.44	7.01	131.40
3/4/98	16:59	14.63	1,191.00	1.38	7.01	126.70

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/5/98
Site/Well No.	W-1-S	Replicate No.		Code No.	
Weather	Overcast, high 30's	Sampling Time:	Begin 8:50	End	10:10

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	58.88
Depth to Water (ft bmp)	25.55
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	4"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Colorless
Odor	None
Appearance	Clear
pH (s.u.)	6.95
Conductivity (mS/cm)	
(µmhos/cm)	1452
Turbidity (NTU)	N/A
Temperature (°C)	15.91
Dissolved Oxygen (mg/L)	0.44
Salinity (%)	
Sampling Method	Flow-thru cell
Remarks	25.55=DTW Final; Sample time = 9:35; ORP = 77.6 mV; HNU = 0 ppm; Nitrate = 13.2 mg/l; Nitrite = 0 mg/l; Ferrous iron = 0 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well W-1-S Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/5/98	9:08	15.06	1,489.00	2.90	7.55	107.10
3/5/98	9:23	15.80	1,463.00	0.45	6.95	78.30
3/5/98	9:28	15.72	1,458.00	0.44	6.96	80.30
3/5/98	9:30	15.87	1,453.00	0.44	6.95	79.30

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/5/98
Site/Well No.	HR-17	Replicate No.		Code No.	
Weather	Overcast, high 30's	Sampling Time:	Begin 10:10	End	11:10

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	48.48
Depth to Water (ft bmp)	22.79
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	4"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Colorless
Odor	None
Appearance	Clear
pH (s.u.)	7.05
Conductivity (mS/cm)	
(µmhos/cm)	1774
Turbidity (NTU)	N/A
Temperature (°C)	13.99
Dissolved Oxygen (mg/L)	2.08
Salinity (%)	
Sampling Method	Flow-thru cell
Remarks	22.79=DTW Final; Sample time = 10:40; ORP = 103.5 mV; HNU = 0.2 ppm; Nitrate = 13.2 mg/l; Nitrite = 0 mg/l; Ferrous Iron = 0 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well HR-17 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/5/98	10:18	11.56	1,473.00	7.27	7.70	102.30
3/5/98	10:25	13.57	1,766.00	2.15	7.06	96.50
3/5/98	10:28	13.71	1,765.00	2.08	7.05	98.80
3/5/98	10:34	14.01	1,777.00	2.07	7.05	104.10

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/5/98
Site/Well No.	EAST	Replicate No.		Code No.	
Weather	Overcast, 40's	Sampling Time:	Begin 12:45	End	14:20

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	71.64
Depth to Water (ft bmp)	27.41
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	2"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Light Brown
Odor	None
Appearance	Slightly Turbid
pH (s.u.)	6.96
Conductivity (mS/cm)	
(µmhos/cm)	1778
Turbidity (NTU)	N/A
Temperature (°C)	18.41
Dissolved Oxygen (mg/L)	0.20
Salinity (%)	
Sampling Method	Flow-thru cell

Remarks: 27.41=DTW final; Sample time = 13:45; ORP = -81.9 mV; HNU = 0 ppm; Nitrate = 17.6 mg/l; Nitrite = .066 mg/l; Ferrous Iron = 0 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
App IX SVOC's (8270B)	1l amber glass	1	Cool
App IX PCB's (8080A)	1l amber glass	1	Cool
App IX Total Metals (6020)	1l plastic	1	Cool, HNO_3
App IX Diss. Metals (6020)	1l plastic	1	Cool, HNO_3
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/l	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well EAST Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/5/98	13:13	17.23	1,790.00	0.26	6.97	30.10
3/5/98	13:31	18.08	1,779.00	0.20	6.96	-78.10
3/5/98	13:34	18.11	1,782.00	0.20	6.96	-84.60
3/5/98	13:38	18.46	1,777.00	0.20	6.96	-80.80

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/5/98
Site/Well No.	HR-1	Replicate No.		Code No.	
Weather	Partly cloudy, high 40's	Sampling Time:	Begin 14:25	End	15:45

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	59.47
Depth to Water (ft bmp)	28.79
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	2"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~2
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Colorless
Odor	None
Appearance	Clear
pH (s.u.)	6.98
Conductivity (mS/cm)	
(µmhos/cm)	1263
Turbidity (NTU)	N/A
Temperature (°C)	20.68
Dissolved Oxygen (mg/L)	0.40
Salinity (%)	
Sampling Method	Flow-thru cell

Remarks: 28.79=DTW Final; Sample time = 15:12; ORP = 47.5 mV; HNU = 0 ppm; Nitrate = 13.2 mg/l; Nitrite = .033 mg/l; Ferrous Iron = 0 mg/l; PVC riser was loose; put back in place.

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Diss.(6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Milligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well HR-1 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/5/98	14:53	15.69	1,261.00	0.62	6.98	60.00
3/5/98	14:58	16.45	1,263.00	0.59	6.97	53.80
3/5/98	15:04	20.84	1,264.00	0.42	6.98	48.90
3/5/98	15:08	20.65	1,263.00	0.40	6.98	47.40

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/5/98
Site/Well No.	W-3-N	Replicate No.		Code No.	
Weather	partly cloudy, 40's	Sampling Time:	Begin 15:55	End	17:30

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	57.88
Depth to Water (ft bmp)	28.17
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	4"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Light Brown
Odor	None
Appearance	Slightly Turbid
pH (s.u.)	7.07
Conductivity (mS/cm)	
(µmhos/cm)	1274
Turbidity (NTU)	N/A
Temperature (°C)	15.18
Dissolved Oxygen (mg/L)	0.17
Salinity (%)	
Sampling Method	Flow-thru cell
Remarks	28.17=DTW Final; Sample time = 16:50; ORP = -87.2 mV; HNU = 0 ppm; Nitrate = 0 mg/l; Nitrite = 0 mg/l; Ferrous Iron = 3.2 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well W-3-N Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/5/98	16:12	13.03	1,251.00	0.44	7.06	31.40
3/5/98	16:30	12.82	1,282.00	0.26	6.95	-5.70
3/5/98	16:32	13.19	1,272.00	0.26	7.00	-32.70
3/5/98	16:36	16.57	1,267.00	0.20	7.06	-71.90
3/5/98	16:40	15.76	1,271.00	0.18	7.07	-83.60
3/5/98	16:43	15.16	1,274.00	0.17	7.07	-87.30

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/6/98
Site/Well No.	HR-9	Replicate No.		Code No.	
Weather	Partly cloudy, high 40's	Sampling Time:	Begin 9:00	End	10:20

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	70.04
Depth to Water (ft bmp)	36.58
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	2"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~4
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Colorless
Odor	None
Appearance	Clear
pH (s.u.)	6.84
Conductivity (mS/cm)	
(µmhos/cm)	1281
Turbidity (NTU)	N/A
Temperature (°C)	15.88
Dissolved Oxygen (mg/L)	0.20
Salinity (%)	
Sampling Method	Flow-thru cell

Remarks: 36.58=DTW Final; Sample time = 9:55; ORP = 31.0 mV; HNU = 0 ppm; Nitrate = 8.8 mg/l; Nitrite = 0 mg/l; Ferrous Iron = 0.2 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and cis-1,2-Dichloroethene (8240B)	40 ml glass vial	3	Cool, HCl
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss.(6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well HR-9 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/6/98	9:26	14.83	1,266.00	0.32	6.86	68.40
3/6/98	9:33	15.25	1,271.00	0.23	6.85	60.50
3/6/98	9:38	15.42	1,273.00	0.21	6.85	48.40
3/6/98	9:42	15.71	1,271.00	0.20	6.84	39.70
3/6/98	9:48	15.80	1,277.00	0.20	6.84	33.00
3/6/98	9:52	15.88	1,281.00	0.20	6.84	30.90

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/6/98
Site/Well No.	GM-24	Replicate No.		Code No.	
Weather	Sunny, high 40's	Sampling Time:	Begin 10:35	End	11:45

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	69.40
Depth to Water (ft bmp)	39.88
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	2"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Light Brown
Odor	None
Appearance	Slightly turbid
pH (s.u.)	7.52
Conductivity (mS/cm)	
(µmhos/cm)	851
Turbidity (NTU)	N/A
Temperature (°C)	17.18
Dissolved Oxygen (mg/L)	5.15
Salinity (%)	
Sampling Method	Flow-thru cell

Remarks: 39.88=DTW Final; Sample time = 11:25; ORP = 42.8 mV; HNU = 0 ppm; Nitrate = 13.2 mg/l; Nitrite = 0 mg/l; Ferrous Iron = 0 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and cis-1,2-Dichloroethene (8240B)	40 ml glass vial	3	Cool, HCl
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well GM-24 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/6/98	10:55	14.77	856.00	5.47	7.55	57.40
3/6/98	11:02	16.65	843.00	5.24	7.54	40.20
3/6/98	11:08	17.16	845.00	5.16	7.53	42.00
3/6/98	11:12	17.18	851.00	5.15	7.52	42.50

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/6/98
Site/Well No.	GM-25	Replicate No.		Code No.	
Weather	Sunny, 50's	Sampling Time:	Begin 13:00	End	14:30

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	63.56
Depth to Water (ft bmp)	39.78
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	2"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	2.5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Light Brown
Odor	None
Appearance	Slightly turbid
pH (s.u.)	7.05
Conductivity (mS/cm)	
(µmhos/cm)	1219
Turbidity (NTU)	N/A
Temperature (°C)	18.36
Dissolved Oxygen (mg/L)	0.14
Salinity (%)	
Sampling Method	Flow-thru cell
Remarks	39.78=DTW Final; Sample time = 14:00; ORP = -198.9 mV; HNU = 0 ppm; Nitrate = 0/0 mg/l; Nitrite = 0/0 mg/l; Ferrous Iron = 2.4/2.4 mg/l.

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well GM-25 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/6/98	13:28	15.02	1,249.00	0.35	7.07	-102.50
3/6/98	13:32	16.22	1,230.00	0.16	7.06	-151.60
3/6/98	13:37	16.49	1,224.00	0.15	7.06	-177.80
3/6/98	13:40	17.15	1,222.00	0.15	7.06	-188.50
3/6/98	13:45	18.38	1,219.00	0.14	7.05	-198.90

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/9/98
Site/Well No.	HR-12	Replicate No.	DUP 58 - 10:25	Code No.	
Weather	Overcast, 30's	Sampling Time:	Begin 9:30	End	10:30

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	130.46
Depth to Water (ft bmp)	35.69
Water-Level Elevation (ft)	
Water Column in Well (ft)	94.77
Casing Diameter/Type	4"
Gallons in Well	61.60 x 3 = 184.8
Gallons Pumped/Bailed Prior to Sampling	185
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin 9:55 end 10:15
Pumping Rate (gpm)	5
Evacuation Method	2" submersible pump, normal

Field Parameters

Color	Colorless
Odor	None
Appearance	Clear
pH (s.u.)	
Conductivity (mS/cm)	
(µmhos/cm)	
Turbidity (NTU)	
Temperature (°C)	
Dissolved Oxygen (mg/L)	
Salinity (%)	
Sampling Method	Tubing after 3-well volumes
Remarks	Sample time = 10:20; RB34 = 9:50; HNU = 0 ppm; Sampled at about 95 ' due to tubing being only 100' long.

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and cis-1,2-Dichloroethene (8240B)	40 ml glass vial	3	Cool, HCl

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/9/98
Site/Well No.	HR-11	Replicate No.		Code No.	
Weather	Overcast, 30's	Sampling Time:	Begin 10:30	End	11:40

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	68.86
Depth to Water (ft bmp)	36.39
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	2"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Light Brown
Odor	None
Appearance	Slightly Turbid
pH (s.u.)	6.77
Conductivity (mS/cm)	
(µmhos/cm)	1664
Turbidity (NTU)	N/A
Temperature (°C)	16.04
Dissolved Oxygen (mg/L)	0.21
Salinity (%)	
Sampling Method	Flow-thru cell

Remarks: 36.39=DTW final; Sample time = 11:05; ORP = 121.7 mV; HNU = 0 ppm; Nitrate = 8.8 mg/l; Nitrite = 0 mg/l; Ferrous Iron = 0 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
App IX SVOC's (8270B)	1l amber glass	1	Cool
App IX PCB's (8080A)	1l amber glass	1	Cool
App IX Total Metals (6020)	1l plastic	1	Cool, HNO_3
App IX Diss. Metals (6020)	1l plastic	1	Cool, HNO_3
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well HR-11 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/9/98	10:41	10.98	1,704.00	4.39	7.49	134.60
3/9/98	10:44	13.33	1,676.00	0.39	6.75	135.50
3/9/98	10:48	14.56	1,665.00	0.28	6.76	130.80
3/9/98	10:53	15.65	1,660.00	0.25	6.77	125.90
3/9/98	10:57	15.99	1,661.00	0.22	6.77	123.20
3/9/98	11:00	16.04	1,664.00	0.21	6.77	121.70

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/9/98
Site/Well No.	GM-23	Replicate No.		Code No.	
Weather	Raining, 30's	Sampling Time:	Begin 12:20	End	13:55

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	33.10
Depth to Water (ft bmp)	25.03
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	2"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Light brown
Odor	None
Appearance	Slightly turbid
pH (s.u.)	6.98
Conductivity (mS/cm)	
(µmhos/cm)	1068
Turbidity (NTU)	N/A
Temperature (°C)	17.85
Dissolved Oxygen (mg/L)	0.41
Salinity (%)	
Sampling Method	Flow-thru cell
Remarks	25.03=DTW final; Sample time = 13:15; ORP = 91.7 mV; HNU = 20 ppm; Nitrate = 17.6 mg/l; Nitrite = .033 mg/l; Ferrous iron = 0 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
App IX SVOC's (8270B)	1l amber glass	1	Cool
App IX PCB's (8080A)	1l amber glass	1	Cool
App IX Total Metals (6020)	1l plastic	1	Cool, HNO_3
App IX Diss. Metals (6020)	1l plastic	1	Cool, HNO_3
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well GM-23 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/9/98	12:40	10.69	981.00	4.38	7.79	131.00
3/9/98	12:44	15.48	1,016.00	1.15	7.00	124.80
3/9/98	12:49	16.59	1,054.00	0.74	6.98	118.70
3/9/98	12:52	16.99	1,063.00	0.68	6.98	110.00
3/9/98	12:59	16.90	1,071.00	0.45	6.98	97.40
3/9/98	13:03	17.77	1,069.00	0.42	6.98	92.70

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/9/98
Site/Well No.	ME-6	Replicate No.		Code No.	
Weather	Rainy, 30's	Sampling Time:	Begin 14:00	End	15:10

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	31.80
Depth to Water (ft bmp)	24.52
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	2"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Very Light Brown
Odor	None
Appearance	Very Slightly turbid
pH (s.u.)	6.98
Conductivity (mS/cm)	
(µmhos/cm)	1975
Turbidity (NTU)	N/A
Temperature (°C)	22.53
Dissolved Oxygen (mg/L)	1.22
Salinity (%)	
Sampling Method	Flow-thru cell

Remarks: 24.50=DTW Final; Sample time = 14:50; ORP = 118.2 mV; HNU = 0 ppm; Nitrate = 22.0 mg/l; Nitrite = .033 mg/l; Ferrous Iron = 0 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chioride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well ME-6 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/9/98	14:22	14.00	1,955.00	6.15	7.68	126.70
3/9/98	14:26	19.25	1,979.00	1.69	7.01	117.70
3/9/98	14:30	21.96	1,980.00	1.47	7.00	116.70
3/9/98	14:34	22.28	1,980.00	1.32	6.99	117.70
3/9/98	14:38	22.53	1,976.00	1.23	6.99	118.60

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/9/98
Site/Well No.	ME-3	Replicate No.		Code No.	
Weather	Rainy, 30's	Sampling Time:	Begin 15:15	End	16:30

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	33.95
Depth to Water (ft bmp)	24.27
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	2"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Very Light Brown
Odor	None
Appearance	Very Slightly turbid
pH (s.u.)	6.93
Conductivity (mS/cm)	
(µmhos/cm)	2244
Turbidity (NTU)	N/A
Temperature (°C)	23.46
Dissolved Oxygen (mg/L)	0.26
Salinity (%)	
Sampling Method	Flow-thru cell

Remarks: 24.27=DTW Final; Sample time = 15:55; ORP = 119.4 mV; HNU = 0 ppm; Nitrate = 0 mg/l; Nitrite = .033 mg/l; Ferrous Iron = 0 mg/l.

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well ME-3 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/9/98	15:29	14.08	2,248.00	4.53	7.61	131.90
3/9/98	15:34	20.32	2,212.00	0.44	6.94	124.20
3/9/98	15:38	22.86	2,239.00	0.37	6.93	122.30
3/9/98	15:42	23.29	2,239.00	0.27	6.93	121.10
3/9/98	15:46	23.46	2,244.00	0.27	6.93	119.40

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/10/98
Site/Well No.	HR-13	Replicate No.		Code No.	
Weather	Cloudy, 20's	Sampling Time:	Begin 14:30	End	16:00

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	86.37
Depth to Water (ft bmp)	29.54
Water-Level Elevation (ft)	
Water Column in Well (ft)	56.83
Casing Diameter/Type	4"
Gallons in Well	36.9 x 3 = 110
Gallons Pumped/Bailed Prior to Sampling	110
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin 14:45 end 15:40
Pumping Rate (gpm)	2
Evacuation Method	2" submersible pump, normal

Field Parameters

Color	Colorless
Odor	None
Appearance	Clear
pH (s.u.)	6.97
Conductivity (mS/cm)	
(µmhos/cm)	1805
Turbidity (NTU)	N/A
Temperature (°C)	14.77
Dissolved Oxygen (mg/L)	0.08
Salinity (%)	
Sampling Method	Tubing after 3-well volumes
Remarks	29.50=DTW Final; Sample time = 15:45; ORP = 151.9 mV; HNU = 0 ppm.

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and cis-1,2-Dichloroethene (8240B)	40 ml glass vial	3	Cool, HCl

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/10/98
Site/Well No.	GM-21	Replicate No.	-	Code No.	
Weather	Cloudy, snowing, low 30's	Sampling Time:	Begin 12:50	End	14:20

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	53.70
Depth to Water (ft bmp)	20.52
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	2"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Colorless
Odor	None
Appearance	Clear
pH (s.u.)	7.13
Conductivity (mS/cm)	
(µmhos/cm)	1884
Turbidity (NTU)	N/A
Temperature (°C)	15.54
Dissolved Oxygen (mg/L)	0.38
Salinity (%)	
Sampling Method	Flow-thru cell

Remarks: 20.51=DTW final; Sample time = 14:00; ORP = 137.4 mV; HNU = 1 ppm; Nitrate = 17.6 mg/l; Nitrite = .066 mg/l; Ferrous Iron = 0 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
App IX SVOC's (8270B)	1l amber glass	1	Cool
App IX PCB's (8080A)	1l amber glass	1	Cool
App IX Total Metals (6020)	1l plastic	1	Cool, HNO_3
App IX Diss. Metals (6020)	1l plastic	1	Cool, HNO_3
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Milligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well GM-21 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/10/98	13:16	4.26	2,083.00	9.32	7.82	202.20
3/10/98	13:21	13.62	1,872.00	0.37	7.16	150.50
3/10/98	13:25	13.53	1,882.00	0.42	7.14	145.70
3/10/98	13:29	15.02	1,867.00	0.41	7.13	142.10
3/10/98	13:34	15.54	1,884.00	0.38	7.13	137.50

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/10/98
Site/Well No.	GM-22	Replicate No.	DUP 57 - 11:05	Code No.	
Weather	Partly cloudy, low 30's	Sampling Time:	Begin 9:20	End	12:00

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	53.10
Depth to Water (ft bmp)	24.58
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	2"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Colorless
Odor	None
Appearance	Clear
pH (s.u.)	7.12
Conductivity (mS/cm)	
(µmhos/cm)	2721
Turbidity (NTU)	N/A
Temperature (°C)	18.74
Dissolved Oxygen (mg/L)	0.25
Salinity (%)	
Sampling Method	Flow-thru cell

Remarks: 24.59=DTW final; Sample time = 11:00; RB33 = 10:20; MS101 = 11:10; MSD101 = 11:15; ORP = 150.3 mV; HNU = 0 ppm; Nitrate = 4.4/4.4 mg/l; Nitrite = .033/.033 mg/l; Ferrous Iron = 0/0 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
App IX SVOC's (8270B)	1l amber glass	1	Cool
App IX PCB's (8080A)	1l amber glass	1	Cool
App IX Total Metals (6020)	1l plastic	1	Cool, HNO_3
App IX Diss. Metals (6020)	1l plastic	1	Cool, HNO_3
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well GM-22 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/10/98	10:30	8.80	539.00	8.02	8.98	151.10
3/10/98	10:34	15.54	1,889.00	1.61	7.37	162.40
3/10/98	10:39	17.17	2,110.00	1.00	7.22	160.00
3/10/98	10:42	18.15	2,273.00	0.57	7.16	158.40
3/10/98	10:46	18.52	2,607.00	0.41	7.15	155.80
3/10/98	10:50	18.58	2,657.00	0.35	7.14	154.80
3/10/98	10:54	18.98	2,678.00	0.29	7.13	153.30
3/10/98	10:58	18.97	2,700.00	0.27	7.13	151.90
3/10/98	11:01	18.76	2,721.00	0.25	7.12	150.40

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/4/98
Site/Well No.	GM-8	Replicate No.	DUP 56=11:20	Code No.	
Weather	Overcast, high-30's	Sampling Time:	Begin 9:40	End	12:20

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	51.68
Depth to Water (ft bmp)	32.74
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	2"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Colorless
Odor	None
Appearance	Clear
pH (s.u.)	7.71
Conductivity (mS/cm)	
(µmhos/cm)	1538
Turbidity (NTU)	N/A
Temperature (°C)	17.49
Dissolved Oxygen (mg/L)	0.16
Salinity (%)	
Sampling Method	Flow-thru cell

Remarks: 32.75 = DTW Final; Sample time = 11:15; MS100 = 11:25; MSD100 = 11:30; RB32 = 10:15; ORP = -144.3 mV; HNU = 0 ppm; Nitrate = 0 mg/l; Nitrite = 0 mg/l; Ferrous Iron = 0.8 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B) and	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well GM-8 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/4/98	10:37	13.96	1,446.00	2.48	8.49	137.00
3/4/98	10:48	11.78	1,532.00	0.46	7.39	63.90
3/4/98	11:02	18.12	1,537.00	0.29	7.92	-79.20
3/4/98	11:07	17.60	1,535.00	0.18	7.93	-86.60
3/4/98	11:16	17.47	1,538.00	0.17	7.70	-141.20
3/4/98	11:22	17.53	1,539.00	0.16	7.70	-145.00

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	3/4/98
Site/Well No.	GM-6	Replicate No.		Code No.	
Weather	Overcast, high-30's	Sampling Time:	Begin 13:45	End	15:45

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	46.48
Depth to Water (ft bmp)	28.18
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	2"
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	~5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Colorless
Odor	None
Appearance	Clear
pH (s.u.)	7.01
Conductivity (mS/cm)	
(µmhos/cm)	1421
Turbidity (NTU)	N/A
Temperature (°C)	18.49
Dissolved Oxygen (mg/L)	0.88
Salinity (%)	
Sampling Method	Flow-thru cell

Remarks: Sample time = 15:00; ORP = 57.7 mV; HNU = 0 ppm; Nitrate = 4.4 mg/l; Nitrite = 0 mg/l; Ferrous Iron = 0 mg/l

Constituents Sampled	Container Description	Number	Preservative
App IX VOCs (8240B) and	40 ml glass vial	3	Cool, HCl
cis-1,2-Dichloroethene (8240B)			
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B) and	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light Hydrocarbons (AM18G)	40 ml amber glass vials	2	Cool
Permanent Gases (AM15.01G)	40 ml amber glass vials	2	Cool

Sampling Personnel: W. J. Ferguson & T. Kuhn

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well GM-6 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
3/4/98	13:58	13.69	1,356.00	4.87	7.51	82.10
3/4/98	14:15	17.55	1,420.00	1.77	7.00	69.10
3/4/98	14:24	17.81	1,423.00	1.63	7.01	66.80
3/4/98	14:42	18.49	1,426.00	1.15	7.01	57.40
3/4/98	14:46	18.55	1,426.00	1.04	7.01	57.30
3/4/98	14:51	18.48	1,422.00	0.95	7.00	57.40
3/4/98	14:55	18.49	1,422.00	0.88	7.00	57.60

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Groundwater Sampling Logs
August 1998

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	8/17/98
Site/Well No.	GM-28	Replicate No.	DUP61	Code No.	
Weather	Sunny 90's	Sampling Time:	Begin 12:49	End	15:30

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	30.70
Depth to Water (ft bmp)	21.54
Water-Level Elevation (ft)	
Water Column in Well (ft)	9.16
Casing Diameter/Type	2"
Gallons in Well	1.46
Gallons Pumped/Bailed Prior to Sampling	
Sample Pump Intake Setting (ft bmp)	5' below W.T.
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" Submersible pump

Field Parameters

Color	Light brown
Odor	
Appearance	Slightly turbid
pH (s.u.)	6.96
Conductivity (mS/cm)	
(µmhos/cm)	1040
Turbidity (NTU)	
Temperature (°C)	19
Dissolved Oxygen (mg/L)	
Salinity (%)	
Sampling Method	Disposable bailer & rope
Remarks	Took RB38 at 15:00; Took MS 103 at 15:15. Took MSD103 at 15:20. Took DUP61 at 15:10. Sample time=15:05

Constituents Sampled	Container Description	Number	Preservative
VOC 8240 short list	40 ml glass vial	3	Cool, HCl

Sampling Personnel: W. J. Ferguson

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	8/19/98
Site/Well No.	GM-27-55/TW	Replicate No.		Code No.	
Weather	Sunny 90's	Sampling Time:	Begin 7:30	End	8:15

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	60.00
Depth to Water (ft bmp)	49.02
Water-Level Elevation (ft)	
Water Column in Well (ft)	10.98
Casing Diameter/Type	2"
Gallons in Well	1.76 x 3 =3.52
Gallons Pumped/Bailed Prior to Sampling	2.5 (going dry after 2.5 gallons)
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	Disposable bailer & rope

Field Parameters

Color	Dark brown
Odor	
Appearance	Extremely silty & turbid
pH (s.u.)	NR
Conductivity (mS/cm)	
(µmhos/cm)	NR
Turbidity (NTU)	N/A
Temperature (°C)	NR
Dissolved Oxygen (mg/L)	
Salinity (%)	
Sampling Method	Disposable bailer & rope
Remarks	A temporary well was set to get water sample at 53-55' interval. Temp well screened 53-55'. Installed at 15:00 on 8/18/98

Constituents Sampled	Container Description	Number	Preservative
VOC 8240 short list	40 ml glass vial	3	Cool, HCl

Sampling Personnel: W. J. Ferguson

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	8/24/98
Site/Well No.	GM-27-08-24-98/GW	Replicate No.		Code No.	
Weather	Sunny 80's	Sampling Time:	Begin 9:30	End	10:55

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	45.00
Depth to Water (ft bmp)	22.41
Water-Level Elevation (ft)	
Water Column in Well (ft)	22.59
Casing Diameter/Type	2"
Gallons in Well	3.9
Gallons Pumped/Bailed Prior to Sampling	40
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump

Field Parameters

Color	Brown
Odor	
Appearance	Turbid
pH (s.u.)	6.70
Conductivity (mS/cm)	
(µmhos/cm)	1005
Turbidity (NTU)	
Temperature (°C)	16.5
Dissolved Oxygen (mg/L)	
Salinity (%)	
Sampling Method	Disposable bailer & rope
Remarks	Sample time=10:50
	Well was developed prior to sampling

Constituents Sampled	Container Description	Number	Preservative
VOC 8240 short list	40 ml glass vial	3	Cool, HCl

Sampling Personnel: W. J. Ferguson

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	8/24/98
Site/Well No.	ME-6-08-24-98/GW	Replicate No.		Code No.	
Weather	Sunny 80's	Sampling Time:	Begin 11:00	End	11:30

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	31.85
Depth to Water (ft bmp)	22.23
Water-Level Elevation (ft)	
Water Column in Well (ft)	9.62
Casing Diameter/Type	2"
Gallons in Well	1.5
Gallons Pumped/Bailed Prior to Sampling	4.5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	Disposable bailer & rope

Field Parameters

Color	Brown
Odor	
Appearance	Turbid
pH (s.u.)	6.53
Conductivity (mS/cm)	
(µmhos/cm)	1300
Turbidity (NTU)	
Temperature (°C)	23
Dissolved Oxygen (mg/L)	
Salinity (%)	
Sampling Method	Disposable bailer & rope
Remarks	Sample time=11:22

Constituents Sampled	Container Description	Number	Preservative
VOC 8240 short list	40 ml glass vial	3	Cool, HCl

Sampling Personnel: W. J. Ferguson

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	8/24/98
Site/Well No.	GM-26-08-24-98/GW	Replicate No.		Code No.	
Weather	Sunny 80's	Sampling Time:	Begin 11:45	End	12:30

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	59.08
Depth to Water (ft bmp)	18.92
Water-Level Elevation (ft)	
Water Column in Well (ft)	40.08
Casing Diameter/Type	2"
Gallons in Well	6.4
Gallons Pumped/Bailed Prior to Sampling	19
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	Disposable bailer & rope

Field Parameters

Color	Light brown
Odor	
Appearance	Slightly turbid
pH (s.u.)	6.57
Conductivity (mS/cm)	
(µmhos/cm)	860
Turbidity (NTU)	
Temperature (°C)	14
Dissolved Oxygen (mg/L)	
Salinity (%)	
Sampling Method	Disposable bailer & rope
Remarks	Sample time=12:20

Constituents Sampled	Container Description	Number	Preservative
VOC 8240 short list	40 ml glass vial	3	Cool, HCl

Sampling Personnel: W. J. Ferguson

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Millisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Milligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	8/24/98
Site/Well No.	HR-3-08-24-98/GW	Replicate No.		Code No.	
Weather	Sunny 80's	Sampling Time:	Begin 13:50	End	14:30

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	60.00
Depth to Water (ft bmp)	29.16
Water-Level Elevation (ft)	
Water Column in Well (ft)	30.84
Casing Diameter/Type	2"
Gallons in Well	4.9
Gallons Pumped/Bailed Prior to Sampling	15
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	Disposable bailer & rope

Field Parameters

Color	Colorless
Odor	
Appearance	Clear
pH (s.u.)	6.62
Conductivity (mS/cm)	
(µmhos/cm)	770
Turbidity (NTU)	
Temperature (°C)	19.9
Dissolved Oxygen (mg/L)	
Salinity (%)	
Sampling Method	Disposable bailer & rope
Remarks	Sample time=14:20

Constituents Sampled	Container Description	Number	Preservative
VOC 8240 short list	40 ml glass vial	3	Cool, HCl

Sampling Personnel: W. J. Ferguson

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	8/24/98
Site/Well No.	HR-1-08-24-98/GW	Replicate No.	DUP64	Code No.	
Weather	Sunny 80's	Sampling Time:	Begin 15:45	End	16:15

Evacuation Data

Measuring Point	Top of PVC Casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	59.20
Depth to Water (ft bmp)	26.65
Water-Level Elevation (ft)	
Water Column in Well (ft)	32.55
Casing Diameter/Type	2"
Gallons in Well	5.2 x 3 = 15.6
Gallons Pumped/Bailed Prior to Sampling	~15
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	Disposable bailer & rope

Field Parameters

Color	Colorless
Odor	
Appearance	Clear
pH (s.u.)	6.52
Conductivity (mS/cm)	
(µmhos/cm)	960
Turbidity (NTU)	
Temperature (°C)	21
Dissolved Oxygen (mg/L)	
Salinity (%)	
Sampling Method	Disposable bailer & rope
Remarks	Took RB41 at 15:50; MS106 = 16:05; MSD 105 = 16:07. DUP64=16:03 Sample time=16:01

Constituents Sampled	Container Description	Number	Preservative
VOC 8240 short list	40 ml glass vial	3	Cool, HCl

Sampling Personnel: W. J. Ferguson

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	8/26/98
Site/Well No.	GM-27/LF	Replicate No.	DUP65=10:15	Code No.	
Weather	Sunny 80's	Sampling Time:	Begin 8:15	End	11:15

Evacuation Data

Measuring Point	Top of PVC casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	
Depth to Water (ft bmp)	
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Brown
Odor	
Appearance	Turbid
pH (s.u.)	6.80
Conductivity (mS/cm)	
(µmhos/cm)	1271
Turbidity (NTU)	
Temperature (°C)	20.27
Dissolved Oxygen (mg/L)	1.34
Salinity (%)	
Sampling Method	Flow-thru cell

Remarks: Took RB-42 at 8:45; MS107=10:30, sample time= 10:00, MSD106=10:45. HNu = 0 ppm. ORP=191.60 mV, Nitrate: 0/0 mg/l, Ferrous Iron 0/0 mg/l Nitrite: 0.5/0.33 mg/L

Constituents Sampled	Container Description	Number	Preservative
VOC 8240 short list	40 ml glass vial	3	Cool, HCl
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light hydrocarbons (AM18G)	40 ml amber glass	2	Cool
Permanent gases (AM15.01G)	40 ml amber glass	2	Cool

Sampling Personnel: W. J. Ferguson

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	mililiter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well GM-27 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
8/26/98	9:14:30	17.80	1319	10.12	6.57	358.20
8/26/98	9:15:30	17.36	1312	4.97	6.66	309.50
8/26/98	9:16:30	17.38	1290	2.81	6.73	268.30
8/26/98	9:17:30	17.61	1283	2.00	6.75	237.30
8/26/98	9:18:30	17.83	1282	1.84	6.76	222.50
8/26/98	9:19:30	18.35	1279	1.66	6.77	209.50
8/26/98	9:20:30	18.98	1278	1.51	6.77	197.10
8/26/98	9:21:30	19.51	1276	1.43	6.79	193.80
8/26/98	9:22:30	19.66	1279	1.40	6.80	194.70
8/26/98	9:23:30	20.27	1271	1.34	6.80	191.60

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	8/26/98
Site/Well No.	GM-23/LF	Replicate No.		Code No.	
Weather	Sunny 80's	Sampling Time:	Begin 11:15	End	12:40

Evacuation Data

Measuring Point	Top of PVC casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	
Depth to Water (ft bmp)	
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Light brown
Odor	
Appearance	Slightly turbid
pH (s.u.)	6.51
Conductivity (mS/cm)	
(µmhos/cm)	952
Turbidity (NTU)	
Temperature (°C)	18.31
Dissolved Oxygen (mg/L)	2.66
Salinity (%)	
Sampling Method	Flow-thru cell

Remarks: Nitrate: 22 mg/l, Ferrous iron: 0 mg/l, Nitrite 0.17 mg/l, ORP=287.10 mV, HNu = 0.5 ppm. Sample time=11:45

Constituents Sampled	Container Description	Number	Preservative
VOC 8240 short list	40 ml glass vial	3	Cool, HCl
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light hydrocarbons (AM18G)	40 ml amber glass	2	Cool
Permanent gases (AM15.01G)	40 ml amber glass	2	Cool

Sampling Personnel: W. J. Ferguson

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well GM-23 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
8/26/98	11:30:00	18.54	850	4.56	6.84	280.80
8/26/98	11:31:00	17.83	863	4.04	6.71	280.70
8/26/98	11:32:00	17.87	886	3.51	6.65	282.50
8/26/98	11:33:00	18.21	927	3.05	6.61	283.70
8/26/98	11:34:00	18.25	943	2.84	6.59	285.40
8/26/98	11:35:00	18.31	952	2.66	6.51	287.10

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

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Water Sampling Log

Project	GMC RFI	Project No.	OH000294.0001(2)	Page	1 of 1
Site Location	Moraine, Ohio			Date	8/26/98
Site/Well No.	GM-28/LF	Replicate No.		Code No.	
Weather	Sunny 80's	Sampling Time:	Begin 12:40	End	14:00

Evacuation Data

Measuring Point	Top of PVC casing
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	
Depth to Water (ft bmp)	
Water-Level Elevation (ft)	
Water Column in Well (ft)	
Casing Diameter/Type	
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	2" submersible pump, low flow

Field Parameters

Color	Brown
Odor	
Appearance	Turbid
pH (s.u.)	7.02
Conductivity (mS/cm)	
(µmhos/cm)	1326
Turbidity (NTU)	
Temperature (°C)	19.24
Dissolved Oxygen (mg/L)	1.25
Salinity (%)	
Sampling Method	Flow-thru cell

Remarks: Ferrous Iron: 0 mg/l, Nitrite 0 mg/l, Nitrate 0 mg/l, ORP=274.70 mV, Sample time=13:05. HNu = 0 ppm. Field test kits taken on 9/16/98

Constituents Sampled	Container Description	Number	Preservative
VOC 8240 short list	40 ml glass vial	3	Cool, HCl
Nitrogen - Ammonia (SM4500NH3-H)	1l plastic	1	Cool, H_2SO_4
Iron & Manganese Diss. (6010A)	1l plastic	1	Cool, HNO_3
Iron & Manganese Tot. (6010A)	1l plastic	1	Cool, HNO_3
Chlorides (SM4500-CL-C)	250 ml plastic	1	Cool
Sulfide (SM4500-S2E)	500 ml plastic	1	Cool, NaOH/ZnAc
TOC (SM5310B)	250 ml plastic	1	Cool, H_2SO_4
Sulfate (SM4500S04-E)	250 ml plastic	1	Cool
Light hydrocarbons (AM18G)	40 ml amber glass	2	Cool
Permanent gases (AM15.01G)	40 ml amber glass	2	Cool

Sampling Personnel: W. J. Ferguson

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

Well GM-28 Field Parameters

Date	Time	Temp °C	SpCond uS/cm	DO mg/L	pH	ORP mV
8/26/98	12:56:30	23.88	1423	3.29	7.38	282.50
8/26/98	12:57:30	19.26	1423	1.84	7.18	274.40
8/26/98	12:58:30	18.92	1366	1.29	7.10	271.00
8/26/98	12:59:30	18.99	1350	1.16	7.05	271.20
8/26/98	13:00:30	19.07	1339	1.18	7.03	272.30
8/26/98	13:01:30	19.24	1326	1.25	7.02	274.70

Notes:

SpCond	Specific Conductivity.
°C	Degrees centigrade.
DO	Dissolved oxygen.
ORP	Oxidation/reduction potential.
mg/l	Milligrams per liter.
mV	Millivolts.
pH	Hydrogen ions.
uS	Microsiemens.

ARCADIS GERAGHTY & MILLER

Soil Boring and Sampling Logs

ARCADIS GERAGHTY & MILLER

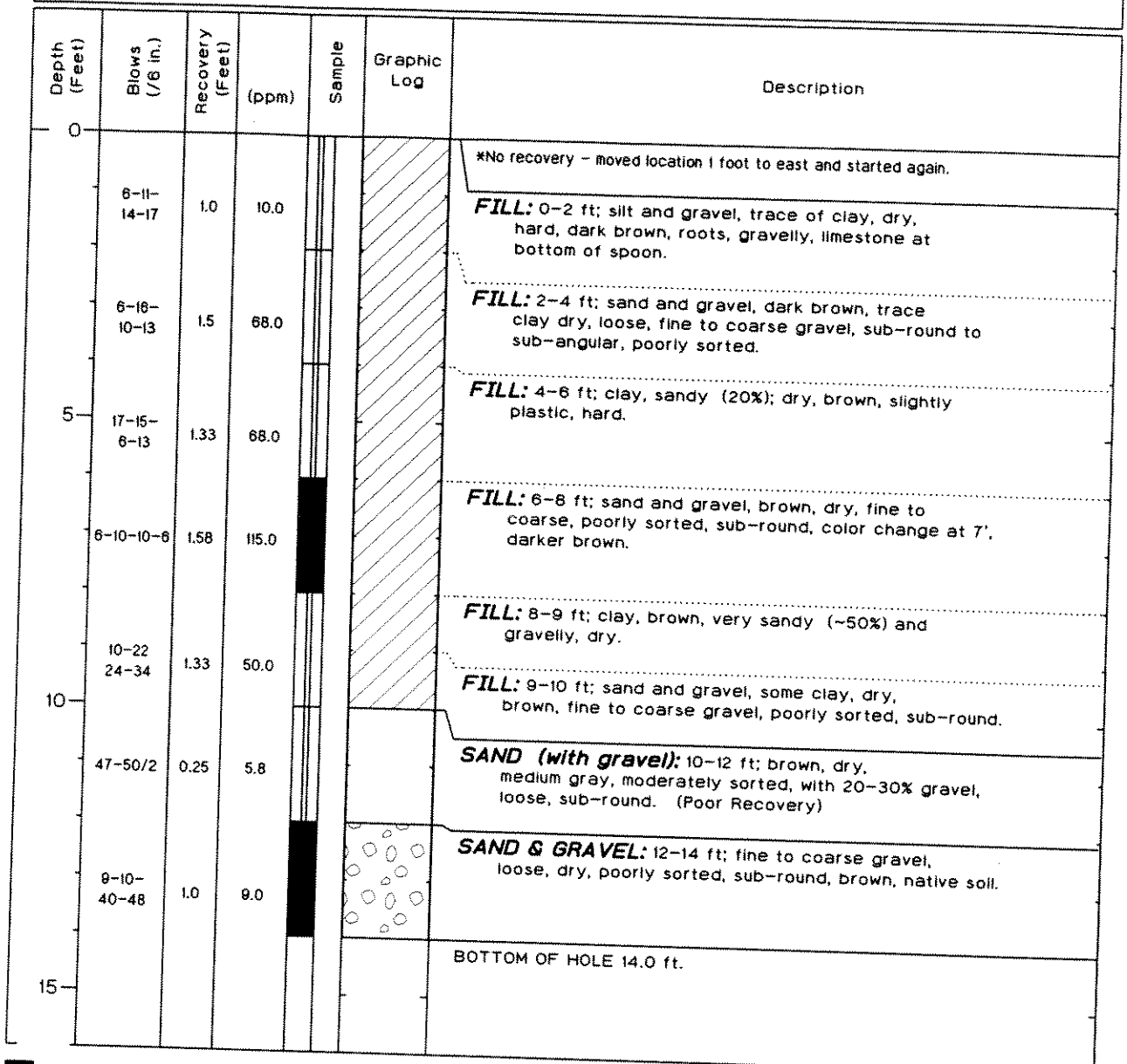
AOI 34 - Excavation Area 1
August 1997

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: EA1-BH01

GENERAL MOTORS

Moraine, Ohio



■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drillers
Driller: Cord/Conrad
Drilling Method: Hollow-Stem Auger
Drilling Fluid: None
Remarks:

Geologist: S. Clouse
Total Depth: 14.0
Surface Elev.:
Datum:
North Coor.:

Begin Drilling: 08/28/97
End Drilling: 08/28/97
Converted to Well: No
Well Name:
East Coor.:

OH0294.001.002

Disk: GM (1); File: EA1-BH01; (rev: 10/28/97)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: General Motors Corporation, Moraine, Ohio

Date: 8/28/97
Project No.: OH000294.0001.00002

Sample No.: EA1-BH01 (6-8)
Coded Replicate No.: DUP-39

Time Sampling Began: 10:05
Time Sampling Ended: 10:15

Sampling Method and Material: Split-spoon sampler with hollow stem auger

From	To	Soil/Sediment/Sludge Description
12	14	Sand and gravel, brown, dry, fine to coarse grain, poorly sorted, subrounded (fill)

OTHER (OVA; Hnu; etc.): 115 ppm

Constituents Sampled	Container Description	Preservative
TCL VOCs	4 oz glass jar	Cool
SVOCs, PCBs, TAL Metals	16 oz glass jar	Cool

Remarks:

Sample Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: General Motors Corporation, Moraine, Ohio

Date: 8/28/97
Project No.: OH000294.0001.00002

Sample No.: EA1-BH01 (12-14)
Coded Replicate No.:

Time Sampling Began: 10:25
Time Sampling Ended: 10:35

Sampling Method and Material: Split-spoon sampler with hollow stem auger

From	To	Soil/Sediment/Sludge Description
12	14	Sand and gravel, fine to coarse grain, loose, dry poorly sorted, subrounded, brown (native soil)

OTHER (OVA; Hnu; etc.): 9.0 ppm

Constituents Sampled	Container Description	Preservative
TCL VOCs	4 oz glass jar	Cool
SVOCs, PCBs, TAL Metals	16 oz glass jar	Cool

Remarks:

Sample Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

AOI 35 - Excavation Area 2
August 1997

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: EA2-BH01

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0						**ASPHALT:** 0–0.2 ft.
	5-14-20-30	0.5	9.4			**FILL:** 0.2–3 ft; sand and gravel, gray, poorly sorted, sub-round, loose, fine to coarse grain, dry.
	25-15-50/2	0.5	6.4			**REFUSAL:** 3–4 ft; will move 3' to North of location.
5	7-29-30-35	0.5	25.0			**FILL:** 4–6 ft; sand and gravel poorly sorted, fine to cobble size, brown, dry, round to sub-round.
	21-27-23-11	0.5	68.0			**FILL:** 6–8 ft; sand and gravel, same as above.
	1-6	0.75	4.0			**FILL:** 8–10 ft; clay brown, moist, plastic with some gravel, last 3" asphalt, moist.
10	0	50/3	NR			**REFUSAL:** 10–12 ft; No Recovery.
	4-3-4-1	1.25	4.5			**FILL:** 12–14 ft; –3" asphalt, slightly moist to wet. –10" sand and gravel, poorly sorted, moist to wet, fine to coarse gravel. –2" clay, brown, hard, plastic, moist, with 30% gravel and sand, coarse, gray.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drillers
Driller: Cord/Conrad
Drilling Method: Hollow-Stem Auger
Drilling Fluid: None
Remarks:

Geologist: S. Clouse
Total Depth: 24.0
Surface Elev.:
Datum:
North Coor.:

Begin Drilling: 08/28/97
End Drilling: 08/28/97
Converted to Well: No
Well Name:
East Coor.:

OH0294.001.002

Disk: GM (1); File: EA2-BH01; (rev: 10/28/97)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: EA2-BH01

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
14						
	10-9-12-8	0	NR			***NO RECOVERY:*** 14-16 ft.
	24-7-13-13	0.17	4.0			***FILL:*** 16-18 ft; sand and gravel, gray, dry, loose, sub-round to sub-angular, poorly sorted, fine to coarse, gray.
19	15-20-30-15	0	NR			***NO RECOVERY:*** 18-20 ft.
	26-6-19-9	0.42	1.0			***SAND & GRAVEL:*** 20-22 ft; looks like native soil, fine to coarse grain, dry, brown, loose, sub-round, poorly sorted. (Drilling Easier).
	15-32-50/4	1.0	3.2			***SAND & GRAVEL:*** 22-24 ft; same as above.
24						BOTTOM OF HOLE 24.0 ft.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drillers
Driller: Cord/Conrad
Drilling Method: Hollow-Stem Auger
Drilling Fluid: None
Remarks:

Geologist: S. Clouse
Total Depth: 24.0
Surface Elev.:
Datum:
North Coor.:

Begin Drilling: 08/28/97
End Drilling: 08/28/97
Converted to Well: No
Well Name:
East Coor.:

OH0294.001.002

Disk: GM (1); File: EA2-BH01; (rev: 10/28/97)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: General Motors Corporation, Moraine, Ohio

Date: 8/28/97
Project No.: OH000294.0001.00002

Sample No.: EA2-BH01 (6-8)
Coded Replicate No.:

Time Sampling Began: 1455
Time Sampling Ended: 1505

Sampling Method and Material: Split-spoon sampler with hollow stem auger

From	To	Soil/Sediment/Sludge Description
6	8	Sand and gravel, brown, dry, loose, fine to cobble size and subrounded (fill)

OTHER (OVA; Hnu; etc.): 68 ppm

Constituents Sampled	Container Description	Preservative
TCL VOCs	4 oz glass jar	Cool
SVOCs, PCBs, TAL Metals	16 oz glass jar	Cool

Remarks: Took rinseate blank (RB-26) at 13:50, prior to sampling this interval

Sample Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: General Motors Corporation, Moraine, Ohio

Date: 8/28/97

Project No.: OH000294.0001.00002

Sample No.: EA2-BH01 (22-24)

Coded Replicate No.:

Time Sampling Began: 1605

Time Sampling Ended: 1615

Sampling Method and Material: Split-spoon sampler with hollow stem auger

From	To	Soil/Sediment/Sludge Description
22	24	Sand and gravel, fine to coarse, brown, dry, loose, subrounded, poorly sorted

OTHER (OVA; Hnu; etc.): 3.2 ppm

Constituents Sampled	Container Description	Preservative
TCL VOCs	4 oz glass jar	Cool
SVOCs, PCBs, TAL Metals	16 oz glass jar	Cool

Remarks:

Sample Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

AOI 13 - Buildings 4, 6, and 13
February 1998

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP1

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	N/A	0	N/A			***NO RECOVERY:*** 0-4 ft.
5	N/A	2.0	0			***CLAY, GRAVEL & SAND:*** 4-8 ft; sand (fine to medium) 30%; gravel (fine to medium) 30%; silt/clay 40%; moderate yellowish brown, moist, loose-pliable.
						BOTTOM OF HOLE 8.0 ft.
10						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 729.4619
Datum: Mean Sea Level
North Coor.: 2403.11022

Begin Drilling: 02/19/98
End Drilling: 02/19/98
Converted to Well: No
Well Name:
East Coor.: 6084.08994

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BDG-DP1 (REV:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/19/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP1-8/SL
Coded Replicate No.:

Time Sampling Began: 7:50
Time Sampling Ended: 7:53

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; Hnu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample sent to NET (8080A) - No DUP taken, not enough recovery

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP2

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0						
	N/A	0.5	0			***CLAY & SILT:*** 0–4 ft; silt and clay 90%; gravel (fine), 10%; moderate yellowish brown, wet, pliable.
5	N/A	3.5	0			***CLAY & SILT:*** 4–8 ft; silt and clay 60%; gravel (fine to coarse) 20%; sand (fine to coarse) 20%; dark yellowish brown, wet, pliable, loose.
						BOTTOM OF HOLE 8.0 ft.
10						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.:
Datum:
Begin Drilling: 02/18/98
End Drilling: 02/18/98
Converted to Well: No
Well Name:
Remarks:
North Coor.:
East Coor.:

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BDG-DP2 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/18/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP2-8/SL
Coded Replicate No.: DUP45

Time Sampling Began: 14:05
Time Sampling Ended: 14:08

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; Hnu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET, RB-27 taken prior to acetate liner being used for this interval and sent to NET (6010A, 7060, 7421, 7470A, 7740, 7841, 8240B, 8080A).

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP3

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	N/A	1.5	0			***GRAVEL & SAND:*** 0–4 ft; gravel 50% (coarse); sand 40% (fine to coarse); silt and clay 10%; dusky yellowish brown, slightly moist, loose.
5	N/A	2.0	0			***CLAY & SILT:*** 4–8 ft; silt and clay 70%; sand 30% (fine to medium); dusky yellowish brown, slightly moist, pliable.
10						BOTTOM OF HOLE 8.0 ft.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 729.3107
Datum: Mean Sea Level
North Coor.: 2447.27921

Begin Drilling: 02/17/98
End Drilling: 02/17/98
Converted to Well: No
Well Name:
East Coor.: 8370.29528

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BDG-DP3 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/17/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP3-8/SL
Coded Replicate No.:

Time Sampling Began: 15:35
Time Sampling Ended: 15:37

Sampling Method and Material: 4" acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET - No DUP taken, not enough recovery

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP4

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	N/A	3.0	0			***CLAY & SILT:*** 0–4 ft; silt and clay 90%; gravel 10% (coarse); moderate yellowish brown, moist, pliable.
5	N/A	3.0	0			***CLAY & SILT:*** 4–8 ft; silt and clay 60%; sand 20% (fine to coarse); gravel 20% (fine to coarse); dark yellowish brown, slightly moist, pliable.
						BOTTOM OF HOLE 8.0 ft.
10						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 729.2791
Datum: Mean Sea Level
North Coor.: 2324.60440

Begin Drilling: 02/17/98
End Drilling: 02/17/98
Converted to Well: No
Well Name:
East Coor.: 6336.47745

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BDG-DP4 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/17/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP4-8/SL
Coded Replicate No.: DUP40

Time Sampling Began: 15:55
Time Sampling Ended: 15:57

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP5

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	N/A	3.0	0			***CLAY & SILT:*** 0-4 ft; silt and clay 70%; gravel 30% (medium to coarse); dark yellowish brown, moist, pliable.
5	N/A	2.0	0			***CLAY & SILT:*** 4-8 ft; silt and clay 70%; sand 20% (fine to medium); gravel 10% (fine); moderate yellowish brown, moist, pliable.
10						BOTTOM OF HOLE 8.0 ft.

■ Sample to Lab ▯▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 729.0853
Datum: Mean Sea Level
North Coor.: 2308.25622

Begin Drilling: 02/18/98
End Drilling: 02/18/98
Converted to Well: No
Well Name:
East Coor.: 6213.92937

OH000294.0001.0002

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/18/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP5-8/SL
Coded Replicate No.:

Time Sampling Began: 14:20
Time Sampling Ended: 14:23

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET - No DUP taken, not enough recovery

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP6

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	N/A	2.0	0			***CLAY & SILT:*** 0–4 ft; silt and clay 90%; sand 10% (fine to medium), moderate yellowish brown, slightly damp, pliable.
5	N/A	1.5	0			***GRAVEL & SAND:*** 4–8 ft; gravel 50% (medium to coarse); sand 30% (fine to coarse); silt and clay 20%; moderate yellowish brown, damp to wet, loose/pliable.
10						BOTTOM OF HOLE 8.0 ft.

■ Sample to Lab ▯▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 729.2783
Datum: Mean Sea Level
North Coor.: 2303.65699

Begin Drilling: 02/17/98
End Drilling: 02/17/98
Converted to Well: No
Well Name:
East Coor.: 6335.91265

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BDG-DP6 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/17/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP6-8/SL
Coded Replicate No.:

Time Sampling Began: 16:10
Time Sampling Ended: 16:12

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET - No DUP taken, not enough recovery

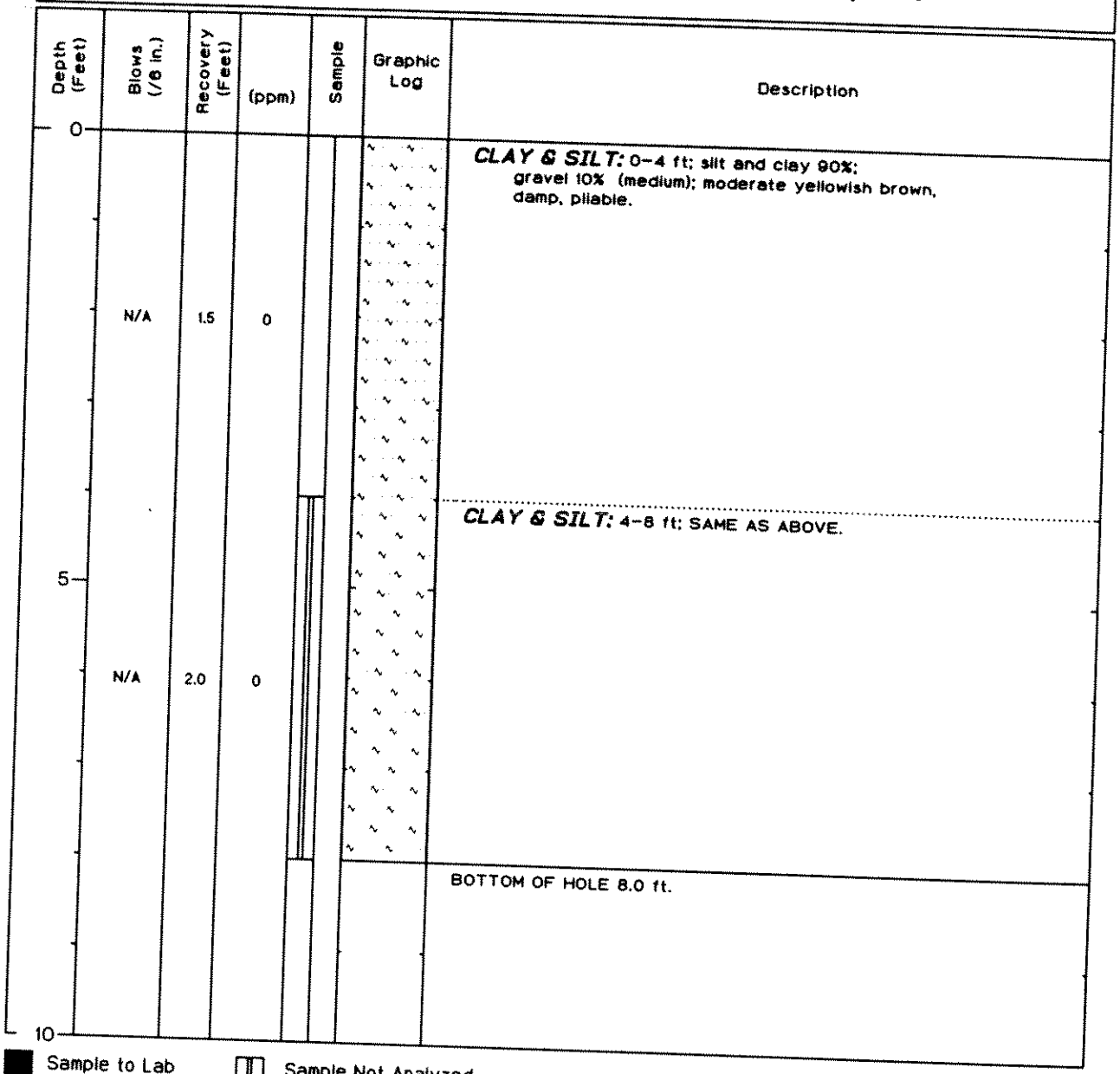
Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP7

GENERAL MOTORS

Moraine, Ohio



Sample to Lab Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 729.2792
Datum: Mean Sea Level
North Coor.: 2306.51814

Begin Drilling: 02/17/98
End Drilling: 02/17/98
Converted to Well: No
Well Name:
East Coor.: 8367.99687

OH000294.0001.0002

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/17/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP7-8/SL
Coded Replicate No.: DUP41

Time Sampling Began: 16:35
Time Sampling Ended: 16:37

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

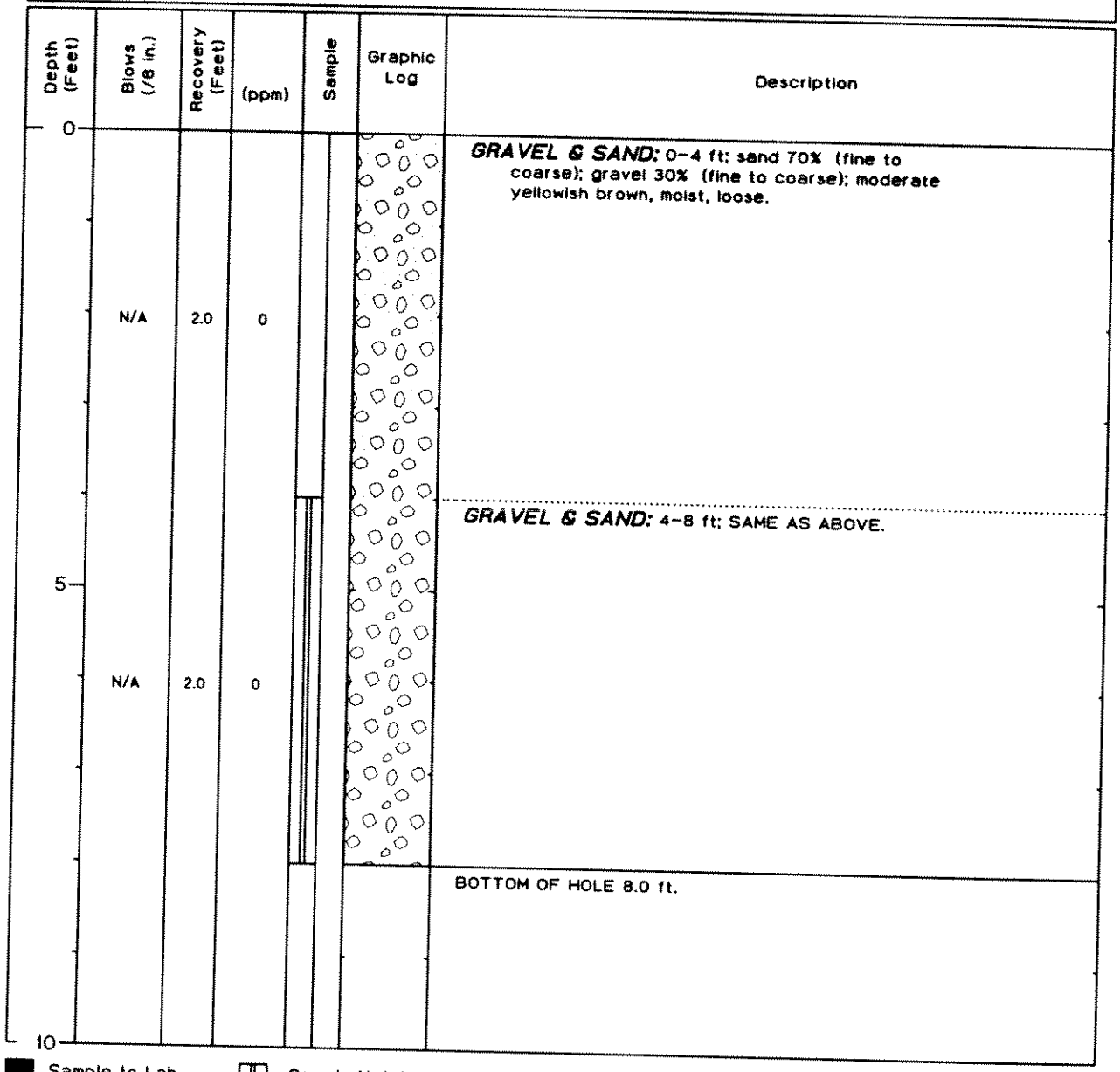
Remarks: Sample not sent to NET

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP8

GENERAL MOTORS — Moraine, Ohio



■ Sample to Lab ▯▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 729.2562
Datum: Mean Sea Level
North Coor.: 2241.13094

Begin Drilling: 02/18/98
End Drilling: 02/18/98
Converted to Well: No
Well Name:
East Coor.: 8002.68047

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BDG-DP8 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/18/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP8-8/SL
Coded Replicate No.:

Time Sampling Began: 15:05
Time Sampling Ended: 15:08

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET - No DUP taken, not enough recovery

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP9

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	N/A	3.0	0			***CLAY & SILT:*** 0-4 ft; silt and clay 60%; sand 20% (fine to coarse); gravel 20% (fine to coarse); moderate yellowish brown, moist, pliable.
5	N/A	2.0	0			***CLAY & SILT:*** 4-8 ft; SAME AS ABOVE.
10						BOTTOM OF HOLE 8.0 ft.

■ Sample to Lab ▯▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 729.3417
Datum: Mean Sea Level
North Coor.: 2198.64205

Begin Drilling: 02/18/98
End Drilling: 02/18/98
Converted to Well: No
Well Name:
East Coor.: 6224.14754

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BDG-DP9 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/18/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP9-8/SL
Coded Replicate No.:

Time Sampling Began: 14:35
Time Sampling Ended: 14:38

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET - No DUP taken, not enough recovery

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP10

GENERAL MOTORS

Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	N/A	2.0	0			***CLAY & SILT:*** 0-4 ft; silt and clay 60%; sand 40% (fine to coarse); moderate yellowish brown, damp, pliable.
5	N/A	2.0	0			***CLAY & SILT:*** 4-8 ft; SAME AS ABOVE.
10						BOTTOM OF HOLE 8.0 ft.

■ Sample to Lab ▯▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 729.3227
Datum: Mean Sea Level
North Coor.: 2244.83481

Begin Drilling: 02/17/98
End Drilling: 02/17/98
Converted to Well: No
Well Name:
East Coor.: 6336.69841

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BDG-DP10 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/17/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP10-8/SL
Coded Replicate No.: DUP42

Time Sampling Began: 16:50
Time Sampling Ended: 16:52

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP11

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	N/A	2.0	0			***CLAY & SILT:*** 0–4 ft; silt and clay 80%; sand 20% (fine to medium); moderate yellowish brown, moist, pliable
5	N/A	2.0	0			***SAND:*** 4–8 ft; sand 60% (fine to coarse); gravel 10% (fine to medium); silt and clay 30%; dark yellowish brown, wet, pliable.
10						BOTTOM OF HOLE 8.0 ft.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 729.2953
Datum: Mean Sea Level
North Coor.: 2185.44454

Begin Drilling: 02/17/98
End Drilling: 02/17/98
Converted to Well: No
Well Name:
East Coor.: 6336.22690

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BDG-DP11 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/17/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP11-8/SL
Coded Replicate No.: DUP43

Time Sampling Began: 17:05
Time Sampling Ended: 17:07

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

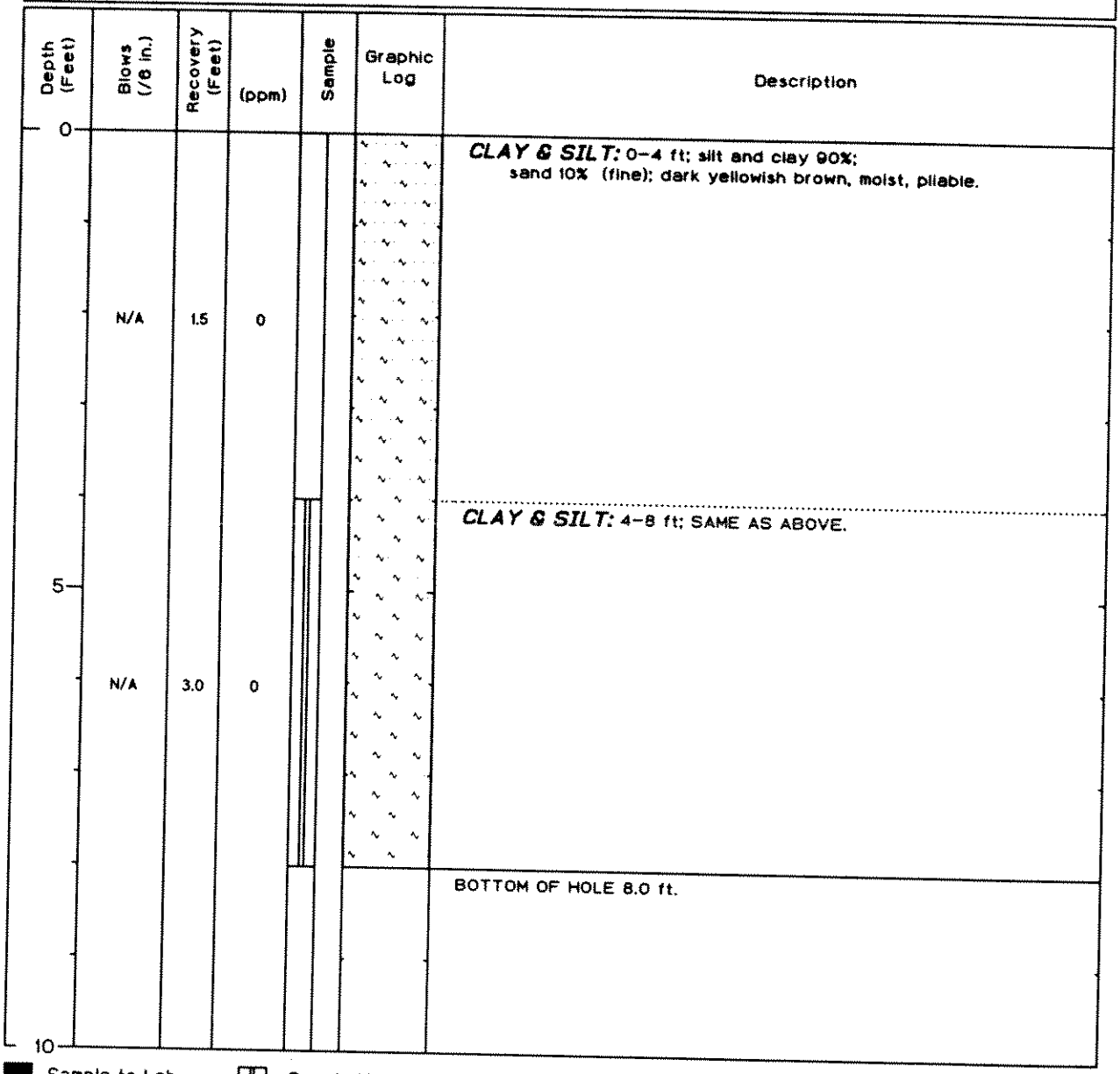
Remarks: Sample not sent to NET

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP12

GENERAL MOTORS — Moraine, Ohio



■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 729.3048
Datum: Mean Sea Level
North Coor.: 2188.23853

Begin Drilling: 02/17/98
End Drilling: 02/17/98
Converted to Well: No
Well Name:
East Coor.: 6359.16523

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BDG-DP12 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/17/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP12-8/SL
Coded Replicate No.: DUP44

Time Sampling Began: 17:21
Time Sampling Ended: 17:23

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

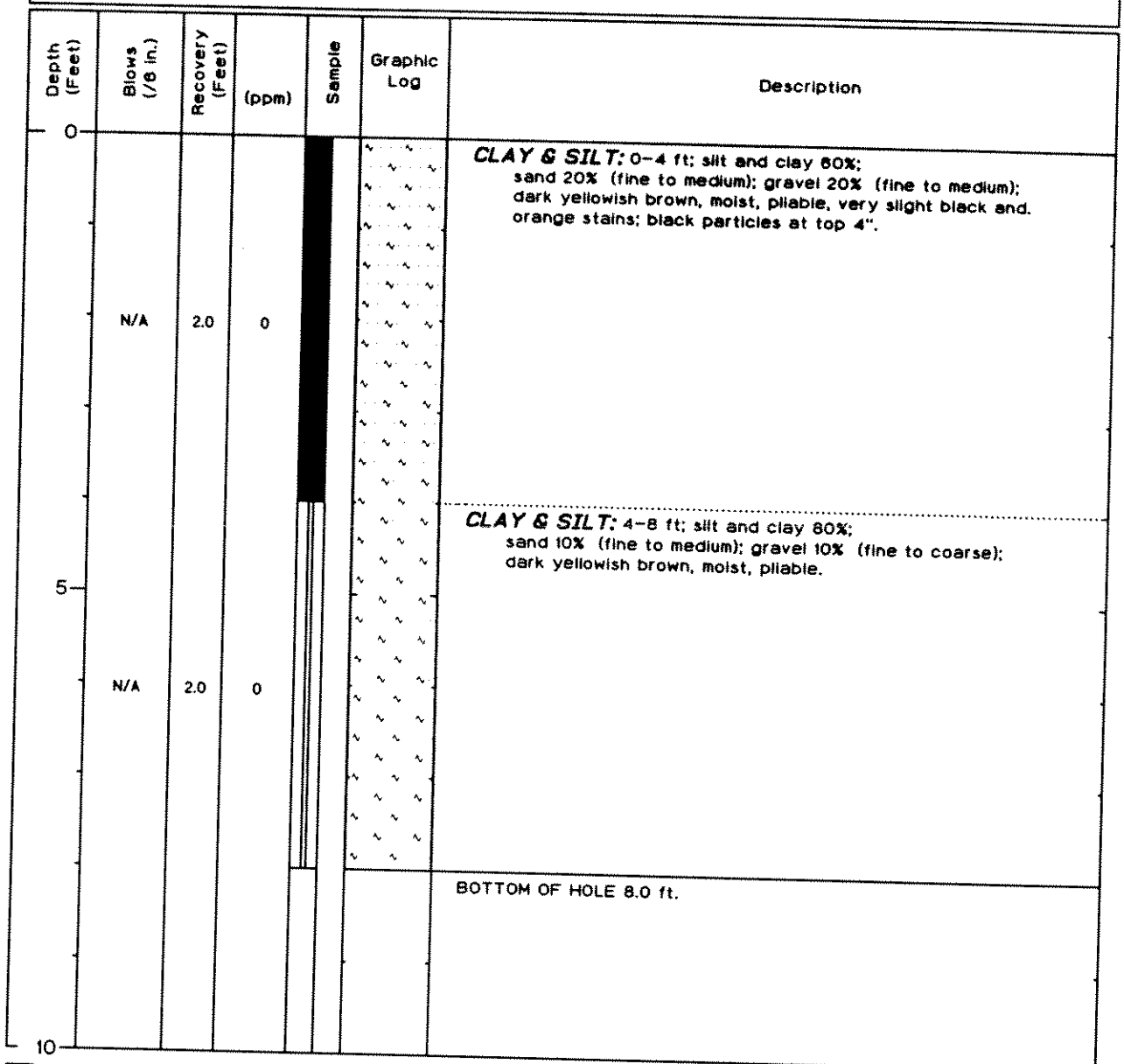
Remarks: Sample not sent to NET

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP13

GENERAL MOTORS — Moraine, Ohio



Sample to Lab Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 729.2391
Datum: Mean Sea Level
North Coor.: 2089.83542

Begin Drilling: 02/19/98
End Drilling: 02/19/98
Converted to Well: No
Well Name:
East Coor.: 6024.14404

OH000294.0001.0002

F:/APPA/GT3/GMCRI/BDG-DP13 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/19/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP13-4/SL
Coded Replicate No.:

Time Sampling Began: 11:10
Time Sampling Ended: 11:13

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
Metals (6010A, 7060A, 7421, 7471A, 7740, 7841)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: No DUP taken due to low recovery. Metals sample sent to NET

Sample Personnel: W. J. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/19/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP13-8/SL
Coded Replicate No.: DUP51

Time Sampling Began: 11:25
Time Sampling Ended: 11:28

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

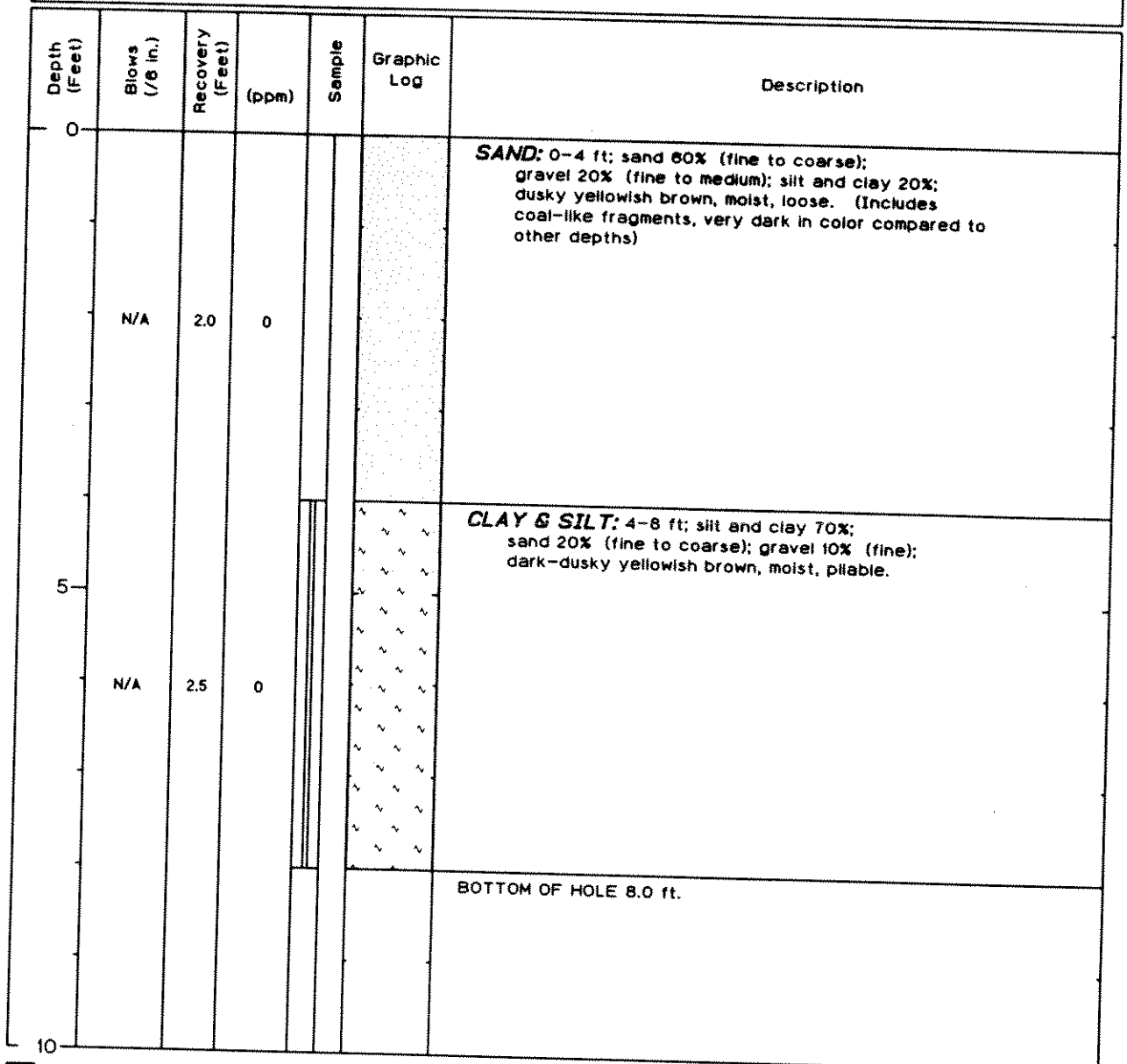
Remarks: Sample not sent to NET

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP14

GENERAL MOTORS — Moraine, Ohio



■ Sample to Lab ▯▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 729.4668
Datum: Mean Sea Level
North Coor.: 1930.82830

Begin Drilling: 02/18/98
End Drilling: 02/18/98
Converted to Well: No
Well Name:
East Coor.: 6050.94853

OH000294.0001.0002

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/18/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP14-8/SL
Coded Replicate No.: DUP46

Time Sampling Began: 15:30
Time Sampling Ended: 15:33

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP15

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0						***CLAY & SILT:*** 0–4 ft; silt and clay 60%; sand 20% (fine to medium); gravel 20% (fine to medium); moderate brown to dusky yellowish brown, moist, cohesive. Considerable blackness, possible staining.
	N/A	2.0	0			
5						***CLAY & SILT:*** 4–8 ft; silt and clay 70%; sand 30% (fine to medium); dark yellowish brown, moist, cohesive. Some black staining toward top of interval (~4 ")
	N/A	3.5	0			
10						BOTTOM OF HOLE 8.0 ft.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 729.3930
Datum: Mean Sea Level
North Coor.: 1927.70141

Begin Drilling: 02/19/98
End Drilling: 02/19/98
Converted to Well: No
Well Name:
East Coor.: 8166.77222

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BDG-DP15 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/19/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP15-8/SL
Coded Replicate No.: DUP48

Time Sampling Began: 8:35
Time Sampling Ended: 8:38

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET.

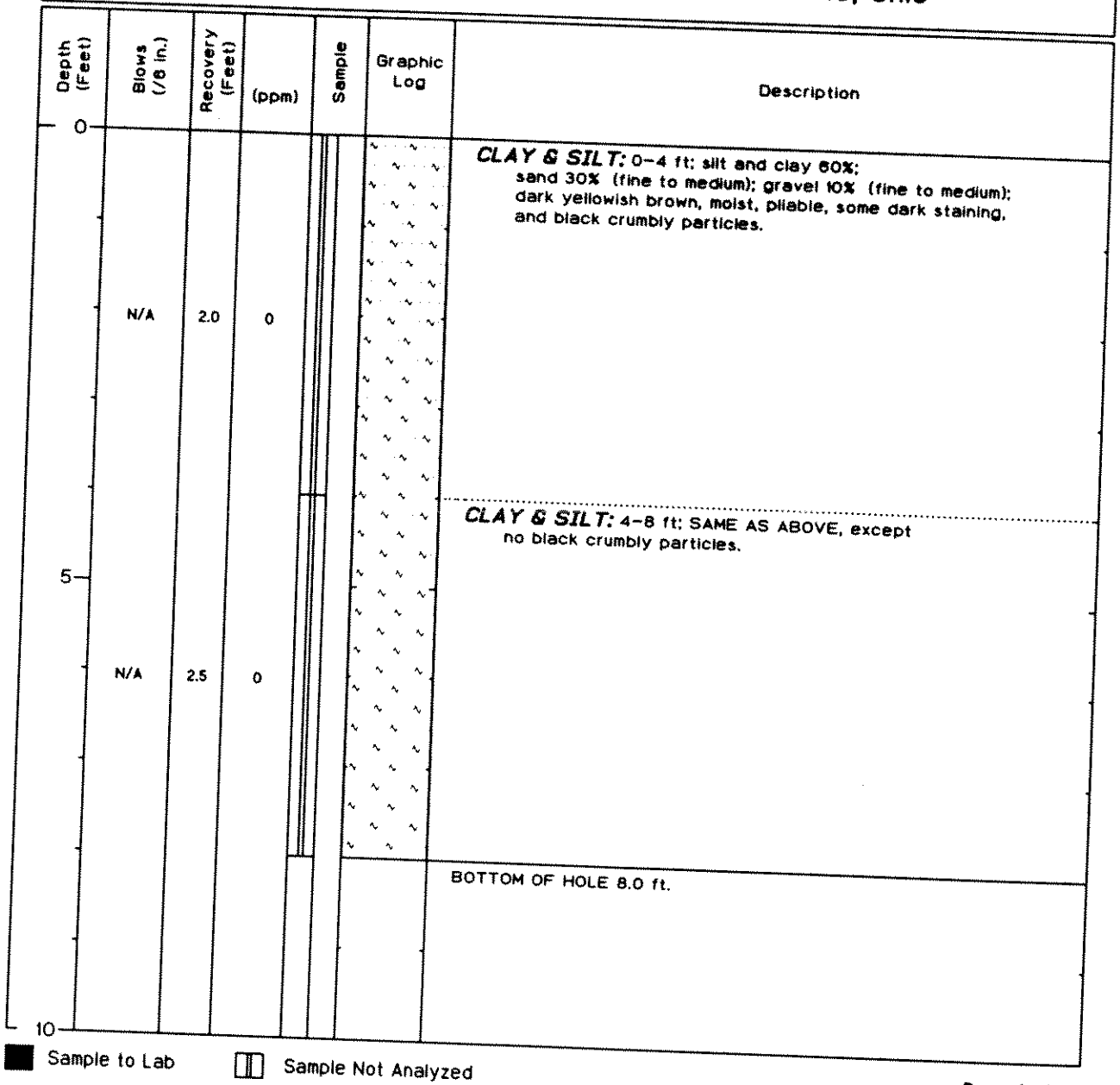
Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP16

GENERAL MOTORS

Moraine, Ohio



■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 729.1928
Datum: Mean Sea Level
North Coor.: 1936.82799

Begin Drilling: 02/19/98
End Drilling: 02/19/98
Converted to Well: No
Well Name: 6
East Coor.: 8277.32627

OH000294.0001.0002

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/19/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP16-4/SL
Coded Replicate No.:

Time Sampling Began: 12:00
Time Sampling Ended: 12:03

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET; No DUP taken not enough recovery.

Sample Personnel: W. J. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/19/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP16-8/SL
Coded Replicate No.: DUP52

Time Sampling Began: 12:05
Time Sampling Ended: 12:08

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET. RB-28 taken prior to acetate liner being used for this interval (time 11:21) and sent to NET (6010A, 7060, 7421, 7470A, 7740, 7841, 8240B, 8080A).

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP17

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	N/A	2.0	0			***CLAY & SILT:*** 0-4 ft; silt and clay 90%; gravel 10% (fine); dark yellowish brown, moist, pliable.
5	N/A	2.0	0			***GRAVEL & SAND:*** 4-8 ft; sand 50% (fine to medium); gravel 30% (fine to coarse); silt and clay 20%; moderate yellowish brown, moist, loose.
10						BOTTOM OF HOLE 8.0 ft.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 724.5194
Datum: Mean Sea Level
North Coor.: 1794.19922

Begin Drilling: 02/18/98
End Drilling: 02/18/98
Converted to Well: No
Well Name:
East Coor.: 6040.16097

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BDG-DP17 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/18/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP17-8/SL
Coded Replicate No.:

Time Sampling Began: 17:25
Time Sampling Ended: 17:28

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET; No DUP taken not enough recovery.

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP18

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0						***SAND:*** 0-4 ft; sand 80% (fine to medium); gravel 10% (fine to medium); silt and clay 10%; dark yellowish brown, damp, loose.
	N/A	2.0	0			
						SAND: 4-8 ft; SAME AS ABOVE.
5						
	N/A	2.0	0			
						BOTTOM OF HOLE 8.0 ft.
10						

■ Sample to Lab ▯▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 724.6746
Datum: Mean Sea level
North Coor.: 1795.28986

Begin Drilling: 02/18/98
End Drilling: 02/18/98
Converted to Well: No
Well Name:
East Coor.: 6285.28682

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BDG-DP18 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/18/98
Project No.: OH000294.0001.00002

Sample No.: BDG-DP18-8/SL
Coded Replicate No.:

Time Sampling Began: 16:50
Time Sampling Ended: 16:53

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET; No DUP taken not enough recovery.

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BDG-DP19

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	N/A	2.0	0			***SAND:*** 0-4 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, damp, loose.
5	N/A	3.0	0			***SAND:*** 4-8 ft; SAME AS ABOVE.
10						BOTTOM OF HOLE 8.0 ft.

■ Sample to Lab ▯▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 724.4834
Datum: Mean Sea Level
North Coor.: 1794.37774

Begin Drilling: 02/18/98
End Drilling: 02/18/98
Converted to Well: No
Well Name:
East Coor.: 6309.10035

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BDG-DP19 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/ Site Location	RFI/General Motors Corporation, Moraine, Ohio	Date	2/18/98
		Project No.	OH000294.0001.00002
Sample No.	BDG-DP19-8/SL	Coded Replicate No.	DUP47
Time Sampling Began	16:35	Time Sampling Ended	16:38

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.) 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET.

Sample Personnel: W. J. Ferguson

ARCADIS GERAGHTY&MILLER

AOI 17 - Building 15
February 1998

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BD15-DP1

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0						
	N/A	1.0	0			***GRAVEL & SAND:*** 0–4 ft; sand 40% (fine to coarse); gravel 50% (fine to medium); silt and clay 10%; moderate yellowish brown, damp, loose.
5	N/A	2.0	0			***GRAVEL:*** 4–8 ft; gravel 80% (medium); sand 15% (fine); silt and clay 5%; moderate yellowish brown, damp, very loose.
						BOTTOM OF HOLE 8.0 ft.
10						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 724.6781
Datum: Mean Sea Level
North Coor.: 1612.28681

Begin Drilling: 02/19/98
End Drilling: 02/19/98
Converted to Well: No
Well Name:
East Coor.: 6082.19378

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BD15-DP1 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/19/98
Project No.: OH000294.0001.00002

Sample No.: BD15-DP1-8/SL
Coded Replicate No.: DUP49

Time Sampling Began: 8:53
Time Sampling Ended: 8:56

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET.

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BD15-DP2

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	N/A	2.0	0			***GRAVEL & SAND:*** 0–4 ft; sand 30% (fine to medium); gravel 30% (fine to coarse); silt and clay 40%; moderate to dark yellowish brown, moist, loose to cohesive.
5	N/A	3.0	0			***SAND:*** 4–8 ft; sand 70% (fine to medium); gravel 20% (medium to coarse); silt and clay 10%; moderate yellowish brown, slightly moist, very loose.
10						BOTTOM OF HOLE 8.0 ft.

■ Sample to Lab ▯▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 724.5368
Datum: Mean Sea Level
North Coor.: 1597.89979

Begin Drilling: 02/19/98
End Drilling: 02/19/98
Converted to Well: No
Well Name:
East Coor.: 6079.49321

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BD15-DP2 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/19/98
Project No.: OH000294.0001.00002

Sample No.: BD15-DP2-8/SL
Coded Replicate No.: DUP50

Time Sampling Began: 9:15
Time Sampling Ended: 9:18

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET.

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: BD15-DP3

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	N/A	3.0	0			***CLAY & SILT:*** 0-4 ft; silt and clay 60%; sand 20% (fine to medium); gravel 20% (fine to medium); moderate-dark yellowish brown, moist, loose to pliable. Some possible staining and very black portions (1-2").
5	N/A	2.0	0			***GRAVEL & SAND:*** 4-8 ft; sand 60% (fine to medium); gravel 30% (medium to coarse); silt and clay 10%; moderate yellowish brown, slightly moist, very loose. Some very black particles (5%) similar to that in (0-4').
10						BOTTOM OF HOLE 8.0 ft.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Wade/Ray
Drilling Method: Direct Push
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 8.0
Surface Elev.: 724.6666
Datum: Mean Sea Level
North Coor.: 1585.71541

Begin Drilling: 02/19/98
End Drilling: 02/19/98
Converted to Well: No
Well Name:
East Coor.: 6083.41104

OH000294.0001.0002

F:/APPS/GT3/GMCRI/BD15-DP3 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/19/98
Project No.: OH000294.0001.00002

Sample No.: BD15-DP3-8/SL
Coded Replicate No.:

Time Sampling Began: 9:40
Time Sampling Ended: 9:43

Sampling Method and Material: 4' acetate liner

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (immunoassay test kits)	4 oz glass jar	Cool
VOCs (field GC)	4 oz glass jar	Cool

Remarks: Sample not sent to NET. No DUP taken due to low recovery.

Sample Personnel: W. J. Ferguson

ARCADIS GERAGHTY & MILLER

AOI 36 - Former Southwest Above Ground Storage Tanks
February 1998

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: AST-BH1

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	3-4-4-7	1.5	0			***CLAY & SILT:*** 0-2 ft; silt and clay 70%; sand 15% (fine to medium); gravel 15% (fine to coarse); moderate yellowish brown, moist, pliable, some mottling and black staining.
	5-5-6-8	1.5	0			***CLAY & SILT:*** 2-4 ft; silt and clay 80%; sand 20% (fine to medium); moderate yellowish brown, moist, pliable.
5	5-8-8-12	1.5	0			***CLAY & SILT:*** 4-6 ft; silt and clay 70%; sand 15% (fine to medium); gravel 15% (fine to coarse); moderate yellowish brown, moist, pliable, some black staining.
	10-12-18-18	1.5	0			***CLAY & SILT:*** 6-8 ft; silt and clay 60%; sand 20% (fine to medium); gravel 20% (fine to coarse); moderate yellowish brown-gray, moist, loose to pliable.
	20-23-35-40	1.3	0			***CLAY & SILT:*** 8-10 ft; SAME AS ABOVE.
10	30-45-50/3"	0.8	0			***GRAVEL & SAND:*** 10-12 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	20-21-18-35	1.0	0			***GRAVEL & SAND:*** 12-14 ft; sand 60% (fine to medium); gravel 40% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.

■ Sample to Lab ▯▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 24.0
Surface Elev.: 724.6108
Datum: Mean Sea Level
North Coor.: 1512.24875

Begin Drilling: 02/19/98
End Drilling: 02/19/98
Converted to Well: No
Well Name:
East Coor.: 5958.79270

OH000294.0001.0002

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: AST-BH1

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
14	23-45-60/5"	1.0	0			***GRAVEL & SAND:*** 14-16 ft; sand 40% (fine to medium); gravel 50% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	25-18-23-28	1.3	0			***GRAVEL & SAND:*** 16-18 ft; sand 40% (fine to medium); gravel 50% (fine to coarse); silt and clay 10%; moderate yellowish brown-pale yellowish brown, moist, loose.
19	30-18-12-20	0.6	0			***GRAVEL & SAND:*** 18-20 ft; sand 50% (fine to medium); gravel and rock 50%, rock pieces have moderate pink color to gray color; moderate yellowish brown, moist, loose.
	21-30-20-31	1.0	0			***GRAVEL & SAND:*** 20-22 ft; sand 50% (fine to medium); gravel 40% (fine to medium); silt and clay 10%; moderate yellowish brown, very damp, loose-cohesive.
	10-35-25-38	1.0	0			***GRAVEL & SAND:*** 22-24 ft; SAME AS ABOVE, except very wet.
24						BOTTOM OF HOLE 24.0 ft.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 24.0
Surface Elev.: 724.6108
Datum: Mean Sea Level
North Coor.: 1512.24875

Begin Drilling: 02/19/98
End Drilling: 02/19/98
Converted to Well: No
Well Name:
East Coor.: 5956.79270

OH000294.0001.0002

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/19/98
Project No.: OH000294.0001.00002

Sample No.: AST-BH1-2/SL
Coded Replicate No.:

Time Sampling Began: 13:05
Time Sampling Ended: 13:10

Sampling Method and Material: 2" Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (8080A)	4 oz glass jar	Cool
VOCs (8240B)	4 oz glass jar	Cool
SVOCs* (8270B)	6 oz glass jar	Cool
Metals (6010A, 7471A, 7060A, 7421, 7740, 7841)	4 oz glass jar	Cool

Remarks: *sample was taken from 2-4 ft interval due to lack of sufficient material in 0-2 ft interval.

Sample Personnel: W. J. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/19/98
Project No.: OH000294.0001.00002

Sample No.: AST-BH1-22/SL
Coded Replicate No.:

Time Sampling Began: 14:30
Time Sampling Ended: 14:35

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (8080A)	4 oz glass jar	Cool
VOCs (8240B)	4 oz glass jar	Cool
SVOCs* (8270B)	6 oz glass jar	Cool
Metals (6010A, 7471A, 7060A, 7421, 7740, 7841)	4 oz glass jar	Cool

Remarks: *sample was taken from 22-24 ft interval due to lack of sufficient material at 20-22 ft interval.

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: AST-BH2

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0						
	3-3-5-5	1.5	0			***CLAY & SILT:*** 0-2 ft; silt and clay 70%; sand 15% (fine to medium); gravel 15% (fine to medium); moderate yellowish brown, moist, pliable, some black and orange staining.
	4-5-5-8	0.1	0			***CLAY & SILT:*** 2-4 ft; SAME AS ABOVE, very little recovery.
5	1-3-5-8	0.1	0			***CLAY, SAND, & SILT:*** 4-6 ft; silt and clay 50%; sand 50% (fine to medium); dark yellowish brown, very wet.
	1'-2-3	1.2	0			***CLAY & SILT:*** 6-8 ft; silt and clay 60%; sand 40% (fine to medium); dark yellowish brown, wet, pliable.
	3-6-8-7	0.2	0			***CLAY & SILT:*** 8-10 ft; SAME AS ABOVE.
10	3-6-8-9	1.5	0			***SAND:*** 10-12 ft; sand 80% (fine to medium); silt and clay 20%; moderate yellowish brown, moist, loose.
	4-8-28-38	1.0	0			***SAND:*** 12-14 ft; SAME AS ABOVE.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 24.0
Surface Elev.: 724.2162
Datum: Mean Sea Level
North Coor.: 1451.28631

Begin Drilling: 02/19/98
End Drilling: 02/19/98
Converted to Well: No
Well Name:
East Coor.: 5962.59774

OH000294.0001.0002

F:/APPS/GT3/GMCRI/AST-BH2 (Rev:5/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: AST-BH2

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
14	8-21-28-30	1.0	0			***GRAVEL & SAND:*** 14–16 ft; sand 50% (fine to medium); gravel 40% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	13-48-40-30	1.0	0			***GRAVEL & SAND:*** 16–18 ft; sand 50% (fine to coarse); gravel 40% (fine to coarse); silt and clay 10%; moderate–pale yellowish brown, moist, loose.
19	25-40-80/4"	0.5	0			***GRAVEL & SAND:*** 18–20 ft; sand 40% (fine to coarse); gravel 50%; silt and clay 10%; moderate yellowish brown–light gray, moist, loose, some orange staining.
	20-21-25-22	1.0	0			***GRAVEL & SAND:*** 20–22 ft; sand 40% (fine to coarse); gravel 40% (fine to medium); silt and clay 20%; moderate yellowish brown, very moist, loose–cohesive.
	5-13-17-25	1.0	0			***GRAVEL & SAND:*** 22–24 ft; SAME AS ABOVE, except very moist to wet.
24						BOTTOM OF HOLE 24.0 ft.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 24.0
Surface Elev.: 724.2162
Datum: Mean Sea Level
North Coor.: 1451.28631

Begin Drilling: 02/19/98
End Drilling: 02/19/98
Converted to Well: No
Well Name:
East Coor.: 5962.59774

OH000294.0001.0002

F:/APPS/GT3/GMCRI/AST-BH2 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/19/98
Project No.: OH000294.0001.00002

Sample No.: AST-BH2-2/SL
Coded Replicate No.:

Time Sampling Began: 15:00
Time Sampling Ended: 15:05

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (8080A)	4 oz glass jar	Cool
VOCs (8240B)	4 oz glass jar	Cool
SVOCs* (8270B)	6 oz glass jar	Cool
Metals (6010A, 7471A, 7060A, 7421, 7740, 7841)	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. J. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/19/98
Project No.: OH000294.0001.00002

Sample No.: AST-BH2-24/SL
Coded Replicate No.: DUP53

Time Sampling Began: 16:45
Time Sampling Ended: 16:50

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs* (8080A)	4 oz glass jar	Cool
VOCs* (8240B)	4 oz glass jar	Cool
SVOCs (8270B)	6 oz glass jar	Cool
Metals (6010A, 7471A, 7060A, 7421, 7740, 7841)	4 oz glass jar	Cool

Remarks: *VOCs & PCBs taken at 22 ft (20-22 ft interval) due to low recovery RB-29 taken prior to 22-24 ft interval being cored and sampled (time 16:30) and sent to NET (8080A, 8240B, 8270B, 6010A, 7060, 7421, 7470A, 7740, 7841).

Sample Personnel: W. J. Ferguson

ARCADIS GERAGHTY & MILLER

AOI 36 - Former Southwest Above Ground Storage Tanks
June 1998

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: A-GS1
Coded Replicate No.: DUP59 (0-2 ft interval prepared in lab)

Time Sampling Began: 11:55
Time Sampling Ended: 2/SL 11:59, 4/SL 12:06

Sampling Method and Material: Gasoline powered 2" diameter hand auger

From	To	Soil/Sediment/Sludge Description
0	2	Sand, silt, gravel, loose, moist, pr srt, brown
2	4	Sand, silt, gravel, loose, moist, pr srt, brown, very wet

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-2 ft interval) for soil area A composite. Composite prepared in lab.
Discrete sample (2-4 ft interval) held by lab.

Sample Personnel: S. Clouse/P. Brennan

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: A-GS2
Coded Replicate No.: DUP59 (0-2 ft interval prepared in lab)

Time Sampling Began: 11:34
Time Sampling Ended: 2/SL 11:37, 4/SL 11:45

Sampling Method and Material: Gasoline powered 2'' diameter hand auger

From	To	Soil/Sediment/Sludge Description
0	2	Clay and silt, loose, damp, not plastic, sand and gravel
2	4	Clay and silt, loose, damp, not plastic, sand and gravel, wet

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-2 ft interval) for soil area A composite. Composite prepared in lab.
Discrete sample (2-4 ft interval) held by lab.

Sample Personnel: S. Clouse/P. Brennan

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98

Project No.: OH000294.0001.00002

Sample No.: A-GS3

Coded Replicate No.: DUP59 (0-2 ft interval prepared in lab)

Time Sampling Began: 13:55

Time Sampling Ended: 2/SL 14:00, 4/SL 14:10

Sampling Method and Material: Gasoline powered 2'' diameter hand auger

From	To	Soil/Sediment/Sludge Description
0	2	Silt, sand & gravel, trace clay, loose, moist, brown
2	4	Silt, sand & gravel, trace clay, loose, moist, brown, very moist to wet

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-2 ft interval) for soil area A composite. Composite prepared in lab.
Discrete sample (2-4 ft interval) held by lab.

Sample Personnel: S. Clouse/P. Brennan

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: A-GS4
Coded Replicate No.: DUP59 (0-2 ft interval prepared in lab)

Time Sampling Began: 12:30
Time Sampling Ended: 2/SL 12:35

Sampling Method and Material: Gasoline powered 2" diameter hand auger

From	To	Soil/Sediment/Sludge Description
0	2	Silt and clay, brown, damp, slight plastic, gravel and very fine sand
2	4	No recovery, no sample collected

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-2 ft interval) for soil area A composite. Composite prepared in lab.

Sample Personnel: S. Clouse/P. Brennan

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: B-GS5
Coded Replicate No.:

Time Sampling Began: 16:26
Time Sampling Ended: 2/SL 16:30, 4/SL 16:45

Sampling Method and Material: Gasoline powered 2'' diameter hand auger

From	To	Soil/Sediment/Sludge Description
0	2	Sand, silt, gravel, loose, moist, brown
2	3.5	Sand, silt, gravel, loose, moist, brown, wet

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-2 ft interval) for soil area B composite. Composite prepared in lab.
Discrete sample (2-3.5 ft interval) held by lab.

Sample Personnel: S. Clouse/P. Brennan

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: B-GS6

Coded Replicate No.:

Time Sampling Began: 16:10

Time Sampling Ended: 1.5/SL 16:15

Sampling Method and Material: Gasoline powered 2'' diameter hand auger

From	To	Soil/Sediment/Sludge Description
0	1.5	Sand, silt, gravel, loose, moist, brown
1.5	4	No recovery, no sample collected

OTHER (OVA; HNu; etc.) N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-1.5 ft interval) for soil area B composite. Composite prepared in lab. RB36 collected before B-GS6 (time 16:00).

Sample Personnel: S. Clouse/P. Brennan

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/11/98
Project No.: OH000294.0001.00002

Sample No.: B-GS7
Coded Replicate No.:

Time Sampling Began: 11:07
Time Sampling Ended: 2/SL 11:10, 4/SL 11:13

Sampling Method and Material: Backhoe bucket

From	To	Soil/Sediment/Sludge Description
0	2	Sand, silt, gravel, loose, moist, brown
2	4	Sand, silt, gravel, loose, moist, brown

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-2 ft interval) for soil area B composite. Composite prepared in lab. Backhoe used to collect samples beneath compacted crushed rock and fill material present as parking lot foundation. Discrete sample (2-4 ft interval) held by lab.

Sample Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: B-GS8
Coded Replicate No.:

Time Sampling Began: 17:00
Time Sampling Ended: 2/SL 17:04

Sampling Method and Material: Gasoline powered 2" diameter hand auger

From	To	Soil/Sediment/Sludge Description
0	2	Sand, silt, gravel, loose, moist, brown
2	4	No recovery, no sample collected.

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-2 ft interval) for soil area B composite. Composite prepared in lab.

Sample Personnel: S. Clouse/P. Brennan

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/11/98
Project No.: OH000294.0001.00002

Sample No.: C-GS9
Coded Replicate No.:

Time Sampling Began: 11:02
Time Sampling Ended: 2/SL 11:07, 4/SL 11:16

Sampling Method and Material: Backhoe bucket

From	To	Soil/Sediment/Sludge Description
0	2	Sand, silt, gravel, loose, moist, brown
2	4	Sand, silt, gravel, loose, moist, brown

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-2 ft interval) for soil area C composite. Composite prepared in lab. Backhoe used to collect samples beneath compacted crushed rock and fill material present as parking lot foundation. Discrete sample (2-4 ft interval) held by lab.

Sample Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: C-GS10
Coded Replicate No.:

Time Sampling Began: 17:29
Time Sampling Ended: 2/SL 17:34

Sampling Method and Material: Gasoline powered 2" diameter hand auger

From	To	Soil/Sediment/Sludge Description
0	2	Sand, silt, gravel, loose, moist, brown
2	4	No recovery, sample not collected

OTHER (OVA; HNu; etc.) N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-2 ft interval) for soil area C composite. Composite prepared in lab.

Sample Personnel: S. Clouse/P. Brennan

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: C-GS11
Coded Replicate No.:

Time Sampling Began: 17:50
Time Sampling Ended: 1/SL 17:59

Sampling Method and Material: Gasoline powered 2" diameter hand auger

From	To	Soil/Sediment/Sludge Description
0	1	Sand, silt, gravel, loose, moist, brown
1	2	No recovery, sample not collected

OTHER (OVA; HNu; etc.) N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-1 ft interval) for soil area C composite. Composite prepared in lab.

Sample Personnel: S. Clouse/P. Brennan

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: C-GS12
Coded Replicate No.:

Time Sampling Began: 18:05
Time Sampling Ended: 2/SL 18:10

Sampling Method and Material: Gasoline powered 2" diameter hand auger

From	To	Soil/Sediment/Sludge Description
0	2	Sand, silt, gravel, loose, moist, brown
2	4	No recovery, sample not collected

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-2 ft interval) for soil area C composite. Composite prepared in lab.

Sample Personnel: S. Clouse/P. Brennan

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/11/98
Project No.: OH000294.0001.00002

Sample No.: D-GS13
Coded Replicate No.:

Time Sampling Began: 11:20
Time Sampling Ended: 2/SL 11:25, 4/SL 11:26

Sampling Method and Material: Backhoe bucket

From	To	Soil/Sediment/Sludge Description
0	2	Sand, silt, gravel, loose, moist, brown
2	4	Sand, silt, gravel, loose, moist, brown

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-2 ft interval) for soil area D composite. Composite prepared in lab. Backhoe used to collect samples beneath compacted fill material present as parking lot foundation. Discrete sample (2-4 ft interval) held by lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/11/98
Project No.: OH000294.0001.00002

Sample No.: D-GS14
Coded Replicate No.:

Time Sampling Began: 11:30
Time Sampling Ended: 2/SL 11:32, 4/SL 11:33

Sampling Method and Material: Backhoe bucket

From	To	Soil/Sediment/Sludge Description
0	2	Sand, silt, gravel, loose, moist, brown
2	4	Sand, silt, gravel, loose, moist, brown

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-2 ft interval) for soil area D composite. Composite prepared in lab. Backhoe used to collect samples beneath compacted fill material present as parking lot foundation. Discrete sample (2-4 ft interval) held by lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/11/98
Project No.: OH000294.0001.00002

Sample No.: D-GS15
Coded Replicate No.:

Time Sampling Began: 11:35
Time Sampling Ended: 2/SL 11:37, 4/SL 11:36

Sampling Method and Material: Backhoe bucket

From	To	Soil/Sediment/Sludge Description
0	2	Sand, silt, gravel, loose, moist, brown
2	4	Sand, silt, gravel, loose, moist, brown

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-2 ft interval) for soil area D composite. Composite prepared in lab. Backhoe used to collect samples beneath compacted fill material present as parking lot foundation. Discrete sample (2-4 ft interval) held by lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/11/98
Project No.: OH000294.0001.00002

Sample No.: D-GS16
Coded Replicate No.:

Time Sampling Began: 11:38

Time Sampling Ended: 2/SL 11:40
4/SL 11:41

Sampling Method and Material: Backhoe bucket

From	To	Soil/Sediment/Sludge Description
0	2	Sand, silt, gravel, loose, moist, brown
2	4	Sand, silt, gravel, loose, moist, brown

OTHER (OVA; HNu; etc.) N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample (0-2 ft interval) for soil area D composite. Composite prepared in lab. Backhoe used to collect samples beneath compacted fill material present as parking lot foundation. Discrete sample (2-4 ft interval) held by lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: E-GS17
Coded Replicate No.:

Time Sampling Began: 11:45
Time Sampling Ended: 11:50

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	0.75	Silt, dry, brown, loose, trace very find sand, roots

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area E composite. Composite prepared in lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: E-GS18
Coded Replicate No.:

Time Sampling Began: 11:29
Time Sampling Ended: 11:33

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	1	Silt, brown, dry, loose, roots, trace very fine grain sand

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area E composite. Composite prepared in lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: E-GS19
Coded Replicate No.:

Time Sampling Began: 11:15
Time Sampling Ended: 11:21

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	0.75	Silt, brown, dry, loose, roots, trace very fine grain sand

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area E composite. Composite prepared in lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: E-GS20
Coded Replicate No.:

Time Sampling Began: 11:00
Time Sampling Ended: 11:07

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	1.5	Silt, brown, loose, roots, trace very fine grain sand

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area E composite. Composite prepared in lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: E-GS21
Coded Replicate No.:

Time Sampling Began: 10:50
Time Sampling Ended: 10:52

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	1.5	Silt, brown, dry, loose, roots, trace very fine grain sand

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area E composite. Composite prepared in lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: F-GS22
Coded Replicate No.:

Time Sampling Began: 14:30
Time Sampling Ended: 14:34

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	1	Silt, dry, brown, loose, trace sand

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area F composite. Composite prepared in lab.
RB35 collected before F-GS22 (time 14:26).

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: F-GS23

Coded
Replicate No.:

Time
Sampling Began: 14:36

Time
Sampling Ended: 14:40

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	1.5	Silt, dry, brown, loose, trace sand

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area F composite. Composite prepared in lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: F-GS24
Coded Replicate No.:

Time Sampling Began: 14:43
Time Sampling Ended: 14:45

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	1.5	Silt, dry, brown, loose, trace sand

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area F composite. Composite prepared in lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98

Project No.: OH000294.0001.00002

Sample No.: F-GS25

Coded Replicate No.:

Time Sampling Began: 14:48

Time Sampling Ended: 14:51

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	1	Silt, dry, brown, loose, trace sand

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area F composite. Composite prepared in lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: F-GS26
Coded Replicate No.:

Time Sampling Began: 14:53
Time Sampling Ended: 14:56

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	1	Silt, dry, brown, loose, trace sand, roots

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area F composite. Composite prepared in lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98

Project No.: OH000294.0001.00002

Sample No.: G-GS27

Coded Replicate No.:

Time Sampling Began: 15:13

Time Sampling Ended: 15:15

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	2	Silt, dry, brown, loose, trace sand, roots

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area G composite. Composite prepared in lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98

Project No.: OH000294.0001.00002

Sample No.: G-GS28

Coded Replicate No.:

Time Sampling Began: 15:20

Time Sampling Ended: 15:24

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	1.5	Silt, dry, brown, loose, trace sand, roots

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area G composite. Composite prepared in lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: G-GS29
Coded Replicate No.:

Time Sampling Began: 15:26
Time Sampling Ended: 15:28

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	1.5	Silt, dry, brown, loose, trace sand, roots

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area G composite. Composite prepared in lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: G-GS30
Coded Replicate No.:

Time Sampling Began: 15:30
Time Sampling Ended: 15:34

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	1.5	Silt, dry, brown, loose, trace sand, roots

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area G composite. Composite prepared in lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98

Project No.: OH000294.0001.00002

Sample No.: G-GS31

Coded Replicate No.:

Time Sampling Began: 15:40

Time Sampling Ended: 15:45

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	1.5	Silt, dry, brown, loose, trace sand, roots

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area G composite. Composite prepared in lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 6/10/98
Project No.: OH000294.0001.00002

Sample No.: G-GS32

Coded Replicate No.:

Time Sampling Began: 15:48

Time Sampling Ended: 15:50

Sampling Method and Material: 2" diameter stainless steel hand auger

From	To	Soil/Sediment/Sludge Description
0	1.5	Silt, dry, brown, loose, trace sand, roots

OTHER (OVA; HNu; etc.): N/A

Constituents Sampled	Container Description	Preservative
Arsenic (7060A)	4 oz glass jar	Cool

Remarks: Discrete sample for berm area G composite. Composite prepared in lab.

Personnel: S. Clouse

ARCADIS GERAGHTY & MILLER

AOI 7 - Former Oil House Area
February 1998

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH1

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	9-17-27-34	1.5	0	■		***GRAVEL & SAND:*** 0-2 ft; gravel 50% (fine to very coarse); sand 40% (fine to medium); silt and clay 10%; moderate yellowish brown and light gray, very slightly moist, loose.
	23-25-30-10	1.2	2.0			***GRAVEL & SAND:*** 2-4 ft; SAME AS ABOVE.
5	21-29-30-35	1.5	0			***GRAVEL & SAND:*** 4-6 ft; SAME AS ABOVE, except now moist.
	16-20-37-25	1.5	4.0	■		***GRAVEL & SAND:*** 6-8 ft; sand 60% (fine to medium); gravel 30% (fine to medium) silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
	10-20-30-35	1.2	3.0			***GRAVEL & SAND:*** 8-10 ft; sand 40% (fine to medium); gravel 50% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
10	15-16-18-28	1.5	0			***GRAVEL & SAND:*** 10-12 ft; sand 60% (fine to medium); gravel 30% (fine to medium); silt and clay 10%; moderate to yellowish brown, moist, loose.
	20-18-16-16	0.8	3.0			***GRAVEL & SAND:*** 4-6 ft; SAME AS ABOVE.
15	7-10-17-35	1.8	4.0			***SAND:*** 14-16 ft; sand 85% (fine to medium); gravel 5% (fine); silt and clay 10%; moderate to dark yellowish brown, moist, loose.
	16-14-19-30	1.5	2.0			***GRAVEL & SAND:*** 16-18 ft; sand 40% (fine to medium); gravel 50% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 32.0
Surface Elev.: 736.3303
Datum: Mean Sea Level
North Coor.: 5866.95245

Begin Drilling: 02/23/98
End Drilling: 02/23/98
Converted to Well: No
Well Name:
East Coor.: 6014.07818

OH000294.0001.0002

F:/APPS/GT3/GMCRI/OH-BH1 (Rev:6/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH1

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
18	13-24-35-25	1.5	3.0			***GRAVEL & SAND:*** 18-20 ft; sand 30% (fine to medium); gravel 60% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	8-20-50/5"	1.0	2.0			***GRAVEL & SAND:*** 20-22 ft; SAME AS ABOVE.
23	10-25-30-28	1.5	2.0			***GRAVEL & SAND:*** 22-24 ft; sand 30% (fine to medium); gravel 60% (fine to medium); silt and clay 10%; moderate-pale yellowish brown, very moist, loose.
	45-50/3"	0.4	0.5			***GRAVEL & SAND:*** 24-26 ft; gravel 60% (fine to medium); sand 30% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	14-15-22-45	1.5	3.0			***GRAVEL & SAND:*** 26-28 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
28	23-36-32-38	1.5	3.0	■		***GRAVEL & SAND:*** 28-30 ft; sand 60% (fine to coarse); gravel 30% (fine to medium); silt and clay 10%; moderate yellowish brown, very moist, loose-cohesive.
	15-18-29-35	1.5	1.0			***GRAVEL & SAND:*** 30-32 ft; SAME AS ABOVE, but wet.
33						BOTTOM OF HOLE 32.0 ft.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Geologist: W.J. Ferguson
Begin Drilling: 02/23/98
Driller: Dave/Russ
Total Depth: 32.0
End Drilling: 02/23/98
Drilling Method: Hollow Stem Auger
Surface Elev.: 736.3303
Converted to Well: No
Drilling Fluid: None
Datum: Mean Sea Level
Well Name:
Remarks:
North Coor.: 5866.95245
East Coor.: 6014.07818

OH000294.0001.0002

F:/APPS/GT3/GMCRI/OH-BH1 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	2/23/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH1-2/SL	Coded Replicate No.	
Time Sampling Began	9:05	Time Sampling Ended	9:07

Sampling Method and Material: 2" Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.) 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (8080A)	4 oz glass jar	Cool
VOCs (8240B)	4 oz glass jar	Cool
SVOCs (8270B)	6 oz glass jar	Cool
Metals (6010A, 7471A, 7060A, 7421, 7740, 7841)	4 oz glass jar	Cool

Remarks

Sample Personnel: W. J. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/23/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH1-8/SL
Coded Replicate No.:

Time Sampling Began: 9:28
Time Sampling Ended: 9:30

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 4 ppm

Constituents Sampled	Container Description	Preservative
PCBs (8080A)	4 oz glass jar	Cool
VOCs (8240B)	4 oz glass jar	Cool
SVOCs (8270B)	6 oz glass jar	Cool
Metals (6010A, 7471A, 7060A, 7421, 7740, 7841)	4 oz glass jar	Cool

Remarks: Highest HNu reading for this borehole.

Sample Personnel: W. J. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/23/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH1-30/SL
Coded Replicate No.: DUP55

Time Sampling Began: 10:35
Time Sampling Ended: 10:40

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 3 ppm

Constituents Sampled	Container Description	Preservative
PCBs (8080A)	4 oz glass jar	Cool
VOCs (8240B)	4 oz glass jar	Cool
SVOCs* (8270B)	6 oz glass jar	Cool
Metals (6010A, 7471A, 7060A, 7421, 7740, 7841)	4 oz glass jar	Cool

Remarks: *SVOC & DUP taken from 26-28 ft interval due to lack of full recovery from 28-30 ft interval

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH2

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0						**ASPHALT:** 0-1 ft.
	7-6-3-3	1.0	0			**GRAVEL & SAND:** 1-3 ft; sand 40% (fine to medium); gravel 40% (fine to medium); silt and clay 20%; moderate yellowish brown, moist, loose-cohesive.
	7-4-8-15	0.9	0			**GRAVEL & SAND:** 3-5 ft; SAME AS ABOVE.
5	5-13-35-45	0.8	0			**GRAVEL & SAND:** 5-7 ft; SAME AS ABOVE.
	12-24-38-30	1.0	0			**GRAVEL & SAND:** 7-9 ft; SAME AS ABOVE.
10	16-30-35-35	1.0	0			**GRAVEL & SAND:** 9-11 ft; SAME AS ABOVE.
	17-25-25-24	1.0	0			**GRAVEL & SAND:** 11-13 ft; sand 40% (fine to medium); gravel 50% (fine to very coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	12-32-34-36	1.0	0			**GRAVEL & SAND:** 13-15 ft; SAME AS ABOVE.
15	47-27-25-24	N/A	0			**GRAVEL & SAND:** 14-16 ft; gravel 60% (fine to medium); sand 30% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	12-24-18-17	1.0	0			**GRAVEL & SAND:** 17-19 ft; gravel 50% (fine to medium); sand 40% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 31.0
Surface Elev.: 735.1401
Datum: Mean Sea Level
North Coor.: 5697.71195

Begin Drilling: 02/20/98
End Drilling: 02/20/98
Converted to Well: No
Well Name:
East Coor.: 5971.76229

OH000294.0001.0002

F:/APPS/GT3/GMCRI/OH-BH2 (Rev:5/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH2

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
19	33-28-26-23	0.5	0			***GRAVEL & SAND:*** 19-21 ft; gravel 70% (very coarse); sand 20% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	17-20-30-40	0.75	0			***GRAVEL & SAND:*** 21-23 ft; SAME AS ABOVE.
24	17-25-50/5"	0.75	0			***GRAVEL & SAND:*** 23-25 ft; sand 60% (fine to medium); gravel 30% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	32-40-50/4"	0.9	0			***GRAVEL & SAND:*** 25-27 ft; sand 40% (fine to medium); gravel 50% (fine to coarse); silt and clay 10%; moderate yellowish brown-orange brown, moist, loose.
	48-47-50/5	0.1	0			***GRAVEL & SAND:*** 27-29 ft; sand 50% (fine to medium); gravel 30% (fine to medium); silt and clay 20%; moderate yellowish brown, moist, cohesive.
29	20-30 50/5"	0.1	0			***GRAVEL & SAND:*** 29-31 ft; SAME AS ABOVE, except moist to wet.
						BOTTOM OF HOLE 31.0 ft.
34						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 31.0
Surface Elev.: 735.1401
Datum: Mean Sea Level
North Coor.: 5697.71195

Begin Drilling: 02/20/98
End Drilling: 02/20/98
Converted to Well: No
Well Name:
East Coor.: 5971.76229

OH000294.0001.0002

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/20/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH2-3/SL
Coded Replicate No.:

Time Sampling Began: 10:10
Time Sampling Ended: 10:15

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (8080A)	4 oz glass jar	Cool
VOCs (8240B)	4 oz glass jar	Cool
SVOCs* (8270B)	6 oz glass jar	Cool
Metals (6010A, 7471A, 7060A, 7421, 7740, 7841)	4 oz glass jar	Cool

Remarks: *SVOCs taken from 3-5 ft interval due to lack of full recovery from 1-3 ft interval

Sample Personnel: W. J. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 2/20/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH2-31/SL
Coded Replicate No.: DUP54

Time Sampling Began: 11:55
Time Sampling Ended: 12:00

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (8080A)	4 oz glass jar	Cool
VOCs (8240B)	4 oz glass jar	Cool
SVOCs* (8270B)	6 oz glass jar	Cool
Metals* (6010A, 7471A, 7060A, 7421, 7740, 7841)	4 oz glass jar	Cool

Remarks: *SVOCs, Metals and their DUPS collected from 27-29 ft interval due to low recovery from 29-31 ft interval.

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH3

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	12-25-28-15	1.2	0	■		***GRAVEL & SAND:*** 0-2 ft; sand 40% (fine to medium); gravel 50% (fine to very coarse); silt and clay 10%; moderate yellowish brown to light gray, very moist, loose.
	12-11-11-22	1.2	1.0			***SAND:*** 2-4 ft; sand 75% (fine to medium); gravel 15% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
5	22-50/11"	0.4	0			***SAND:*** 4-6 ft; SAME AS ABOVE.
	15-16-25-36	1.3	0.5			***GRAVEL & SAND:*** 6-8 ft; sand 40% (fine to medium); gravel 50% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	16-25-35-31	1.0	0.5			***GRAVEL & SAND:*** 8-10 ft; sand 40% (fine to medium); gravel 50% (fine to very coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
10	12-14-17-29	1.2	1.0			***GRAVEL & SAND:*** 10-12 ft; SAME AS ABOVE.
	20-22-28-28	1.2	1.0			***GRAVEL & SAND:*** 12-14 ft; SAME AS ABOVE.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 26.0
Surface Elev.: 734.8044
Datum: Mean Sea Level
North Coor.: 5665.36216

Begin Drilling: 02/23/98
End Drilling: 02/23/98
Converted to Well: No
Well Name:
East Coor.: 8140.19178

OH000294.0001.0002

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH3

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
14	16-20-30-36	1.5	1.0	■		***GRAVEL & SAND:*** 14-16 ft; sand 50% (fine to medium); gravel 40% (fine to very coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
				■		***GRAVEL & SAND:*** 16-18 ft; SAME AS ABOVE.
	10-25-31-40	1.0	0.5	■		***GRAVEL & SAND:*** 18-20 ft; sand 40% (fine to coarse); gravel 50% (fine to very coarse); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
19	13-30-31-38	1.2	0.5	■		
				■		***GRAVEL & SAND:*** 20-22 ft; sand 40% (fine to coarse); gravel 50% (fine to very coarse); silt and clay 10%; dark yellowish brown, moist, loose.
	40-42-50/3"	1.0	0.5	■		
				■		***CLAY & SILT:*** 22-24 ft; silt and clay 80%; sand 20% (fine to medium); gravel 20% (fine to very coarse); moderate yellowish brown to light gray, very moist, loose-cohesive.
	18-14-18-20	1.0	0.5	■		
24				▯		***CLAY & SILT:*** 24-26 ft; silt and clay 70%; sand 15% (fine); gravel 15% (fine); moderate yellowish brown, very moist to wet, cohesive.
	12-18-21-35	1.3	0.5	■		
						BOTTOM OF HOLE 26.0 ft.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 26.0
Surface Elev.: 734.8044
Datum: Mean Sea Level
North Coor.: 5665.36216

Begin Drilling: 02/23/98
End Drilling: 02/23/98
Converted to Well: No
Well Name:
East Coor.: 6140.19178

OH000294.0001.0002

F:/APPS/GT3/GMCRI/OH-BH3 (Rev:5/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	2/23/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH3-2/SL	Coded Replicate No.	
Time Sampling Began	13:10	Time Sampling Ended	13:13

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.) 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (8080A)	4 oz glass jar	Cool
VOCs (8240B)	4 oz glass jar	Cool
SVOCs (8270B)	6 oz glass jar	Cool
Metals (6010A, 7471A, 7060A,	4 oz glass jar	Cool
7421, 7740, 7841)		

Remarks RB-30 taken before this sample with split spoon (time 12:15) and sent to NET (8080A, 8240B, 8270B, 6010A, 7060, 7421, 7470A, 7740, 7841).

Sample Personnel W. J. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	2/23/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH3-16/SL	Coded Replicate No.	
Time Sampling Began	14:00	Time Sampling Ended	14:03

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.) 1 ppm

Constituents Sampled	Container Description	Preservative
PCBs (8080A)	4 oz glass jar	Cool
VOCs (8240B)	4 oz glass jar	Cool
SVOCs (8270B)	6 oz glass jar	Cool
Metals (6010A, 7471A, 7060A, 7421, 7740, 7841)	4 oz glass jar	Cool

Remarks: Highest HNu reading in borehole.

Sample Personnel: W. J. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	2/23/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH3-26/SL	Coded Replicate No.	
Time Sampling Began	14:25	Time Sampling Ended	14:28

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.) 0.5 ppm

Constituents Sampled	Container Description	Preservative
PCBs (8080A)	4 oz glass jar	Cool
VOCs (8240B)	4 oz glass jar	Cool
SVOCs (8270B)	6 oz glass jar	Cool
Metals (6010A, 7471A, 7060A, 7421, 7740, 7841)	4 oz glass jar	Cool

Remarks

Sample Personnel: W. J. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH4

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	22-18-29-35	1.0	0			***GRAVEL & SAND:*** 0-2 ft; sand 60% (fine to medium); gravel 30% (fine to medium); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
	16-9-5-17	1.3	0			***GRAVEL & SAND:*** 2-4 ft; sand 60% (fine to medium); gravel 20% (fine to medium); silt and clay 20%; moderate yellowish brown, moist, loose-cohesive.
5	14-12-8-11	1.3	1.0			***SAND:*** 4-6 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	12-16-23-28	1.5	1.0			***SAND:*** 6-8 ft; SAME AS ABOVE.
	48-50/4"	0.7	0			***GRAVEL & SAND:*** 8-10 ft; sand 60% (fine to medium); gravel 30% (fine to very coarse); silt and clay 10%; moderate yellowish brown to light gray, slightly moist, loose.
10	25-30-28-15	1.2	0			***GRAVEL & SAND:*** 10-12 ft; sand 50% (fine to medium); gravel 40% (fine to medium); silt and clay 10%; moderate yellowish brown, slightly moist, loose.
	10-18-15-25	1.0	0.5			***GRAVEL & SAND:*** 12-14 ft; gravel 60% (fine to medium); sand 30% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 26.0
Surface Elev.: 729.8784
Datum: Mean Sea Level
North Coor.: 5174.76492

Begin Drilling: 02/23/98
End Drilling: 02/23/98
Converted to Well: No
Well Name:
East Coor.: 6009.44632

OH000294.0001.0002

F:/APP/GT3/GMCRI/OH-BH4 (Rev:5/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH4

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
14	25-21-35-35	1.0	0.5			***SAND:*** 14-16 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose-cohesive.
	50/3"	0.2	0.5			***GRAVEL & SAND:*** 16-18 ft; sand 40% (fine to medium); gravel 50% (fine to very coarse); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
19	35-37-21-25	1.3	0.5			***GRAVEL & SAND:*** 18-20 ft; sand 60% (fine to coarse); gravel 30% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	13-27-32-35	1.5	1.0			***GRAVEL & SAND:*** 20-22 ft; SAME AS ABOVE.
	11-27-35-30	1.5	0.5	■		***SILTY GRAVEL & SAND:*** 22-24 ft; sand 30% (fine to medium); gravel 40% (fine to medium); silt and clay 30%; moderate yellowish brown, very moist, loose-cohesive.
24	18-45-40-35	2.0	0.5			***SILTY GRAVEL & SAND:*** 24-26 ft; sand 50% (fine to medium); gravel 25% (fine to medium); silt and clay 25%; moderate yellowish brown, wet, cohesive.
						BOTTOM OF HOLE 26.0 ft.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 26.0
Surface Elev.: 729.8784
Datum: Mean Sea Level
North Coor.: 5174.76492

Begin Drilling: 02/23/98
End Drilling: 02/23/98
Converted to Well: No
Well Name:
East Coor.: 6009.44632

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	2/23/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH4-2/SL	Coded Replicate No.	
Time Sampling Began	16:15	Time Sampling Ended	16:18

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.) 0 ppm

Constituents Sampled	Container Description	Preservative
PCBs (8080A)	4 oz glass jar	Cool
VOCs (8240B)	4 oz glass jar	Cool
SVOCs (8270B)	6 oz glass jar	Cool
Metals (6010A, 7471A, 7060A,	4 oz glass jar	Cool
7421, 7740, 7841)		

Remarks: RB-31 taken before taking this sample with split spoon (time 15:35) and sent to NET (8080A, 8240B, 8270B, 6010A, 7060, 7421, 7470A, 7740, 7841).

Sample Personnel: W. J. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	2/23/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH4-8/SL	Coded Replicate No.	
Time Sampling Began	16:30	Time Sampling Ended	16:35

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.) 1 ppm

Constituents Sampled	Container Description	Preservative
PCBs (8080A)	4 oz glass jar	Cool
VOCs (8240B)	4 oz glass jar	Cool
SVOCs (8270B)	6 oz glass jar	Cool
Metals (6010A, 7471A, 7060A,	4 oz glass jar	Cool
7421, 7740, 7841)		

Remarks: Sample with highest HNu reading in borehole.

Sample Personnel: W. J. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	2/23/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH4-24/SL	Coded Replicate No.	
Time Sampling Began	17:30	Time Sampling Ended	17:35

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		(see corresponding "Sample/Core Log")

OTHER (OVA; HNu; etc.) 0.5 ppm

Constituents Sampled	Container Description	Preservative
PCBs (8080A)	4 oz glass jar	Cool
VOCs (8240B)	4 oz glass jar	Cool
SVOCs (8270B)	6 oz glass jar	Cool
Metals (6010A, 7471A, 7060A,	4 oz glass jar	Cool
7421, 7740, 7841)		

Remarks

Sample Personnel W. J. Ferguson

AOI 7 - Former Oil House Area
August 1998

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH5

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0	6-13-19-22	1.0	0	■		***SAND & GRAVEL:*** 0-2 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; moderate yellowish brown to dark yellowish brown, moist, loose.
	9-16-16-12	1.0	0			***SAND & GRAVEL:*** 2-4 ft; SAME AS ABOVE.
5	9-12-13-12	1.0	0.5			***SAND & GRAVEL:*** 4-6 ft; sand 60% (fine to medium); gravel 30% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	10-11-21-29	1.2	1.0			***SAND & GRAVEL:*** 6-8 ft; sand 70% (fine to coarse); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	10-13-21-29	1.5	1.5			***SAND & GRAVEL:*** 8-10 ft; sand 70% (fine to coarse); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
10	20-17-13-22	1.0	2.0			***SAND & GRAVEL:*** 10-12 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	24-36-24-37	1.0	2.0			***SAND & GRAVEL:*** 12-14 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
15	24-53-36-24	1.2	1.0			***SAND & GRAVEL:*** 14-16 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 734.7921
Datum: Mean Sea Level
North Coor.: 5629.74918

Begin Drilling: 08/14/98
End Drilling: 08/14/98
Converted to Well: No
Well Name:
East Coor.: 6038.35587

OH000294.0001.0002

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH5

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
16	11-11-13-19	0.8	1.0			***SAND & GRAVEL:*** 16-18 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	26-35-50	1.0	3.0			***SAND & GRAVEL:*** 18-20 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
21	17-27-50	1.0	3.0			***SAND & GRAVEL:*** 20-22 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	27-17-50	1.0	2.0			***SAND & GRAVEL:*** 22-24 ft; sand 60% (fine to medium); gravel 30% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	0-10-21-38	0.8	3.2			***SAND & GRAVEL:*** 24-26 ft; sand 70% (fine to coarse); gravel 20% (fine); silt and clay 10%; moderate yellowish brown, moist, loose.
26	27-29-38-38	1.0	0.5			***SAND & GRAVEL:*** 26-28 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose.
	7-6-7-6	0.7	0.5			***SAND & GRAVEL:*** 28-30 ft; sand 60% (fine to medium); gravel 30% (fine to medium); silt and clay 10%; moderate yellowish brown, wet, loose.
31	21-25-27-20	1.2	7.5			***SAND:*** 30-32 ft; sand 25% (medium to coarse); sand 50% (fine); gravel 15% (fine); silt and clay 10%; moderate yellowish brown except gray in fine sand on bottom 4 inches, wet, loose-cohesive, 3mm layer of black staining in fine sand ~6" above bottom.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 734.7921
Datum: Mean Sea Level
North Coor.: 5629.74918

Begin Drilling: 08/14/98
End Drilling: 08/14/98
Converted to Well: No
Well Name:
East Coor.: 6038.35587

OH000294.0001.0002

G:/GMOTORS/GMCFRI/GTGS/OH-BH5 (Rev:12/18/

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH5

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
32		1.3	8.0			***SAND & GRAVEL:*** 32–33.5 ft; sand 80% (fine to medium); gravel 10% (fine to coarse); silt and clay 10%; dark yellowish brown, wet, loose.
						SILT & CLAY: 33.5–34 ft; silt and clay 80%; sand 20% (fine); dark yellowish brown, very moist to wet, pliable.
	10–17–15–18	1.2	4.5			***SAND & GRAVEL:*** 34–36 ft; sand 75% (fine to coarse); gravel 10% (coarse); silt and clay 15%; dark yellowish brown and gray, wet, loose–pliable.
37	7–12–15–18	1.8	13.0/4.0			***SAND:*** 36–37.5 ft; sand 80% (fine to coarse); gravel 5% (fine); silt and clay 15%; gray, wet, loose–cohesive.
						TILL: 37.5–38 ft; silt and clay 80%; gravel 10% (fine); sand 10% (fine); gray, slightly moist, very cohesive.
						TOTAL DEPTH: 38 ft.
42						
47						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 734.7921
Datum: Mean Sea Level
North Coor.: 5629.74918

Begin Drilling: 08/14/98
End Drilling: 08/14/98
Converted to Well: No
Well Name:
East Coor.: 6038.35587

OH000294.0001.0002

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/14/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH5-2/SL
Coded Replicate No.:

Time Sampling Began: 9:00
Time Sampling Ended: 9:02

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	8/14/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH5-20/SL	Coded Replicate No.	
Time Sampling Began	10:30	Time Sampling Ended	10:33

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) 3.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool

Remarks

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	8/14/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH5-26/SL	Coded Replicate No.	
Time Sampling Began	10:55	Time Sampling Ended	11:30

Sampling Method and Material: 2' Stainless steel split-spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) 3.2 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool
HP - VOCs 8240 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Took hydropunch OH-BH5-37/HP (time 11:30) description: brown, very turbid

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH6

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0	9-11-11-8	1.5	4.5	■		***SAND & GRAVEL:*** 0-2 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose, contained also 2 inches very black odorous sand and gravel near middle of spoon.
	12-11-18-18	0.75	1.5	■		***SAND & GRAVEL:*** 2-4 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
5	17-28-50/4"	0.75	1.5	■		***SAND & GRAVEL:*** 4-6 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light to moderate yellowish brown, moist, loose.
	18-38-26-50	1.0	4.5	■		***SAND & GRAVEL:*** 6-8 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	17-19-15-10	0.25	4.5	■		***SAND & GRAVEL:*** 8-10 ft; sand 60% (fine to medium); gravel 30% (coarse); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
10	10-31-49-39	1.0	2.0	■		***SAND & GRAVEL:*** 10-12 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, very moist, loose-cohesive.
	26-26-42-32	1.5	4.0	■		***SAND & GRAVEL:*** 12-14 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 32
Surface Elev.: 732.3313
Datum: Mean Sea Level
North Coor.: 5524.47665

Begin Drilling: 08/12/98
End Drilling: 08/12/98
Converted to Well: No
Well Name:
East Coor.: 6024.49274

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH6 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH6

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
14	12-17-28-25	1.8	2.5			***SAND & GRAVEL:*** 14-16 ft; sand 75% (fine to coarse); gravel 15% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	10-16-22-28	1.0	3.0			***SAND & GRAVEL:*** 16-18 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown to light gray, moist, loose-cohesive.
19	16-32-50	0.75	3.5			***SAND & GRAVEL:*** 18-20 ft; sand 75% (fine to coarse); gravel 15% (fine to medium); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
	11-37-36-35	1.0	4.5			***SAND & GRAVEL:*** 20-22 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
	16-20 25-28	1.2	7.0	■		***SAND & GRAVEL:*** 22-24 ft; sand 75% (fine to medium); gravel 15% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
24	4-15-14-13	1.0	1.5			***SAND & GRAVEL:*** 24-26 ft; sand 80% (fine to coarse); gravel 10% (fine); silt and clay 10%; moderate yellowish brown, wet, loose-cohesive.
	25-31-30-28	1.2	0.5			***SAND & GRAVEL:*** 26-28 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose-cohesive.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 32
Surface Elev.: 732.3313
Datum: Mean Sea Level
North Coor.: 5524.47665

Begin Drilling: 08/12/98
End Drilling: 08/12/98
Converted to Well: No
Well Name:
East Coor.: 6024.49274

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH6 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH6

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
28	6-16-21-18	1.2	22.0			***SAND:*** 28-30 ft; sand 85% (fine to medium); gravel 5% (medium); silt and clay 10%; moderate yellowish brown except for bottom 5 inches where color is dark gray to black and odorous; no visible separate phase or sheen, wet, loose.
	6-15-20-50	2.0				30-31.5 ft.; completely stained black
						TILL: 31.5-32 ft; silt and clay 90%; sand 5% (fine); gravel 5% (fine); dark gray with some black and orange staining; very moist, very cohesive.
33						***TOTAL DEPTH:*** 32 ft.
38						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 32
Surface Elev.: 732.3313
Datum: Mean Sea Level
North Coor.: 5524.47665

Begin Drilling: 08/12/98
End Drilling: 08/12/98
Converted to Well: No
Well Name:
East Coor.: 6024.49274

OH000294.0001.0002

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/12/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH6-2/SL

Coded Replicate No.: DUP60

Time Sampling Began: 9:50

Time Sampling Ended: 10:00

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 4.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool

Remarks: DUP60: (time 9:55) - OHBH6-2/SL RB37: (time 9:00) prior to OHBH6-2/SL

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/12/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH6-8/SL

Coded Replicate No.:

Time Sampling Began: 11:00

Time Sampling Ended: 11:02

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 4.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/12/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH6-24/SL
Coded Replicate No.:

Time Sampling Began: 11:40
Time Sampling Ended: 14:00

Sampling Method and Material: 2' Stainless steel split-spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 7 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool
HP - VOCs 8240 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: MS102: OH-BH6-24SL (time 11:40) MSD102: OH-BH6-24SL (time 11:40)
Took hydropunch OH-BH6-31.5/HP (time 14:00) description: moderately turbid; brown

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH7

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0						**CONCRETE:** 0-0.5 ft;
	8-60	1.0	0.5			**SAND & GRAVEL:** 0.5-2 ft; sand 50% (fine to coarse); gravel 40% (fine to coarse); silt and clay 10%; light yellowish brown to light gray, moist, loose.
	8-26-39-46	2.0	0			**SAND & GRAVEL:** 2-4 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown to light gray, moist, loose, slight orange staining.
5	25-50/3"	.5	0.5			**SAND & GRAVEL:** 4-6 ft; same as above except no staining
	15-34-30-37	1.0	1.0			**SAND & GRAVEL:** 6-8 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	7-18-34-37	1.5	2.0			**SAND & GRAVEL:** 8-10 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
10	15-25-35-37	1.5	7.0			**SAND & GRAVEL:** 10-12 ft; sand 40% (fine to medium); gravel 50% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	20-21-44-28	1.0	3.0			**SAND & GRAVEL:** 12-14 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate to light yellowish brown, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 31.5
Surface Elev.: 730.0450
Datum: Mean Sea Level
North Coor.: 5283.81666

Begin Drilling: 08/10/98
End Drilling: 08/10/98
Converted to Well: No
Well Name:
East Coor.: 6017.83429

OH000294.0001.0002

F:/APP/GT3/GMCRI/OH-BH7 (Rev:12/07/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH7

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
14	17-25-28-30	1.5	8.0			***SAND & GRAVEL:*** 14-16 ft; sand 60% (fine to medium); gravel 30% (fine to medium); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
	23-26-28-30	1.2	8.0			***SAND & GRAVEL:*** 16-18 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
19	48-29-25-38	1.2	19.0			***SAND & GRAVEL:*** 18-20 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
	2-12-17-19	1.1	10.0			***SAND & GRAVEL:*** 20-22 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, very moist, loose.
	10-12-15-20	1.5	2.0			***SAND & GRAVEL:*** 22-24 ft; sand 75% (medium to coarse); gravel 15% (fine to coarse); silt and clay 10%; dark yellowish brown, very moist to wet, loose.
24	5-25-31-14	1.5	0			***SAND & GRAVEL:*** 24-26 ft; sand 40% (fine to coarse); gravel 50% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose to cohesive.
	12-17-24-36	1.2	8.0			***SAND & GRAVEL:*** 26-28 ft; sand 75% (fine to medium); gravel 10% (fine to medium); silt and clay 15%; moderate yellowish brown, wet, slightly cohesive.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 31.5
Surface Elev.: 730.0450
Datum: Mean Sea Level
North Coor.: 5283.81666

Begin Drilling: 08/10/98
End Drilling: 08/10/98
Converted to Well: No
Well Name:
East Coor.: 6017.83429

OH000294.0001.0002

F:/APP/GT3/GMCRI/OH-BH7 (Rev:12/07/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH7

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
28	5-12-8-27	1.5	1.0			***SAND:*** 28-30 ft; sand 70% (fine to medium); gravel 10% (fine to medium); silt and clay 20%; moderate yellowish brown, wet, slightly cohesive.
	18-53-127	1.5	4.0 0.0			***SAND:*** 30-30.5 ft; sand 80% (fine to medium); silt and clay 10%; moderate yellowish brown, wet, semi cohesive. ***TILL:*** 30.5-31.5 ft; silt and clay 80%; gravel 20% (fine to medium); dark gray; moist, very cohesive. ***TOTAL DEPTH:*** 31.5 ft;
33						
38						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 31.5
Surface Elev.: 730.0450
Datum: Mean Sea Level
North Coor.: 5283.81666

Begin Drilling: 08/10/98
End Drilling: 08/10/98
Converted to Well: No
Well Name:
East Coor.: 6017.83429

OH000294.0001.0002

F:/APP/GT3/GMCRI/OH-BH7 (Rev:12/07/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/10/98

Project No.: OH000294.0001.00002

Sample No.: OH-BH7-2/SL

Coded Replicate No.:

Time Sampling Began: 14:33

Time Sampling Ended: 14:35

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 0.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/10/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH7-20/SL
Coded Replicate No.:

Time Sampling Began: 16:00
Time Sampling Ended: 16:02

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 19 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/10/98

Project No.: OH000294.0001.00002

Sample No.: OH-BH7-24/SL

Coded Replicate No.:

Time Sampling Began: 16:20

Time Sampling Ended: 9:00 (8/11/98)

Sampling Method and Material: 2' Stainless steel split-spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 2 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool
HP - VOCs 8240 shortlist	3-40 ml glass vials	HCl, Cool

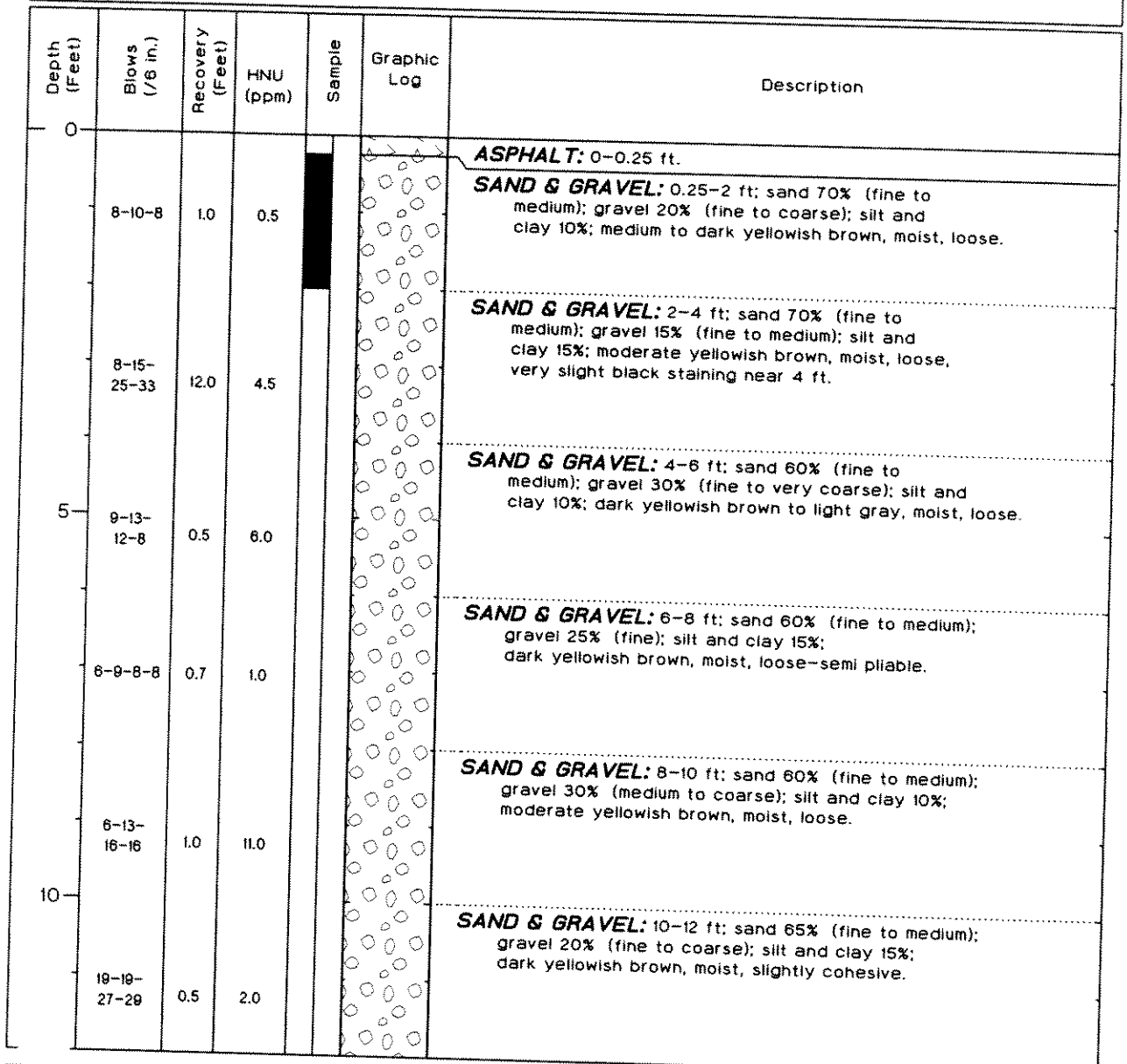
Remarks: Took hydropunch OHBH-7-30/HP (time 9:00) taken with bailer after 3 tries with hydropunch. Last HP was left in overnight. Still no water. Bailer was 1/3 full. Very turbid and silty.

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH8

GENERAL MOTORS — Moraine, Ohio



Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0						**ASPHALT:** 0–0.25 ft.
	8–10–8	1.0	0.5			**SAND & GRAVEL:** 0.25–2 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; medium to dark yellowish brown, moist, loose.
	8–15–25–33	12.0	4.5			**SAND & GRAVEL:** 2–4 ft; sand 70% (fine to medium); gravel 15% (fine to medium); silt and clay 15%; moderate yellowish brown, moist, loose, very slight black staining near 4 ft.
5	9–13–12–8	0.5	6.0			**SAND & GRAVEL:** 4–6 ft; sand 60% (fine to medium); gravel 30% (fine to very coarse); silt and clay 10%; dark yellowish brown to light gray, moist, loose.
	6–9–8–8	0.7	1.0			**SAND & GRAVEL:** 6–8 ft; sand 60% (fine to medium); gravel 25% (fine); silt and clay 15%; dark yellowish brown, moist, loose–semi pliable.
	6–13–16–16	1.0	11.0			**SAND & GRAVEL:** 8–10 ft; sand 60% (fine to medium); gravel 30% (medium to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
10	19–19–27–29	0.5	2.0			**SAND & GRAVEL:** 10–12 ft; sand 65% (fine to medium); gravel 20% (fine to coarse); silt and clay 15%; dark yellowish brown, moist, slightly cohesive.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Scott/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 735.6513
Datum: Mean Sea Level
North Coor.: 5749.14810

Begin Drilling: 08/18/98
End Drilling: 08/18/98
Converted to Well: No
Well Name:
East Coor.: 6005.94093

OH000294.0001.0002

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH8

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
12	10-13-23-33	1.5	12.0			***SAND & GRAVEL:*** 12-14 ft; sand 50% (fine to coarse); gravel 40% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose, one spot ~3mm of slight black staining.
	11-6-21-19	0.7	11.0			***SAND & GRAVEL:*** 14-16 ft; sand 60% (fine); sand 10% (medium); gravel 20% (fine); silt and clay 10%; moderate yellowish brown, moist, loose.
17	13-19-19-16	1.2	13.0	■		***SAND & GRAVEL:*** 16-18 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	7-12-8-8	1.3	10.0			***SAND:*** 18-20 ft; sand 75% (fine to medium); gravel 15% (fine); silt and clay 10%; moderate yellowish brown, moist, loose.
22	32-27-25-32-	1.0	9.5			***SAND & GRAVEL:*** 20-22 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light yellowish brown to light gray, moist, loose; trace dark orange staining.
	13-33 23-6	1.0	11.5			***SAND & GRAVEL:*** 22-24 ft; sand 40% (fine to medium); gravel 50% (very coarse); silt and clay 10%; light yellowish brown with slight orange staining, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Scott/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 735.6513
Datum: Mean Sea Level
North Coor.: 5749.14810

Begin Drilling: 08/18/98
End Drilling: 08/18/98
Converted to Well: No
Well Name:
East Coor.: 6005.94093

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH8 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH8

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
24						
	6-8-7-15	2.0	1.0			***TILL:*** 24-25 ft; silt and clay 80%, gravel 15% (fine); sand 5% (fine); light yellowish brown, moist, cohesive.
						TILL: 25-26 ft; same as above except dark gray.
						SILT & CLAY: 26-26.5 ft; sand 15% (fine to medium); gravel 10% (fine); silt and clay 75%; moderate yellowish brown, slightly moist, cohesive-pliable.
	9-11-16-40	2.0	1.0			***TILL:*** 26.5-27.8 ft; sand 5% (fine); gravel 15% (fine); silt and clay 80%; moderate yellowish brown to gray, slightly moist, cohesive.
						SAND & GRAVEL: 27.8-28.0 ft; sand 30% (fine to medium); gravel 40%; silt and clay 30%; moderate yellowish brown, moist, loose.
29	10-20-22-15	1.2	2.0			***SAND & GRAVEL:*** 28.0-30.0 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose.
	8-19-25-27	1.5	9.5			***SAND:*** 30-32.0 ft; sand 60% (fine); sand 20% (medium to coarse); gravel 10% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose.
	28-26 36-35	1.5	5.0			***SAND & GRAVEL:*** 32-34 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose-cohesive.
34						***SAND & GRAVEL:*** 34-36 ft; sand 60% (fine to coarse); gravel 30% (fine to very coarse); silt and clay 10%; moderate yellowish brown except for much black staining on last 3-4 inches, wet, loose.
	9-17-40-40	2.0	4.0			

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Scott/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 735.6513
Datum: Mean Sea Level
North Coor.: 5749.14810

Begin Drilling: 08/18/98
End Drilling: 08/18/98
Converted to Well: No
Well Name:
East Coor.: 6005.94093

OH000294.0001.0002

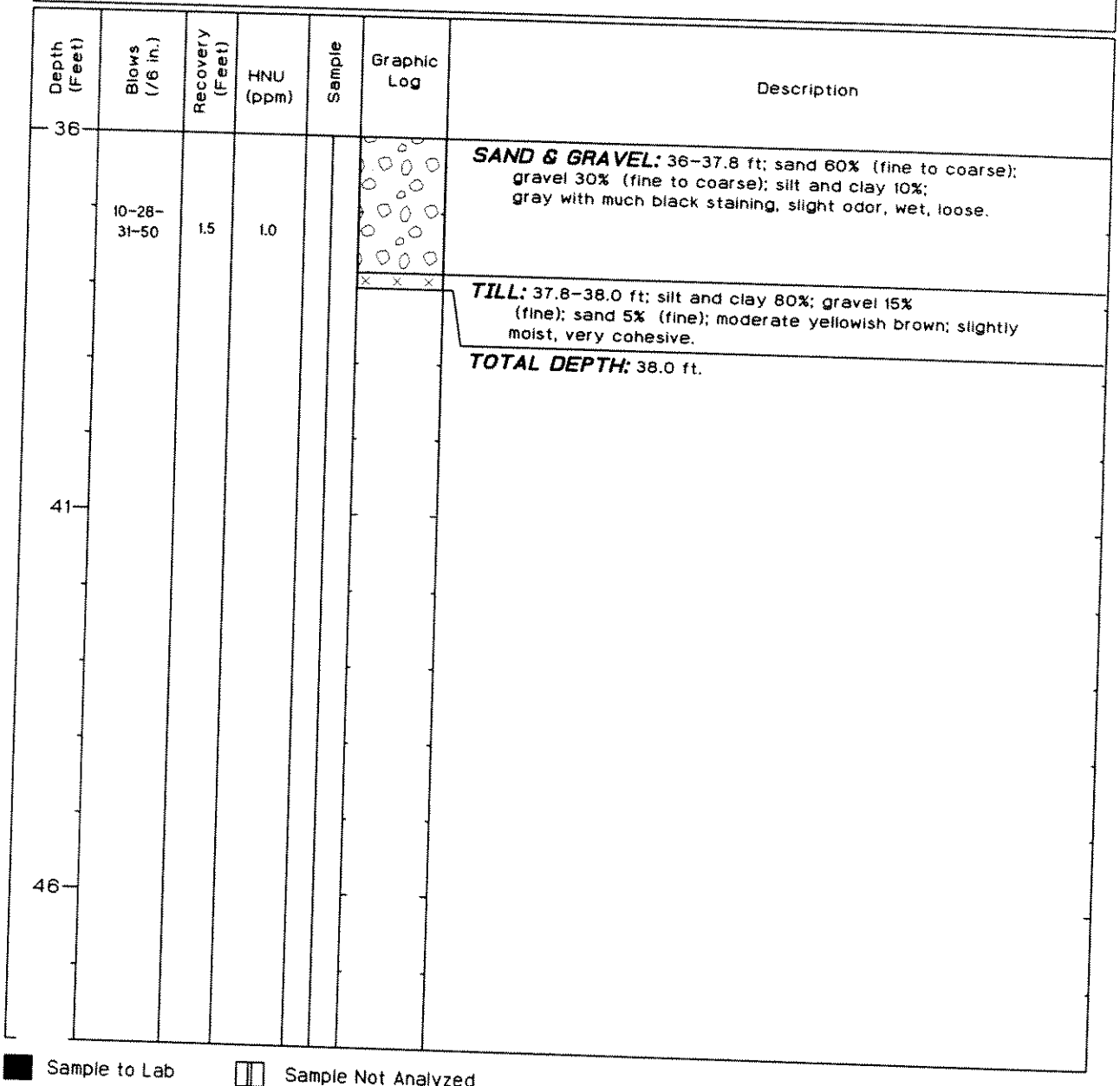
I:/GMOTORS/GMCRI/GTGS/OH-BH8 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH8

GENERAL MOTORS

Moraine, Ohio



■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Scott/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 735.6513
Datum: Mean Sea Level
North Coor.: 5749.14810

Begin Drilling: 08/18/98
End Drilling: 08/18/98
Converted to Well: No
Well Name:
East Coor.: 6005.94093

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH8 (12/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/18/98

Project No.: OH000294.0001.00002

Sample No.: OH-BH8-2/SL

Coded Replicate No.:

Time Sampling Began: 8:50

Time Sampling Ended: 8:52

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 0.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/18/98

Project No.: OH000294.0001.00002

Sample No.: OH-BH8-18/SL

Coded Replicate No.:

Time Sampling Began: 9:15

Time Sampling Ended: 9:18

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 13.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/18/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH8-28/SL
Coded Replicate No.:

Time Sampling Began: 11:45
Time Sampling Ended: 14:00

Sampling Method and Material: 2" Stainless steel split spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 0.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool
HP - VOCs 8240 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Took hydropunch OH-BH-8-38/HP (time 14:00) description: light gray, very turbid

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH9

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0						**CONCRETE:** 0-0.5 ft.
	2-8-14	1.2	0			**SAND & GRAVEL:** 0.5-2 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light to moderate yellowish brown, slightly moist, loose.
	9-16-17-29	1.3	0			**SAND & GRAVEL:** 2-4 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, slight moist, loose,
5	8-15-22-27	1.5	0			**SAND & GRAVEL:** 4-6 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; light to moderate yellowish brown, slightly moist, loose.
	10-13-19-23	1.6	0			**SAND & GRAVEL:** 6-8 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown with light gray, slightly moist, loose.
	9-19-24-30	1.4	0			**SAND & GRAVEL:** 8-10 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown with light gray, slightly moist, loose.
10	11-15-16-20	0.4	0			**SAND & GRAVEL:** 10-12 ft; sand 50% (fine to medium); gravel 40% (medium to coarse); silt and clay 10%; light yellowish brown to light gray, slightly moist, loose.
	6-40-50/5"	0.4	0			**SAND & GRAVEL:** 12-14 ft; sand 60% (fine to medium); gravel 30% (medium to coarse); silt and clay 10%; moderate yellowish brown, slightly moist, loose.
15	3-17-32-21	1.5	0			**SAND & GRAVEL:** 14-16 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; light to moderate yellowish brown, slightly moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Scott/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 737.6163
Datum: Mean Sea Level
North Coor.: 6001.62750

Begin Drilling: 08/19/98
End Drilling: 08/19/98
Converted to Well: No
Well Name:
East Coor.: 5994.23062

OH000294.0001.0002

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH9

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
16	8-8-6-27	1.4	0			***SAND:*** 16-18 ft; sand 80% (fine to medium); gravel 10% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose-cohesive.
	7-12-30-28	1.4	0			***SAND & GRAVEL:*** 18-20 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light yellowish brown to light gray; slightly moist, loose.
21	9-28-39-50	1.6	0			***SAND & GRAVEL:*** 20-22 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; light to moderate yellowish brown, moist, loose-cohesive.
	12-36-41-49	1.8	0			***SAND & GRAVEL:*** 22-24 ft; sand 60% (fine to coarse); gravel 30% (fine to very coarse); silt and clay 10%; moderate yellowish brown to light gray, slightly moist, loose.
	12-31-39-42	1.7	0			***SAND & GRAVEL:*** 24-26 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; light yellowish brown to light gray, moist, loose-cohesive,
26	16-40-50	1.2	0			***SAND & GRAVEL:*** 26-28 ft; sand 70% (fine to coarse); gravel 20% (fine to medium); silt and clay 10%; light yellowish brown with slight orange staining, moist, loose.
	22-38-39-34	1.7	0			***SAND & GRAVEL:*** 28-30 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, very moist, loose-cohesive.
31	12-17-20-20	1.2	0			***SAND & GRAVEL:*** 30-32 ft; sand 70% (fine to coarse); gravel 20% (fine to medium); silt and clay 10%; dark yellowish brown, very wet, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Beiasco Drilling
Driller: Scott/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 737.6163
Datum: Mean Sea Level
North Coor.: 6001.62750

Begin Drilling: 08/19/98
End Drilling: 08/19/98
Converted to Well: No
Well Name:
East Coor.: 5994.23062

OH000294.0001.0002

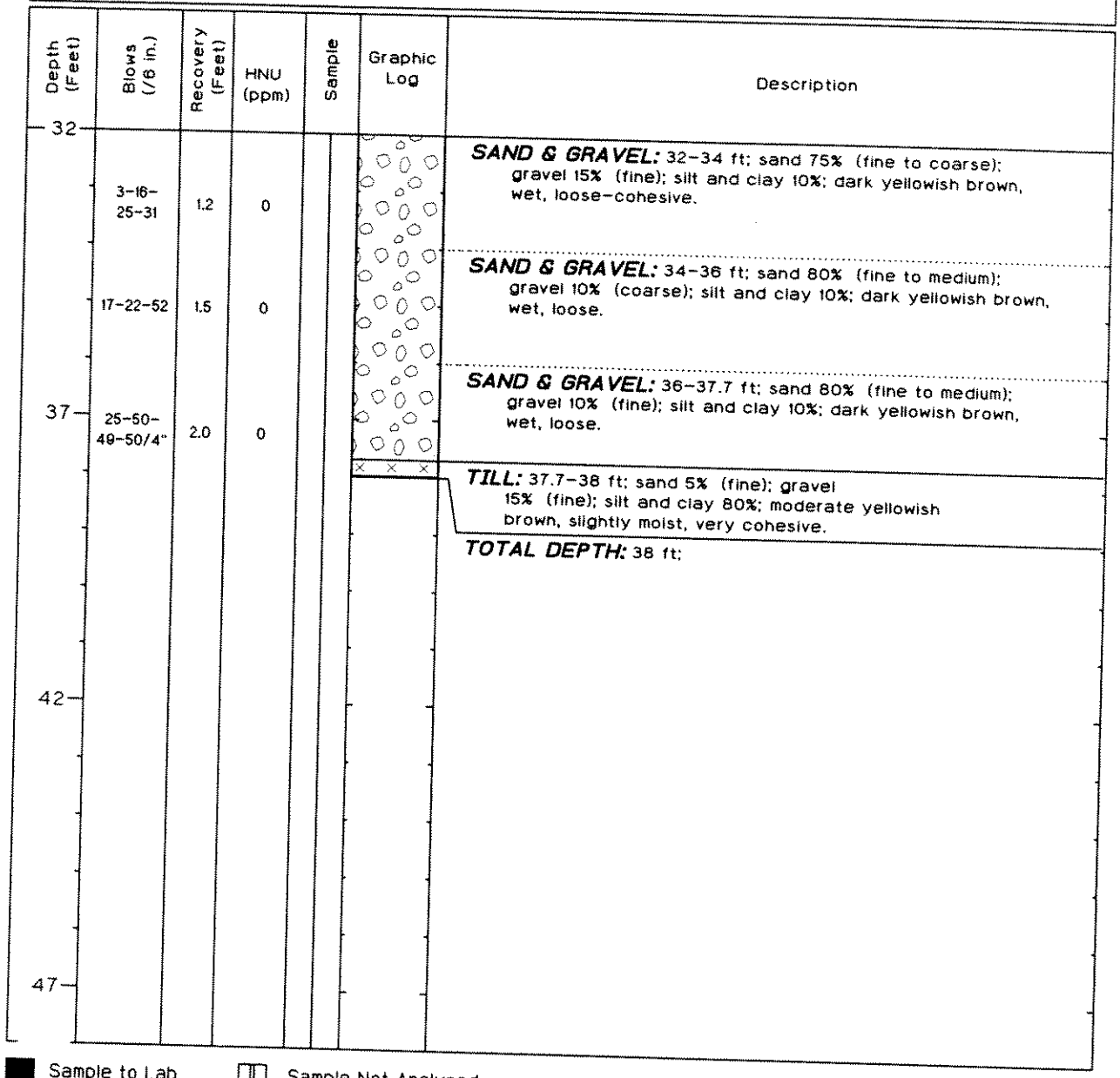
I:/GMOTORS/GMCRI/GTGS/OH-BH9 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH9

GENERAL MOTORS

Moraine, Ohio



■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Scott/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 737.6163
Datum: Mean Sea Level
North Coor.: 6001.62750

Begin Drilling: 08/19/98
End Drilling: 08/19/98
Converted to Well: No
Well Name:
East Coor.: 5994.23062

OH000294.0001.0002

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/19/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH9-2/SL
Coded Replicate No.:

Time Sampling Began: 10:13
Time Sampling Ended: 10:15

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/19/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH9-30/SL
Coded Replicate No.: DUP 62

Time Sampling Began: 11:55
Time Sampling Ended: 14:55

Sampling Method and Material: 2' Stainless steel split-spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool
HP - VOCs 8240 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Took hydropunch OH-BH9-38/HP (time 14:45); DUP 63 (time 14:50). RB40 taken before HP at 12:50; MS105 (time 14:55) For soil: Took RB39 prior to OHBH9-30/SL at 11:10. Took MSD104 at 12:02; MS104 at 12:00 DUP62 (time 11:55)

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH10

GENERAL MOTORS

Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0						**ASPHALT:** 0–0.25 ft.
	6-17-16	1.0	2.0			**SAND & GRAVEL:** 0.25–2 ft; sand 40% (fine to medium); gravel 50% (fine to coarse); silt and clay 10%; light brown to light gray, slightly moist, loose.
	6-20-23-16	1.5	4.0			**SAND & GRAVEL:** 2–4 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, slightly moist, loose,
5	16-27-50	1.5	2.5			**SAND & GRAVEL:** 4–6 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; moderate yellowish brown to light gray, slightly moist, loose.
	18-22-26-40	1.5	10.0			**SAND & GRAVEL:** 6–8 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; moderate yellowish brown, slightly moist, loose.
	11-15-22-27	0.8	5.0			**SAND & GRAVEL:** 8–10 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; moderate yellowish brown with light gray, slightly moist, loose.
10	14-18-20-30	1.0	9.5			**SAND & GRAVEL:** 10–12 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown to light gray, slightly moist, loose.
	29-50/5"	0.7	3.0			**SAND & GRAVEL:** 12–14 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light to moderate yellowish brown, slightly moist, loose.
15	22-25-32-25	1.3	14.0			**SAND & GRAVEL:** 14–16 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; light to moderate yellowish brown, slightly moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Scott/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 35.0
Surface Elev.: 736.4667
Datum: Mean Sea Level
North Coor.: 5708.84730

Begin Drilling: 08/18/98
End Drilling: 08/18/98
Converted to Well: No
Well Name:
East Coor.: 5911.95073

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH10 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH10

GENERAL MOTORS

Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
16	15-20-21-30	1.2	3.5			***SAND & GRAVEL:*** 16-18 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose-cohesive.
	15-20-21-30	1.8	12.5			***SAND & GRAVEL:*** 18-20 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown with trace dark orange and black staining; slightly moist, loose.
21	12-22-25-50	0.8	3.0			***SAND & GRAVEL:*** 20-22 ft; sand 50% (fine to coarse); gravel 40% (fine to coarse); silt and clay 10%; light yellowish brown to light gray, moist, loose-cohesive.
	27-31-44-38	1.2	2.5			***SAND & GRAVEL:*** 22-24 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, very moist, loose-cohesive.
	24-40-50/5"	1.2	4.5			***SAND & GRAVEL:*** 24-26 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light yellowish brown, very moist, loose-cohesive; trace orange staining.
26	18-20-50/4"	0.8	17.0	■		***SAND & GRAVEL:*** 26-28 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	2-16-18-20	1.0	3.5			***SAND & GRAVEL:*** 28-30 ft; sand 70% (fine to coarse); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, very wet, loose.
31	18-24-27-28	1.0	2.5			***SAND & GRAVEL:*** 30-32 ft; sand 70% (fine to coarse); gravel 20% (fine); silt and clay 10%; moderate yellowish brown, wet, loose-cohesive.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Scott/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 35.0
Surface Elev.: 736.4667
Datum: Mean Sea Level
North Coor.: 5708.84730

Begin Drilling: 08/18/98
End Drilling: 08/18/98
Converted to Well: No
Well Name:
East Coor.: 5911.95073

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH10 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH10

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
32	4-10-50	1.2	3.5			**SAND:** 32-34 ft; sand 85% (fine to medium); gravel 5% (fine); silt and clay 10%; moderate yellowish brown, wet, loose-cohesive.
	5-50	0.8	0.0			**TILL:** 34-35 ft; sand 5% (fine); gravel 15% (fine); silt and clay 80%; moderate yellowish brown, slightly moist, very cohesive.
						TOTAL DEPTH: 35 ft;
37						
42						
47						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Scott/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 35.0
Surface Elev.: 736.4667
Datum: Mean Sea Level
North Coor.: 5708.84730

Begin Drilling: 08/18/98
End Drilling: 08/18/98
Converted to Well: No
Well Name:
East Coor.: 5911.95073

OH000294.0001.0002

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/18/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH10-2/SL
Coded Replicate No.:

Time Sampling Began: 16:38
Time Sampling Ended: 16:40

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 2.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/18/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH10-16/SL
Coded Replicate No.:

Time Sampling Began: 17:30
Time Sampling Ended: 17:33

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 14.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/18/98

Project No.: OH000294.0001.00002

Sample No.: OH-BH10-28/SL

Coded Replicate No.:

Time Sampling Began: 18:15

Time Sampling Ended: 9:00 (8/19/98)

Sampling Method and Material: 2' Stainless steel split-spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 17.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool
HP - VOCs 8240 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Took hydropunch OH-BH10-34/HP (time 9:00) on 8/19/98

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

AOI 7 - Former Oil House Area
November 1998

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH2A

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0						**ASPHALT:** 0–0.25 ft.
	6-5-7	0.5	1.0			**SAND & GRAVEL:** 0.25–2 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; dark yellowish brown, moist, loose.
	5-2-3-20	1.0	1.5			**SAND:** 2–4 ft; sand 80% (fine to medium); gravel 10% (fine); silt and clay 10%, moderate yellowish brown, moist, loose.
5	33-9-9-12	1.3	4.0			**SAND:** 4–6 ft; sand 75% (fine to medium); gravel 15% (fine); silt and clay 10%; moderate yellowish brown, moist, loose.
	16-24-23-38	1.0	3.0			**SAND & GRAVEL:** 6–8 ft; sand 70% (fine to coarse); gravel 20% (fine to medium); silt and clay 10%; light yellowish brown to light gray, moist, loose.
	3-14-16-20	2.0	2.5			**SAND & GRAVEL:** 8–10 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
10	14-24-31-13	1.5	3.0			**SAND & GRAVEL:** 10–12 ft; sand 50% (fine to coarse); gravel 40% (fine to coarse); silt and clay 10%; light to moderate yellowish brown, moist, loose.
	5-19-27-15	1.5	16.0			**SAND & GRAVEL:** 12–14 ft; sand 50% (fine to medium); gravel 40% (medium to coarse); silt and clay 10%; light yellowish brown, moist, loose.
15	7-16-7-7	1.2	4.0			**SAND & GRAVEL:** 14–16 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, very moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 735.1980
Datum: Mean Sea Level
North Coor.: 5698.93706

Begin Drilling: 11/02/98
End Drilling: 11/02/98
Converted to Well: No
Well Name:
East Coor.: 5977.19145

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH2A (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH2A

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
16	16-15-19-12	1.3	6.0			***SAND & GRAVEL:*** 16-18 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; light yellowish brown, moist, loose.
	39-25-28-25	0.3	4.0			***SAND & GRAVEL:*** 18-20 ft; sand 50% (fine to medium); gravel 40% (coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
21	26-26-24-23	1.7	4.0			***SAND & GRAVEL:*** 20-22 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light yellowish brown to light gray, moist, loose.
	4-20-12-30	1.5	6.5			***SAND & GRAVEL:*** 22-24 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	46-44-35-29	1.5	9.0			***SAND & GRAVEL:*** 24-26 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
26	7-21-37-22	1.3	<0.5			***SAND & GRAVEL:*** 26-28 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, very moist, loose.
	2-11-11-21	1.5	16.0			***SAND & GRAVEL:*** 28-30 ft; sand 80% (fine to medium); gravel 10% (fine); silt and clay 10%; moderate yellowish brown with slight orange staining, wet, loose.
31	16-21-21-22	1.5	35.0			***SAND & GRAVEL:*** 30-32 ft; sand 60% (fine to medium); gravel 20% (fine to medium); silt and clay 20%; moderate yellowish brown with some black staining, wet, loose-semi-cohesive.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 735.1980
Datum: Mean Sea Level
North Coor.: 5698.93706

Begin Drilling: 11/02/98
End Drilling: 11/02/98
Converted to Well: No
Well Name:
East Coor.: 5977.19145

OH000294.0001.0002

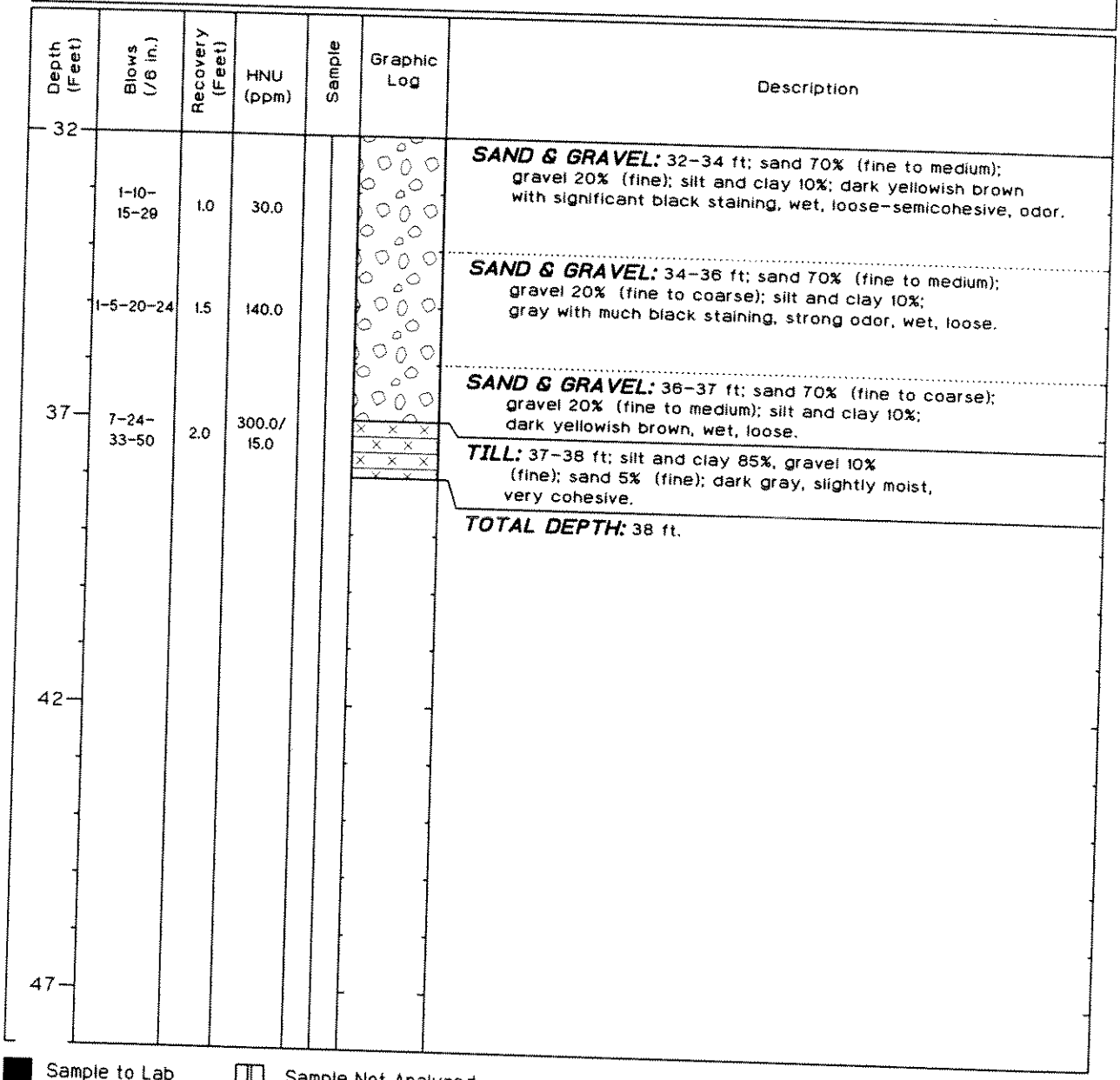
I:/GMOTORS/GMCRI/GTGS/OH-BH2A (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH2A

GENERAL MOTORS

Moraine, Ohio



■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 735.1980
Datum: Mean Sea Level
North Coor.: 5698.93706

Begin Drilling: 11/02/98
End Drilling: 11/02/98
Converted to Well: No
Well Name:
East Coor.: 5977.19145

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH2A (12/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/2/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH2A-14/SL
Coded Replicate No.: DUP66

Time Sampling Began: 12:30
Time Sampling Ended: 8:20 on 11/3/98

Sampling Method and Material: 2' Stainless steel split spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 16.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool
HP - VOCs 8260 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Soil: Took MS108 at 12:40; MSD107 at 12:45; DUP66 at 12:35. Took hydropunch OHBH2A-37/HP at 8:10 on 11/3/98 (via temporary well); Took RB43 prior to this sample at 14:30 on 11/2/98. Took hydropunch DUP67 at 8:12 on 11/3/98; MS109 at 8:14 on 11/3/98; MSD108 at 8:16 on 11/3/98.

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH3A

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0						***CONCRETE:*** 0–0.5 ft.
	7-13-17	1.5	<0.5			***SAND & GRAVEL:*** 0.5–2 ft; sand 60% (fine to medium), gravel 30% (fine to very coarse); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
	10-13-13-10	2.0	<0.5			***SAND:*** 2–4 ft; sand 80% (fine) gravel 10% (fine); silt and clay 10%; moderate yellowish brown, moist, loose.
5	4-9-21-19	2.0	<0.5			***SAND:*** 4–6 ft; SAME AS ABOVE.
	6-19-30-38	0.8	<0.5			***SAND & GRAVEL:*** 6–8 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	13-20-24-30	1.6	1.0			***SAND & GRAVEL:*** 8–10 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; light to moderate yellowish brown, moist, loose.
10	9-27-27-22	0.8	<0.5			***SAND & GRAVEL:*** 10–12 ft; sand 60% (fine to medium); gravel 30% (fine to medium); silt and clay 10%; light to moderate yellowish brown, moist, loose.
	9-13-20-20	1.5	0.8			***SAND & GRAVEL:*** 12–14 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
15	6-20-25-18	1.4	0.5			***SAND & GRAVEL:*** 14–16 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
	11-40-30-16	1.5	0.5			***SAND & GRAVEL:*** 16–18 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 32.0
Surface Elev.: 734.8966
Datum: Mean Sea Level
North Coor.: 5659.87374

Begin Drilling: 11/06/98
End Drilling: 11/06/98
Converted to Well: No
Well Name:
East Coor.: 6144.76092

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH3A (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH3A

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
18	24-25-30-38	0.7	1.5	■		***SAND & GRAVEL:*** 18-20 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	32-50/5"	0.7	2.5	■		***SAND & GRAVEL:*** 20-22 ft; sand 60% (fine to medium); gravel 30% (fine to very coarse); silt and clay 10%; moderate yellowish brown, very moist, loose.
23	27-44-27-22	2.0	1.5	■		***SAND & GRAVEL:*** 22-24 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; light yellowish brown to light gray, moist, loose.
	7-15-19-19	1.6	0.5			***SAND:*** 24-26 ft; sand 80% (fine); gravel 10% (fine); silt and clay 10%; moderate yellowish brown, moist, semi-cohesive.
	20-50/4"	0.5	1.5			***SAND:*** 26-28 ft; sand 80% (fine); gravel 10% (fine); silt and clay 10%; moderate to dark yellowish brown, very moist, semi-cohesive.
28	12-39-50/4"	1.1	1.0			***SAND:*** 28-30 ft; SAME AS ABOVE but wet.
	60-50/3"	1.0	<0.5		××××	***TILL:*** 30-32 ft; silt and clay 75%; gravel 15% (fine); sand 10% (fine); dark gray, slightly moist, very cohesive.
33						***TOTAL DEPTH:*** 32 ft;

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 32.0
Surface Elev.: 734.8966
Datum: Mean Sea Level
North Coor.: 5659.87374

Begin Drilling: 11/06/98
End Drilling: 11/06/98
Converted to Well: No
Well Name:
East Coor.: 6144.76092

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH3A (12/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/6/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH3A-22/SL
Coded Replicate No.:

Time Sampling Began: 11:00
Time Sampling Ended: 17:15

Sampling Method and Material: 2' Stainless steel split spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 2.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool
HP - VOCs 8260 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Took hydropunch OH-BH3A-30/HP at 17:10 via temporary well.

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH11

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0						***CONCRETE:*** 0–0.5 ft;
	5-9-6-5	0.3	<0.5	■		***SAND & GRAVEL:*** 0.5–2 ft; sand 50% (fine to medium); gravel 40% (fine); silt and clay 10%; moderate yellowish brown, very moist, loose.
	6-7-5-6	1.2	4.0			***SAND & GRAVEL:*** 2–4 ft; sand 40% (fine to medium); gravel 50% (fine); silt and clay 10%; moderate yellowish brown, moist, loose.
5	10-15-14-25	1.0	2.0			***SAND & GRAVEL:*** 4–6 ft; sand 50% (fine to coarse); gravel 40% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	8-15-25-39	1.2	3.0			***SAND & GRAVEL:*** 6–8 ft; sand 70% (fine to medium); gravel 20% (fine); silt and clay 10%; moderate yellowish brown, moist, loose.
	25-25-22-14	1.0	4.5			***SAND & GRAVEL:*** 8–10 ft; sand 60% (fine to medium); gravel 30% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
10	7-19-28-37	1.3	6.0			***SAND & GRAVEL:*** 10–12 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	10-22-25-23	1.5	5.5			***SAND & GRAVEL:*** 12–14 ft; sand 60% (fine to medium); gravel 30% (fine); silt and clay 10%; moderate yellowish brown, moist, loose.
15	20-28-20-21	1.2	3.0			***SAND & GRAVEL:*** 14–16 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light to moderate yellowish brown, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 34.0
Surface Elev.: 731.4519
Datum: Mean Sea Level
North Coor.: 5391.78704

Begin Drilling: 11/03/98
End Drilling: 11/03/98
Converted to Well: No
Well Name:
East Coor.: 5968.40268

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH11 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH11

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
16	5-14-14-16	1.3	3.0			***SAND & GRAVEL:*** 16-18 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	15-22-28-33	1.2	10.0			***SAND & GRAVEL:*** 18-20 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
21	4-14-23-26	1.1	4.0			***SAND & GRAVEL:*** 20-22 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	4-27-37-11	1.0	5.0			***SAND & GRAVEL:*** 22-24 ft; sand 60% (fine to medium); gravel 30% (medium to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	14-10-10-16	1.3	2.0			***SAND & GRAVEL:*** 24-26 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, very moist, loose.
26	4-13-50/4"	1.0	4.0			***SAND & GRAVEL:*** 26-28 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, very moist-wet, loose, one area of black staining approximately 1-inch thick.
	9-24-34-38	2.0	5.0			***SAND & GRAVEL:*** 28-30 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose.
31	9-24-54-50/4"	2.0	11.0			***SAND & GRAVEL:*** 30-32 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; dark yellowish brown, wet, loose-cohesive.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 34.0
Surface Elev.: 731.4519
Datum: Mean Sea Level
North Coor.: 5391.78704

Begin Drilling: 11/03/98
End Drilling: 11/03/98
Converted to Well: No
Well Name:
East Coor.: 5968.40268

OH000294.0001.0002

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH11

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
32	17-28 50/4"	1.5	2.0/ 1.0			***SAND & GRAVEL:*** 32-33.5 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; dark yellowish brown, wet, loose.
						TILL: 33.5-34 ft; silt and clay 80%; gravel 15% (fine); sand 5% (fine); dark gray, slightly moist, very cohesive.
						TOTAL DEPTH: 34 ft.
37						
42						
47						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 34.0
Surface Elev.: 731.4519
Datum: Mean Sea Level
North Coor.: 5391.78704

Begin Drilling: 11/03/98
End Drilling: 11/03/98
Converted to Well: No
Well Name:
East Coor.: 5968.40268

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH11 (12/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/3/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH11-2/SL
Coded Replicate No.:

Time Sampling Began: 9:55
Time Sampling Ended: 10:00

Sampling Method and Material: 2" Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): <0.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks: Took RB44 prior to OHBH-11-2/SL at 9:30.

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/3/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH11-20/SL
Coded Replicate No.:

Time Sampling Began: 10:45
Time Sampling Ended: 10:50

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 10.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/3/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH11-28/SL
Coded Replicate No.:

Time Sampling Began: 11:40
Time Sampling Ended: 14:30

Sampling Method and Material: 2" Stainless steel split spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 4.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool
HP - VOCs 8260 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Took hydropunch OHBH11-33/HP at 14:25.

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH12

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0						
	10-30 50/4"	1.0	<0.5			***CONCRETE:*** 0-0.5 ft;
						SAND & GRAVEL: 0.5-2 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; dark yellowish brown to light gray; moist, loose.
	15-22-25-27	2.0	0.5			***SAND & GRAVEL:*** 2-4 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%, moderate yellowish brown, moist, loose.
5	19-20 20-16	2.0	0.7			***SAND & GRAVEL:*** 4-6 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	15-25-27-42	1.1	2.0			***SAND & GRAVEL:*** 6-8 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	50-50/4"	0.8	0.7			***SAND & GRAVEL:*** 8-10 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
10	9-8-11-13	1.8	1.0			***SAND & GRAVEL:*** 10-12 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, very moist, loose.
	4-24-26-23	1.5	6.5			***SAND & GRAVEL:*** 12-14 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; dark yellowish brown, moist, loose.
15	10-17-17-20	0.5	0.5			***SAND:*** 14-16 ft; sand 80% (fine to medium); gravel 10% (fine); silt and clay 10%; dark yellowish brown, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 34.0
Surface Elev.: 733.4085
Datum: Mean Sea Level
North Coor.: 5571.67255

Begin Drilling: 11/06/98
End Drilling: 11/06/98
Converted to Well: No
Well Name:
East Coor.: 5936.19339

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH12 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH12

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
16	3-10-22-28	1.2	1.7			***SAND & GRAVEL:*** 16-18 ft; sand 70% (fine to coarse); gravel 20% (fine to medium); silt and clay 10%; dark yellowish brown, moist, loose.
	7-13-8-7	0.9	1.8			***SAND & GRAVEL:*** 18-20 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
21	13-32-32-35	1.5	2.0			***SAND & GRAVEL:*** 20-22 ft; sand 50% (fine to medium); gravel 40% (fine to very coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	20-50/4"	0.8	1.5			***SAND & GRAVEL:*** 22-24 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	12-15-20-30	1.3	2.0			***SAND & GRAVEL:*** 24-26 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; dark yellowish brown, moist, loose.
26	11-44-32-33	1.5	0.7	■		***SAND:*** 26-28 ft; sand 80% (fine to medium); gravel 10% (fine); silt and clay 10%; dark yellowish brown, moist, loose-semicohesive.
	1-11-38-29	1.7	0.6			***SAND & GRAVEL:*** 28-30 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; dark yellowish brown, wet, loose-semicohesive.
31	1-17-15-16	1.8	0.5			***SAND:*** 30-32 ft; sand 80% (fine to medium); gravel 10% (fine); silt and clay 10%; dark yellowish brown, wet, loose-semicohesive, 1/2-inch staining.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 34.0
Surface Elev.: 733.4085
Datum: Mean Sea Level
North Coor.: 5571.67255

Begin Drilling: 11/06/98
End Drilling: 11/06/98
Converted to Well: No
Well Name:
East Coor.: 5936.19339

OH000294.0001.0002

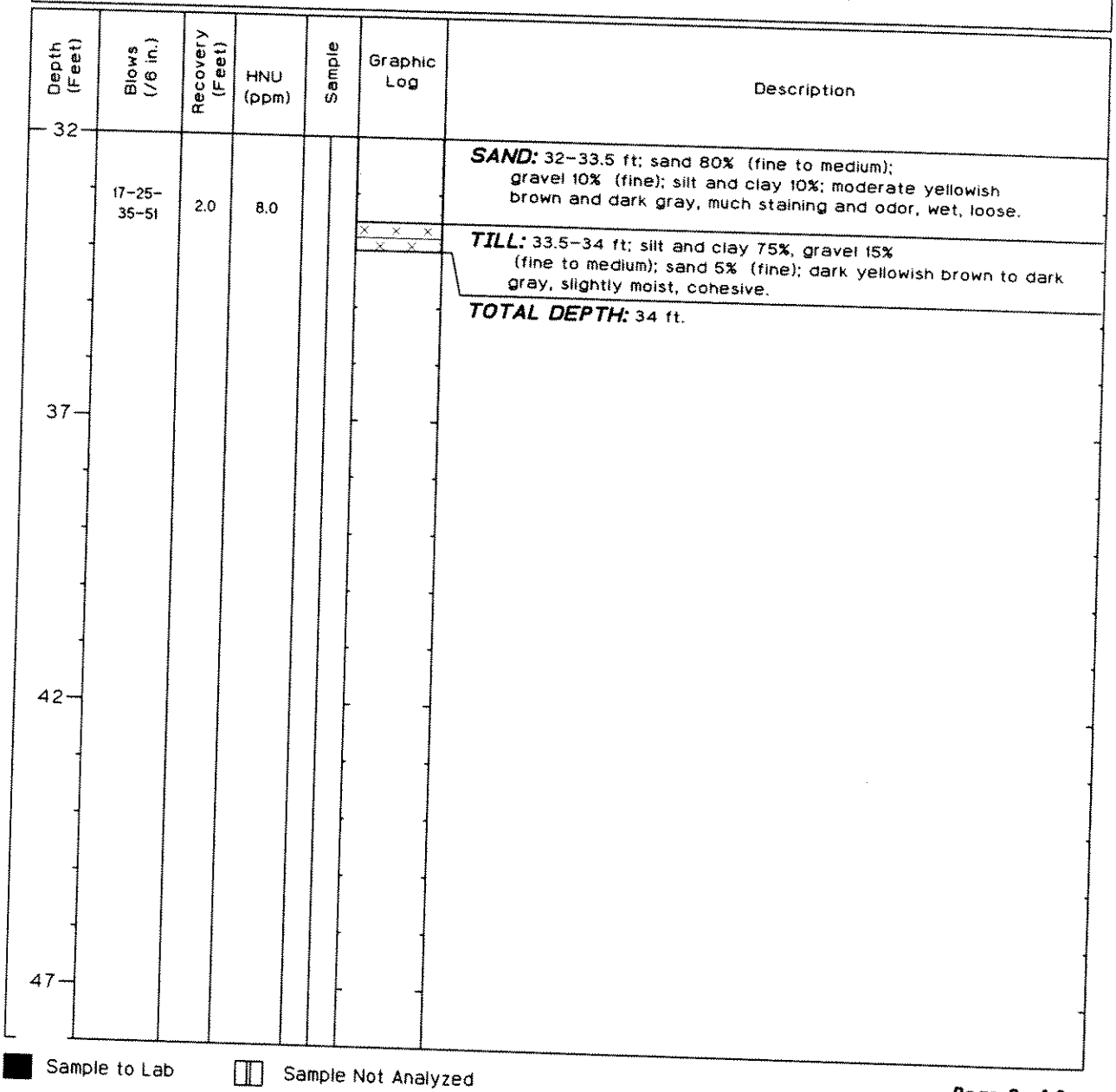
I:/GMOTORS/GMCRI/GTGS/OH-BH12 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH12

GENERAL MOTORS

Moraine, Ohio



■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 34.0
Surface Elev.: 733.4085
Datum: Mean Sea Level
North Coor.: 5571.67255

Begin Drilling: 11/06/98
End Drilling: 11/06/98
Converted to Well: No
Well Name:
East Coor.: 5936.19339

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH12 (12/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/6/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH12-2/SL
Coded Replicate No.:

Time Sampling Began: 14:20
Time Sampling Ended: 14:25

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): <0.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/6/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH12-14/SL
Coded Replicate No.:

Time Sampling Began: 15:00
Time Sampling Ended: 15:05

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 6.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/6/98

Project No.: OH000294.0001.00002

Sample No.: OH-BH12-28/SL

Coded Replicate No.:

Time Sampling Began: 16:30

Time Sampling Ended: 17:35

Sampling Method and Material: 2' Stainless steel split spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) 0.7 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool
HP - VOCs 8260 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Took hydropunch OHBH12-33.5/HP at 17:30.

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH13

GENERAL MOTORS

Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0						**CONCRETE:** 0-0.5 ft;
	7-21-20	0.5	0.0			**SAND & GRAVEL:** 0.5-2 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; moderate yellowish brown to light gray; very moist, loose.
	13-39-30-29	0.8	0.0			**SAND & GRAVEL:** 2-4 ft; sand 50% (fine to medium); gravel 40% (fine to very coarse); silt and clay 10%, moderate yellowish brown, moist, loose.
5	9-32-50	1.0	0.0			**SAND & GRAVEL:** 4-6 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	32-50-	0.5	0.0			**SAND & GRAVEL:** 6-8 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	9-12-15-22	2.0	0.0			**SAND & GRAVEL:** 8-10 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
10	15-42-50	1.2	0.0			**SAND & GRAVEL:** 10-12 ft; sand 70% (fine to coarse); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	32-39-50	1.2	0.0			**SAND & GRAVEL:** 12-14 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; light yellowish brown with some dark orange staining, moist, loose.
15	36-37-31-28	1.1	0.0			**SAND & GRAVEL:** 14-16 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; light yellowish brown, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 28.0
Surface Elev.: 731.4436
Datum: Mean Sea Level
North Coor.: 5493.17656

Begin Drilling: 11/10/98
End Drilling: 11/10/98
Converted to Well: No
Well Name:
East Coor.: 6158.19856

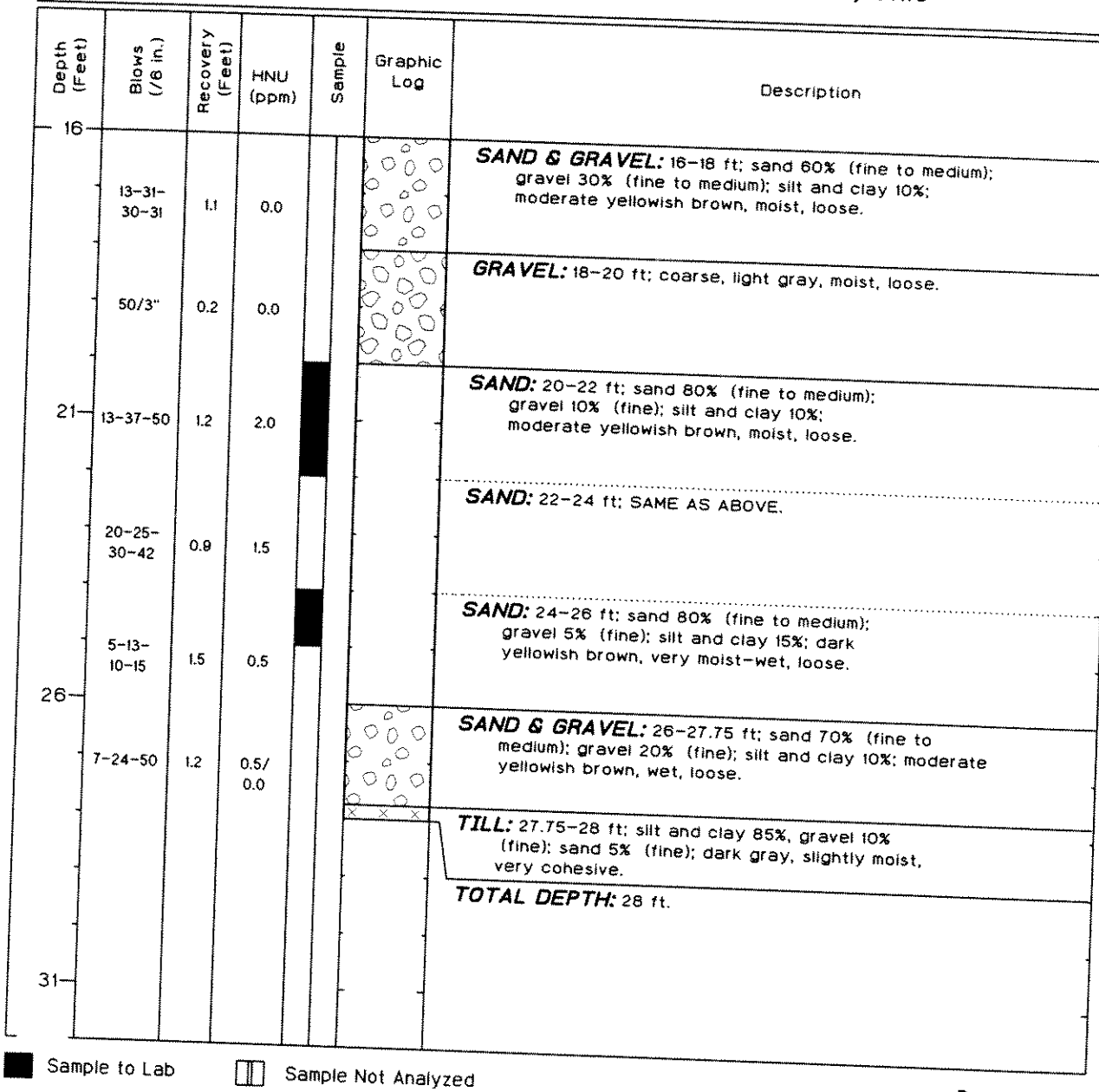
OH000294.0001.0002

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH13

GENERAL MOTORS

Moraine, Ohio



■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 28.0
Surface Elev.: 731.4436
Datum: Mean Sea Level
North Coor.: 5493.17656

Begin Drilling: 11/10/98
End Drilling: 11/10/98
Converted to Well: No
Well Name:
East Coor.: 6158.19856

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH13 (12/16/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/10/98

Project No.: OH000294.0001.00002

Sample No.: OH-BH13-2/SL

Coded Replicate No.:

Time Sampling Began: 9:30

Time Sampling Ended: 9:35

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) 0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks: Took RB46 at 9:00 prior to OHBH13-2/SL.

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/10/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH13-22/SL
Coded Replicate No.: DUP69

Time Sampling Began: 11:15
Time Sampling Ended: 11:20

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) 2.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks: Collected DUP69 at 11:17.

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/10/98

Project No.: OH000294.0001.00002

Sample No.: OH-BH13-25/SL

Coded Replicate No.:

Time Sampling Began: 11:30

Time Sampling Ended: 12:55

Sampling Method and Material: 2' Stainless steel split spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 0.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool
HP - VOCs 8260 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Took MS111 at 11:31. Took MSD110 at 11:33. Took hydropunch OHBH13-27/HP at 12:50.

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH14

GENERAL MOTORS

Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0						**CONCRETE:** 0-0.5 ft.
	5-12-13	0.8	0.0	■		**SAND & GRAVEL:** 0.5-2 ft; sand 40% (fine to medium); gravel 50% (fine to coarse); silt and clay 10%; moderate yellowish brown; very moist, loose.
	15-18-22-17	1.0	0.0			**SAND & GRAVEL:** 2-4 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%, light yellowish brown, moist, loose.
5	15-20-31-33	0.9	0.0			**SAND & GRAVEL:** 4-6 ft; sand 60% (fine to coarse); gravel 30% (fine to medium); silt and clay 10%; light yellowish brown, wet, loose.
	21-16-36-45	1.0	0.0			**SAND & GRAVEL:** 6-8 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light yellowish brown, moist, loose.
	9-25-26-23	1.5	0.0			**SAND & GRAVEL:** 8-10 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; light to moderate yellowish brown, moist, loose.
10	40-50	1.0	0.0			**SAND & GRAVEL:** 10-12 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	6-16-32-40	1.0	0.0			**SAND & GRAVEL:** 12-14 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; light to moderate yellowish brown, moist, loose.
15	34-41-50	1.0	0.0			**SAND & GRAVEL:** 14-16 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light yellowish brown to light gray, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 33.0
Surface Elev.: 728.6029
Datum: Mean Sea Level
North Coor.: 5224.70217

Begin Drilling: 11/10/98
End Drilling: 11/10/98
Converted to Well: No
Well Name:
East Coor.: 6150.61651

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/OH-BH14 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH14

GENERAL MOTORS

Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
16	12-50-40-50/4"	1.0	0.0			***SAND & GRAVEL:*** 16-18 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light to moderate yellowish brown, moist, loose.
	20-50	0.2	0.0			***SAND & GRAVEL:*** 18-20 ft; sand 30% (fine to medium); gravel 60% (fine to coarse); silt and clay 10%; light to moderate yellowish brown, moist, loose.
21	50/0"	0	0.0			***NO RECOVERY:*** 20-22 ft;
	11-15-27-37	1.1	0.0	■		***SAND & GRAVEL:*** 22-24 ft; sand 60% (fine to medium); gravel 20% (fine to medium); silt and clay 20%; moderate to dark yellowish brown, very moist-wet, loose to cohesive.
	45-28-17-28	2.0	0.0			***SAND & GRAVEL:*** 24-26 ft; sand 70% (fine to medium); gravel 20% (fine); silt and clay 10%; moderate to dark yellowish brown, wet, loose.
26	51-25-38-38	1.3	0.0			***SAND & GRAVEL:*** 26-28 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; dark yellowish brown, wet, loose.
	50-50	0.8	0.0			***SAND & GRAVEL:*** 28-30 ft; sand 70% (fine to medium); gravel 20% (fine); silt and clay 10%; dark yellowish brown, wet, loose.
31	22-36-29-100	0.8	0.0			***SAND:*** 30-32 ft; sand 80% (fine to medium); gravel 10% (fine); silt and clay 10%; dark yellowish brown, wet, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 33.0
Surface Elev.: 728.6029
Datum: Mean Sea Level
North Coor.: 5224.70217

Begin Drilling: 11/10/98
End Drilling: 11/10/98
Converted to Well: No
Well Name:
East Coor.: 6150.61851

OH000294.0001.0002

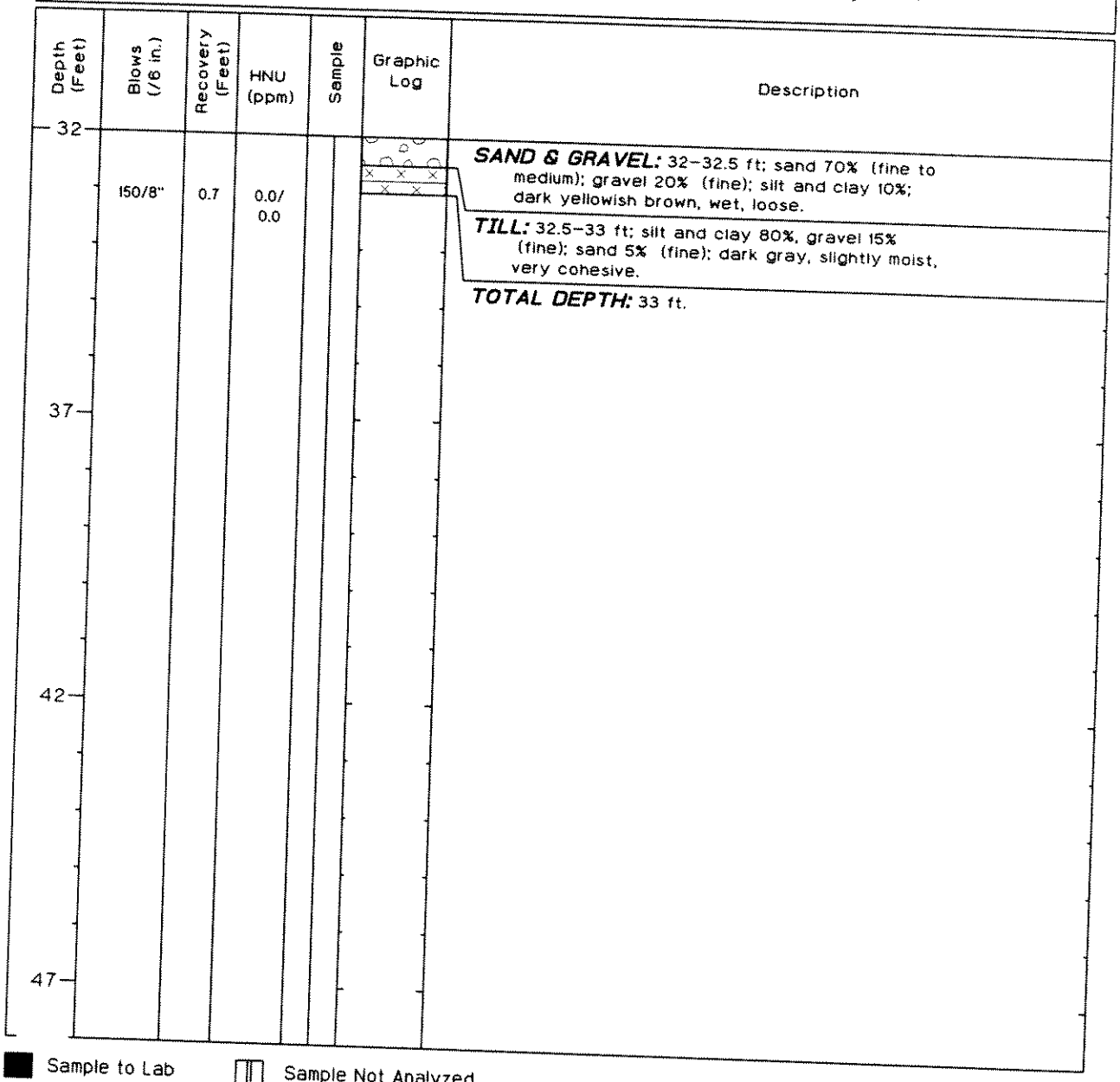
I:/GMOTORS/GMCRI/GTGS/OH-BH14 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH14

GENERAL MOTORS

Moraine, Ohio



■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 33.0
Surface Elev.: 728.6029
Datum: Mean Sea Level
North Coor.: 5224.70217

Begin Drilling: 11/10/98
End Drilling: 11/10/98
Converted to Well: No
Well Name:
East Coor.: 6150.61651

OH000294.0001.0002

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/10/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH14-2/SL
Coded Replicate No.:

Time Sampling Began: 13:45
Time Sampling Ended: 13:47

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) 0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/10/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH14-24/SL
Coded Replicate No.:

Time Sampling Began: 17:20
Time Sampling Ended: 14:16 on 11/11/98

Sampling Method and Material: 2' Stainless steel split spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool
HP - VOCs 8260 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Took hydropunch OHBH-14-32/HP at 14:10 on 11/11/98 via temporary well. Took hydropunch DUP70 at 14:12; MS112 at 14:14 and MSD111 at 14:16 on 11/11/98

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH15

GENERAL MOTORS

Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0						**ASPHALT:** 0–0.25 ft.
	34-47-39	1.5	<0.5			**SAND & GRAVEL:** 0.25–2 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light gray to dark yellowish brown; moist, loose, 1" black staining.
	10-20-24-24	1.5	1.5			**SAND & GRAVEL:** 2–4 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%, moderate to dark yellowish brown, moist, loose, slight black staining.
5	10-9-10-8	1.0	1.0			**SAND & GRAVEL:** 4–6 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; dark yellowish brown, moist, loose.
	1-4-4-11	1.7	0.0			**SAND:** 6–8 ft; sand 60% (fine); silt 30%; gravel 10% (fine); moderate yellowish brown, wet (very moist), cohesive.
	1-7-7-40	1.5	1.0			**SAND & GRAVEL:** 8–10 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
10	16-34-27-33-	1.3	1.3			**SAND & GRAVEL:** 10–12 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 42.0
Surface Elev.: 731.4147
Datum: Mean Sea Level
North Coor.: 5230.67889

Begin Drilling: 11/04/98
End Drilling: 11/05/98
Converted to Well: No
Well Name:
East Coor.: 5930.43428

OH000294.0001.0002

I:/GMOTORS/GMCFRI/GTGS/OH-BH15 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH15

GENERAL MOTORS

Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
12	15-24 26-30	1.5	2.0			**SAND & GRAVEL:** 12-14 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	9-16- 13-17	1.0	1.5			**SAND & GRAVEL:** 14-16 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
17	5-17- 20-21	1.3	3.5			**SAND & GRAVEL:** 16-18 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; dark yellowish brown, moist, loose.
	14-22- 35-41	1.0	1.0			**SAND & GRAVEL:** 18-20 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; dark yellowish brown, moist, loose.
	10-15- 15-15	1.7	2.5			**SAND & GRAVEL:** 20-22 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; dark yellowish brown, moist, loose.
22	1-12- 15-15-	1.5	2.0			**SAND & GRAVEL:** 22-24 ft; sand 70% (fine to medium); gravel 20% (fine); silt and clay 10%; dark yellowish brown, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 42.0
Surface Elev.: 731.4147
Datum: Mean Sea Level
North Coor.: 5230.67889

Begin Drilling: 11/04/98
End Drilling: 11/05/98
Converted to Well: No
Well Name:
East Coor.: 5930.43428

OH000294.0001.0002

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH15

GENERAL MOTORS

Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
24	12-17-13-35	0.9	1.5			***SAND & GRAVEL:*** 24-26 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; dark yellowish brown, very moist, loose.
	3-10-12-12	1.0	0.7			***SAND & GRAVEL:*** 26-28 ft; sand 50% (fine to coarse); gravel 40% (fine to coarse); silt and clay 10%; dark yellowish brown, wet, loose.
29	11-15-14-16	1.5	<0.5			***SAND & GRAVEL:*** 28-30 ft; sand 30% (fine); gravel 40% (fine); silt 30%; dark yellowish brown, wet, loose, looks like till but sandy and wet.
	3-16-19-18	1.5	<0.5			***SAND & GRAVEL:*** 30-32 ft; sand 40% (fine to medium); gravel 35% (fine to medium); silt and clay 25%; dark yellowish brown, wet, pliable.
	5-13-30-21	1.0	<0.5			***SAND & GRAVEL:*** 32-34 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; dark yellowish brown, wet, loose.
34	11-5-11-17	1.0	<0.5			***SAND & GRAVEL:*** 34-36 ft; sand 70% (fine to coarse), gravel 20% (fine to coarse); silt and clay 20%; moderate yellowish brown, wet, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 42.0
Surface Elev.: 731.4147
Datum: Mean Sea Level
North Coor.: 5230.67889

Begin Drilling: 11/04/98
End Drilling: 11/05/98
Converted to Well: No
Well Name:
East Coor.: 5930.43428

OH000294.0001.0002

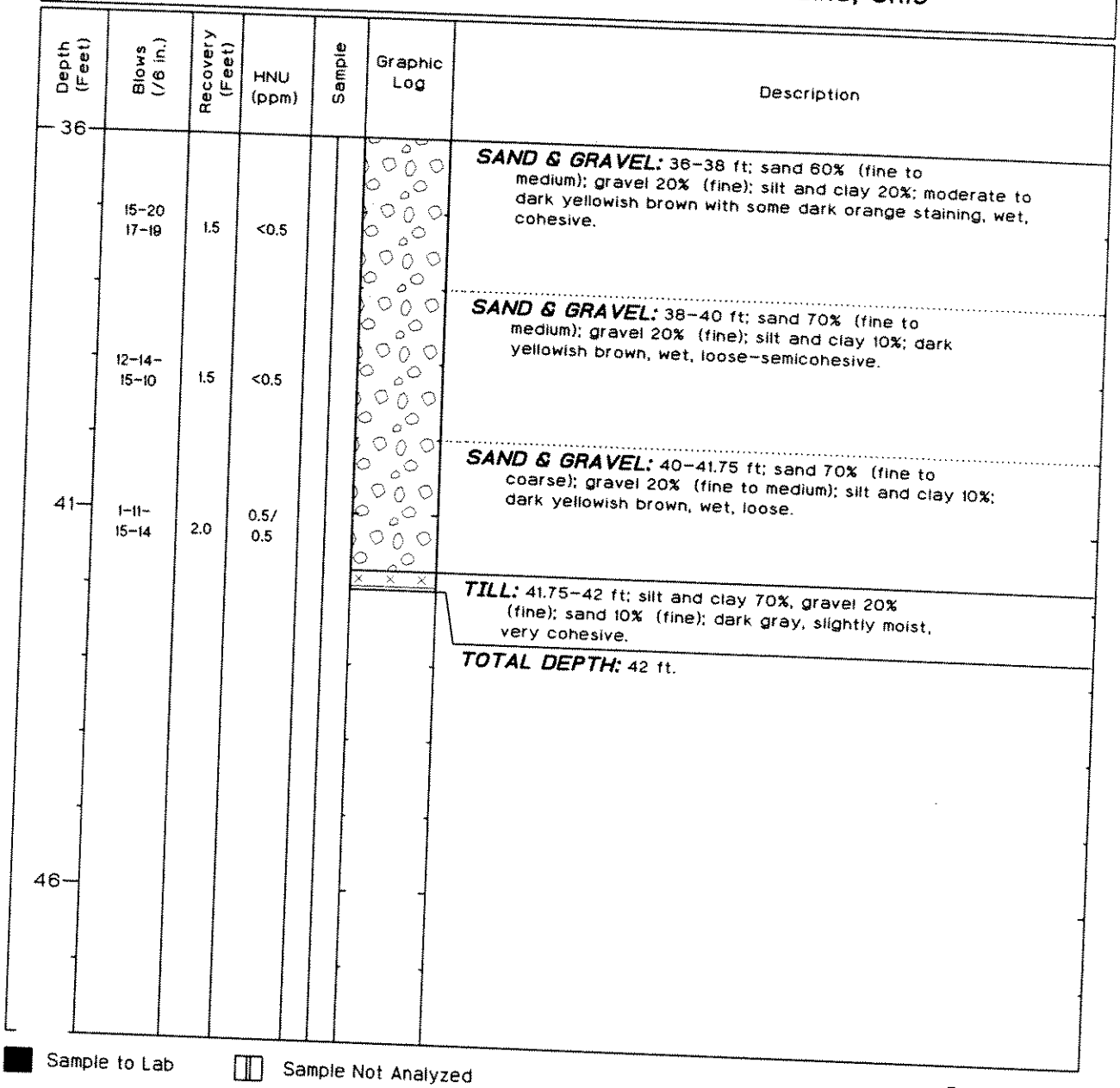
I:/GMOTORS/GMCFRI/GTGS/OH-BH15 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH15

GENERAL MOTORS

Moraine, Ohio



■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 42.0
Surface Elev.: 731.4147
Datum: Mean Sea Level
North Coor.: 5230.67889

Begin Drilling: 11/04/98
End Drilling: 11/05/98
Converted to Well: No
Well Name:
East Coor.: 5930.43428

OH000294.0001.0002

I:/GMOTORS/GMCFRI/GTGS/OH-BH15 (12/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/4/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH15-2/SL
Coded Replicate No.:

Time Sampling Began: 15:30
Time Sampling Ended: 15:35

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): <0.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/4/98

Project No.: OH000294.0001.00002

Sample No.: OH-BH15-18/SL

Coded Replicate No.:

Time Sampling Began: 16:30

Time Sampling Ended: 16:35

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 3.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/4/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH15-26/SL
Coded Replicate No.:

Time Sampling Began: 17:00
Time Sampling Ended: 15:50 on 11/5/98

Sampling Method and Material: 2' Stainless steel split spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 1.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool
HP - VOCs 8260 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Took hydropunch OHBH-15-42/HP at 15:45 on 11/5/98

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH16

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0	3-5-8-8	0.5	0.0	■		***SAND & GRAVEL:*** 0-2 ft; sand 60% (fine to medium); gravel 20% (fine to medium); silt and clay 20%; dark brown, some black, moist, loose.
	3-5-7-710	0.8	0.0			***SAND & GRAVEL:*** 2-4 ft; same as above.
5	1-9-6-6	0.8	0.0			***SAND & GRAVEL:*** 4-6 ft; same as above.
	1-7-8-11	1.2	0.0			***SAND & GRAVEL:*** 6-8 ft; sand 50% (fine to medium); gravel 30%; silt and clay 20%; dark yellowish brown, very moist, loose-cohesive.
	4-10-11-12	0.2	0.0			***SAND & GRAVEL:*** 8-10 ft; sand 60% (fine to medium); gravel 20% (fine to medium); silt and clay 20%; dark brown, moist, cohesive.
10	2-2-3-7	0				***NO RECOVERY:*** 10-12 ft;
	2-4-6-6	0.7	0.0			***SAND:*** 12-14 ft; sand 70% (fine to medium); gravel 10% (fine); silt and clay 20%; dark gray, very moist, pliable-cohesive.
15	1-3-3-7	0.7	0.0			***SAND:*** 14-16 ft; same as above.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 62.0
Surface Elev.: 734.7903
Datum: Mean Sea Level
North Coor.: 5780.02132

Begin Drilling: 11/12/98
End Drilling: 11/12/98
Converted to Well: No
Well Name:
East Coor.: 5759.87716

OH000294.0001.0002

I:/GMOTORS/GMCFRI/GTGS/OH-BH16 (1/05/99)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH16

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
16	12-31-42	1.5	0.0			***SAND:*** 16-18 ft; sand 60% (fine); gravel 10% (fine); silt and clay 30%; dark gray, very moist, cohesive.
	10-12-21-33	1.2	0.0			***SAND & GRAVEL:*** 18-20 ft; sand 40% (fine to medium); gravel 50% (fine to coarse); silt and clay 10%; light yellowish brown, moist, loose.
21	50	0.2	0.0			***SAND & GRAVEL:*** 20-22 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	40-50	0.5	0.0			***SAND & GRAVEL:*** 22-24 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	37-50	0.6	0.0			***SAND & GRAVEL:*** 24-26 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
26	9-50	0.7	0.0			***SAND & GRAVEL:*** 26-28 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	12-29-50	1.2	0.0			***SAND & GRAVEL:*** 28-30 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, very moist, loose.
31	20-33-50	0.8	0.0			***SAND & GRAVEL:*** 30-32 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 62.0
Surface Elev.: 734.7903
Datum: Mean Sea Level
North Coor.: 5780.02132

Begin Drilling: 11/12/98
End Drilling: 11/12/98
Converted to Well: No
Well Name:
East Coor.: 5759.87716

OH000294.0001.0002

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH16

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
32	25-50-21-50	1.8	0.0			***SAND & GRAVEL:*** 32-34 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose.
	30-32-50-50	2.0	0.0			***SAND & GRAVEL:*** 34-36 ft; sand 70% (fine to coarse), gravel 20% (fine to medium); silt and clay 10%; moderate to dark yellowish brown, wet, loose.
37	20-50	0.3	0.0			***SAND:*** 36-38 ft; sand 85% (fine); gravel 5% (fine); silt and clay 10%; moderate yellowish brown, wet, loose.
	50-50	1.0	0.0			***SAND:*** 38-40 ft; sand 85% (fine to medium); gravel 5% (fine); silt and clay 10%; dark yellowish brown, wet, loose.
	100	0.5	0.0			***SAND:*** 40-42 ft; same as above.
42	50	1.0	0.0			***SAND:*** 42-44 ft; same as above.
	50-50	0.6	0.0			***SAND:*** 44-46 ft; same as above.
47	50-50	0.7	0.0			***SAND:*** 46-48 ft; same as above.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 62.0
Surface Elev.: 734.7903
Datum: Mean Sea Level
North Coor.: 5780.02132

Begin Drilling: 11/12/98
End Drilling: 11/12/98
Converted to Well: No
Well Name:
East Coor.: 5759.87716

OH000294.0001.0002

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH16

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
48	50-50	1.0	0.0			***SAND:*** 48-50 ft; sand 80% (fine); gravel 10% (fine); silt and clay 10%; dark yellowish brown, wet, loose.
	73	0.8	0.0			***SAND:*** 50-52 ft; same as above.
53	70	0				***NO RECOVERY:*** 52-54 ft.
	50-50	1.0	0.0			***SAND & GRAVEL:*** 54-56 ft; sand 60% (fine to medium), gravel 30% (fine to coarse); silt and clay 10%; dark yellowish brown, wet, loose-slightly cohesive.
	19-50	1.0	0.0			***SAND & GRAVEL:*** 56-58 ft; sand 70% (fine to medium), gravel 20% (fine to coarse); silt and clay 10%; dark yellowish brown, wet, loose.
58	50	0.5	0.0			***SAND:*** 58-60 ft; sand 85% (fine to medium); gravel 5% (fine); silt and clay 10%; dark yellowish brown, wet, loose.
	70	1.0	0.0			***SAND:*** 60-61.75 ft; same as above.
63						***TILL:*** 61.75-62 ft; silt and clay 85%; gravel 10% (fine); sand 5% (fine); dark gray, slightly moist, very cohesive.
						TOTAL DEPTH: 62 ft.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 62.0
Surface Elev.: 734.7903
Datum: Mean Sea Level
North Coor.: 5780.02132

Begin Drilling: 11/12/98
End Drilling: 11/12/98
Converted to Well: No
Well Name:
East Coor.: 5759.87716

OH000294.0001.0002

I:/GMOTORS/GMCFRI/GTGS/OH-BH16 (1/05/99)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	11/12/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH16-2/SL	Coded Replicate No.	
Time Sampling Began	9:40	Time Sampling Ended	9:45

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) 0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	11/12/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH16-30/SL	Coded Replicate No.	
Time Sampling Began	11:10	Time Sampling Ended	16:55

Sampling Method and Material: 2' Stainless steel split spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) 0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool
HP - VOCs 8260 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Took hydropunch OHBH16-61/HP at 15:50; Took RB47 prior to this hydropunch sample at 12:30. Took hydropunch OHBH-16-33/HP at 16:50.

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH17

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0	4-50	1.2	0.0	■		***SAND & GRAVEL:*** 0-2 ft; sand 60% (fine to medium); gravel 30% (fine to medium); silt and clay 10%; light to dark yellowish brown, some black, moist, loose.
	7-13-7-10	0.7	0.0	■		***SAND & GRAVEL:*** 2-4 ft; sand 70% (fine to medium); gravel 20% (fine); silt and clay 10%; moderate yellowish brown, moist, loose.
5	17-50	0.2	0.0	■		***SAND & GRAVEL:*** 4-6 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; dark yellowish brown, moist, loose.
	5-10-13	0.9	0.0	■		***SAND:*** 6-8 ft; sand 80% (fine to medium); gravel 10% (fine to medium); silt and clay 10%; moderate yellowish brown and black, moist, loose.
	1-4-6-7	1.2	0.0	■		***SAND & GRAVEL:*** 8-10 ft; sand 50% (fine to medium); gravel 20% (fine to medium); silt and clay 30%; dark yellowish brown with some orange staining, moist, loose-pliable.
10	3-5-8-6	0		▯		***NO RECOVERY:*** 10-12 ft;
	26-7-7-12	0.2	0.0	■		***SAND & GRAVEL:*** 12-14 ft; sand 50% (fine to medium); gravel 20% (coarse); silt and clay 30%; dark yellowish brown, moist, pliable.
15	5-7-9-7	0.3	0.0	■		***SAND& GRAVEL:*** 14-16 ft; same as above.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 58.0
Surface Elev.: 734.9285
Datum: Mean Sea Level
North Coor.: 5576.83790

Begin Drilling: 11/13/98
End Drilling: 11/13/98
Converted to Well: No
Well Name:
East Coor.: 5750.78051

OH000294.0001.0002

I:/GMOTORS/GMCFRI/GTGS/OH-BH17 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH17

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
16	3-2-7-17	1.5	0.0			***CLAY:*** 16-18 ft; silt and clay 70%; sand 20% (fine to medium); gravel 10% (fine); medium gray, pliable to cohesive, doesn't look like upper clay till.
	8-23-34-28	1.0	0.0			***SAND & GRAVEL:*** 18-20 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light orangish brown, moist, loose.
21	11-37-25-44	1.2	0.0			***SAND & GRAVEL:*** 20-22 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light yellowish brown, moist, loose.
	18-24-50	1.0	0.0			***SAND & GRAVEL:*** 22-24 ft; sand 60% (fine to medium); gravel 20% (fine); silt and clay 20%; moderate yellowish brown, moist, loose-cohesive.
	38-50	0.8	0.0			***SAND & GRAVEL:*** 24-26 ft; sand 50% (fine to medium); gravel 40% (coarse); silt and clay 10%; light yellowish brown, moist, loose.
26	37-50	1.0	0.0			***SAND & GRAVEL:*** 26-28 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; light yellowish brown, moist, loose.
	50	0.5	0.5			***SAND & GRAVEL:*** 28-30 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light yellowish brown, moist, loose.
31	50-20	1.7	0.0			***SAND & GRAVEL:*** 30-32 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose-cohesive.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 58.0
Surface Elev.: 734.9285
Datum: Mean Sea Level
North Coor.: 5576.83790

Begin Drilling: 11/13/98
End Drilling: 11/13/98
Converted to Well: No
Well Name:
East Coor.: 5750.78051

OH000294.0001.0002

I:/GMOTORS/GMCFRI/GTGS/OH-BH17 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH17

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
32	100	1.5	0.0			***SAND & GRAVEL:*** 32–34 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose.
	9–94	1.0	0.0			***SAND & GRAVEL:*** 34–36 ft; sand 70% (fine to medium), gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown with slight orange staining, wet, loose.
37	50	0.5	<0.5			***SAND & GRAVEL:*** 36–38 ft; sand 70% (fine to medium); gravel 20% (fine); silt and clay 10%; moderate yellowish brown, wet, loose.
	50	0.7	0.0			***SAND & GRAVEL:*** 38–40 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose.
	16–10–20–17	1.1	0.0			***SAND & GRAVEL:*** 40–42 ft; sand 70% (fine to medium); gravel 20% (fine); silt and clay 10%; dark yellowish brown, wet, loose.
42	27–50	1.1	0.0			***SAND & GRAVEL:*** 42–44 ft; sand 70% (fine to medium); gravel 20% (fine); silt and clay 10%; dark yellowish brown, wet, loose.
	15–43–50	1.5	0.0			***SAND & GRAVEL:*** 44–46 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; dark yellowish brown, wet, loose.
47	50	0				***NO RECOVERY:*** 46–48 ft.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 58.0
Surface Elev.: 734.9285
Datum: Mean Sea Level
North Coor.: 5576.83790

Begin Drilling: 11/13/98
End Drilling: 11/13/98
Converted to Well: No
Well Name:
East Coor.: 5750.78051

OH000294.0001.0002

I:/GMOTORS/GMCFRI/GTGS/OH-BH17 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH17

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
48	27-49-28-47	2.0	0.0			***SAND & GRAVEL:*** 48-50 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; dark yellowish brown, wet, loose.
	8-35-27-50	1.5	0.0			***SAND:*** 50-52 ft; sand 80% (fine to coarse); gravel 10% (fine); silt and clay 10%; dark yellowish brown, wet, loose.
53	27-29-50	1.5	0.0			***SAND:*** 52-54 ft; same as above.
	20-29-50	1.2	0.0			***SAND & GRAVEL:*** 54-56 ft; sand 70% (fine to coarse), gravel 20% (fine to coarse); silt and clay 10%; dark yellowish brown, wet, loose.
	20-27-50	1.5	0.0			***SAND & GRAVEL:*** 56-57 ft; same as above.
58						***TILL:*** 57-58 ft; silt and clay 85%; gravel 10% (fine); sand 5% (fine); dark gray, slightly moist, very cohesive.
						TOTAL DEPTH: 58 ft.
63						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 58.0
Surface Elev.: 734.9285
Datum: Mean Sea Level
North Coor.: 5576.83790

Begin Drilling: 11/13/98
End Drilling: 11/13/98
Converted to Well: No
Well Name:
East Coor.: 5750.78051

OH000294.0001.0002

I:/GMOTORS/GMCFRI/GTGS/OH-BH17 (12/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/13/98

Project No.: OH000294.0001.00002

Sample No.: OH-BH17-2/SL

Coded Replicate No.: DUP71

Time Sampling Began: 9:30

Time Sampling Ended: 9:40

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks: Took RB48 at 9:15 prior to OHBH17-2/SL. Took MS113 at 9:34 and MSD 112 at 9:36. Took DUP71 at 9:32.

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/13/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH17-30/SL
Coded Replicate No.:

Time Sampling Began: 11:25
Time Sampling Ended: 16:05

Sampling Method and Material: 2' Stainless steel split spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 0.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool
HP - VOCs 8260 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Collected hydropunch OHBH17-40/HP at 13:25 and OHBH17-57/HP at 16:00.

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH18

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0						***ASPHALT:*** 0–0.25 ft.
	6-17-19	0.7	1.0			***SAND & GRAVEL:*** 0.25–2 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; light yellowish brown to light gray, slightly moist, loose.
	14-32 37-26	1.0	2.5			***SAND & GRAVEL:*** 2–4 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, slightly moist, loose.
5	10-15-7-13	1.0	5.5			***SAND & GRAVEL:*** 4–6 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	4-10-7-10	1.7	3.0			***SAND:*** 6–8 ft; sand 80% (fine to medium); gravel 10% (fine); silt and clay 10%; moderate yellowish brown, moist, loose.
	2-19-23-20	1.1	4.5			***SAND & GRAVEL:*** 8–10 ft; sand 60% (fine to medium); gravel 30% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
10	14-23-14-7	1.0	2.0			***SAND & GRAVEL:*** 10–12 ft; sand 60% (fine to medium); gravel 30% (coarse); silt and clay 10%; light yellowish brown, moist, loose.
	15-21-23-24	1.0	2.0			***SAND & GRAVEL:*** 12–14 ft; sand 70% (fine to medium); gravel 20% (coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
15	8-10-26-31	1.2	2.0			***SAND & GRAVEL:*** 14–16 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; light yellowish brown to light gray, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 36.0
Surface Elev.: 737.6973
Datum: Mean Sea Level
North Coor.: 6118.38181

Begin Drilling: 11/04/98
End Drilling: 11/04/98
Converted to Well: No
Well Name:
East Coor.: 6082.64607

OH000294.0001.0002

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH18

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
16	19-26-25-20	1.7	4.0			***SAND & GRAVEL:*** 16-18 ft; sand 60% (fine to coarse) gravel 30% (fine to coarse); silt and clay (10%), light yellowish brown, moist, loose.
	20-28-32-50	2.0	3.0			***SAND & GRAVEL:*** 18-20 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; light yellowish brown, moist, loose.
21	29-50/5"	0.6	1.0			***SAND & GRAVEL:*** 20-22 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; light yellowish brown, moist, loose.
	6-17-10-13	1.5	2.5			***SAND:*** 22-24 ft; sand 90% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	8-17-29-37	1.7	1.0			***SAND & GRAVEL:*** 24-26 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light yellowish brown and light gray, moist, loose, 1" of black staining.
26	22-41-50	1.5	1.0			***SAND & GRAVEL:*** 26-28 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light yellowish brown, moist, loose.
	29-50	0.8	1.0			***SAND & GRAVEL:*** 28-30 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; light yellowish brown, moist, loose.
31	10-21-14-8	1.3	0.5			***SAND & GRAVEL:*** 30-32 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; moderate to dark yellowish brown, moist, loose, wet at 31'.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 36.0
Surface Elev.: 737.6973
Datum: Mean Sea Level
North Coor.: 6118.38181

Begin Drilling: 11/04/98
End Drilling: 11/04/98
Converted to Well: No
Well Name:
East Coor.: 6082.64607

OH000294.0001.0002

I:/GMOTORS/GMCFRI/GTGS/OH-BH18 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH18

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
32	7-20-18-29	1.5	0.0			***SAND & GRAVEL:*** 32–34 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose.
	19-18-20-50	1.5	0.0/0.0			***SAND & GRAVEL:*** 34–35.5 ft; sand 70% (fine to coarse), gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose–cohesive.
						TILL: 35.5–36 ft; silt and clay 80%; gravel 15% (fine); sand 5% (fine); dark gray, slightly moist, very cohesive.
37						***TOTAL DEPTH:*** 36 ft.
42						
47						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 36.0
Surface Elev.: 737.6973
Datum: Mean Sea Level
North Coor.: 6118.38181

Begin Drilling: 11/04/98
End Drilling: 11/04/98
Converted to Well: No
Well Name:
East Coor.: 6082.64607

OH000294.0001.0002

I:/GMOTORS/GMCFRI/GTGS/OH-BH18 (12/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/4/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH18-2/SL
Coded Replicate No.:

Time Sampling Began: 10:40
Time Sampling Ended: 10:45

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 1.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	11/4/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH18-6/SL	Coded Replicate No.	
Time Sampling Began	11:00	Time Sampling Ended	11:05

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) 5.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/4/98
Project No.: OH000294.0001.00002

Sample No.: OH-BH18-31/SL
Coded Replicate No.:

Time Sampling Began: 12:50
Time Sampling Ended: 14:35

Sampling Method and Material: 2' Stainless steel split spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 0.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool
HP - VOCs 8260 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Took hydropunch OHBH-18-35.5/HP at 14:30

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH19

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0	10-14-18-12	2.0	<0.5	■		***SAND & GRAVEL:*** 0-2 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, slightly moist, loose.
	12-15-23-35	2.0	0.0	■		***SAND & GRAVEL:*** 2-4 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; light to moderate yellowish brown, slightly moist, loose.
5	12-27-20-43	2.0	0.0	■		***SAND & GRAVEL:*** 4-6 ft; sand 60% (fine to medium); gravel 30% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	11-11-16-29	1.7	0.0	■		***SAND:*** 6-8 ft; sand 80% (fine to medium); gravel 10% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	10-20-25-30	2.0	0.0	■		***SAND & GRAVEL:*** 8-10 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
10	22-34-24-23	1.0	0.0	■		***SAND & GRAVEL:*** 10-12 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
	10-14-12-22	1.4	0.0	■		***SAND & GRAVEL:*** 12-14 ft; sand 60% (fine to medium); gravel 30% (fine to very coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
15	16-22-17-23	1.8	0.0	■		***SAND & GRAVEL:*** 14-16 ft; sand 50% (fine to medium); gravel 40% (fine to very coarse); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 36.0
Surface Elev.: 738.5345
Datum: Mean Sea Level
North Coor.: 6338.98524

Begin Drilling: 11/09/98
End Drilling: 11/09/98
Converted to Well: No
Well Name:
East Coor.: 6089.95636

OH000294.0001.0002

I:/GMOTORS/GMCFRI/GTGS/OH-BH19 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH19

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
16	7-11-10-8	1.7	0.0			***SAND & GRAVEL:*** 16-18 ft; sand 70% (fine to medium) gravel 20% (fine to coarse); silt and clay (10%), light to moderate yellowish brown, moist, loose.
	7-12-15-22	1.3	0.0			***SAND & GRAVEL:*** 18-20 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; dark yellowish brown with some dark orange staining, moist, loose.
21	13-26-23-24	1.7	0.0			***SAND & GRAVEL:*** 20-22 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; light yellowish brown, moist, loose.
	9-14-16-24	1.5	0.0			***SAND & GRAVEL:*** 22-24 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	2-7-13-17	1.5	0.0			***SAND:*** 24-26 ft; sand 80% (fine to coarse); gravel 10% (fine); silt and clay 10%; moderate to dark yellowish brown, moist, loose.
26	2-18-34-38	1.3	0.0			***SAND & GRAVEL:*** 26-28 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; light to moderate yellowish brown, moist, loose.
	16-42-50	1.2	0.0			***SAND & GRAVEL:*** 28-30 ft; sand 60% (fine to medium); gravel 20% (fine to coarse); silt and clay 20%; moderate yellowish brown, moist, loose.
31	18-25-24-36	1.6	0.0			***SAND & GRAVEL:*** 30-32 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; dark yellowish brown, very moist, loose-semicohesive.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 36.0
Surface Elev.: 738.5345
Datum: Mean Sea Level
North Coor.: 6338.98524

Begin Drilling: 11/09/98
End Drilling: 11/09/98
Converted to Well: No
Well Name:
East Coor.: 6089.95636

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH19

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
32	5-16-25-20	1.2	0.0			***SAND & GRAVEL:*** 32-34 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; dark yellowish brown, wet, loose.
	20-47-50/4"	1.5	0.0/0.0			***SAND & GRAVEL:*** 34-35 ft; sand 70% (fine to medium), gravel 20% (fine to medium); silt and clay 10%; dark yellowish brown, wet, loose.
						TILL: 35-36 ft; silt and clay 85%; gravel 10% (fine); sand 5% (fine); dark yellowish brown to dark gray, slightly moist, very cohesive.
37						***TOTAL DEPTH:*** 36 ft.
42						
47						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Geologist: W.J. Ferguson
Total Depth: 36.0
Surface Elev.: 738.5345
Datum: Mean Sea Level
Begin Drilling: 11/09/98
End Drilling: 11/09/98
Converted to Well: No
Well Name:
Remarks:
North Coor.: 6338.98524
East Coor.: 6089.95636

OH000294.0001.0002

I:/GMOTORS/GMCFRI/GTGS/OH-BH19 (12/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	11/9/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH19-2/SL	Coded Replicate No.	
Time Sampling Began	10:35	Time Sampling Ended	10:40

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) <0.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	11/9/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH19-32/SL	Coded Replicate No.	
Time Sampling Began	12:45	Time Sampling Ended	8:35 on 11/11/98

Sampling Method and Material: 2' Stainless steel split spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) 0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool
HP - VOCs 8260 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Took hydropunch OHBH19-35/HP (Temporary well) 3/4 vial on 11/9/98 dry on morning of 11/10/98. Got 1 vial at 8:30 on 11/11/98 (submitted to laboratory) 11/12/98 8:15 dry.

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH20

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0	3-10-10-15	1.2	0.0	■		***SAND & GRAVEL:*** 0-2 ft; sand 60% (fine to medium); gravel 20% (fine to medium); silt and clay 20%; dark brown, moist, cohesive.
	6-11-11-14	1.5	0.0	■		***SAND & GRAVEL:*** 2-4 ft; same as above.
5	9-23-22-23	0.8	0.0	■		***SAND & GRAVEL:*** 4-6 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; light gray, moist, loose.
	22-24-40-30	0.7	0.0	■		***SAND & GRAVEL:*** 6-8 ft; same as above.
	16-50	0.5	0.0	■		***SAND & GRAVEL:*** 8-10 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown to light gray, moist, loose.
10	5-23-18-19	1.0	0.0	■		***SAND & GRAVEL:*** 10-12 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; dark yellowish brown, moist, loose.
	3-13-14-22	1.5	0.0	■		***SAND & GRAVEL:*** 12-14 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; dark yellowish brown, moist, loose.
15	2-9-31-31	1.5	0.0	■		***SAND:*** 14-16 ft; sand 80% (fine to medium); gravel 10% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 740.3458
Datum: Mean Sea Level
North Coor.: 6695.86139

Begin Drilling: 11/11/98
End Drilling: 11/11/98
Converted to Well: No
Well Name:
East Coor.: 6042.45580

OH000294.0001.0002

I:/GMOTORS/GMCFRI/GTGS/OH-BH20 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH20

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
16						
	15-17-50	1.0	0.0			***SAND & GRAVEL:*** 16-18 ft; sand 70% (fine to medium) gravel 20% (fine to medium); silt and clay (10%); moderate yellowish brown, moist, loose.
	20-38-39-37	1.7	0.0			***SAND & GRAVEL:*** 18-20 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
21	14-35-50	0.9	0.0			***SAND & GRAVEL:*** 20-22 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	8-38-28-42	1.5	0.0			***SAND & GRAVEL:*** 22-24 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	11-36-33-26	1.2	0.0			***SAND & GRAVEL:*** 24-26 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
26						
	8-18-43-50	1.5	0.0			***SAND:*** 26-28 ft; sand 80% (fine to medium); gravel 10% (fine); silt and clay 10%; dark yellowish brown, moist, loose.
	8-32-33-50	1.2	0.0			***SAND & GRAVEL:*** 28-30 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
31	36-48-50	0.5	0.0			***SAND & GRAVEL:*** 30-32 ft; sand 70% (fine to medium); gravel 20% (fine); silt and clay 10%; dark yellowish brown, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 740.3458
Datum: Mean Sea Level
North Coor.: 6695.86139

Begin Drilling: 11/11/98
End Drilling: 11/11/98
Converted to Well: No
Well Name:
East Coor.: 6042.45580

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: OH-BH20

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
32	8-25-50	1.0	0.0	■		***SAND:*** 32-34 ft; sand 80% (fine to medium); gravel 10% (fine); silt and clay 10%; dark yellowish brown, moist, loose.
	5-19-21-23	1.3	0.0	■		***SAND & GRAVEL:*** 34-36 ft; sand 70% (fine to medium), gravel 20% (fine); silt and clay 10%; dark yellowish brown, very moist-wet, loose.
37	24-50-50	1.2	0.0			***SAND & GRAVEL:*** 36-37.9 ft; same as above except wet.
						TILL: 37.9-38 ft; silt and clay 80%; gravel 15% (fine); sand 5% (fine); dark yellowish brown, slightly moist, very cohesive.
						TOTAL DEPTH: 38ft.
42						
47						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 38.0
Surface Elev.: 740.3458
Datum: Mean Sea Level
North Coor.: 6695.86139

Begin Drilling: 11/11/98
End Drilling: 11/11/98
Converted to Well: No
Well Name:
East Coor.: 6042.45580

OH000294.0001.0002

I:/GMOTORS/GMCFRI/GTGS/OH-BH20 (12/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	11/11/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH20-2/SL	Coded Replicate No.	
Time Sampling Began	10:25	Time Sampling Ended	10:30

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) 0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	11/11/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	OH-BH20-35/SL	Coded Replicate No.	
Time Sampling Began	12:45	Time Sampling Ended	15:05

Sampling Method and Material: 2' Stainless steel split spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) 0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool
HP - VOCs 8260 shortlist	3-40 ml glass vials	HCl, Cool

Remarks: Took hydropunch OHBH20-38/HP at 15:00

Sample Personnel: W. Ferguson

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: GM-23A

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0						***CONCRETE:*** 0–0.5 ft;
	6-12-24	1.5	17.0			***SAND & GRAVEL:*** 0.5–2 ft; sand 60% (fine to medium), gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	26-50/5"	0.5	170.0			***SAND & GRAVEL:*** 2–4 ft; sand 50% (fine to coarse); gravel 40% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
5	12-17-19-14	1.5	15.0			***SAND & GRAVEL:*** 4–6 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	15-20-21-20	2.0	4.0			***SAND & GRAVEL:*** 6–8 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	10-21-27-18	1.5	5.0			***SAND & GRAVEL:*** 8–10 ft; sand 60% (fine to medium); gravel 30% (fine to very coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
10	5-8-13-29	0.5	1.5			***SAND & GRAVEL:*** 10–12 ft; sand 60% (fine to medium); gravel 30% (fine to very coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	9-11-13-13	1.5	5.0			***SAND & GRAVEL:*** 12–14 ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
15	17-22-19-16	1.3	10.0			***SAND & GRAVEL:*** 14–16 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 26.0
Surface Elev.: 731.0646
Datum: Mean Sea Level
North Coor.: 5395.92437

Begin Drilling: 11/05/98
End Drilling: 11/05/98
Converted to Well: No
Well Name:
East Coor.: 6018.98651

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/GM-23A (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: GM-23A

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
16						
	9-16-40-12	1.4	3.5			***SAND & GRAVEL:*** 16-18 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	12-31-22-23	1.2	19.0			***SAND & GRAVEL:*** 18-20 ft; sand 60% (fine to coarse); gravel 30% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
21	4-18-17-21	1.7	14.0			***SAND:*** 20-22 ft; sand 80% (fine); gravel 10% (fine); silt and clay 10%; moderate yellowish brown, moist, loose.
	11-14-15-19	2.0	6.0			***SAND:*** 22-24 ft; sand 85% (fine); silt and clay 15%; moderate yellowish brown, very moist, loose.
	2-11-15-17	1.8	3.0			***SAND:*** 24-26 ft; SAME AS ABOVE, except wet.
26						***TOTAL DEPTH:*** 26 feet.
31						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 26.0
Surface Elev.: 731.0646
Datum: Mean Sea Level
North Coor.: 5395.92437

Begin Drilling: 11/05/98
End Drilling: 11/05/98
Converted to Well: No
Well Name:
East Coor.: 6018.98651

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/GM-23A (12/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/5/98

Project No.: OH000294.0001.00002

Sample No.: GM23A-2/SL

Coded Replicate No.:

Time Sampling Began: 14:00

Time Sampling Ended: 14:05

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 17.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks: Took RB45 prior to GM23A-2/SL at 10:45.

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Sample No.: GM23A-4/SL

Time Sampling Began: 14:10

Date: 11/5/98

Project No.: OH000294.0001.00002

Coded Replicate No.:

Time Sampling Ended: 14:15

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 170.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/5/98

Project No.: OH000294.0001.00002

Sample No.: GM23A-5/SL

Coded Replicate No.: DUP68

Time Sampling Began: 14:45

Time Sampling Ended: 14:55

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 15.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks: Took MS110 at 14:49 and MSD109 at 14:51. Collected DUP68 at 14:47.

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/
Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 11/5/98
Project No.: OH000294.0001.00002

Sample No.: GM23A-10/SL
Coded Replicate No.:

Time Sampling Began: 17:00
Time Sampling Ended: 17:10

Sampling Method and Material: 2' Stainless steel split spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 5.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8260 shortlist	4 oz glass jar	Cool

Remarks:

Sample Personnel: W. Ferguson

Well Boring and Construction Logs

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: GM-26

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
0	3-8-15-25	1.2	0			***CLAY & SILT:*** 0-2 ft; silt and clay 80% (fine to medium); sand 20% (fine to medium); dark yellowish brown, moist, very cohesive.
	20-14-14-15	1.8	0			***CLAY & SILT:*** 2-4 ft; SAME AS ABOVE, except light brown.
5	9-14-15-21	1.2	0			***CLAY & SILT:*** 4-6 ft; silt and clay 60%; sand 20% (fine to coarse), gravel, 20% (fine to medium); moderate yellowinsh brown, moist, loose-cohesive.
	10-10-18-20	1.2	0			***GRAVEL & SAND:*** 6-8 ft; sand 50% (fine to medium); gravel 40% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	30-40-33-30	1.2	0			***GRAVEL & SAND:*** 8-10 ft; sand 40% (fine to coarse); gravel 50% (fine to coarse); silt and clay 10%; moderate-pale yellowish brown, moist, loose.
10	50	0	N/A			***NO RECOVERY:*** 10-12 ft.
	32-33-45-35	1.0	0			***GRAVEL & SAND:*** 12-14 ft; sand 50% (fine to coarse); gravel 40% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
15	10-25-17-41	1.0	0			***GRAVEL & SAND:*** 14-16 ft; SAME AS ABOVE.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 60.0
Surface Elev.: 722.2903
Datum: Mean Sea Level
North Coor.: -988.45579

Begin Drilling: 02/24/98
End Drilling: 02/24/98
Converted to Well: Yes
Well Name: GM-26
East Coor.: 4961.65526

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: GM-26

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
16	50/4"	0	N/A			***NO RECOVERY:*** 16-18 ft.
	6-8-10-12	1.0	0			***GRAVEL:*** 18-20 ft; gravel 70% (fine to medium); sand 20% (fine to medium); silt and clay 10%; moderate yellowish brown, wet, loose.
21	9-9-12-18	1.0	0			***GRAVEL:*** 20-22 ft; SAME AS ABOVE.
	4-11-15-32	1.0	0			***GRAVEL & SAND:*** 22-24 ft; sand 40% (fine to medium); gravel 50% (fine to medium); silt and clay 10%; moderate yellowish brown, wet, loose.
	10-17-28-27	1.2	0			***SAND:*** 24-26 ft; sand 70% (fine to coarse); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, wet, loose.
26	4-9-13-22	1.0	0			***GRAVEL & SAND:*** 26-28 ft; sand 60% (fine to coarse); gravel 30% (fine to medium); silt and clay 10%; moderate yellowish brown, wet, loose.
	12-18-26-38	0.7	0			***GRAVEL & SAND:*** 28-30 ft; sand 50% (fine to coarse); gravel 40% (fine to medium); silt and clay 10%; moderate yellowish brown, wet, loose.
31	7-11-24-26	1.2	0			***GRAVEL & SAND:*** 30-32 ft; sand 40% (fine to coarse); gravel 50% (fine to medium); silt and clay 10%; moderate yellowish brown, wet, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Geologist: W.J. Ferguson
Total Depth: 60.0
Surface Elev.: 722.2903
Datum: Mean Sea Level
Begin Drilling: 02/24/98
End Drilling: 02/24/98
Converted to Well: Yes
Well Name: GM-26
Remarks:
North Coor.: -988.45579
East Coor.: 4961.65526

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: GM-26

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
32						
	9-15-22-28	1.0	0			***GRAVEL & SAND:*** 32-34 ft; SAME AS ABOVE.
	6-17-18-19	0.75	0			***GRAVEL:*** 34-36 ft; gravel 70%; sand 20% (fine to medium); silt and clay 10%; moderate yellowish brown, wet, loose.
37	10-12-31-35	1.3	0			***GRAVEL:*** 36-38 ft; SAME AS ABOVE.
	14-30-34-30	1.0	0			***GRAVEL & SAND:*** 38-40 ft; gravel 50% (fine to coarse); sand 40% (fine to medium); silt and clay 10%; moderate yellowish brown, wet, loose.
	12-14-24-33	1.5	0			***GRAVEL & SAND:*** 40-42 ft; SAME AS ABOVE.
42	44-50/2"	1.0	0			***GRAVEL & SAND:*** 42-44 ft; gravel 50% (fine to medium); sand 40% (fine to medium); silt and clay 10%; moderate yellowish brown, wet, loose.
	26-30-35-46	1.5	0			***GRAVEL & SAND:*** 44-46 ft; sand 60% (fine to coarse); gravel 30% (fine to medium); silt and clay 10%; moderate yellowish brown, wet, loose.
47	22-35-45-30	2.0	0			***GRAVEL & SAND:*** 46-48 ft; SAME AS ABOVE.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 60.0
Surface Elev.: 722.2903
Datum: Mean Sea Level
North Coor.: -988.45579

Begin Drilling: 02/24/98
End Drilling: 02/24/98
Converted to Well: Yes
Well Name: GM-26
East Coor.: 4961.65526

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: GM-26

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	(ppm)	Sample	Graphic Log	Description
48						
	12-22-28-31	1.5	0			***GRAVEL & SAND:*** 48–50 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose.
	25-30-48-44	1.5	0			***GRAVEL & SAND:*** 50–52 ft; SAME AS ABOVE.
53	20-30-38-47	1.2	0			***GRAVEL & SAND:*** 52–54 ft; sand 60% (fine to coarse); gravel 20% (fine to medium); silt and clay 20%; moderate yellowish brown, wet, cohesive.
	32-31-35-44	1.5	0			***GRAVEL & SAND:*** 54–56 ft; sand 50% (fine to coarse); gravel 30% (fine to medium); silt and clay 20%; moderate yellowish brown, wet, cohesive.
	21-32-50/5"	1.0	0			***GRAVEL & SAND:*** 56–58 ft; SAME AS ABOVE.
58						***SAND:*** 58–59 ft; sand 70% (fine to medium); gravel 10% (fine to medium); silt and clay 20%; moderate yellowish brown, wet, cohesive.
	12-14-24-40	1.3	0			***CLAY & SILT:*** 59–60 ft; silt and clay 80%; sand 20% (fine); moderate yellowish brown, wet, very cohesive.
						BOTTOM OF HOLE 60.0 ft.
63						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

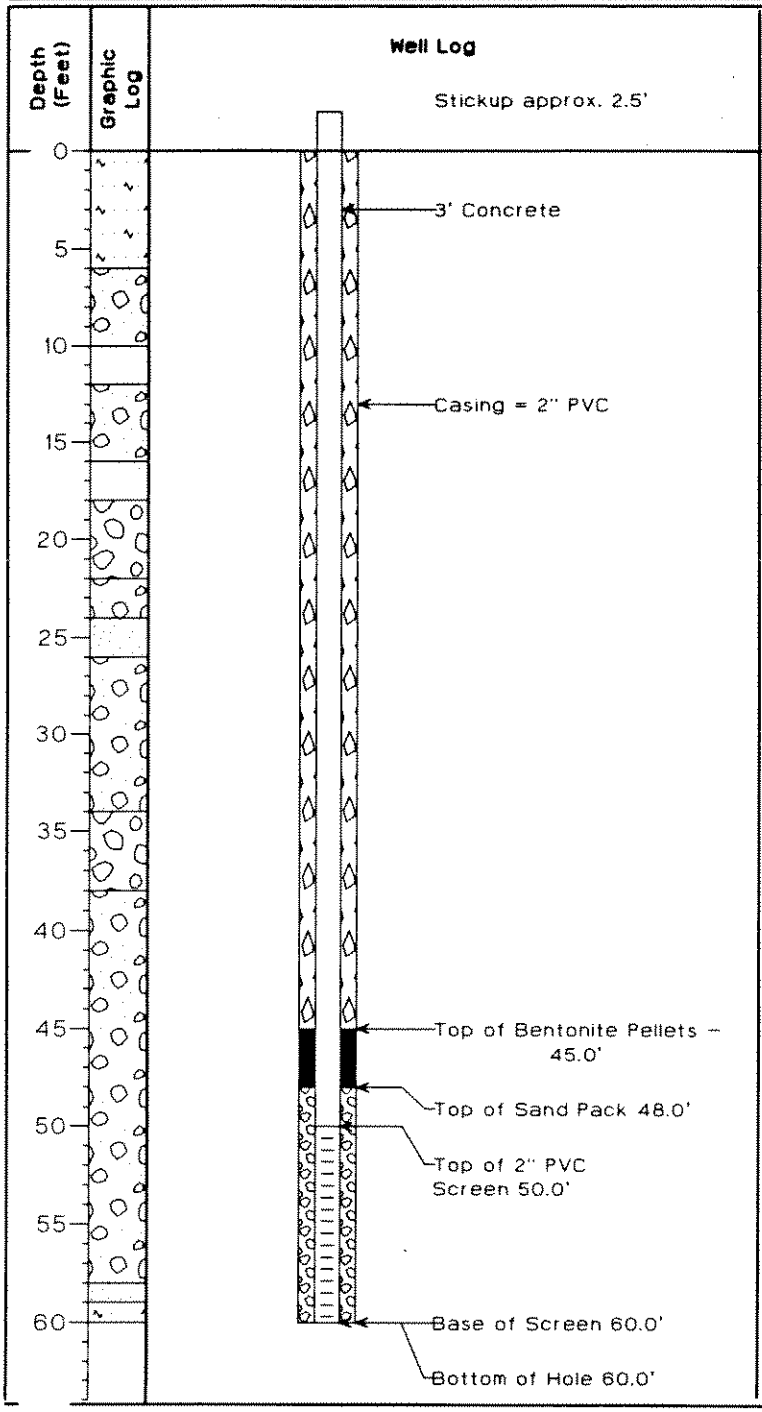
Geologist: W.J. Ferguson
Total Depth: 60.0
Surface Elev.: 722.2903
Datum: Mean Sea Level
North Coor.: -988.45579

Begin Drilling: 02/24/98
End Drilling: 02/24/98
Converted to Well: Yes
Well Name: GM-26
East Coor.: 4961.65526

Geraghty & Miller, Inc.
Environmental Services

Well Construction Log: GM-26

GENERAL MOTORS — Moraine, Ohio



Well Construction Details

Well Type: Monitoring
Total Depth Drilled: 60.0
Surface Elev.: 722.2903
Meas. Point Elev.:
Meas. Point Desc.:
Datum: Mean Sea Level
Drilling Co.: Belasco Drilling
Driller: Dave/Russ
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Begin Drilling: 02/24/98
End Drilling: 02/24/98
Begin Well Instal.: 02/24/98
End Well Instal.: 02/24/98
Development Tech.:
Begin Development: 03/02/98
End Development: 03/02/98
Fluid Loss:
Fluid Developed:
Pumping DTW:
Pumping Duration:
Yield:
Specific Capacity:
Static Water Level:
Fracture Zones:

For Lithologic Descriptions See Log of Boring: *GM-26*

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West Coor.: 988.45579 South Coor.: 4961.65526

Remarks:

Geologist: W.J. Ferguson

OH000294.0001.0002

F:/APPS/GT3/GMCRI/GM-26 (Rev:5/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: GM-27

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0						***CONCRETE:*** 0–0.5 ft; sand 60% (fine to
	11–10 14–17	1.5	1.0	■		***SAND & GRAVEL:*** 0.5–2 ft; sand 60% (fine to coarse); gravel 30% (fine to medium); silt and clay 10%; dark yellowish brown, slightly moist, loose–cohesive.
	11–9– 14–11	1.5	3.0			***SAND & GRAVEL:*** 2–4 ft; sand 70% (fine to coarse); gravel 20% (fine to medium); silt and clay 30%; dark yellowish brown to light gray, slight moist, loose.
5	7–5–7–7	1.5	2.0			***SAND & GRAVEL:*** 4–6 ft; sand 40% (fine to medium); gravel 30% (fine); silt and clay 30%; dark brown, moist, loose–cohesive.
	7–5–3–1	0.25	2.0			***SAND & GRAVEL:*** 6–8 ft; sand 50% (fine to medium); gravel 25% (fine); silt and clay 25%; moderate yellowish brown, moist, loose–cohesive.
	2–1–2–2	0.5	2.0			***SAND & GRAVEL:*** 8–10 ft; sand 60% (fine to medium); gravel 20% (fine); silt and clay 20%; moderate yellowish brown, moist, loose–slightly cohesive.
10	5–6–10–7	0.5	17.0			***SAND & GRAVEL:*** 10–12 ft; same as above.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Mike/Ray
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 58.0
Surface Elev.: 731.0336
Datum: Mean Sea Level
North Coor.: 5392.70451

Begin Drilling: 08/04/98
End Drilling: 08/13/98
Converted to Well: Yes
Well Name: GM-27
East Coor.: 6029.36758

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/GM-27 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: GM-27

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
12						***NO RECOVERY:*** 12–14 ft.
	21–23–21–9	0				
	12–15 41–20	0.25	3.5			***SAND & GRAVEL:*** 14–16 ft; sand 60% (fine to medium); gravel 20% (fine); silt and clay 20%; moderate yellowish brown, moist, loose–slightly cohesive.
17	8–15–13–31	0.5	9.0			***SAND & GRAVEL:*** 16–18 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; light gray to light yellowish brown, slightly moist, loose.
	7–11–15–17	1.0	19.0			***SAND & GRAVEL:*** 18–20 ft; sand 60% (fine to medium); gravel 30% (fine to medium); silt and clay 10%; moderate yellowish brown, moist, loose.
	5–6–12–14	1.0	15.5			***SAND & GRAVEL:*** 20–22 ft; sand 70% (fine to medium); gravel 15% (fine to medium); silt and clay 15%; moderate yellowish brown, moist, loose.
22	8–15–10–23	1.0	6.5			***SAND:*** 22–24 ft; sand 70% (fine to medium); gravel 10% (fine); silt and clay 20%; moderate yellowish brown, very moist, loose–cohesive.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Mike/Ray
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 58.0
Surface Elev.: 731.0336
Datum: Mean Sea Level
North Coor.: 5392.70451

Begin Drilling: 08/04/98
End Drilling: 08/13/98
Converted to Well: Yes
Well Name: GM-27
East Coor.: 6029.36758

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/GM-27 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: GM-27

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
24	2-7-7-6	2.0	12.0			***SAND:*** 24-26 ft; sand 90% (fine); trace gravel (fine); trace silt and clay; moderate yellowish brown, very moist/wet, slightly cohesive.
	5-7-21-22	1.5	9.0			***SAND & GRAVEL:*** 26-28 ft; sand 60% (fine to medium); gravel 15% (fine); silt and clay 25%; moderate yellowish brown, wet, slightly cohesive.
29	8-15-48-41	2.0	12.5			***SAND & GRAVEL:*** 28-30 ft; sand 50% (fine to medium); gravel 30% (fine to medium); silt and clay 20%; moderate to dark yellowish brown, wet, loose-cohesive, slight odor.
		1.5	9.0/2.0			***SAND & GRAVEL:*** 30-31.5ft; sand 70% (fine to medium); gravel 20% (fine to medium); silt and clay 10%; dark yellowish brown, wet, cohesive.
						TILL: 31.5-32 ft; sand 10% (fine); gravel 10% (fine); silt and clay 80%; dark gray, moist, very cohesive.
						NO SOIL SAMPLE COLLECTED: 32-34 ft; The following log describes the lithology from the second attempted hole.
34	48-50/4"	1.0	0			***TILL:*** 34-36ft; sand 5% (fine); gravel 10% (fine to medium); silt and clay 85%; dark gray; dry, very cohesive.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Mike/Ray
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 58.0
Surface Elev.: 731.0336
Datum: Mean Sea Level
North Coor.: 5392.70451

Begin Drilling: 08/04/98
End Drilling: 08/13/98
Converted to Well: Yes
Well Name: GM-27
East Coor.: 6029.36758

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/GM-27 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: GM-27

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
36	48-36-50/3"	1.5	0			***TILL:*** 36-38ft; sand 5% (fine to medium); gravel 15% (fine to coarse); silt and clay 80%; dark gray; wet, very cohesive but slightly softer than above.
	10-28-50	1.0	<0.5			***SAND & GRAVEL:*** 38-40 ft; sand 80% (fine to coarse); gravel 10% (fine); silt and clay 10%; dark yellowish brown, wet, loose.
41	20-61-50	1.0	0			***SAND & GRAVEL:*** 40-42 ft; sand 75% (fine to coarse); gravel 15% (fine to coarse); silt and clay 10%; dark yellowish brown, wet, loose-cohesive.
	38-57-50	1.2	0			***SAND & GRAVEL:*** 42-44 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; dark yellowish brown, wet, loose-cohesive.
	15-45-50	1.0	0			***SAND & GRAVEL:*** 44-46 ft; sand 70% (fine to coarse); gravel 20% (fine to medium); silt and clay 10%; dark yellowish brown, wet, loose.
46	100-94	0.8	0			***SAND & GRAVEL:*** 46-48 ft; sand 70% (fine to coarse); gravel 20% (fine to medium); silt and clay 10%; dark yellowish brown, wet, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Mike/Ray
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 58.0
Surface Elev.: 731.0336
Datum: Mean Sea Level
North Coor.: 5392.70451

Begin Drilling: 08/04/98
End Drilling: 08/13/98
Converted to Well: Yes
Well Name: GM-27
East Coor.: 6029.36758

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/GM-27 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: GM-27

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
48	52-47-32-48	0.8	<0.5			***SAND & GRAVEL:*** 48-50 ft; sand 75% (fine to coarse); gravel 15% (fine); silt and clay 10%; dark yellowish brown, wet, loose.
	135/4"	0.3	0			***SAND & GRAVEL:*** 50-52 ft; sand 90% (fine to coarse); silt and clay 10%; dark yellowish brown, wet, loose.
53	135/4"	0.3	0			***SAND & GRAVEL:*** 52-54 ft; same as above.
	150/4"	0.3	0			***SAND & GRAVEL:*** 54-55 ft; sand 80% (fine to coarse); gravel 10% (fine); silt and clay 10%; dark yellowish brown, wet, loose.
	39-48-57	1.5	0			***TILL:*** 55-56ft; silt and clay 80%; gravel 15% (fine to medium); sand 5% (fine); dark gray to dark yellowish brown, slightly moist, very cohesive.
58						***TILL:*** 56-58ft; same as above.
						TOTAL DEPTH: 58 ft;

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Mike/Ray
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 58.0
Surface Elev.: 731.0336
Datum: Mean Sea Level
North Coor.: 5392.70451

Begin Drilling: 08/04/98
End Drilling: 08/13/98
Converted to Well: Yes
Well Name: GM-27
East Coor.: 6029.36758

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/GM-27 (12/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/

Site Location: RFI/General Motors Corporation, Moraine, Ohio

Date: 8/4/98

Project No.: OH000294.0001.00002

Sample No.: GM-27-2/SL

Coded Replicate No.:

Time Sampling Began: 12:50

Time Sampling Ended: 12:52

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.): 1.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool

Remarks

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	8/4/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	GM-27-20/SL	Coded Replicate No.	
Time Sampling Began	14:00	Time Sampling Ended	14:02

Sampling Method and Material: 2' Stainless steel split-spoon

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) 19.0 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool

Remarks

Sample Personnel: W. Ferguson

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	8/4/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	GM-27-24/SL	Coded Replicate No.	
Time Sampling Began	14:15	Time Sampling Ended	15:45

Sampling Method and Material: 2' Stainless steel split-spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) 6.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool
HP - VOCs 8240 shortlist	3-40 ml glass vials	HCl, Cool

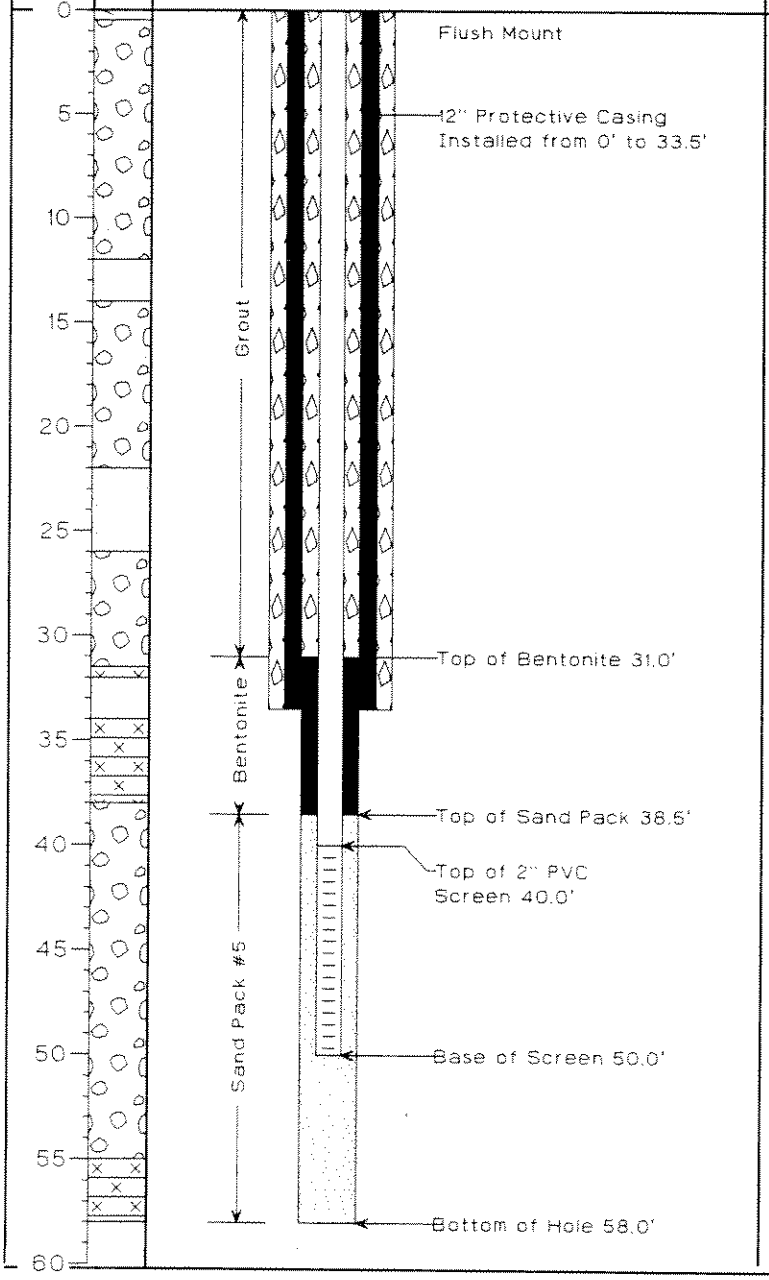
Remarks: Took hydropunch GM-27-32/HP (time 15:45) description: brown, very turbid, 8/4/98
Took hydropunch GM-27-39/HP (time 10:45) description: brown, moderately turbid, 8/13/98
Took hydropunch GM-27-50/HP (time 14:45) description: brown, very turbid, 8/13/98

Sample Personnel: W. Ferguson

Geraghty & Miller, Inc.
Environmental Services

Well Construction Log: GM-27

GENERAL MOTORS — Moraine, Ohio



Well Construction Details

Well Type: Groundwater Monitoring
Total Depth Drilled: 58.0
Surface Elev.: 731.0336
Meas. Point Elev.: 730.59
Meas. Point Desc.: Top Of Casing
Datum: Mean Sea Level
Drilling Co.: Belasco Drilling
Driller: Mike/Ray
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Begin Drilling: 08/04/98
End Drilling: 08/13/98
Begin Well Instal.: 08/04/98
End Well Instal.: 08/20/98
Development Tech.: Pump
Begin Development: 8/24/98
End Development: 8/24/98
Fluid Loss:
Fluid Developed: 40
Pumping DTW:
Pumping Duration: ~2 Hours
Yield:
Specific Capacity:
Static Water Level: 718.18
Fracture Zones:

For Lithologic Descriptions See Log of Boring: *GM-27*

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West Coor.: 5392.70451 South Coor.: 6029.36758

Remarks:
OH000294.0001.0002

Geologist: W.J. Ferguson

I:/GMOTORS/GMCRI/GTGS/GM-27 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: GM-28

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
0						***ASPHALT:*** 0–0.25 ft;
	9–15–21–20	1.0	0			***SAND & GRAVEL:*** 0.25–2 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; multicolored including black, gray, and light brown, slightly moist, loose.
	50	<.25	0			***SAND & GRAVEL:*** 2–4 ft; sand 50% (fine to medium); gravel 40% (fine to coarse); silt and clay 10%; dark yellowish brown, moist, loose.
5	10–10 20–21	1.0	0			***SAND & GRAVEL:*** 4–6 ft; sand 60% (fine to medium), gravel 30% (fine to medium), silt and clay 10%, medium yellowish brown, slightly moist, loose.
	19–37–35–41	1.5	0			***SAND & GRAVEL:*** 6–8 ft; sand 40% (fine to medium); gravel 50% (fine to coarse); silt and clay 10%; light yellowish brown to light gray, slightly moist, loose. (STOPPED DRILLING THIS HOLE. Started new hole ~2.5 feet east. Continue split-spoon sampling at 8 feet.)
	18–50–33–33	1.5	0			***SAND & GRAVEL:*** 8–10 ft; sand 60% (fine to medium); gravel 30% (fine); silt and clay 10%; light to moderate yellowish brown, slightly moist, loose.
10	18–50–53–50	1.5	0			***SAND & GRAVEL:*** 10–12 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light yellowish brown, slightly moist, loose.
	12–26–31–35	1.5	0			***SAND & GRAVEL:*** 12–14 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, slightly moist, loose.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 32.0
Surface Elev.: 729.8962
Datum: Mean Sea Level
North Coor.: 5041.36994

Begin Drilling: 08/05/98
End Drilling: 08/05/98
Converted to Well: Yes
Well Name: GM-28
East Coor.: 5916.17795

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/GM-28 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: GM-28

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
14	4-24-50/5"	1.0	0			***SAND & GRAVEL:*** 14-16 ft; sand 60% (fine to medium); gravel 30% (fine to coarse); silt and clay 10%; light yellowish brown, slightly moist, loose.
	9-16-25-27	1.0	0			***SAND & GRAVEL:*** 16-18 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
19	9-17-20-22	1.0	0			***SAND & GRAVEL:*** 18-20 ft; sand 70% (fine to coarse); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	5-15-16-30	1.0	0.5			***SAND & GRAVEL:*** 20-22 ft; sand 70% (fine to medium); gravel 20% (fine to coarse); silt and clay 10%; moderate yellowish brown, moist, loose.
	11-15-13-20	1.0	<0.5			***SAND & GRAVEL:*** 22-24 ft; sand 70% (fine to coarse); gravel 20% (fine); silt and clay 10%; moderate yellowish brown, very moist to wet, loose-cohesive.
24	8-16-20-15	1.0	0			***SAND & GRAVEL:*** 24-26 ft; sand 60% (fine to coarse); gravel 30% (fine to coarse); silt and clay 10%; moderate yellowish brown, wet, loose-cohesive.
	15-19-21-36	1.0	0			***SAND & GRAVEL:*** 26-28 ft; sand 70% (fine to coarse); gravel 20% (fine to medium); silt and clay 10%; moderate yellowish brown, wet, loose-cohesive.

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 32.0
Surface Elev.: 729.8962
Datum: Mean Sea Level
North Coor.: 5041.36994

Begin Drilling: 08/05/98
End Drilling: 08/05/98
Converted to Well: Yes
Well Name: GM-28
East Coor.: 5916.17795

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/GM-28 (12/18/98)

ARCADIS Geraghty & Miller
Environmental Services

Log of Boring: GM-28

GENERAL MOTORS — Moraine, Ohio

Depth (Feet)	Blows (/6 in.)	Recovery (Feet)	HNU (ppm)	Sample	Graphic Log	Description
28	19-34 36-37	2.0	~0.5			***SAND & GRAVEL:*** 28-30 ft; sand 80% (fine to coarse); gravel 10% (fine to medium); silt and clay 10%; moderate yellowish brown, wet, loose-cohesive.
	44-64- 50/3"	1.5	1.0/ 0			***SAND & GRAVEL:*** 30-31.5 ft; sand 80% (fine to coarse); gravel 10% (fine to medium), silt and clay 10%; moderate yellowish brown, wet, loose-cohesive.
						TILL: 31.5-32 ft; silt and clay 90%; gravel 5% (fine) and sand 5%, dark gray; moist, very cohesive.
						TOTAL DEPTH: 32 ft;
33						
38						

■ Sample to Lab ▯ Sample Not Analyzed

Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Remarks:

Geologist: W.J. Ferguson
Total Depth: 32.0
Surface Elev.: 729.8962
Datum: Mean Sea Level
North Coor.: 5041.36994

Begin Drilling: 08/05/98
End Drilling: 08/05/98
Converted to Well: Yes
Well Name: GM-28
East Coor.: 5916.17795

OH000294.0001.0002

I:/GMOTORS/GMCRI/GTGS/GM-28 (12/18/98)

ARCADIS GERAGHTY & MILLER

Soil/Sediment/Sludge Sampling Log

Project/		Date	8/5/98
Site Location	RFI/General Motors Corporation, Moraine, Ohio	Project No.	OH000294.0001.00002
Sample No.	GM-28-22/SL	Coded Replicate No.	
Time Sampling Began	15:00	Time Sampling Ended	16:00

Sampling Method and Material: 2' Stainless steel split-spoon and hydropunch

From	To	Soil/Sediment/Sludge Description
		See lithologic log

OTHER (OVA; HNu; etc.) 0.5 ppm

Constituents Sampled	Container Description	Preservative
Soil - VOCs 8240 shortlist	4 oz glass jar	Cool
HP - VOCs 8240 shortlist	3-40 ml glass vials	HCl, Cool

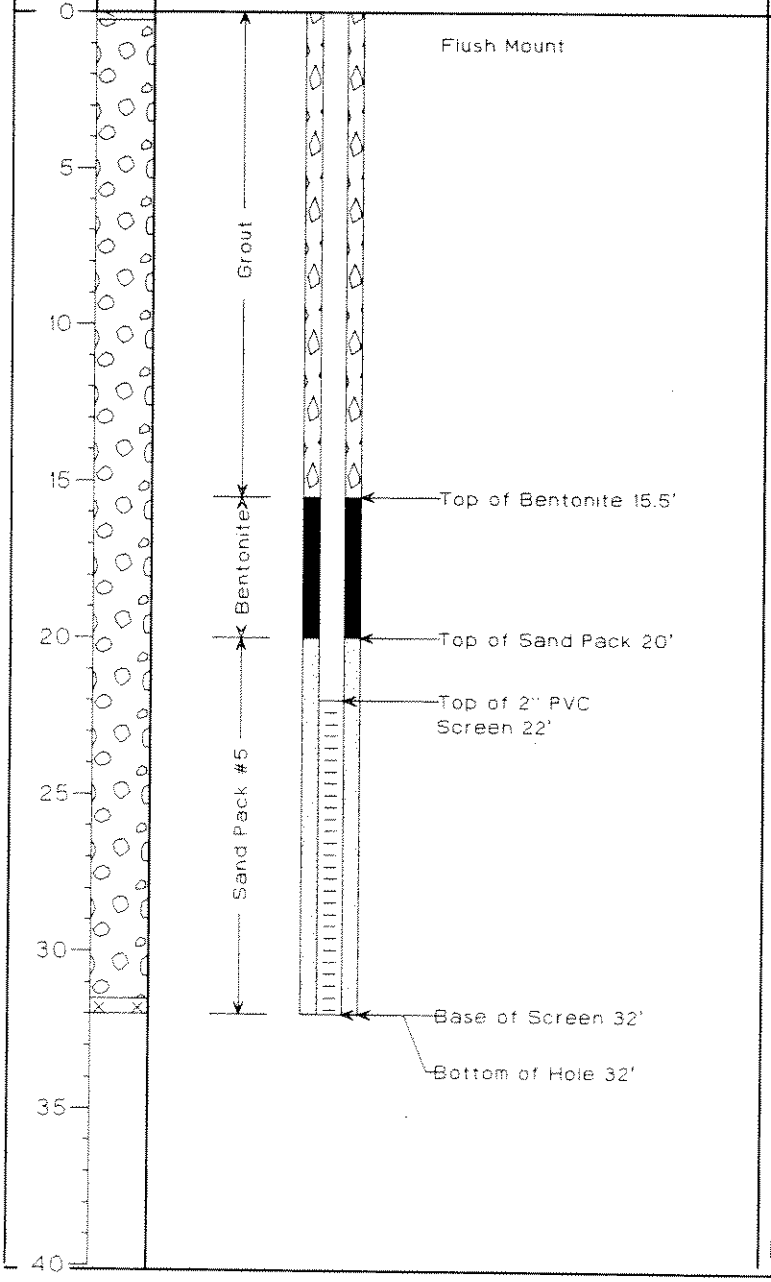
Remarks: Took hydropunch GM-28-32/HP (time 16:00) description: very turbid, brown

Sample Personnel: W. Ferguson

Geraghty & Miller, Inc.
Environmental Services

Well Construction Log: GM-28

GENERAL MOTORS — Moraine, Ohio



Well Construction Details

Well Type: Groundwater Monitoring
Total Depth Drilled: 32.0
Surface Elev.: 729.8962
Meas. Point Elev.: 729.19
Meas. Point Desc.: Top of Casing
Datum: Mean Sea Level
Drilling Co.: Belasco Drilling
Driller: Ray/Mike
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Begin Drilling: 08/05/98
End Drilling: 08/05/98
Begin Well Instal.: 08/05/98
End Well Instal.: 08/05/98
Development Tech.: Pump/Bailer
Begin Development: 8/17/98
End Development: 8/17/98
Fluid Loss:
Fluid Developed: >210
Pumping DTW:
Pumping Duration:
Yield:
Specific Capacity:
Static Water Level: 727.65
Fracture Zones:

For Lithologic Descriptions See Log of Boring: *GM-28*

Page 1 of 1

West Coor.: 5041.36994 South Coor.: 5916.17795

Remarks:
OH000294.0001.0002

Geologist: W.J. Ferguson

I:/GMOTORS/GMCRI/GTGS/GM-28 (12/18/98)

Appendix E

- Slug Test Analysis

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Appendix E - Slug Test Analysis

General Motors Powertrain Group
Moraine Engine Plant & General Motors Truck Group Moraine Assembly Plant
Moraine, Ohio

PREPARED FOR

General Motors Corporation
May 1999

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E-7 Slug test data and type curve for GM-23: Rising head test; unconfined aquifer assumption.

1. Slug Test Analysis

1.1 Introduction

Slug tests were performed at AOI 7 - Former Oil House Area as part of the Supplemental RFI activities on November 2, 1998 in order to provide estimates of hydraulic conductivity which are representative of this area. Hydraulic characteristics of the upper aquifer in the vicinity of the North Settling Lagoon were determined by evaluation of data from pumping tests conducted in 1985 and in 1989. The median hydraulic conductivity (K) value that was estimated from the pumping test data was 1,650 ft/day. However, for purposes of investigating the area of AOI 7, a more site-specific determination of hydraulic characteristics was deemed necessary. To achieve this, slug tests were performed on the three upper aquifer monitoring wells in AOI 7. These wells are GM-23, GM-27, and GM-28. Although the area of influence of a slug test is much smaller than that of a pumping test, slug tests were used in order to provide an efficient and inexpensive means to estimate the hydraulic characteristics of the upper aquifer. The three monitoring wells used allowed for estimating the hydraulic characteristics of the two portions of the upper aquifer which are separated by the upper clay till in the vicinity of AOI 7. Monitoring wells GM-23 and GM-28 are screened in the portion of the upper aquifer which is above the upper clay till. Monitoring well GM-27 is screened in the portion of the upper aquifer which is below the upper clay till and above the regional clay till confining layer. Where possible, both falling head tests and rising head tests were conducted at each monitoring well to provide more data for estimating hydraulic characteristics.

1.2 Slug Test Assumptions

Slug test data were analyzed using the AQTESOLV modeling software (Geraghty & Miller, Inc., 1989). Slug test data from monitoring wells GM-23 and GM-28 were analyzed assuming unconfined aquifer conditions. This assumption is justified because the wells are screened above the upper clay till, and this portion of the upper aquifer can be assumed to act as a water-table aquifer. Slug test data from monitoring well GM-27 were analyzed assuming unconfined aquifer conditions, and were analyzed again assuming confined aquifer conditions. The last assumption may be justified for this well, because the part of the aquifer in which the well is screened is confined by the upper clay till and the regional clay till.

1.3 Slug Test Results

Table E-1 provides a summary of the results of the slug tests performed at AOI 7. Figures E-1 through E-7 provide the data points and type curve fitting of each slug test. The slug tests results suggest that an estimate of the hydraulic conductivity of the upper aquifer in the vicinity of AOI 7 is 10^{-5} to 10^{-4} meters per second (m/s). The results further suggest that the values of hydraulic conductivity of the two parts of the upper aquifer are not significantly different.

2. References

Geraghty & Miller, Inc. 1989. AQTESOLV Aquifer Test Solver Version 1.00, Reston, VA, October 17, 1989.

Table E-1. Results of Slug Tests Performed at AOI 7, Former Oil House Area, General Motors Corporation, Moraine, Ohio.

Well	Test Name	Test Type	Aquifer Assumption	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (m/s)	Quality of Type Curve Match
GM-27	Test 0	Falling Head	Confined	6.8256	2.41274E-05	poor
GM-27	Test 0	Falling Head	Unconfined	53.7264	1.89914E-04	fair
GM-28	Test 2	Falling Head	Unconfined	48.4128	1.71131E-04	good
GM-28	Test 3	Rising Head	Unconfined	78.2208	2.76497E-04	excellent
GM-23	Test 6	Falling Head	Unconfined	16.3296	5.77224E-05	fair*
GM-23	Test 6	Falling Head	Unconfined	3.82032	1.35042E-05	fair**
GM-23	Test 7	Rising Head	Unconfined	7.17984	2.53795E-05	very good

Slug tests were performed on November 2, 1998.

* Type curve was matched to earlier data points due to poor overall fit.

** Type curve was matched to later data points due to poor overall fit.

ft - feet.

m - meter.

s - second.

Figure E-1. Slug test data and type curve for GM-27: Falling head test; confined aquifer assumption.

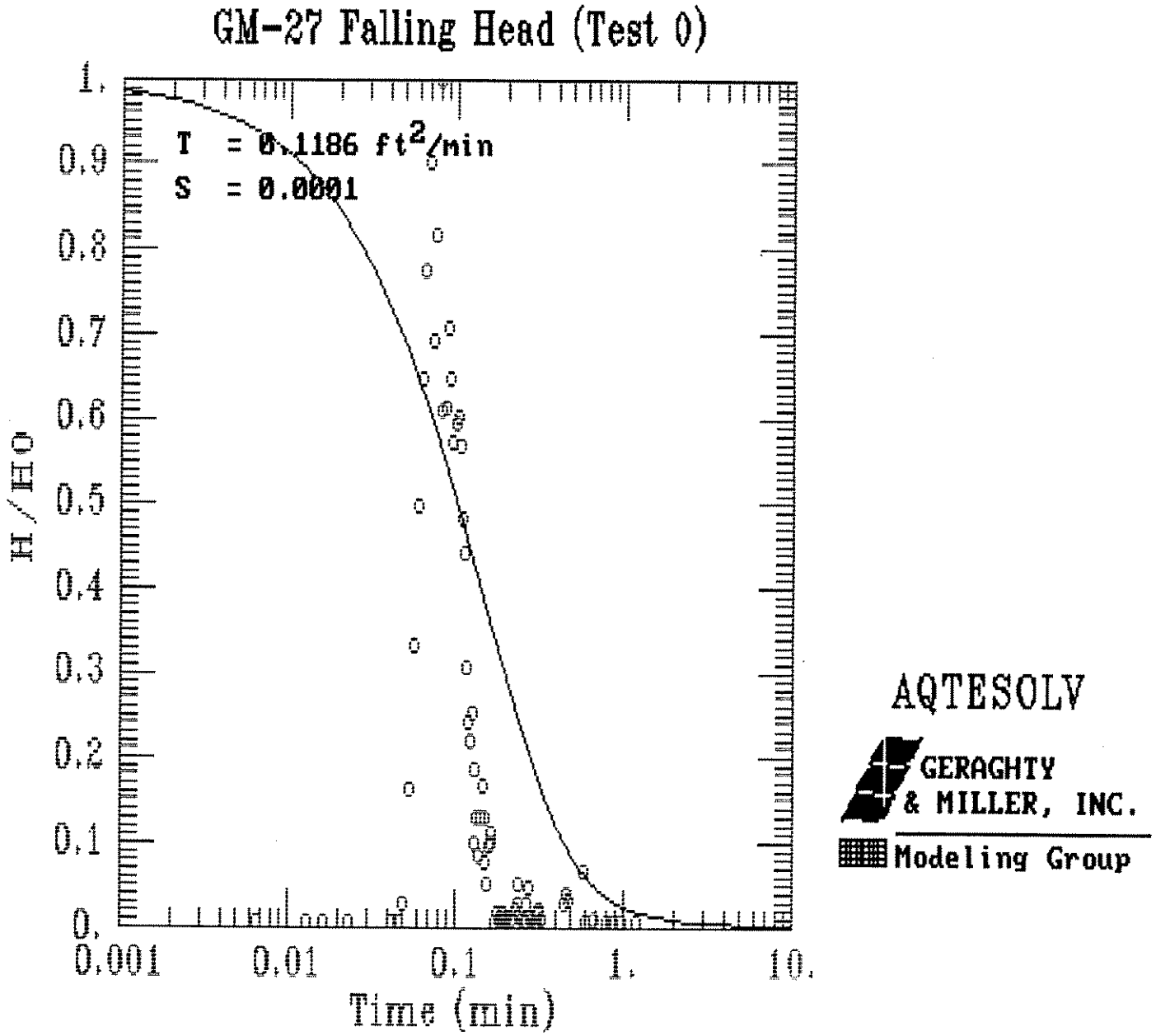


Figure E-2. Slug test data and type curve for GM-27: Falling head test; unconfined aquifer assumption.

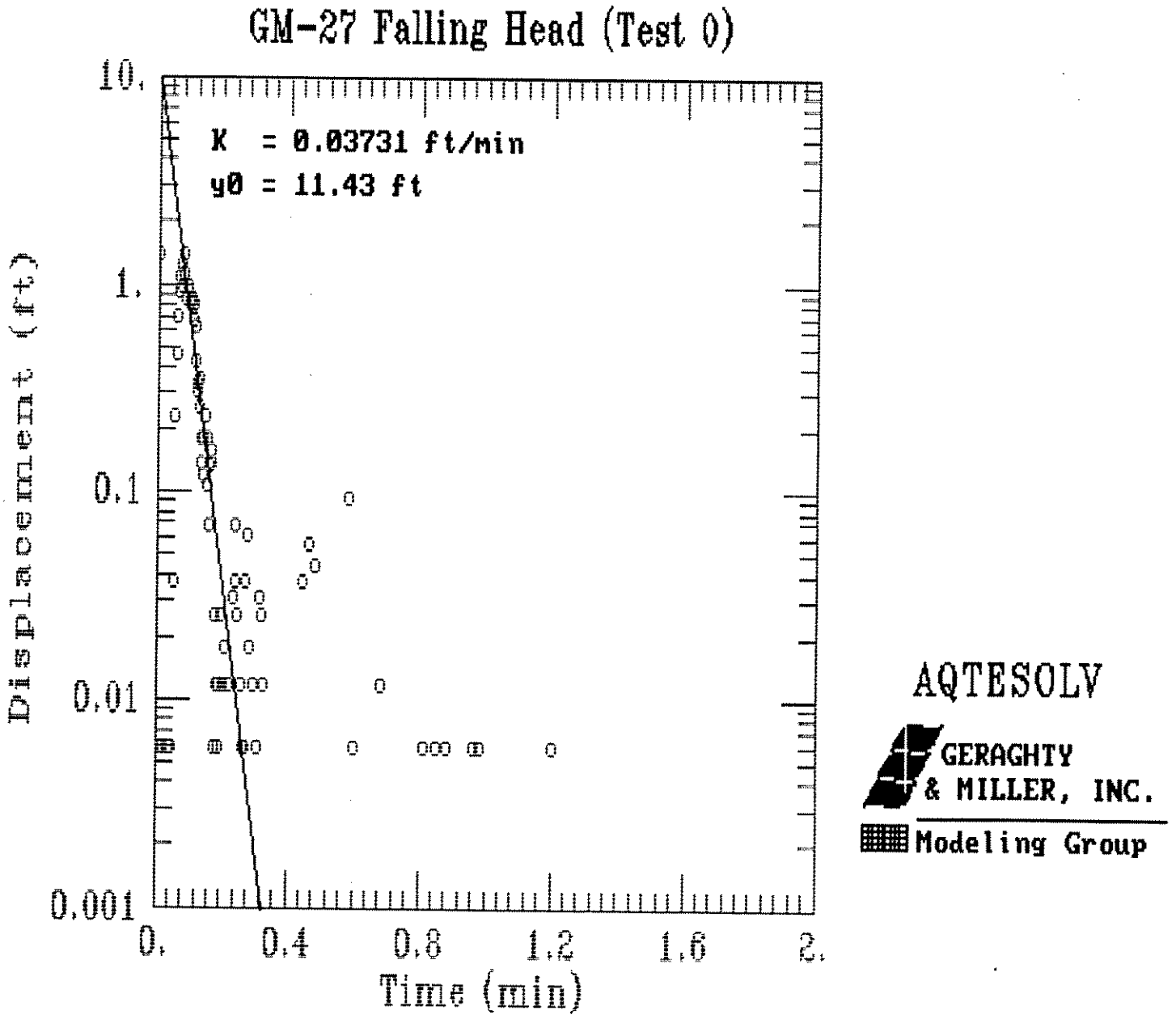


Figure E-3. Slug test data and type curve for GM-28: Falling head test; unconfined aquifer assumption.

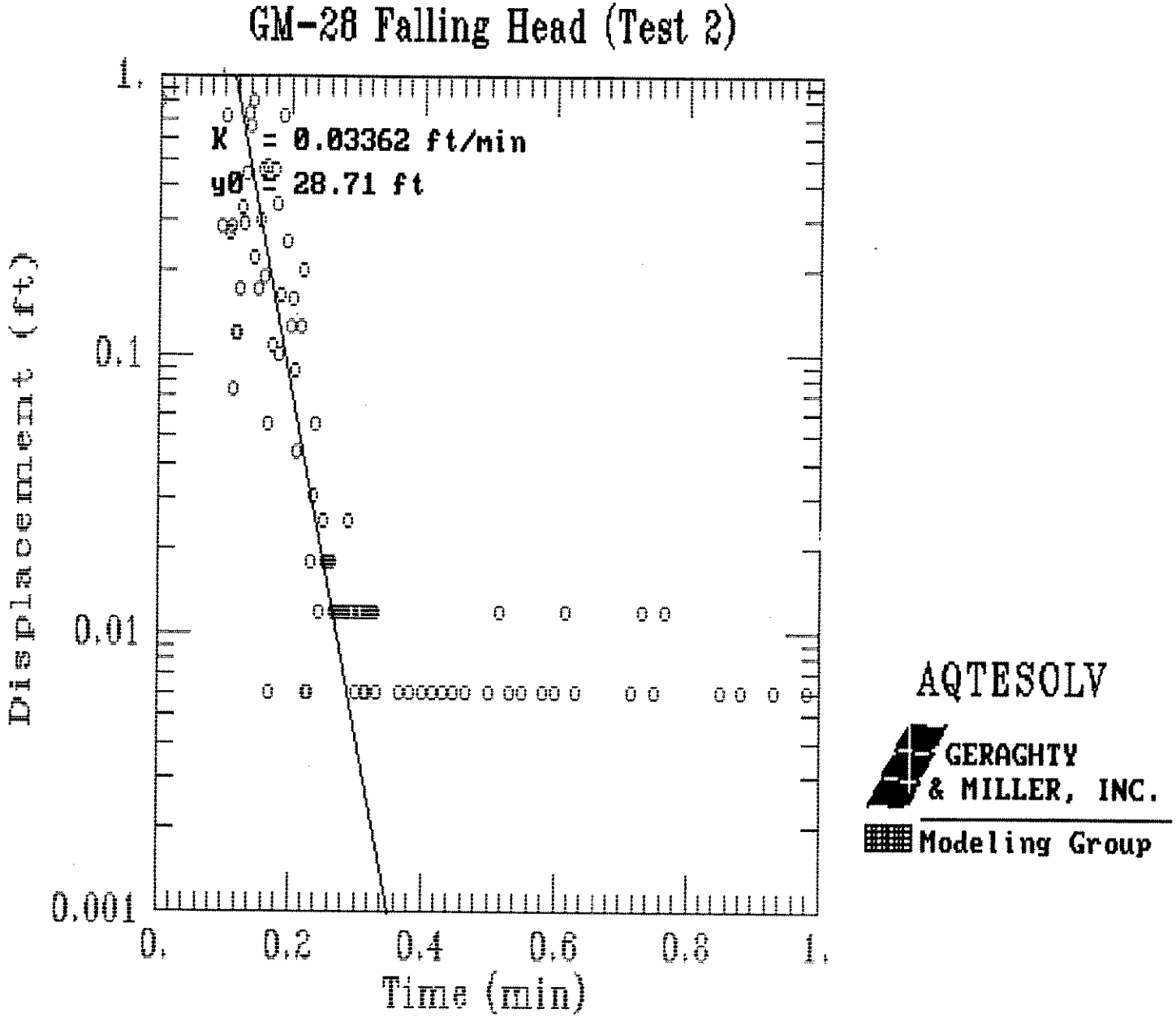


Figure E-4. Slug test data and type curve for GM-28: Rising head test; unconfined aquifer assumption.

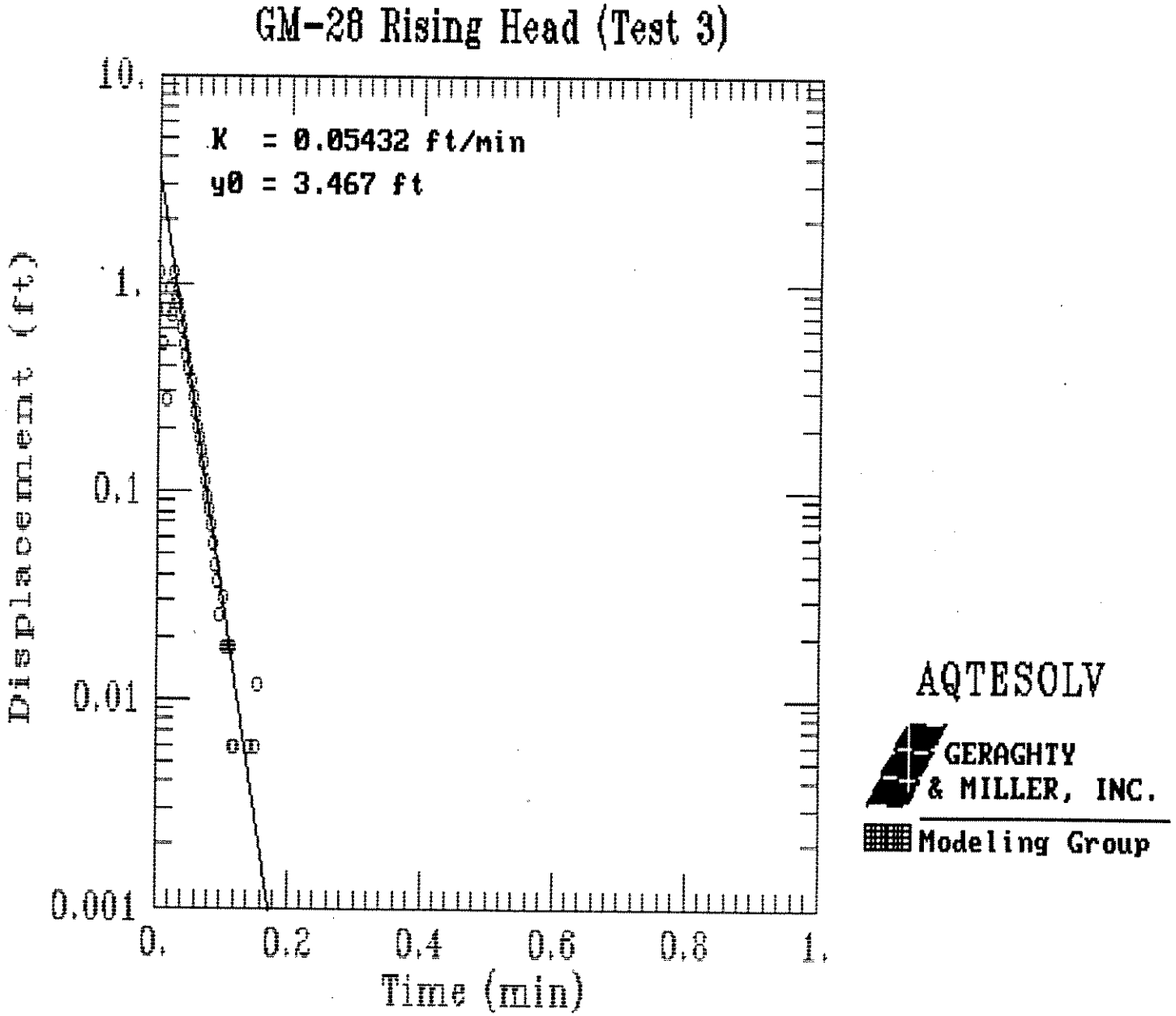


Figure E-5. Slug test data and type curve for GM-23: Falling head test; unconfined aquifer assumption.

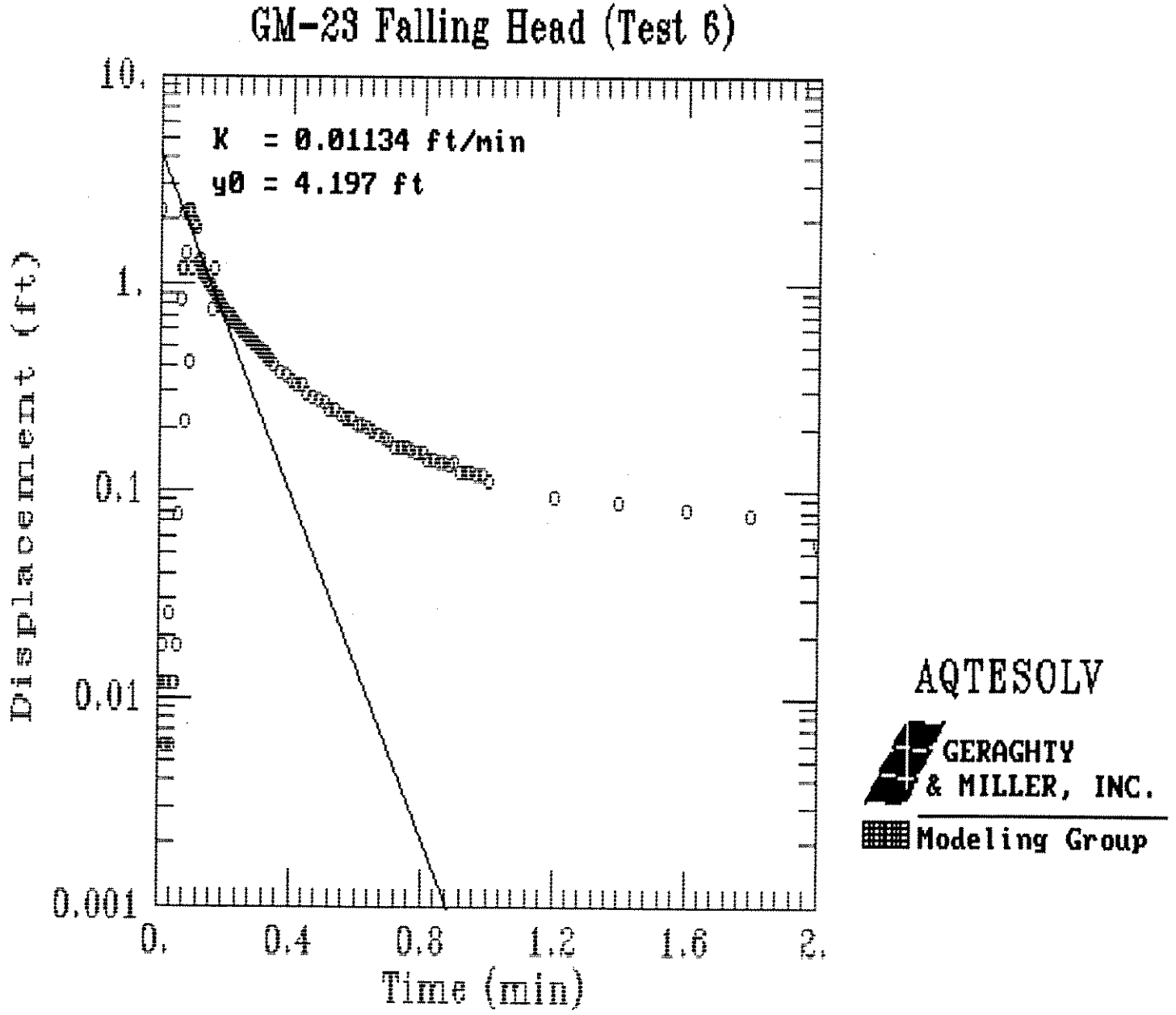


Figure E-6. Slug test data and type curve for GM-23: Falling head test; unconfined aquifer assumption.

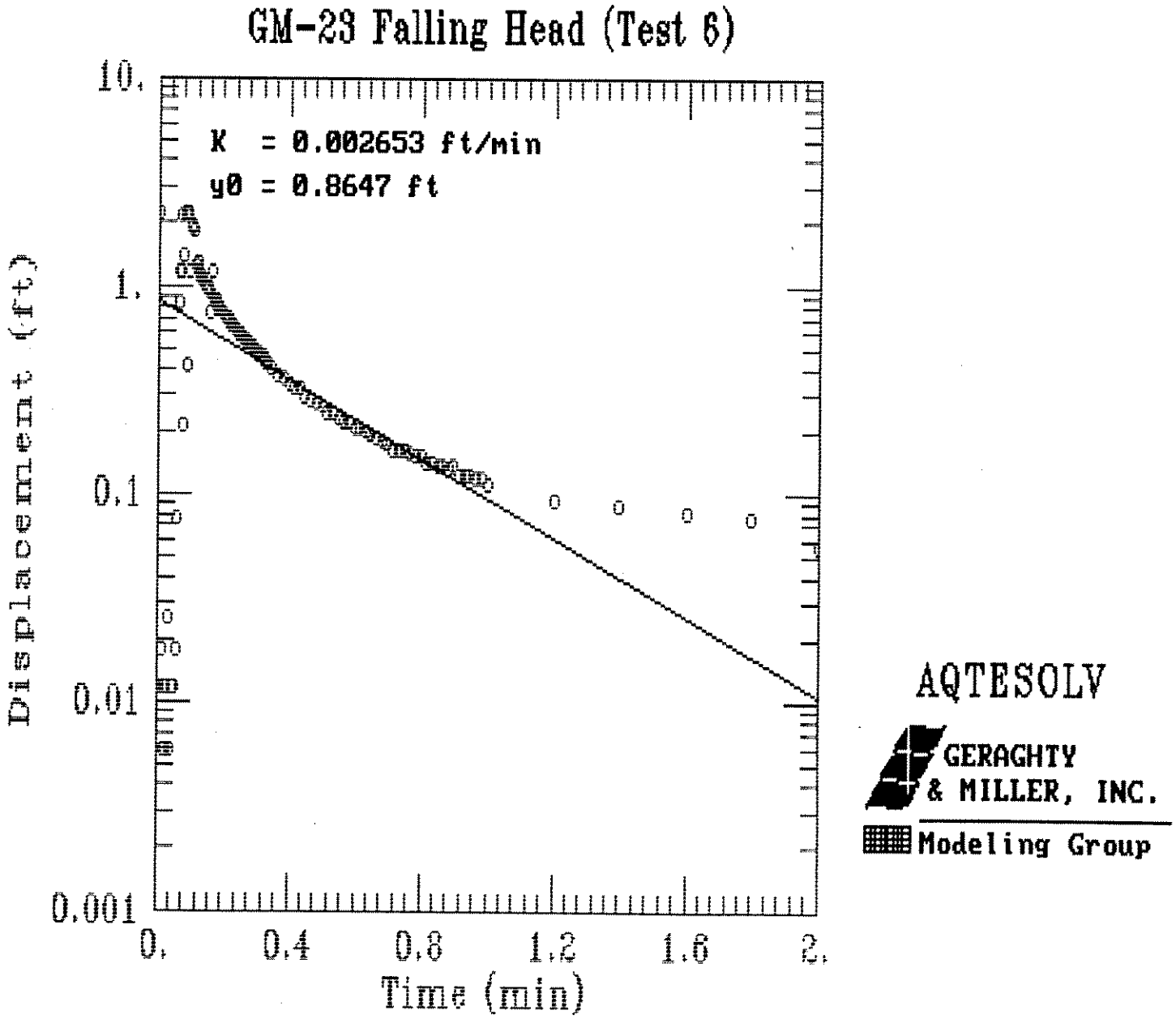
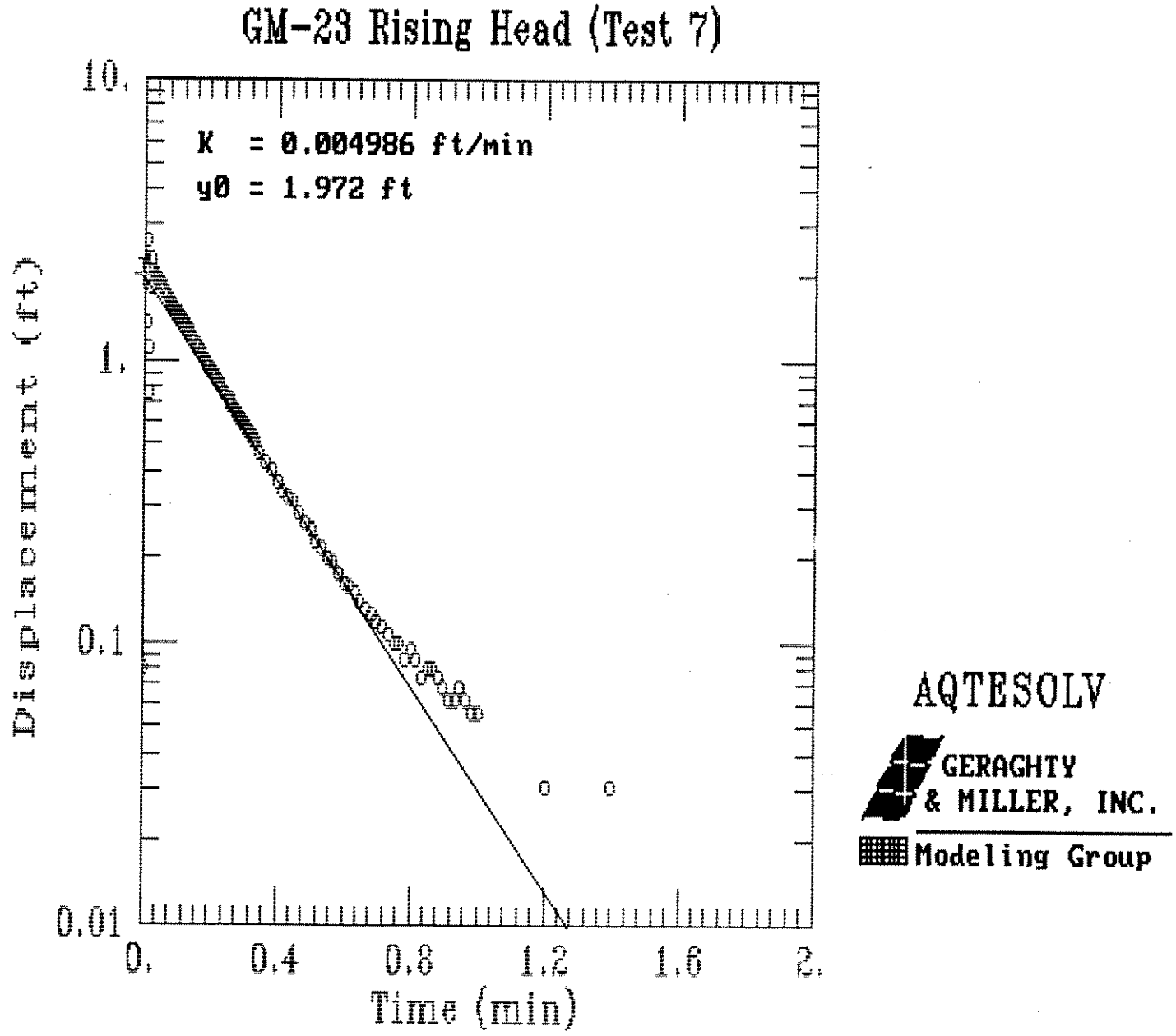


Figure E-7. Slug test data and type curve for GM-23: Rising head test; unconfined aquifer assumption.



Appendix F

Topographic Map, March 1968

SUPPLEMENTAL
RESOURCE CONSERVATION AND RECOVERY ACT
FACILITY INVESTIGATION REPORT

VOLUME II
SUPPLEMENTAL BASELINE RISK ASSESSMENT

GENERAL MOTORS POWERTRAIN GROUP
MORAINE ENGINE PLANT AND
GENERAL MOTORS TRUCK GROUP
MORAINE ASSEMBLY PLANT
MORAINE, OHIO

Prepared for

General Motors Corporation
Detroit, Michigan

Prepared by

ENVIRON Corporation
214 Carnegie Center
Princeton, New Jersey

June 1999
Revised April 2000

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APPENDICES

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EXECUTIVE SUMMARY

1 Background

This second volume of the *Supplemental RFI Report* presents the supplemental baseline risk assessment for the General Motors Powertrain Group, Moraine Engine Plant (Moraine Engine) and the General Motors Truck Group, Moraine Assembly Plant (Moraine Assembly). This baseline risk assessment supplements the baseline risk assessment completed in 1996 as part of the RCRA Facility Investigation (RFI) at the Delphi Harrison Thermal Systems, Moraine Plant (Delphi Thermal), which adjoins the Moraine Engine and Moraine Assembly facilities.

The 1996 baseline risk assessment evaluated the potential risk to human health and the environment posed by releases of hazardous waste and constituents from the 14 solid waste management units (SWMUs) investigated in the RFI at Delphi Thermal, including SWMUs undergoing closure under Ohio EPA's RCRA program (i.e., the North and South Settling Lagoons). Potential exposures to constituents in soil/waste at the SWMUs via direct contact, airborne transport, and ground water transport were evaluated to determine whether soil/waste at the SWMUs warrants corrective measures and to support identification of appropriate corrective measures alternatives by determining which potential exposure pathways, if any, pose a significant risk. The conceptual site model for the 1996 baseline risk assessment established the reasonably anticipated future land uses and ground water uses at and around Delphi Thermal, the potential exposure pathways associated with constituents in soil/waste at the 14 SWMUs, and the potentially exposed populations on-site and off-site. The conceptual site model was reviewed extensively through written correspondence between USEPA and Delphi Thermal before starting the risk assessment. Several key aspects of the technical methodology (e.g., ground water modeling) and key assumptions (e.g., exposure factors) relating to the estimation of potential exposures were also reviewed with USEPA. The baseline risk assessment for the SWMUs at Delphi Thermal was submitted to USEPA in the draft *RFI Final Report, Volume II* (ENVIRON 1996).

The 1996 baseline risk assessment concluded that constituents in soil/waste at the SWMUs do not present a significant risk under reasonable maximum exposures via direct contact, airborne transport, or ground water transport. With respect to the assessment of potential risk via ground water transport, the 1996 baseline risk assessment was designed to evaluate potential threats to ground water uses posed by constituents in soil/waste which may leach into

ground water at the SWMUs. It was not specifically designed to evaluate potential risk posed by concentrations of constituents already present in ground water. This design was consistent with the objective of determining whether soil/waste at a specific SWMU warrants corrective measures. However, as suggested by USEPA's June 11, 1996 comments on the risk assessment, this design did not provide a clear approach for determining whether existing ground water conditions warrant corrective measures (including the continuation of current interim measures to address the presence of volatile organic compounds in shallow ground water at the downgradient boundary of Delphi Thermal).

GM's September 11, 1996 response to the June 11, 1996 USEPA comments reiterated the conclusions of the 1996 baseline risk assessment, which was that soil/waste at the SWMUs does not warrant corrective measures. The response acknowledged that continuation of current interim measures was appropriate since constituent concentrations in site-wide ground water were not specifically assessed in the 1996 risk assessment and, in many cases, are clearly not attributable to the SWMUs investigated in the RFI at Delphi Thermal. In response to USEPA comments on assigning ground water data to specific SWMUs, GM provided detailed explanations of the pitfalls associated with assigning constituent concentrations in ground water to a SWMU where no evidence of a causal link exists. Along with these explanations, an alternate method for assessing the potential impact on ground water from soil/waste at a SWMU was proposed. The proposed method was designed to minimize incorrect attribution of ground water impact to soil/waste at a SWMU by using soil/waste characterization data rather than ground water data (where justified) to estimate the potential for soil/waste to affect current or reasonably anticipated future ground water uses. USEPA's comments on the 1996 baseline risk assessment did not request modifications to other aspects of the risk assessment.

In a letter dated October 1, 1996, USEPA withdrew its June 11, 1996 request for a revised RFI report (including revisions to the 1996 baseline risk assessment) in light of GM's plans to prepare a supplemental RFI for Moraine Engine and Moraine Assembly. Because large parts of the two adjoining facilities are located upgradient of Delphi Thermal, one objective of the supplemental RFI was to investigate areas at Moraine Engine and Moraine Assembly that may have affected, or may continue to affect, ground water conditions at Delphi Thermal. Six such areas of interest (AOIs) were investigated in the supplemental RFI. Soil conditions at the AOIs were characterized to allow an assessment of potential exposures to constituents in soil at the AOIs via direct contact, airborne transport, and ground water transport. The supplemental RFI also included characterization of site-wide ground water conditions and an extensive characterization of ground water conditions at AOI 7 (Former Oil House Area at Moraine Engine) where initial ground water monitoring data indicated potentially significant contamination.

As discussed in the *Supplemental RFI Report, Volume I*, Sections 3.4 and 4.4, the extensive characterization of AOI 7 during the supplemental RFI found evidence that dense nonaqueous-phase liquids (DNAPL) may be present in the shallow saturated zone underlying AOI 7 above an upper clay till layer. The constituents present in the shallow ground water at AOI 7 consist primarily of tetrachloroethene, trichloroethene and their degradation products (i.e., 1,2-dichloroethene and vinyl chloride). Because AOI 7 is upgradient of most of Moraine Engine and Delphi Thermal, the contamination in shallow ground water above the upper clay till at AOI 7 is likely a significant contributor to the presence of similar volatile organic compounds in site-wide ground water at these facilities. Furthermore, considering the composition and concentrations of volatile organic compounds in ground water at AOI 7, the contamination in ground water at AOI 7 is the primary contributor of the volatile organic compounds being addressed by the interim measures at the downgradient boundary of Delphi Thermal.

2 Purpose and Scope

The RFI at Delphi Thermal and the supplemental RFI at Moraine Engine and Moraine Assembly provide a comprehensive characterization of site-wide ground water conditions as well as soil/waste conditions at 14 SWMUs and six AOIs. The RFI and supplemental RFI baseline risk assessments were conducted with the primary objective of addressing the following questions:

1. Do constituents in soil/waste at any of the SWMUs at Delphi Thermal pose an unacceptable risk which warrants corrective measures[1]?

2. Do constituents in soil at any of the AOIs at Moraine Engine and Moraine Assembly pose an unacceptable risk which warrants corrective measures?

3. Do constituents in ground water at any of the SWMUs or AOIs pose an unacceptable risk which warrants corrective measures?

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[1] Closure of the North Settling Lagoon and South Settling Lagoon is being conducted with the Ohio EPA. Accordingly, USEPA has indicated it will not evaluate whether a corrective measures study is warranted for these SWMUs (USEPA 2000). Closure plans and ground water monitoring are discussed in Volume I of this *Supplemental RFI Report*.

As discussed above, the 1996 baseline risk assessment was designed to answer the first question. It concluded that constituents in soil/waste at the SWMUs do not present an unacceptable risk under reasonable maximum exposures via direct contact, airborne transport, or ground water transport.

The supplemental baseline risk assessment, as described in this volume of the *Supplemental RFI Report*, is designed to answer the second question. It evaluates potential exposures to constituents in soil at the AOIs using the same general approach and methods reviewed by USEPA in the 1996 baseline risk assessment for the SWMUs at Delphi Thermal, except in estimating ground water source concentrations. Specifically, potential exposures to constituents in soil at the AOIs via direct contact, airborne transport, and ground water transport are evaluated to determine whether soil at the AOIs warrants corrective measures. Because Moraine Engine and Moraine Assembly adjoin Delphi Thermal and the nature of operations at the three facilities is similar, the conceptual site model for the supplemental baseline risk assessment generally follows the conceptual site model used in 1996. That is, the potential exposure pathways associated with the AOIs at Moraine Engine and Moraine Assembly are evaluated under the same current and future land use and ground water use scenarios established in the 1996 baseline risk assessment.

To address USEPA comments on the 1996 baseline risk assessment, the supplemental baseline risk assessment evaluates potential exposures via ground water transport of constituents in soil/waste at both the AOIs and SWMUs using the alternate method for estimating ground water source concentrations as described in GM's September 11, 1996 response to comments. As discussed above and in the September 11, 1996 response, the alternate method was designed to minimize incorrect attribution of ground water impact to soil/waste at a SWMU or AOI by using soil/waste characterization data rather than ground water data (where justified) to estimate the potential for soil/waste to affect ground water. Potential exposures at current and reasonably expected points of ground water use are evaluated by combining potential contributions from both the AOIs at Moraine Engine and Moraine Assembly and the SWMUs at Delphi Thermal, to provide a comprehensive assessment of potential exposures to constituents in soil/waste via ground water transport.

The supplemental baseline risk assessment is also designed to answer the third question. Because site-wide ground water is primarily affected by contamination from the shallow ground water at AOI 7, the supplemental baseline risk assessment is focused on evaluation of the effects of ground water conditions at AOI 7 on site-wide ground water. Specifically, potential exposures to constituents in ground water at AOI 7 are evaluated to determine whether ground water at AOI 7 warrants corrective measures. This evaluation is done separately from the evaluation of potential exposures to constituents in soil at AOI 7, so that

the need for corrective measures to address each medium at AOI 7 can be determined separately. Unlike ground water contamination across other areas of the site which cannot be causally linked to specific SWMUs or AOIs in those areas, the ground water contamination at AOI 7 can be confidently attributed to AOI 7. Evaluation of potential exposures, if any, to existing constituents in site-wide ground water not attributable to AOI 7 will be done as part of the assessment of the effectiveness of interim measures being implemented by GM to address the AOI 7 ground water contamination. A work plan for this evaluation of the interim measures is being submitted separately to USEPA.

3 Methodology

As mentioned above, the supplemental baseline risk assessment uses the same conceptual site model used in 1996. That is, the potential exposure pathways associated with the AOIs at Moraine Engine and Moraine Assembly are evaluated under the same current and future land use and ground water use scenarios established in the 1996 baseline risk assessment. Potential exposures to constituents in soil at the AOIs are evaluated using the same general approach and methods reviewed by USEPA in the 1996 baseline risk assessment for the SWMUs at Delphi Thermal, except in estimating ground water source concentrations, as discussed above.

The 1996 comprehensive review of information pertinent to future land use patterns surrounding Delphi Thermal, Moraine Engine and Moraine Assembly was updated with a review of land use patterns in the City of Kettering, because a small part of the Moraine Assembly property is located in the City of Kettering, which borders the City of Moraine to the east. The updated review confirms that the assumption of continued industrial land use at the three facilities is appropriate. As such, the potential for human exposure to the AOIs at Moraine Engine and Moraine Assembly is evaluated in the supplemental baseline risk assessment for the following current and reasonably anticipated future land uses:

- Industrial land use at Moraine Engine and Moraine Assembly; and
- Industrial/commercial, residential, and recreational land uses around the facilities.

The potentially exposed populations under these land uses are:

- On-facility and off-facility workers
- Off-facility residents

Ground water in the lower aquifer in the region surrounding the three facilities is a drinking and industrial water source; but the ground water in the upper aquifer underlying the

facilities is not a drinking or industrial water source and is not reasonably expected to serve as either type of water source in the future. The ground water in the upper aquifer, however, is a medium for potential transport of constituents from the SWMUs at Delphi Thermal and the AOIs at Moraine Engine and Moraine Assembly to the lower aquifer and the Great Miami River. As such, the supplemental baseline risk assessment includes an assessment of the extent to which the hydraulic interconnections could result in migration of constituents to the lower aquifer or to the River in concentrations of significance to human health.

The potential for drinking water exposure to ground water is evaluated in the supplemental baseline risk assessment using the same ground water use scenarios evaluated in the 1996 baseline risk assessment. Specifically, potential exposure is evaluated for current or potential drinking water use of ground water extracted from the following municipal well fields:

- West Carrollton: as West Carrollton's drinking water supply
- Miami Shores: as Greater Moraine Water System (GMWS) of Montgomery County's primary emergency drinking water supply
- Dryden Road South: as GMWS's secondary emergency drinking water supply

Although the Dryden Road North well field is not expected to serve as a drinking water supply or as an emergency drinking water supply, the ground water quality at this well field is also evaluated.

Like the 1996 baseline risk assessment, the supplemental baseline risk assessment also evaluates the potential for exposures that may occur through current and potential nonpotable industrial use of ground water extracted from industrial wells. Based on currently active production wells and potential operation of inactive production wells, potential exposures through nonpotable ground water use is evaluated for the following on-site industrial wells:

- Delphi Thermal inactive production wells: as a potential industrial water supply
- Moraine Assembly active production wells: as an industrial water supply
- Moraine Engine active production wells: as an industrial water supply
- Moraine Engine inactive production well: as a potential industrial water supply

The significance of waste constituents potentially transported to the Great Miami River via ground water flow from the upper aquifer is also evaluated, as in the 1996 baseline risk assessment.

Potential exposures are quantitatively evaluated for incidental ingestion of and dermal contact with soil and inhalation of soil constituents in vapor and particulates. Potential

exposures via these pathways are quantified by the product of the concentration of waste constituents in an environmental medium at locations of potential exposure over an expected period of exposure and the intake of the environmental medium by a potentially exposed population. The product of these components is combined with toxicity values to estimate potential carcinogenic risk and noncarcinogenic effects. As in the 1996 baseline risk assessment, potential ground water and surface water exposures are evaluated by comparison of exposure concentrations in ground water and surface water at potential points of contact with maximum contaminant levels (MCLs) under the Safe Drinking Water Act, or similar risk-based drinking water concentrations for constituents without MCLs.

Variability in the factors affecting exposure within a potentially exposed population is considered in estimating potential current and future exposures by quantifying both central tendency and high-end estimates of exposure, consistent with USEPA guidance. In the supplemental baseline risk assessment, high-end estimates are calculated using conservative (i.e., screening-level) estimates of exposure concentrations and high-end exposure factors, while the central tendency estimates are calculated using typical exposure factors. The exposure factors used in the supplemental baseline risk assessment are the same as those used in the 1996 baseline risk assessment.

Current USEPA-derived toxicity values are used when such values are available. However, many of the constituents included in the quantitative exposure assessment do not have USEPA-derived toxicity values for evaluating cancer risk or noncancer effects via the inhalation route of exposure. USEPA also has not established any toxicity values for evaluating risks or effects via the dermal route. To provide a quantitative analysis of the potential uncertainties in the estimates of risk (which use only USEPA-derived toxicity values), estimates of cancer risk and noncancer effects are developed using route-to-route extrapolations, as in the 1996 baseline risk assessment

The results of the exposure assessment and toxicity assessment are combined to estimate potential cumulative cancer risk and noncancer effects for each of the potential exposure pathways. The soil- and air-related cumulative cancer and noncancer risk estimates are compared with levels that USEPA has established as protective of human health (i.e., site-related cumulative cancer risk range of 10^{-4} to 10^{-6}, and hazard index of 1). Estimated ground water concentrations at potential points of ground water use and estimated surface water concentrations in the Great Miami River are compared with MCLs, or similar risk-based drinking water concentrations. MCLs or risk-based drinking water concentrations are appropriate for evaluating potential drinking water exposures and are conservative screening levels for evaluating potential non-drinking water exposures (e.g., nonpotable industrial ground water use, surface water exposures in the Great Miami River). For active nonpotable

industrial water supply wells where predicted constituent concentrations are higher than MCLs or risk-based drinking water concentrations, their predicted constituent concentrations are further assessed based on the actual exposure setting and water usage.

4 Conclusions

As discussed above, the 1996 baseline risk assessment concluded that constituents in soil/waste at the Delphi Thermal SWMUs do not present an unacceptable risk under reasonable maximum exposures via direct contact, airborne transport, or ground water transport. The supplemental baseline risk assessment described in this report reevaluated whether soil/waste at any of the SWMUs at Delphi Thermal pose an unacceptable risk via ground water transport. This reevaluation was performed to assess the combined effect of the SWMUs at Delphi Thermal with the AOIs at Moraine Engine and Moraine Assembly and to address USEPA's June 11, 1996 comments. It also evaluated whether soil at any of the AOIs at Moraine Engine and Moraine Assembly pose an unacceptable risk via direct contact, airborne transport, and ground water transport. Additionally, the supplemental baseline risk assessment evaluated whether constituents already in ground water at the primary source area within AOI 7 pose an unacceptable risk to current and reasonably expected future ground water uses.

The conclusions of the supplemental baseline risk assessment are as follows:

1. Constituents in soil at the Moraine Engine and Moraine Assembly AOIs do not pose an unacceptable risk via direct contact or airborne transport. Estimates of potential cumulative cancer risk and noncancer hazard index for potential exposures to constituents in soil at the AOIs via soil- and air-related pathways, assuming reasonable maximum exposures, are below levels USEPA considers protective of human health. Based on the risk estimated in the baseline risk assessment, including consideration of the risk estimates developed for the uncertainty analysis, no significant risk drivers were identified. As shown on Table 5-2, none of the high-end cancer risk estimates exceed the low end of USEPA's acceptable risk range. Even for the highest high-end risk estimates developed for the uncertainty analysis (see Table 5-5a), the only risk estimate exceeding the low end of the acceptable risk range was for AOI 34 (with a high-end risk estimate of 2×10^{-6} for the ingestion pathway); this risk estimate is principally associated with the presence of arsenic at 85 mg/kg at AOI 34.

2. Constituents in soil/waste at the SWMUs and AOIs also do not pose an unacceptable risk via ground water transport under the 10 ground water use scenarios evaluated.

- Under current ground water use conditions, without or with taking into account the current interim measures (Scenarios 1 and 6, respectively), potential leaching of constituents from soil/waste to ground water is not predicted to cause concentrations at points of ground water use to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs).

- In the event that the Miami Shores well field is used to supply water in an emergency without the need to also use the Dryden Road South well field (Scenarios 2, 3, 7, and 8), potential leaching of constituents from soil/waste to ground water is not predicted to cause concentrations at points of ground water use to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) with or without current interim measures.

- In the very unlikely event that the Miami Shores and Dryden Road South well fields are both needed to supply water in an emergency without current interim measures (Scenarios 4 and 5), potential leaching of constituents from soil/waste at the SWMUs (primarily Landfill L1 and the Waste Pile Staging Area) is predicted to cause concentrations at Dryden Road South to exceed MCLs for a few constituents. Specifically, PCE (0.01 mg/L in Scenario 4 and 0.009 mg/L in Scenario 5, compared to the MCL of 0.005 mg/L), TCE (0.02 mg/L in Scenario 4 and 0.01 mg/L in Scenario 5, compared to the MCL of 0.005 mg/L), chromium (0.2 mg/L in Scenario 4 and 0.13 mg/L in Scenario 5, compared to the MCL of 0.1 mg/L), lead (0.02 mg/L in Scenario 4, compared to the MCL of 0.015 mg/L), and nickel (0.1 mg/L in Scenario 4, compared to the Ohio MCL of 0.1 mg/L) are predicted to exceed MCLs. However, these results are expected to overstate potential reasonable maximum exposures because of the low likelihood that the Dryden Road South well field would be used. Also, the predicted effects attributed to Landfill L1 actually may be from upgradient ground water at AOI 7, and the predicted effects attributed to the Waste Pile Staging Area are not supported by on-site ground water monitoring data. In the corresponding scenarios which account for the current interim measures (Scenarios 9 and 10), potential leaching of constituents from soil/waste at the SWMUs and AOIs is not predicted to cause concentrations at points of ground water use to exceed

MCLs (or similar risk-based drinking water concentrations for constituents without MCLs).

3. Constituents in ground water at the primary source area within AOI 7 may affect ground water quality at some points of current and reasonably expected future ground water use, under the 10 ground water use scenarios evaluated.

   - The migration of constituents in ground water from AOI 7 is not predicted to cause concentrations at current drinking water supplies (i.e., the West Carrollton well field) to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) under any of the 10 ground water scenarios evaluated (with or without the current interim measures).

   - The migration of constituents in ground water from AOI 7 is not predicted to cause concentrations at the Miami Shores well field to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) if it is used as an emergency drinking water supply (with or without the current interim measures).

   - The migration of constituents in ground water from AOI 7 is not predicted to cause concentrations at the currently inactive Delphi Thermal industrial production wells to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) if they were placed into service under the pumping scenarios evaluated.

   - The migration of tetrachloroethene (PCE) and trichloroethene (TCE) in ground water from AOI 7 is predicted to cause concentrations in ground water at the Moraine Engine and Moraine Assembly industrial production wells to exceed MCLs (0.005 mg/L for both PCE and TCE) under several ground water use scenarios (including those with the current interim measures). The predicted concentrations of PCE range from approximately 0.005 mg/L to 0.04 mg/L and the predicted concentrations of TCE range from below the MCL to 0.006 mg/L. However, ground water from these production wells is currently used as nonpotable uses and the predicted bounding estimates of indoor air concentrations of PCE and TCE represent

concentrations approximately 10,000-fold below OSHA PELs to workers under current use.

- The migration of PCE and TCE in ground water from AOI 7 is predicted to cause concentrations in ground water to exceed MCLs (0.005 mg/L for both PCE and TCE) at the Dryden Road North well field under ground water use scenarios with the current interim measures and at the Dryden Road South well field for several ground water use scenarios with and without the current interim measures. The predicted concentrations of PCE range from approximately 0.007 mg/L to 0.01 mg/L and the predicted concentrations of TCE range from 0.01 mg/L to 0.02 mg/L. However, ground water use at these well fields is very unlikely, and therefore, potential exposures to these constituents from these well fields are likely overstated.

No unacceptable human exposures have been determined to be currently occurring. However, constituents in ground water at AOI 7 have been determined to have a potential to migrate to the extent that reasonably expected future uses of ground water in the lower aquifer might be affected. As such, GM is implementing an interim measure (IM) to remediate the source area contamination at AOI 7. The details of this IM are presented in a separate work plan, which was submitted to USEPA on June 24, 1999 (G&M 1999).

1.0 INTRODUCTION

1.1 Background

This second volume of the *Supplemental RFI Report* presents the supplemental baseline risk assessment for the General Motors Powertrain Group, Moraine Engine Plant (Moraine Engine) and the General Motors Truck Group, Moraine Assembly Plant (Moraine Assembly). This baseline risk assessment supplements the baseline risk assessment completed in 1996 as part of the RCRA Facility Investigation (RFI) at the Delphi Harrison Thermal Systems, Moraine Plant (Delphi Thermal), which adjoins the Moraine Engine and Moraine Assembly facilities.

The 1996 baseline risk assessment evaluated the potential risk to human health and the environment posed by releases of hazardous waste and constituents from the 14 solid waste management units (SWMUs) investigated in the RFI at Delphi Thermal, including SWMUs undergoing closure under Ohio EPA's RCRA program (i.e., the North and South Settling Lagoons). Potential exposures to constituents in soil/waste at the SWMUs via direct contact, airborne transport, and ground water transport were evaluated to determine whether soil/waste at the SWMUs warrants corrective measures and to support identification of appropriate corrective measures alternatives by determining which potential exposure pathways, if any, pose a significant risk. The conceptual site model for the 1996 baseline risk assessment established the reasonably anticipated future land uses and ground water uses at and around Delphi Thermal, the potential exposure pathways associated with constituents in soil/waste at the 14 SWMUs, and the potentially exposed populations on-site and off-site. The conceptual site model was reviewed extensively through written correspondence between USEPA and Delphi Thermal before starting the risk assessment. Several key aspects of the technical methodology (e.g., ground water modeling) and key assumptions (e.g., exposure factors) relating to the estimation of potential exposures were also reviewed with USEPA. The baseline risk assessment for the SWMUs at Delphi Thermal was submitted to USEPA in the draft *RFI Final Report, Volume II* (ENVIRON 1996).

The 1996 baseline risk assessment concluded that constituents in soil/waste at the SWMUs do not present a significant risk under reasonable maximum exposures via direct contact, airborne transport, or ground water transport. With respect to the assessment of potential risk via ground water transport, the 1996 baseline risk assessment was designed to evaluate potential threats to ground water uses posed by constituents in soil/waste which may leach into ground water at the SWMUs. It was not specifically designed to evaluate potential risk posed

by concentrations of constituents already present in ground water. This design was consistent with the objective of determining whether soil/waste at a specific SWMU warrants corrective measures. However, as suggested by USEPA's June 11, 1996 comments on the risk assessment, this design did not provide a clear approach for determining whether existing ground water conditions warrant corrective measures (including the continuation of current interim measures to address the presence of volatile organic compounds in shallow ground water at the downgradient boundary of Delphi Thermal).

GM's September 11, 1996 response to the June 11, 1996 USEPA comments reiterated the conclusions of the 1996 baseline risk assessment, which was that soil/waste at the SWMUs does not warrant corrective measures. The response acknowledged that continuation of current interim measures was appropriate since constituent concentrations in site-wide ground water were not specifically assessed in the 1996 risk assessment and, in many cases, are clearly not attributable to the SWMUs investigated in the RFI at Delphi Thermal. In response to USEPA comments on assigning ground water data to specific SWMUs, GM provided detailed explanations of the pitfalls associated with assigning constituent concentrations in ground water to a SWMU where no evidence of a causal link exists. Along with these explanations, an alternate method for assessing the potential impact on ground water from soil/waste at a SWMU was proposed. The proposed method was designed to minimize incorrect attribution of ground water impact to soil/waste at a SWMU by using soil/waste characterization data rather than ground water data (where justified) to estimate the potential for soil/waste to affect current or reasonably anticipated future ground water uses. USEPA's comments on the 1996 baseline risk assessment did not request modifications to other aspects of the risk assessment.

In a letter dated October 1, 1996, USEPA withdrew its June 11, 1996 request for a revised RFI report (including revisions to the 1996 baseline risk assessment) in light of GM's plans to prepare a supplemental RFI for Moraine Engine and Moraine Assembly. Because large parts of the two adjoining facilities are located upgradient of Delphi Thermal, one objective of the supplemental RFI was to investigate areas at Moraine Engine and Moraine Assembly that may have affected, or may continue to affect, ground water conditions at Delphi Thermal. Six such areas of interest (AOIs) were investigated in the supplemental RFI. Soil conditions at the AOIs were characterized to allow an assessment of potential exposures to constituents in soil at the AOIs via direct contact, airborne transport, and ground water transport. The supplemental RFI also included characterization of site-wide ground water conditions and an extensive characterization of ground water conditions at AOI 7 (Former Oil House Area at Moraine Engine) where initial ground water monitoring data indicated potentially significant contamination.

As discussed in the *Supplemental RFI Report, Volume I*, Sections 3.4 and 4.4, the extensive characterization of AOI 7 during the supplemental RFI found evidence that dense nonaqueous-phase liquids (DNAPL) may be present in the shallow saturated zone underlying AOI 7 above an upper clay till layer. The constituents present in the shallow ground water at AOI 7 consist primarily of tetrachloroethene, trichloroethene and their degradation products (i.e., 1,2-dichloroethene, and vinyl chloride). Because AOI 7 is upgradient of most of Moraine Engine and Delphi Thermal, the contamination in shallow ground water above the upper clay till at AOI 7 is likely a significant contributor to the presence of similar volatile organic compounds in site-wide ground water at these facilities. Furthermore, considering the composition and concentrations of volatile organic compounds in ground water at AOI 7, the contamination in ground water at AOI 7 is the primary contributor of the volatile organic compounds being addressed by the interim measures at the downgradient boundary of Delphi Thermal.

1.2 Purpose and Scope

The RFI at Delphi Thermal and the supplemental RFI at Moraine Engine and Moraine Assembly provide a comprehensive characterization of site-wide ground water conditions as well as soil/waste conditions at 14 SWMUs and six AOIs. The RFI and supplemental RFI baseline risk assessments were conducted with the primary objective of addressing the following questions:

1. Do constituents in soil/waste at any of the SWMUs at Delphi Thermal pose an unacceptable risk which warrants corrective measures[2]?

2. Do constituents in soil at any of the AOIs at Moraine Engine and Moraine Assembly pose an unacceptable risk which warrants corrective measures?

3. Do constituents in ground water at any of the SWMUs or AOIs pose an unacceptable risk which warrants corrective measures?

As discussed above, the 1996 baseline risk assessment was designed to answer the first question. It concluded that constituents in soil/waste at the SWMUs do not present an

[2] Closure of the North Settling Lagoon and South Settling Lagoon is being conducted with the Ohio EPA. Accordingly, USEPA has indicated it will not evaluate whether a corrective measures study is warranted for these SWMUs (USEPA 2000). Closure plans and ground water monitoring are discussed in Volume I of this *Supplemental RFI Report*.

unacceptable risk under reasonable maximum exposures via direct contact, airborne transport, or ground water transport.

The supplemental baseline risk assessment, as described in this volume of the *Supplemental RFI Report*, is designed to answer the second question. It evaluates potential exposures to constituents in soil at the AOIs using the same general approach and methods reviewed by USEPA in the 1996 baseline risk assessment for the SWMUs at Delphi Thermal, except in estimating ground water source concentrations. Specifically, potential exposures to constituents in soil at the AOIs via direct contact, airborne transport, and ground water transport are evaluated to determine whether soil at the AOIs warrants corrective measures. Because Moraine Engine and Moraine Assembly adjoin Delphi Thermal and the nature of operations at the three facilities is similar, the conceptual site model for the supplemental baseline risk assessment generally follows the conceptual site model used in 1996. That is, the potential exposure pathways associated with the AOIs at Moraine Engine and Moraine Assembly are evaluated under the same current and future land use and ground water use scenarios established in the 1996 baseline risk assessment.

To address USEPA comments on the 1996 baseline risk assessment, the supplemental baseline risk assessment evaluates potential exposures via ground water transport of constituents in soil/waste at both the AOIs and SWMUs using the alternate method for estimating ground water source concentrations as described in GM's September 11, 1996 response to comments. As discussed above and in the September 11, 1996 response, the alternate method was designed to minimize incorrect attribution of ground water impact to soil/waste at a SWMU or AOI by using soil/waste characterization data rather than ground water data (where justified) to estimate the potential for soil/waste to affect ground water. Potential exposures at current and reasonably expected points of ground water use are evaluated by combining potential contributions from both the AOIs at Moraine Engine and Moraine Assembly and the SWMUs at Delphi Thermal, to provide a comprehensive assessment of potential exposures to constituents in soil/waste via ground water transport.

The supplemental baseline risk assessment is also designed to answer the third question. Because site-wide ground water is primarily affected by contamination from the shallow ground water at AOI 7, the supplemental baseline risk assessment is focused on evaluation of the effects of ground water conditions at AOI 7 on site-wide ground water. Specifically, potential exposures to constituents in ground water at AOI 7 are evaluated to determine whether ground water at AOI 7 warrants corrective measures. This evaluation is done separately from the evaluation of potential exposures to constituents in soil at AOI 7, so that the need for corrective measures to address each medium at AOI 7 can be determined separately. Unlike ground water contamination across other areas of the site which cannot be

causally linked to specific SWMUs or AOIs in those areas, the ground water contamination at AOI 7 can be confidently attributed to AOI 7. Evaluation of potential exposures, if any, to existing constituents in site-wide ground water not attributable to AOI 7 will be done as part of the assessment of the effectiveness of interim measures being implemented by GM to address the AOI 7 ground water contamination. A work plan for this evaluation of the interim measures is being submitted separately to USEPA.

2.0 IDENTIFICATION OF HAZARDOUS WASTE CONSTITUENTS

In the 1996 baseline risk assessment, analytical data collected during the RFI at Delphi Thermal were evaluated to identify the hazardous constituents appropriate for quantitative human health risk assessment. This evaluation was described in Section 2 of the 1996 baseline risk assessment (ENVIRON 1996). The hazardous waste constituents in soil/waste and ground water that were identified for quantitative risk assessment were summarized in Tables 2-4a, 2-4b and 2-5 of the 1996 baseline risk assessment, respectively. These constituents are also included herein because potential exposures to constituents in soil/waste at the SWMUs via ground water transport are reevaluated in the supplemental baseline risk assessment, as discussed above in Section 1.

The analytical data collected during the supplemental RFI to characterize soil conditions at the AOIs at Moraine Engine and Moraine Assembly are evaluated in this section to identify the hazardous waste constituents appropriate for quantitative human health risk assessment. All characterization data collected during the supplemental RFI are reported in Appendix B of the *Supplemental RFI Report, Volume I*. The objectives and strategies for the collection of the supplemental RFI data are discussed in Section 2 of the *Supplemental RFI Report, Volume I*. The procedures used in the evaluation and reporting of data quality for analytical data collected during the RFI and the results of the evaluation are discussed in Appendix C of the *Supplemental RFI Report, Volume I*. Validation of the supplemental RFI data was performed by ARCADIS Geraghty & Miller in accordance with the procedures in Appendices B and D of the *Supplemental RFI Work Plan* (G&M 1997B).

Section 2.1 describes the procedures used in evaluating the usability of the validated supplemental RFI data and the basis for selecting constituents for the quantitative risk assessment. The procedures for evaluating data usability are the same as those reviewed by USEPA in the 1996 baseline risk assessment. Section 2.2 compares the soil characterization data for the AOIs with constituent concentrations in natural background soil. The background soil data collected during the RFI at Delphi Thermal are used in the comparison and the method of comparison is the same as that reviewed by USEPA in the 1996 baseline risk assessment. Section 2.3 summarizes the constituents that are included in the exposure assessment presented in Section 3 and the toxicity assessment presented in Section 4.

2.1 Data Evaluation

Evaluation of the analytical data to identify waste constituents appropriate for quantitative risk assessment follows USEPA's *Guidance for Data Useability in Risk Assessment* (USEPA 1992B) and *Risk Assessment Guidance for Superfund* (USEPA 1989A). Considerations pertinent to the evaluation of the supplemental RFI data include the following:

- Qualified Data

  Data that were qualified as estimated during data validation (i.e., J-qualified data) are included for evaluation. Data that were qualified as rejected during data validation (i.e., R-qualified data) are eliminated. Measured concentrations that were qualified as not detected during data validation (i.e., U-qualified or UJ-qualified) due to contamination in associated quality control blanks (e.g., analytical method blanks) are considered not detected to minimize the potential for false positive determinations.

- Field Duplicate Samples

  Data in duplicate samples are averaged to obtain a representative datum for the sample location. When only one datum in a duplicate pair had a detected concentration, the detected concentration is averaged with the reported sample quantitation limit (SQL) for the sample in which the analyte was not detected, and the result is considered a detected concentration to minimize the potential for false negative determinations.

- Constituents Not Detected in Any Sample

  Soil data for the AOIs are reviewed for constituents that were not detected in any sample. Constituents not detected in any soil sample are excluded from the quantitative assessment of risks associated with soil in the AOIs.

- AOI 17 Field Screening Data

  Field screening data collected at AOI 17 (Building 15) showed that the total concentration of all volatile organic compounds in soil was below a 1 mg/kg screening criterion and no polychlorinated biphenyls (PCBs) were detected above the USEPA action level of 10 to 25 mg/kg (G&M 1998). Based on these results, no significant release of hazardous constituents was evident that warranted collection of samples for laboratory analysis and, in accordance with the *Supplemental RFI Work Plan,* no soil samples for laboratory analysis were required to be collected at AOI 17. As such, AOI 17 is not included in the supplemental baseline risk assessment and constituents

detected in the field screening data are not included in the identification of constituents for quantitative risk assessment.

2.2 Background Levels in Soil

This section discusses the comparison of constituent concentrations in soil samples from the AOIs with naturally occurring concentrations that represent background levels of exposure. Discussion of the supplemental RFI ground water quality data with respect to background ground water quality and potential upgradient sources is presented in Section 4 of the *Supplemental RFI Report, Volume I.*

Samples of background soil were collected during the RFI for Delphi Thermal to assess naturally occurring levels of inorganic constituents (i.e., metals and cyanide) in soil at Delphi Thermal. Because Moraine Engine and Moraine Assembly adjoin Delphi Thermal and the geology at all three facilities is similar, the background soil samples collected during the RFI at Delphi Thermal are appropriate for comparison with the soil samples from the AOIs at Moraine Engine and Moraine Assembly. The background soil samples were collected from 12 soil borings in an area of Delphi Thermal where no waste management activities are known to have occurred. Surface (0 to 2 feet) and subsurface (14 to 16 feet) soil samples were taken from each boring. The collection of these samples was discussed in Section 4.4.1 of the draft *RFI Final Report, Volume I* (G&M 1996) and the results were reported in Appendices A and D of the draft *RFI Final Report, Volume I.*

For evaluating background exposure to inorganic constituents in soil at Moraine Engine and Moraine Assembly, the results of surface background soil samples, rather than the subsurface samples, are used to estimate the background levels of inorganic constituents. Concentrations of inorganic constituents in surface soil are representative of background exposures, since contact with subsurface soil (e.g., soil at 14 to 16 feet below ground surface) would be expected only during major excavations, which would occur, if at all, rarely and for short durations.

The comparison of inorganic constituent concentrations in investigative soil samples with background levels is conducted using one-sided 99% upper prediction limits, consistent with the *RFI Work Plan* (G&M 1992). A 99% upper prediction limit (UPL) for a specific constituent is a statistical limit that is higher than a future measurement of background concentration with a 99% level of confidence (USEPA 1989C, Hahn and Meeker 1991). Concentrations of the inorganic constituent in investigative soil samples from an AOI that are lower than the 99% UPL for the constituent are considered to be within background levels; concentrations higher than the 99% UPL are considered to be above background levels.

The 99% UPL for a constituent is calculated from the surface background concentrations of the constituent. When calculation of the 99% UPL includes a nondetected measurement, the SQL for the measurement is used. Because the concentrations of inorganic constituents in natural background soil and in contaminated soil are often lognormally distributed, the 99% UPLs are calculated using natural-log-transformed data (USEPA 1992D). The calculated 99% UPLs reviewed by USEPA in the 1996 baseline risk assessment are presented in Table 2-1, along with the maximum concentrations measured in soil samples at each AOI.

A 99% UPL was not calculated for antimony, cyanide, mercury, and thallium for the reasons explained in the 1996 baseline risk assessment. These reasons were as follows:

- Antimony was not detected in the seven valid surface background samples, with SQLs ranging from 7.1 mg/kg to 8.7 mg/kg. The maximum concentration of antimony detected in the subsurface background soil was an estimated 52.8 mg/kg. A background level for antimony is not included in Table 2-1.

- Cyanide was detected in only one of six valid surface background samples at an estimated concentration of 0.4 mg/kg. It was not detected in the six subsurface background samples. The detected concentration of 0.4 mg/kg is used to represent the background level of cyanide in Table 2-1.

- Mercury was detected in only one of the 12 valid surface background samples at a concentration of 0.69 mg/kg. It was not detected in the 12 subsurface background samples. The detected concentration of 0.69 mg/kg is used to represent the background level of mercury in Table 2-1.

- Thallium was not detected in any of the 12 valid surface background samples, with SQLs ranging from 0.44 mg/kg to 0.51 mg/kg. It was detected in one of the 12 subsurface background samples at an estimated concentration of 2.3 mg/kg. A background level of thallium is not included in Table 2-1.

As shown in Table 2-1, in one AOI (AOI 13 - Buildings 4, 6, and 13) all of the detected inorganic concentrations were below background levels. At the remaining AOIs, only arsenic, thallium and/or zinc were detected at concentrations above the background levels; all other inorganics detected at these AOIs were below background levels.

All inorganic constituents are included in the supplemental baseline risk assessment, but the contribution by natural background levels to risk estimates developed in the supplemental baseline risk assessment is evaluated in Section 5.4.2.

2.3 Summary of Constituents Included in Quantitative Assessment

The hazardous waste constituents in surface and subsurface soil at the Moraine Engine and Moraine Assembly AOIs that are evaluated in the quantitative risk assessment are summarized in Table 2-2. Constituents identified in ground water monitoring data collected during the supplemental RFI at Delphi Thermal, Moraine Engine, and Moraine Assembly are summarized in Table 2-3. The summary tables include the following information for each constituent:

- Number of valid sample results
- Number of detections
- Minimum detected concentration (mg/kg or mg/L)
- Maximum detected concentration (mg/kg or mg/L)
- Minimum SQL for nondetected measurements (mg/kg or mg/L)
- Maximum SQL for nondetected measurements (mg/kg or mg/L)

The list of constituents evaluated in the supplemental baseline risk assessment, including the list identified in the 1996 baseline risk assessment for the SWMUs at Delphi Thermal, is shown in Table 2-4.

3.0 EXPOSURE ASSESSMENT

The purpose of the exposure assessment is to estimate the type and magnitude of potential exposures to releases of hazardous constituents from the SWMUs investigated in the RFI at Delphi Thermal and from the AOIs investigated in the supplemental RFI at Moraine Engine and Moraine Assembly. In the 1996 baseline risk assessment, potential exposures to constituents in soil/waste at the SWMUs via direct contact, airborne transport, and ground water transport were evaluated. In this supplemental baseline risk assessment, potential exposures to constituents in soil at the AOIs are evaluated using the same general approach and methods reviewed by USEPA in the 1996 baseline risk assessment for the SWMUs at Delphi Thermal, except in estimating ground water source concentrations.

USEPA's June 11, 1996 comments on the baseline risk assessment expressed concerns with the method used for estimating potential exposures via ground water transport of constituents in soil/waste from the SWMUs to points of potential ground water use. Specifically, USEPA was concerned with the method used in estimating the ground water source concentrations at some SWMUs as described in Section 3.3.3.3 of the 1996 baseline risk assessment. USEPA's comments on the 1996 baseline risk assessment did not request modifications to other aspects of the exposure assessment.

In its September 11, 1996 response to USEPA's comments, GM proposed an alternate method for estimating ground water source concentrations at the SWMUs. As explained in the September 11, 1996 response, the alternate method was designed to minimize incorrect attribution of ground water impact to soil/waste at a SWMU by using soil/waste characterization data rather than ground water characterization data (where justified) to estimate the potential for soil/waste to affect ground water. To address USEPA's comments on the 1996 baseline risk assessment, potential exposures to constituents in soil/waste at the Delphi Thermal SWMUs via ground water transport are reevaluated in this supplemental baseline risk assessment using the alternate method, as discussed in Section 3.3.3.3 below. Potential exposures to constituents in soil at the Moraine Engine and Moraine Assembly AOIs via ground water transport are also evaluated using the same alternate method. Potential exposures at current and reasonably expected points of ground water use are then evaluated by combining potential contributions from both the AOIs at Moraine Engine and Moraine Assembly and the SWMUs at Delphi Thermal.

The exposure assessment in the supplemental baseline risk assessment is discussed below in the same format as that in the 1996 baseline risk assessment. The discussion is organized into three parts, which are presented in the following sections:

3.1 Characterization of Exposure Setting
3.2 Identification of Potential Exposure Pathways
3.3 Quantification of Potential Exposures

Because the exposure assessment discussed below in this supplemental baseline risk assessment uses the same conceptual site model and many of the same methods for estimating potential exposures as those in the 1996 baseline risk assessment, much of the discussion in these sections is the same as that reviewed by USEPA in the 1996 baseline risk assessment.

3.1 Characterization of Exposure Setting

The exposure setting is characterized with respect to (1) the general physical characteristics of Delphi Thermal, Moraine Engine, and Moraine Assembly and their surroundings and (2) the characteristics of the populations at and near these facilities. Section 3.1.1 summarizes briefly the types of information on the physical setting at these facilities that has been previously presented to USEPA.

The locations and types of potentially exposed human populations are characterized with respect to current and reasonably anticipated future land use and ground water use at and surrounding the facilities, in the following sections:

3.1.2 Land Use
3.1.3 Ground Water Use

A summary of the characteristics of the potentially exposed populations is included at the end of each of these two sections.

3.1.1 Physical Setting

Characterization of the physical setting has been presented in Section 2 of the *Description of Current Conditions* (*DOCC*) report prepared by ARCADIS Geraghty & Miller (G&M 1991) and submitted to USEPA in 1991 and in Section 2 of the *Supplemental DOCC* report prepared by ARCADIS Geraghty & Miller (G&M 1997A) and submitted to USEPA in 1997. Section 2 of the *DOCC* report (entitled Site Characterization) and *Supplemental DOCC* report provided the following site information:

- Location
- Description of facility ownership and operations
- Topography
- Climate
- Surficial soils
- Surface water and drainage features
- Hydrogeology

3.1.2 Land Use

In the 1996 baseline risk assessment, information on historical and current land use at and around Delphi Thermal were combined with considerations of local land use development patterns to establish reasonably anticipated future land use at Delphi Thermal. In particular, the likelihood of future residential and recreational land use at Delphi Thermal was evaluated. This evaluation was conducted according to USEPA guidance (55 FR 8666, March 8, 1990, p. 8710) which states that "the assumption of future residential land use is not a requirement" and "may not be justifiable if the probability that the site will support residential use in the future is small." USEPA guidance (1992B, 1991B) further states that "sites that are surrounded by operating industrial facilities can be assumed to remain as industrial areas unless there is an indication that this assumption is not appropriate."

Accordingly, a comprehensive review of information pertinent to future land use patterns surrounding Delphi Thermal was conducted in the 1996 baseline risk assessment to evaluate the appropriateness of assuming continued industrial land use at Delphi Thermal. The evaluation considered the sources and types of information identified in USEPA guidance (USEPA 1995D). The following were the primary sources of information consulted:

- Comprehensive Plan for the City of Moraine
- City of Moraine Zoning Ordinance
- Official Zoning Map for the City of Moraine
- City Planner of Moraine

Although Delphi Thermal is not located within the City of West Carrollton, the following information sources for the City of West Carrollton, which borders the City of Moraine to the south of Delphi Thermal, were also consulted:

- Comprehensive Plan for the City of West Carrollton
- Official Zoning Map for the City of West Carrollton
- Wellhead Protection Plan for the City of West Carrollton
- City Planner of West Carrollton

The evaluation of information from these sources in the 1996 baseline risk assessment, although primarily focused on land use at Delphi Thermal, is also appropriate to determination of reasonably anticipated future land use at Moraine Engine and Moraine Assembly, because the three facilities are contiguous in the City of Moraine and have similar histories and operations. However, because a small part of the Moraine Assembly property is located in the City of Kettering, which borders the City of Moraine to the east, the following additional sources of information were consulted in the supplemental baseline risk assessment:

- City of Kettering Zoning Ordinance
- Official Zoning Map for the City of Kettering
- Kettering Demographic Trends Report
- City Planner of Kettering

The discussion of land use at Moraine Engine and Moraine Assembly in the following subsections is based on the information evaluated in the 1996 baseline risk assessment and supplemental information on land use in the City of Kettering. Because the primary sources of information relevant to land use at Moraine Engine and Moraine Assembly are the same as those relevant to land use at Delphi Thermal, the discussion in the following subsections is largely the same as that reviewed by USEPA in the 1996 baseline risk assessment. The discussion is organized following the outline of the types of information identified in USEPA guidance (USEPA 1995D), as follows:

3.1.2.1 Historical and Current Land Use

- Current land use
- Zoning maps
- Historical and recent development patterns
- Site location in relation to urban, residential, commercial, industrial, agricultural, and recreational areas

3.1.2.2 Zoning and Future Land Use Plans

- Zoning laws
- Comprehensive community master plans

3.1.2.3 Likelihood of Future Residential Use

- Population growth patterns and projections
- Accessibility of site to existing infrastructure

3.1.2.4 Other Information Potentially Related to Land Use

- Federal/State land use designation
- Cultural factors
- Natural resources information
- Location of wellhead protection areas
- Environmental justice issues
- Location of on-site or nearby wetlands
- Proximity of site to a floodplain
- Proximity of site to critical habitats of endangered or threatened species
- Geologic and hydrogeologic information

3.1.2.1 Historical and Current Land Use

The Moraine Engine and Moraine Assembly facilities are located in an area of the City of Moraine (Moraine) that historically has been and currently is developed largely for industrial and commercial uses. The part of Moraine in which the facilities are located is called "Subarea A" in the *Comprehensive Plan for Moraine, Ohio, 1995-2015* (the Moraine Plan, BWSC 1994). Approximately 70%, or about 1,200 acres, of the land in Subarea A is currently under industrial use. Moraine Engine and Moraine Assembly together occupy approximately 300 acres of this area (Figure 3-1, Study Area Map for Moraine).

The land occupied by the facilities has been under industrial use since 1916 and has been under GM ownership since the mid-1920s. Through the approximately 70 years of continuous operation, GM has modernized, modified, and expanded the operations at these facilities. For example, several additions were made to the manufacturing buildings at Moraine Assembly during the early 1990s, including construction of a new paint building in 1993 for production of a redesigned utility vehicle. Currently, modifications and expansions of manufacturing operations are taking place at both Moraine Engine and Moraine Assembly. As a result, GM has established a strong and consistent presence in Moraine, despite widespread changes

in the automobile industry. GM expects that the current operations or similar operations will continue at this location.

Land use surrounding Moraine Engine and Moraine Assembly in Subarea A, as shown on the Official Zoning Map of the City of Moraine (Figure 3-2), is almost entirely industrial and commercial, with only a few small areas of residential use. This is in contrast to other parts of Moraine which have more varied land use. Bordering Subarea A to the south, as shown on the Official Zoning District Map for West Carrollton (Figure 3-3), the land adjoining Moraine is solely in manufacturing and commercial use and, as such, separates the industrialized Subarea A of Moraine from residential land use further south in West Carrollton. Bordering Subarea A to the east, as shown on the Official Zoning Map for the City of Kettering (Figure 3-4), the land adjoining Moraine is largely in commercial and general business use and, as such, separates the industrialized Subarea A of Moraine from the western portion of Kettering which includes industrial, general business, as well as residential land use.

According to the Moraine Plan, the inventory of residential and industrial/commercial land use in Moraine between 1967 and 1993 was as follows:

Inventory of Residential and Industrial/Commercial Land Use
City of Moraine, Ohio

Land Use Classification	Acreage		% of Developed Area		% of Total Area	
	1967	1993	1967	1993	1967	1993
Total Residential	641	862	19.5	22.0	13.2	14.6
Total Industrial/Commercial	1,227	1,506	37.4	40.5	23.5	25.5

Adapted from BWSC 1994.

Of the 1967 and 1993 inventory of total industrial/commercial acreage, 93% and 83%, respectively, were classified as industrial (as opposed to commercial). Overall, the mix of residential and industrial/commercial land use in Moraine since 1967 has changed little. In terms of the percentage of developed area and the percentage of total area, industrial/commercial growth has actually out paced residential growth slightly during the 26-year period.

3.1.2.2 Zoning and Future Land Use Plans

The City of Moraine recently adopted the Moraine Plan as a guide for long-range, future land use planning, following a comprehensive planning process which involved 20 public meetings and interviews with 20 key stakeholders from both public and private sectors in the Moraine area. The Moraine Plan sets forth the goals and

policies developed during the planning process. Although it does not change any existing zoning, the Moraine Plan recommends amendments to the Moraine Zoning Ordinance that would require the ordinance itself and any amendments to the ordinance to be consistent with the Moraine Plan.

For Subarea A, where the Moraine Engine and Moraine Assembly facilities are located, the Moraine Plan aims to maintain existing industries and businesses while expanding commercial/industrial development to promote new business growth. The goal of enhancing industrial/commercial growth in Subarea A, and elsewhere in Moraine, is consistent not only with Moraine's history of maintaining a favorable business environment but also with the importance of business growth to Moraine. During the 1980s, Moraine experienced a 24% increase in employment while the Dayton Economic Trade Area (ETA), which includes seven other neighboring cities, experienced only a 5% increase. The ratio of workers to residents in Moraine was approximately 2.8 in 1990, which is about 4 to 13 times higher than the ratio for the other cities in the Dayton ETA.

Because Subarea A is already heavily developed for industrial and commercial use, the primary strategy for promoting further economic growth is redevelopment of underutilized properties. Such redevelopment may include industrial redevelopment of selected residential neighborhoods (including a mobile home park west of the Delphi Thermal facility) and construction of new commercial strips to service existing businesses and industries in the area. Consistent with the goals for Subarea A, the Moraine Plan envisions no expansion of residential land use in Subarea A. Potential residential growth in Moraine is planned for Subareas B and C, which are several miles west of the facilities.

Like the Moraine Plan, the *Comprehensive Plan for West Carrollton, Ohio 2010* (West Carrollton Plan, West Carrollton 1994) does not dictate regulatory measures, but rather, provides general policy, guidelines, and recommendations for zoning changes. For example, the West Carrollton Plan includes implementation plans for updating certain zoning codes, regulations, and ordinances to be consistent with the West Carrollton Plan. The City of Kettering does not have a comprehensive plan similar to those for the City of Moraine or the City of West Carrollton, but according to the City Planner (Aidt 1998), approximately 90% of the land in Kettering is already developed and no major changes in zoning districts is anticipated.

3.1.2.3 Likelihood of Future Residential Use

The likelihood of future residential land use at Moraine Engine and Moraine Assembly is discussed below in terms of the importance of the facilities to the local economy, the suitability of the area for residential development, and historical and predicted population trends in the area.

- Importance to the Local Economy

  The Moraine Engine and Moraine Assembly facilities are not only an important part of GM's operations but also represent a large part of Moraine's job base. They are major employers in Moraine, employing over 4,500 people, or approximately 30% of the city's workforce. GM expects that the current operations or similar operations will continue at the facilities and remain an important part of the business community in Moraine and the surrounding area. However, in the event that GM should cease its operations at Moraine Engine and Moraine Assembly, the Moraine Plan's goal for economic growth in Subarea A suggests that substantial community support would be forthcoming for maintaining a similar job base for skilled workers at this location.

- Suitability for Residential Development

  There are several features on or near the Moraine Engine and Moraine Assembly facilities that are incompatible with potential residential development, in the unlikely event that the facilities were to cease operations. First, the facilities are located near three landfills (Landfills L1, L2, and L3) and two RCRA surface impoundments (North Settling Lagoon and South Settling Lagoon) at the adjoining Delphi Thermal facility which would make these locations unattractive for potential residential development. Second, the facilities border a major north/south Conrail freight line, which would also tend to hinder potential residential development because of potential concerns with noise and safety. Conversely, the facilities' proximity to the Conrail line and Interstate-75 makes their locations ideal for commerce and continued industrial use. Third, the facilities are in the flight path of the Montgomery County Airport located just west of the Great Miami River, which would likewise present noise and safety issues to potential residential development. Fourth, the Moraine Plan establishes a policy that "buffers should be provided when a proposed development could result in a land use

conflict with adjacent activities," such as buffering between manufacturing or commercial uses and adjacent residential areas. Because the facilities are virtually surrounded by industrial and commercial development and major transportation arteries, the required buffer areas would significantly limit any land area at the facilities that would remain available for new residential development. Finally, no zoning changes to allow residential land use are foreseen in the area of the City of Kettering that borders the facilities.

- Historical and Predicted Population Trends

  Trends in Moraine's population indicate that the probability of future residential land use at the facilities is small. Between 1970 and 1990, Moraine experienced a slight decrease in population density from 1.4 to 1.3 persons per acre (BWSC 1994). Although Moraine's population increased 23% during this period, it was the result of Moraine's annexation of property in what is now called Subareas B and C (rather than Subarea A) which increased the total land area by 28%. Therefore, for the 20-year period, Moraine experienced no real population growth. According to the Moraine Plan, the absence of real growth can be attributed to several factors, including current land uses not conducive to residential growth (e.g., Pinnacle Road landfill in Subarea B, sludge pits, etc.) and a lack of efficient access to potential residential areas in Subarea C (BWSC 1994).

  As a result of these and other factors, projected population densities and growth rates are similarly low. In fact, the population density is projected to remain virtually unchanged from 1.3 persons per acre in 1990 to 1.4 persons per acre in 2015. Moraine's population growth rate is projected to be only 0.5% per year through the year 2000, and is optimistically assumed to increase to an average rate of 2.2% per year from year 2000 to 2015. Residential growth, if any actually occurs, is planned for Subareas B and C, rather than for Subarea A where the Moraine Engine and Moraine Assembly facilities are located. The Moraine Plan states that "it is unlikely that the population projections from 2000 to 2015 will be attained because Moraine has no school district, and children from Moraine currently attend school in three other school districts" (BWSC 1994). Furthermore, the Moraine Plan contains no specific provisions or recommendations for creating a school district. Future residential growth could also be limited if construction of the

proposed Route 892 through Subarea C is delayed, since the proposed highway is necessary to access residential developments in that area.

The residential population of West Carrollton is growing at a much slower rate than in previous decades (22% between 1970 and 1980 versus 10% between 1980 and 1990). Much of this growth has occurred in the southern portion of West Carrollton away from the City of Moraine. Because there are very few vacant sites suitable for residential development, the number of housing units added each decade is predicted to be very small. Instead, the West Carrollton Plan proposes annexation of additional land from unincorporated townships to West Carrollton as the most practical method to increase housing stock. Property maintenance efforts are also suggested as a way to maintain housing stock.

The residential population of Kettering has been stable after experiencing rapid growth between 1960 and 1970 and a decline between 1970 and 1980, according to the Kettering Demographic Trends Report (KPDD 1990). Because approximately 90% of the land in the City of Kettering is already developed and zoning districts are not expected to change significantly in the future, significant changes in size of the city's population or distribution of the population are not expected.

- Potential Future Recreational Use

The probability of future recreational land use on any portion of the Moraine Engine and Moraine Assembly facilities is small for two reasons. First, most of Moraine in Subarea A is adequately served by existing parks and any future recreational facilities needed to accommodate potential residential growth in Subareas B and C are planned for Subarea B (BWSC 1994). Hence, Moraine projects no need for recreational areas at or near Moraine Engine and Moraine Assembly. Second, the highly industrial character of the land surrounding the facilities and the proximity to Interstate-75 make the locations unattractive for recreational areas. For these reasons, the City Planner of Moraine considers it highly unlikely that this area would be developed for recreational use (Watson 1995). Further, no zoning changes are foreseen in the area of the City of Kettering that borders the facilities to allow development of recreational areas (Aidt 1998).

3.1.2.4 Other Information Potentially Related to Land Use

The following sources and types of information are considered not to be pertinent to the determination of future land use at the Moraine Engine and Moraine Assembly facilities.

- Federal/State land use designation
  Based on review of the zoning maps for Moraine, Kettering, and West Carrollton, the Moraine Engine and Moraine Assembly facilities are not located on or near land controlled by the Federal or State government.

- Cultural factors
  Based on review of the Moraine Plan, the City of Kettering Zoning Ordinance, and the West Carrollton Plan, the Moraine Engine and Moraine Assembly facilities do not appear to be located near historical or Native American religious sites.

- Natural resources information
  The Moraine Plan and West Carrollton Plan do not identify any specific natural resources, as defined in CERCLA Section 101, at or near the Moraine Engine and Moraine Assembly facilities. Ground water and drinking water supplies are discussed in Section 3.1.3.

- Location of wellhead protection areas
  Section 1428 of the Safe Drinking Water Act requires each State to develop a State program to protect wellhead areas within its jurisdiction from contaminants that may adversely affect human health. Ohio has developed an Ohio Wellhead Protection Program (OEPA 1992, 1994), which requires owners/operators of public water supplies that are derived from ground water to develop and implement local wellhead protection plans. The Ohio Wellhead Protection Program requires a local wellhead protection plan to include (1) a wellhead protection area delineated by ground water time-of-travel, (2) an inventory of potential pollution sources, and (3) a strategy for managing the wellhead protection area to prevent adverse impacts to water supply wells. Management options for wellhead protection areas may include the control of land use, although the Ohio Wellhead Protection Program does

not specify any particular activities that are prohibited in wellhead protection areas.

The City of Moraine has established regulations on land use within a "WP" Well Field Protection Overlay District to protect public water supplies located in Moraine (Moraine Zoning Code Section 1129.12). The Well Field Protection Overlay District includes existing public water supply wells and their 1-year ground water capture area. As shown on the Official Zoning Map of the City of Moraine (Figure 3-2), the Moraine Engine and Moraine Assembly facilities are not located within the Well Field Protection Overlay. As such, ground water protection regulations governing the use (storage, handling, and use/production) of chemicals within the wellhead protection area are not applicable to the Moraine Engine and Moraine Assembly facilities. Even if the facilities were located within the Well Field Protection Overlay District, the regulations governing chemical use allow existing "nonconforming" uses to continue to run with the land.

The nearest public water supply wells in use downgradient of the Moraine Engine and Moraine Assembly facilities are those in the City of West Carrollton. The City of West Carrollton's Wellhead Protection Plan (CH2M Hill 1993) includes wellhead protection areas delineated by 1-year, 5-year, and 10-year ground water times-of-travel. The Moraine Engine and Moraine Assembly facilities are not located within any of these wellhead protection areas.

- Environmental justice issues

According to the Moraine Plan, the West Carrollton Plan, and the Kettering Demographic Trends Report, the "white" populations of these cities in 1990 were at least 95% of the total, 12% higher than the average for the region (i.e., the Dayton Economic Trade Area), and 10% higher than the average for Ohio. The percentages of families below the poverty level were approximately 11% for Moraine, 5% for West Carrollton, and 4% for Kettering. For comparison, approximately 10% of families in Ohio were below the poverty level. The information sources provide no information on the geographic distribution of minority or low-income communities within these cities. The City Planners of Moraine and West Carrollton provided no information that indicates the existence of environmental justice issues near

the Moraine Engine and Moraine Assembly facilities (Humphries 1995; Watson 1995).

- Location of on-site or nearby wetlands

  The AOIs at the Moraine Engine and Moraine Assembly facilities are not located near any wetlands. The facilities are located over one-half mile from a strip of land bordering the Great Miami River that extends north from Sellars Road for approximately 1.3 miles. This strip of land contains several small ponds and is divided into different lots, which are owned by the Miami Conservancy District, Montgomery County, and private industries.

- Proximity of site to a floodplain

  The Moraine Engine and Moraine Assembly facilities are not located in a 100-year floodplain. The Flood Insurance Rate Map for Moraine shows the area that would be affected by a 100-year flood and the proximity of the area to the facilities (Figure 2-2 of the *Supplemental DOCC* report).

- Proximity of site to critical habitats of endangered or threatened species

  The Ohio Department of Natural Resources, Division of Natural Areas and Preserves, which maintains records on rare and endangered species, and high-quality plant species, has stated that it has no records of rare and endangered species in the area around the Moraine Engine and Moraine Assembly facilities (ODNR 1993).

- Geologic and hydrogeologic information

  A detailed description of the geology and hydrogeology at and surrounding the Moraine Engine and Moraine Assembly facilities is provided in Sections 2.3.3 and 2.3.5 of the *DOCC* report, as supplemented by information provided in Section 2.5 of the *Supplemental DOCC* report. There are no known geologic features (e.g., seismic features) at or near the Moraine Engine and Moraine Assembly facilities that would be pertinent to the determination of future land use at the facilities.

3.1.2.5 Summary of Potentially Exposed Populations

In the 1996 baseline risk assessment, the assumption of continued industrial land use at Delphi Thermal was determined to be appropriate based on a comprehensive review of information pertinent to future land use at and around the facility. Because Moraine Engine and Moraine Assembly are contiguous with Delphi Thermal and have similar histories and operations, the assumption of continued industrial land use at these facilities is appropriate for the same reasons enumerated in the 1996 baseline risk assessment. Specifically, given the long history of industrial land use at the facilities, GM's plans for continuing operations, the City of Moraine's plans for enhancing industrial/commercial development around the facilities, the local economic importance of the facilities, and the unsuitability of the facilities' location for potential residential development, the probability is small that land use at this location will become residential. The limited population growth expected in the future and Moraine's plans to direct the potential growth to parts of the city away from the facilities and surrounding industrial/commercial development further underscore the small probability of future residential or recreational land use at this location. The supplemental information regarding land use in the City of Kettering reviewed in this supplemental baseline risk assessment also support the determination that an assumption of continued industrial land use is appropriate for both Moraine Engine and Moraine Assembly.

Therefore, the potential for exposure to constituents in soil at the AOIs at Moraine Engine and Moraine Assembly is evaluated in the supplemental baseline risk assessment for the following current and reasonably anticipated future land uses:

- Industrial land use at Moraine Engine and Moraine Assembly; and
- Industrial/commercial, residential, and recreational land uses surrounding the facilities.

The potentially exposed populations under these land uses are as follows:

- On-facility and off-facility workers

  The vast majority of workers at Moraine Engine and Moraine Assembly are employed in manufacturing functions which take place within manufacturing buildings. These workers rarely, if ever, perform job functions that would bring them into contact with the AOIs. Routine incidental contact with outdoor areas at the facilities may occur during lunch, breaks, and walks to

and from parking lots. The extent of such outdoor activities is expected to vary seasonally. A small number of the facilities' workers, however, may have more intensive contact with the AOIs through occasional excavation activities (e.g., replacing pavement, maintenance of underground utilities).

Based on the similarity of industrial and commercial land use surrounding Moraine Engine and Moraine Assembly, workers at neighboring facilities are expected to have activity patterns similar to those for the majority of the workers at Moraine Engine and Moraine Assembly. That is, the majority of these workers are expected to work mostly indoors and spend little of their work day outdoors.

- Off-facility residents

  The nearest residents to Moraine Engine and Moraine Assembly are in the few single family and multiple family residential areas east, south, and southeast of the facilities that are beyond the adjacent industrial and commercial areas. Trespassing by residents onto Moraine Engine and Moraine Assembly is expected to be unlikely because public access to these facilities is controlled by perimeter fencing and guards.

3.1.3 Ground Water Use

Ground water underlying the Moraine Engine and Moraine Assembly facilities is found primarily in two aquifers, as described in Section 2.3.5 of the *DOCC* report and Section 2.5 of the *Supplemental DOCC* report. A shallow water-table aquifer (upper aquifer) underlies the facilities and is largely separated by an aquitard from a deeper semi-confined aquifer (lower aquifer). As discussed in the 1996 baseline risk assessment for the adjacent Delphi Thermal facility, the determination of whether a potential exists for exposure to ground water in the upper and lower aquifers was based on consideration of actual and reasonably expected uses of the ground water. Factors considered in the determination made in the 1996 baseline risk assessment include those described in *EPA's Ground-Water Protection Principles* (USEPA 1991C), *Ground-Water Protection Strategy* (USEPA 1984), and *Guidelines for Ground-Water Classification under the EPA Ground-Water Protection Strategy* (USEPA 1986). Also considered were the criteria set forth in Section 3746.04(10) of enacted Ohio Senate Bill 221, which directs Ohio EPA to establish a State of Ohio classification system for characterizing ground water according to its capability to support human use. The specific factors considered in the 1996 baseline risk assessment include the following:

- Regional availability of alternative sources of drinking water;
- Historical and existing uses of ground water;
- Productivity of the aquifers;
- Quality and treatability of the ground water;
- Local laws governing ground water use; and
- Degree of interconnection between the aquifers.

3.1.3.1 Lower Aquifer

The lower aquifer in the vicinity of the Moraine Engine and Moraine Assembly facilities was historically used as a municipal drinking water supply. The Greater Moraine Water System (GMWS) of Montgomery County has four well fields that, until late 1986, withdrew ground water from the lower aquifer to serve the cities of Moraine, Kettering, and Centerville. The well fields are located at Lamme Road, Dryden Road North, Dryden Road South, and Miami Shores. The GMWS service area is shown in Figure 3-5 (Water Infrastructure for Moraine). The capacity of the GMWS well fields while they were active, in million gallons per day (MGD), was as follows:

- Lamme Road 8 MGD
- Dryden Road (North and South) 13 MGD
- Miami Shores 26 MGD

The combined average water pumpage from these well fields in 1981 was about 20 MGD (CH2M Hill 1982). In 1981, the average water quality from the four GMWS well fields was:

- Total hardness 400 mg/L as $CaCO_3$
- Iron 0.3 mg/L as Fe
- Manganese 0.1 mg/L as Mn

Ground water from the Miami Shores wells has levels of iron as high as 0.7 mg/L and manganese as high as 0.3 mg/L (CH2M Hill 1982). Ohio secondary maximum contaminant levels (SMCLs) for iron and manganese are 0.3 mg/L and 0.05 mg/L, respectively (OAC Chapter 3745-82).

Faced with the need to construct treatment capacity to reduce the natural hardness, iron, and manganese content of the water provided to its customers who were unhappy with the water quality, Montgomery County conducted a feasibility study (CH2M Hill 1982) of alternatives for supplying drinking water to its customers. The alternative determined to be the most cost-effective and practical for meeting the water quantity and water quality demands of the GMWS customers was use of treated water produced by the Dayton Water System (DWS). For comparison with the water produced by the GMWS well fields, the average water quality in 1981 from the DWS was:

- Total hardness — 145 mg/L as $CaCO_3$
- Iron — < 0.03 mg/L as Fe
- Manganese — < 0.002 mg/L as Mn

Through a February 1983 Agreement between the City of Dayton and the Board of County Commissioners of Montgomery County, the DWS became the source of water to the GMWS. The City of Dayton and Montgomery County developed water production, treatment, and delivery capacity in the DWS to ensure delivery of 52 MGD of treated water to the GMWS to meet forecasted average-day demand of 26 MGD and maximum-day demand of 42 MGD to the year 2000 (CH2M Hill 1982). During late 1986, customers of the GMWS began obtaining drinking water produced by the City of Dayton.

Since 1986, the GMWS well fields have been used twice to supplement the water supply from the DWS during peak demand periods in the unusually dry summers of 1987 and 1988. Of the well fields located downgradient of the Facility (i.e., Dryden Road North, Dryden Road South, and Miami Shores), the Dryden Road South and Miami Shores well fields were pumped intermittently at an average rate of approximately 2 MGD each during May to August, 1987. During June to September, 1988, the Miami Shores well field was pumped continuously at an average rate of approximately 10 MGD. More recently, the capacity of the DWS has been increased to ensure delivery of approximately 74 MGD of treated water to the GMWS to meet forecasted demand to the year 2005 (Merrill 1995). Since 1988, the GMWS well fields have not been used to supplement the water supply from the DWS. With the increased delivery capacity of the DWS, future use of the GMWS well fields to supplement the DWS supply of drinking water is expected to be even more infrequent than in the past, but some future use to supply water in emergencies is possible.

In case ground water from the GMWS well fields is needed in an emergency, Montgomery County plans to use the Miami Shores well field as the primary emergency supply, as it did in 1988, since it is capable of fulfilling by itself the average total water demand in the GMWS. As such, use of Miami Shores as the primary emergency water supply is expected to meet any likely emergency water demand. In the rare event of an emergency in which the use of Miami Shores is insufficient to meet demand, Montgomery County would institute voluntary and/or mandatory water use restrictions to reduce demand to a level that could be met by Miami Shores. If water use restrictions were unsuccessful, Montgomery County might consider using Dryden Road South as a secondary emergency water supply. The need to use Dryden Road North to supplement both Miami Shores and Dryden Road South in an emergency is expected to be very unlikely (Westerfield 1995).

Approximately 2 miles south of the Moraine Engine and Moraine Assembly facilities is the nearest downgradient, active municipal well field, which is the City of West Carrollton's water supply. West Carrollton operates three wells with a total capacity of approximately 3.6 million gallons per day (MGD). According to West Carrollton's Wellhead Protection Plan (CH2M Hill 1993), the Moraine Engine and Moraine Assembly facilities are not located within any of West Carrollton's wellhead protection areas, which include areas delineated by 1-year, 5-year, and 10-year ground water times-of-travel. Based on monthly Drinking Water Operation Reports for 1994, monthly pumpage in 1994 ranged from 0.9 MGD to 2.7 MGD. Iron and manganese concentrations measured in April 1988 at two of the wells were:

- Iron — < 0.05 mg/L to 0.587 mg/L as Fe
- Manganese — 0.088 mg/L to 0.153 mg/L as Mn

Iron and manganese concentrations following water treatment, based on data from 1988, 1991, and 1994 monthly Drinking Water Operations Reports, were < 0.050 mg/L as Fe and < 0.015 mg/L to 0.151 mg/L as Mn.

The lower aquifer in the region is also used as an industrial water supply. The Moraine Engine and Moraine Assembly facilities have several wells that currently withdraw, or in the past have withdrawn, ground water from the lower aquifer. By 1987, with the GMWS's ability to deliver higher quality water from the DWS, the facilities switched to water from the DWS for potable use, although they have several wells in the lower aquifer that currently withdraw water for nonpotable, industrial

uses. Treatment of the ground water, however, is necessary for some of these industrial uses because of the naturally high mineral content of the ground water.

Water for potable use at the Moraine Engine and Moraine Assembly facilities is expected to continue to be supplied by the GMWS, with the DWS as the water source, because of the higher quality of water and because redevelopment of the industrial wells to supply potable water would be subject to control under Ohio laws discussed in Section 3.1.3.2. As such, future potable use of ground water from the industrial wells at Moraine Engine and Moraine Assembly is not reasonably expected. However, continued nonpotable industrial use of the lower aquifer can be reasonably expected.

3.1.3.2 Upper Aquifer

In contrast to the lower aquifer, the upper aquifer in the vicinity of the Moraine Engine and Moraine Assembly facilities has not been used historically, and is not used currently, as a municipal or industrial water supply. Historical development of the lower rather than the upper aquifer for such uses is likely attributable to the upper aquifer's relatively low sustainable yield. Based on a regional hydraulic conductivity of about 150 feet/day and saturated thickness of only 10 to 40 feet, an estimated sustainable yield for the upper aquifer would be approximately 100 gallons per minute, or about 0.1 MGD. For comparison, the pumping rates for typical industrial water supply wells in the region range from 1 to 3 MGD (Norris and Spieker 1966). The well fields in the GMWS were designed to withdraw ground water at even higher rates (ranging from 8 to 26 MGD). Heavy ground water pumping required to support these uses cannot be sustained by the upper aquifer.

Future development of the upper aquifer as an industrial or municipal water supply is not reasonably expected not only because of limited sustainable yield, but also due to the availability of dependable and higher quality water from the DWS and the availability of the GMWS well fields to provide emergency capacity. Furthermore, the development of public water systems using ground water as a source is governed by Ohio statute (Chapter 6109 of the Ohio Revised Code), and Ohio EPA regulations and guidelines adopted thereunder (OAC Chapters 3745-1 through 3745-82, OEPA 1991). Likewise, the installation of private water wells is governed by Ohio Department of Health regulations (OAC Chapter 3701-28).

Regulatory control over the development of ground water systems includes the following key elements:

- Plans for system development must be approved by the Ohio EPA or Ohio Department of Health to ensure protection of human health.

- A public ground water system may be developed only if connection to an existing public water system is economically infeasible.

- A public water system must remove Fe and Mn from the ground water if the ground water has (1) Fe content exceeding 0.3 mg/L; (2) Mn content exceeding 0.05 mg/L; or (3) total Fe and Mn content exceeding 0.3 mg/L.

- A well cannot be located within 50 feet to 300 feet of any known or possible source of contamination, depending on the expected water usage rate.

- A well owner must own the land within the isolation radius of possible sources of contamination, and OEPA must approve land use within the radius.

These controls, alone and in combination, make improbable the development of drinking water wells in the upper aquifer, or redevelopment of industrial wells in the lower aquifer for potable use, at and in the vicinity of the Moraine Engine and Moraine Assembly facilities. The principal reasons are as follows:

- Because the facilities and the surrounding community are served by the GMWS (which is supplied by the DWS), residential and commercial/industrial connection to the GMWS, rather than development of new drinking water wells, is expected to be economically feasible, and therefore, would be required by Ohio EPA.

- The natural hardness, Fe, and Mn contents of the ground water in the upper aquifer are similar to those of the lower aquifer. Therefore, the ground water is expected to require treatment for potable use; such treatment was previously determined to be not cost-effective relative to the use of treated water from the DWS.

- There are many potential sources of ground water contamination in the area around the facilities, which would severely limit locations that would be

suitable for development of drinking water wells. As indicated in Section 4.2 and Figure 4-14 of the *DOCC* report (G&M 1991), several active and inactive landfills and other waste management facilities are located around the facilities. Of these, more than a dozen are located in the City of Moraine, including the South Sanitary Landfill on Cardington Road (upgradient of Moraine Engine and Moraine Assembly), which is a Superfund site.

Historical records show that private water wells in the upper aquifer have been installed in the vicinity of the facilities, but GM has confirmed that these wells are no longer in use. According to the Montgomery County Health Department (Hut 1995), no private water wells have been installed in the GMWS service area based on a search of records since 1983, when Montgomery County established the agreement with the City of Dayton to use water from the DWS.

Although it is not a current or potential source of drinking water in the vicinity of the Moraine Engine and Assembly facilities, the upper aquifer is hydraulically interconnected to the lower aquifer, which is considered a potential drinking water source. Over many parts of the region and in the vicinity of the Moraine Engine and Moraine Assembly facilities, the upper aquifer is separated from the lower aquifer by a clay-rich aquitard, which acts as a leaky confining unit restricting the degree of hydraulic connection with the lower aquifer. The degree of hydraulic interconnection estimated using a ground water flow model for the facilities and surrounding region was summarized in a water budget analysis (G&M 1994, Figure 4.12). According to the analysis, regional net flow of water from the upper aquifer to the lower aquifer is approximately 9 MGD. The ground water flow model also indicates that the upper aquifer is hydraulically connected to the Great Miami River.

3.1.3.3 Summary of Potential Ground Water Exposures

In the 1996 baseline risk assessment, use of the lower aquifer as a drinking water source was determined to be reasonably expected, based on consideration of factors pertinent to potential regional ground water use. However, use of the upper aquifer as a drinking water source was determined to be not reasonably expected, based on considerations of the same factors. That is, given the regional availability of alternative sources of drinking water that are more dependable and of higher quality, and local laws governing ground water use, exposure to upper aquifer ground water in the vicinity of the Moraine Engine and Assembly facilities was determined to be not

reasonably expected. However, because the upper aquifer is a medium for potential transport of constituents to the lower aquifer and the Great Miami River, the supplemental baseline risk assessment (like the 1996 baseline risk assessment) includes an assessment of the extent to which the hydraulic interconnections could result in migration of constituents to the lower aquifer or to the River in concentrations of significance to human health.

The potential for drinking water exposure to ground water is evaluated in the supplemental baseline risk assessment using the same ground water use scenarios evaluated in the 1996 baseline risk assessment. Specifically, potential exposure is evaluated for current or potential drinking water use of ground water extracted from the following municipal well fields:

- West Carrollton: as West Carrollton's drinking water supply
- Miami Shores: as GMWS's primary emergency drinking water supply
- Dryden Road South: as GMWS's secondary emergency drinking water supply

Although the Dryden Road North well field is not expected to serve as a drinking water supply or as an emergency drinking water supply, the ground water quality at this well field is also evaluated.

Like the 1996 baseline risk assessment, the supplemental baseline risk assessment also evaluates the potential for exposures that may occur through current and potential nonpotable industrial use of ground water extracted from industrial wells. Based on currently active production wells and potential operation of inactive production wells, potential exposures through nonpotable ground water use is evaluated for the following on-site industrial wells:

- Delphi Thermal inactive production wells: as a potential industrial water supply
- Moraine Assembly active production wells: as an industrial water supply
- Moraine Engine active production wells: as an industrial water supply
- Moraine Engine inactive production well: as a potential industrial water supply

The significance of waste constituents potentially transported to the Great Miami River via ground water flow from the upper aquifer is also evaluated, as in the 1996 baseline risk assessment.

3.2 Identification of Potential Exposure Pathways

An exposure pathway generally requires the existence of (1) a waste source and a mechanism of waste constituent release, (2) a transport medium, (3) a point of potential human contact with the affected medium, and (4) an exposure route at the point of contact. The characteristics of the AOIs investigated in the supplemental RFI were described in Section 3.2 of the *Supplemental DOCC* (G&M July 1997A). Sections 3.2.1 through 3.2.5 below describe the potential presence of hazardous waste constituents in soil at the AOIs, the potential transport of constituents from soil to other environmental media, and the potential exposure pathways that are evaluated in the supplemental baseline risk assessment. Section 3.2.6 describes the potential ground water exposure pathways that are evaluated. The potential exposures identified for the quantitative exposure assessment for each AOI are summarized in Table 3-1.

3.2.1 AOI 7 - Former Oil House Area

The Former Oil House Area consists of an area previously occupied by the former Oil House (Building 7), an outdoor area that formerly managed underground storage tanks (USTs) and above-ground storage tanks (ASTs), a former drum storage area, and an area north of the former Oil House that was used during 1979 for temporary storage of equipment and materials. Currently, most of the area is covered by asphalt and concrete pavement, with small areas covered by vegetation. The location of the former Oil House tank farm is occupied by Moraine Engine's current tank farm. Volatile constituents at and near ground surface in unpaved areas or areas where pavement is removed may volatilize into the air, and constituents on soil particles at any unvegetated areas may become airborne as a result of wind erosion. Constituents in soil at unpaved areas also may leach to groundwater.

Potential exposure to workers might occur during routine industrial activities in the area. Potential routes of exposure to workers would include incidental ingestion and dermal contact with exposed soil, and inhalation of vapor and particulate emitted from the soil. These potential exposures to on-facility workers are evaluated in the supplemental baseline risk assessment.

Potential exposures to workers might also occur during occasional excavation of soil during minor construction (e.g., installation of underground utilities) or maintenance (e.g.,

pavement removal or repair) in the area. Potential routes of exposure to workers doing soil excavation would include incidental ingestion and dermal contact with exposed soil, and inhalation of vapor and particulate emitted from the soil. These potential exposures to excavation workers are evaluated in the supplemental baseline risk assessment.

Potential exposure to off-facility workers and residents might occur via inhalation of vapor and particulates emitted from the soil at AOI 7. These potential exposures are evaluated in the supplemental baseline risk assessment by estimating exposure to hypothetical off-facility residential receptors at locations as near AOI 7 as possible. The potential off-facility exposures estimated in this way are considered conservative screening-level estimates.

3.2.2 AOI 13 - Buildings 4, 6 and 13

The three buildings were demolished in this area, and the concrete floor and foundations remain in place. The area is currently covered with an asphalt parking lot. Pavement and the concrete floor currently prevent any human exposure to the underlying soil. If the pavement and floor were removed in the future, potential exposures may occur via direct contact, airborne transport, and ground water transport.

If the existing pavement and building floor were removed and the area remained unpaved, potential exposure to workers might occur during routine industrial activities in the area. Potential routes of exposure to workers would include incidental ingestion and dermal contact with the underlying soil, and inhalation of vapor and particulate emitted from the soil. These potential exposures to on-facility workers are evaluated in the supplemental baseline risk assessment.

Potential exposures to workers might also occur during occasional excavation of soil for minor construction (e.g., installation of underground utilities) or maintenance (e.g., pavement removal or repair) in the area. Potential routes of exposure to workers doing soil excavation would include incidental ingestion and dermal contact with exposed soil, and inhalation of vapor and particulate emitted from the soil. These potential exposures to excavation workers are evaluated in the supplemental baseline risk assessment.

Potential exposure to off-facility workers and residents might occur via inhalation of vapor and particulates emitted from the soil at AOI 13, if the pavement and building floor were removed. These potential exposures are evaluated in the supplemental baseline risk assessment by estimating exposure to hypothetical off-facility residential receptors at locations as near AOI 13 as possible. The potential off-facility exposures estimated in this way are considered conservative screening-level estimates.

3.2.3 AOI 34 - Excavation Area 1

The fill material at AOI 34 is currently covered by an asphalt parking lot. Pavement over the area currently prevents any human exposure to the underlying soil. If the pavement were removed in the future, potential exposures may occur via direct contact, airborne transport, and ground water transport.

If the existing pavement were removed and the area remained unpaved, potential exposure to workers might occur during routine industrial activities in the area. Potential routes of exposure to workers would include incidental ingestion and dermal contact with the underlying soil, and inhalation of vapor and particulate emitted from the soil. These potential exposures to on-facility workers are evaluated in the supplemental baseline risk assessment.

Potential exposures to workers might also occur during occasional excavation of soil for minor construction (e.g., installation of underground utilities) or maintenance (e.g., pavement removal or repair) in the area. Potential routes of exposure to workers doing soil excavation would include incidental ingestion and dermal contact with exposed soil, and inhalation of vapor and particulate emitted from the soil. These potential exposures to excavation workers are evaluated in the supplemental baseline risk assessment.

Potential exposure to off-facility workers and residents might occur via inhalation of vapor and particulates emitted from the soil at AOI 34, if the pavement were removed. These potential exposures are evaluated in the supplemental baseline risk assessment by estimating exposure to hypothetical off-facility residential receptors at locations as near AOI 34 as possible. The potential off-facility exposures estimated in this way are considered conservative screening-level estimates.

3.2.4 AOI 35 - Excavation Area 2

The fill material at AOI 35 is currently covered by a parking lot. The parking lot currently prevents any human exposure to the underlying soil. If the pavement were removed in the future, potential exposures may occur via direct contact, airborne transport, and ground water transport.

If the pavement were removed and the area remained unpaved, potential exposure to workers might occur during routine industrial activities in the area. Potential routes of exposure to workers would include incidental ingestion and dermal contact with the underlying soil, and inhalation of vapor and particulate emitted from the soil. These potential exposures to on-facility workers are evaluated in the supplemental baseline risk assessment.

Potential exposures to workers might also occur during occasional excavation of soil for minor construction (e.g., installation of underground utilities) or maintenance (e.g., pavement removal or repair) in the area. Potential routes of exposure to workers doing soil excavation would include incidental ingestion and dermal contact with exposed soil, and inhalation of vapor and particulate emitted from the soil. These potential exposures to excavation workers are evaluated in the supplemental baseline risk assessment.

Potential exposure to off-facility workers and residents might occur via inhalation of vapor and particulates emitted from the soil at AOI 35, if the pavement were removed. These potential exposures are evaluated in the supplemental baseline risk assessment by estimating exposure to hypothetical off-facility residential receptors at locations as near AOI 35 as possible. The potential off-facility exposures estimated in this way are considered conservative screening-level estimates.

3.2.5 AOI 36 - Former Southwest ASTs

The former Southwest ASTs area is currently covered by an asphalt parking lot. Pavement over the area currently prevents any human exposure to the underlying soil. If the pavement were removed in the future, potential exposures may occur via direct contact, airborne transport, and ground water transport.

If the existing pavement were removed and the area remained unpaved, potential exposure to workers might occur during routine industrial activities in the area. Potential routes of exposure to workers would include incidental ingestion and dermal contact with the underlying soil, and inhalation of vapor and particulate emitted from the soil. These potential exposures to on-facility workers are evaluated in the supplemental baseline risk assessment.

Potential exposures to workers might also occur during occasional excavation of soil for minor construction (e.g., installation of underground utilities) or maintenance (e.g., pavement removal or repair) in the area. Potential routes of exposure to workers doing soil excavation would include incidental ingestion and dermal contact with exposed soil, and inhalation of vapor and particulate emitted from the soil. These potential exposures to excavation workers are evaluated in the supplemental baseline risk assessment.

Potential exposure to off-facility workers and residents might occur via inhalation of vapor and particulates emitted from the soil at AOI 36, if the pavement were removed. These potential exposures are evaluated in the supplemental baseline risk assessment by estimating exposure to hypothetical off-facility residential receptors at locations as near the former Southwest ASTs as possible. The potential off-facility exposures estimated in this way are considered conservative screening-level estimates.

3.2.6 Ground Water and Surface Water

Potential exposure to constituents in soil/waste at the SWMUs and AOIs may occur via ground water transport. Constituents may leach from soil/waste in currently unpaved areas or areas that become unpaved. Potential leaching of constituents to ground water and transport to locations of ground water use are evaluated for all SWMUs at Delphi Thermal and all AOIs at Moraine Engine and Moraine Assembly. In addition, as discussed above in Section 1, potential transport of constituents already in ground water at AOI 7 to locations of ground water use is also evaluated.

The potential points of exposure to ground water, as discussed in Sections 3.1.3, include municipal wells and industrial wells. Potential routes of exposures to ground water from municipal wells include ingestion, and dermal contact and inhalation of vapor during showering and other household uses. These potential exposures are evaluated using maximum contaminant levels (MCLs) established by USEPA under the Safe Drinking Water Act, or similar risk-based drinking water concentrations for constituents without MCLs.

The most potentially significant route of exposure to ground water from on-site industrial wells is inhalation of vapor from ground water by workers during nonpotable use in manufacturing operations. Incidental dermal contact with ground water in manufacturing operations is also possible, but is expected to be insignificant compared with potential inhalation exposures. Workers who may contact process water generally wear gloves and other protective clothing, and water for hand washing in restrooms is supplied by the City of Dayton via the Greater Moraine Water System. Potential exposures from nonpotable industrial use of ground water are first screened as drinking water exposures in this supplemental baseline risk assessment, using MCLs or risk-based drinking water concentrations as conservative screening levels. For constituents with predicted ground water concentrations higher than MCLs or risk-based drinking water concentrations, potential exposures via inhalation of vapors from ground water are then evaluated considering site-specific process water usage. Workplace air concentrations resulting from process water usage are estimated and compared with applicable occupational standards.

Potential routes of exposures to surface water in the Great Miami River would include incidental ingestion of and dermal contact with surface water during swimming, although swimming in the River is expected to be very infrequent because of serious drowning hazards (Bebbington 1995). In this supplemental baseline risk assessment, potential exposures to constituents in the Great Miami River are evaluated using MCLs or risk-based drinking water concentrations as conservative screening levels.

3.3 Quantification of Potential Exposures

Potential exposures via the pathways identified in Section 3.2 are quantified by the product of (1) the concentrations of waste constituents in an environmental medium at locations of potential exposure over an expected duration of exposure, and (2) the intake of the environmental medium by a potentially exposed population. The product of these components is called the potential dose (USEPA 1992C). The potential dose is combined with toxicity values (presented in Section 4) to estimate potential exposure risk (presented in Section 5).

The potential dose is calculated differently for evaluating potential carcinogenic risk and for evaluating noncarcinogenic effects. For evaluating carcinogenic risk, intake is averaged over a lifetime (USEPA 1989A) and the dose is called the lifetime average daily dose (LADD). For evaluating noncarcinogenic effects, intake is averaged over the period of exposure and the dose is called the average daily dose (ADD). The LADD and ADD of a constituent for a specific route of exposure (e.g., soil ingestion) are given by:

$$ADD_{route} = Concentration_{medium} \bullet Intake_{exposure\ duration,\ route}$$

$$LADD_{route} = Concentration_{medium} \bullet Intake_{lifetime,\ route}$$

For evaluating dermal exposures to soil, the potential dose is converted to an absorbed dose by multiplying the potential dose by an absorption fraction (AF_{derm}), which is the fraction of the potential dose that is absorbed through the skin. Because chemical-specific dermal absorption fractions are generally unavailable, USEPA default values of 1% for organic constituents and 0.1% for inorganic constituents are used (USEPA 1995C). As discussed below in Section 3.3.7.2, these default values are used in combination with high-end default values of soil adherence recommended by USEPA (1992a). These are the same default values used in the 1996 baseline risk assessment.

The estimation of exposure concentrations is presented in the following sections:

3.3.1 Exposure Concentrations in Soil
3.3.2 Exposure Concentrations in Ambient Air
3.3.3 Exposure Concentrations in Ground Water
3.3.4 Exposure Concentrations in Surface Water
3.3.5 Exposure Concentrations in Workplace Air

transform of the supplemental RFI data often exceed the maximum concentration, sometimes by large margins. Therefore, consistent with USEPA guidance, the maximum concentration, which is the simplest and most conservative estimate of the exposure concentration, is used in calculations of soil-related LADDs and ADDs (except for certain constituents at AOI 7 and AOI 36, as discussed below). When combined with high-end exposure factors, these exposure concentrations provide estimates of maximum high-end LADDs and ADDs. As shown in Section 5, the maximum high-end LADDs and ADDs present no significant cancer risk or noncancer effects; therefore, more refined estimation of exposure concentrations is unnecessary.

The maximum concentration of constituents detected in soil samples are not used in the calculation of LADDs and ADDs in the following cases:

- AOI 7 - Volatile Organic Compounds

  As discussed in Section 3.4 of the *Supplemental RFI Report, Volume I*, an extensive investigation was performed at AOI 7 to characterize the presence and extent of tetrachloroethene, trichloroethene and their degradation products in soil and ground water. Some soil samples collected during the investigation were collected at the water table or capillary fringe (ranging from approximately 22 feet to 35 feet below ground surface). These samples contained volatile organic compounds, specifically cis-1,2-dichloroethene, tetrachloroethene, trichloroethene, and 1,1,1-trichloroethane, at concentrations higher than concentrations in shallower soil samples. In fact, cis-1,2-dichloroethene and 1,1,1-trichloroethane were not detected in shallower samples. Because these results were likely caused by contamination in ground water at AOI 7, the concentrations of constituents in these soil samples are not representative of the concentrations in the unsaturated zone soil that workers may encounter during routine industrial or excavation activities. Therefore, the concentrations of volatile organic compounds used in estimating the exposure concentrations for direct contact and airborne exposures are maximum concentrations among soil samples at AOI 7 not including these deep samples.

- AOI 36 - Arsenic

  As discussed in Section 3.3 of the *Supplemental RFI Report, Volume I*, additional soil sampling was performed at AOI 36 after the initial supplemental RFI sampling to better characterize the presence of arsenic in surface soil at AOI 36. Specifically, while data from the initial sampling were being reviewed, soil at

AOI 36 and the surrounding area was regraded as part of ongoing construction activities at Moraine Engine. Regrading activities included preparing a level area for the construction of a parking lot and the creation of a landscape soil berm along the perimeter of the parking area. As such, the additional soil sampling was designed to estimate representative concentrations of arsenic in surface soil across the entire regraded area. Because of the large area involved, the area was divided into four sampling units (approximately 34,000 square feet each) and three berm segments, in accordance with the USEPA-approved sampling plan dated May 29, 1998 and revised June 9, 1998. Because surface soil at AOI 36 and the surrounding area was regraded and the additional sampling was designed to obtain more representative concentrations of arsenic than in the initial sampling, the exposure concentration of arsenic in surface soil at AOI 36 is represented by the data from the Composite "A" soil sample, which was collected from the sampling unit in which AOI 36 is located.

Except as noted above, the maximum concentration of each constituent detected in soil at each AOI is presented in Table 3-2. For each AOI, the maximum constituent concentrations in the surface data are used to evaluate potential exposures during routine facility operations, while the maximum constituent concentrations among both the surface and subsurface data are used to evaluate potential exposures during excavation at the AOI. For borings where surface soil samples were not collected (i.e., 0 to 2 feet bgs), the shallowest sample in the boring (e.g., 6 to 8 feet bgs for boring EA1-BH01 at AOI 34) is used to represent soil above that sample interval.

3.3.2 Exposure Concentrations in Ambient Air

Exposure concentrations in ambient air resulting from potential vapor and particulate emission from surface soil are estimated using mathematical models in combination with the exposure concentrations in soil discussed above in Section 3.3.1. The vapor emission model and the particulate emission model are both used by USEPA for screening-level analysis (USEPA 1996, 1992E). The details of these models are presented in Appendix A. The air dispersion model for estimating on-source and off-source air concentrations is also a USEPA screening-level model (USEPA 1996, 1995B). The following discussion summarizes the major features and assumptions in the emission and dispersion models.

The screening-level model for estimating vapor emission from soil is a model USEPA used in its *Soil Screening Guidance* (USEPA 1996). It estimates annual average vapor

flux from the soil surface over a specific period of exposure under unsteady-state conditions, with the assumption that contaminants in soil extend to an infinite depth. The assumption of infinite contaminant depth is expected to overestimate average vapor fluxes from the AOIs but can be used for screening-level analysis. Site-specific soil properties (i.e., porosity, fraction of organic carbon, and soil moisture) and chemical-specific transport properties (i.e., K_{oc}, Henry's law constant, diffusivity in air, and solubility in water) compiled by USEPA (1996) are used in the calculation of vapor flux.

The particulate emission model is based on the suspension of surface soil or waste by wind erosion. It estimates the emission of respirable soil particles, defined as being 10 μm in diameter or smaller (i.e., PM_{10}). The key parameters in the model that influence particulate emission are the threshold friction velocity for the soil and the mean annual wind speed. For the threshold friction velocity, which is correlated to the mode of the soil aggregate size distribution, USEPA's default mode aggregate size of 0.5 mm is used. A mean annual wind speed of 9.9 miles per hour (or 4.4 m/s) from the National Oceanic and Atmospheric Administration (NOAA 1993) for Dayton, Ohio is used. USEPA default values are used for other model parameters.

Particulate emission resulting from potential on-facility excavation is conservatively estimated using data compiled by USEPA (USEPA 1985, 1989B). The data indicate that dust emission from "heavy construction operations" is 1.2 tons per acre of construction per month of activity (or 1×10^{-7} kg-soil/m^2-sec) and consists of particles that are 30 μm in diameter and smaller. The respirable fraction of the dust is estimated to be approximately 0.5 (USEPA 1989B). Therefore, the emission flux of respirable particles is estimated as 5×10^{-8} kg-soil/m^2-sec.

On-source and off-source air concentrations are estimated using USEPA's SCREEN3 air dispersion model (USEPA 1995B). The area source algorithm in SCREEN3 is used with worst-case meteorological conditions (selected by the model) and rural dispersion to estimate maximum 1-hour concentrations at ground level at each AOI and at the nearest off-facility location, regardless of wind direction, from the boundary of each AOI. The AOIs are approximated as square source areas. The approximate areas and off-facility distances for each AOI are shown in Appendix A. The maximum 1-hour air concentrations calculated by SCREEN3 are converted to maximum annual average air concentrations using a conservative factor of 0.2 for on-source air concentrations and concentrations within a distance that is one-half the length of the source. This conversion results in on-source air concentrations that match the 90th percentile on-source air concentrations calculated by USEPA (1996) for use in its *Soil Screening Guidance*. A

conversion factor of 0.08 (USEPA 1995B) was used for distances beyond a half-source distance.

The estimated concentrations of constituents in ambient air for each AOI at the AOI (on-source) and at the nearest off-facility distance from the AOI (off-source) are presented in Table 3-3. The exposure concentrations in ambient air at each AOI are combined with estimates of air intake by workers to estimate the LADDs and ADDs to workers due to their activities at an AOI. Exposure concentrations in air at a facility boundary attributable to an AOI are combined with estimates of air intake by off-facility residents to estimate the LADDs and ADDs from the AOI to these receptors. These estimates of LADDs and ADDs are combined with toxicity values (presented in Section 4) to estimate potential exposure risk (presented in Section 5).

3.3.3 Exposure Concentrations in Ground Water

Potential exposures to ground water under current and reasonably expected future ground water uses at Delphi Thermal, Moraine Engine, Moraine Assembly, and in the region are described in Section 3.1.3. To estimate the magnitude of the potential exposures at the identified exposure points, mathematical models are used in combination with soil and ground water monitoring data collected during the RFI and supplemental RFI. Specifically, the MODFLOW ground water flow model (G&M 1994) developed for Delphi Thermal and the surrounding region (including Moraine Engine and Moraine Assembly) is used to support the estimation of potential concentrations in ground water at the identified points of potential ground water use.

3.3.3.1 Ground Water Modeling Scenarios

Ten ground water modeling scenarios are evaluated to predict potential waste constituent migration from the SWMUs and AOIs at the three facilities to potential points of ground water exposure under various ground water pumping patterns in the region. Table 3-4 presents the 10 modeling scenarios. Each modeling scenario is defined by (1) a ground water use scenario, (2) a set of wells that are expected to be pumping under the ground water use scenario, and (3) a set of associated ground water exposure points that are evaluated in the risk assessment. These scenarios are the same as those used in the 1996 baseline risk assessment, except they are updated with the current operations of on-site industrial wells and potential use of an inactive industrial well at Moraine Engine.

The first five ground water modeling scenarios evaluate potential exposures without interim measures; i.e., these scenarios evaluate ground water conditions in the

absence of pumping at wells TW2 and DN13. The first ground water modeling scenario (Scenario 1) in Table 3-4 is the baseline ground water use scenario which represents current ground water use conditions as discussed in Section 3.1.3. Scenario 2 is the baseline condition with the addition of the Miami Shores well field pumping as an emergency drinking water supply. Scenario 3 represents a more unlikely condition in which Miami Shores is pumping as an emergency drinking water supply, Delphi Thermal places several existing wells into service as an industrial water supply, and Moraine Engine places a currently inactive well (Well 28) into service as an additional industrial water supply. Scenarios 4 and 5 represent even less likely conditions in which the Dryden Road South well field is added to the conditions modeled in Scenarios 2 and 3 as a secondary emergency drinking water supply to supplement Miami Shores as the primary emergency drinking water supply.

Five additional ground water modeling scenarios (Scenarios 6 through 10) are evaluated in which interim measures are implemented (i.e., with wells TW2 and DN13 acting as ground water recovery wells). These scenarios are identical to Scenarios 1 through 5, except that the interim measures wells are assumed to be pumping.

The estimated pumping rates for the pumping locations identified in Table 3-4 are presented in Appendix B. The pumping rates are based on either information provided with the *Revised Three-Dimensional Steady-State Flow Model Report* (G&M 1994) for active wells, current operations of on-site industrial wells, or estimated usage for wells that may become active in the future. They represent the estimated total average daily ground water withdrawal rates for the pumping locations. For a pumping location with multiple wells (i.e., a well field), the total rate is divided among the individual pumping wells, as appropriate, for the model simulations. The pumping rates for the interim measures wells are taken from the USEPA-approved *Interim Measures Work Plan* (G&M 1994).

In addition to allowing an exposure assessment of current and reasonably expected future use of ground water, the modeling scenarios in Table 3-4 also allow USEPA (per its February 8, 1995 comments) to consider the unlikely case of ground water use from the Dryden Road North well field or nonemergency use of ground water from the Miami Shores and Dryden Road South well fields, although such use of ground water is unlikely for the reasons previously discussed in Section 3.1.3. The Dryden Road North well field is evaluated as a worst-case scenario. Concentrations in ground water extracted from the Dryden Road North well field on a continuous basis are estimated using the ground water concentrations predicted for the interim

measures well DN13 (which is in the Dryden Road North well field) in Scenarios 6 through 10. The concentrations from well DN13 can be used to provide a bounding estimate of exposure, which USEPA defines as beyond a high-end estimate (i.e., greater than the 99.9th percentile of potential exposures in a population, 57 FR 22888, May 29, 1992).

3.3.3.2 Modeling Methodology

The MODFLOW model (G&M 1994) developed to evaluate ground water flow at the three facilities and in the region under various pumping conditions is used in this exposure assessment as the basis for approximating the transport of waste constituents from the SWMUs and AOIs to potential points of ground water use. The ground water modeling methodology is the same as that used in the 1996 baseline risk assessment.

The ground water flow model facilitates the approximation of transport of constituents in ground water by allowing the calculation of source reduction factors that account for the natural dilution of constituents as they move in ground water from under the facilities to potential exposure points. The source reduction factors are calculated by using the MODFLOW model in combination with MODALL (Potter 1995), a complete-mix model designed to work with MODFLOW. The MODALL model uses the cell-by-cell flow terms computed by MODFLOW to calculate source reduction factors for a specified source within each downgradient cell or block in the finite difference domain of the MODFLOW model. The source reduction factors are computed for steady-state transport (without dispersion) with the following conservative assumptions:

- Each SWMU or AOI provides a continuous, steady-state flux of constituents into the upper aquifer.
- No degradation of constituents occurs during transport.
- No dispersion of constituents occurs during transport.

A source reduction factor is computed by setting the concentration of the ground water beneath a source to a constant, unit concentration (or dimensionless concentration C/C_0), such that the calculated concentration at an exposure point ranges from zero to one. The concentration estimated at the potential exposure point for a unit source concentration is the source reduction factor for that source and exposure point combination.

The source reduction factors computed using the model for each combination of SWMU or AOI and potential ground water exposure point for each of the 10 ground water modeling scenarios are presented in Appendix B. The estimated exposure concentration of a constituent at an exposure point resulting from all SWMUs and AOIs is obtained by multiplying the ground water concentration at the SWMU or AOI with the source reduction factor and summing all the products.

3.3.3.3 Ground Water Source Concentrations

The ground water source concentrations are calculated based on the methodology discussed in Attachment 1 of GM's September 11, 1996 response to USEPA comments on the 1996 baseline risk assessment. The ground water concentrations at a SWMU or AOI are estimated from the soil/waste data using both an "equilibrium-partitioning" (also called "soil/water partition" (USEPA 1996) and a "leach test" method (USEPA 1996). USEPA's leach test method (SW-846, Method 1312) is simulated by assuming a hypothetical worst-case leach test in which the entire mass of the constituent in soil/waste is extracted into the leaching fluid. With this assumption, the concentration of a constituent in soil can be divided by 20 (which is the ratio of the mass of leaching fluid to the mass of soil in the leaching test) to estimate its ground water source term concentration. For each constituent, the estimated source term concentration corresponding to the more realistic of the two estimation methods is used.

For constituents which are relatively immobile in the subsurface, the equilibrium-partitioning method provides a more realistic (yet conservative) ground water concentration because it assumes that the constituent concentration in soil remains constant (since the constituent is immobile, its concentration in soil does not significantly decrease over time). For constituents which are relatively mobile, the leach test method provides a more realistic (yet conservative) ground water concentration because it accounts for a finite amount of constituent mass in the soil. By selecting the lower of the estimated ground water concentrations based on either the equilibrium-partitioning method or the leach test method as the ground water source term concentration, the predicted concentration corresponding to the more realistic, yet conservative, prediction method is used. These two methods of estimating ground water concentrations are also conservative since the methods ignore attenuation of the constituent concentration in the vadose zone and dilution at the water table.

If a constituent was not detected in any soil/waste samples at a SWMU or AOI and it was also not detected in ground water, no source term is calculated for that constituent for the SWMU or AOI. If a constituent was not analyzed in soil/waste at a SWMU or AOI, no source term is calculated for that constituent at that SWMU or AOI. If a constituent was analyzed and not detected in soil/waste at a SWMU or AOI but it was detected in ground water, the maximum sample quantitation limit (SQL) among the soil/waste samples collected at the SWMU or AOI is used to calculate the source term for the constituent.

If a constituent was detected in soil/waste at a SWMU or AOI, the maximum concentration at the SWMU or AOI is used to calculate the source term for the constituent, with the following exceptions:

- Average concentrations at certain SWMUs (e.g., Waste Pile Staging Area), as noted in Appendix C, Section 3 of the 1996 baseline risk assessment, are used instead of maximum concentrations, because the maximums in these cases are not representative of the soil concentrations that could affect ground water.

- For AOI 7, numerous soil samples were collected during an extensive investigation to characterize the presence and extent of tetrachloroethene, trichloroethene and their degradation products. Because of the relatively large area over which soil samples were collected and the range of concentrations measured (particularly for tetrachloroethene), the maximum concentrations would not be representative of source concentrations of constituents in soil at AOI 7. For tetrachloroethene, which had a relatively large number of concentrations above the detection limit, a volume weighted-average source concentration calculated from the unsaturated soil samples (excluding those collected at the water table or capillary fringe) is used (see Appendix B, Section 3).

- For the Fill Area at Delphi Thermal, AOI 34, and AOI 35, ground water source terms are based on predictions from the maximum concentrations among the soil samples collected from beneath the fill material. Because the fill materials at the Fill Area, AOI 34, and AOI 35 have been in place for many years during which they were subjected to varying degrees of leaching

by rainfall infiltration, the soil sample results from under the fill are more representative of the soil conditions that could affect ground water.

- For the landfills at Delphi Thermal, the maximum ground water concentration of a constituent measured during the supplemental RFI (or the RFI, if no data were collected during the supplemental RFI) from monitoring wells associated with the landfills (see Appendix C, Section 1 of the 1996 baseline risk assessment) is considered to be representative of the concentration that leaches from the landfill waste. Per the *RFI Work Plan* (G&M 1992), the ground water concentration is used as the source term, which may tend to overestimate the source concentration since this approach does not account for potential contributions from upgradient sources.

- For the lagoons at Delphi Thermal, the maximum ground water concentration of a constituent measured during the supplemental RFI (or the RFI, if no data were collected during the supplemental RFI) from monitoring wells associated with the lagoons (see Appendix C, Section 1 of the 1996 baseline risk assessment) is considered to be representative of the concentration that leaches from the lagoon waste, and is used as the source term, if the constituent was detected in the lagoon sludge or is a degradation product of constituents detected in the sludge (see Appendix B, Section 3). This approach may tend to overestimate the source concentration since it does not account for potential contributions from upgradient sources.

- For AOI 36, as discussed in Section 2.1, the arsenic data from the Composite "A" soil sample is used in the calculation of the ground water source concentration for arsenic at this AOI, for the reasons discussed above in Section 3.3.1.

For inorganics, metal concentrations in soil/waste samples from the SWMUs and AOIs are first compared with background soil concentrations. If concentrations detected in the SWMUs or AOIs are below the background concentration, then a source term for that constituent is not estimated for that SWMU or AOI. Otherwise, the concentration detected in the SWMU or AOI is used to estimate the source concentrations representing contributions by the SWMUs and AOIs without adjustment for background contributions.

For the reasons discussed above in Section 1, in addition to evaluating potential ground water exposures to constituents that may leach from soil/waste at the SWMUs and AOIs, the supplemental baseline risk assessment also evaluates potential ground water exposures to constituents already in ground water at AOI 7. The extensive investigation to characterize the presence of tetrachloroethene, trichloroethene and their degradation products at AOI 7 found high dissolved-phase concentrations of these constituents in shallow ground water and evidence that DNAPL may be present in the shallow ground water above an upper clay till. Significantly lower ground water concentrations, however, were measured in the upper aquifer below the upper clay till. Among the ground water characterization data collected during the supplemental RFI from monitoring wells and hydropunch samples at AOI 7, the concentrations of constituents in ground water migrating from AOI 7 appear to be best represented by ground water monitoring data from well GM-28. Well GM-28 was installed during the supplemental RFI at the downgradient extent of AOI 7 and is screened over an interval of the upper aquifer above the upper clay till that is representative of the pathway for migration of ground water constituents from AOI 7 to potential points of ground water use.

In each of the approaches used for estimating ground water source concentrations, the source strength is assumed to remain constant. This approach is conservative particularly for SWMUs that are former waste management units where only residual constituents remain in the soil (e.g., former underground storage tank areas) and AOIs where operations are no longer present (e.g., former buildings). The ground water source concentrations assigned to each SWMU or AOI (including AOI 7 ground water) for evaluating exposure concentrations associated with the ground water pathway are presented in Appendix B.

3.3.3.4 Ground Water Concentrations at Pumping Wells

The ground water concentrations of constituents from each SWMU or AOI at each point of potential ground water use under each of the 10 modeling scenarios are presented in Appendix B. The aggregate effect of all the SWMUs and AOIs on the ground water concentration at each potential exposure point is shown on Tables 3-5 through 3-14. The aggregate effect is calculated by adding the concentration contributions from the individual SWMUs and AOIs. The resulting exposure concentrations in ground water at the potential points of exposure are then compared to ground water protection standards (discussed in Section 5).

For ground water that is or may be used as a drinking water supply, the appropriate ground water protection standards are the MCLs, or similar risk-based drinking water concentrations for constituents without MCLs. As discussed in Section 3.2, potential exposures to ground water include nonpotable industrial uses. Ground water for such uses does not need to meet MCLs or risk-based drinking water concentrations. However, to streamline the assessment of such ground water uses, predicted ground water concentrations from on-site industrial production wells are also compared with MCLs or risk-based drinking water concentrations as conservative screening levels. For a constituent with predicted ground water concentration higher than its MCL or risk-based drinking water concentration, exposure concentration of the constituent in workplace air is estimated as discussed below in Section 3.3.5.

3.3.4 Exposure Concentrations in Surface Water

Exposure concentrations in the Great Miami River resulting from ground water flow are estimated using an approach similar to the methodology for estimating ground water exposure concentrations discussed in Section 3.3.3. Surface water concentrations in the River are estimated for each of the ground water modeling scenarios described in Section 3.3.3.1 using mass loading factors calculated by the MODFLOW and MODALL models. The mass loading factors are calculated based on the predicted mass flow of a constituent in ground water into the River, with the ground water concentration of the constituent under a SWMU or AOI set to a constant, unit concentration. The mass flow rate into the River is divided by the river flow rate to obtain the mass loading factor. The 50-year annual average river flow rate of 2,454 ft^3/s is used (Shindel et al. 1987) to calculate the mass loading factor. The estimated surface water exposure concentrations attributable to a SWMU or AOI for each modeling scenario are calculated by multiplying the ground water source concentrations (see Section 3.3.3.3) for the SWMU or AOI by the mass loading factor. The exposure concentrations in the River are calculated by summing the contributions from the individual SWMUs and AOIs. As shown in Appendix B, the highest estimated constituent concentration in the Great Miami River is 0.000011 mg/L. The human health significance of these estimated concentrations is discussed in Section 5.

3.3.5 Exposure Concentrations in Workplace Air

Workplace air concentrations of constituents that volatilize from ground water during use in manufacturing process operations are estimated based on site-specific usage. Ground water from on-site production wells is currently used as process water at Moraine Engine and Moraine Assembly. A review of the manufacturing operations at these facilities

determined that process water use in some operations might allow constituents to volatilize into workplace air. Specifically, in the Moraine Engine plant, the following water usage and ventilation system information was obtained:

- Process equipment utilizing on-site well water is distributed throughout approximately one-half of the manufacturing plant (approximately 560,000 ft^2). This water is used for contact cooling water in parts grinding operations and in parts washers. Most of these units are closed processes which limit the potential for VOCs volatilizing from the water to migrate into the ambient air. These processes are also automated and do not require workers to be in close proximity to the equipment (the majority of the plant workers are involved with engine assembly, which is a dry operation).

- The building ventilation system is divided into 42 cells to provide uniform air supply/exhaust throughout the building. Each cell covers approximately 30,000 ft^2 of the plant. Each cell system contains one air supply house (providing filtered and heated air) with a supply capacity of 30,000 cfm, six summer supply fans with a supply capacity of 10,000 cfm each, and 2 exhaust fans providing a exhaust capacity of 30,000 cfm each. This system allows for at least one air exchange per hour (winter conditions) and more than six changes per hour (summer conditions) in each building cell. Because there are no barriers between these ventilation cells, air can mix between cells.

Process water is used elsewhere at Moraine Engine and Moraine Assembly, but these operations either involve closed-loop water use (e.g., noncontact cooling water) or pretreatment of the water prior to use in the operation (e.g., body washer), and/or do not affect ambient workplace air quality within the main plant areas because they are separately ventilated (e.g., paint booth).

The workplace air concentration of a constituent that volatilizes from ground water during process use in the Moraine Engine plant is estimated using an overall mass balance for the air volume in the 560,000 ft^2 manufacturing area in which operations might allow constituents to volatilize into the workplace air. That is, the workplace air concentration is calculated by dividing the emission rate of the constituent from ground water by the flow rate of air through the area. Given the distribution of water usage within the building and the uniform coverage of the building ventilation system, the assumption that VOCs in process water are likely to disperse only within the 560,000 ft^2 area in which water use

occurs likely underestimates the dispersion of the air into the remaining portion of the building where workers spend most of their time. Therefore, the estimated air concentrations are considered bounding estimates.

The rate of constituent emission into the air volume in the manufacturing area is calculated from the product of the rate of ground water use in the area, the concentration of the constituent in ground water, and the fraction of the constituent mass that volatilizes from the ground water during use. Based on records of process water use from 1996 to 1998, the rate of contact process water use in the manufacturing area is approximately 175 gallons/minute (39,750 L/hr). The concentration of the constituent in ground water is estimated as described above in Section 3.3.3. The fraction of the constituent mass that volatilizes during use is dependent on the types of process water use. However, to provide a bounding estimate, the entire constituent mass is assumed to volatilize during use.

The airflow rate through the area is the product of the air volume in the area and the air exchange rate. The height of the 560,000 ft^2 area is 34 feet, so that the air volume is approximately 19,000,000 ft^3 (539,000 m^3). The air exchange rate for the area is controlled by a ventilation system which is operated to provide an air exchange rate of 1.1/hour during the colder half of the year and 6.6/hour during the warmer half of the year. Therefore, the airflow rate through the area ranges from approximately 593,000 m^3/hr to 3,558,000 m^3/hr.

The workplace air concentrations for tetrachloroethene and trichloroethene are calculated based on the ground water concentrations at the Moraine Engine production wells that are predicted to exceed the MCLs, as shown in Tables 3-5 through 3-14. The maximum predicted concentrations of tetrachloroethene and trichloroethene at the Moraine Engine and Moraine Assembly production wells are approximately 0.04 mg/L and 0.006 mg/L, respectively. The bounding estimates of workplace air concentrations corresponding to these predicted maximum ground water concentrations are as follows:

- Tetrachloroethene: 0.0004 mg/m^3 to 0.003 mg/m^3
- Trichloroethene: 0.00007 mg/m^3 to 0.0004 mg/m^3

These ranges correspond to the range of air exchange rates (i.e., 6.6/hour to 1.1/hour) and conservatively assume that the entire mass of the constituent in ground water volatilizes during use.

3.3.6 Estimation of Media Intake

Estimates of media intake are developed for the following potentially exposed populations (receptors) and exposure scenarios, as identified in Section 3.2:

- On-facility worker (routine industrial)
  - incidental soil ingestion
  - dermal contact with soil
  - inhalation of ambient air
- On-facility worker (excavation)
  - incidental soil ingestion
  - dermal contact with soil
  - inhalation of ambient air
- Off-facility adult resident
  - inhalation of ambient air
  - ingestion of drinking water

The general equation for estimating intake of an environmental medium for each receptor by each exposure route is as follows:

$$Intake = \frac{CR \bullet EF \bullet FC \bullet ED}{BW \bullet AT}$$

where:

CR = contact rate, which is either:
- soil ingestion rate (IR)
- skin surface area (SA) and soil-to-skin adherence (AD)
- ambient air inhalation rate (BR)
- drinking water rate (DR)

EF = exposure frequency

FC = fraction of medium ingested, contacted, or inhaled at or from an AOI

ED = exposure duration

BW = body weight

AT = averaging time; AT_{carc} (carcinogens) is equal to lifetime of 70 years, and $AT_{noncarc}$ (noncarcinogens) is equal to exposure duration, ED

The specific equations used to calculate media intakes for each route of exposure are presented in Appendix A.

Variability in the factors affecting exposure within a potentially exposed population should be considered in estimating potential current and future exposures. As one means of characterizing the distribution of possible exposures in a population, USEPA (1995A) recommends that central tendency and high-end estimates of exposure be developed. Central tendency (i.e., typical) estimates represent the average, or most likely, exposures in the population. High-end (often referred to as reasonable maximum) estimates represent the exposures "above the 90th percentile of the population distribution, but not higher than the individual in the population who has the highest exposure." (USEPA 1995C) The exposure factors for estimating typical and high-end intakes of soil and ambient air are presented in the following sections and summarized in Tables 3-15 and 3-16. These exposure factors are the same as those reviewed by USEPA in the 1996 baseline risk assessment.

3.3.7 Intake of Soil

3.3.7.1 Soil Ingestion Rates

Consistent with USEPA guidance (1993, 1991A), the typical and high-end soil ingestion rates of 25 mg/day and 50 mg/day, respectively, used in this assessment for adult workers during non-excavation activities (e.g., routine industrial activities and groundskeeping) are based on the same study (Calabrese et al. 1990) that USEPA uses for deriving ingestion rates for adults in residential settings, but are adjusted by half to account for an 8-hour work day (USEPA 1991A). The typical soil ingestion rate of 100 mg/day used for adult workers during excavation activities is taken from USEPA (1993), which is presumably based on the high-end value used for adult residents. The high-end soil ingestion rate of 480 mg/day used for workers performing excavation is taken from USEPA (1993, 1991A).

3.3.7.2 Dermal Contact Rates

Dermal contact rate is calculated as the product of exposed skin surface area and soil-to-skin adherence, which yields an effective mass of soil per day, analogous to the daily intake of soil from ingestion. The typical and high-end values for soil adherence of 0.2 mg/cm^2 and 1 mg/cm^2, respectively, are taken from USEPA (1992A). The soil adherence factor (for this range of values) is expected to be inversely related to the absorption fraction, which is the fraction of the dose that is absorbed into the skin

(USEPA 1992A). That is, a higher mass loading on the skin results in a lower fraction of chemicals that will be absorbed from the soil into the skin.

In the absence of USEPA guidance on exposed surface area for worker scenarios, USEPA (1992A, 1989A) guidance on adult clothing scenarios for outdoor activities and site-specific information is used as a basis to estimate exposed skin surface area throughout a work day. For non-excavation workers, the typical and high-end values are based on current practices at the facilities regarding the clothing worn by workers at GM facilities, which are expected to be representative of clothing worn by workers in industrial facilities in general. The typical value of 1,400 cm^2 is estimated using the face and hands of an average adult, based on data presented by USEPA (USEPA 1992A, Table 8-3). This is similar to the typical scenario recommended by USEPA (1992A), except that exposure is estimated to occur to the face only (rather than the whole head). The high-end value of 3,000 cm^2 is based on the surface areas of the forearms, head, and hands. This is similar to the high-end scenario recommended by USEPA (1992A), except that shorts are expected not to be worn at work.

For the excavation worker, the typical value of 600 cm^2 is based on a worker who wears Level D personal protective equipment, as described in the Health and Safety Plan for the supplemental RFI. A representative Level D ensemble includes coverall, gloves, boots/shoes, safety glasses/goggles, and hard hat. Accordingly, the typical scenario is based on the surface area of the face of an average adult. The associated high-end value of 3,000 cm^2 is based on exposure of forearms, head, and hands (because contact can occur when gloves are removed). USEPA's (1992A) recommendation to use 25% of total body surface as a high-end value is not pertinent at the facilities because it is based on wearing shorts or potential exposures where contaminants are carried in a fine dust or liquid suspension, which may be able to penetrate clothing (as found in studies with pesticide workers). Soil conditions, as well as routine and excavation activities at the facilities, are expected to not result in such high penetration of clothing. However, use of 25% of total body surface as a high-end value is evaluated as part of the uncertainty analysis in Section 5.

3.3.7.3 Exposure Frequencies

The typical and high-end values of 250 days/year for workers performing routine work is based on a 5-day work week for 50 weeks per year, consistent with USEPA (1993, 1991A) guidance. As discussed in Section 3.3.7.4 below, the estimate of the actual number of days per year a worker is potentially exposed to an AOI is obtained

by adjusting this "standard" exposure frequency by a "fractional contact" term to account for site-specific factors.

The typical and high-end values for excavation activities for the AOIs are based on the duration and frequency of previous excavations at Moraine Engine and Moraine Assembly. The typical number of days that a worker is expected to excavate at one AOI for routine maintenance or minor construction (e.g., repairing or replacing pavement) during his typical work life of 4 years at a facility is estimated to be 2 days. Based on the number of days required to remove underground storage tanks from tank farms at the facilities in the past, the high-end value is 10 days during the reasonable maximum work life of 21 years.

3.3.7.4 Fraction Ingested, Contacted, or Inhaled (FC)

Consistent with USEPA (1993, 1989A) guidance, the intake of an environmental medium is multiplied by a fractional contact (FC) term to estimate the fraction of the total intake that is attributable to a specific AOI. The FC term generally consists of several parts that may include site-specific meteorological factors, behavioral factors, and AOI-specific factors. In this assessment, the FC term for estimating soil intake from a specific AOI includes the following factors:

- Actual work days at the facility, e.g., to account for holidays and sick days;
- Days per year when soil is available for contact, e.g., ground not frozen or snow-covered;
- Fraction of work day that a worker spends outdoors, e.g., based on job duties, inclement weather, etc.; and
- Area of an AOI relative to the total area where intake of soil may occur.

The first three factors are not AOI-specific. They estimate the fraction of the "standard" intake that is expected from both AOIs and non-AOI areas of Moraine Engine and Moraine Assembly. The basis for these factors and their use in estimating intake are discussed below.

Actual work days are calculated by subtracting days off from work (e.g., due to holidays and sick days) from the USEPA default value of 250 days per year (which already accounts for weekends and 10 vacation days). For estimating typical exposures in this assessment, 16 days are subtracted from the default value of 250 days. This is expected to be somewhat conservative, since the adjustment accounts for only the facilities' 16 days of holidays scheduled in 1999 and does not account for

any sick days. For estimating high-end exposures, adjustment for holidays and sick days is not made.

The fraction of the year that soil is available for contact (F_{avail}) is estimated based on days per year when temperatures are above freezing in Ohio, excluding those days below freezing during which contact with outdoor soil would be unlikely. According to data compiled by NOAA (1993), temperatures are below freezing for 116 days per year (or approximately 4 months per year), based on 30 years of data. This fraction is used for both typical and high-end estimates.

A typical value for the fraction of time spent outdoors (F_{out}) is 0.125 (i.e., 1 hour per 8-hour work day). This value is based on mean hours per day outdoors (1.8 hours) presented in USEPA (1991A) and is adjusted by approximately one-half to account for an 8-hour work day out of 16 waking hours that could be spent outdoors. A high-end value is 0.19 (i.e., 1.5 hours per 8-hour work day), based on professional judgment.

The adjustments for work days, days when soil is available for contact, and fraction of work day spent outdoors give the following expression for the facility-specific (but not AOI-specific) portion of the FC term:

$$FC_f = \frac{Actual\ work\ days}{Standard\ work\ days} \bullet F_{avail} \bullet F_{out}$$

where:

F_{avail} = Fraction of year that soil is available for contact

F_{out} = Fraction of time spent outdoors

The facility-specific part of the FC term, FC_f, when combined with the default exposure frequency, provides an estimate of the amount of time a worker spends outdoors at the facilities, during which contact with soil at an AOI may occur.

During the time spent outdoors, the worker may spend only a fraction of the time at a particular AOI. The fraction of time that a worker may spend at an AOI during routine industrial work, over the long term, could be assumed to be proportional to the area of that AOI relative to the total outdoor area where intake unrelated to the AOI is expected to occur. In this case, the AOI-specific part of the FC term would be as follows:

$$FC_i = \frac{A_i}{A_{out}}$$

where:

A_i = Area of the *i*th AOI

A_{out} = Total outdoor area at the facilities

Based on the potential exposure pathways identified in Section 3.2, workers at Moraine Engine and Moraine Assembly may contact five AOIs (i.e., AOIs 7, 13, 34, 35, and 36) during routine industrial work. For estimating typical exposures, the ratio of the area of each AOI to the outdoor area that a worker may contact during routine industrial activities is used to calculate each FC_i term. The approximate areas of the AOIs and the outdoor areas are provided in Appendix A. For estimating potential high-end exposures, the workers are assumed to spend their time outdoors equally divided among the AOIs.

Potential exposures during excavation are expected to be less dependent on actual work days or daily weather conditions, so the FC terms for this potential exposure are based on different factors. For workers excavating at an AOI, the typical value for FC of 0.5 is based on the assumption that a worker typically spends 4 hours of an 8-hour day in contact with soil while excavating at an AOI. The high-end value of 1 is based on a full work day of contact with soil during excavation.

3.3.7.5 Exposure Durations

The typical and high-end values of 4 years and 21 years for workers are the median and 90th percentile number of years workers work at one location (USDOL 1992).

3.3.7.6 Body Weights

The value of 70 kg for adult workers is taken from USEPA (1993, 1990) and is used in estimating both typical and high-end exposures.

3.3.7.7 Averaging Times

The averaging time for evaluating carcinogenic risks is equal to a lifetime of 70 years. The averaging time for evaluating noncarcinogenic effects is equal to the exposure duration.

3.3.8 Intake of Ambient Air

3.3.8.1 Breathing Rates

The typical value for workers performing non-excavation activities (1.3 m^3/hour, which is 10.4 m^3 per work day) corresponds to the mean inhalation rate for an average adult (male or female) combined with average activity patterns while outdoors, calculated using data compiled by USEPA (USEPA 1990, Tables 3-1 and 3-2). The high-end value is 20 m^3 per work day (or 2.5 m^3/hour), which is a reasonable upper-bound inhalation rate for occupational settings (USEPA 1991A), based on worst-case activity patterns combined with average adult inhalation rates.

The typical inhalation rate of 2.1 m^3/hour (or 16.8 m^3 per work day) for workers performing excavation is based on an inhalation rate representative of moderate activities for an average adult (male or female) (USEPA 1990, Table 3-1); this value is also representative of an average adult male "digging with a spade" (USEPA 1990). The high-end value is 20 m^3 per work day (or 2.5 m^3/hour) based on USEPA (1991A).

Potential inhalation exposure by off-facility residents is estimated based on adult, as opposed to child, exposure factors. Risk estimates based on exposures of adults and children would be similar for carcinogens. For noncarcinogens, USEPA's reference doses (RfDs) and reference concentrations (RfCs) already incorporate an uncertainty factor specifically to protect sensitive subpopulations, including children. Combining high-end exposure factors for children with chronic RfDs would result in overly conservative estimates of exposure risk. Further, USEPA guidance states that potential exposures to children 6 years of age are not considered chronic exposures and should not be evaluated using chronic RfDs. As such, the high-end inhalation rate for adults combined with the RfD or RfC should provide adequate conservatism.

The typical value of 0.68 m^3/hour for off-facility residents is based on mean adult inhalation rates combined with the mix of daily activity patterns while indoors and outdoors, calculated using data from Tables 3-1 and 3-2 of USEPA (1990). The high-end value of 0.83 m^3/hour for off-facility residents is taken from USEPA (1993, 1991A) and, according to USEPA (1991A), is based on mean inhalation rates combined with worst-case activity patterns.

3.3.8.2 Exposure Frequencies

The exposure frequencies for intake of ambient air by workers are as presented above in Section 3.3.7.3 for estimating potential intake from direct contact with soil/waste.

During routine activities of on-facility workers, the typical and high-end exposure frequencies of 350 days/year for off-facility residents are taken from USEPA (1993). For estimating typical exposures, the "standard" frequency for residents is adjusted as described in the next section. During periods of excavation, the typical and high-end exposure frequencies for off-facility residents are the same as the corresponding values for estimating excavation exposures to workers.

3.3.8.3 Fraction Ingested, Contacted, or Inhaled (FC)

The FC terms for intake of ambient air are as presented in Section 3.3.7.4 for workers performing routine industrial and excavation activities.

Consistent with USEPA (1993), a typical value for FC for off-facility residents for routine exposure is the average percent of time spent at home (64% or 15.4 hours/day), calculated from time use data compiled in USEPA (1990). The high-end value of 1 is based on persons who spend the majority of their day at home. The same FC terms apply for estimating potential exposures to off-facility residents during any potential excavation at an AOI.

3.3.8.4 Exposure Durations

The typical and high-end values for workers are as presented in the corresponding section above. The typical and high-end values of 9 years and 30 years for off-facility residents are the median and 90th percentile number of years, respectively, that individuals live at one residence, as recommended by USEPA (1993, 1991A, 1989A).

3.3.8.5 Body Weights

The value of 70 kg for adult workers and adult residents is taken from USEPA (1993, 1990) and is used in estimating both typical and high-end exposures.

3.3.8.6 Averaging Times

The averaging time for evaluating carcinogenic risks is equal to a lifetime of 70 years. The averaging time for evaluating non-carcinogenic effects is equal to the exposure duration.

3.3.9 Intake of Drinking Water

As discussed in Section 3.3.3.4, potential ground water and surface water exposures are evaluated by comparing estimated ground water and surface water exposure concentrations to MCLs. For constituents that do not have MCLs, risk-based drinking water concentrations are

calculated using estimates of drinking water intake. The exposure factors for estimating drinking water intake are 2 L/day, 350 days/year, for 30 years, for an adult of 70 kg (USEPA 1993, 1991A).

4.0 TOXICITY ASSESSMENT

The purposes of a toxicity assessment are (1) to determine whether exposure to a chemical can cause an increased incidence of adverse human health effects and (2) to establish a quantitative dose-response relationship for the chemical so that a toxicity value can be derived for estimating the potential for adverse effects as a function of exposure to the chemical. Because USEPA has performed toxicity assessments for most of the constituents identified in Section 2 and has established toxicity values for many of the constituents for oral and inhalation exposures, the supplemental baseline risk assessment uses USEPA-derived toxicity values when such values are available (USEPA 1989A). The following sections discuss the compilation of USEPA-derived toxicity values for the constituents identified in Section 2 and the approach to evaluating potential cancer risk and noncancer effects when USEPA-derived toxicity values are unavailable for a chemical or are unavailable for a specific route of human exposure.

4.1 USEPA Toxicity Values

The USEPA Integrated Risk Information System (IRIS) is used as the primary source of USEPA-derived toxicity values for the waste constituents identified in Section 2 (see Table 2-4). When a toxicity value is not available in IRIS for a constituent, the most current USEPA Health Effects Assessment Summary Tables (HEAST) is used to obtain toxicity values. The toxicity values compiled from IRIS are current as of March 1999 (USEPA 1999). The toxicity values compiled from HEAST are current as of the annual edition published in July 1997 (USEPA 1997A).

For evaluating carcinogenic risks associated with the potential exposures discussed in Section 3, USEPA-derived cancer slope factors (SFs) are compiled for constituents having a USEPA weight-of-evidence classification of group A, B, or C. The SFs are 95% upper confidence bounds on the risk per unit dose. For evaluating noncarcinogenic effects associated with the potential exposures discussed in Section 3, USEPA-derived chronic reference doses (RfDs) are used. The RfD represents a conservative estimate of the daily exposure to the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. USEPA's derivation of RfDs

incorporates several uncertainty (or safety) factors which, in combination, are generally 1,000-fold or greater.

Oral SFs and oral RfDs are used for evaluating oral exposures. Inhalation SFs and inhalation RfDs are used for evaluating inhalation exposures. ENVIRON calculated inhalation SFs from USEPA-derived inhalation unit risks, and calculated inhalation RfDs from USEPA-derived inhalation reference concentrations (RfCs) as follows:

$$Inhalation\ SF\ (mg/kg/day)^{-1} = Unit\ Risk\ (\mu g/m^3)^{-1} \bullet \frac{70\ kg}{20\ m^3/day} \bullet 1000\ \mu g/mg$$

$$Inhalation\ RfD\ (mg/kg/day) = RfC\ (mg/m^3) \bullet \frac{20\ m^3/day}{70\ kg}$$

The oral and inhalation SFs and chronic RfDs compiled from IRIS and HEAST are presented in Table 4-1, along with USEPA's weight-of-evidence classification groups, combined UFs, and reference citations.

Several of the constituents identified in Section 2 do not have toxicity values in IRIS or HEAST. The toxicity values for these constituents, presented in Table 4-1, are taken from similar chemicals with toxicity values in IRIS or HEAST, or from provisional guidance by USEPA's National Center for Environmental Assessment (NCEA). The sources or bases for these toxicity values are explained in the notes on Table 4-1.

4.2 Constituents Without USEPA Toxicity Values

USEPA-derived inhalation toxicity values are not available for several of the constituents identified in Section 2, and USEPA-derived dermal toxicity values are not available for any chemical. Therefore, quantitative evaluation of cancer risk and noncancer effects for these combinations of constituents and routes of exposure is not possible without performing independent evaluations of toxicity data in the open literature to derive toxicity values. USEPA guidance (1989A) does not require performing independent toxicity assessments to derive toxicity values.

According to USEPA (1989A), toxicity values available for one route of exposure may be used to approximate toxicity values for another route. However, such extrapolations introduce significant uncertainties because the toxicity of a chemical may differ from one route of exposure to another. USEPA guidance (USEPA 1989A) does not require route-to-route extrapolation.

Because potential inhalation and dermal risks (cancer and noncancer) may contribute to the overall risk associated with the potential exposures estimated in Section 3, route-to-route extrapolation using available USEPA-derived toxicity values is performed to allow a quantitative uncertainty analysis of the potential cancer risk and noncancer effects for these combinations of constituents and routes of exposure. For the uncertainty analysis, route-to-route extrapolation using USEPA-derived toxicity values is performed as follows:

- Oral SFs and RfDs are used for the inhalation route, for constituents lacking inhalation SFs or RfDs.

- Oral SFs and RfDs are used for dermal exposures.

5.0 RISK CHARACTERIZATION

The human health significance of the potential exposures estimated in Section 3 is evaluated in this section. For potential exposures to waste constituents via soil- and air-related pathways, estimates of dose for each potential route of exposure are combined with the toxicity values identified in Section 4 to estimate potential cancer risks and noncancer effects. The characterization of these potential cancer risks and noncancer effects is presented in Section 5.1, along with a comparison to USEPA-established acceptable levels. For potential exposures via ground water, estimates of exposure concentrations at well fields and in the Great Miami River are compared with ground water protection standards in Section 5.2. For potential inhalation exposures via nonpotable industrial use of ground water, estimates of exposure concentrations in workplace air are compared with occupational protection standards in Section 5.3. Uncertainties in the risk characterization are presented in Section 5.4.

5.1 Potential Soil and Ambient Air Exposures

Estimates of lifetime average daily dose (LADD) for each constituent for each route of potential exposure are multiplied by the route-specific cancer slope factor (SF) for the constituent to estimate potential cancer risk, as follows:

$$Cancer\ Risk = LADD_{route} \bullet SF_{route}$$

Estimates of average daily dose (ADD) for each constituent for each route of potential exposure are divided by the route-specific reference dose (RfD) for the constituent to estimate potential noncancer effect as a hazard quotient (HQ), as follows:

$$Hazard\ Quotient = \frac{ADD_{route}}{RfD_{route}}$$

The estimation of LADDs and ADDs for the potential exposures to constituents in soil at the AOIs at Moraine Engine and Moraine Assembly (as identified in Section 3.2) is discussed in Section 3.3. To provide a characterization of variabilities in the LADDs and ADDs resulting from variabilities in the factors affecting exposure within a potentially exposed population, central tendency and high-end estimates of LADDs and ADDs are calculated using the central tendency and high-end exposure factors presented in Section 3.3. The calculated LADDs and

ADDs for each constituent for each route of exposure for each AOI are presented in Appendix A. Corresponding central tendency and high-end estimates of potential cancer risks and noncancer effects are also presented in Appendix A. The central tendency estimates of cancer risk and noncancer effects, however, account for only variabilities in exposures and do not account for variabilities in susceptibility (i.e., toxicity) in the population. USEPA toxicity values are used in calculating both the central tendency and high-end estimates. These USEPA toxicity values include safety factors and, therefore, are considered to be conservative, i.e., more likely to overestimate than to underestimate risk.

The potential cancer and noncancer effects that may result from exposure to the combination of constituents at each AOI are estimated following USEPA guidance (USEPA 1989A), as follows:

$$Risk_{cumulative} = \sum Risk_i$$

$$HI = \sum HQ_i$$

where:

$Risk_{cumulative}$	=	estimated cumulative cancer risk from all constituents
$Risk_i$	=	estimated cancer risk for the *i*th constituent
HI	=	hazard index from all constituents
HQ_i	=	hazard quotient for the *i*th constituent

According to USEPA (1989A, 1991B), the cumulative baseline cancer risk and HI for a site should include all media and pathways that the high-end exposure scenario indicates are appropriate to combine. However, high-end cancer and noncancer risk estimates for more than one pathway should not be combined unless an individual is likely to consistently face the high-end exposure via more than one pathway simultaneously. As such, the estimates of cumulative cancer risk and HI for the soil ingestion pathway and the inhalation pathway are kept separate (i.e., not summed) in this supplemental baseline risk assessment. As discussed in Section 3, the estimates of worker exposure via each pathway are derived using maximum constituent concentrations in each medium. The estimated exposures to the maximum concentrations in each medium, however, will generally occur at different locations at an AOI. Specifically, the maximum concentration of a constituent in air is predicted at the hypothetical downwind edge of an AOI, as discussed in Section 3.3.2, while the maximum concentration in soil is usually not at the AOI boundary. Because exposure estimates for each pathway are derived for exposures at different locations at an AOI, combining the estimates of ingestion and inhalation

exposures would result in highly unlikely and overly conservative estimates of potential worker exposure.

The USEPA-established acceptable cumulative cancer risk range and noncancer effects level from exposure to multiple constituents are 10^{-4} to 10^{-6} and HI of 1, respectively, based on reasonable maximum exposures (or high-end exposures) under both current and reasonably anticipated future land use. Site-related baseline risks below these levels do not warrant response action (40 CFR 300.430(e)(2); USEPA 1991B). Likewise, for RCRA corrective action, USEPA has established that cumulative site-related cancer risk not exceeding 10^{-4} and an HI not exceeding 1 are protective of human health and, therefore, do not warrant corrective measures (55 FR 30798, July 27, 1990 and 61 FR 19432, May 1, 1996).

The central tendency and high-end estimates of cumulative cancer risks and HIs for each potentially exposed population are presented by route of exposure and by AOI in Tables 5-1 and 5-2. These estimates include only calculations using USEPA-derived toxicity values, which are not available for any constituent for the dermal route and not available for some constituents for the inhalation route. Estimates that also include calculations using dermal and/or inhalation toxicity values obtained by route-to-route extrapolation from USEPA-derived oral toxicity values, as discussed in Section 4.2, are provided in the quantitative uncertainty analysis in Section 5.4. The following is a summary of the estimates of cumulative cancer risks and HIs in Tables 5-1 and 5-2 for each potentially exposed population.

Summary of Cumulative Cancer Risk and Hazard Index Estimates				
	Cumulative Cancer Risk		Hazard Index	
	Central	High-End	Central	High-End
On-Facility Worker				
Routine Industrial:				
Ingestion of soil	2×10^{-8}	8×10^{-7}	8×10^{-4}	6×10^{-3}
Inhalation of ambient air	6×10^{-10}	5×10^{-9}	1×10^{-3}	1×10^{-3}
Excavation:				
Ingestion of soil	7×10^{-9}	3×10^{-7}	4×10^{-4}	4×10^{-3}
Inhalation of ambient air	2×10^{-8}	3×10^{-7}	1×10^{-2}	2×10^{-2}
Off-Facility Resident				
Inhalation of ambient air	2×10^{-8}	1×10^{-7}	1×10^{-2}	2×10^{-2}

The following are explanatory notes to the above summary:

- The summary includes estimates of cancer and noncancer risk under both current and reasonably anticipated future land use. Current potential on-facility and off-facility risks are associated with AOI 7 (Former Oil House Area) and excavation activities at AOIs 13, 34, 35, and 36, which are presented in Tables 5-1 and 5-2. All other risks are associated with exposures that currently do not exist but are possible under current and future land use at the facilities.

- For the routine industrial scenario, the estimates of cumulative cancer risk and HI for workers at Moraine Engine and Moraine Assembly are the sums of the cumulative cancer risks and HIs for AOIs 7, 13, 34, 35, and 36 where worker exposure during routine industrial operations may be possible in the future (and currently at AOI 7).

- For the excavation scenario, the estimates of cumulative cancer risks (ingestion) and estimates of cumulative HIs (ingestion) are for AOI 34 (Excavation Area 1) and AOI 13 (Buildings 4, 6 and 13), respectively, which are the maximums among the AOIs. The estimates of cumulative cancer risks (inhalation) and estimates of cumulative HIs (inhalation) are for AOI 13 (Buildings 4, 6 and 13), which are the maximums among the AOIs. Summing estimates of risk and HI across all AOIs is inappropriate for this scenario since an individual worker would not likely receive the estimated excavation exposures from more than one AOI, given the expected infrequency of excavation at AOIs.

- For the off-facility residential exposure scenario, estimates of cumulative cancer risk and HIs are for potential exposures from AOI 13 (Buildings 4, 6 and 13), which are the maximums among the AOIs. Summing estimates of risks and HIs across all of the AOIs is inappropriate for this scenario because the exposure estimates for each AOI are developed assuming that an off-facility receptor is located at the nearest facility boundary to the AOI, and therefore, would not be located adjacent to other AOIs.

The estimates of cumulative risk and HI in Tables 5-1 and 5-2 (and in the above summary) include both AOI-related as well as natural background contributions. An estimate of the contribution from natural background levels of constituents in soil is presented in Section 5.4. As shown in the above summary, the high-end estimates of cumulative cancer risk and noncancer effects are below USEPA's acceptable levels.

The estimates of high-end risks developed in this assessment are derived using conservative estimates of exposure concentrations and exposure assumptions that are combined

with conservative estimates of toxicity. As such, they are considered screening-level estimates, which are expected to be above the 90th percentile of the distribution of population risks and potentially higher than risks to the maximally exposed individual. Had the screening-level estimates of high-end risks exceeded the levels established by USEPA as protective of human health, further characterization of the variability of the potential distributions of risk in the potentially exposed populations (e.g., by using Monte Carlo-type techniques) would have been performed to derive high-end estimates of risks that, according to USEPA (1992C), are "above the 90th percentile of the population distribution, but not higher than the individual in the population who has the highest exposure." A rigorous characterization of the high-end of the risk distribution is unnecessary in this case, since the screening-level estimates are well within USEPA's acceptable levels. The highest estimates of cumulative risk and HI are approximately 25-fold below the levels USEPA has established as protective. The uncertainties in the risk characterization using the screening-level estimates are discussed in Section 5.4.

5.2 Potential Ground Water Exposures

As discussed in Section 3.3.3, potential exposures via the ground water pathway are evaluated for 10 ground water use scenarios (Table 3-4). The 10 scenarios are divided into two groups of five scenarios. One group (Scenarios 6 through 10) includes current interim measures (i.e., operation of wells TW2 and DN13 for hydraulic control) in each scenario and the other group does not include interim measures (Scenarios 1 through 5). The first scenario (Scenario 1) is the baseline ground water use scenario, which represents current ground water use conditions as discussed in Section 3.1.3. Scenario 2 is the baseline condition with the addition of the Miami Shores well field pumping as an emergency drinking water supply. Scenario 3 represents a more unlikely condition in which Miami Shores is pumping as an emergency drinking water supply and currently inactive on-site industrial production wells are placed into service as nonpotable industrial water supplies. Scenarios 4 and 5 represent even less likely conditions in which the Dryden Road South well field is added to the conditions modeled in Scenarios 2 and 3 as a secondary emergency drinking water supply to supplement Miami Shores as the primary emergency drinking water supply.

Estimates of constituent concentrations in ground water at each point of ground water use in each ground water use scenario are calculated as described in Section 3.3.3, and are summarized in Tables 3-5 to 3-14. The contributions to the exposure concentrations at each point of exposure in each ground water use scenario from each SWMU and AOI are presented in Appendix B. Estimates of constituent concentrations in the Great Miami River attributable to ground water flow from beneath the three facilities to the River are calculated as described

in Section 3.3.4. Because the maximum estimated SWMU- and AOI-related constituent concentrations in the Great Miami River is only approximately 0.00001 mg/L, the estimated concentrations in the River under the 10 ground water use scenarios are not shown in Tables 3-5 to 3-14.

Acceptable concentrations of constituents in drinking water are established as maximum contaminant levels (MCLs) in regulations promulgated under the Safe Drinking Water Act. For a constituent that does not have an MCL, a comparable risk-based drinking water concentration is calculated using the drinking water intake assumptions presented in Section 3.3.9. Risk-specific drinking water concentrations are calculated using a HQ of 1 and a cancer risk level of 10^{-6}. For a constituent whose calculated risk-specific drinking water concentration is lower than what is typically measurable, the practical quantitation limit (PQL) for the constituent in ground water as specified in the *Supplemental RFI Work Plan's* Quality Assurance Project Plan (QAPP) is used instead. However, in no case is a risk-based drinking water concentration set above 10^{-4} risk, consistent with USEPA policy under the Safe Drinking Water Act. The MCLs, risk-based drinking water concentrations, and PQLs used for evaluating estimated ground water exposure concentrations are presented in Table 5-3.

Although some potential exposures via the ground water pathway are not drinking water exposures (i.e., nonpotable industrial ground water use, water contact while swimming in the Great Miami River), MCLs or risk-based drinking water concentrations are used as conservative screening criteria to evaluate the estimated exposure concentrations at potential points of ground water and surface water exposure. For constituents predicted to have concentrations higher than MCLs or risk-based drinking water concentrations in ground water from on-site industrial production wells, estimated exposure concentrations of the constituents in workplace air are compared with occupational protection standards in Section 5.3.

A comparison of the estimated constituent concentrations with the MCL or risk-based drinking water concentrations is provided on Tables 3-5 through 3-14 for each of the 10 ground water use scenarios. For each ground water use scenario, the constituents that are predicted to exceed MCLs or risk-based drinking water concentrations at potential points of ground water use are summarized below in two tables. The first table summarizes the results when contributions from constituents in soil/waste at all AOIs and SWMUs are considered. The second table summarizes the results when contributions from constituents already in ground water at AOI 7 are also included.

Summary of Predicted MCL Exceedances Contributions from Soil/Waste At All AOIs and SWMUs							
	Dryden Rd North	Dryden Rd South	Miami Shores	Moraine Assembly	Moraine Engine	Delphi Thermal	West Carrollton
Scenario 1	--	--	--			--	
Scenario 2	--	--				--	
Scenario 3	--	--					
Scenario 4	--	PCE, TCE, Cr, Pb, Ni				--	
Scenario 5	--	PCE, TCE, Cr					
Scenario 6		--	--			--	
Scenario 7		--				--	
Scenario 8		--					
Scenario 9						--	
Scenario 10							
Refer to Table 3-4 for a listing of each scenario.							

Summary of Predicted MCL Exceedances Contributions from Soil/Waste At All AOIs and SWMUS, and Including AOI 7 Ground Water							
	Dryden Rd North	Dryden Rd South	Miami Shores	Moraine Assembly	Moraine Engine	Delphi Thermal	West Carrollton
Scenario 1	--	--	--	PCE	PCE	--	
Scenario 2	--	--		PCE	PCE	--	
Scenario 3	--	--		PCE	[PCE, TCE]		
Scenario 4	--	PCE, TCE, Cr, Pb, Ni		PCE	PCE	--	
Scenario 5	--	PCE, TCE, Cr		PCE	[PCE, TCE]		
Scenario 6	PCE	--	--	PCE	PCE	--	
Scenario 7	PCE	--			PCE	--	
Scenario 8	PCE	--			PCE		
Scenario 9	PCE	PCE			PCE	--	
Scenario 10	PCE	PCE			PCE		
Refer to Table 3-4 for a listing of each scenario.							

A blank in the above summaries means that no estimated constituent concentration exceeds MCLs or risk-based drinking water concentrations. A dash (--) means that the well field is not pumping in a scenario. The acronyms in the summaries represent the following constituents: tetrachloroethene (PCE), trichloroethene (TCE); chromium, total (Cr); lead (Pb); and nickel (Ni). Constituents enclosed in brackets [ ] under Moraine Engine refer to predicted concentrations exceeding MCLs only at the currently inactive production well (Well 28). These summaries are discussed below in the next two subsections.

5.2.1 Constituents in Soil/Waste

The first summary table presented above, which does not include effects from constituents already in ground water at AOI 7, shows that potential leaching of constituents from soil/waste at the SWMUs and AOIs is unlikely to adversely affect current and reasonably expected future ground water uses. Predicted ground water concentrations do not exceed MCLs or risk-based drinking water concentrations at any currently used well field or on-site industrial well under any scenario. Predicted ground water concentrations exceed MCLs for a few constituents only at the Dryden Road South well field in some unlikely hypothetical scenarios (Scenarios 4 and 5) in which the well field is used as a secondary emergency drinking water supply. The low probability of needing the Dryden Road South well field to supplement both the drinking water supply from the City of Dayton and the Miami Shores well field is discussed further below in Section 5.4.6.

In the unlikely event that the Dryden Road South well field is needed as a secondary emergency water supply, the potential leaching of constituents from soil/waste still would have limited effect. The constituents predicted to exceed MCLs at the Dryden Road South well field are PCE (0.01 mg/L in Scenario 4 and 0.009 mg/L in Scenario 5, compared to the MCL of 0.005 mg/L), TCE (0.02 mg/L in Scenario 4 and 0.01 mg/L in Scenario 5, compared to the MCL of 0.005 mg/L), chromium (0.2 mg/L in Scenario 4 and 0.13 mg/L in Scenario 5, compared to the MCL of 0.1 mg/L), lead (0.02 mg/L in Scenario 4, compared to the MCL of 0.015 mg/L at the tap), and nickel (0.1 mg/L in Scenario 4, compared to the Ohio MCL of 0.1 mg/L). The primary sources contributing these constituents are as follows:

- The primary contributor of PCE and TCE concentration is Landfill L1, based on assigning ground water concentration of PCE and TCE from monitoring well GM-6 to Landfill L1.

water from AOI 7 are far more likely and potentially more significant. Although the migration of constituents in ground water from AOI 7 are not expected to adversely affect current drinking water supplies (i.e., the West Carrollton well field), PCE and TCE in ground water at AOI 7 are predicted to cause concentrations in ground water at industrial wells at Moraine Engine and Moraine Assembly to exceed MCLs (0.005 mg/L for both PCE and TCE) under several ground water use scenarios. These constituents are also predicted to affect ground water quality at the Dryden Road South and Dryden Road North well fields, although ground water use at these well fields is unlikely.

In Scenarios 1 through 5 (without pumping at the interim measures wells), the predicted concentrations of PCE at the Moraine Engine and Moraine Assembly productions wells are as follows:

- Moraine Engine active production wells: 0.005 mg/L to 0.006 mg/L
- Moraine Engine inactive production well (Well 28): 0.04 mg/L
- Moraine Assembly active production wells: 0.009 mg/L to 0.03 mg/L

The inactive production well at Moraine Engine (Well 28) is also predicted to have TCE at 0.006 mg/L in Scenarios 3 and 5.

In Scenarios 6 through 10 (with pumping at the interim measures wells), the predicted concentrations of PCE at the Moraine Engine and Moraine Assembly productions wells are as follows:

- Moraine Engine active production wells: 0.005 mg/L to 0.006 mg/L
- Moraine Engine inactive production well: 0.03 mg/L
- Moraine Assembly active production wells: 0.006 mg/L in Scenario 6 (and lower than the MCL in Scenarios 7 through 10)

TCE was not predicted to exceed the MCL in Scenarios 6 through 10.

Ground water from the industrial production wells at Moraine Engine and Moraine Assembly is currently used as nonpotable process water. The facilities obtain potable water from the City of Dayton via the Greater Moraine Water System. As such, ground water from the industrial production wells do not need to meet MCLs or risk-based drinking water concentrations under current use. As discussed above in Section 3.2.6, the most potentially significant route of exposure to ground water from the industrial wells is inhalation of vapor from ground water by workers during nonpotable use in manufacturing operations. For the constituents predicted to be at concentrations exceeding MCLs (PCE

and TCE), the potential significance of these concentrations for this potential route of exposure is evaluated below in Section 5.3.

The concentrations of PCE and TCE is predicted to exceed the MCL at the Dryden Road South well field in the hypothetical scenarios (Scenarios 4, 5, 9, and 10) in which the well field is used as a secondary emergency drinking water supply. The predicted concentrations of PCE range from approximately 0.007 mg/L to 0.01 mg/L and the predicted concentrations of TCE range from approximately 0.01 mg/L to 0.02 mg/L. However, the use of ground water from this well field is unlikely. The low probability of needing the Dryden Road South well field to supplement both the drinking water supply from the City of Dayton and the Miami Shores well field is discussed further below in Section 5.4.6. The concentration of PCE is also predicted to exceed the MCL at the interim measures well DN13 (Dryden Road North). The predicted concentrations of PCE range from approximately 0.008 mg/L to 0.01 mg/L. However, the use of ground water from this well as a drinking water supply or an emergency supply is expected to be highly unlikely, if at all, as discussed above in Sections 3.1.3.1, 3.1.3.3 and 3.3.3.1.

5.3 Potential Workplace Air Exposures

As discussed in Section 3.2.6, the most potentially significant route of exposure to ground water from on-site production wells is inhalation of vapors from ground water by workers during nonpotable use in manufacturing operations. Constituents predicted to have ground water concentrations lower than MCLs or risk-based drinking water concentrations are considered to be at levels that are protective of workers. As discussed above, only PCE and TCE were predicted to be at ground water concentrations that exceed MCLs at the production wells. For these constituents, bounding estimates of workplace air concentrations are calculated as discussed in Section 3.3.5. These estimates are based on site-specific process water usage in operations at Moraine Engine that might allow PCE and TCE to volatilize into workplace air.

The estimates of workplace air concentrations of PCE and TCE can be compared with Occupational Safety and Health Administration (OSHA) standards to determine whether workers may receive unacceptable occupational exposures. The OSHA 8-hour time-weighted average standards (or permissible exposure limits, PELs) for PCE and TCE are 678 mg/m^3 and 537 mg/m^3, respectively. By comparison, the bounding estimates of PCE and TCE workplace air concentrations are 0.003 mg/m^3 and 0.0004 mg/m^3, respectively. These estimates are 100,000-fold less than the PELs, which indicates that potential exposures to workers via inhalation of PCE and TCE vapors from ground water are expected to be insignificant.

5.4 Uncertainty Analysis

5.4.1 Cumulative Risks

The summation of cancer risks and noncancer effects for multiple constituents is based on dose additivity, which assumes that there are no synergistic or antagonistic interactions among the constituents in a mixture and that each constituent has the same mode of action and elicits the same health effects (USEPA 1989B). The cumulative estimates are considered screening-level estimates because they tend to overestimate cumulative cancer risks and noncancer effects.

For example, the estimate of cumulative cancer risk is a sum of upper bound estimates of cancer risk, which are calculated with slope factors representing upper 95% confidence bounds of cancer potency. Constituents with lesser evidence of human carcinogenicity are treated the same as constituents with greater evidence (i.e., USEPA weight-of-evidence Groups B and C carcinogens are given the same weight as Group A carcinogens). Similarly, constituents with RfDs of lower confidence (i.e., larger uncertainty factors) are treated the same as constituents with RfDs of higher confidence. The estimates of HIs presented in this baseline risk assessment include constituents that may induce different health effects or that may act by different mechanisms. However, refinement of the screening-level HIs by segregating constituents by effects and mechanisms of actions is unnecessary in this case, because cumulative HI is less than 1 for all scenarios, as discussed in Section 5.1.

5.4.2 Background Risks

As discussed in Section 2.2, inorganic constituents at naturally occurring background levels are included in the constituent concentrations used in deriving the estimates of cumulative risk and noncancer effects presented in Section 5.1 above. As such, these estimates include a background component that is not AOI-related. The background component of the risk estimates is quantified by applying the methods and assumptions that are discussed in Sections 3, 4, and 5.1 to the background levels of inorganics presented in Table 3.2. For the types of potential exposures evaluated in this baseline risk assessment and assuming background levels of inorganics at each AOI, the highest central tendency estimate of background cumulative risk is 2×10^{-8}. The highest high-end estimate of cumulative risk is 3×10^{-7} The highest central tendency estimate of background HI is 4×10^{-2}. The highest high-end estimate of HI is 5×10^{-2}. These estimates are calculated using only USEPA-derived toxicity data (i.e., without any route-to-route extrapolation). Comparison of these estimates with those summarized in Section 5.1 (Tables 5-1 and 5-2)

shows that natural background contributes a significant component to many of the estimates of cumulative cancer risk and HI.

5.4.3 Extrapolated Inhalation and Dermal Toxicity Values

As noted in Section 4, many of the constituents included in the quantitative exposure assessment do not have USEPA-derived toxicity values for evaluating cancer risk or noncancer effects via the inhalation route of exposure. USEPA also has not established any toxicity values for evaluating risks or effects via the dermal route. To provide a quantitative analysis of the potential uncertainties in the estimates of risk discussed in Section 5.1 above (which use only USEPA toxicity values), estimates of cancer risk and noncancer effects are developed using the route-to-route extrapolations discussed in Section 4.2.

The calculations of cumulative risk and HI using both the USEPA-derived toxicity values and the extrapolated toxicity values are presented in Appendix A. A summary of the results using only USEPA-derived toxicity values is presented in Tables 5-1 and 5-2. A summary of the results using both USEPA-derived toxicity values and extrapolated toxicity values is presented in Tables 5-4 and 5-5. A comparison of the estimates obtained with and without the use of extrapolated toxicity data shows the following:

- Using extrapolated toxicity values, the highest central tendency estimate of cumulative risk for the inhalation route remains the same at 2×10^{-8}.

- Using extrapolated toxicity values, the highest high-end estimate of cumulative risk for the inhalation route remains the same at 3×10^{-7}.

- Using extrapolated toxicity values, the highest central tendency estimate of cumulative risk for the dermal route is 2×10^{-10} and the highest high-end estimate is 5×10^{-8}. Both of these estimates are primarily the result of using a dermal toxicity value for arsenic that is extrapolated from the oral SF.

- Using extrapolated toxicity values, the highest central tendency estimate of HI for the inhalation route remained the same at 1×10^{-2}.

- Using extrapolated toxicity values, the highest high-end estimate of HI for the inhalation route remained the same at 2×10^{-2}.

- Using extrapolated toxicity values, the highest central tendency estimate of HI for the dermal route is 9×10^{-6} and the highest high-end estimate is 4×10^{-4}. Both of these estimates are primarily the result of using a dermal toxicity value for arsenic that is extrapolated from the oral RfD.

As discussed in Section 4.2, the extrapolation of toxicity values from one route to another introduces significant uncertainties because the toxicity of a chemical may differ from one route of exposure to another. As such, the estimates of cumulative cancer risk and noncancer effects obtained with extrapolated toxicity values should not be combined with the estimates obtained without extrapolation, since the results may not be an accurate indication of the risks associated with that route of exposure.

5.4.4 Skin Surface Area

The skin surface area used in the calculation of the high-end estimates of potential dermal exposures is 3,000 cm^2 because USEPA's basis for its recommendation to use 25% of the body surface (i.e., 5,800 cm^2) as a high-end value is expected to be not pertinent to the work conditions at the Facility, as discussed in Section 3.3.7.2. Using 5,800 cm^2, however, would not significantly alter the conclusions of the assessment because doubling the skin surface area would double the highest high-end estimate of cumulative risk for the dermal route from 5×10^{-8} to 1×10^{-7} and the highest high-end estimate of HI from 2×10^{-4} to 8×10^{-4}. These higher estimates are still well below USEPA-established levels for protection of human health. Additionally, the uncertainties in the estimates of dermal risks (cancer and noncancer) are dominated by uncertainties in dermal toxicity, rather than by uncertainties in exposure.

5.4.5 Chromium

In the RFI, chromium was measured as chromium (total) and is evaluated in the risk assessment as hexavalent chromium. Hexavalent chromium has an oral RfD that is 200-fold lower than that for trivalent chromium and, unlike trivalent chromium, is evaluated by USEPA as a human carcinogen. As such, potential cancer risks and non-cancer effects for chromium (total) are likely to be overestimated in this assessment because chromium detected at the Moraine Plants is likely to be largely in the trivalent, rather than hexavalent, form. Furthermore, the estimated cancer and noncancer risks for chromium are associated with concentrations that are within site-specific background levels, so that they represent background risks.

5.4.6 Combined Pathway Risks

As discussed in Section 5.1, the cumulative baseline cancer risk and HI for a site should include all media and pathways that the high-end exposure scenario indicates are appropriate to combine (USEPA 1989A, 1991B). Based on the exposure assessment conducted for these facilities (see Section 3.2), a worker may be exposed via both the inhalation and ingestion pathways. However, in developing the conservative risk estimates for these pathways, maximum concentrations have been used, and the maximum concentration for the soil ingestion pathway is generally not at the same location as the maximum concentration for the inhalation pathway. Also, the location of the maximum concentration for one constituent does not necessarily occur at the same location as another constituent. Because an individual is not likely to be exposed consistently to the maximum concentrations by the different pathways simultaneously, then consistent with USEPA's guidance (RAGS), the risk estimates were not combined for the baseline assessment. Combining these estimates would overstate the estimated high-end risks associated with potential worker exposures.

However, combining the risk estimates associated with these pathways for the routine and excavation worker exposures would not significantly alter the conclusions of the assessment for any AOI. As shown on Table 5-5, combining the routine worker pathways for an AOI results in the highest high-end estimate of cumulative risk for a single AOI of 5×10^{-7} and the highest high-end cumulative HI for a single AOI of 4×10^{-3}. The overall combined high-end cumulative risk estimate and HI across all AOIs and pathways is 8×10^{-7} and 8×10^{-3}, respectively. Similarly, for the excavation worker, the highest high-end estimate of cumulative risk for a single AOI is 5×10^{-7} and the highest high-end cumulative HI for a single AOI is 2×10^{-2}. These higher estimates are still USEPA-established levels for protection of human health.

5.4.7 Fraction Contacted

As described in Section 3.3.7.4, it is assumed that a worker may spend a portion of a workday outdoors, during which contact with soil at an AOI may occur. For estimating the potential high-end exposures, the workers are assumed to spend their outdoor time equally divided among the AOIs. Given that these are manufacturing facilities, GM does not expect its routine workers to be present for any extended period during a workday in any of the outdoor AOIs. Further, GM has already accounted for those job responsibilities that may be different than the manufacturing worker (i.e., excavation worker). However, in the unlikely event that a routine worker spends his entire day outdoors at one AOI, the conclusions of this assessment would not be significantly altered.

As shown on Table 5-5a, changing the distribution of outdoor time from being evenly distributed across AOIs to being spent entirely at a single AOI would increase the highest high-end estimate of cumulative risk for a single AOI from 5×10^{-7} to 2×10^{-6} and the highest high-end cumulative HI for a single AOI from 4×10^{-3} to 2×10^{-2} (note that in this case, it would be inappropriate to sum the risk estimates across the AOIs). These higher estimates are still at the low-end of USEPA-established levels for protection of human health.

5.4.8 Ground Water Exposure Scenarios

As discussed in Section 5.2, under certain unlikely pumping scenarios (Scenarios 4 and 5, and 7 through 10), which include the hypothetical use of the Miami Shores, Dryden Road South, and/or Dryden Road North well fields, the conservative estimates of ground water concentrations may exceed MCLs for certain constituents. These estimates of constituent concentrations, however, are expected to overstate the potential reasonable maximum exposures to the constituents because of the low probability of occurrence of these scenarios. The low likelihood of these scenarios is discussed in detail in Section 3.1.3 and is summarized below:

- For Scenario 4 to occur, the Miami Shores (as a primary emergency drinking water supply) and Dryden Road South well fields (as a secondary emergency supply) would have to be pumping at the same time. Because the Miami Shores well field was used during only two summers in the past 11 years, the probability that this well field would be used in an emergency could be conservatively estimated to be 2 events per 11 years. This would be conservative for several reasons, including: (1) it does not account for the decreased probability of use of this well field due to increased delivery capacity of the Dayton Water System (DWS) since Miami Shores was last used; and (2) the Montgomery County Water Department has indicated it would institute water curtailment measures before resorting to alternate water supplies if the DWS were not able to meet demand (Westerfield 1995).

  Because Montgomery County plans to use Miami Shores as the primary emergency well field, it is even less likely that Dryden Road South would be used. However, since this well field was used intermittently one summer in the last 11 years (before the increase in the delivery capacity of the DWS), the probability of use of this well field could be conservatively estimated to be 1 event per 11 years. This estimate would be conservative for the same reasons

listed above. The joint probability of these two well fields pumping simultaneously could be conservatively estimated to be less than 2% (i.e., 2/11 x 1/11).

- Scenario 5 is even less likely because it would require not only the simultaneous pumping of Miami Shores and Dryden Road South, but also the simultaneous redevelopment of industrial wells at Delphi Thermal which have been inactive for nearly 13 years and the redevelopment of Moraine Engine Well 28. That is, the probability of these three unlikely events occurring simultaneously is expected to be much less than 1%.

5.4.9 Ground Water Exposure Concentrations

As discussed in Section 3.3.3, mathematical models of ground water flow and transport are used in combination with soil and ground water monitoring data to estimate ground water concentrations at current and reasonably expected points of ground water use. These models incorporate a number of assumptions that are designed to provide an evaluation of the potential transport of constituents from SWMUs and AOIs that is conservative overall. The key assumptions include:

- Each SWMU or AOI provides a continuous, steady-state flux of constituents into the upper aquifer.
- No degradation of constituents occurs during transport.
- No dispersion of constituents occurs during transport.

The first assumption means that the mass of constituents at a SWMU or AOI is assumed to remain constant over time (i.e., disregarding the depletion of mass that would actually occur with leaching from soil/waste). This assumption of "infinite mass" is highly conservative for SWMUs or AOIs where only residual levels of constituents remain in soil (e.g., locations where tanks have been removed). This assumption may be more realistic for modeling relatively immobile constituents at SWMUs where a large volume of waste remains in place or the ground water conditions at AOI 7 where DNAPL may be present in the saturated zone.

The second assumption means that the model does not account for transformation of constituents during transport in ground water. For constituents observed to transform in ground water (e.g., PCE and TCE), the model is expected to over predict the concentrations of parent constituents (e.g., PCE) and under predict the concentrations of

degradation products (e.g., cis-1,2-dichloroethene). The degree of degradation of a constituent during ground water transport is determined primarily by travel time of the constituent to a particular point and the rate of constituent degradation. However, both travel time and rate of degradation are difficult to quantify, based on existing site-specific data.

The third assumption means that constituent concentrations are predicted to be higher within the body of a ground water plume but the plume has slightly less spread. The effects of this assumption are difficult to quantify but are expected to be minimal because the model provides steady-state results at pumping wells (rather than transient results at plume edges which may be more sensitive to this assumption).

Overall, the model is expected to provide conservative estimates of constituent concentrations in ground water at the identified points of potential ground water use. Table 5-6 provides a comparison of the model predictions for the interim measures wells (TW2 and DN13) and the active Moraine Engine and Moraine Assembly production wells with ground water monitoring data from these wells. Among the 10 ground water use scenarios evaluated in the supplemental baseline risk assessment, Scenario 6 is the most similar to the more recent ground water pumping conditions in the immediate vicinity of the facilities. As shown in Table 5-6, the model-predicted ground water concentrations are higher than or within the same order of magnitude as the concentrations measured in ground water from the industrial production wells; and as expected, the model overpredicted the concentrations of parent compounds (e.g., PCE, TCE) and underpredicted the concentrations of degradation products (e.g., cis-1,2-dichloroethene and vinyl chloride).

Among the degradation products, vinyl chloride has been detected in monitoring data from the Moraine Engine production wells (Wells 31 and 39) at concentrations slightly higher than its MCL of 0.002 mg/L. However, the maximum detected concentration of 0.0043 mg/L is expected to result in no unacceptable exposure to workers under current use of the ground water as process water in manufacturing operations. The bounding estimates of workplace air concentrations corresponding to this maximum detected ground water concentration (calculated as described in Section 3.3.5) is 0.00005 mg/m^3 to 0.0003 mg/m^3. These bounding estimates are 8,500-fold less than the OSHA PEL for vinyl chloride and are lower than detection limits for vinyl chloride in air.

5.5 Conclusions

As discussed in Section 1.2, the 1996 baseline risk assessment and the supplemental RFI baseline risk assessment were conducted with the primary objective of addressing the following questions:

1. Do constituents in soil/waste at any of the SWMUs at Delphi Thermal pose an unacceptable risk which warrants corrective measures?

2. Do constituents in soil at any of the AOIs at Moraine Engine and Moraine Assembly pose an unacceptable risk which warrants corrective measures?

3. Do constituents in ground water at any of the SWMUs or AOIs pose an unacceptable risk which warrants corrective measures?

The 1996 baseline risk assessment concluded that constituents in soil/waste at the Delphi Thermal SWMUs do not present an unacceptable risk under reasonable maximum exposures via direct contact, airborne transport, or ground water transport.

The supplemental baseline risk assessment described in this report reevaluated whether soil/waste at any of the SWMUs at Delphi Thermal pose an unacceptable risk via ground water transport. This reevaluation was performed to assess the combined effect of the SWMUs at Delphi Thermal with the AOIs at Moraine Engine and Moraine Assembly and to address USEPA's June 11, 1996 comments. It also evaluated whether soil at any of the AOIs at Moraine Engine and Moraine Assembly pose an unacceptable risk via direct contact, airborne transport, and ground water transport. Additionally, the supplemental baseline risk assessment evaluated whether constituents already in ground water at the primary source area within AOI 7 pose an unacceptable risk to current and reasonably expected future ground water uses. The conclusions of the supplemental baseline risk assessment are as follows:

1. Constituents in soil at the Moraine Engine and Moraine Assembly AOIs do not pose an unacceptable risk via direct contact or airborne transport. Estimates of potential cumulative cancer risk and noncancer hazard index for potential exposures to constituents in soil at the AOIs via soil- and air-related pathways, assuming reasonable maximum exposures, are below levels USEPA considers protective of human health. Based on the risk estimated in the baseline risk assessment, including consideration of the risk estimates developed for the uncertainty analysis, no significant risk drivers were identified. As shown on Table 5-2, none of the high-end cancer risk estimates

exceed the low end of USEPA's acceptable risk range. Even for the highest high-end risk estimates developed for the uncertainty analysis (see Table 5-5a), the only risk estimate exceeding the low end of the acceptable risk range was for AOI 34 (with a high-end risk estimate of 2×10^{-6} for the ingestion pathway); this risk estimate is principally associated with the presence of arsenic at 85 mg/kg at AOI 34.

2. Constituents in soil/waste at the SWMUs and AOIs also do not pose an unacceptable risk via ground water transport under the 10 ground water use scenarios evaluated.

   - Under current ground water use conditions, without or with taking into account the current interim measures (Scenarios 1 and 6, respectively), potential leaching of constituents from soil/waste to ground water is not predicted to cause concentrations at points of ground water use to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs).

   - In the event that the Miami Shores well field is used to supply water in an emergency without the need to also use the Dryden Road South well field (Scenarios 2, 3, 7, and 8), potential leaching of constituents from soil/waste to ground water is not predicted to cause concentrations at points of ground water use to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) with or without current interim measures.

   - In the very unlikely event that the Miami Shores and Dryden Road South well fields are both needed to supply water in an emergency without current interim measures (Scenarios 4 and 5), potential leaching of constituents from soil/waste at the SWMUs (primarily Landfill L1 and the Waste Pile Staging Area) is predicted to cause concentrations at Dryden Road South to exceed MCLs for a few constituents. Specifically, PCE (0.01 mg/L in Scenario 4 and 0.009 mg/L in Scenario 5, compared to the MCL of 0.005 mg/L), TCE (0.02 mg/L in Scenario 4 and 0.01 mg/L in Scenario 5, compared to the MCL of 0.005 mg/L), chromium (0.2 mg/L in Scenario 4 and 0.13 mg/L in Scenario 5, compared to the MCL of 0.1 mg/L), lead (0.02 mg/L in Scenario 4, compared to the MCL of 0.015 mg/L), and nickel (0.1 mg/L in Scenario 4, compared to the Ohio MCL of 0.1 mg/L) are predicted to exceed MCLs.

However, these results are expected to overstate potential reasonable maximum exposures because of the low likelihood that the Dryden Road South well field would be used. Also, the predicted effects attributed to Landfill L1 actually may be from upgradient ground water at AOI 7, and the predicted effects attributed to the Waste Pile Staging Area are not supported by on-site ground water monitoring data. In the corresponding scenarios which account for the current interim measures (Scenarios 9 and 10), potential leaching of constituents from soil/waste at the SWMUs and AOIs is not predicted to cause concentrations at points of ground water use to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs).

3. Constituents in ground water at the primary source area within AOI 7 may affect ground water quality at some points of current and reasonably expected future ground water use, under the 10 ground water use scenarios evaluated.

   - The migration of constituents in ground water from AOI 7 is not predicted to cause concentrations at current drinking water supplies (i.e., the West Carrollton well field) to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) under any of the 10 ground water scenarios evaluated (with or without the current interim measures).

   - The migration of constituents in ground water from AOI 7 is not predicted to cause concentrations at the Miami Shores well field to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) if it is used as an emergency drinking water supply (with or without the current interim measures).

   - The migration of constituents in ground water from AOI 7 is not predicted to cause concentrations at the currently inactive Delphi Thermal industrial production wells to exceed MCLs (or similar risk-based drinking water concentrations for constituents without MCLs) if they were placed into service under the pumping scenarios evaluated.

   - The migration of tetrachloroethene (PCE) and trichloroethene (TCE) in ground water from AOI 7 is predicted to cause concentrations in ground

water at the Moraine Engine and Moraine Assembly industrial production wells to exceed MCLs (0.005 mg/L for both PCE and TCE) under several ground water use scenarios (including those with the current interim measures). The predicted concentrations of PCE range from approximately 0.005 mg/L to 0.04 mg/L and the predicted concentrations of TCE range from below the MCL to 0.006 mg/L. However, ground water from these production wells is currently used as nonpotable uses and the predicted bounding estimates of indoor air concentrations of PCE and TCE represent concentrations approximately 10,000-fold below OSHA PELs to workers under current use.

- The migration of PCE and TCE in ground water from AOI 7 is predicted to cause concentrations in ground water to exceed MCLs (0.005 mg/L for both PCE and TCE) at the Dryden Road North well field under ground water use scenarios with the current interim measures and at the Dryden Road South well field for several ground water use scenarios with and without the current interim measures. The predicted concentrations of PCE range from approximately 0.007 mg/L to 0.01 mg/L and the predicted concentrations of TCE range from 0.01 mg/L to 0.02 mg/L. However, ground water use at these well fields is very unlikely, and therefore, potential exposures to these constituents from these well fields are likely overstated.

No unacceptable human exposures have been determined to be currently occurring. However, constituents in ground water at AOI 7 have been determined to have a potential to migrate to the extent that reasonably expected future uses of ground water in the lower aquifer might be affected. As such, GM is implementing an interim measure (IM) to remediate the source area contamination at AOI 7. The details of this IM are presented in a separate work plan, which was submitted to USEPA on June 24, 1999 (G&M 1999).

6.0 REFERENCES

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Table 2-1: Comparison of Maximum Concentrations (mg/kg) of Inorganics in Soil at AOIs with Background Levels
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

Constituent	CASRN	Surface Background Level	Total Background Level	AOI 7	AOI 13	AOI 34	AOI 35	AOI 36
Antimony	7440-36-0		221.7					
Arsenic	7440-38-2	28.5	24.5	10.4	6.19	85.25	3.24	325
Barium	7440-39-3	229	429	30.2	103	62.55	53.8	86
Beryllium	7440-41-7	2.41	1.84	1.1	0.6	0.85		0.9
Cadmium	7440-43-9	12.6	16.4					
Chromium (total)	7440-47-3	47.4	43.1	8.6	9.7	13.55	13	11
Cobalt	7440-48-4	26.0	49.6	4.1	4.16	7.06		7.9
Copper	7440-50-8	41.0	36.8	13	13.1	15.2		25.5
Cyanide (total)	57-12-5	0.4	0.5					
Lead	7439-92-1	49.1	77.6	9.39	23.1	17.9	17.4	17.1
Manganese	7439-96-5	1600	1744	331	611	714	311	619
Mercury	7439-97-6	0.69	0.69	0.052	0.182	0.0285	0.012	0.033
Nickel	7440-02-0	63.7	34.6	25.2	10.9	24	7.6	17.4
Selenium	7782-49-2	1.5	1.5		0.643			0.924
Silver	7440-22-4	0.76	1.07					
Thallium	7440-28-0		2.3			0.927	0.683	0.5915
Vanadium	7440-62-2	84.4	85.1		16.5	22.8		20.1
Zinc	7440-66-6	152	170	227	82.3	122.5	49	67.9

Notes:
1. A blank means the constituent was not detected.
2. Surface Background Levels were calculated from background data collected from 0-2 feet below ground surface.
3. Total Background Levels were calculated from background data collected from all depths.
4. Soil data based on samples collected at all depths within each AOI.

Table 2-2: Summary of Constituents in Soil Evaluated in Risk Assessment, Supplemental RFI
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

AOI	TCL/TAL Group	Constituent	CASRN	Number of Valid Results	Number of Detections	Minimum Detected (mg/kg)	Maximum Detected (mg/kg)	Min SQL for Nondetects (mg/kg)	Max SQL for Nondetects (mg/kg)	Sample ID for Maximum Detected Value
AOI 07	VOC	1,1,1-Trichloroethane	71-55-6	63	1	0.0064	0.0064	0.005	0.525	OH-BH13-25/SL
AOI 07	VOC	cis-1,2-Dichloroethene	156-59-2	52	5	0.0054	0.0617	0.005	0.050	OH-BH11-28/SL
AOI 07	VOC	Tetrachloroethene	127-18-4	63	55	0.0068	9.44	0.005	0.005	GM-23A-04/SL
AOI 07	VOC	Trichloroethene	79-01-6	63	32	0.00505	1.78	0.005	0.525	OHBH13-25/SL
AOI 07	SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	11	1	0.65	0.65	0.344	3.51	OH-BH01-02/SL
AOI 07	SVOC	Fluoranthene	206-44-0	11	1	4.57	4.57	0.342	0.363	OH-BH02-03/SL
AOI 07	SVOC	Phenanthrene	85-01-8	11	1	3.77	3.77	0.342	0.363	OH-BH02-03/SL
AOI 07	INORG	Arsenic	7440-38-2	11	11	1.0255	10.4			OH-BH03-02/SL
AOI 07	INORG	Barium	7440-39-3	11	11	7.7	30.2			OH-BH02-03/SL, OH-BH03-02/SL
AOI 07	INORG	Beryllium	7440-41-7	11	8	0.8	1.1	0.8	0.9	OH-BH02-03/SL
AOI 07	INORG	Chromium (total)	7440-47-3	11	1	8.6	8.6	5.7	7.45	OH-BH01-02/SL
AOI 07	INORG	Cobalt	7440-48-4	11	2	3.9	4.1	2.9	3.75	OH-BH03-16/SL
AOI 07	INORG	Copper	7440-50-8	11	11	3.9	13			OH-BH03-16/SL
AOI 07	INORG	Lead	7439-92-1	11	11	2.72	9.39			OH-BH03-02/SL
AOI 07	INORG	Manganese	7439-96-5	11	11	142	331			OH-BH03-16/SL
AOI 07	INORG	Mercury	7439-97-6	11	7	0.012	0.052	0.01	0.011	OH-BH03-02/SL
AOI 07	INORG	Nickel	7440-02-0	11	11	4.3	25.2			OH-BH01-02/SL
AOI 07	INORG	Zinc	7440-66-6	11	11	16	227			OH-BH03-16/SL
AOI 13	P/PCB	Aroclor-1254	11097-69-1	1	1	7.86	7.86			BDG-DP01-08/SL
AOI 13	INORG	Arsenic	7440-38-2	1	1	6.19	6.19			BDG-DP13-04/SL
AOI 13	INORG	Barium	7440-39-3	1	1	103	103			BDG-DP13-04/SL
AOI 13	INORG	Beryllium	7440-41-7	1	1	0.6	0.6			BDG-DP13-04/SL
AOI 13	INORG	Chromium (total)	7440-47-3	1	1	9.7	9.7			BDG-DP13-04/SL
AOI 13	INORG	Cobalt	7440-48-4	1	1	4.16	4.16			BDG-DP13-04/SL
AOI 13	INORG	Copper	7440-50-8	1	1	13.1	13.1			BDG-DP13-04/SL
AOI 13	INORG	Lead	7439-92-1	1	1	23.1	23.1			BDG-DP13-04/SL
AOI 13	INORG	Manganese	7439-96-5	1	1	611	611			BDG-DP13-04/SL
AOI 13	INORG	Mercury	7439-97-6	1	1	0.182	0.182			BDG-DP13-04/SL
AOI 13	INORG	Nickel	7440-02-0	1	1	10.9	10.9			BDG-DP13-04/SL
AOI 13	INORG	Selenium	7782-49-2	1	1	0.643	0.643			BDG-DP13-04/SL
AOI 13	INORG	Vanadium	7440-62-2	1	1	16.5	16.5			BDG-DP13-04/SL
AOI 13	INORG	Zinc	7440-66-6	1	1	82.3	82.3			BDG-DP13-04/SL
AOI 34	SVOC	Fluoranthene	206-44-0	2	1	0.3895	0.3895	0.33	0.33	EA1-BH01(06-08)SL-AVG
AOI 34	SVOC	Pyrene	129-00-0	2	1	0.39	0.39	0.33	0.33	EA1-BH01(06-08)SL-AVG

Table 2-2: Summary of Constituents in Soil Evaluated in Risk Assessment, Supplemental RFI
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

AOI	TCL/TAL Group	Constituent	CASRN	Number of Valid Results	Number of Detections	Minimum Detected (mg/kg)	Maximum Detected (mg/kg)	Min SQL for Nondetects (mg/kg)	Max SQL for Nondetects (mg/kg)	Sample ID for Maximum Detected Value
AOI 34	INORG	Arsenic	7440-38-2	2	2	3.18	85.25			EA1-BH01(06-08)SL-AVG
AOI 34	INORG	Barium	7440-39-3	2	2	22	62.55			EA1-BH01(06-08)SL-AVG
AOI 34	INORG	Beryllium	7440-41-7	2	1	0.85	0.85	2	2	EA1-BH01(06-08)SL-AVG
AOI 34	INORG	Chromium (total)	7440-47-3	2	1	13.55	13.55	13	13	EA1-BH01(06-08)SL-AVG
AOI 34	INORG	Cobalt	7440-48-4	2	1	7.06	7.06	6.4	6.4	EA1-BH01(06-08)SL-AVG
AOI 34	INORG	Copper	7440-50-8	2	1	15.2	15.2	6.4	6.4	EA1-BH01(06-08)SL-AVG
AOI 34	INORG	Lead	7439-92-1	2	2	3.5	17.9			EA1-BH01(06-08)SL-AVG
AOI 34	INORG	Manganese	7439-96-5	2	2	304	714			EA1-BH01(12-14)SL
AOI 34	INORG	Mercury	7439-97-6	2	1	0.0285	0.0285	0.01	0.01	EA1-BH01(06-08)SL-AVG
AOI 34	INORG	Nickel	7440-02-0	2	2	16.95	24			EA1-BH01(12-14)SL
AOI 34	INORG	Thallium	7440-28-0	2	1	0.927	0.927	0.5	0.5	EA1-BH01(12-14)SL
AOI 34	INORG	Vanadium	7440-62-2	2	1	22.8	22.8	16	16	EA1-BH01(06-08)SL-AVG
AOI 34	INORG	Zinc	7440-66-6	2	2	20	122.5			EA1-BH01(06-08)SL-AVG
AOI 35	SVOC	Fluoranthene	206-44-0	2	1	0.402	0.402	0.33	0.33	EA2-BH01(06-08)SL
AOI 35	SVOC	Pyrene	129-00-0	2	1	0.472	0.472	0.33	0.33	EA2-BH01(06-08)SL
AOI 35	INORG	Arsenic	7440-38-2	2	2	3.16	3.24			EA2-BH01(22-24)SL
AOI 35	INORG	Barium	7440-39-3	2	2	15	53.8			EA2-BH01(06-08)SL
AOI 35	INORG	Chromium (total)	7440-47-3	2	1	13	13	13	13	EA2-BH01(06-08)SL
AOI 35	INORG	Lead	7439-92-1	2	2	4.32	17.4			EA2-BH01(06-08)SL
AOI 35	INORG	Manganese	7439-96-5	2	2	299	311			EA2-BH01(22-24)SL
AOI 35	INORG	Mercury	7439-97-6	2	1	0.012	0.012	0.01	0.01	EA2-BH01(06-08)SL
AOI 35	INORG	Nickel	7440-02-0	2	2	7.3	7.6			EA2-BH01(22-24)SL
AOI 35	INORG	Thallium	7440-28-0	2	1	0.683	0.683	0.5	0.5	EA2-BH01(22-24)SL
AOI 35	INORG	Zinc	7440-66-6	2	2	28	49			EA2-BH01(06-08)SL
AOI 36	VOC	Tetrachloroethene	127-18-4	4	1	0.006	0.006	0.00555	0.0061	AST-BH01-22/SL
AOI 36	VOC	Trichloroethene	79-01-6	4	2	0.00575	0.0065	0.006	0.0061	AST-BH01-22/SL
AOI 36	SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	4	1	1.23	1.23	0.365	0.403	AST-BH01-22/SL
AOI 36	INORG	Arsenic	7440-38-2	11	11	1.57	325			AST-BH01-02/SL
AOI 36	INORG	Barium	7440-39-3	4	4	11	86			AST-BH01-02/SL
AOI 36	INORG	Beryllium	7440-41-7	4	3	0.8	0.9	0.9	0.9	AST-BH02-02/SL
AOI 36	INORG	Chromium (total)	7440-47-3	4	2	11	11	6.15	6.9	AST-BH01-02/SL, AST-BH02-02/SL
AOI 36	INORG	Cobalt	7440-48-4	4	2	6.4	7.9	3.1	3.4	AST-BH01-02/SL
AOI 36	INORG	Copper	7440-50-8	4	4	6.9	25.5			AST-BH01-02/SL
AOI 36	INORG	Lead	7439-92-1	4	4	3.27	17.1			AST-BH01-02/SL

Table 2-2: Summary of Constituents in Soil Evaluated in Risk Assessment, Supplemental RFI
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

AOI	TCL/TAL Group	Constituent	CASRN	Number of Valid Results	Number of Detections	Minimum Detected (mg/kg)	Maximum Detected (mg/kg)	Min SQL for Nondetects (mg/kg)	Max SQL for Nondetects (mg/kg)	Sample ID for Maximum Detected Value
AOI 36	INORG	Manganese	7439-96-5	4	4	123	619			AST-BH01-02/SL
AOI 36	INORG	Mercury	7439-97-6	4	2	0.032	0.033	0.011	0.011	AST-BH01-02/SL
AOI 36	INORG	Nickel	7440-02-0	4	4	4.3	17.4			AST-BH01-02/SL
AOI 36	INORG	Selenium	7782-49-2	4	3	0.798	0.924	0.888	0.888	AST-BH02-24/SL-AVG
AOI 36	INORG	Thallium	7440-28-0	4	1	0.5915	0.5915	0.54	0.61	AST-BH02-24/SL-AVG
AOI 36	INORG	Vanadium	7440-62-2	4	2	14.3	20.1	7.75	8.6	AST-BH01-02/SL
AOI 36	INORG	Zinc	7440-66-6	4	4	17.9	67.9			AST-BH01-02/SL

Table 2-3: Summary of Constituents in Ground Water Evaluated in Risk Assessment, Supplemental RFI
Delphi Thermal, Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

TCL/TAL Group	Constituent	Prep Level	CASRN	Number of Valid Results	Number of Detections	Minimum Detected (mg/L)	Maximum Detected (mg/L)	Min SQL for Nondetects (mg/L)	Max SQL for Nondetects (mg/L)	Sample ID for Maximum Detected Value
VOC	1,1,1-Trichloroethane	TOTAL	71-55-6	60	33	0.0011	0.0888	0.001	0.2	OH-BH18-35.5/HP
VOC	1,1-Dichloroethane	TOTAL	75-34-3	60	38	0.0012	0.222	0.001	0.2	OH-BH02A-37/HP-AVG
VOC	1,1-Dichloroethene	TOTAL	75-35-4	60	12	0.00105	0.0841	0.001	0.2	OH-BH05-37/HP
VOC	1.2-Dichloroethane	TOTAL	107-06-2	26	1	0.0018	0.0018	0.001	0.2	HR-09-030698/GW
VOC	Benzene	TOTAL	71-43-2	26	1	0.0023	0.0023	0.001	0.2	GM-08-030498/GW-AVG
VOC	Bromodichloromethane	TOTAL	75-27-4	26	1	0.0034	0.0034	0.001	0.2	GM-24-030698/GW
VOC	Chloroethane	TOTAL	75-00-3	26	1	0.0165	0.0165	0.01	2	GM-08-030498/GW-AVG
VOC	Chloroform	TOTAL	67-66-3	26	1	0.0151	0.0151	0.001	0.2	GM-24-030698/GW
VOC	cis-1,2-Dichloroethene	TOTAL	156-59-2	60	46	0.0013	10.75	0.001	0.01	OH-BH02A-37/HP-AVG
VOC	Ethyl Benzene	TOTAL	100-41-4	26	1	0.02825	0.02825	0.001	0.2	GM-08-030498/GW-AVG
VOC	Tetrachloroethene	TOTAL	127-18-4	60	46	0.0012	11.2	0.001	0.01	GM-23-030998/GW
VOC	trans-1,2-Dichloroethene	TOTAL	156-60-5	60	26	0.0011	0.0428	0.001	0.2	GM-27-32/HP
VOC	Trichloroethene	TOTAL	79-01-6	60	48	0.0018	3.87	0.001	0.01	GM-23-030998/GW
VOC	Trichlorofluoromethane	TOTAL	75-69-4	26	3	0.0032	0.0049	0.001	0.2	GM-21-031098/GW
VOC	Vinyl Chloride	TOTAL	75-01-4	60	21	0.0023	7.32	0.002	0.02	GM-27-32/HP
VOC	Xylenes (total)	TOTAL	1330-20-7	26	1	0.01025	0.01025	0.001	0.2	GM-08-030498/GW-AVG
INORG	Antimony	TOTAL	7440-36-0	6	2	0.0012	0.0161	0.001	0.005	EAST-030598/GW
INORG	Barium	TOTAL	7440-39-3	6	6	0.0808	0.172			HR-11-030998/GW
INORG	Cadmium	TOTAL	7440-43-9	6	1	0.00165	0.00165	0.001	0.005	GM-22-031098/GW-AVG
INORG	Chromium (total)	TOTAL	7440-47-3	6	3	0.0069	0.066	0.00235	0.016	EAST-030598/GW
INORG	Cobalt	TOTAL	7440-48-4	6	1	0.0094	0.0094	0.005	0.025	GM-21-031098/GW
INORG	Lead	TOTAL	7439-92-1	6	5	0.0011	0.0129	0.001	0.001	GM-23-030998/GW
INORG	Manganese	TOTAL	7439-96-5	23	19	0.033	2.63	0.01	0.01	GM-23-030998/GW
INORG	Nickel	TOTAL	7440-02-0	6	6	0.0056	0.06065			GM-22-031098/GW-AVG
INORG	Antimony	DISSOLVED	7440-36-0	2	1	0.0078	0.0078	0.001	0.001	EAST-030598/GW
INORG	Barium	DISSOLVED	7440-39-3	6	6	0.0634	0.113			GM-22-031098/GW-AVG
INORG	Iron	DISSOLVED	7439-89-6	18	5	0.14	4.44	0.1	0.1	W-3-N-030598/GW
INORG	Manganese	DISSOLVED	7439-96-5	19	17	0.01	1	0.01	0.01	GM-06-030498/GW
INORG	Nickel	DISSOLVED	7440-02-0	6	3	0.0062	0.0455	0.005	0.005	GM-22-031098/GW-AVG

Note:
1. 1,2-Dichloroethane and Bromodichloromethane were only detected in the Supplemental RFI Background Wells and are not included in the constituent list.

Table 2-4: Constituents Evaluated for Risk Assessment, RFI and Supplemental RFI
Delphi Thermal, Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

TCL/TAL Group	Constituent	CASRN	EPA Group	RFI Soil Data	RFI Groundwater Data	Supplemental RFI Soil Data	Supplemental RFI Groundwater Data
VOC	1,1,1-Trichloroethane	71-55-6	D	✓	✓	✓	✓
VOC	1,1-Dichloroethane	75-34-3	C	✓	✓		✓
VOC	1,1-Dichloroethene	75-35-4	C		✓		✓
VOC	1,2-Dichloroethene (total)	540-59-0		✓			
VOC	2-Butanone	78-93-3	D	✓			
VOC	Acetone	67-64-1	D	✓		✓	
VOC	Benzene	71-43-2	A	✓	✓		✓
VOC	Carbon Disulfide	75-15-0		✓	✓		
VOC	Chlorobenzene	108-90-7	D		✓		
VOC	Chloroethane	75-00-3			✓		✓
VOC	Chloroform	67-66-3	B2		✓		✓
VOC	cis-1,2-Dichloroethene	156-59-2	D			✓	✓
VOC	Ethyl Benzene	100-41-4	D	✓	✓		✓
VOC	Styrene	100-42-5		✓			
VOC	Tetrachloroethene	127-18-4	C-B2	✓	✓	✓	✓
VOC	Toluene	108-88-3	D	✓	✓		
VOC	trans-1,2-Dichloroethene	156-60-5			✓		✓
VOC	Trichloroethene	79-01-6	C-B2	✓	✓	✓	✓
VOC	Trichlorofluoromethane	75-69-4			✓		✓
VOC	Vinyl Chloride	75-01-4	A		✓		✓
VOC	Xylenes (total)	1330-20-7	D	✓	✓		✓
SVOC	1,2-Dichlorobenzene	95-50-1	D	✓			
SVOC	2-Methylnaphthalene	91-57-6	D	✓			
SVOC	Benzo(a)anthracene	56-55-3	B2	✓			
SVOC	Benzo(a)pyrene	50-32-8	B2	✓			
SVOC	Benzo(b)fluoranthene	205-99-2	B2	✓			
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	B2	✓	✓	✓	
SVOC	Butylbenzylphthalate	85-68-7	C	✓			
SVOC	Chrysene	218-01-9	B2	✓			
SVOC	Di-n-butylphthalate	84-74-2	D	✓			
SVOC	Fluoranthene	206-44-0	D	✓		✓	
SVOC	Fluorene	86-73-7	D	✓			
SVOC	Naphthalene	91-20-3	C	✓			
SVOC	Phenanthrene	85-01-8	D	✓		✓	
SVOC	Pyrene	129-00-0	D	✓		✓	
P/PCB	Aroclor-1242	53469-21-9	B2	✓			
P/PCB	Aroclor-1254	11097-69-1	B2	✓		✓	
P/PCB	Aroclor-1260	11096-82-5	B2	✓			
INORG	Antimony	7440-36-0		✓	✓		✓
INORG	Arsenic	7440-38-2	A	✓	✓	✓	
INORG	Barium	7440-39-3	D	✓	✓	✓	✓
INORG	Beryllium	7440-41-7	B1	✓	✓	✓	
INORG	Cadmium	7440-43-9	B1	✓	✓		✓
INORG	Chromium (total)	7440-47-3	A	✓	✓	✓	✓
INORG	Cobalt	7440-48-4		✓	✓	✓	✓
INORG	Copper	7440-50-8	D	✓	✓	✓	
INORG	Cyanide (total)	57-12-5	D	✓	✓		
INORG	Lead	7439-92-1	B2	✓	✓	✓	✓
INORG	Manganese	7439-96-5	D	✓		✓	✓
INORG	Mercury	7439-97-6	D	✓	✓	✓	
INORG	Nickel	7440-02-0	A	✓	✓	✓	✓
INORG	Selenium	7782-49-2	D	✓	✓	✓	
INORG	Silver	7440-22-4	D	✓			
INORG	Thallium	7440-28-0		✓		✓	
INORG	Vanadium	7440-62-2		✓	✓	✓	
INORG	Zinc	7440-66-6	D	✓	✓	✓	

Note:
1. 1,2-Dichloroethane and Bromodichloromethane were only detected in the Supplemental RFI Background Wells and are not included in the constituent list.

Table 3-1: Scenarios for Potential Human Exposure
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

Exposure Area & Exposure Point(s)	Receptor Population	Exposure Route	Exposure Medium	Possible Currently	Possible in Future	Comments
On-Facility						
Moraine Assembly and Moraine Engine						
Production well in the lower aquifer at Moraine Assembly and Moraine Engine	Routine Workers	ingestion	groundwater	No	No	The production wells at Moraine Assembly and Moraine Engine supply water for nonpotable industrial use.
		dermal contact	groundwater	Yes	Yes	
		inhalation	vapor from groundwater	Yes	Yes	
Former Oil House Area (AOI 7)	Routine Workers	ingestion and dermal contact	surface soil	Yes	Yes	The Former Oil House Area is mostly covered with asphalt and concrete, but vegetated in some sections.
		inhalation	vapor and particulates in air from surface soil	Yes	Yes	
	Occasional Excavation/ Maintenance Workers	ingestion and dermal contact	surface and subsurface soil	Yes	Yes	
		inhalation	vapor and particulates in air from disturbed soil	Yes	Yes	
Former Buildings 4, 6, and 13 (AOI 13)	Routine Workers	ingestion and dermal contact	surface soil	No	Yes	Former Bldgs 4, 6, and 13 were demolished in 1996. The concrete floor and foundations remain in place. The area is currently covered with an asphalt parking lot. Potential exposures may occur if the parking lot were removed.
		inhalation	vapor and particulates in air from surface soil	No	Yes	
	Occasional Excavation/ Maintenance Workers	ingestion and dermal contact	surface and subsurface soil	Yes	Yes	
		inhalation	vapor and particulates in air from disturbed soil	Yes	Yes	
Excavation Area 1 (AOI 34), and Former Southwest ASTs (AOI 36)	Routine Workers	ingestion and dermal contact	surface soil	No	Yes	These areas are currently covered with parking lots.
		inhalation	vapor and particulates in air from surface soil	No	Yes	
	Occasional Excavation/ Maintenance Workers	ingestion and dermal contact	surface and subsurface soil	Yes	Yes	
		inhalation	vapor and particulates in air from disturbed soil	Yes	Yes	

Table 3-1: Scenarios for Potential Human Exposure
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

Exposure Area & Exposure Point(s)	Receptor Population	Exposure Route	Exposure Medium	Possible Currently	Possible in Future	Comments
Excavation Area 2 (AOI 35)	Routine Workers	ingestion and dermal contact	surface soil	No	Yes	This area is currently covered with a parking lot.
		inhalation	vapor and particulates in air from surface soil	No	Yes	
	Occasional Excavation/ Maintenance Workers	ingestion and dermal contact	surface and subsurface soil	Yes	Yes	
		inhalation	vapor and particulates in air from disturbed soil	Yes	Yes	
Off-Facility						
Local off-Facility residences	Residents	inhalation	vapor and particulates in air	Yes	Yes	Potential airborne exposures may occur from the unpaved areas at AOI 7. Potential airborne exposures may also occur from AOI 13, AOI 34, AOI 35 and AOI 36, if pavement were removed from these areas.
Municipal wells in the lower aquifer at West Carrollton, Miami Shores, and Dryden	Residents	ingestion and dermal contact	groundwater	Yes	Yes	The West Carrollton well field is a current drinking water supply. The Miami Shores well field is GMWS's primary emergency drinking water supply and the Dryden Rd. South well field is GMWS's secondary emergency supply.
		inhalation	vapor from groundwater	Yes	Yes	
Great Miami River	Swimmers	ingestion and dermal contact	surface water	Yes	Yes	Potential exposures may occur through swimming in the River. However, swimming in the River is expected to be very infrequent because of serious drowning hazards.
		inhalation	vapor from surface water	Yes	Yes	

Table 3-2: Exposure Concentrations (mg/kg) for Constituents Evaluated in Soil [1]
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

TCL/TAL Group	Constituent	CASRN	AOI 7 (surface)	AOI 7 [2] (all)	AOI 13 (surface)	AOI 13 (all)	AOI 34 (surface)	AOI 34 (all)	AOI 35 (surface)	AOI 35 (all)	AOI 36 (surface)	AOI 36 (all)	Background (surface)[3]
VOC	1,1,1-Trichloroethane	71-55-6											
VOC	1,1-Dichloroethane	75-34-3											
VOC	1,1-Dichloroethene	75-35-4											
VOC	1,2-Dichloroethene (total)	540-59-0											
VOC	2-Butanone	78-93-3											
VOC	Acetone	67-64-1											
VOC	Benzene	71-43-2											
VOC	Carbon Disulfide	75-15-0											
VOC	Chlorobenzene	108-90-7											
VOC	Chloroethane	75-00-3											
VOC	Chloroform	67-66-3											
VOC	cis-1,2-Dichloroethene	156-59-2											
VOC	Ethyl Benzene	100-41-4											
VOC	Styrene	100-42-5											
VOC	Tetrachloroethene	127-18-4	0.675	9.44									
VOC	Toluene	108-88-3										0.006	
VOC	trans-1,2-Dichloroethene	156-60-5											
VOC	Trichloroethene	79-01-6	0.0358	0.052								0.0065	
VOC	Trichlorofluoromethane	75-69-4											
VOC	Vinyl Chloride	75-01-4											
VOC	Xylenes (total)	1330-20-7											
SVOC	1,2-Dichlorobenzene	95-50-1											
SVOC	2-Methylnaphthalene	91-57-6											
SVOC	Benzo(a)anthracene	56-55-3											
SVOC	Benzo(a)pyrene	50-32-8											
SVOC	Benzo(b)fluoranthene	205-99-2											
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	0.65	0.65								1.23	
SVOC	Butylbenzylphthalate	85-68-7											
SVOC	Chrysene	218-01-9											
SVOC	Di-n-butylphthalate	84-74-2											
SVOC	Fluoranthene	206-44-0	4.57	4.57			0.3895	0.3895	0.402	0.402			
SVOC	Fluorene	86-73-7											
SVOC	Naphthalene	91-20-3											
SVOC	Phenanthrene	85-01-8	3.77	3.77									
SVOC	Pyrene	129-00-0					0.39	0.39	0.472	0.472			
P/PCB	Aroclor-1242	53469-21-9											
P/PCB	Aroclor-1254	11097-69-1				7.86							
P/PCB	Aroclor-1260	11096-82-5											
INORG	Antimony	7440-36-0											
INORG	Arsenic	7440-38-2	10.4	10.4	6.19	6.19	85.25	85.25	3.16	3.24	33.1	33.1	11.3
INORG	Barium	7440-39-3	30.2	30.2	103	103	62.55	62.55	53.8	53.8	86	86	98.7
INORG	Beryllium	7440-41-7	1.1	1.1	0.6	0.6	0.85	0.85			0.9	0.9	0.956
INORG	Cadmium (diet)	7440-43-9											5.32
INORG	Chromium (total)	7440-47-3	8.6	8.6	9.7	9.7	13.55	13.55	13	13	11	11	19.9
INORG	Cobalt	7440-48-4	3.9	4.1	4.16	4.16	7.06	7.06			7.9	7.9	11.9
INORG	Copper	7440-50-8	12	13	13.1	13.1	15.2	15.2			25.5	25.5	19.4
INORG	Cyanide (total)	57-12-5											0.4
INORG	Lead	7439-92-1	9.39	9.39	23.1	23.1	17.9	17.9	17.4	17.4	17.1	17.1	21.7
INORG	Manganese (diet)	7439-96-5	302	331	611	611	304	714	299	311	619	619	720
INORG	Mercury	7439-97-6	0.052	0.052	0.182	0.182	0.0285	0.0285	0.012	0.012	0.033	0.033	0.69
INORG	Nickel	7440-02-0	25.2	25.2	10.9	10.9	16.95	24	7.3	7.6	17.4	17.4	20
INORG	Selenium	7782-49-2			0.643	0.643					0.808	0.924	1.35
INORG	Silver	7440-22-4											0.76
INORG	Thallium	7440-28-0						0.927		0.683		0.5915	
INORG	Vanadium	7440-62-2			16.5	16.5	22.8	22.8			20.1	20.1	34.1
INORG	Zinc	7440-66-6	42.6	227	82.3	82.3	122.5	122.5	49	49	67.9	67.9	71.4

Notes:

1. The arsenic concentration at AOI 36 is represented by data collected susequent to regrading activities at this AOI. All other concentrations for all other AOIs are represented by the maximum concentration detected in the surface soil samples or the maximum concentration detected at all soil depths.
2. The concentrations listed for AOI 7 (all) do not include data for samples collected at the water table or capillary fringe.
3. Except for cyanide and mercury, the inorganic concentrations for background are represented by the 95% upper confidence limit on the mean calculated using a nonparametric bootstrap procedure (USEPA 1997b). The single detected value for cyanide and mercury were used to represent the background concentration.

Table 3-3: Estimated Exposure Concentrations (mg/m^3) in Ambient Air
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

			Former Oil House Area				Buildings 4, 6, and 13				Excavation Area 1				Excavation Area 2				Former Southwest ASTs			
		Activity:	Routine		Excavation		Routine		Excavation		Routine		Excavation		Routine		Excavation		Routine		Excavation	
		Source:	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
		Location:	At Area	Off-Facility	At Area	Off-Facility	At Area	Off-Facility	At Area	Off-Facility	At Area	Off-Facility	At Area	Off-Facility	At Area	Off-Facility	At Area	Off-Facility	At Area	Off-Facility	At Area	Off-Facility
		C/Q (kg/m^3 per $kg/m^2/s$):	2.5E+01	2.6E+00	2.5E+01	2.6E+00	2.6E+01	1.1E+01	2.6E+01	1.1E+01	1.4E+01	1.3E+00	1.4E+01	1.3E+00	1.7E+01	5.2E+00	1.7E+01	5.2E+00	1.2E+01	1.2E+01	1.2E+01	1.2E+01
TCL/TAL Group	Constituent	CASRN	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)	C_{air} (mg/m^3)
VOC	1,1,1-Trichloroethane	71-55-6																				
VOC	1,1-Dichloroethane	75-34-3																				
VOC	1,1-Dichloroethene	75-35-4																				
VOC	1,2-Dichloroethene (total)	540-59-0																				
VOC	2-Butanone	78-93-3																				
VOC	Acetone	67-64-1																				
VOC	Benzene	71-43-2																				
VOC	Carbon Disulfide	75-15-0																				
VOC	Chlorobenzene	108-90-7																				
VOC	Chloroethane	75-00-3																				
VOC	Chloroform	67-66-3																				
VOC	cis-1,2-Dichloroethene	156-59-2																				
VOC	Ethyl Benzene	100-41-4																				
VOC	Styrene	100-42-5																				
VOC	Tetrachloroethene	127-18-4	8.44E-04	5.92E-05	2.25E-01	2.37E-02																
VOC	Toluene	108-88-3																			7.0E-05	7.0E-05
VOC	trans-1,2-Dichloroethene	156-60-5																				
VOC	Trichloroethene	79-01-6	3.46E-05	2.43E-06	9.61E-04	1.01E-04																
VOC	Trichlorofluoromethane	75-69-4																			5.8E-05	5.8E-05
VOC	Vinyl Chloride	75-01-4																				
VOC	Xylenes (total)	1330-20-7																				
SVOC	1,2-Dichlorobenzene	95-50-1																				
SVOC	2-Methylnaphthalene	91-57-6																				
SVOC	Benzo(a)anthracene	56-55-3																				
SVOC	Benzo(a)pyrene	50-32-8																				
SVOC	Benzo(b)fluoranthene	205-99-2																				
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	2.08E-08	1.48E-09	1.20E-06	1.26E-07															1.1E-06	1.1E-06
SVOC	Butylbenzylphthalate	85-68-7																				
SVOC	Chrysene	218-01-9																				
SVOC	Di-n-butylphthalate	84-74-2																				
SVOC	Fluoranthene	206-44-0	5.05E-06	3.54E-07	1.02E-04	1.07E-05					2.5E-07	1.5E-08	5.0E-06	4.6E-07	3.1E-07	6.2E-08	6.2E-06	1.9E-06				
SVOC	Fluorene	86-73-7																				
SVOC	Naphthalene	91-20-3																				
SVOC	Phenanthrene	85-01-8	1.79E-05	1.25E-06	3.46E-04	3.64E-05																
SVOC	Pyrene	129-00-0									2.1E-07	1.3E-08	4.3E-06	3.9E-07	3.1E-07	6.2E-08	6.2E-06	1.9E-06				
P/PCB	Aroclor-1242	53469-21-9																				
P/PCB	Aroclor-1254	11097-69-1							9.1E-04	4.0E-04												
P/PCB	Aroclor-1260	11096-82-5																				
INORG	Antimony	7440-36-0																				
INORG	Arsenic	7440-38-2	9.38E-09	9.86E-10	1.30E-05	1.37E-06	5.7E-09	2.5E-09	8.0E-06	3.5E-06	4.4E-08	4.0E-09	6.1E-05	5.6E-06	2.0E-09	6.0E-10	2.8E-06	8.5E-07	1.5E-08	1.5E-08	2.0E-05	2.0E-05
INORG	Barium	7440-39-3	2.72E-08	2.86E-09	3.78E-05	3.97E-06	9.5E-08	4.2E-08	1.3E-04	5.8E-05	3.2E-08	3.0E-09	4.5E-05	4.1E-06	3.3E-08	1.0E-08	4.6E-05	1.4E-05	3.8E-08	3.8E-08	5.2E-05	5.2E-05
INORG	Beryllium	7440-41-7	9.92E-10	1.04E-10	1.38E-06	1.45E-07	5.6E-10	2.4E-10	7.7E-07	3.4E-07	4.4E-10	4.0E-11	6.1E-07	5.6E-08					4.0E-10	4.0E-10	5.5E-07	5.5E-07
INORG	Cadmium (diet)	7440-43-9																				
INORG	Chromium (total)	7440-47-3	7.75E-09	8.16E-10	1.08E-05	1.13E-06	9.0E-09	3.9E-09	1.2E-05	5.5E-06	7.0E-09	6.4E-10	9.7E-06	8.9E-07	8.1E-09	2.5E-09	1.1E-05	3.4E-06	4.8E-09	4.8E-09	6.7E-06	6.7E-06
INORG	Cobalt	7440-48-4	3.52E-09	3.70E-10	5.13E-06	5.39E-07	3.9E-09	1.7E-09	5.3E-06	2.3E-06	3.7E-09	3.3E-10	5.1E-06	4.6E-07					3.5E-09	3.5E-09	4.8E-06	4.8E-06
INORG	Copper	7440-50-8	1.08E-08	1.14E-09	1.63E-05	1.71E-06	1.2E-08	5.3E-09	1.7E-05	7.4E-06	7.9E-09	7.2E-10	1.1E-05	1.0E-06					1.1E-08	1.1E-08	1.6E-05	1.6E-05
INORG	Cyanide (total)	57-12-5																				
INORG	Lead	7439-92-1	8.47E-09	8.91E-10	1.17E-05	1.23E-06	2.1E-08	9.4E-09	3.0E-05	1.3E-05	9.3E-09	8.5E-10	1.3E-05	1.2E-06	1.1E-08	3.3E-09	1.5E-05	4.6E-06	7.5E-09	7.5E-09	1.0E-05	1.0E-05
INORG	Manganese (diet)	7439-96-5	2.72E-07	2.86E-08	4.14E-04	4.35E-05	5.7E-07	2.5E-07	7.9E-04	3.4E-04	1.6E-07	1.4E-08	5.1E-04	4.7E-05	1.9E-07	5.7E-08	2.7E-04	8.2E-05	2.7E-07	2.7E-07	3.8E-04	3.8E-04
INORG	Mercury	7439-97-6	4.88E-06	3.42E-07	9.33E-05	9.82E-06	1.8E-05	5.1E-06	3.4E-04	1.5E-04	1.5E-06	9.3E-08	2.9E-05	2.7E-06	7.7E-07	1.6E-07	1.5E-05	4.5E-06	1.5E-06	1.0E-06	2.9E-05	2.9E-05
INORG	Nickel	7440-02-0	2.27E-08	2.39E-09	3.15E-05	3.31E-06	1.0E-08	4.4E-09	1.4E-05	6.1E-06	8.8E-09	8.0E-10	1.7E-05	1.6E-06	4.5E-09	1.4E-09	6.5E-06	2.0E-06	7.6E-09	7.6E-09	1.1E-05	1.1E-05
INORG	Selenium	7782-49-2					6.0E-10	2.6E-10	8.3E-07	3.6E-07									3.5E-10	3.5E-10	5.6E-07	5.6E-07
INORG	Silver	7440-22-4																				
INORG	Thallium	7440-28-0											6.7E-07	6.1E-08			5.9E-07	1.8E-07			3.6E-07	3.6E-07
INORG	Vanadium	7440-62-2					1.5E-08	6.7E-09	2.1E-05	9.3E-06	1.2E-08	1.1E-09	1.6E-05	1.5E-06					8.8E-09	8.8E-09	1.2E-05	1.2E-05
INORG	Zinc	7440-66-6	3.84E-08	4.04E-09	2.84E-04	2.99E-05	7.6E-08	3.3E-08	1.1E-04	4.6E-05	6.4E-08	5.8E-09	8.8E-05	8.0E-06	3.0E-08	9.3E-09	4.2E-05	1.3E-05	3.0E-08	3.0E-08	4.1E-05	4.1E-05

Table 3-4: Ground Water Modeling Scenarios
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

Ground Water Use Scenario	Pumping Locations	Potential Exposure Points
Scenario 1: Baseline conditions	• Baseline wells[1]	• West Carrollton municipal well field • Moraine Assembly industrial wells (11A, 12A) • Moraine Engine industrial wells (31, 39)
Scenario 2: Potential use of Miami Shores in emergency	• Baseline wells • Miami Shores	• West Carrollton municipal well field • Moraine Assembly industrial wells (11A, 12A) • Moraine Engine industrial wells (31, 39) • Miami Shores well field
Scenario 3: Potential use of Miami Shores in emergency and redevelopment of Delphi Thermal wells and Well 28	• Baseline wells • Miami Shores • Delphi Thermal wells • Moraine Engine Well 28	• West Carrollton municipal well field • Moraine Assembly industrial wells (11A, 12A) • Moraine Engine industrial wells (31, 39) • Miami Shores well field • Delphi Thermal industrial wells (42, 44, 45) • Moraine Engine Well 28
Scenario 4: Potential use of Miami Shores with Dryden Rd South in severe emergency	• Baseline wells • Miami Shores • Dryden Rd South	• West Carrollton municipal well field • Moraine Assembly industrial wells (11A, 12A) • Moraine Engine industrial wells (31, 39) • Miami Shores well field • Dryden Rd South well field
Scenario 5: Potential use of Miami Shores with Dryden Rd South in severe emergency and redevelopment of Delphi Thermal wells and Well 28	• Baseline wells • Miami Shores • Dryden Rd South • Delphi Thermal wells • Moraine Engine Well 28	• West Carrollton municipal well field • Moraine Assembly industrial wells (11A, 12A) • Moraine Engine industrial wells (31, 39) • Miami Shores well field • Dryden Rd South well field • Delphi Thermal industrial wells (42, 44, 45) • Moraine Engine Well 28
Scenario 6: Same as Scenario 1 but with interim measures	• Same as Scenario 1 • TW2 and DN13	• Same as in Scenario 1
Scenario 7: Same as Scenario 2 but with interim measures	• Same as Scenario 2 • TW2 and DN13	• Same as in Scenario 2
Scenario 8: Same as Scenario 3 but with interim measures	• Same as Scenario 3 • TW2 and DN13	• Same as in Scenario 3
Scenario 9: Same as Scenario 4 but with interim measures	• Same as Scenario 4 • TW2 and DN13	• Same as in Scenario 4
Scenario 10: Same as Scenario 5 but with interim measures	• Same as Scenario 5 • TW2 and DN13	• Same as in Scenario 5

[1]Baseline wells include: Appleton Paper, Beerman Realty, Cains Mobile Home Park, Moraine Engine (31, 39), Moraine Assembly, Miami Paper, Moraine Country Club, NCR Country Club, Siebenthaler Nursery, City of West Carrollton, West Carrollton Parchment (G&M 1994)

[2] Well 44 is currently maintained for fire protection

Table 3-5: Summary of Estimated Ground Water Concentrations (mg/L) for Ground Water Use Evaluated in Scenario 1
Delphi Thermal, Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

TCL/TAL Group	Constituent	CASRN	Moraine Assembly	Moraine Engine	West Carrollton	Criteria	Flag
VOC	1,1,1-Trichloroethane	71-55-6	0.0001	0.	0.	0.2	
VOC	1,1-Dichloroethane	75-34-3	0.0001	0.	0.	3.65	
VOC	1,1-Dichloroethene	75-35-4	0.0001	0.	0.	0.007	
VOC	1,2-Dichloroethene (total)	540-59-0	0.	0.	0.	0.07	
VOC	2-Butanone	78-93-3	0.	0.	0.	21.9	
VOC	Acetone	67-64-1	0.	0.	0.	3.65	
VOC	Benzene	71-43-2	0.	0.	0.	0.005	
VOC	Carbon Disulfide	75-15-0	0.	0.	0.	3.65	
VOC	Chlorobenzene	108-90-7	0.	0.	0.	0.1	
VOC	Chloroethane	75-00-3	0.0001	0.	0.	0.01	
VOC	Chloroform	67-66-3	0.	0.	0.	0.1	
VOC	cis-1,2-Dichloroethene	156-59-2	0.0014	0.0003	0.	0.07	
VOC	Ethyl Benzene	100-41-4	0.	0.	0.	0.7	
VOC	Styrene	100-42-5	0.	0.	0.	0.1	
VOC	Tetrachloroethene	127-18-4	0.0255	0.0053	0.	0.005	OVER
VOC	Toluene	108-88-3	0.	0.	0.	1.	
VOC	trans-1,2-Dichloroethene	156-60-5	0.0001	0.	0.	0.1	
VOC	Trichloroethene	79-01-6	0.0034	0.0007	0.	0.005	
VOC	Trichlorofluoromethane	75-69-4	0.	0.	0.	10.95	
VOC	Vinyl Chloride	75-01-4	0.	0.	0.	0.002	
VOC	Xylenes (total)	1330-20-7	0.	0.	0.0001	10.	
SVOC	1,2-Dichlorobenzene	95-50-1	0.	0.	0.	0.6	
SVOC	2-Methylnaphthalene	91-57-6	0.	0.	0.	0.73	
SVOC	Benzo(a)anthracene	56-55-3	0.	0.	0.	0.01	
SVOC	Benzo(a)pyrene	50-32-8	0.	0.	0.	0.0002	
SVOC	Benzo(b)fluoranthene	205-99-2	0.	0.	0.	0.01	
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	0.	0.	0.	0.006	
SVOC	Butylbenzylphthalate	85-68-7	0.	0.	0.	7.3	
SVOC	Chrysene	218-01-9	0.	0.	0.	0.0117	
SVOC	Di-n-butylphthalate	84-74-2	0.	0.	0.	3.65	
SVOC	Fluoranthene	206-44-0	0.0001	0.	0.	1.46	
SVOC	Fluorene	86-73-7	0.	0.	0.	1.46	
SVOC	Naphthalene	91-20-3	0.	0.	0.	0.73	
SVOC	Phenanthrene	85-01-8	0.0009	0.0002	0.	1.095	
SVOC	Pyrene	129-00-0	0.	0.	0.	1.095	
P/PCB	Aroclor-1242	53469-21-9	0.	0.	0.	0.0005	
P/PCB	Aroclor-1254	11097-69-1	0.	0.	0.	0.0005	
P/PCB	Aroclor-1260	11096-82-5	0.	0.	0.	0.0005	
INORG	Antimony	7440-36-0	0.	0.	0.	0.006	
INORG	Arsenic	7440-38-2	0.	0.	0.	0.05	
INORG	Barium	7440-39-3	0.0006	0.0005	0.0009	2.	
INORG	Beryllium	7440-41-7	0.	0.	0.	0.004	
INORG	Cadmium	7440-43-9	0.	0.	0.	0.005	
INORG	Chromium (total)	7440-47-3	0.	0.	0.0004	0.1	
INORG	Cobalt	7440-48-4	0.0001	0.0001	0.	2.19	
INORG	Copper	7440-50-8	0.	0.	0.	1.3	
INORG	Cyanide (total)	57-12-5	0.	0.	0.	0.2	
INORG	Lead	7439-92-1	0.	0.	0.0001	0.015	
INORG	Manganese	7439-96-5	0.2167	0.0369	0.0007	5.11	
INORG	Mercury	7439-97-6	0.	0.	0.	0.002	
INORG	Nickel	7440-02-0	0.	0.	0.0002	0.1	
INORG	Selenium	7782-49-2	0.0036	0.0006	0.	0.05	
INORG	Silver	7440-22-4	0.	0.	0.	0.1825	
INORG	Thallium	7440-28-0	0.	0.	0.	0.002	
INORG	Vanadium	7440-62-2	0.	0.	0.	0.2555	
INORG	Zinc	7440-66-6	0.1256	0.0259	0.0002	10.95	

Table 3-6: Summary of Estimated Ground Water Concentrations (mg/L) for Ground Water Use Evaluated in Scenario 2

Delphi Thermal, Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

TCL/TAL Group	Constituent	CASRN	Miami Shores	Moraine Assembly	Moraine Engine	West Carrollton	Criteria	Flag
VOC	1,1,1-Trichloroethane	71-55-6	0.0007	0.0001	0.	0.	0.2	
VOC	1,1-Dichloroethane	75-34-3	0.0013	0.0001	0.	0.	3.65	
VOC	1,1-Dichloroethene	75-35-4	0.	0.0001	0.	0.	0.007	
VOC	1,2-Dichloroethene (total)	540-59-0	0.0005	0.	0.	0.	0.07	
VOC	2-Butanone	78-93-3	0.0007	0.	0.	0.	21.9	
VOC	Acetone	67-64-1	0.0005	0.0001	0.	0.	3.65	
VOC	Benzene	71-43-2	0.0001	0.	0.	0.	0.005	
VOC	Carbon Disulfide	75-15-0	0.0001	0.	0.	0.	3.65	
VOC	Chlorobenzene	108-90-7	0.	0.	0.	0.	0.1	
VOC	Chloroethane	75-00-3	0.0002	0.0001	0.	0.	0.01	
VOC	Chloroform	67-66-3	0.	0.	0.	0.	0.1	
VOC	cis-1,2-Dichloroethene	156-59-2	0.0012	0.001	0.0003	0.	0.07	
VOC	Ethyl Benzene	100-41-4	0.0009	0.	0.	0.	0.7	
VOC	Styrene	100-42-5	0.	0.	0.	0.	0.1	
VOC	Tetrachloroethene	127-18-4	0.0013	0.0187	0.0061	0.	0.005	OVER
VOC	Toluene	108-88-3	0.0023	0.	0.	0.	1.	
VOC	trans-1,2-Dichloroethene	156-60-5	0.0001	0.0001	0.	0.	0.1	
VOC	Trichloroethene	79-01-6	0.0013	0.0025	0.0008	0.	0.005	
VOC	Trichlorofluoromethane	75-69-4	0.	0.	0.	0.	10.95	
VOC	Vinyl Chloride	75-01-4	0.0001	0.	0.	0.	0.002	
VOC	Xylenes (total)	1330-20-7	0.003	0.	0.	0.	10.	
SVOC	1,2-Dichlorobenzene	95-50-1	0.	0.	0.	0.	0.6	
SVOC	2-Methylnaphthalene	91-57-6	0.0001	0.	0.	0.	0.73	
SVOC	Benzo(a)anthracene	56-55-3	0.	0.	0.	0.	0.01	
SVOC	Benzo(a)pyrene	50-32-8	0.	0.	0.	0.	0.0002	
SVOC	Benzo(b)fluoranthene	205-99-2	0.	0.	0.	0.	0.01	
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	0.	0.	0.	0.	0.006	
SVOC	Butylbenzylphthalate	85-68-7	0.0001	0.	0.	0.	7.3	
SVOC	Chrysene	218-01-9	0.	0.	0.	0.	0.0117	
SVOC	Di-n-butylphthalate	84-74-2	0.	0.	0.	0.	3.65	
SVOC	Fluoranthene	206-44-0	0.0002	0.0001	0.	0.	1.46	
SVOC	Fluorene	86-73-7	0.	0.	0.	0.	1.46	
SVOC	Naphthalene	91-20-3	0.0002	0.	0.	0.	0.73	
SVOC	Phenanthrene	85-01-8	0.0017	0.0007	0.0002	0.	1.095	
SVOC	Pyrene	129-00-0	0.0002	0.	0.	0.	1.095	
P/PCB	Aroclor-1242	53469-21-9	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1254	11097-69-1	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1260	11096-82-5	0.	0.	0.	0.	0.0005	
INORG	Antimony	7440-36-0	0.0001	0.	0.	0.	0.006	
INORG	Arsenic	7440-38-2	0.0017	0.	0.	0.	0.05	
INORG	Barium	7440-39-3	0.0166	0.	0.	0.0007	2.	
INORG	Beryllium	7440-41-7	0.	0.0001	0.	0.	0.004	
INORG	Cadmium	7440-43-9	0.0003	0.	0.	0.	0.005	
INORG	Chromium (total)	7440-47-3	0.017	0.	0.	0.0001	0.1	
INORG	Cobalt	7440-48-4	0.0005	0.	0.	0.	2.19	
INORG	Copper	7440-50-8	0.0011	0.	0.	0.	1.3	
INORG	Cyanide (total)	57-12-5	0.	0.	0.	0.	0.2	
INORG	Lead	7439-92-1	0.0018	0.	0.	0.	0.015	
INORG	Manganese	7439-96-5	0.0298	0.3213	0.0705	0.0003	5.11	
INORG	Mercury	7439-97-6	0.	0.	0.	0.	0.002	
INORG	Nickel	7440-02-0	0.0086	0.	0.	0.	0.1	
INORG	Selenium	7782-49-2	0.0001	0.004	0.0009	0.	0.05	
INORG	Silver	7440-22-4	0.0001	0.	0.	0.	0.1825	
INORG	Thallium	7440-28-0	0.	0.	0.	0.	0.002	
INORG	Vanadium	7440-62-2	0.	0.	0.	0.	0.2555	
INORG	Zinc	7440-66-6	0.0117	0.0919	0.0299	0.	10.95	

Table 3-7: Summary of Estimated Ground Water Concentrations (mg/L) for Ground Water Use Evaluated in Scenario 3

Delphi Thermal, Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

TCL/TAL Group	Constituent	CASRN	Miami Shores	Moraine Assembly	Moraine Engine	Well 28	Delphi Thermal	West Carrollton	Criteria	Flag
VOC	1,1,1-Trichloroethane	71-55-6	0.0003	0.	0.	0.0001	0.0003	0.	0.2	
VOC	1,1-Dichloroethane	75-34-3	0.0005	0.	0.	0.0002	0.0004	0.	3.65	
VOC	1,1-Dichloroethene	75-35-4	0.	0.	0.	0.0002	0.	0.	0.007	
VOC	1,2-Dichloroethene (total)	540-59-0	0.0001	0.	0.	0.	0.0004	0.	0.07	
VOC	2-Butanone	78-93-3	0.0002	0.	0.	0.	0.0013	0.	21.9	
VOC	Acetone	67-64-1	0.0002	0.0001	0.	0.0001	0.0008	0.	3.65	
VOC	Benzene	71-43-2	0.	0.	0.	0.	0.0001	0.	0.005	
VOC	Carbon Disulfide	75-15-0	0.	0.	0.	0.	0.0001	0.	3.65	
VOC	Chlorobenzene	108-90-7	0.	0.	0.	0.	0.	0.	0.1	
VOC	Chloroethane	75-00-3	0.0001	0.0001	0.	0.0002	0.	0.	0.01	
VOC	Chloroform	67-66-3	0.	0.	0.	0.	0.	0.	0.1	
VOC	cis-1,2-Dichloroethene	156-59-2	0.0004	0.0006	0.0002	0.0092	0.0058	0.	0.07	
VOC	Ethyl Benzene	100-41-4	0.0003	0.	0.	0.	0.0003	0.	0.7	
VOC	Styrene	100-42-5	0.	0.	0.	0.	0.	0.	0.1	
VOC	Tetrachloroethene	127-18-4	0.0005	0.0098	0.0035	0.0441	0.0007	0.	0.005	OVER
VOC	Toluene	108-88-3	0.0007	0.	0.	0.	0.0015	0.	1.	
VOC	trans-1,2-Dichloroethene	156-60-5	0.	0.	0.	0.0003	0.0001	0.	0.1	
VOC	Trichloroethene	79-01-6	0.0006	0.0013	0.0005	0.0062	0.0004	0.	0.005	OVER
VOC	Trichlorofluoromethane	75-69-4	0.	0.	0.	0.	0.	0.	10.95	
VOC	Vinyl Chloride	75-01-4	0.	0.	0.	0.0005	0.0004	0.	0.002	
VOC	Xylenes (total)	1330-20-7	0.001	0.	0.	0.	0.0018	0.	10.	
SVOC	1,2-Dichlorobenzene	95-50-1	0.	0.	0.	0.	0.	0.	0.6	
SVOC	2-Methylnaphthalene	91-57-6	0.	0.	0.	0.	0.0001	0.	0.73	
SVOC	Benzo(a)anthracene	56-55-3	0.	0.	0.	0.	0.	0.	0.01	
SVOC	Benzo(a)pyrene	50-32-8	0.	0.	0.	0.	0.	0.	0.0002	
SVOC	Benzo(b)fluoranthene	205-99-2	0.	0.	0.	0.	0.	0.	0.01	
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	0.	0.	0.	0.	0.	0.	0.006	
SVOC	Butylbenzylphthalate	85-68-7	0.	0.	0.	0.	0.0001	0.	7.3	
SVOC	Chrysene	218-01-9	0.	0.	0.	0.	0.	0.	0.0117	
SVOC	Di-n-butylphthalate	84-74-2	0.	0.	0.	0.	0.	0.	3.65	
SVOC	Fluoranthene	206-44-0	0.0001	0.0001	0.	0.0003	0.0001	0.	1.46	
SVOC	Fluorene	86-73-7	0.	0.	0.	0.	0.	0.	1.46	
SVOC	Naphthalene	91-20-3	0.0001	0.	0.	0.	0.0005	0.	0.73	
SVOC	Phenanthrene	85-01-8	0.0005	0.0004	0.0001	0.0016	0.0011	0.	1.095	
SVOC	Pyrene	129-00-0	0.0001	0.	0.	0.	0.0001	0.	1.095	
P/PCB	Aroclor-1242	53469-21-9	0.	0.	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1254	11097-69-1	0.	0.	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1260	11096-82-5	0.	0.	0.	0.	0.	0.	0.0005	
INORG	Antimony	7440-36-0	0.	0.	0.	0.0013	0.0012	0.	0.006	
INORG	Arsenic	7440-38-2	0.0006	0.	0.	0.	0.0008	0.	0.05	
INORG	Barium	7440-39-3	0.0045	0.0004	0.0005	0.0144	0.0237	0.0002	2.	
INORG	Beryllium	7440-41-7	0.	0.0001	0.	0.0001	0.	0.	0.004	
INORG	Cadmium	7440-43-9	0.0001	0.	0.	0.	0.0002	0.	0.005	
INORG	Chromium (total)	7440-47-3	0.0054	0.	0.	0.	0.0107	0.	0.1	
INORG	Cobalt	7440-48-4	0.0001	0.0001	0.0001	0.0027	0.0006	0.	2.19	
INORG	Copper	7440-50-8	0.0003	0.	0.	0.	0.0007	0.	1.3	
INORG	Cyanide (total)	57-12-5	0.	0.	0.	0.	0.0001	0.	0.2	
INORG	Lead	7439-92-1	0.0007	0.	0.	0.0003	0.0013	0.	0.015	
INORG	Manganese	7439-96-5	0.0111	0.2873	0.0734	0.5786	0.1743	0.0001	5.11	
INORG	Mercury	7439-97-6	0.	0.	0.	0.	0.	0.	0.002	
INORG	Nickel	7440-02-0	0.0027	0.	0.	0.0003	0.0057	0.	0.1	
INORG	Selenium	7782-49-2	0.	0.0033	0.0008	0.007	0.0002	0.	0.05	
INORG	Silver	7440-22-4	0.	0.	0.	0.	0.	0.	0.1825	
INORG	Thallium	7440-28-0	0.	0.	0.	0.	0.	0.	0.002	
INORG	Vanadium	7440-62-2	0.	0.	0.	0.	0.	0.	0.2555	
INORG	Zinc	7440-66-6	0.0036	0.0484	0.017	0.2164	0.0079	0.	10.95	

Table 3-8: Summary of Estimated Ground Water Concentrations (mg/L) for Ground Water Use Evaluated in Scenario 4
Delphi Thermal, Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

TCL/TAL Group	Constituent	CASRN	Dryden Road South	Miami Shores	Moraine Assembly	Moraine Engine	West Carrollton	Criteria	Flag
VOC	1,1,1-Trichloroethane	71-55-6	0.0087	0.0005	0.0001	0.	0.	0.2	
VOC	1,1-Dichloroethane	75-34-3	0.0152	0.0009	0.0001	0.	0.	3.65	
VOC	1,1-Dichloroethene	75-35-4	0.0001	0.	0.0001	0.	0.	0.007	
VOC	1,2-Dichloroethene (total)	540-59-0	0.0057	0.0003	0.	0.	0.	0.07	
VOC	2-Butanone	78-93-3	0.0083	0.0005	0.	0.	0.	21.9	
VOC	Acetone	67-64-1	0.0069	0.0005	0.0001	0.	0.	3.65	
VOC	Benzene	71-43-2	0.001	0.	0.	0.	0.	0.005	
VOC	Carbon Disulfide	75-15-0	0.0007	0.	0.	0.	0.	3.65	
VOC	Chlorobenzene	108-90-7	0.	0.	0.	0.	0.	0.1	
VOC	Chloroethane	75-00-3	0.002	0.0001	0.0001	0.	0.	0.01	
VOC	Chloroform	67-66-3	0.	0.	0.	0.	0.	0.1	
VOC	cis-1,2-Dichloroethene	156-59-2	0.0136	0.0009	0.0009	0.0004	0.	0.07	
VOC	Ethyl Benzene	100-41-4	0.01	0.0005	0.	0.	0.	0.7	
VOC	Styrene	100-42-5	0.	0.	0.	0.	0.	0.1	
VOC	Tetrachloroethene	127-18-4	0.0148	0.0007	0.0162	0.006	0.	0.005	OVER
VOC	Toluene	108-88-3	0.029	0.0018	0.	0.	0.	1.	
VOC	trans-1,2-Dichloroethene	156-60-5	0.0013	0.0001	0.0001	0.	0.	0.1	
VOC	Trichloroethene	79-01-6	0.0154	0.0008	0.0022	0.0008	0.	0.005	OVER
VOC	Trichlorofluoromethane	75-69-4	0.	0.	0.	0.	0.	10.95	
VOC	Vinyl Chloride	75-01-4	0.0015	0.0001	0.	0.	0.	0.002	
VOC	Xylenes (total)	1330-20-7	0.0373	0.0023	0.	0.	0.	10.	
SVOC	1,2-Dichlorobenzene	95-50-1	0.	0.	0.	0.	0.	0.6	
SVOC	2-Methylnaphthalene	91-57-6	0.0008	0.0001	0.	0.	0.	0.73	
SVOC	Benzo(a)anthracene	56-55-3	0.	0.	0.	0.	0.	0.01	
SVOC	Benzo(a)pyrene	50-32-8	0.0002	0.	0.	0.	0.	0.0002	
SVOC	Benzo(b)fluoranthene	205-99-2	0.0003	0.	0.	0.	0.	0.01	
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	0.	0.	0.	0.	0.	0.006	
SVOC	Butylbenzylphthalate	85-68-7	0.0015	0.0001	0.	0.	0.	7.3	
SVOC	Chrysene	218-01-9	0.0004	0.	0.	0.	0.	0.0117	
SVOC	Di-n-butylphthalate	84-74-2	0.	0.	0.	0.	0.	3.65	
SVOC	Fluoranthene	206-44-0	0.0029	0.0002	0.0001	0.	0.	1.46	
SVOC	Fluorene	86-73-7	0.	0.	0.	0.	0.	1.46	
SVOC	Naphthalene	91-20-3	0.003	0.0002	0.	0.	0.	0.73	
SVOC	Phenanthrene	85-01-8	0.0214	0.0014	0.0006	0.0002	0.	1.095	
SVOC	Pyrene	129-00-0	0.0028	0.0002	0.	0.	0.	1.095	
P/PCB	Aroclor-1242	53469-21-9	0.	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1254	11097-69-1	0.	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1260	11096-82-5	0.	0.	0.	0.	0.	0.0005	
INORG	Antimony	7440-36-0	0.0008	0.0001	0.	0.	0.	0.006	
INORG	Arsenic	7440-38-2	0.0234	0.0019	0.	0.	0.	0.05	
INORG	Barium	7440-39-3	0.152	0.0165	0.0004	0.0006	0.0006	2.	
INORG	Beryllium	7440-41-7	0.	0.	0.0001	0.	0.	0.004	
INORG	Cadmium	7440-43-9	0.0042	0.0003	0.	0.	0.	0.005	
INORG	Chromium (total)	7440-47-3	0.2164	0.0136	0.	0.	0.	0.1	OVER
INORG	Cobalt	7440-48-4	0.0034	0.0004	0.0001	0.0001	0.	2.19	
INORG	Copper	7440-50-8	0.0136	0.0009	0.	0.	0.	1.3	
INORG	Cyanide (total)	57-12-5	0.0003	0.	0.	0.	0.	0.2	
INORG	Lead	7439-92-1	0.0177	0.0009	0.	0.	0.	0.015	OVER
INORG	Manganese	7439-96-5	0.3955	0.0461	0.3896	0.0953	0.0002	5.11	
INORG	Mercury	7439-97-6	0.0002	0.	0.	0.	0.	0.002	
INORG	Nickel	7440-02-0	0.1097	0.0069	0.	0.	0.	0.1	OVER
INORG	Selenium	7782-49-2	0.0018	0.0002	0.0039	0.0011	0.	0.05	
INORG	Silver	7440-22-4	0.0006	0.	0.	0.	0.	0.1825	
INORG	Thallium	7440-28-0	0.	0.	0.	0.	0.	0.002	
INORG	Vanadium	7440-62-2	0.	0.	0.	0.	0.	0.2555	
INORG	Zinc	7440-66-6	0.151	0.0107	0.0798	0.0293	0.	10.95	

Table 3-9: Summary of Estimated Ground Water Concentrations (mg/L) for Ground Water Use Evaluated in Scenario 5
Delphi Thermal, Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

TCL/TAL Group	Constituent	CASRN	Dryden Road South	Miami Shores	Moraine Assembly	Moraine Engine	Well 28	Delphi Thermal	West Carrollton	Criteria	Flag
VOC	1,1,1-Trichloroethane	71-55-6	0.0056	0.0004	0.	0.	0.0001	0.0002	0.	0.2	
VOC	1,1-Dichloroethane	75-34-3	0.0101	0.0006	0.	0.	0.0001	0.0003	0.	3.65	
VOC	1,1-Dichloroethene	75-35-4	0.0001	0.	0.	0.	0.0001	0.	0.	0.007	
VOC	1,2-Dichloroethene (total)	540-59-0	0.0034	0.0002	0.	0.	0.	0.0004	0.	0.07	
VOC	2-Butanone	78-93-3	0.0048	0.0004	0.	0.	0.	0.0011	0.	21.9	
VOC	Acetone	67-64-1	0.0041	0.0004	0.0001	0.	0.0001	0.0006	0.	3.65	
VOC	Benzene	71-43-2	0.0006	0.	0.	0.	0.	0.0001	0.	0.005	
VOC	Carbon Disulfide	75-15-0	0.0004	0.	0.	0.	0.	0.0001	0.	3.65	
VOC	Chlorobenzene	108-90-7	0.	0.	0.	0.	0.	0.	0.	0.1	
VOC	Chloroethane	75-00-3	0.0014	0.0001	0.0001	0.	0.0002	0.	0.	0.01	
VOC	Chloroform	67-66-3	0.	0.	0.	0.	0.	0.	0.	0.1	
VOC	cis-1,2-Dichloroethene	156-59-2	0.0083	0.0006	0.0005	0.0002	0.0084	0.0041	0.	0.07	
VOC	Ethyl Benzene	100-41-4	0.0068	0.0004	0.	0.	0.	0.0002	0.	0.7	
VOC	Styrene	100-42-5	0.	0.	0.	0.	0.	0.	0.	0.1	
VOC	Tetrachloroethene	127-18-4	0.0095	0.0006	0.0086	0.0022	0.0417	0.0005	0.	0.005	OVER
VOC	Toluene	108-88-3	0.017	0.0012	0.	0.	0.	0.0012	0.	1.	
VOC	trans-1,2-Dichloroethene	156-60-5	0.0009	0.0001	0.	0.	0.0003	0.0001	0.	0.1	
VOC	Trichloroethene	79-01-6	0.0108	0.0006	0.0012	0.0003	0.0058	0.0003	0.	0.005	OVER
VOC	Trichlorofluoromethane	75-69-4	0.	0.	0.	0.	0.	0.	0.	10.95	
VOC	Vinyl Chloride	75-01-4	0.001	0.0001	0.	0.	0.0005	0.0003	0.	0.002	
VOC	Xylenes (total)	1330-20-7	0.0222	0.0016	0.	0.	0.	0.0014	0.	10.	
SVOC	1,2-Dichlorobenzene	95-50-1	0.	0.	0.	0.	0.	0.	0.	0.6	
SVOC	2-Methylnaphthalene	91-57-6	0.0005	0.	0.	0.	0.	0.0001	0.	0.73	
SVOC	Benzo(a)anthracene	56-55-3	0.	0.	0.	0.	0.	0.	0.	0.01	
SVOC	Benzo(a)pyrene	50-32-8	0.0001	0.	0.	0.	0.	0.	0.	0.0002	
SVOC	Benzo(b)fluoranthene	205-99-2	0.0002	0.	0.	0.	0.	0.	0.	0.01	
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	0.	0.	0.	0.	0.	0.	0.	0.006	
SVOC	Butylbenzylphthalate	85-68-7	0.0009	0.0001	0.	0.	0.	0.0001	0.	7.3	
SVOC	Chrysene	218-01-9	0.0002	0.	0.	0.	0.	0.	0.	0.0117	
SVOC	Di-n-butylphthalate	84-74-2	0.	0.	0.	0.	0.	0.	0.	3.65	
SVOC	Fluoranthene	206-44-0	0.0017	0.0001	0.	0.	0.0002	0.0001	0.	1.46	
SVOC	Fluorene	86-73-7	0.	0.	0.	0.	0.	0.	0.	1.46	
SVOC	Naphthalene	91-20-3	0.0018	0.0002	0.	0.	0.	0.0004	0.	0.73	
SVOC	Phenanthrene	85-01-8	0.0125	0.0009	0.0003	0.0001	0.0015	0.0008	0.	1.095	
SVOC	Pyrene	129-00-0	0.0016	0.0001	0.	0.	0.	0.0001	0.	1.095	
P/PCB	Aroclor-1242	53469-21-9	0.	0.	0.	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1254	11097-69-1	0.	0.	0.	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1260	11096-82-5	0.	0.	0.	0.	0.	0.	0.	0.0005	
INORG	Antimony	7440-36-0	0.0003	0.	0.	0.	0.0011	0.0008	0.	0.006	
INORG	Arsenic	7440-38-2	0.014	0.0012	0.	0.	0.	0.0006	0.	0.05	
INORG	Barium	7440-39-3	0.0938	0.0088	0.0003	0.0005	0.0136	0.0226	0.0002	2.	
INORG	Beryllium	7440-41-7	0.	0.	0.0001	0.	0.0001	0.	0.	0.004	
INORG	Cadmium	7440-43-9	0.0024	0.0002	0.	0.	0.	0.0002	0.	0.005	
INORG	Chromium (total)	7440-47-3	0.1265	0.0092	0.	0.	0.	0.0086	0.	0.1	OVER
INORG	Cobalt	7440-48-4	0.0023	0.0002	0.0001	0.0001	0.0026	0.0006	0.	2.19	
INORG	Copper	7440-50-8	0.0079	0.0006	0.	0.	0.	0.0005	0.	1.3	
INORG	Cyanide (total)	57-12-5	0.0002	0.	0.	0.	0.	0.	0.	0.2	
INORG	Lead	7439-92-1	0.0117	0.0006	0.	0.	0.0003	0.001	0.	0.015	
INORG	Manganese	7439-96-5	0.3397	0.0378	0.2737	0.065	0.59	0.1062	0.0001	5.11	
INORG	Mercury	7439-97-6	0.0001	0.	0.	0.	0.	0.	0.	0.002	
INORG	Nickel	7440-02-0	0.064	0.0047	0.	0.	0.0003	0.0045	0.	0.1	
INORG	Selenium	7782-49-2	0.001	0.0001	0.0031	0.0006	0.007	0.0002	0.	0.05	
INORG	Silver	7440-22-4	0.0004	0.	0.	0.	0.	0.	0.	0.1825	
INORG	Thallium	7440-28-0	0.	0.	0.	0.	0.	0.	0.	0.002	
INORG	Vanadium	7440-62-2	0.	0.	0.	0.	0.	0.	0.	0.2555	
INORG	Zinc	7440-66-6	0.0854	0.0064	0.0424	0.0109	0.2051	0.0063	0.	10.95	

Table 3-10: Summary of Estimated Ground Water Concentrations (mg/L) for Ground Water Use Evaluated in Scenario 6
Delphi Thermal, Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

TCL/TAL Group	Constituent	CASRN	Dryden Road North	Moraine Assembly	Moraine Engine	West Carrollton	Criteria	Flag
VOC	1,1,1-Trichloroethane	71-55-6	0.0008	0.	0.	0.	0.2	
VOC	1,1-Dichloroethane	75-34-3	0.0015	0.	0.	0.	3.65	
VOC	1,1-Dichloroethene	75-35-4	0.0001	0.	0.	0.	0.007	
VOC	1,2-Dichloroethene (total)	540-59-0	0.0003	0.	0.	0.	0.07	
VOC	2-Butanone	78-93-3	0.0006	0.	0.	0.	21.9	
VOC	Acetone	67-64-1	0.0006	0.0001	0.	0.	3.65	
VOC	Benzene	71-43-2	0.0001	0.	0.	0.	0.005	
VOC	Carbon Disulfide	75-15-0	0.0001	0.	0.	0.	3.65	
VOC	Chlorobenzene	108-90-7	0.	0.	0.	0.	0.1	
VOC	Chloroethane	75-00-3	0.0003	0.0001	0.	0.	0.01	
VOC	Chloroform	67-66-3	0.	0.	0.	0.	0.1	
VOC	cis-1,2-Dichloroethene	156-59-2	0.0048	0.0003	0.0003	0.	0.07	
VOC	Ethyl Benzene	100-41-4	0.001	0.	0.	0.	0.7	
VOC	Styrene	100-42-5	0.	0.	0.	0.	0.1	
VOC	Tetrachloroethene	127-18-4	0.012	0.0056	0.0053	0.	0.005	OVER
VOC	Toluene	108-88-3	0.0016	0.	0.	0.	1.	
VOC	trans-1,2-Dichloroethene	156-60-5	0.0002	0.	0.	0.	0.1	
VOC	Trichloroethene	79-01-6	0.0033	0.0008	0.0007	0.	0.005	
VOC	Trichlorofluoromethane	75-69-4	0.	0.	0.	0.	10.95	
VOC	Vinyl Chloride	75-01-4	0.0004	0.	0.	0.	0.002	
VOC	Xylenes (total)	1330-20-7	0.0022	0.	0.	0.	10.	
SVOC	1,2-Dichlorobenzene	95-50-1	0.	0.	0.	0.	0.6	
SVOC	2-Methylnaphthalene	91-57-6	0.0001	0.	0.	0.	0.73	
SVOC	Benzo(a)anthracene	56-55-3	0.	0.	0.	0.	0.01	
SVOC	Benzo(a)pyrene	50-32-8	0.	0.	0.	0.	0.0002	
SVOC	Benzo(b)fluoranthene	205-99-2	0.	0.	0.	0.	0.01	
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	0.	0.	0.	0.	0.006	
SVOC	Butylbenzylphthalate	85-68-7	0.0001	0.	0.	0.	7.3	
SVOC	Chrysene	218-01-9	0.	0.	0.	0.	0.0117	
SVOC	Di-n-butylphthalate	84-74-2	0.	0.	0.	0.	3.65	
SVOC	Fluoranthene	206-44-0	0.0002	0.	0.	0.	1.46	
SVOC	Fluorene	86-73-7	0.	0.	0.	0.	1.46	
SVOC	Naphthalene	91-20-3	0.0003	0.	0.	0.	0.73	
SVOC	Phenanthrene	85-01-8	0.0015	0.0002	0.0002	0.	1.095	
SVOC	Pyrene	129-00-0	0.0002	0.	0.	0.	1.095	
P/PCB	Aroclor-1242	53469-21-9	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1254	11097-69-1	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1260	11096-82-5	0.	0.	0.	0.	0.0005	
INORG	Antimony	7440-36-0	0.0006	0.	0.	0.	0.006	
INORG	Arsenic	7440-38-2	0.0078	0.	0.	0.	0.05	
INORG	Barium	7440-39-3	0.0371	0.0001	0.0005	0.	2.	
INORG	Beryllium	7440-41-7	0.	0.0001	0.	0.	0.004	
INORG	Cadmium	7440-43-9	0.0002	0.	0.	0.	0.005	
INORG	Chromium (total)	7440-47-3	0.0116	0.	0.	0.	0.1	
INORG	Cobalt	7440-48-4	0.0015	0.	0.0001	0.	2.19	
INORG	Copper	7440-50-8	0.0007	0.	0.	0.	1.3	
INORG	Cyanide (total)	57-12-5	0.	0.	0.	0.	0.2	
INORG	Lead	7439-92-1	0.0025	0.	0.	0.	0.015	
INORG	Manganese	7439-96-5	0.5807	0.266	0.0882	0.	5.11	
INORG	Mercury	7439-97-6	0.	0.	0.	0.	0.002	
INORG	Nickel	7440-02-0	0.006	0.	0.	0.	0.1	
INORG	Selenium	7782-49-2	0.0015	0.0028	0.001	0.	0.05	
INORG	Silver	7440-22-4	0.0001	0.	0.	0.	0.1825	
INORG	Thallium	7440-28-0	0.	0.	0.	0.	0.002	
INORG	Vanadium	7440-62-2	0.	0.	0.	0.	0.2555	
INORG	Zinc	7440-66-6	0.0586	0.0277	0.026	0.	10.95	

Table 3-11: Summary of Estimated Ground Water Concentrations (mg/L) for Ground Water Use Evaluated in Scenario 7
Delphi Thermal, Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

TCL/TAL Group	Constituent	CASRN	Dryden Road North	Miami Shores	Moraine Assembly	Moraine Engine	West Carrollton	Criteria	Flag
VOC	1,1,1-Trichloroethane	71-55-6	0.0014	0.	0.	0.	0.	0.2	
VOC	1,1-Dichloroethane	75-34-3	0.0027	0.	0.	0.	0.	3.65	
VOC	1,1-Dichloroethene	75-35-4	0.0001	0.	0.	0.	0.	0.007	
VOC	1,2-Dichloroethene (total)	540-59-0	0.0006	0.	0.	0.	0.	0.07	
VOC	2-Butanone	78-93-3	0.0009	0.	0.	0.	0.	21.9	
VOC	Acetone	67-64-1	0.0011	0.	0.0001	0.	0.	3.65	
VOC	Benzene	71-43-2	0.0002	0.	0.	0.	0.	0.005	
VOC	Carbon Disulfide	75-15-0	0.0001	0.	0.	0.	0.	3.65	
VOC	Chlorobenzene	108-90-7	0.	0.	0.	0.	0.	0.1	
VOC	Chloroethane	75-00-3	0.0005	0.	0.0001	0.	0.	0.01	
VOC	Chloroform	67-66-3	0.	0.	0.	0.	0.	0.1	
VOC	cis-1,2-Dichloroethene	156-59-2	0.0072	0.	0.0002	0.0003	0.	0.07	
VOC	Ethyl Benzene	100-41-4	0.0017	0.	0.	0.	0.	0.7	
VOC	Styrene	100-42-5	0.	0.	0.	0.	0.	0.1	
VOC	Tetrachloroethene	127-18-4	0.0138	0.0001	0.003	0.0051	0.	0.005	OVER
VOC	Toluene	108-88-3	0.0028	0.	0.	0.	0.	1.	
VOC	trans-1,2-Dichloroethene	156-60-5	0.0004	0.	0.	0.	0.	0.1	
VOC	Trichloroethene	79-01-6	0.0049	0.	0.0004	0.0007	0.	0.005	
VOC	Trichlorofluoromethane	75-69-4	0.	0.	0.	0.	0.	10.95	
VOC	Vinyl Chloride	75-01-4	0.0006	0.	0.	0.	0.	0.002	
VOC	Xylenes (total)	1330-20-7	0.004	0.	0.	0.	0.	10.	
SVOC	1,2-Dichlorobenzene	95-50-1	0.	0.	0.	0.	0.	0.6	
SVOC	2-Methylnaphthalene	91-57-6	0.0002	0.	0.	0.	0.	0.73	
SVOC	Benzo(a)anthracene	56-55-3	0.	0.	0.	0.	0.	0.01	
SVOC	Benzo(a)pyrene	50-32-8	0.	0.	0.	0.	0.	0.0002	
SVOC	Benzo(b)fluoranthene	205-99-2	0.	0.	0.	0.	0.	0.01	
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	0.	0.	0.	0.	0.	0.006	
SVOC	Butylbenzylphthalate	85-68-7	0.0001	0.	0.	0.	0.	7.3	
SVOC	Chrysene	218-01-9	0.	0.	0.	0.	0.	0.0117	
SVOC	Di-n-butylphthalate	84-74-2	0.	0.	0.	0.	0.	3.65	
SVOC	Fluoranthene	206-44-0	0.0003	0.	0.	0.	0.	1.46	
SVOC	Fluorene	86-73-7	0.	0.	0.	0.	0.	1.46	
SVOC	Naphthalene	91-20-3	0.0007	0.	0.	0.	0.	0.73	
SVOC	Phenanthrene	85-01-8	0.0024	0.	0.0001	0.0002	0.	1.095	
SVOC	Pyrene	129-00-0	0.0003	0.	0.	0.	0.	1.095	
P/PCB	Aroclor-1242	53469-21-9	0.	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1254	11097-69-1	0.0001	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1260	11096-82-5	0.	0.	0.	0.	0.	0.0005	
INORG	Antimony	7440-36-0	0.0009	0.	0.	0.	0.	0.006	
INORG	Arsenic	7440-38-2	0.0132	0.	0.	0.	0.	0.05	
INORG	Barium	7440-39-3	0.056	0.0003	0.	0.0005	0.	2.	
INORG	Beryllium	7440-41-7	0.	0.	0.0001	0.	0.	0.004	
INORG	Cadmium	7440-43-9	0.0004	0.	0.	0.	0.	0.005	
INORG	Chromium (total)	7440-47-3	0.0207	0.	0.	0.	0.	0.1	
INORG	Cobalt	7440-48-4	0.0021	0.	0.	0.0001	0.	2.19	
INORG	Copper	7440-50-8	0.0013	0.	0.	0.	0.	1.3	
INORG	Cyanide (total)	57-12-5	0.0001	0.	0.	0.	0.	0.2	
INORG	Lead	7439-92-1	0.0033	0.	0.	0.	0.	0.015	
INORG	Manganese	7439-96-5	0.8159	0.0022	0.2097	0.0882	0.	5.11	
INORG	Mercury	7439-97-6	0.	0.	0.	0.	0.	0.002	
INORG	Nickel	7440-02-0	0.0107	0.	0.	0.	0.	0.1	
INORG	Selenium	7782-49-2	0.0017	0.	0.0023	0.001	0.	0.05	
INORG	Silver	7440-22-4	0.0001	0.	0.	0.	0.	0.1825	
INORG	Thallium	7440-28-0	0.	0.	0.	0.	0.	0.002	
INORG	Vanadium	7440-62-2	0.	0.	0.	0.	0.	0.2555	
INORG	Zinc	7440-66-6	0.0679	0.0003	0.0148	0.0253	0.	10.95	

Table 3-12: Summary of Estimated Ground Water Concentrations (mg/L) for Ground Water Use Evaluated in Scenario 8
Delphi Thermal, Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

TCL/TAL Group	Constituent	CASRN	Dryden Road North	Miami Shores	Moraine Assembly	Moraine Engine	Well 28	Delphi Thermal	West Carrollton	Criteria	Flag
VOC	1,1,1-Trichloroethane	71-55-6	0.001	0.	0.	0.	0.0001	0.0001	0.	0.2	
VOC	1,1-Dichloroethane	75-34-3	0.0019	0.	0.	0.	0.0001	0.0002	0.	3.65	
VOC	1,1-Dichloroethene	75-35-4	0.	0.	0.	0.	0.0001	0.	0.	0.007	
VOC	1,2-Dichloroethene (total)	540-59-0	0.0004	0.	0.	0.	0.	0.0002	0.	0.07	
VOC	2-Butanone	78-93-3	0.0006	0.	0.	0.	0.	0.0008	0.	21.9	
VOC	Acetone	67-64-1	0.0009	0.	0.	0.	0.0002	0.0003	0.	3.65	
VOC	Benzene	71-43-2	0.0001	0.	0.	0.	0.	0.0001	0.	0.005	
VOC	Carbon Disulfide	75-15-0	0.0001	0.	0.	0.	0.	0.0001	0.	3.65	
VOC	Chlorobenzene	108-90-7	0.	0.	0.	0.	0.	0.	0.	0.1	
VOC	Chloroethane	75-00-3	0.0003	0.	0.0001	0.	0.0002	0.	0.	0.01	
VOC	Chloroform	67-66-3	0.	0.	0.	0.	0.	0.	0.	0.1	
VOC	cis-1,2-Dichloroethene	156-59-2	0.0066	0.	0.0001	0.0004	0.0036	0.0037	0.	0.07	
VOC	Ethyl Benzene	100-41-4	0.0012	0.	0.	0.	0.	0.0001	0.	0.7	
VOC	Styrene	100-42-5	0.	0.	0.	0.	0.	0.	0.	0.1	
VOC	Tetrachloroethene	127-18-4	0.008	0.	0.0019	0.0063	0.0337	0.0003	0.	0.005	OVER
VOC	Toluene	108-88-3	0.002	0.	0.	0.	0.	0.0006	0.	1.	
VOC	trans-1,2-Dichloroethene	156-60-5	0.0003	0.	0.	0.	0.0002	0.	0.	0.1	
VOC	Trichloroethene	79-01-6	0.0032	0.	0.0003	0.0009	0.0046	0.0002	0.	0.005	
VOC	Trichlorofluoromethane	75-69-4	0.	0.	0.	0.	0.	0.	0.	10.95	
VOC	Vinyl Chloride	75-01-4	0.0005	0.	0.	0.	0.0002	0.0003	0.	0.002	
VOC	Xylenes (total)	1330-20-7	0.0028	0.	0.	0.	0.	0.0007	0.	10.	
SVOC	1,2-Dichlorobenzene	95-50-1	0.	0.	0.	0.	0.	0.	0.	0.6	
SVOC	2-Methylnaphthalene	91-57-6	0.0001	0.	0.	0.	0.	0.	0.	0.73	
SVOC	Benzo(a)anthracene	56-55-3	0.	0.	0.	0.	0.	0.	0.	0.01	
SVOC	Benzo(a)pyrene	50-32-8	0.	0.	0.	0.	0.	0.	0.	0.0002	
SVOC	Benzo(b)fluoranthene	205-99-2	0.	0.	0.	0.	0.	0.	0.	0.01	
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	0.	0.	0.	0.	0.	0.	0.	0.006	
SVOC	Butylbenzylphthalate	85-68-7	0.0001	0.	0.	0.	0.	0.	0.	7.3	
SVOC	Chrysene	218-01-9	0.	0.	0.	0.	0.	0.	0.	0.0117	
SVOC	Di-n-butylphthalate	84-74-2	0.	0.	0.	0.	0.	0.	0.	3.65	
SVOC	Fluoranthene	206-44-0	0.0002	0.	0.	0.	0.0002	0.0001	0.	1.46	
SVOC	Fluorene	86-73-7	0.	0.	0.	0.	0.	0.	0.	1.46	
SVOC	Naphthalene	91-20-3	0.0005	0.	0.	0.	0.	0.0002	0.	0.73	
SVOC	Phenanthrene	85-01-8	0.0017	0.	0.0001	0.0002	0.0012	0.0004	0.	1.095	
SVOC	Pyrene	129-00-0	0.0002	0.	0.	0.	0.	0.0001	0.	1.095	
P/PCB	Aroclor-1242	53469-21-9	0.	0.	0.	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1254	11097-69-1	0.0001	0.	0.	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1260	11096-82-5	0.	0.	0.	0.	0.	0.	0.	0.0005	
INORG	Antimony	7440-36-0	0.001	0.	0.	0.	0.0003	0.0007	0.	0.006	
INORG	Arsenic	7440-38-2	0.0097	0.	0.	0.	0.	0.0003	0.	0.05	
INORG	Barium	7440-39-3	0.0496	0.	0.0001	0.0004	0.0063	0.0118	0.	2.	
INORG	Beryllium	7440-41-7	0.	0.	0.	0.	0.0001	0.	0.	0.004	
INORG	Cadmium	7440-43-9	0.0003	0.	0.	0.	0.	0.0001	0.	0.005	
INORG	Chromium (total)	7440-47-3	0.0147	0.	0.	0.	0.	0.0044	0.	0.1	
INORG	Cobalt	7440-48-4	0.0019	0.	0.	0.0001	0.0013	0.0004	0.	2.19	
INORG	Copper	7440-50-8	0.0009	0.	0.	0.	0.	0.0003	0.	1.3	
INORG	Cyanide (total)	57-12-5	0.0001	0.	0.	0.	0.	0.	0.	0.2	
INORG	Lead	7439-92-1	0.0026	0.	0.	0.	0.0002	0.0005	0.	0.015	
INORG	Manganese	7439-96-5	0.6958	0.0002	0.1396	0.0854	0.6896	0.0228	0.	5.11	
INORG	Mercury	7439-97-6	0.	0.	0.	0.	0.	0.	0.	0.002	
INORG	Nickel	7440-02-0	0.0077	0.	0.	0.	0.0001	0.0024	0.	0.1	
INORG	Selenium	7782-49-2	0.0009	0.	0.0018	0.001	0.0073	0.0001	0.	0.05	
INORG	Silver	7440-22-4	0.	0.	0.	0.	0.	0.	0.	0.1825	
INORG	Thallium	7440-28-0	0.	0.	0.	0.	0.	0.	0.	0.002	
INORG	Vanadium	7440-62-2	0.	0.	0.	0.	0.	0.	0.	0.2555	
INORG	Zinc	7440-66-6	0.0395	0.	0.0093	0.0312	0.166	0.0032	0.	10.95	

Table 3-13: Summary of Estimated Ground Water Concentrations (mg/L) for Ground Water Use Evaluated in Scenario 9
Delphi Thermal, Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

TCL/TAL Group	Constituent	CASRN	Dryden Road North	Dryden Road South	Miami Shores	Moraine Assembly	Moraine Engine	West Carrollton	Criteria	Flag
VOC	1,1,1-Trichloroethane	71-55-6	0.0016	0.0006	0.	0.	0.	0.	0.2	
VOC	1,1-Dichloroethane	75-34-3	0.003	0.0012	0.	0.	0.	0.	3.65	
VOC	1,1-Dichloroethene	75-35-4	0.0001	0.0001	0.	0.	0.	0.	0.007	
VOC	1,2-Dichloroethene (total)	540-59-0	0.0007	0.0002	0.	0.	0.	0.	0.07	
VOC	2-Butanone	78-93-3	0.001	0.0002	0.	0.	0.	0.	21.9	
VOC	Acetone	67-64-1	0.0014	0.0005	0.	0.0001	0.	0.	3.65	
VOC	Benzene	71-43-2	0.0002	0.0001	0.	0.	0.	0.	0.005	
VOC	Carbon Disulfide	75-15-0	0.0001	0.	0.	0.	0.	0.	3.65	
VOC	Chlorobenzene	108-90-7	0.	0.	0.	0.	0.	0.	0.1	
VOC	Chloroethane	75-00-3	0.0005	0.0003	0.	0.0001	0.	0.	0.01	
VOC	Chloroform	67-66-3	0.	0.	0.	0.	0.	0.	0.1	
VOC	cis-1,2-Dichloroethene	156-59-2	0.0074	0.0039	0.	0.0001	0.0003	0.	0.07	
VOC	Ethyl Benzene	100-41-4	0.0018	0.0007	0.	0.	0.	0.	0.7	
VOC	Styrene	100-42-5	0.	0.	0.	0.	0.	0.	0.1	
VOC	Tetrachloroethene	127-18-4	0.0108	0.014	0.0001	0.0026	0.0051	0.	0.005	OVER
VOC	Toluene	108-88-3	0.0033	0.0011	0.	0.	0.	0.	1.	
VOC	trans-1,2-Dichloroethene	156-60-5	0.0004	0.0002	0.	0.	0.	0.	0.1	
VOC	Trichloroethene	79-01-6	0.0048	0.0033	0.	0.0003	0.0007	0.	0.005	
VOC	Trichlorofluoromethane	75-69-4	0.	0.	0.	0.	0.	0.	10.95	
VOC	Vinyl Chloride	75-01-4	0.0006	0.0003	0.	0.	0.	0.	0.002	
VOC	Xylenes (total)	1330-20-7	0.0047	0.0016	0.	0.	0.	0.	10.	
SVOC	1,2-Dichlorobenzene	95-50-1	0.	0.	0.	0.	0.	0.	0.6	
SVOC	2-Methylnaphthalene	91-57-6	0.0002	0.0001	0.	0.	0.	0.	0.73	
SVOC	Benzo(a)anthracene	56-55-3	0.	0.	0.	0.	0.	0.	0.01	
SVOC	Benzo(a)pyrene	50-32-8	0.	0.	0.	0.	0.	0.	0.0002	
SVOC	Benzo(b)fluoranthene	205-99-2	0.	0.	0.	0.	0.	0.	0.01	
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	0.	0.	0.	0.	0.	0.	0.006	
SVOC	Butylbenzylphthalate	85-68-7	0.0002	0.0001	0.	0.	0.	0.	7.3	
SVOC	Chrysene	218-01-9	0.	0.	0.	0.	0.	0.	0.0117	
SVOC	Di-n-butylphthalate	84-74-2	0.	0.	0.	0.	0.	0.	3.65	
SVOC	Fluoranthene	206-44-0	0.0004	0.0002	0.	0.	0.	0.	1.46	
SVOC	Fluorene	86-73-7	0.	0.	0.	0.	0.	0.	1.46	
SVOC	Naphthalene	91-20-3	0.0008	0.0003	0.	0.	0.	0.	0.73	
SVOC	Phenanthrene	85-01-8	0.0027	0.0013	0.	0.0001	0.0002	0.	1.095	
SVOC	Pyrene	129-00-0	0.0003	0.0001	0.	0.	0.	0.	1.095	
P/PCB	Aroclor-1242	53469-21-9	0.	0.	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1254	11097-69-1	0.0001	0.	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1260	11096-82-5	0.	0.	0.	0.	0.	0.	0.0005	
INORG	Antimony	7440-36-0	0.0009	0.0004	0.	0.	0.	0.	0.006	
INORG	Arsenic	7440-38-2	0.0135	0.0097	0.	0.	0.	0.	0.05	
INORG	Barium	7440-39-3	0.0624	0.0182	0.0003	0.	0.0005	0.	2.	
INORG	Beryllium	7440-41-7	0.	0.	0.	0.0001	0.	0.	0.004	
INORG	Cadmium	7440-43-9	0.0005	0.0002	0.	0.	0.	0.	0.005	
INORG	Chromium (total)	7440-47-3	0.0249	0.0083	0.	0.	0.	0.	0.1	
INORG	Cobalt	7440-48-4	0.0022	0.0008	0.	0.	0.0001	0.	2.19	
INORG	Copper	7440-50-8	0.0016	0.0005	0.	0.	0.	0.	1.3	
INORG	Cyanide (total)	57-12-5	0.0001	0.	0.	0.	0.	0.	0.2	
INORG	Lead	7439-92-1	0.0034	0.0007	0.	0.	0.	0.	0.015	
INORG	Manganese	7439-96-5	0.7698	0.6737	0.0037	0.198	0.0881	0.	5.11	
INORG	Mercury	7439-97-6	0.	0.	0.	0.	0.	0.	0.002	
INORG	Nickel	7440-02-0	0.0128	0.0043	0.	0.	0.	0.	0.1	
INORG	Selenium	7782-49-2	0.0014	0.0018	0.	0.0022	0.001	0.	0.05	
INORG	Silver	7440-22-4	0.0001	0.	0.	0.	0.	0.	0.1825	
INORG	Thallium	7440-28-0	0.	0.	0.	0.	0.	0.	0.002	
INORG	Vanadium	7440-62-2	0.	0.	0.	0.	0.	0.	0.2555	
INORG	Zinc	7440-66-6	0.0546	0.0684	0.0006	0.0126	0.0251	0.	10.95	

Table 3-14: Summary of Estimated Ground Water Concentrations (mg/L) for Ground Water Use Evaluated in Scenario 10
Delphi Thermal, Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

TCL/TAL Group	Constituent	CASRN	Dryden Road North	Dryden Road South	Miami Shores	Moraine Assembly	Moraine Engine	Well 28	Delphi Thermal	West Carrollton	Criteria	Flag
VOC	1,1,1-Trichloroethane	71-55-6	0.0012	0.0002	0.	0.	0.	0.0001	0.0001	0.	0.2	
VOC	1,1-Dichloroethane	75-34-3	0.0023	0.0004	0.	0.	0.	0.0001	0.0001	0.	3.65	
VOC	1,1-Dichloroethene	75-35-4	0.	0.	0.	0.	0.	0.0001	0.	0.	0.007	
VOC	1,2-Dichloroethene (total)	540-59-0	0.0005	0.0001	0.	0.	0.	0.	0.0002	0.	0.07	
VOC	2-Butanone	78-93-3	0.0007	0.0001	0.	0.	0.	0.	0.0007	0.	21.9	
VOC	Acetone	67-64-1	0.0003	0.	0.	0.	0.	0.0002	0.0001	0.	3.65	
VOC	Benzene	71-43-2	0.0001	0.	0.	0.	0.	0.	0.	0.	0.005	
VOC	Carbon Disulfide	75-15-0	0.0001	0.	0.	0.	0.	0.	0.	0.	3.65	
VOC	Chlorobenzene	108-90-7	0.	0.	0.	0.	0.	0.	0.	0.	0.1	
VOC	Chloroethane	75-00-3	0.0004	0.0001	0.	0.0001	0.	0.0002	0.	0.	0.01	
VOC	Chloroform	67-66-3	0.	0.	0.	0.	0.	0.	0.	0.	0.1	
VOC	cis-1,2-Dichloroethene	156-59-2	0.0079	0.0023	0.	0.0001	0.0004	0.0034	0.0035	0.	0.07	
VOC	Ethyl Benzene	100-41-4	0.0014	0.0002	0.	0.	0.	0.	0.0001	0.	0.7	
VOC	Styrene	100-42-5	0.	0.	0.	0.	0.	0.	0.	0.	0.1	
VOC	Tetrachloroethene	127-18-4	0.0079	0.0066	0.	0.0016	0.0062	0.032	0.0003	0.	0.005	OVER
VOC	Toluene	108-88-3	0.0025	0.0003	0.	0.	0.	0.	0.0005	0.	1.	
VOC	trans-1,2-Dichloroethene	156-60-5	0.0003	0.0001	0.	0.	0.	0.0002	0.	0.	0.1	
VOC	Trichloroethene	79-01-6	0.0037	0.0014	0.	0.0002	0.0008	0.0044	0.0002	0.	0.005	
VOC	Trichlorofluoromethane	75-69-4	0.	0.	0.	0.	0.	0.	0.	0.	10.95	
VOC	Vinyl Chloride	75-01-4	0.0006	0.0002	0.	0.	0.	0.0002	0.0002	0.	0.002	
VOC	Xylenes (total)	1330-20-7	0.0035	0.0004	0.	0.	0.	0.	0.0006	0.	10.	
SVOC	1,2-Dichlorobenzene	95-50-1	0.	0.	0.	0.	0.	0.	0.	0.	0.6	
SVOC	2-Methylnaphthalene	91-57-6	0.	0.	0.	0.	0.	0.	0.	0.	0.73	
SVOC	Benzo(a)anthracene	56-55-3	0.	0.	0.	0.	0.	0.	0.	0.	0.01	
SVOC	Benzo(a)pyrene	50-32-8	0.	0.	0.	0.	0.	0.	0.	0.	0.0002	
SVOC	Benzo(b)fluoranthene	205-99-2	0.	0.	0.	0.	0.	0.	0.	0.	0.01	
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	0.	0.	0.	0.	0.	0.	0.	0.	0.006	
SVOC	Butylbenzylphthalate	85-68-7	0.0001	0.	0.	0.	0.	0.	0.	0.	7.3	
SVOC	Chrysene	218-01-9	0.	0.	0.	0.	0.	0.	0.	0.	0.0117	
SVOC	Di-n-butylphthalate	84-74-2	0.	0.	0.	0.	0.	0.	0.	0.	3.65	
SVOC	Fluoranthene	206-44-0	0.0003	0.0001	0.	0.	0.	0.0002	0.	0.	1.46	
SVOC	Fluorene	86-73-7	0.	0.	0.	0.	0.	0.	0.	0.	1.46	
SVOC	Naphthalene	91-20-3	0.	0.	0.	0.	0.	0.	0.	0.	0.73	
SVOC	Phenanthrene	85-01-8	0.0021	0.0004	0.	0.0001	0.0002	0.0012	0.0004	0.	1.095	
SVOC	Pyrene	129-00-0	0.0002	0.	0.	0.	0.	0.	0.	0.	1.095	
P/PCB	Aroclor-1242	53469-21-9	0.	0.	0.	0.	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1254	11097-69-1	0.0001	0.	0.	0.	0.	0.	0.	0.	0.0005	
P/PCB	Aroclor-1260	11096-82-5	0.	0.	0.	0.	0.	0.	0.	0.	0.0005	
INORG	Antimony	7440-36-0	0.0012	0.0003	0.	0.	0.	0.0003	0.0007	0.	0.006	
INORG	Arsenic	7440-38-2	0.0114	0.0037	0.	0.	0.	0.	0.0002	0.	0.05	
INORG	Barium	7440-39-3	0.0329	0.0029	0.	0.	0.0004	0.006	0.0059	0.	2.	
INORG	Beryllium	7440-41-7	0.	0.	0.	0.	0.	0.0001	0.	0.	0.004	
INORG	Cadmium	7440-43-9	0.0004	0.	0.	0.	0.	0.	0.0001	0.	0.005	
INORG	Chromium (total)	7440-47-3	0.0189	0.0022	0.	0.	0.	0.	0.0036	0.	0.1	
INORG	Cobalt	7440-48-4	0.0021	0.0004	0.	0.	0.0001	0.0012	0.0004	0.	2.19	
INORG	Copper	7440-50-8	0.0012	0.0001	0.	0.	0.	0.	0.0002	0.	1.3	
INORG	Cyanide (total)	57-12-5	0.	0.	0.	0.	0.	0.	0.	0.	0.2	
INORG	Lead	7439-92-1	0.0027	0.0002	0.	0.	0.	0.0002	0.0005	0.	0.015	
INORG	Manganese	7439-96-5	0.7455	0.2933	0.0009	0.134	0.0777	0.5995	0.0161	0.	5.11	
INORG	Mercury	7439-97-6	0.	0.	0.	0.	0.	0.	0.	0.	0.002	
INORG	Nickel	7440-02-0	0.0099	0.0012	0.	0.	0.	0.0001	0.002	0.	0.1	
INORG	Selenium	7782-49-2	0.0007	0.0007	0.	0.0017	0.001	0.0065	0.	0.	0.05	
INORG	Silver	7440-22-4	0.	0.	0.	0.	0.	0.	0.	0.	0.1825	
INORG	Thallium	7440-28-0	0.	0.	0.	0.	0.	0.	0.	0.	0.002	
INORG	Vanadium	7440-62-2	0.	0.	0.	0.	0.	0.	0.	0.	0.2555	
INORG	Zinc	7440-66-6	0.0397	0.0322	0.0002	0.0079	0.0308	0.1572	0.0026	0.	10.95	

Table 3-15: Central Tendency Exposure Factors and Estimated Intakes
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

		Industrial Land Use		Residential Land Use	
		On-Facility Industrial Worker		Off-Facility Resident	
		Routine Industrial Activities	Excavation Activities	Routine Industrial Activities	Excavation Activities
Soil Ingestion					
Ingestion Rate (mg-soil/d)	IR	25	100		
Conversion Factor (kg/mg)	CF	1E-06	1E-06		
Fraction Contacted (unitless)	FC	0.078	0.5		
Exposure Frequency (d/yr)	EF	250	2		
Exposure Duration (yr)	ED	4	1		
Body Weight (kg-bw)	BW	70	70		
Averaging Time, carc (d)	AT_c	25550	25550		
Averaging Time, noncarc (d)	AT_{nc}	1460	1460		
Intake, carc (kg-soil/kg-bw/d)		**1.09E-09**	**5.59E-11**		
Intake, noncarc (kg-soil/kg-bw/d)		**1.91E-08**	**9.78E-10**		
Soil Dermal Contact					
Adherence Factor (mg-soil/cm^2)	AD	0.2	0.2		
Skin Surface Area (cm^2/d)	SA	1400	600		
Conversion Factor (kg/mg)	CF	1E-06	1E-06		
Fraction Contacted (unitless)	FC	0.078	0.5		
Exposure Frequency (d/yr)	EF	250	2		
Exposure Duration (yr)	ED	4	1		
Body Weight (kg-bw)	BW	70	70		
Averaging Time, carc (d)	AT_c	25550	25550		
Averaging Time, noncarc (d)	AT_{nc}	1460	1460		
Intake, carc (kg-soil/kg-bw/d)		**1.22E-08**	**6.71E-11**		
Intake, noncarc (kg-soil/kg-bw/d)		**2.14E-07**	**1.17E-09**		
Ambient Air Inhalation					
Breathing Rate (m^3-air/d)	BR	10.4	16.8	16.3	16.3
Fraction Contacted (unitless)	FC	0.078	0.5	0.64	0.64
Exposure Frequency (d/yr)	EF	250	2	350	2
Exposure Duration (yr)	ED	4	1	9	1
Body Weight (kg-bw)	BW	70	70	70	70
Averaging Time, carc (d)	AT_c	25550	25550	25550	25550
Averaging Time, noncarc (d)	AT_{nc}	1460	1460	3285	3285
Intake, carc (m^3-air/kg-bw/d)		**4.54E-04**	**9.39E-06**	**1.84E-02**	**1.17E-05**
Intake, noncarc (m^3-air/kg-bw/d)		**7.94E-03**	**1.64E-04**	**1.43E-01**	**9.07E-05**

Table 3-16: High-End Exposure Factors and Estimated Intakes
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

		Industrial Land Use		Residential Land Use	
		On-Facility Industrial Worker		Off-Facility Resident	
		Routine Industrial Activities	Excavation Activities	Routine Industrial Activities	Excavation Activities
Soil Ingestion					
Ingestion Rate (mg-soil/d)	IR	50	480		
Conversion Factor (kg/mg)	CF	1E-06	1E-06		
Fraction Contacted (unitless)	FC	0.125	1		
Exposure Frequency (d/yr)	EF	250	10		
Exposure Duration (yr)	ED	21	1		
Body Weight (kg-bw)	BW	70	70		
Averaging Time, carc (d)	AT_c	25550	25550		
Averaging Time, noncarc (d)	AT_{nc}	7665	7665		
Intake, carc (kg-soil/kg-bw/d)		**1.83E-08**	**2.68E-09**		
Intake, noncarc (kg-soil/kg-bw/d)		**6.12E-08**	**8.95E-09**		
Soil Dermal Contact					
Adherence Factor (mg-soil/cm^2)	AD	1.0	1.0		
Skin Surface Area (cm^2/d)	SA	3000	3000		
Conversion Factor (kg/mg)	CF	1E-06	1E-06		
Fraction Contacted (unitless)	FC	0.125	1.0		
Exposure Frequency (d/yr)	EF	250	10		
Exposure Duration (yr)	ED	21	1		
Body Weight (kg-bw)	BW	70	70		
Averaging Time, carc (d)	AT_c	25550	25550		
Averaging Time, noncarc (d)	AT_{nc}	7665	7665		
Intake, carc (kg-soil/kg-bw/d)		**1.10E-06**	**1.68E-08**		
Intake, noncarc (kg-soil/kg-bw/d)		**3.67E-06**	**5.59E-08**		
Ambient Air Inhalation					
Breathing Rate (m^3-air/d)	BR	20	20	20.0	20.0
Fraction Contacted (unitless)	FC	0.125	1.0	1.00	1.00
Exposure Frequency (d/yr)	EF	250	10	350	10
Exposure Duration (yr)	ED	21	1	30	1
Body Weight (kg-bw)	BW	70	70	70	70
Averaging Time, carc (d)	AT_c	25550	25550	25550	25550
Averaging Time, noncarc (d)	AT_{nc}	7665	7665	10950	10950
Intake, carc (m^3-air/kg-bw/d)		**7.34E-03**	**1.12E-04**	**1.17E-01**	**1.12E-04**
Intake, noncarc (m^3-air/kg-bw/d)		**2.45E-02**	**3.73E-04**	**2.74E-01**	**2.61E-04**
Drinking Water Consumption					
Drinking Rate (L-water/d)	DR			2	
Fraction Contacted (unitless)	FC			1.00	
Exposure Frequency (d/yr)	EF			350	
Exposure Duration (yr)	ED			30	
Body Weight (kg)	BW			70	
Averaging Time, carc (d)	AT_c			25550	
Averaging Time, noncarc (d)	AT_{nc}			10950	
Intake, carc (L-water/kg-bw/d)				**1.17E-02**	
Intake, noncarc (L-water/kg-bw/d)				**2.74E-02**	

Table 4-1: USEPA Toxicity Values for Constituents Identified for Risk Assessment
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

TCL/TAL Group	Constituent	CASRN	EPA Group	SF_{Oral} $(mg/kg/d)^{-1}$			SF_{inh} $(mg/kg/d)^{-1}$			RfD_{Oral} (mg/kg/d)				RfD_{inh} (mg/kg/d)			
				Value	Ref	Note	Value	Ref	Note	Value	UF	Ref	Note	Value	UF	Ref	Note
VOC	1,1,1-Trichloroethane	71-55-6	D							2.00E-01	1000	68		2.86E-01	300	66	47
VOC	1,1-Dichloroethane	75-34-3	C							1.00E-01	1000	2	26,6	1.43E-01	1000	2	3,47
VOC	1,1-Dichloroethene	75-35-4	C	6.00E-01	1		1.75E-01	1	52	9.00E-03	1000	1	6				
VOC	1,2-Dichloroethene (total)	540-59-0								9.00E-03	1000	2					
VOC	2-Butanone	78-93-3	D							6.00E-01	3000	1		2.86E-01	3000	1	47
VOC	Acetone	67-64-1	D							1.00E-01	1000	1					
VOC	Benzene	71-43-2	A	2.90E-02	1	26,6	7.70E-03	1	52,60								
VOC	Carbon Disulfide	75-15-0								1.00E-01	100	1		2.00E-01	30	1	47
VOC	Chlorobenzene	108-90-7	D							2.00E-02	1000	1		5.71E-03	1000	2	3,47
VOC	Chloroethane	75-00-3												2.86E+00	300	1	47
VOC	Chloroform	67-66-3	B2	6.10E-03	1		8.05E-02	1	52	1.00E-02	1000	1					
VOC	cis-1,2-Dichloroethene	156-59-2	D							1.00E-02	3000	2	6				
VOC	Ethyl Benzene	100-41-4	D							1.00E-01	1000	1		2.86E-01	300	1	47
VOC	Styrene	100-42-5								2.00E-01	1000	1	6	2.86E-01	30	1	47
VOC	Tetrachloroethene	127-18-4	C-B2	5.20E-02	51		2.03E-03	51	52	1.00E-02	1000	1					
VOC	Toluene	108-88-3	D							2.00E-01	1000	1		1.14E-01	300	1	47
VOC	trans-1,2-Dichloroethene	156-60-5								2.00E-02	1000	1					
VOC	Trichloroethene	79-01-6	C-B2	1.10E-02	49		5.95E-03	49	52	6.00E-03	3000	46	6				
VOC	Trichlorofluoromethane	75-69-4								3.00E-01		1		2.00E-01		2	3
VOC	Vinyl Chloride	75-01-4	A	1.90E+00	2	7	2.94E-01	2	52								
VOC	Xylenes (total)	1330-20-7	D							2.00E+00	100	1					6
SVOC	1,2-Dichlorobenzene	95-50-1	D							9.00E-02	1000	1		5.71E-02	1000	2	3,47
SVOC	2-Methylnaphthalene	91-57-6	D							2.00E-02	3000	1	61	8.57E-03	3000	1	47,61
SVOC	Benzo(a)anthracene	56-55-3	B2	7.30E-01	10	5											
SVOC	Benzo(a)pyrene	50-32-8	B2	7.30E+00	1												
SVOC	Benzo(b)fluoranthene	205-99-2	B2	7.30E-01	10	5											
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	B2	1.40E-02	1					2.00E-02	1000	1					
SVOC	Butylbenzylphthalate	85-68-7	C							2.00E-01	1000	1					
SVOC	Chrysene	218-01-9	B2	7.30E-03	10	5											
SVOC	Di-n-butylphthalate	84-74-2	D							1.00E-01	1000	1	6				
SVOC	Fluoranthene	206-44-0	D							4.00E-02	3000	1					
SVOC	Fluorene	86-73-7	D							4.00E-02	3000	1					
SVOC	Naphthalene	91-20-3	C							2.00E-02	3000	1		8.57E-03	3000	1	47
SVOC	Phenanthrene	85-01-8	D							3.00E-02			20				
SVOC	Pyrene	129-00-0	D							3.00E-02	3000	1					
P/PCB	Aroclor-1242	53469-21-9	B2	2.00E+00		30,32,53	2.00E+00		30,32,53	7.00E-05	100	9	16				
P/PCB	Aroclor-1254	11097-69-1	B2	2.00E+00		30,32,53	2.00E+00		30,32,53	2.00E-05	300	1					
P/PCB	Aroclor-1260	11096-82-5	B2	2.00E+00		30,32,53	2.00E+00		30,32,53	2.00E-05	300	9	17				
INORG	Antimony	7440-36-0								4.00E-04	1000	1					
INORG	Arsenic	7440-38-2	A	1.50E+00	1		1.51E+01	1	52	3.00E-04	3	1					
INORG	Barium	7440-39-3	D							7.00E-02	3	1					
INORG	Beryllium	7440-41-7	B1				8.40E+00	1	52	2.00E-03	300	1		5.71E-06	10	1	47
INORG	Cadmium (diet)	7440-43-9	B1				6.30E+00	1	52	1.00E-03	10	1					
INORG	Cadmium (water)	7440-43-9	B1							5.00E-04	10	1					
INORG	Chromium (total)	7440-47-3	A				4.20E+01		8,52	3.00E-03	900		8	2.90E-05	300		8,47,59
INORG	Cobalt	7440-48-4								6.00E-02		37		5.71E-06	100	36	47
INORG	Copper	7440-50-8	D							4.00E-02	2	50	49				
INORG	Cyanide (total)	57-12-5	D							2.00E-02	500	1					
INORG	Lead	7439-92-1	B2														
INORG	Manganese	7439-96-5	D														
INORG	Mercury	7439-97-6	D														
INORG	Nickel	7440-02-0	A				8.40E-01	1	52	3.00E-04	1000	1	54	8.57E-05	30	1	47
INORG	Selenium	7782-49-2	D							2.00E-02	300	1					
INORG	Silver	7440-22-4	D							5.00E-03	3	1					
INORG	Thallium	7440-28-0								5.00E-03	3	1					
INORG	Vanadium	7440-62-2								7.00E-05	3000	52	49				
INORG	Zinc	7440-66-6	D							7.00E-03	100	2	6				
										3.00E-01	3	1					

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Table 4-1: USEPA Toxicity Values for Constituents Identified for Risk Assessment
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

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52	USEPA. 57 FR 31776, July 17, 1992. National Primary Drinking Water Regulations -- Synthetic Organic Chemicals and Inorganic Chemicals; National Primary Drinking Water Regulations Implementation. Final Rule.
66	USEPA. NCEA. 1996. Risk Assessment Issue Paper for: Derivation of a Chronic RfC for 1,1,1-Trichloroethane [CASRN 71-55-6]. August 9.
68	USEPA. NCEA. 1996. Risk Assessment Issue Paper for: Derivation of a Chronic RfD for 1,1,1-Trichloroethane [CASRN 71-55-6]. August 9.

Notes:

3	HEAST Alternate Method.
5	Based on analogy to Benzo(a)pyrene [CASRN 50-32-8] using USEPA relative potency described in reference 10.
6	Under review, according to IRIS.
7	Interim number.
8	ENVIRON used Chromium VI [CASRN 18540-29-9] value from IRIS (reference 1) as a surrogate.
16	USEPA used Arocior 1016 [CASRN 12674-11-2] value from IRIS (reference 1) as a surrogate.
17	USEPA used Arocior 1254 [CASRN 11097-69-1] value from IRIS (reference 1) as a surrogate.
20	ENVIRON used Pyrene [CASRN 129-00-0] value from IRIS (reference 1) as a surrogate.
26	USEPA obtained value by route-to-route extrapolation.
30	Upper-bound slope factor.
32	High risk & persistence tier.Use for: food chain exposure;sediment/soil ingestion;dust/aerosol inhalation;dermal exposure, if an absorption factor has been applied;presence of dioxin-like,tumor-promoting/persistent congeners;all early life exposures.
36	IRIS recommends applying a modifying factor of 3 when using this RfD in assessing exposures to drinking water or soil.
47	ENVIRON derived from the chronic RfC provided in the indicated reference.
49	ENVIRON derived CRFDO from adverse health effect level value presented in the indicated reference.
52	ENVIRON derived CSFI value from URFI value presented in the indicated reference, using standard USEPA methodology presented in HEAST.
53	ENVIRON used Polychlorinated Biphenyl [CASRN 1336-36-3] value from IRIS (Reference 1) as a surrogate.
54	ENVIRON used Mercuric Chloride [CASRN 7487-94-7] value from the indicated reference as a surrogate.
60	IRIS provides a range of 2.2E-6 to 7.8E-6 (ug/m3)-1as the Inhalation Unit Risk Factor (URFI) for Benzene.
61	ENVIRON used Naphthalene [CASRN 91-20-3] value from indicated reference as a surrogate.

Table 5-1: Central Tendency Cumulative Cancer Risks and Hazard Index Estimates Using USEPA Toxicity Values

Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

Central Tendency Cumulative Cancer Risk Estimates

	On-Facility Workers						Off-Facility Residents
	Routine Industrial Workers			Excavation Workers			
Exposure Area	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	$Inhalation_{soil}$
7 - Former Oil House Area	7.E-09		5.E-10	9.E-10		1.E-08	5.E-09
13 - Buildings 4, 6, and 13	5.E-09		1.E-10	1.E-09		2.E-08	2.E-08
34 - Excavation Area 1	2.E-09		7.E-12	7.E-09		1.E-08	3.E-09
35 - Excavation Area 2	2.E-10		7.E-12	3.E-10		5.E-09	4.E-09
36 - Former Southwest ASTs	4.E-10		2.E-12	3.E-09		6.E-09	1.E-08
Sum	**2.E-08**		**6.E-10**				

Central Tendency Hazard Index Estimates

	On-Facility Workers						Off-Facility Residents
	Routine Industrial Workers			Excavation Workers			
Exposure Area	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	$Inhalation_{soil}$
7 - Former Oil House Area	4.E-04		3.E-04	4.E-05		5.E-03	1.E-03
13 - Buildings 4, 6, and 13	3.E-04		1.E-03	4.E-04		1.E-02	1.E-02
34 - Excavation Area 1	1.E-04		4.E-06	3.E-04		6.E-03	6.E-04
35 - Excavation Area 2	2.E-05		8.E-06	3.E-05		3.E-03	1.E-03
36 - Former Southwest ASTs	2.E-05		2.E-06	1.E-04		5.E-03	7.E-03
Sum	**8.E-04**		**1.E-03**				

Table 5-2: High-End Cumulative Cancer Risks and Hazard Index Estimates Using USEPA Toxicity Values
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

High-End Cumulative Cancer Risk Estimates

	On-Facility Workers						Off-Facility Residents
	Routine Industrial Workers			Excavation Workers			
Exposure Area	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	$Inhalation_{soil}$
7 - Former Oil House Area	6.E-08		2.E-09	4.E-08		1.E-07	3.E-08
13 - Buildings 4, 6, and 13	3.E-08		7.E-10	7.E-08		3.E-07	1.E-07
34 - Excavation Area 1	5.E-07		1.E-09	3.E-07		2.E-07	2.E-08
35 - Excavation Area 2	2.E-08		5.E-10	1.E-08		6.E-08	3.E-08
36 - Former Southwest ASTs	2.E-07		6.E-10	1.E-07		7.E-08	1.E-07
Sum	**8.E-07**		**5.E-09**				

High-End Hazard Index Estimates

	On-Facility Workers						Off-Facility Residents
	Routine Industrial Workers			Excavation Workers			
Exposure Area	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	$Inhalation_{soil}$
7 - Former Oil House Area	5.E-04		2.E-04	4.E-04		1.E-02	2.E-03
13 - Buildings 4, 6, and 13	4.E-04		6.E-04	4.E-03		2.E-02	2.E-02
34 - Excavation Area 1	4.E-03		1.E-04	3.E-03		1.E-02	1.E-03
35 - Excavation Area 2	2.E-04		8.E-05	3.E-04		7.E-03	3.E-03
36 - Former Southwest ASTs	2.E-03		1.E-04	1.E-03		1.E-02	1.E-02
Sum	**6.E-03**		**1.E-03**				

Table 5-3: Acceptable Drinking Water Concentrations (mg/L)
Delphi Thermal, Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

TCL/TAL Group	Constituent	CASRN	Criterion Used	Basis
VOC	1,1,1-Trichloroethane	71-55-6	0.2	Federal MCL
VOC	1,1-Dichloroethane	75-34-3	3.65	Hazard Quotient of 1
VOC	1,1-Dichloroethene	75-35-4	0.007	Federal MCL
VOC	1,2-Dichloroethene (total)	540-59-0	0.07	Federal MCL
VOC	2-Butanone	78-93-3	21.9	Hazard Quotient of 1
VOC	Acetone	67-64-1	3.65	Hazard Quotient of 1
VOC	Benzene	71-43-2	0.005	Federal MCL
VOC	Carbon Disulfide	75-15-0	3.65	Hazard Quotient of 1
VOC	Chlorobenzene	108-90-7	0.1	Federal MCL
VOC	Chloroethane	75-00-3	0.01	Practical Quantitation Limit
VOC	Chloroform	67-66-3	0.1	Federal MCL
VOC	cis-1,2-Dichloroethene	156-59-2	0.07	Federal MCL
VOC	Ethyl Benzene	100-41-4	0.7	Federal MCL
VOC	Styrene	100-42-5	0.1	Federal MCL
VOC	Tetrachloroethene	127-18-4	0.005	Federal MCL
VOC	Toluene	108-88-3	1.	Federal MCL
VOC	trans-1,2-Dichloroethene	156-60-5	0.1	Federal MCL
VOC	Trichloroethene	79-01-6	0.005	Federal MCL
VOC	Trichlorofluoromethane	75-69-4	10.95	Hazard Quotient of 1
VOC	Vinyl Chloride	75-01-4	0.002	Federal MCL
VOC	Xylenes (total)	1330-20-7	10.	Federal MCL
SVOC	1,2-Dichlorobenzene	95-50-1	0.6	Federal MCL
SVOC	2-Methylnaphthalene	91-57-6	0.73	Hazard Quotient of 1
SVOC	Benzo(a)anthracene	56-55-3	0.01	Practical Quantitation Limit
SVOC	Benzo(a)pyrene	50-32-8	0.0002	Federal MCL
SVOC	Benzo(b)fluoranthene	205-99-2	0.01	Practical Quantitation Limit
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	0.006	Federal MCL
SVOC	Butylbenzylphthalate	85-68-7	7.3	Hazard Quotient of 1
SVOC	Chrysene	218-01-9	0.0117	10^{-6} Risk Level
SVOC	Di-n-butylphthalate	84-74-2	3.65	Hazard Quotient of 1
SVOC	Fluoranthene	206-44-0	1.46	Hazard Quotient of 1
SVOC	Fluorene	86-73-7	1.46	Hazard Quotient of 1
SVOC	Naphthalene	91-20-3	0.73	Hazard Quotient of 1
SVOC	Phenanthrene	85-01-8	1.095	Hazard Quotient of 1
SVOC	Pyrene	129-00-0	1.095	Hazard Quotient of 1
P/PCB	Aroclor-1242	53469-21-9	0.0005	Federal MCL
P/PCB	Aroclor-1254	11097-69-1	0.0005	Federal MCL
P/PCB	Aroclor-1260	11096-82-5	0.0005	Federal MCL
INORG	Antimony	7440-36-0	0.006	Federal MCL
INORG	Arsenic	7440-38-2	0.05	Federal MCL
INORG	Barium	7440-39-3	2.	Federal MCL
INORG	Beryllium	7440-41-7	0.004	Federal MCL
INORG	Cadmium	7440-43-9	0.005	Federal MCL
INORG	Chromium (total)	7440-47-3	0.1	Federal MCL
INORG	Cobalt	7440-48-4	2.19	Hazard Quotient of 1
INORG	Copper	7440-50-8	1.3	Federal MCL
INORG	Cyanide (total)	57-12-5	0.2	Federal MCL
INORG	Lead	7439-92-1	0.015	Federal MCL
INORG	Manganese	7439-96-5	5.11	Hazard Quotient of 1
INORG	Mercury	7439-97-6	0.002	Federal MCL
INORG	Nickel	7440-02-0	0.1	Ohio MCL
INORG	Selenium	7782-49-2	0.05	Federal MCL
INORG	Silver	7440-22-4	0.1825	Hazard Quotient of 1
INORG	Thallium	7440-28-0	0.002	Federal MCL
INORG	Vanadium	7440-62-2	0.2555	Hazard Quotient of 1
INORG	Zinc	7440-66-6	10.95	Hazard Quotient of 1

* The Ohio MCL for nickel is currently 0.1 mg/L, although the Federal MCL for nickel was withdrawn on June 29, 1995 (60 FR 33929).

Table 5-4: Central Tendency Cumulative Cancer Risks and Hazard Index Estimates Using Both USEPA and Extrapolated Inhalation and Dermal Toxicity Values
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

Central Tendency Cumulative Cancer Risk Estimates

	On-Facility Workers						Off-Facility Residents
	Routine Industrial Workers			Excavation Workers			
Exposure Area	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	$Inhalation_{soil}$
7 - Former Oil House Area	7.E-09	8.E-11	5.E-10	9.E-10	1.E-12	1.E-08	5.E-09
13 - Buildings 4, 6, and 13	5.E-09	6.E-11	1.E-10	1.E-09	1.E-11	2.E-08	2.E-08
34 - Excavation Area 1	2.E-09	3.E-11	7.E-12	7.E-09	9.E-12	1.E-08	3.E-09
35 - Excavation Area 2	2.E-10	2.E-12	7.E-12	3.E-10	3.E-13	5.E-09	4.E-09
36 - Former Southwest ASTs	4.E-10	5.E-12	2.E-12	3.E-09	3.E-12	6.E-09	1.E-08
Sum	**2.E-08**	**2.E-10**	**6.E-10**				

Central Tendency Hazard Index Estimates

	On-Facility Workers						Off-Facility Residents
	Routine Industrial Workers			Excavation Workers			
Exposure Area	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	$Inhalation_{soil}$
7 - Former Oil House Area	4.E-04	4.E-06	3.E-04	4.E-05	7.E-08	5.E-03	1.E-03
13 - Buildings 4, 6, and 13	3.E-04	4.E-06	1.E-03	4.E-04	5.E-06	1.E-02	1.E-02
34 - Excavation Area 1	1.E-04	1.E-06	4.E-06	3.E-04	4.E-07	6.E-03	6.E-04
35 - Excavation Area 2	2.E-05	2.E-07	8.E-06	3.E-05	3.E-08	3.E-03	1.E-03
36 - Former Southwest ASTs	2.E-05	2.E-07	2.E-06	1.E-04	2.E-07	5.E-03	7.E-03
Sum	**8.E-04**	**9.E-06**	**1.E-03**				

Table 5-5: High-End Cumulative Cancer Risks and Hazard Index Estimates Using Both USEPA and Extrapolated Inhalation and Dermal Toxicity Values
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

High-End Cumulative Cancer Risk Estimates

	On-Facility Workers								Off-Facility Residents
	Routine Industrial Workers				Excavation Workers				
Exposure Area	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	Sum	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	Sum	$Inhalation_{soil}$
7 - Former Oil House Area	6E-08	4E-09	2E-09	6E-08	4E-08	3E-10	1E-07	2E-07	3E-08
13 - Buildings 4, 6, and 13	3E-08	2E-09	7E-10	4E-08	7E-08	3E-09	3E-07	3E-07	1E-07
34 - Excavation Area 1	5E-07	3E-08	1E-09	5E-07	3E-07	2E-09	2E-07	5E-07	2E-08
35 - Excavation Area 2	2E-08	1E-09	5E-10	2E-08	1E-08	8E-11	6E-08	7E-08	3E-08
36 - Former Southwest ASTs	2E-07	1E-08	6E-10	2E-07	1E-07	8E-10	7E-08	2E-07	1E-07
Sum	**8E-07**	**5E-08**	**5E-09**	**8E-07**					

High-End Hazard Index Estimates

	On-Facility Workers								Off-Facility Residents
	Routine Industrial Workers				Excavation Workers				
Exposure Area	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	Sum	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	Sum	$Inhalation_{soil}$
7 - Former Oil House Area	5E-04	3E-05	2E-04	8E-04	4E-04	3E-06	1E-02	1E-02	2E-03
13 - Buildings 4, 6, and 13	4E-04	3E-05	6E-04	1E-03	4E-03	2E-04	2E-02	3E-02	2E-02
34 - Excavation Area 1	4E-03	2E-04	1E-04	4E-03	3E-03	2E-05	1E-02	2E-02	1E-03
35 - Excavation Area 2	2E-04	1E-05	8E-05	3E-04	3E-04	2E-06	7E-03	7E-03	3E-03
36 - Former Southwest ASTs	2E-03	9E-05	1E-04	2E-03	1E-03	8E-06	1E-02	1E-02	1E-02
Sum	**6E-03**	**4E-04**	**1E-03**	**8E-03**					

Table 5-5a: High-End Cumulative Cancer Risks and Hazard Index Estimates Using Both USEPA and Extrapolated Inhalation and Dermal Toxicity Values with FCi of 1 Instead of 0.2
Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

High-End Cumulative Cancer Risk Estimates

	On-Facility Workers								Off-Facility Residents
	Routine Industrial Workers				Excavation Workers				
Exposure Area	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	Sum	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	Sum	$Inhalation_{soil}$
7 - Former Oil House Area	3E-07	2E-08	1E-08	3E-07	4E-08	3E-10	1E-07	2E-07	3E-08
13 - Buildings 4, 6, and 13	2E-07	1E-08	4E-09	2E-07	7E-08	3E-09	3E-07	3E-07	1E-07
34 - Excavation Area 1	2E-06	1E-07	7E-09	2E-06	3E-07	2E-09	2E-07	5E-07	2E-08
35 - Excavation Area 2	9E-08	5E-09	3E-09	9E-08	1E-08	8E-11	6E-08	7E-08	3E-08
36 - Former Southwest ASTs	9E-07	5E-08	3E-09	1E-06	1E-07	8E-10	7E-08	2E-07	1E-07

High-End Hazard Index Estimates

	On-Facility Workers								Off-Facility Residents
	Routine Industrial Workers				Excavation Workers				
Exposure Area	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	Sum	Ingestion	$Dermal_{soil}$	$Inhalation_{soil}$	Sum	$Inhalation_{soil}$
7 - Former Oil House Area	3E-03	2E-04	1E-03	4E-03	4E-04	3E-06	1E-02	1E-02	2E-03
13 - Buildings 4, 6, and 13	2E-03	1E-04	3E-03	5E-03	4E-03	2E-04	2E-02	3E-02	2E-02
34 - Excavation Area 1	2E-02	1E-03	5E-04	2E-02	3E-03	2E-05	1E-02	2E-02	1E-03
35 - Excavation Area 2	1E-03	7E-05	4E-04	2E-03	3E-04	2E-06	7E-03	7E-03	3E-03
36 - Former Southwest ASTs	8E-03	5E-04	7E-04	9E-03	1E-03	8E-06	1E-02	1E-02	1E-02

Table 5-6: Comparison of Ground Water Modeling Predictions with Actual Monitoring Data Delphi Thermal, Moraine Engine and Moraine Assembly Plants - GMC, Moraine, Ohio

Interim Measures Well TW2 (Upper Aquifer)		
Constituent	Model Prediction[1]	Monitoring Data[2]
Tetrachloroethene	0.14	ND to 0.0265
Trichloroethene	0.13	0.043 to 0.0735
cis-1,2-Dichloroethene	0.12	ND to 0.0413
Vinyl chloride	0.013	0.0033 to 0.0324
Interim Measures Well DN13 (Lower Aquifer)		
Constituent	Model Prediction[1]	Monitoring Data[3]
Tetrachloroethene	0.012	ND
Trichloroethene	0.003	0.0033 to 0.0056
cis-1,2-Dichloroethene	0.0047	0.0034 to 0.0078
Vinyl chloride	0.0004	ND
Moraine Engine Production Wells 31 and 39		
Constituent	Model Prediction[1]	Monitoring Data[4]
Tetrachloroethene	0.0053	ND
Trichloroethene	0.0007	ND to 0.0132
cis-1,2-Dichloroethene	0.0003	ND to 0.0107
Vinyl chloride	0	ND to 0.0043
Moraine Assembly Production Wells 11A and 12A		
Constituent	Model Prediction[1]	Monitoring Data[5]
Tetrachloroethene	0.0056	ND
Trichloroethene	0.0008	ND to 0.0015
cis-1,2-Dichloroethene	0.0003	ND
Vinyl chloride	0	ND

Notes:

1. Model-predicted ground water concentrations (mg/L) in Scenario 6.
2. Data (mg/L) from 1/96 to 7/98, as reported in 4/21/99 Interim Measures Capture Zone Report.
3. Data (mg/L) from 1/97 to 3/99, as reported in March 1999 Monthly Technical Progress Report.
4. Data (mg/L) from 1/98 to 4/99.
5. Data (mg/L) from 1/98 to 4/99.

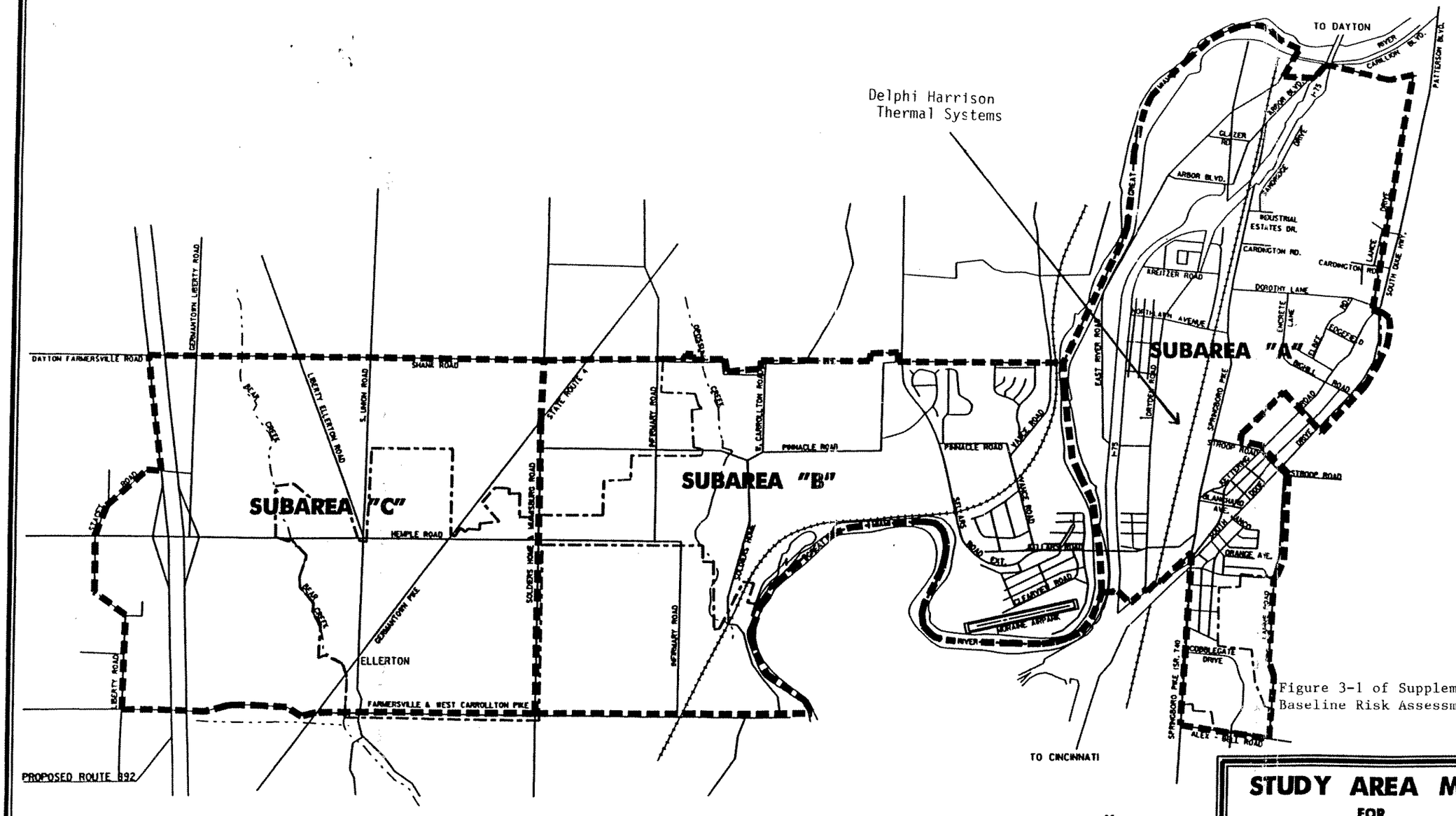

Figure 3-1 of Supplemental Baseline Risk Assessment

STUDY AREA MAP
FOR
CITY OF MORAINE, OHIO
COMPREHENSIVE PLAN

Burgess Wagoner Summer and Cannon Inc.

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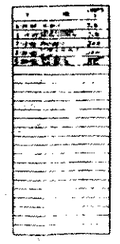
WEST CARROLLTON 2010

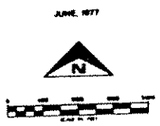
A
Comprehensive Plan
For
West Carrollton, Ohio

Figure 4-2
OFFICIAL ZONING DISTRICT MAP

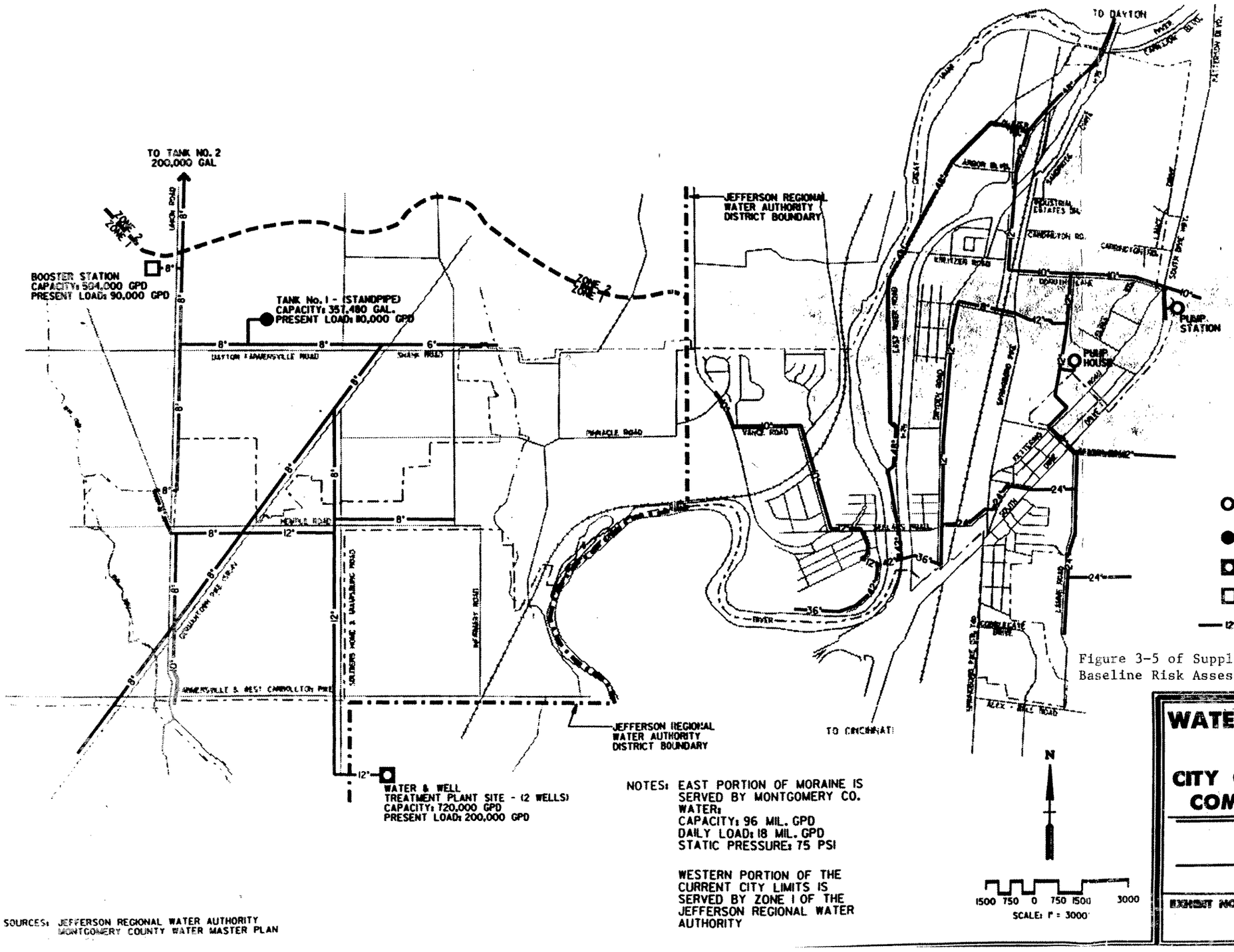
M-2	MANUFACTURING DISTRICT
M-1	INDUSTRIAL PARK DISTRICT
B-2	GENERAL COMMERCIAL DISTRICT
B-1	CONVENIENCE COMMERCIAL DISTRICT
O	OFFICE DISTRICT
O-R	OFFICE RESIDENTIAL DISTRICT
R-MHP	MOBILE HOME PARK DISTRICT
R-PUD	PLANNED UNIT DEVELOPMENT DISTRICT
R-5	MULTIPLE FAMILY RESIDENTIAL DISTRICT
R-4	MULTIPLE FAMILY RESIDENTIAL DISTRICT
R-3	RESIDENTIAL DISTRICT
R-2	SINGLE FAMILY RESIDENTIAL DISTRICT
R-1	SINGLE FAMILY RESIDENTIAL DISTRICT
RE	RESIDENTIAL ESTATE DISTRICT
A-1	AGRICULTURAL DISTRICT
LD	LIMITED DEVELOPMENT DISTRICT
M-3	RURAL MANUFACTURING DISTRICT
R-MHP-1	MOBILE HOME PARK DISTRICT
SPI	SPECIAL INTEREST DISTRICT

Figure 3-3 of Supplemental
Baseline Risk Assessment





City of
West Carrollton



NOTES: EAST PORTION OF MORAINE IS SERVED BY MONTGOMERY CO. WATER:
CAPACITY: 96 MIL. GPD
DAILY LOAD: 18 MIL. GPD
STATIC PRESSURE: 75 PSI

WESTERN PORTION OF THE CURRENT CITY LIMITS IS SERVED BY ZONE I OF THE JEFFERSON REGIONAL WATER AUTHORITY

SOURCES: JEFFERSON REGIONAL WATER AUTHORITY
MONTGOMERY COUNTY WATER MASTER PLAN

Figure 3-5 of Supplemental Baseline Risk Assessment

WATER INFRASTRUCTURE
FOR
CITY OF MORAINE, OHIO COMPREHENSIVE PLAN

Burgess Wordsworth Sumner and Cannon Inc.

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