PRELIMINARY INTERIM MEASURES WORK PLAN HARRISON DIVISION - GMC MORAINE, OHIO

May 1994

Prepared for

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INTRODUCTION

The Harrison Division of General Motors Corporation (Harrison) received an Administrative Order on December 31, 1990, from the United States Environmental Protection Agency (U.S. EPA) Region V. The Administrative Order issued under Section 3008(h) of the Resource Conservation and Recovery Act (RCRA), as amended by 42 U.S.C. 6928(h), in part requires Harrison to conduct a RCRA Facility Investigation (RFI). The primary objectives of the RFI are to 1) support a baseline risk assessment and additional groundwater modeling (if required) which will be used to develop proposed Media Protection Standards for groundwater, surface water, sediment, and soil at the facility, 2) collect data, as discussed in the Pre-Investigation Evaluation of Corrective Measure Technologies document (Geraghty & Miller, Inc. 1991), to support a Corrective Measures Study, if required, and 3) fulfill the general requirements of the RCRA Facility Investigation (RFI) Scope of Work included in the RFI Work Plan.

Geraghty & Miller, Inc. was retained by Harrison to prepare and implement the Harrison RFI Work Plan (Geraghty & Miller, Inc. 1992). The investigative portion of the RFI Work Plan was approved by the U.S. EPA in a letter dated September 22, 1992. The initial phase of the RFI field activities began in October 1992 and was completed in February 1993. Harrison submitted an Interim RFI Report to the U.S. EPA, summarizing the RFI field activities, on July 9, 1993 (Geraghty & Miller, Inc. 1993). The U.S. EPA submitted a comment letter to Harrison on the Interim RFI Report on October 19, 1993. The U.S. EPA informed Harrison, in their October 19, 1993 correspondence, that interim measures must be implemented to control the migration of groundwater which contains volatile organic compounds (VOCs), until a long term solution is implemented at the facility.

On November 16, 1993, Harrison agreed to perform interim measures to control groundwater in the shallow aquifer from migrating off-site and to submit to the U.S. EPA, within 60 days, a Preliminary Interim Measures Work Plan. Upon U.S. EPA approval of this Preliminary Interim Measures Work Plan, final interim measures design plans which will include final design drawings and specifications, an operation and maintenance plan, and a schedule for implementation of the interim measures will be developed and submitted to the U.S. EPA. Geraghty & Miller was retained by Harrison to prepare the Preliminary Interim Measures Work Plan.

Harrison submitted the Preliminary Interim Measures Work Plan to the U.S. EPA on January 14, 1994. Harrison received U.S. EPA comments on the work plan on March 24, 1994 and submitted responses to those comments back to the U.S. EPA on April 14, 1994. Based on information presented in the response to comments report, Harrison agreed to revise this work plan to indicate that interim measures will consist of hydraulic control for both the shallow and deep aquifers to prevent off-site migration of contaminated groundwater. In a meeting with Harrison on May 5, 1994, the U.S. EPA approved the Preliminary Interim Measures Work Plan with modifications which were enclosed in their letter dated May 10, 1994. In the May 5, 1994 meeting, Harrison agreed to submit a modified Preliminary Interim Measures Work Plan by May 25, 1994. This work plan fulfills that agreement.

SITE BACKGROUND

The Harrison facility is located approximately one mile south of Dayton at 3600 Dryden Road in Moraine, Ohio (Figure 1). The facility encompasses 165 acres and is bounded to the north by Northlawn Avenue, to the west by Dryden Road and Interstate-75, to the east by the Penn Central Railroad tracks, and to the south by Sellers Road. The facility's major operations are the machining and assembly of automotive air conditioning compressors, accumulator dehydrators, and miscellaneous air conditioning valves.

INTERIM MEASURES PURPOSE AND OBJECTIVES

The purpose of this preliminary interim measures work plan is to develop and submit to the U.S. EPA, a conceptual design for a groundwater remediation system to prevent off-site migration of groundwater in the shallow aquifer at the southern property boundary. The objectives of this work plan are to demonstrate how the hydraulic control of the shallow and deep aquifers will effectively prevent off-site migration; to discuss the technical approach, preliminary engineering design and plans, and the permit requirements for the selected groundwater remediation system for the shallow aquifer; to present a preliminary interim measures schedule; and to document the project management structure. These objectives are in accordance with RCRA guidance for interim measures (U.S. EPA 1988).

DESCRIPTION OF INTERIM MEASURES HYDRAULIC CONTROL OF THE SHALLOW AND DEEP AQUIFERS

Hydraulic control will be maintained at the southern property boundary of the Harrison facility by pumping DN-13 (deep aquifer) at a rate of 2.663 million gallons per day (mgd) and pumping Recovery Well 2 (TW-2) (shallow aquifer) at a rate of 166 gallons per minute (gpm). The locations of these wells are indicated on Figure 2. Capture zones have been modeled in order to verify hydraulic control of both the shallow and deep aquifers, using the recalibrated model (Geraghty & Miller, Inc. 1994). The capture zone for pumping TW-2 is shown on Figure 2 and the capture zone for pumping DN-13 is shown on Figure 3.

Montgomery County has been operating a Pump-to-Waste Program since March 1990 by pumping DN-13 at a rate of 2.663 mgd. The purpose for pumping this well is for protection of their Miami Shores well field. The pumped water is discharged directly to the Miami River without treatment. Harrison will work with Montgomery County to ensure hydraulic control of the lower aquifer is maintained. A small downward vertical gradient has existed at the Dryden Road North well field prior to the Pump-to-Waste Program being initiated in 1990 and continues to exist throughout extended Pump-to-Waste shutdowns. A hydrograph of a shallow/deep well pair, located at the Dryden Road North well field, which indicates the relationship of water-level elevations before and during Pump-to-Waste activities is included as Figure 4.

As shown on Figure 4, there have been occasions when the Pump-to-Waste Program was shutdown. The recalibrated model was used to determine the impact on the deep aquifer during periods of shutdown. Results from this modeling effort indicated that particles which had migrated south of the southern property boundary during shutdown were captured when pumping was resumed at DN-13.

In response to the agency's comment regarding the settling basins, Montgomery County has communicated to Harrison their intentions of constructing settling basins south of the Harrison facility. During construction, the county will implement dewatering activities. The effect this dewatering will have on pumping DN-13 and TW-2 cannot be evaluated until more detailed information can be supplied to Harrison by the county.

DESCRIPTION OF INTERIM MEASURES REMEDIATION SYSTEM FOR THE SHALLOW AQUIFER

The remediation system will consist of pumping groundwater in the shallow aquifer, from a recovery well TW-2, at a rate that will insure adequate capture of groundwater to meet the interim measures objectives, treatment through an air stripper tower, and discharge through a National Pollutant Discharge Elimination System (NPDES) permitted outfall to the Miami River.

The following items, associated with the interim measures objectives, will be discussed for this remediation system: design basis and parameters for the air stripper including pre- and post-treatment considerations, process description including a preliminary process flow diagram, permit requirements, and an interim measures schedule. Interim measures will be implemented concurrently with RFI activities; therefore, the RFI Health and Safety Plan and the RFI Community Relations Plan will be sufficient for the interim measures activities.

DESIGN BASIS AND PARAMETERS

The purpose of this section is to present the design basis and parameters for the air stripper tower. The design will be based on a groundwater pumping rate which insures capture of groundwater in the shallow aquifer (Figure 2), existing groundwater quality, and treatment criteria. The design parameters include the air stripper tower specifications and pre and post treatment considerations.

GROUNDWATER PUMPING RATE

Based on its location and construction, TW-2 was selected as the recovery well to be used for interim measures. This well was installed in May 1989, near the southern Inactive Site (Figure 2). TW-2 is 45 feet deep, is constructed of 10 inch diameter steel casing, and is screened between 35 and 45 feet with stainless steel screen (Geraghty & Miller, Inc. 1991). A pumping test was performed on this well in August 1989 and the results indicated that TW-2 could be pumped at a rate of 170 gpm for a period of 18 hours (Geraghty & Miller, Inc. 1990). TW-2 has remained inactive since the August 1989 pumping test, but will be inspected (via televiewing procedure) during resampling activities to verify its usefulness for interim measures.

To determine the appropriate pumping rate for the remediation system, the three-dimensional steady-state groundwater flow model previously developed for Harrison was recalibrated to evaluate particle tracking within a capture area (Geraghty & Miller, Inc. 1994). The preliminary analysis included pumping all wells simulated in the steady-state model, including DN-13 in the deep aquifer pumping at a rate of 2.663 mgd. The results of the particle tracking analysis indicated that pumping TW-2 at a rate of 166 gpm would provide an adequate capture area in the upper aquifer to meet the interim measures objectives. The modeled capture zone is indicated on Figure 2.

GROUNDWATER QUALITY

TW-2 was last sampled in May 1989 and the detected VOC analytical results from this sampling event are listed in Table 1. The VOCs detected in TW-2 include the following: benzene, dichlorodifluoromethane, 1,1-dichloroethane, 1,1-dichloroethene, trans-1,2-dichloroethene, toluene, 1,1,1-trichloroethane, trichloroethene, trichlorofluoromethane, vinyl chloride, and xylenes. The analytical results in Table 1 represent the groundwater quality in TW-2 in 1989 and does not take into account the fact that pumping TW-2 at a rate of 166 gpm may increase VOC concentrations due to contributions from upgradient sources. The analytical results for TW-2 with a 25 percent contingency added, were compared to more recent data from the RFI and semiannual monitoring events. Table 2 presents data from shallow wells (shown on Figure 5) in the vicinity of TW-2. Based on this comparison, the total VOC concentration in TW-2 is higher than the other wells. The highest VOC concentration detected at each well listed in Table 2 will be used for the preliminary design, which results in a conservative design basis. Prior to final design of the remediation system, TW-2 will be resampled to verify the VOC concentrations. Table 3 presents the analyses that will be conducted, the analytical methods, and the method detection limits.

During the May 1989 sampling of TW-2, several inorganic parameters were also analyzed. The results of these inorganic analyses are listed in Tables 4 and 5. The following inorganic parameters were reported which may cause an operations problem in the remediation system: iron [0.479 milligrams per liter (mg/L)], magnesium (13.5 mg/L), calcium (29.1 mg/L), and manganese (0.075 mg/L). Hardness (calcium and magnesium carbonate) data was not collected; however, a typical range for hardness in the Dayton, Ohio area is 300 to 500 mg/L (Miami Conservancy District 1973). The presence of these inorganic parameters at high concentrations may pose significant operation and maintenance problems due to fouling of the air stripper and effluent pump. Prior to final design of the remediation system, TW-2 will be resampled to verify the hardness concentrations (Table 3).

Additional inorganic concentrations in groundwater were also evaluated in TW-2 to determine if they pose a potential concern to surface water quality. Table 4 compares surface water quality criteria to the concentrations of inorganic parameters detected in TW-2. Table 5 compares surface water quality criteria to the concentrations of Appendix IX total metals and cyanide that have been detected in TW-2 and four surrounding shallow monitor wells (Figure 5). These surface water quality criteria are from the Ohio Administrative Code (OAC) 3745-1-07 Tables 7-1, 7-10, and 7-11. The values listed are the lowest values presented in the OAC tables, based on human health criteria and the Great Miami River's designation as a warm water habitat and agricultural water supply. These values are conservative in the fact that they represent water quality criteria outside the mixing zone and, therefore, are lower than any expected discharge limit.

Of the Appendix IX total metals and cyanide, only cyanide exceeded surface water quality criteria. Cyanide was detected at concentrations of 175 ug/L, 17 ug/L, and 14 ug/L in wells TW-2, GM-8, and 4S, respectively. It appears that the 175 ug/L concentration detected in TW-2 may be an anomaly since none of the other wells in the area detected cyanide concentrations much above the water quality criteria of 12 ug/L.

Several other inorganic parameters were detected in TW-2 (Table 4) that may affect surface water discharge criteria for the remediation system. Several of these parameters are listed in Table 2D-2 Group B of the NPDES permit application instructions. The NPDES instructions require that estimates of data on the parameters listed in Group B be reported if the applicant knows or has reason to believe the parameters will be discharged. The following Group B parameters were detected in TW-2: fluoride, nitrate/nitrite, oil and grease, phosphorus, sulfate, surfactants, boron, iron, magnesium, manganese, and molybdenum. Chloride was also detected in TW-2; however, Group B lists chlorine and not chloride. Table 4 lists the water quality criteria from OAC 3745-1-07 for the parameters which have criteria established. Fluoride was the only Group B parameter detected that potentially exceeded surface water quality criteria. After the tower discharge is combined with Outfall 002 current flow of 1.67 mgd, it is estimated that the fluoride concentrations would be less than 4 mg/L. This would result in a fluoride concentration in the Great Miami River that would be well below the water quality criteria.

To verify the concentrations of inorganic parameters in the groundwater near TW-2, the following sampling and analyses will be conducted prior to final design of the remediation system. TW-2 will be sampled and analyzed for the complete Appendix IX metals list, cyanide, fluoride, and total residual chlorine. In addition, total organic carbon (TOC), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), ammonia nitrogen, temperature, and pH will be analyzed when TW-2 is resampled since these parameters are listed in the NPDES permit application Table 2D-2 Group A (data for Group A parameters must be provided by all NPDES applicants). Shallow monitor well GM-6 will be sampled and analyzed for the complete Appendix IX total metals list and cyanide since this well is located adjacent to TW-2 and no previous data for these parameters were collected at this location during Phase I RFI sampling. Surrounding shallow monitor wells, GM-2, GM-8, and 4S, will be sampled and analyzed for cyanide and a few selected Appendix IX metals. The selected Appendix IX metals include copper, cadmium, mercury, and silver since previous detection limits for these metals were above their respective water quality criteria.

Method detection limits for cadmium, mercury, and silver can be lowered by changing the analytical method, as indicated on Table 3. The reporting level for mercury, however, will remain at 0.2 ug/L because this is the lowest reporting level that can be achieved by a laboratory. Analysis for mercury will be performed by using Method EPA 245.1/EPA 245.2 where the laboratory site-specific method detection limit study data for mercury is 0.05 ug/L (NET Dayton Division). Obtained analytical results lower than 0.2 ug/L, but above 0.05 ug/L, can be flagged as being detected, but not quantified due to statistical inaccuracy.

The most conservative water quality criteria for mercury was listed as 0.012 ug/L in Table 5; however, the other water quality criteria for mercury listed in OAC 3745-1-07 (0.20 ug/L, 1.1 ug/L, 2.2 ug/L) are at or above the method detection limit. Sufficient data on the remaining Appendix IX metals exists for the surrounding wells.

Based on two assumptions, it is expected that effluent limits for metals will not be issued for the remediation system effluent and, as a result, pretreatment for inorganic constituents is not proposed at this time. The first assumption is that the additional sampling will conclude that Appendix IX metals and cyanide concentrations in TW-2 and surrounding wells are below established surface water quality criteria. The second assumption is that the Ohio EPA will not impose surface water discharge criteria for fluoride for the following reasons: (1) fluoride is not a priority pollutant, (2) there is no established fluoride surface water quality criteria for a warm water habitat, and (3) the established fluoride surface water quality criteria is for an agricultural water supply and it does not appear that the Great Miami River is used for this purpose in the vicinity of the Harrison facility.

TREATMENT CRITERIA

The actual treatment criteria for the remediation system will be defined in the NPDES permit covering the effluent discharge. Discussions with Ohio EPA Division of Surface Water have indicated that the discharge limit for a VOC could be as low as 5 ug/L. Therefore, for the purposes of a conservative design, it will be assumed that the effluent treatment criteria for each of the VOCs detected in the groundwater at TW-2 will be 5 ug/L. The following VOCs in TW-2 and surrounding wells exceed effluent design concentration of 5 ug/L: benzene, chloroethane, 1,1-dichloroethane, trans 1,2-dichloroethane, ethylbenzene, toluene, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene, vinyl chloride, and xylenes. The remedial system will be designed based on these VOCs. Prior to final design, the analytical results from resampling TW-2 will be reviewed.

AIR STRIPPER SYSTEM SPECIFICATIONS

The design of an air stripping process is guided by the Henry's Law constant and concentration of each VOC and anticipated air-to-water ratio for operation. To accomplish air stripping for this application, a countercurrent packed aeration tower will be used. The countercurrent configuration utilizes a forced draft of air moving upward through random packing in the tower while water enters the top of the tower and flows downward through the packing, thus creating intimate contact of water and air.

The first design step was to determine the packed bed depth, overall tower height, and tower diameter required to achieve the desired VOC removal at the required treatment rate to meet the effluent treatment criteria. The air stripper design computer program used for this project was Air Strip, Release 1.2 (Haraoff and Schoeller 1988). The program indicated that the Henry's Law constant and concentration of trichloroethene controls the packing height requirements, with all other VOCs being treated at or below their respective effluent treatment criteria, as shown in Table 6.

Using an air to water ratio of 40 to 1 and assuming standard 2-inch diameter (Jaeger Tripacks) packing, the program determined that a packed height of 20 feet was required for a 2.5 foot diameter tower. An air stripper model was also run by a tower manufacturer. Using the same assumptions, the manufacturer's program determined that a packed height of 25 feet was required for a 2.5 foot diameter tower. The larger tower dimensions were selected for this preliminary design to be more conservative and because the larger tower can handle higher flow rates (possibly up to 190 gpm) which provides a reasonable safety factor for the design. A design flow rate of 170 gpm was selected; as a result, the air flow rate would be 900 cubic feet per minute (cfm). A print-out of the air stripper program results for trichloroethene are included in Appendix A. The preliminary air stripper specifications are summarized in Table 7.

PRETREATMENT CONSIDERATIONS

Groundwater pretreatment should be implemented to control water hardness and prevent fouling of the tower and effluent pump. Several general approaches to address the hardness problem exist. One approach is to remove the calcium carbonate by causing it to precipitate out of solution by means of a reaction with other chemicals or a change in pH. The precipitated calcium carbonate and other inorganics present in the water, would then be removed by sedimentation or filtration, with the resultant waste stream requiring disposal. Other approaches include chemically cleaning the tower during periodic downtimes to keep the calcium carbonate in solution during the air stripping process. The latter pretreatment approach requires the addition of a chemical upstream of the air stripper which is specifically designed to sequester the calcium carbonate and other soluble inorganic constituents, and keep them in solution.

The following pretreatment options were investigated to determine the most cost-effective solution: periodic acid washing of the tower, pH adjustment by acid addition, pH adjustment by carbon dioxide addition, hardness pretreatment (softening), and chemical addition of a sequestering agent. After investigating the advantages, disadvantages, and costs associated with each option, it has been determined that the addition of a chemical sequestering agent would be the most cost-effective solution.

Hardness pretreatment and pH adjustment by carbon dioxide addition were removed from consideration because of their high annual operating costs, greater than $30,000 per year and greater than $75,000 per year, respectively, assuming a flow rate of 170 gpm. The addition of acid to adjust the pH was also removed from consideration due to its relatively high annual operating cost (greater than $20,000 per year) and its potential for worker exposure or a release to the river. Periodic acid washing of the tower was considered; however, it is not recommended due to the frequency with which washing would be required and since the waste stream would require disposal. In addition, this option does not control calcium build-up in the effluent pump and piping system.

A chemical sequestering agent would address the calcium deposition problem within the tower and within the effluent pump and piping system. The chemical would be injected into the influent pipe and would sequester the calcium carbonate and other inorganic constituents to keep them in solution and to prevent fouling throughout the system. The capital and operation and maintenance costs for chemical sequestering are approximately $2,000 and $15,000 per year, respectively. A consideration when selecting the appropriate sequestering agent is to verify that it does not contain levels of any constituents (i.e., phosphates) which may cause the treated water to exceed the NPDES requirements or affect aquatic life in the receiving stream.

POST TREATMENT CONSIDERATIONS

Using a conservative assumption that 100 percent of VOCs are removed from the groundwater by the air stripper, the total mass of contaminants released to the atmosphere would be 2.06 pounds per day (which is based on the highest VOC concentrations detected in TW-2 [with the 25 percent increase] and the surrounding wells). The supporting calculations for the air loading rate are included in Appendix B. The current Ohio EPA Regional Air Pollution Control Agency (RAPCA) guidance infers that post treatment may not be required if the total mass of noncarcinogenic VOCs does not exceed 15 pounds per day.

Post treatment requirements are considered on a case-by-case basis for the carcinogenic VOC air emissions. The following compounds detected in TW-2, benzene, 1,1-dichloroethane, 1,1-dichloroethene, trichloroethene, and vinyl chloride, are considered to be carcinogens as indicated on Table 1. A risk evaluation of emissions of VOCs will be conducted as part of the air permitting process. The Industrial Source Complex Long Term (ISCLT) air quality dispersion model will be used for the evaluation of air emissions. This evaluation will calculate ground level concentrations of VOCs and will determine if these concentrations pose an unacceptable risk. For this preliminary work plan, it has been assumed that post treatment of off-gases from the air stripper will not be required; however, if post treatment is required, best available technology (BAT) will be used in accordance with OAC 3745-31-05 (A)(3).

PROCESS DESCRIPTION

The interim measures groundwater recovery and treatment system to extract, treat, and convey the treated water to the Miami River, through an NPDES permitted outfall, is described in this section. The conceptual location of the remediation system is presented on Figure 5 and a preliminary air stripper schematic is presented on Figure 6. Figure 7 depicts the process flow diagram of the system. The system will include the following key components:

- Groundwater extraction
- Influent conveyance
- Treatment system
- Effluent conveyance
- System controls

GROUNDWATER EXTRACTION

Groundwater will be extracted from recovery well TW-2 at an average flow rate of 170 gpm, with a maximum flow rate of 190 gpm, to develop the desired capture zone in the shallow aquifer. Groundwater extraction will be driven by a 7.5 horsepower (HP) submersible pump capable of delivering a maximum of 190 gpm at 100 feet total dynamic head (TDH).

INFLUENT CONVEYANCE

The extracted groundwater will be conveyed approximately 800 feet north to the treatment system through a 4-inch diameter high-density polyethylene (HDPE) carrier pipe with heat-bonded joints. This piping was sized to ensure sufficient velocity to eliminate settling of suspended solids. Flow velocity through the 4-inch influent carrier piping below ground will be 4.4 feet per second (fps) at an average flow rate of 170 gpm. The 4-inch diameter influent pipe will require installation beneath a railroad track located approximately 700 feet north of the treatment system. A drain line will be installed in the influent piping to enable untreated groundwater to be returned to the recovery well during periods of system failure or deactivation for maintenance.

TREATMENT SYSTEM

The treatment system consists of chemical pretreatment to control calcium carbonate deposition and a packed column air stripper to remove VOCs from the groundwater. The chemical sequestering agent will be injected by a chemical feed pump into above-ground influent piping located near the base of the air stripper tower. An in-line mixer in the vertical piping leading to the top of the tower will assist in maximizing contact between the influent groundwater and the chemical sequestering agent. The injection rate of the chemical sequestering agent cannot be determined until hardness analyses are conducted on the groundwater and an appropriate chemical product is selected.

Influent water will be introduced into the top of the column and, after passing through a water distribution tray, will flow by gravity through the packed bed. VOC removal in the air stripper tower will be accomplished by passing the influent groundwater through a bed of 2-inch diameter polypropylene packing material in contact with a countercurrent stream of air. The packed bed will promote contact between the water and air so that maximum removal of VOCs from the water stream to the air stream can occur.

The treated water will be collected in a sump at the base of the column before discharging by gravity flow to an effluent holding tank.

Air will be introduced at a rate of 900 cfm at the base of the column above the holding sump and will rise by forced draft through the packed bed. After stripping the VOCs from the water stream, the air will pass through a mist eliminator to remove water droplets and will be discharged at the top of the column through a stack. The stack will be designed to optimize exit velocity to insure adequate dispersion of VOCs in the off-gas to further minimize ground-level concentrations from this source.

EFFLUENT CONVEYANCE

Treated effluent will be transferred from the effluent holding tank to the effluent conveyance pipe by a centrifugal pump capable of supplying a maximum of 190 gpm at 20 feet TDH. The treated water will be conveyed through 6-inch diameter schedule 40 polyvinyl chloride (PVC) pipe to Outfall 002 for discharge to the Great Miami River. The actual tie in and monitoring location will be specified in the NPDES permit modification.

SYSTEM CONTROLS

The extraction and treatment system will be designed with sufficient instrumentation and controls to enable unattended, fully-automatic operation. The groundwater extraction pump will be controlled by a pump controller unit which will be mounted on the main control panel. The pump controller will monitor the amperage drawn on the groundwater extraction pump and will deactivate the pump if the groundwater level in TW-2 is drawn down to the pump intake or if electrical problems occur, such as an excessive current draw or voltage fault.

The discharge from the groundwater extraction pump will be controlled and monitored by a series of devices. A ball valve will be used to achieve the desired discharge flow rate and to also provide ON-OFF isolation of the groundwater extraction pump as necessary for maintenance. The flow rate of the extracted groundwater will be measured by a flow element which will communicate by a flow transmitter to a flow meter and totalizer. The effluent from the groundwater extraction pump will also be monitored for delivery pressure by an in-line direct reading pressure gauge.

The water level in the effluent holding tank will be monitored by a level sensor which will communicate to a level controller and control valve on the discharge of the effluent pump to maintain the water level in the tank at 70 percent capacity. High level switches located in the tower sump and the effluent holding tank will be linked to the groundwater extraction pump to deactivate the pump if water levels reach the switches.

A pressure gauge and switch device (Photohelic) will be used to detect pressure changes across the tower packing. If the pressure in the tower becomes too great, indicating a potential problem with the packed tower, or too low, indicating a blower malfunction, the Photohelic switch will deactivate the groundwater extraction pump.

The temperature of the water leaving the tower will be monitored by a thermometer located in the effluent piping. Since the system will be pumping groundwater, the temperature should range around 50 to 60°F.

PERMIT REQUIREMENTS

The following sections describe the permit requirements for the proposed remediation system.

PERMITS TO INSTALL

An Ohio EPA Air Pollution Control (APC) Permit to Install (PTI) is required for new or modified sources of air pollution under the provisions of Ohio Administrative Code (OAC) Rule 3745-31. The PTI application must be completed and submitted to RAPCA along with the associated fees. RAPCA reviews the application and forwards a permit recommendation to the Ohio EPA Division of Air Pollution Control. Typically, an APC PTI application is processed and approved within 2 to 3 months. Upon completion of construction of the source and prior to start-up, an installation certification must be sent to RAPCA.

An Ohio EPA Water Pollution Control (WPC) PTI is also required under the provisions of OAC 3745-31. A WPC PTI must be completed and submitted to the Ohio EPA WPC division along with the associated fees. Typically, a WPC PTI application is processed and approved within 5 to 6 months. Timely review of the APC PTI and WPC PTI applications is critical to meet the interim measures schedule.

PERMIT TO OPERATE

An Ohio EPA APC Permit to Operate (PTO) is required for air contaminant sources under the provisions of OAC Rule 3745-35-02(B). The PTO application will be submitted to RAPCA with the APC PTI application. The entire PTO review and issuance process takes 4 to 6 weeks, based on the Ohio EPA Air Permit Application Guidance Manual. Once the APC PTI is approved, it will serve as the PTO for one year or until the PTO is approved.

NPDES PERMIT

An NPDES permit is required for facilities that discharge treated groundwater into the waters of the United States. Harrison currently has an NPDES permit (Ohio EPA Permit No. 1IC00008*ED) that covers Outfalls 001 and 002 which contain non-contact cooling water, boiler blowdown, condensate, and storm water. The effluent from the proposed remediation system will be connected to the storm water system that discharges to the Miami River through Outfall 002. Therefore, a modification to the existing permit will be requested to cover the discharge from the proposed remediation system. Timely review of the NPDES permit application is critical to meet the interim measures schedule.

LOCAL PERMITS

Discussions with the Moraine Zoning and Building officials have indicated that a building permit will not be required for the proposed remediation system since the construction will not include a roofed structure under which people will enter. However, zoning approval may be required. To receive zoning approval, general site plans and elevations and a brief narrative of the function, purpose, and regulatory requirements of the remediation system must be submitted to the Moraine Zoning Commission for review. If the remediation system does not comply with the Moraine Zoning resolution regarding property setback distances, height restrictions, etc. then zoning variances may be required.

PRELIMINARY INTERIM MEASURES MONITORING PROGRAM

The purpose of the interim measures monitoring program is to demonstrate hydraulic control of the shallow and deep aquifers. The present distribution and number of wells is adequate to monitor TW-2 and DN-13. These monitor wells are indicated on Figure 8. The monitoring program will consist of the following components:

- Quarterly measurement of water levels in both the shallow and deep aquifers using existing wells.

- The following existing shallow wells surrounding TW-2 will be used for collecting water levels: GM-2, GM-6, GM-8, 4S, GM-17, GM-18, and if access is approved by Wright State University, WS-17, WS-18, and WS-19. Drawdown surrounding TW-2 was observed during the August 1989 pumping test at GM-6, WS-17, and WS-19. This array of nine wells are sufficient to monitor water levels and to verify model results.

- The following existing deep wells surrounding DN-13 will be used for collecting water levels: GM-1, GM-3, GM-4, GM-5, GM-7R, GM-9, GM-11, GM-13, GM-14, GM-15, and, if access is approved by Montgomery County, M73C. An additional deep well will be installed during Phase II RFI activities. This well will be located due south of Landfill L1, south of Sellars Road, and east of Dryden Road. This new well will also be used for monitoring water levels. This array of 12 wells are within the cone-of-depression of DN-13 and are sufficient to monitor water levels and verify model results.

- Quarterly comparison of water-level measurement results to model predictions, and generation of an annual report illustrating capture.

This monitoring program will be further defined in a monitoring plan which will be part of the Final Interim Measures Design Plans.

PRELIMINARY INTERIM MEASURES SCHEDULE

A preliminary schedule for the implementation of interim measures is presented in Figure 9. The schedule includes submittal and agency review of this preliminary work plan. TW-2 and surrounding wells will be resampled and 1 month will be required for laboratory analysis QA/QC. Overall, it will take 7 months for the Final Interim Measures Design Plans to be prepared (the contents of the design plans are discussed in the following section), during which time the permit applications will also be prepared and submitted for RAPCA and Ohio EPA review. It is anticipated that 4 months will be required for RAPCA and Ohio EPA to review and approve the permit applications. Upon approval of the permit applications, the Final Interim Measures Design Plans will be finalized and submitted to U.S. EPA in 1 month. It is anticipated that 2 months will be required for U.S. EPA to review the final design plans. Timely review of the permit applications and Final Interim Measures Design Plans is critical to meet the interim measures schedule.

The final interim measures schedule will be submitted to the agencies with the design plans. This schedule will include contractor bidding, construction, and implementation of the remediation system.

INTERIM MEASURES DESIGN PROGRAM

After this Preliminary Interim Measures Work Plan is approved, final design of the groundwater extraction and treatment system will be completed and submitted to U.S. EPA for approval. The final design will include the Interim Measures Design Plan, detailed design drawings, technical specifications, an operation and maintenance plan, and a schedule of implementation. The final design documents will be 100 percent complete and will be certified by a Professional Engineer licensed in the State of Ohio.

FINAL INTERIM MEASURES DESIGN PLANS

The Final Interim Measures Design Plans will include the following components:

1. Discussion of the design strategy and the design basis including compliance with applicable or relevant environmental and public health standards and minimization of public health and environmental impacts.

2. Discussion of technical factors including the use of currently accepted environmental control measures and technology, the constructability of the design, and the use of currently accepted construction practices and techniques.

3. Descriptions and detailed justifications of assumptions made.

4. Discussion of possible sources of error and references to possible operation and maintenance problems.

5. Tables listing material balances.

6. Sample calculations.

7. Derivation of equations essential to understanding the design.

8. Development of a monitoring plan to verify interim measure objectives are being met.

DESIGN DRAWINGS AND SPECIFICATIONS

The final design drawings for the groundwater extraction and treatment system will consist of D size (24 inches by 36 inches) drawings depicting the general, civil, structural, mechanical, electrical, and instrumentation requirements for construction. It is estimated that the final design package will consist of 13 drawings. A preliminary list of the drawings is provided on Table 8.

The specifications document may consist of two parts: one containing contracting documents, if construction is not performed by Harrison, and one containing detailed requirements for construction. The contracting documents would include the requirements under which the bidders should prepare and submit a proposal to perform the work, as well as the contractual requirements under which the successful bidder (contractor) should perform the work. The contracting documents would conform to guidance established by the Engineer's Joint Contract Document Committee. The detailed requirements for construction will be provided in the technical specifications which will describe materials, equipment, and methods to be used during construction. The technical specifications will conform to the format of the Construction Standards Institute, or equivalent. A preliminary outline of the specifications document is provided in Table 9.

The technical specifications and the design drawings will be prepared such that a general correlation exists between the documents to facilitate their understanding.

OPERATION AND MAINTENANCE PLAN

The operation and maintenance plan will provide information necessary to safely and effectively operate and service the groundwater extraction and treatment system. The plan will include a description of the function and operation of the system and of all the associated equipment. Normal and abnormal operating conditions and procedures will be addressed, as well as start-up and deactivation procedures. Regulatory monitoring requirements and procedures and operator training will also be included. A preliminary outline of the operation and maintenance plan is provided in Table 10.

INTERIM MEASURES SCHEDULE OF IMPLEMENTATION

A detailed project schedule for construction and implementation of interim measures will be submitted with the final design documents. The schedule will specifically identify timing for initiation and completion of all critical path tasks, dates for major interim measures milestones, and a date for system installation and start-up.

PROJECT MANAGEMENT STRUCTURE

The project management organization is designed for meeting the following goals:

1. Ensure adherence to the technical, financial, and administrative performance requirements of the Interim Measures Work Plan.

2. Provide a central point of contact for Harrison concerning all contractual and technical functions.

3. Provide a coordinated management framework for implementing the technical approach, safety program, and data and technical information exchanges.

PROJECT MANAGEMENT TEAM

The project management team will consist of the personnel listed in Section 2.0 of the RFI Data Management Plan (Geraghty & Miller, Inc. 1992) and the additional personnel identified for the purposes of implementing interim measures, an engineer of record and engineering task managers. These additional project team members will report to the RFI Project Manager. The responsibilities of the additional personnel are defined below.

James J. Reid, Engineer of Record (GMCE, Inc.)

- Responsible for all engineering activities conducted to implement this interim measure and will provide technical review of documents generated during the course of interim measures.

- Responsible for certifying the final engineering design plans as a Professional Engineer, registered in the State of Ohio.

Susan M. Loder and Nancy A. Gillotti, Engineering Task Managers (Geraghty & Miller)

- Responsible for developing the Interim Measures Design Plans and completing permit applications.

- Responsible for managing the construction contractors and staff supervision.

- Responsible for training Harrison personnel to operate and maintain the remediation system.

PROJECT PERSONNEL AND QUALIFICATIONS

The qualifications of the RFI personnel were defined in Section 4.0 of the RFI Data Management Plan (Geraghty & Miller, Inc. 1992). The qualifications of the additional interim measures personnel are listed below.

James J. Reid, P.E., GMCE, Inc.

James J. Reid, Engineer of Record, is a Vice President of GMCE, Inc., a Florida based company licensed to practice engineering in the state of Ohio. Geraghty & Miller will subcontract all engineering services on this project through GMCE, Inc. Mr. Reid is a civil engineer with over 14 years of experience on process system design, construction, operation, and maintenance, as well as extensive project management experience. His experience has involved the design of process and environmental control systems for a petro-chemical facility, systems for remediating groundwater contaminant plumes containing VOCs and petroleum based products, as well as the completion of numerous feasibility studies on the applicability of available technologies for remediating groundwater plumes.

Susan M. Loder, Geraghty & Miller, Inc.

Ms. Loder has five years experience in the environmental field, during which time her assignments have included investigative projects as well as engineering projects. Ms. Loder's experience in environmental engineering has included design, construction management, and operation and maintenance of two groundwater pump and treat systems implementing air stripping technology at a state Superfund site in Ohio. For the first system, Ms. Loder managed construction and start-up of the system, trained facility personnel on the operation of the system, and developed the operation and maintenance plan. For the second system, Ms. Loder performed permitting activities and supervised the design of the system, implementing changes in the design based on her experience gained during the construction and operation of the first system.

Nancy A. Gillotti, Geraghty & Miller, Inc.

Ms. Gillotti is a chemical engineer with 7 years of experience as a consulting environmental engineer. Ms. Gillotti's areas of specialization include RCRA Closure Plans, RCRA Facility Investigations, CERCLA Remedial Investigations/Feasibility Studies, and CERCLA Remedial Design/Remedial Action. Ms. Gillotti designed an aboveground submerged fixed film bioreactor to remediate VOC contaminated groundwater for a state Superfund site as part of the remedial design/remedial action. She developed an operation and maintenance plan for the system, provided construction oversight, and performed start-up and operation of the system.

REFERENCES

Geraghty & Miller, Inc. 1990. A Technical Memorandum, Data Analysis and Evaluation of Aquifer Tests, Harrison Radiator Facility, Moraine, Ohio. January 1990.

Geraghty & Miller, Inc. 1991. Description of Current Conditions, Task 1 of the RCRA Facility Investigation for Harrison Radiator Division - GMC, Moraine, Ohio. January 1991.

Geraghty & Miller, Inc. 1992. RCRA Facility Investigation Work Plan for the Harrison Division - GMC, Moraine, Ohio. November 1992.

Geraghty & Miller, Inc. 1993. Interim RFI Report, Harrison Division - General Motors Corporation, Moraine, Ohio. July 1993.

Geraghty & Miller, Inc. 1994. Revised Three-Dimensional Steady-State Flow Model Construction and Calibration, Harrison Division General Motors Corporation, Moraine, Ohio. May 1994.

Miami Conservancy District. 1973. An Investigation of the Effects of Waste Disposal Practices on Groundwater Quality of Montgomery County, Ohio.

United States Environmental Protection Agency. 1988. RCRA Corrective Action Interim Measures Guidance (Interim Final). Office of Solid Waste and Office of Waste Programs Enforcement. EPA/530-SW-88-029. June 1988.

Table 1. Concentrations of VOCs in TW-2, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

VOCs	Analytical Results[a] (ug/L)	Influent Concentrations[b] (ug/L)	Carcinogenic?	U.S. EPA Classification[c]
Benzene	3.1	4	Yes	A
Dichlorodifluoromethane	1	1	No	D
1,1-Dichloroethane	143	179	Yes	C
1,1-Dichloroethene	1	1	Yes	C
trans-1,2-Dichloroethene	10.4	13	No	D
Toluene	2.7	3	No	D
1,1,1-Trichloroethane	7.1	9	No	D
Trichloroethene	309	386	Yes	B2
Trichlorofluoromethane	0.6	0.8	No	D
Vinyl Chloride	3.3	4	Yes	A
Xylenes	10.6	13	No	D

a Analytical results are based on data collected by Geraghty & Miller on May 26, 1989.
b A 25% contingency was added to the analytical results.
c Integrated Risk Information System, 1993.
VOCs Volatile organic compounds.
ug/L Micrograms per liter.

Classification Codes:
A Known human carcinogen.
B2 Probable human carcinogen--sufficient evidence in animals and inadequate data in humans.
C Possible human carcinogen--limited evidence in animals.
D Inadequate information to classify.

HARRISON.P1MWP\WKPLN\TABLE1.WPS

Table 2. Concentrations of VOCs in TW-2 and Surrounding Wells, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

VOCs	TW-2[a] 5/89	Concentrations in Surrounding Wells and Date Sampled												Design Basis[d]
		GM-2 1/93[b]	GM-2 6/93[c]	GM-2 11/93[c]	GM-6 1/93[b]	GM-6 6/93[c]	GM-6 11/93[c]	GM-8 1/93[b]	GM-8 6/93[c]	GM-8 11/93[c]	4S 1/93[b]	4S 6/93[c]	4S 11/93[c]	
Benzene	4	ND	ND	ND	NA	ND	7.8	6	ND	9.3	ND	ND	1.8	9.3
Dichlorodifluoromethane	1	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	1
1,1-Dichloroethane	179	3.1	ND	2.2	NA	99.5	145	120	108	154	77.8	41.7	63	179
1,1-Dichloroethene	1	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	1
trans-1,2-Dichloroethene	13	ND	ND	ND	NA	ND	11.3	13	11.8	17.4	ND	ND	3.7	17.4
Toluene	3	ND	ND	ND	NA	10.5	7.7	1.1	ND	2.6	ND	ND	ND	10.5
1,1,1-Trichloroethane	9	13.7	12.7	13.8	NA	ND	3.8	7.3	ND	9.7	ND	ND	ND	13.8
Trichloroethene	386	108	102	102	NA	ND	23.1	69.4	53.4	43.7	ND	ND	1.4	386
Trichlorofluoromethane	0.8	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	0.8
Vinyl Chloride	4	ND	ND	ND	NA	ND	36.2	28.3	ND	42.4	ND	ND	ND	42.4
Xylenes	13	ND	ND	ND	NA	ND	30.2	70.6	ND	2.8	24	ND	ND	70.6
Chloroethane	ND	ND	ND	ND	NA	ND	40.1	30.8	ND	77.2	ND	ND	14.6	77.2
Ethyl Benzene	ND	ND	ND	ND	NA	78.5	191	108	93.9	107	45.9	27.8	24.6	191
Tetrachloroethene	ND	7.6	9.1	10.6	NA	ND	1.5	2.2	ND	4	ND	ND	ND	10.6
Total VOCs	614	132	124	129	--	189	498	457	267	470	148	69.5	109	1010.6

VOCs Volatile organic compounds.
ND Not detected.
NA Not analyzed.
Concentrations shown in micrograms per liter (ug/L).
a A 25% contingency was added to the analytical results.
b RFI analytical results.
c Groundwater semiannual sampling analytical results.
d Design basis developed by using the highest concentration in any well.

HARRISON.PIMWP\WKPLN\TABLE2.WPS

Table 3. Parameters to be Analyzed During Resampling of TW-2 and Surrounding Wells, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

Parameter	Analytical Method[a]	Method Detection Limit
TW-2		
VOCs		
Benzene	8240	1 ug/L
Chloroethane	8240	10 ug/L[b]
Dichlorodifluoromethane	8240	10 ug/L[b]
1,1-Dichloroethane	8240	1 ug/L
1,1-Dichloroethene	8240	1 ug/L
trans-1,2-Dichloroethene	8240	1 ug/L
Ethyl Benzene	8240	1 ug/L
Tetrachloroethene	8240	1 ug/L
Toluene	8240	1 ug/L
1,1,1-Trichloroethane	8240	1 ug/L
Trichloroethene	8240	1 ug/L
Trichlorofluoromethane	8240	1 ug/L
Vinyl Chloride	8240	5 ug/L
Xylenes	8240	1 ug/L
Additional Parameters[g]		
Total Hardness	EPA 130.2	1.0 mg/L
Calcium Hardness[c]	EPA 200.7	1.0 mg/L
Fluoride	4500 F,C[d]	0.1 mg/L
Total Residual Chlorine	Field test	---
Total Organic Carbon	5310 C[d]	1 mg/L
Biochemical Oxygen Demand	EPA 405.1	2 mg/L
Chemical Oxygen Demand	EPA 410.4	10 mg/L
Total Suspended Solids	EPA 160.2	3 mg/L
Ammonia Nitrogen	EPA 350.1, 350.2	0.3 mg/L
Temperature	Field test	---
pH	EPA 150.1, Field test	0-14

Table 3. Parameters to be Analyzed During Resampling of TW-2 and Surrounding Wells, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

Parameter	Analytical Method[a]	Method Detection Limit
TW-2 and GM-6		
Appendix IX Metals and Cyanide		
Antimony	6010	30 ug/L
Arsenic	7060	2.0 ug/L
Barium	6010	10 ug/L
Beryllium	6010	1.0 ug/L
Cadmium	7131[e]	0.1 ug/L
Chromium	6010	5.0 ug/L
Cobalt	6010	5.0 ug/L
Copper	6010	5.0 ug/L
Lead	7421	2.0 ug/L
Mercury	EPA 245.1/EPA 245.2[h]	0.2 ug/L
Nickel	6010	10.0 ug/L[f]
Selenium	7740	1.0 ug/L
Silver	7761[e]	0.2 ug/L
Thallium	7841	2 ug/L
Tin	6010	50 ug/L
Vanadium	6010	5 ug/L
Zinc	6010	5 ug/L
Cyanide	CLP 3/90 Mod. 335.2	5 ug/L
GM-2, GM-8, and 4S		
Selected Metals And Cyanide		
Cadmium	7131[e]	0.1 ug/L
Copper	6010	5.0 ug/L
Silver	7761[e]	0.2 ug/L
Cyanide	CLP 3/90 Mod. 335.2	5 ug/L
Mercury	EPA 245.1/EPA 245.2[h]	0.2 ug/L

See next page for notes

Table 3. Parameters to be Analyzed During Resampling of TW-2 and Surrounding Wells, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

VOCs Volatile organic compounds.
ug/L Micrograms per liter.
mg/L Milligrams per liter.
[a] Analytical methods are SW-846 (unless otherwise noted) as defined in the RFI QAPP (Geraghty & Miller, Inc. 1992).
[b] The VOC treatment criteria (5 ug/L) falls between the instrument detection limit and the method detection limit. Any analytical result that is below the method detection limit but is above the instrument detection will be flagged as estimated but will still be reported.
[c] Calcium hardness is actually a direct analysis for calcium. This result can then be calculated and expressed in terms of calcium carbonate ($CaCO_3$).
[d] Method reference is based upon Standard Methods for the Examination of Water and Wastewater, 17th edition.
[e] Analytical method not defined in the RFI QAPP because the method was changed in order to lower the detection limit.
[f] Method detection limit changed from 5 ug/L to 10 ug/L because of instrument drift based on NET Cambridge's quarterly method detection limit update per CLP protocol.
[g] Parameters not included in the RFI QAPP (Geraghty & Miller, Inc. 1992).
[h] Analytical method not defined in the RFI QAPP. The reporting level for mercury will remain at 0.2 ug/L; however, the site specific (NET Dayton Division) method detection limit study data is 0.05 ug/L. Obtained analytical results lower than 0.2 ug/L, but above 0.05 ug/L, can be flagged as being detected, but not quantified due to statistical inaccuracy.

HARRISON.PIMWP\WKPLN\PARAMETER.REV

Table 4. Additional Inorganic Parameters Detected in TW-2, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

Parameter	Concentration Units	Analytical Results[1]	Water Quality Criteria[2]
Boron	mg/L	118	NE
Calcium	mg/L	29.1	NE
Iron	mg/L	0.479	1
Magnesium	mg/L	13.5	NE
Manganese	mg/L	0.075	50[3]
Molybdenum	mg/L	0.257	NE
Ammonia Nitrogen, Direct	mg/L	2.91	13
Biochemical Oxygen Demand	mg/L	9	NE
Chemical Oxygen Demand	mg/L	105	NE
Chloride	mg/L	180	250[3]
Color	CU	100	NE
Fluoride	mg/L	30	2[4]
Kjeldhal Nitrogen	mg/L	5.1	NE
Nitrate/Nitrite	mg/L	1.68	100[4]
Oil and Grease	mg/L	4	10
Phenols	mg/L	0.033	0.370
Phosphorus, Total	mg/L as P	1.69	NE
Sulfate	mg/L	136	250[3]
Surfactants	mg/L	0.34	NE
Suspended Solids	mg/L	6	NE

mg/L Milligrams per liter.
CU Colorimetric units.
NE Not established.
1 Analytical results from samples collected by Geraghty & Miller on May 26, 1989.
2 Value listed is the lowest value presented in OAC 3745-1-07 Tables 7-1, 7-10, and 7-11. All values are for the 30-day average outside the mixing zone, assuming a surface water hardness of 250 mg/L, unless otherwise specified.
3 Public water supply criterion; included as reference only; not applicable to Great Miami River at this location.
4 Agricultural water supply criterion.

HARRISON.PIMWP\WKPLN\INORG.T04

Table 5. Appendix IX Total Metals and Cyanide Concentrations in TW-2 and Surrounding Wells, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

Parameter	Water Quality Criteria[1]	Concentrations in Site Wells and Date Sampled				
		TW-2 5/26/89	GM-2 1/21/93	GM-8 1/20/93	4S 1/22/93	GM-17 1/27/93
Antimony	190	NA	<50	63.2	<50	<50
Arsenic	100[2]	13	<2	13.6	27.6	3
Barium	1000[3]	NA	174	129	357	78.8
Beryllium	1.17[4]	NA	<1	<1	<1	<1
Cadmium	2.9	NA	<4	<4	<4	<4
Chromium	100[2]	41	<4	<4	8.9	<4
Cobalt	NE	NA	33.5	14.5	40.4	14
Copper	27	25	<5	<39.4	<43.1	<5
Lead	22	7	4.4	<2	17.8	<2
Mercury	0.012[4]	NA	<0.2	<0.2	<0.2	<0.2
Nickel	200[2]	20	39.1	<14	42.6	<14
Selenium	5	NA	<1	<1	<5	<1
Silver	1.3	NA	<4	<4	<4	<4
Thallium	16	NA	<2	<10	<2	<2
Tin	NE	NA	<200	<200	<200	<200
Vanadium	NE	NA	<5	<5	8.8	<5
Zinc	230	20	<6	<28.2	<85.5	<6
Cyanide	12	175	<5	17	14	<5

[1] Value listed is the lowest value presented in OAC 3745-1-07 Tables 7-1, 7-10, and 7-11. All values are for the 30-day average outside the mixing zone, assuming a surface water hardness of 250 mg/L, unless otherwise specified.
[2] Agricultural water supply criterion.
[3] Public water supply criterion; included as reference only; not applicable to Great Miami River at this location.
[4] Human health 30-day average criterion outside the mixing zone.
NE Not established.
NA Not analyzed.
Concentrations shown in micrograms per liter (ug/L).

HARRISON.PIMP\WKPLN\TABLES.WP

Table 6. Air Stripper Design Parameters, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

VOCs	Influent Design Concentration (ug/L)	Calculated Effluent Concentration (ug/L)	Percent Removed (%)	Effluent Treatment Criteria (ug/L)
Benzene	9.3	0.3	97	5
Chloroethane	77.2	2	97	5
1,1-Dichloroethane	179	5	97	5
Ethyl Benzene	191	5	97	5
Tetrachloroethene	10.6	0.3	97	5
Toluene	10.5	0.3	97	5
trans-1,2-Dichloroethene	17.4	0.5	97	5
1,1,1-Trichloroethane	13.8	0.4	97	5
Trichloroethene	386	5	98.7	5
Vinyl Chloride	42.4	0.4	99	5
Xylenes	70.6	2	97	5

Design Basis:

Packing height: 25 feet
Tower height: 36 feet
Volumetric air/water ratio: 40/1

VOCs Volatile organic compounds.
ug/L Micrograms per liter.

Table 7. Preliminary Air Stripper Specifications, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

Air Stripper System Details

Water Flow Rate:	170 gpm
Air Flow Rate:	900 cfm
Air/Water Ratio:	40/1

Air Stripper Specifications

Tower Diameter:	2.5 feet
Packing Height:	25 feet
Overall Tower Height:	36 feet
Packing Type:	2-inch Jaeger Tripacks
Miscellaneous:	18-inch dump manholes above and below packing and above distribution tray

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gpm Gallons per minute.
cfm Cubic feet per minute.

Table 8. Preliminary List of Final Design Drawings, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

General

G1 Location Map, Generai ... egend, and List of Drawings
G2 Plot Plan and Treatment Area Plan

Civil

C1 Piping Plan and Profile
C2 Trench Details

Structural

S1 Treatment System Foundation Plan and Profile
S2 Concrete and Paving Details

Mechanical

M1 Wellhead and Piping Details
M2 Process and Instrumentation Diagram
M3 Process and Instrumentation Legend and Symbols

Electrical

E1 Three Line and One Line Diagram
E2 Conduit Piping and Ground Conductor Plan

Instrumentation

I1 Main Control Panel
I2 Motor Starters and Disconnects

HARRISON.P1NWP\WKPLN\TABLE8.WP

Table 9. Preliminary Outline of Specifications Document, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

Invitation to Bid

Instructions to Bidders

Bid Form

Bidders' Qualification Questionnaire

General Conditions of the Construction Contract

Supplementary Conditions of the Construction Contract

Construction Agreement

Technical Specifications

Division 1 - General Requirements

01010	Summary of Work
01040	Control and Inspection
01050	Field Engineering
01060	Regulatory Requirement and Responsibility to the Public
01070	Standards
01150	Measurement and Payment
01200	Project Meetings
01300	Submittals
01500	Temporary Facilities and Controls
01700	Contract Close Out

Division 2 - Site Work

02110	Site Clearing
02225	Trenching
02270	Erosion and Sediment Control
02513	Paving and Parking Areas
02831	Chain Link Fence and Gates
02936	Seedings

Division 3 - Concrete

03200	Concrete Reinforcement
03300	Cast-in-Place Concrete

Division 5 - Structural

05500	Metal Fabrications

Table 9. Preliminary Outline of Specifications Document, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

Division 15 - Mechanic…	
15050	Valves
15060	Supports and Anchors
15160	Pumps
15260	Piping Insulation
15410	Pipe and Pipe Fittings
15560	Air Stripper System
15952	Controls and Instrumentation
Division 16 - Electrical	
16010	General Electrical Requirements
16050	Basic Materials and Methods
16160	Cabinets and Enclosures
16375	Underground Power Distribution
16400	Service and Distribution (600 Volts and Below)
16420	Service Entrance
16500	Lighting
16910	Electrical Systems Control

Table 10. Preliminary Outline of Operation and Maintenance Plan, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

1.0 System Function and Process Description

- 1.1 Groundwater Extraction
- 1.2 Chemical Pretreatment
- 1.3 Influent Conveyance
- 1.4 Treatment System
- 1.5 Effluent Conveyance
- 1.6 System Controls

2.0 Equipment Descriptions

3.0 Operator Training

4.0 Start-Up Procedures

5.0 Normal Operating Conditions and Procedures

6.0 Abnormal Operating Conditions and Response Actions

7.0 System Deactivation

- 7.1 During Normal Operating Conditions
- 7.2 During Abnormal Operating Conditions

8.0 Personnel Safety

- 8.1 Sampling and Maintenance Precautions
- 8.2 Lock Out/Tag Out Procedures

9.0 Regulatory Monitoring

- 9.1 Water-Level Monitoring
- 9.2 Influent and Effluent Sampling
- 9.3 Permit Conditions
- 9.4 Reporting
- 9.5 Record Keeping
- 9.6 Non-Compliance Notification

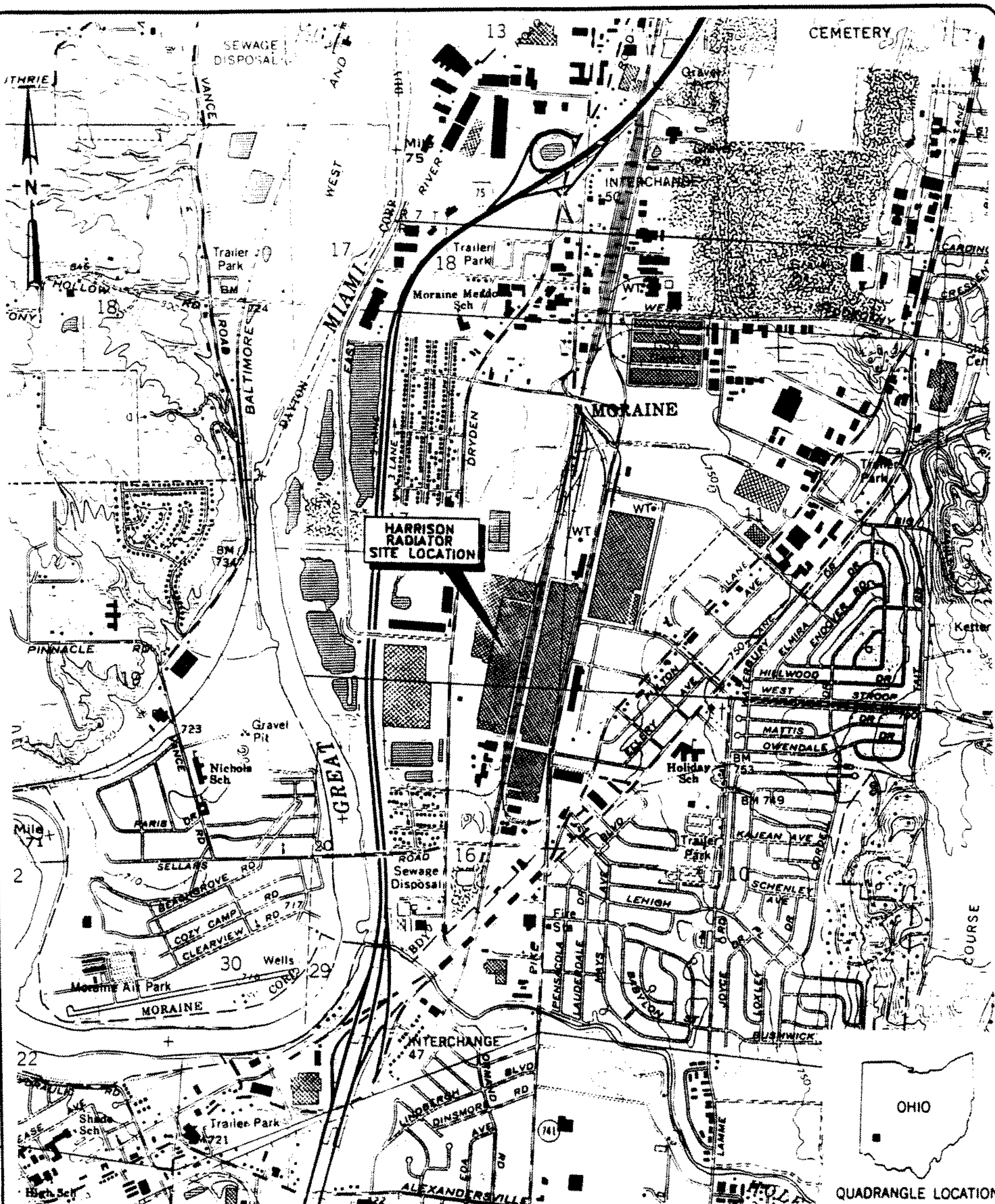
10.0 Tower Inspection

Table 10. Preliminary Outline of Operation and Maintenance Plan, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

Figures

Tables

Appendices



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APPROVED: B.B.

CHECKED: N.G.

DRAWING: BORDER

FILE NO.: HAR\MWP

PROJECT NO.: OH0019.018

DWG DATE: -

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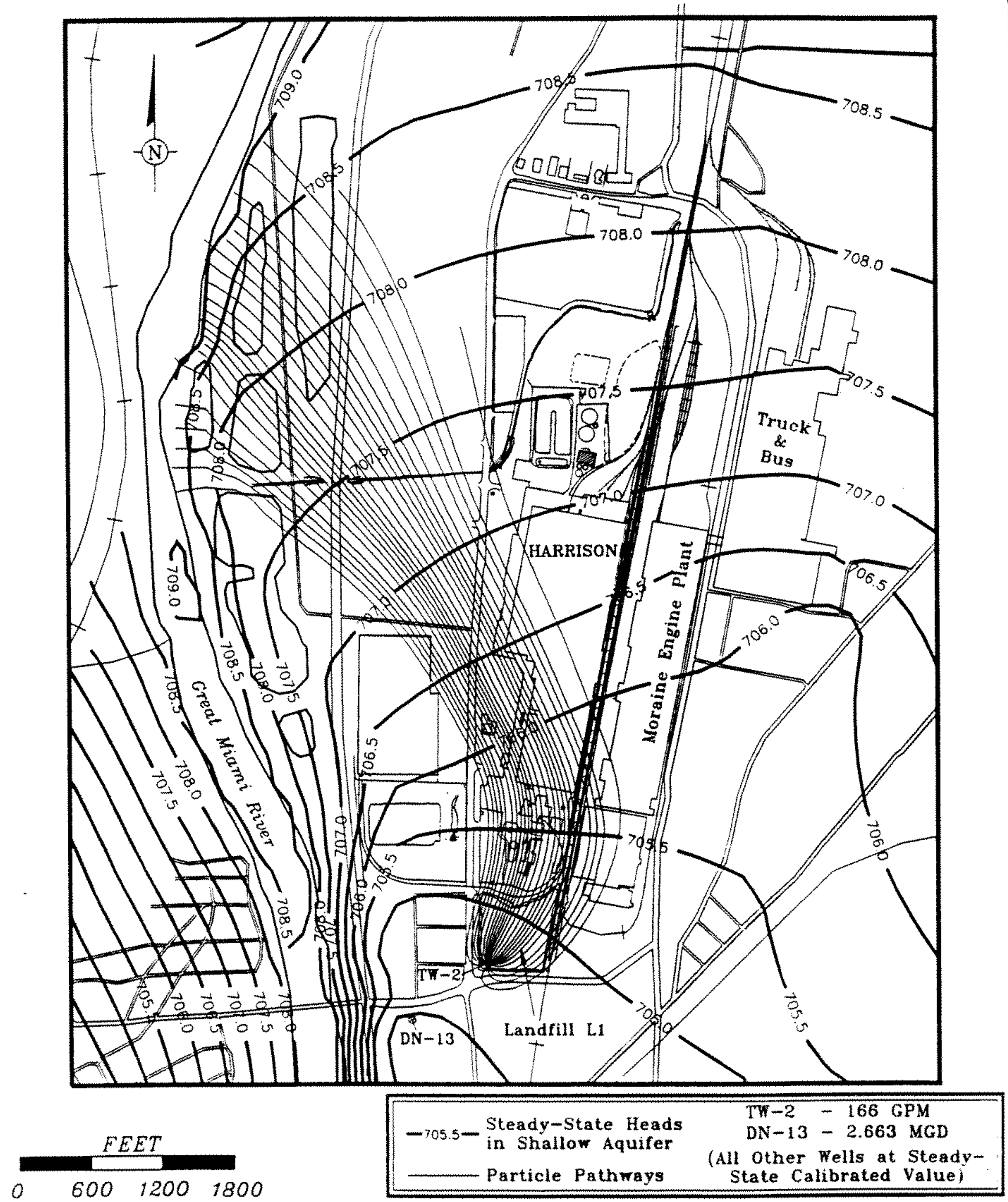
Environmental Services

SITE LOCATION MAP (USGS BASE)

HARRISON DIVISION – GMC
MORAINE, OHIO

FIGURE 1



GERAGHTY & MILLER, INC.
Environmental Services

Particle Tracking Results in the Shallow Aquifer From Pumping TW-2 and Pumping DN-13 in Deep Aquifer
Preliminary Interim Measures Work Plan
HARRISON DIVISION - GMC
MORAINE, OHIO

FIGURE
2

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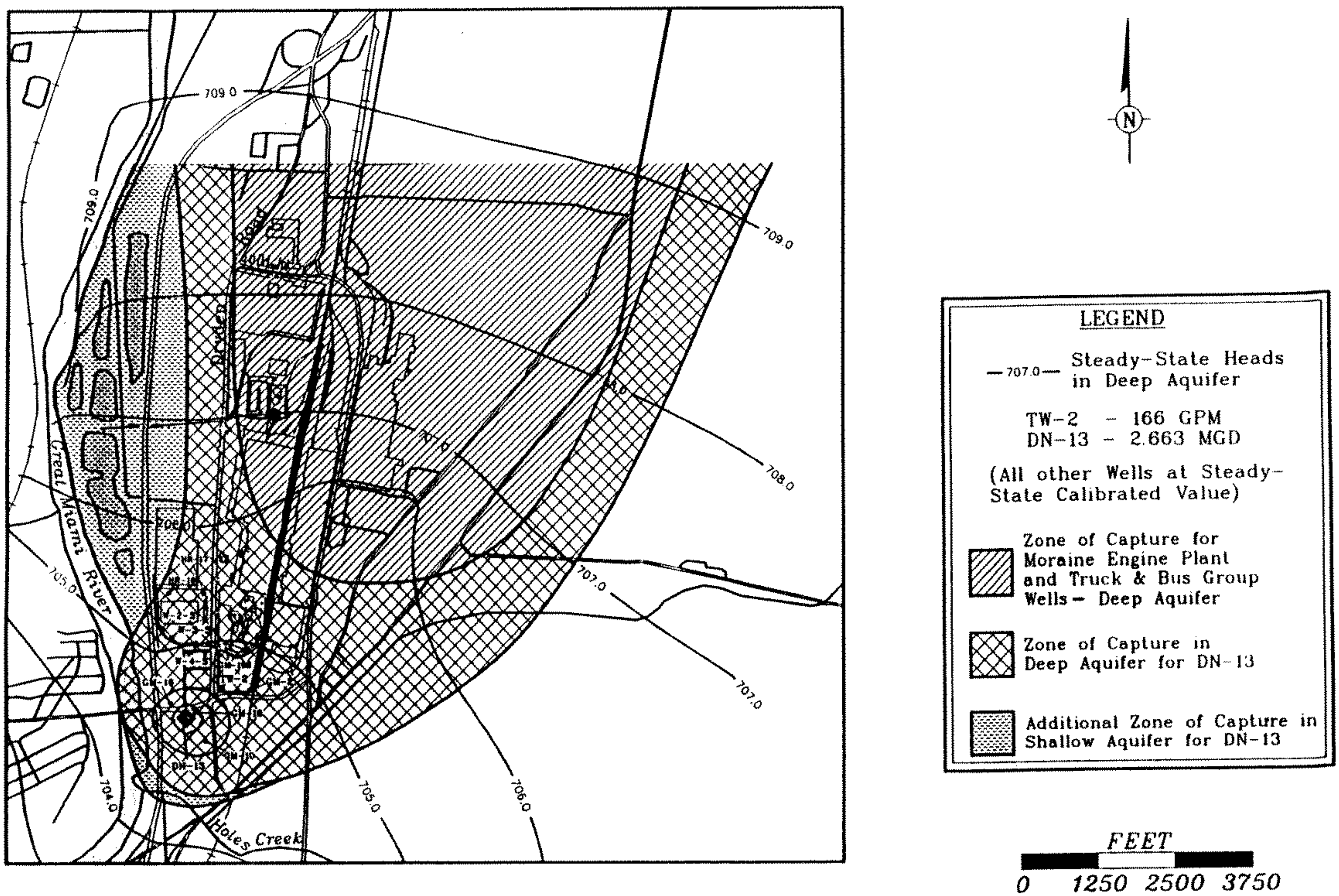

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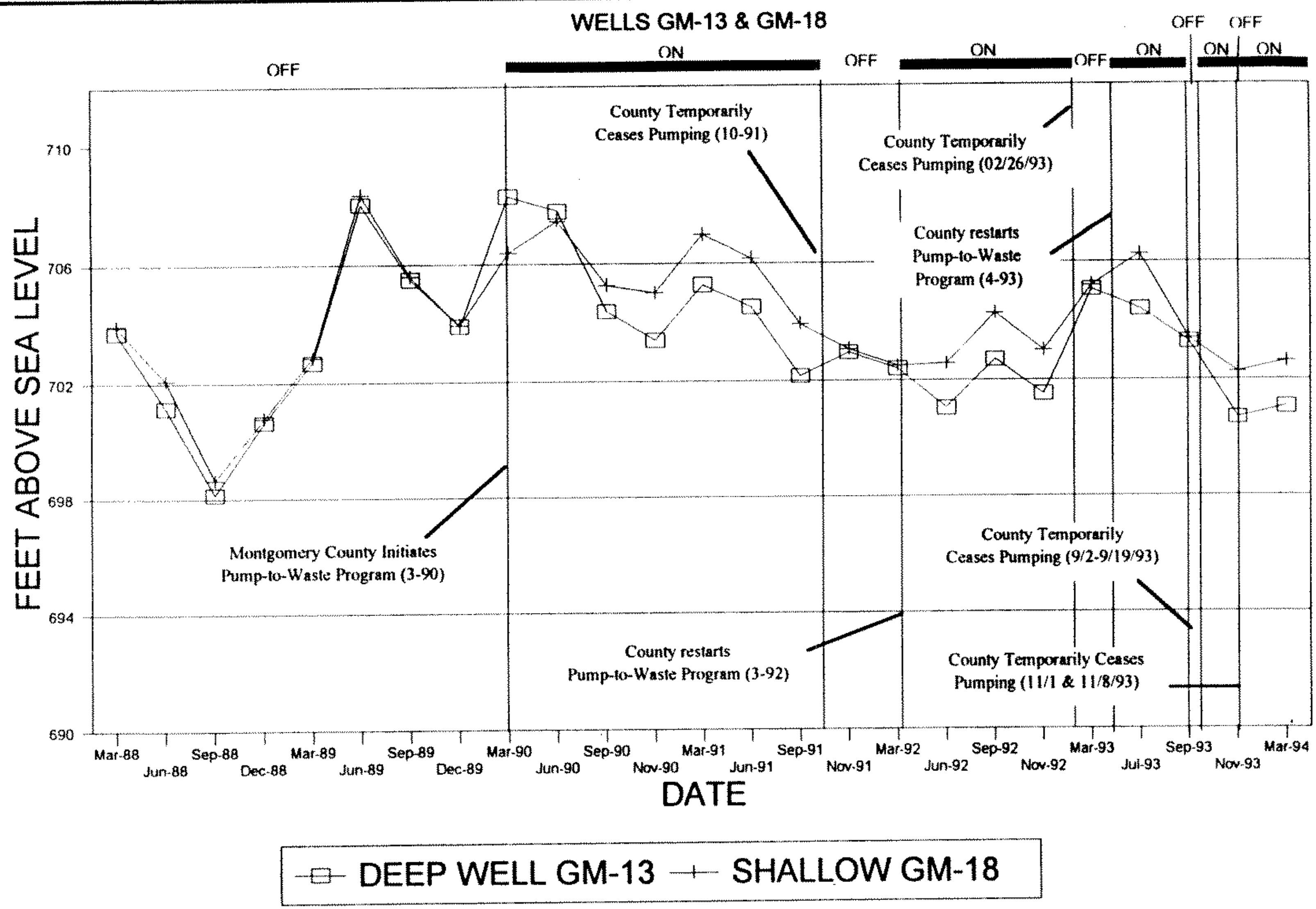
Environmental Services

Zones of Capture for DN-13, Moraine Engine Plant, and Truck & Bus Group wells

HARRISON DIVISION - GMC
MORAINE, OHIO

FIGURE 3

DWG DATE: -- | PRJCT NO.: OH0019.018 | FILE NO.: HAR\IMWP | DRAWING: BORDER | CHECKED: N.G. | APPROVED: B.B. | DRAFTER: RTS



GERAGHTY & MILLER, INC.
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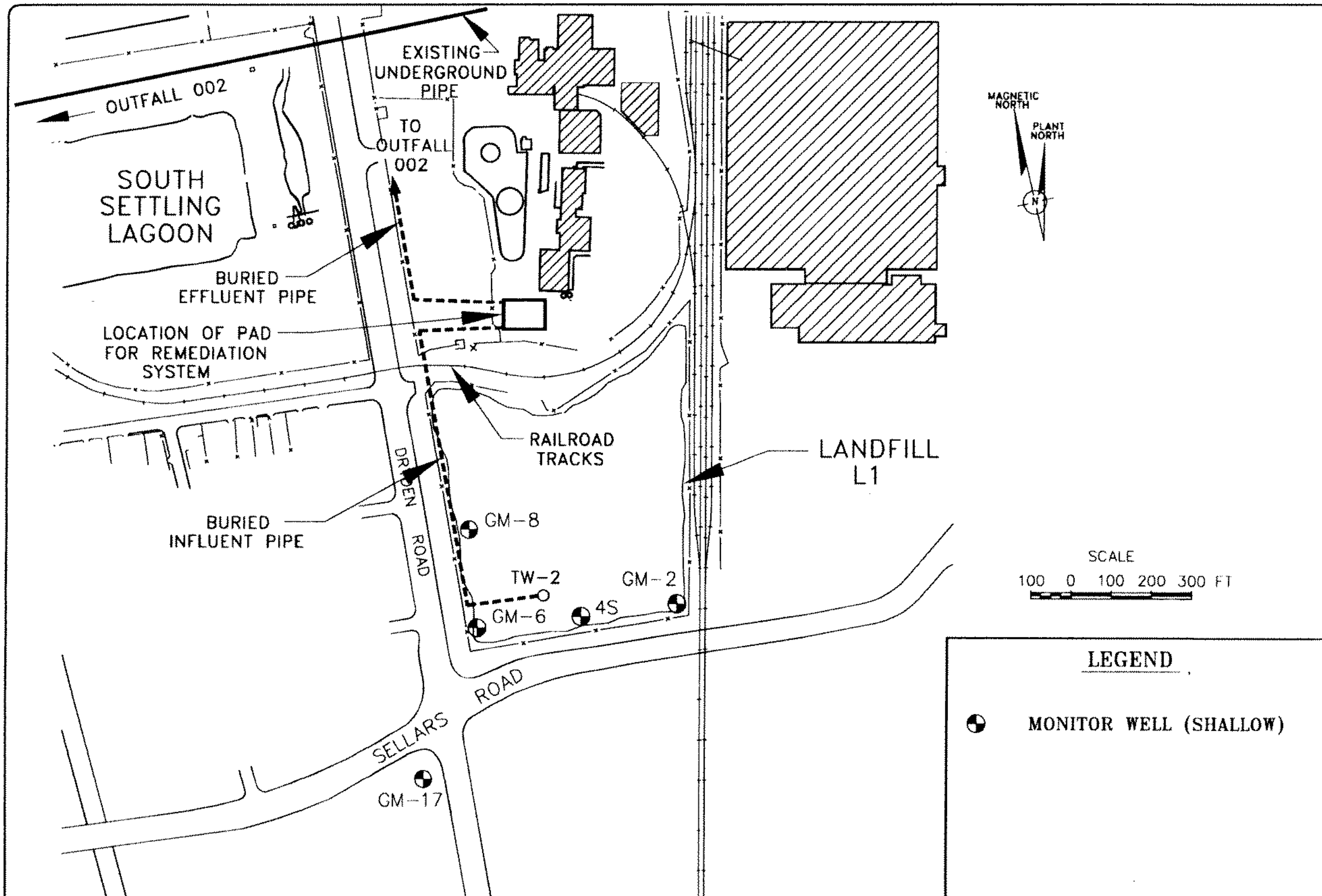
SHALLOW\DEEP WELL PAIR HYDROGRAPH
PRELIMINARY INTERIM MEASURES WORK PLAN

HARRISON DIVISION -- GMC
MORAINE, OHIO

FIGURE 4



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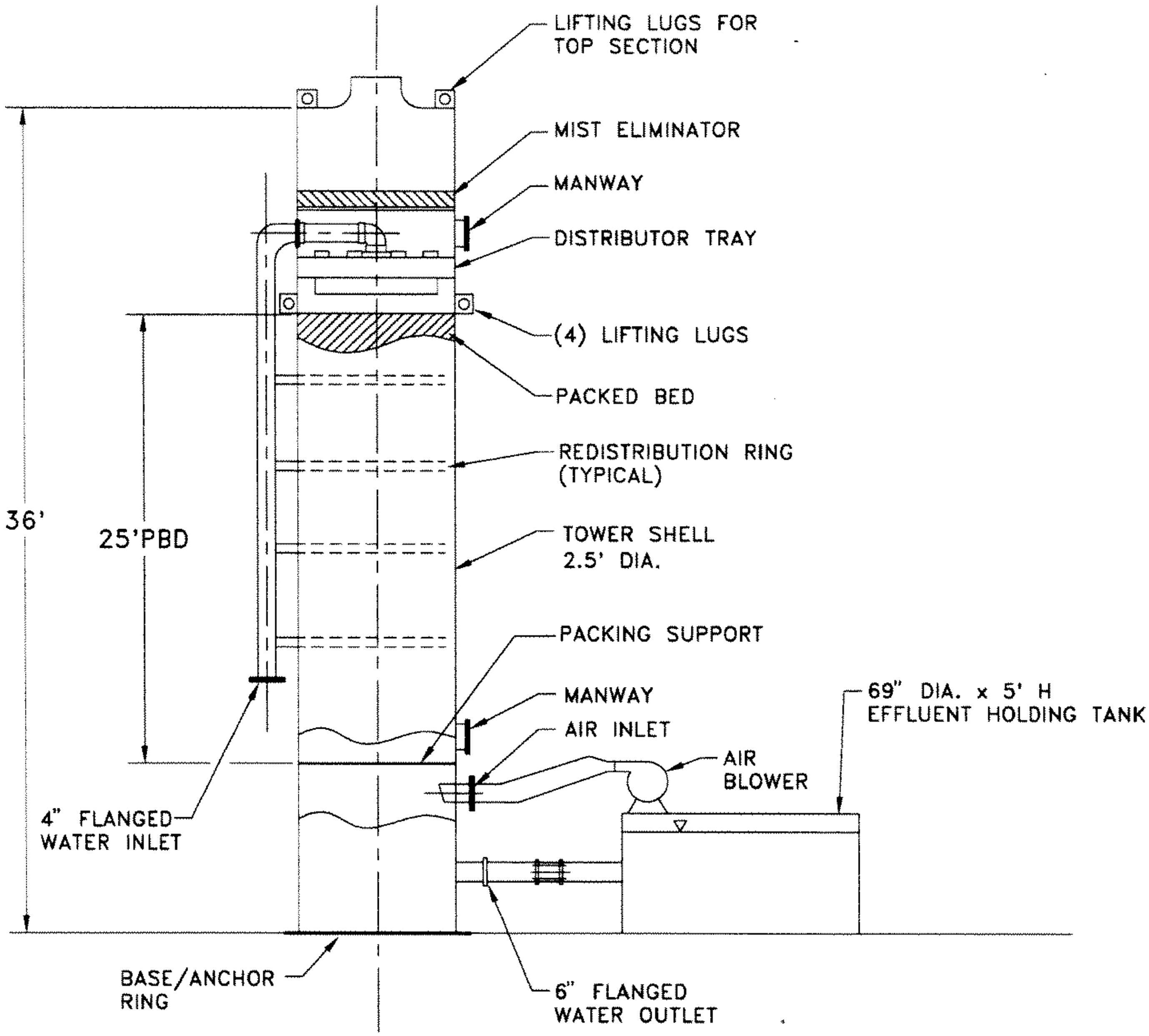
PROJECT NO.: OH0019.021	FILE NO. HAR\WP
DRAWING: L1-TV-E	PLOT SIZE: -
DRAFTED BY: RTS	DATE: 23DEC93
CHECKED BY: N.G.	DATE:
APPROVED BY: B.B.	DATE: -

REMEDIATION SYSTEM PLAN VIEW
PRELIMINARY INTERIM MEASURES WORK PLAN
HARRISON DIVISION - GMC
MORAINE, OHIO

FIGURE
5



DRAFTER: RTS | APPROVED: B.B. | CHECKED: N.G. | DRAWING: AIRSTIP | FILE NO.: HAR\IMWP | PRJCT NO.: OH0019.018 | DWG DATE: 22DEC93

GERAGHTY & MILLER, INC.
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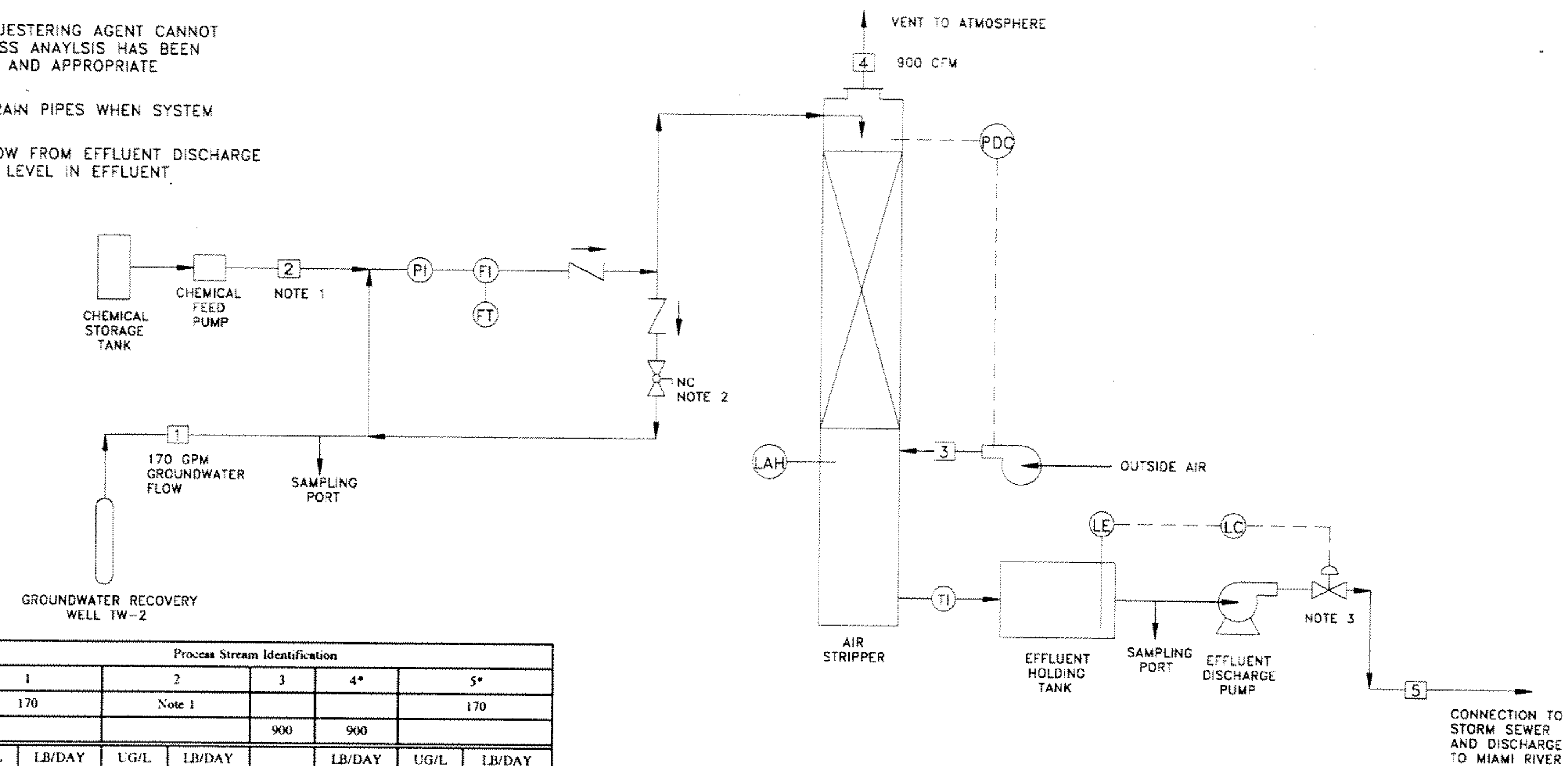
PRELIMINARY AIR STRIPPER SCHEMATIC
PRELIMINARY INTERIM MEASURES
WORK PLAN
HARRISON DIVISION – GMC
MORAINE, OHIO

FIGURE
6

DWG DATE: 22DEC93 | PRJCT NO.: OH0019.018 | FILE NO.: HAR\IMWP | DRAWING: P-F-D | CHECKED: N.G. | APPROVED: B.B. | DRAFTER: RTS

NOTES:
1. FLOW RATE OF CHEMICAL SEQUESTERING AGENT CANNOT BE DETERMINED UNTIL HARDNESS ANAYLSIS HAS BEEN CONDUCTED ON GROUNDWATER AND APPROPRIATE CHEMICAL IS SELECTED.
2. VALVE IS ONLY OPENED TO DRAIN PIPES WHEN SYSTEM IS DEACTIVATED.
3. CONTROL VALVE CONTROLS FLOW FROM EFFLUENT DISCHARGE PIPE TO MAINTAIN 70% WATER LEVEL IN EFFLUENT HOLDING TANK.



Description/Parameter	Process Stream Identification							
	1		2		3	4*	5*	
Gallons per Minute (gpm)	170		Note 1				170	
Air Cubic Feet per Minute (cfm)					900	900		
Contaminant Concentration/Loading	UG/L	LB/DAY	UG/L	LB/DAY		LB/DAY	UG/L	LB/DAY
Benzene	9.3	0.019	--	--	--	0.018	0.3	0.0006
Dichlorodifluoromethane	1	0.002	--	--	--	0.0019	0.03	0.0001
1,1-Dichloroethane	179	0.365	--	--	--	0.354	5	0.011
1,1-Dichloroethene	1	0.002	--	--	--	0.0019	0.03	0.0001
trans-1,2-Dichloroethene	17.4	0.035	--	--	--	0.034	0.5	0.001
Toluene	10.5	0.021	--	--	--	0.02	0.3	0.0006
1,1,1-Trichloroethane	13.8	0.028	--	--	--	0.027	0.4	0.0008
Trichloroethene	386	0.787	--	--	--	0.777	5	0.010
Trichlorofluoromethane	0.8	0.002	--	--	--	0.0019	0.024	0.001
Vinyl Chloride	42.4	0.086	--	--	--	0.083	0.4	0.003
Xylenes	70.6	0.14	--	--	--	0.136	2	0.004
Chloroethane	77.2	0.16	--	--	--	0.155	2	0.005
Ethyl Benzene	191	0.39	--	--	--	0.378	5	0.012
Tetrachloroethane	10.6	0.022	--	--	--	0.021	0.3	0.0007
Chemical Sequestering Agent	--	--			--	--		
Total VOC Concentration/Loading	1010.6	2.06			--	2.01	21.3	0.05

* Assumes a 97% removal efficiency of VOCs for the air stripper, 98.7% removal efficiency for Trichloroethene, and 99% removal efficiency for vinyl chloride.

LEGEND

CHECK VALVE

CONTROL VALVE

BALL VALVE

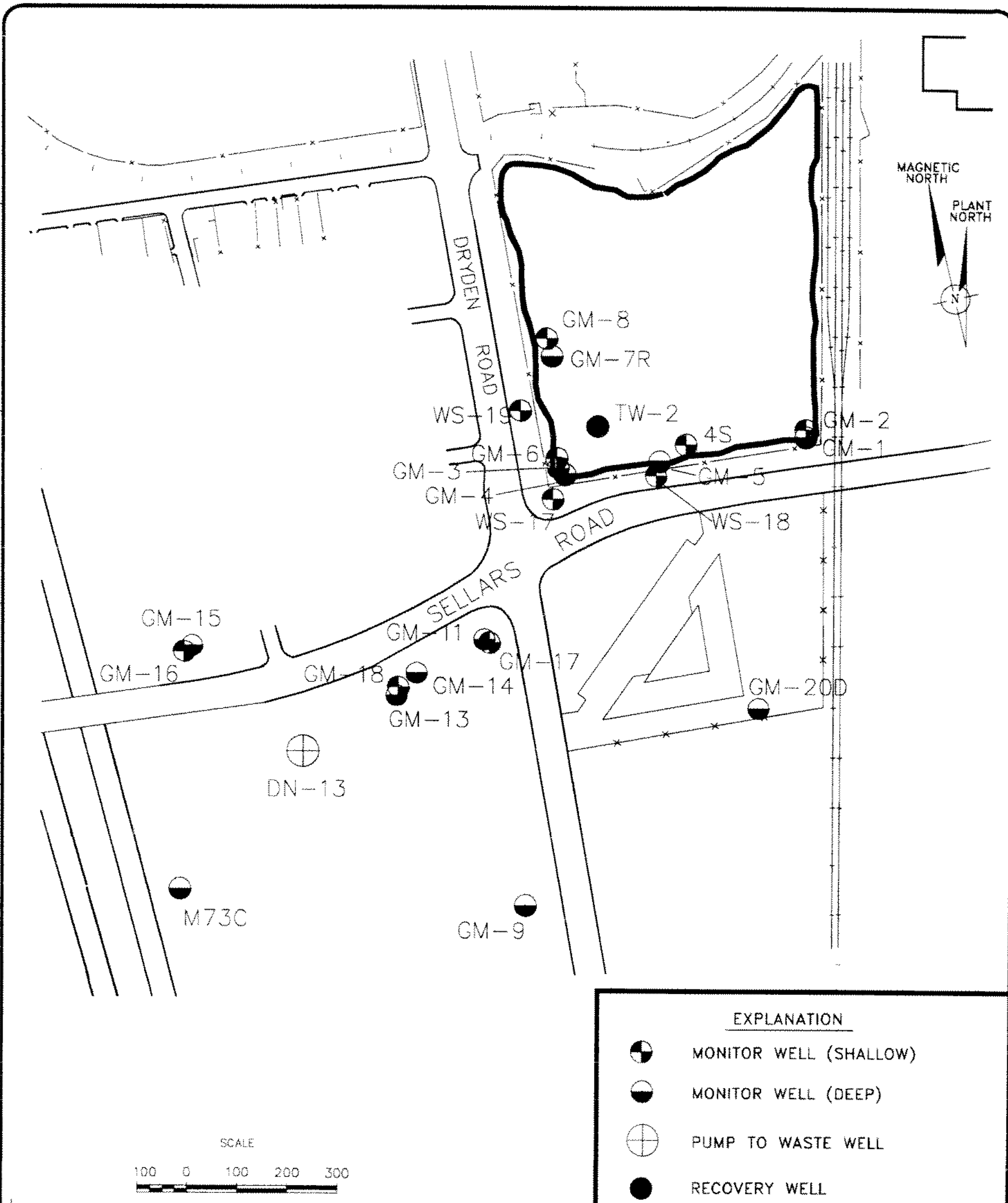
PDC	PRESSURE DIFFERENTIAL CONTROLLER
PI	PRESSURE INDICATOR
FI	FLOW INDICATOR
FT	FLOW TOTALIZER
NC	NORMALLY CLOSED
CFM	CUBIC FEET PER MINUTE
LAH	LEVEL ALARM HIGH
TI	TEMPERATURE INDICATOR
LE	LEVEL SENSOR
LC	LEVEL CONTROL
UG/L	MICROGRAMS PER LITER
LB/DAY	POUNDS PER DAY
GPM	GALLONS PER MINUTE

GERAGHTY & MILLER, INC.
Environmental Services

PRELIMINARY PROCESS FLOW DIAGRAM
PRELIMINARY INTERIM MEASURES WORK PLAN

HARRISON DIVISION – GMC
MORAINE, OHIO

FIGURE 7



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Environmental Services

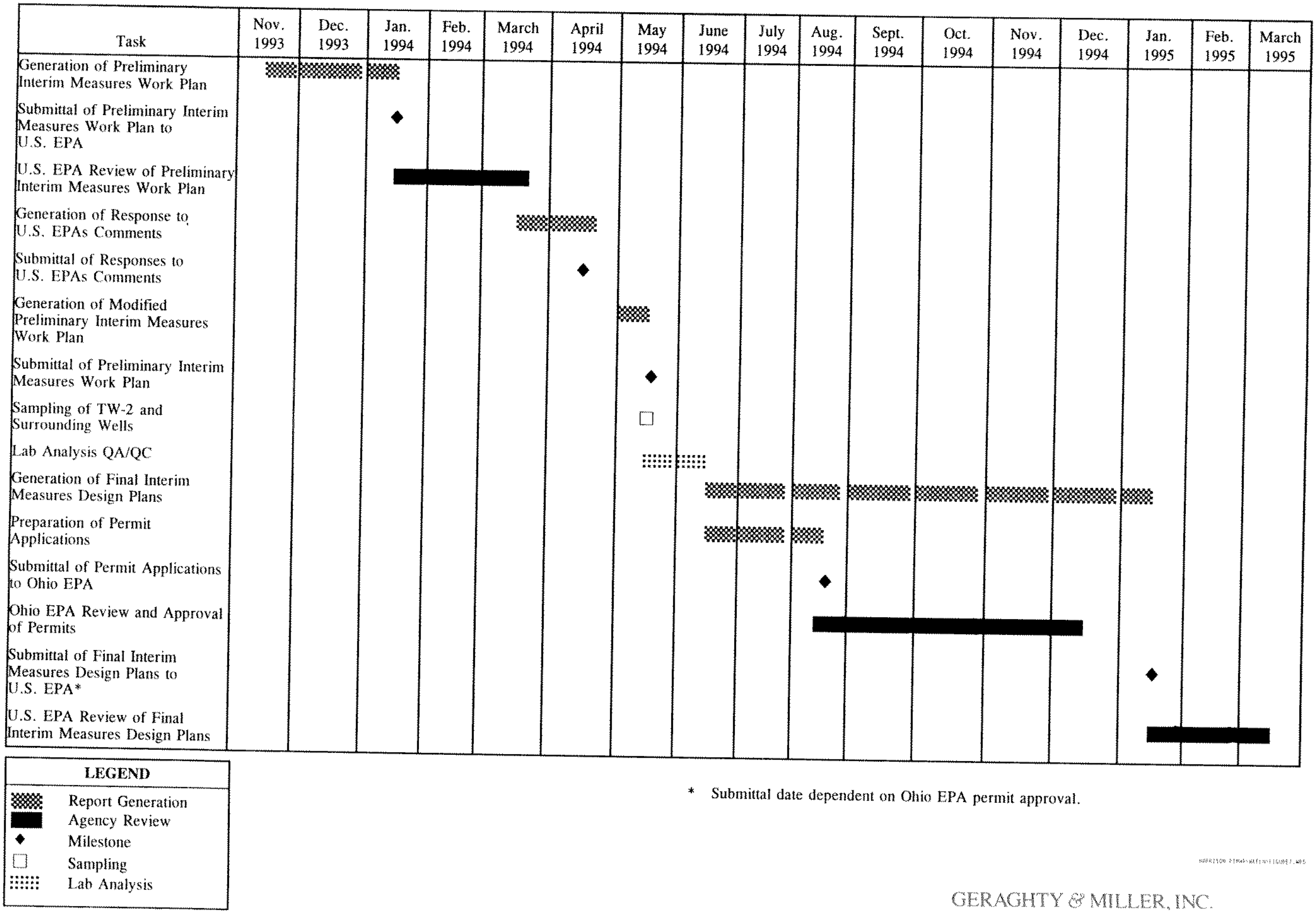
LOCATIONS OF WELLS TO BE USED FOR MONITORING INTERIM MEASURES

HARRISON DIVISION - GMC
MORAINE, OHIO

FIGURE 8

DWG DATE: 16MAY94 | PRJCT NO.: OH0019.021 | FILE NO.: HARRISON\ | DRAWING: L1-IM | CHECKED: N.G. | APPROVED: N.G. | DRAFTER: RTS

Figure 9. Preliminary Interim Measures Schedule, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.



* Submittal date dependent on Ohio EPA permit approval.

GERAGHTY & MILLER, INC.

APPENDIX A

AIR STRIPPER PROGRAM RESULTS

G&M ENVIRONMENTAL EQUIPMENT
A Division of Geraghty & Miller, Inc.

******* A N A L Y S I S OF S T R I P P I N G T O W E R *******

PROJECT : G&M, Inc.-Harrison Radiator DATE : 12/21/1993

ENGINEER : NM Shuaib

PHYSICAL CONSTANTS

Design temperature	:	55.0 degrees F.
Density of water	:	62.4 lb/ft^3
Density of air	:	0.0771 lb/ft^3
Viscosity of water	:	8.13E-04 lb/ft.s
Viscosity of air	:	1.17E-05 lb/ft.s
Surface tension of water	:	74 dyne/cm
Atmospheric pressure	:	1.00 atm

CONTAMINANT PROPERTIES

Name	:	Trichloroethylene
Molecular weight	:	131.3 g/mol
Boiling point	:	189 degrees F.
Molal volume at boiling point	:	0.1071 L/mol
Henry's Constant	:	0.38000
Temperature Constant	:	1909 deg K
Molecular diffusivity in air	:	8.68E-05 ft^2/s
Molecular diffusivity in water	:	7.27E-09 ft^2/s

PACKING PROPERTIES

Name	:	Jaeger Tripacks
Packing Material	:	Plastic
Nominal Size	:	2.00 inch
Specific Area	:	47.9 ft^2/ft^3
Critical surface tension	:	33 dyne/cm
Packing depth	:	20.0 ft
Air friction factor	:	15

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******* A N A L Y S I S   OF   S T R I P P I N G   T O W E R *******

PROJECT : G&M, Inc.-Harrison Radiator   DATE : 12/21/1993

ENGINEER : NM Shuaib   PAGE : 2/2

LOADING RATES

Water mass loading rate	:	4.82 lb/ft^2.s	*
Air mass loading rate	:	0.238 lb/ft^2.s	*
Water volumetric loading rate	:	34.64 gpm/ft^2	*
Air volumetric loading rate	:	1386 gpm/ft^2	*
Air pressure gradient	:	0.118 " H2O/ft	#
Volumetric air/water ratio	:	40.0	
Stripping factor	:	10.7	

MASS TRANSFER PARAMETERS

Percentage of packing area wetted	:	58.7 %	
Wetted packing area	:	28.1 ft^2/ft^3	*
Transfer rate constant in water	:	0.000733 ft/s	
Transfer rate constant in air	:	0.054129 ft/s	
Overall transfer rate constant	:	0.000697 ft/s	
Overall mass transfer coefficient	:	0.0196 1/s	
NTU	:	4.8641	
HTU	:	4.1118 ft	

CONTAMINANT REMOVAL

Influent concentration	:	386.00 ug/L	
Effluent concentration	:	4.26 ug/L	
Fraction removed	:	98.9 %	
Mass of contaminant removed	:	0.15874 lb/ft^2.day	*
Concentration in airstream	:	0.02510 mg/ft^2.ft^3	

*   Expressed per unit of stripping tower cross-sectional area
\#   Expressed per unit of tower length

G&M ENVIRONMENTAL EQUIPMENT
A Division of Geraghty & Miller, Inc.

APPENDIX B

AIR EMISSIONS CALCULATIONS

Appendix B. Air Emissions Calculations, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

Input Data:

VOC	Influent Water Concentration (ug/L)
Benzene	9.3
Dichlorodifluoromethane	1
1,1-Dichloroethane	179
1,1-Dichloroethene	1
trans-1,2-Dichloroethene	17.4
Toluene	10.5
1,1,1-Trichloroethane	13.8
Trichloroethene	386
Trichlorofluoromethane	0.8
Vinyl Chloride	42.4
Xylenes	70.6
Chloroethane	77.2
Ethyl Benzene	191
Tetrachloroethene	10.6

Water Flow Rate = 170 gal/min.

Calculate air emissions from the tower for each VOC, assuming 100% of the VOCs strip from the water and are transferred to the air.

Benzene:

$$\left(9.3\frac{ug}{L}\right)\left(170\frac{gal}{min}\right)\left(\frac{1\ L}{0.2642\ gal}\right)\left(\frac{1x10^{-6}\ g}{1\ ug}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{2.2x10^{-3}\ lb}{1\ g}\right) = 0.019\ \frac{lb}{day}$$

Dichlorodifluoromethane:

$$\left(1\frac{ug}{L}\right)\left(170\frac{gal}{min}\right)\left(\frac{1\ L}{0.2642\ gal}\right)\left(\frac{1x10^{-6}\ g}{1\ ug}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{2.2x10^{-3}\ lb}{1\ g}\right) = 0.002\ \frac{lb}{day}$$

1,1-Dichloroethane:

$$\left(179\frac{ug}{L}\right)\left(170\frac{gal}{min}\right)\left(\frac{1\ L}{0.2642\ gal}\right)\left(\frac{1x10^{-6}\ g}{1\ ug}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{2.2x10^{-3}\ lb}{1\ g}\right) = 0.365\ \frac{lb}{day}$$

Appendix B. Air Emissions Calculations, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

1,1-Dichloroethene:

$$\left(1\frac{ug}{L}\right)\left(170\frac{gal}{min}\right)\left(\frac{1\ L}{0.2642\ gal}\right)\left(\frac{1x10^{-6}\ g}{1\ ug}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{2.2x10^{-3}\ lb}{1\ g}\right) = 0.002\ \frac{lb}{day}$$

trans-1,2-Dichloroethene:

$$\left(17.4\frac{ug}{L}\right)\left(170\frac{gal}{min}\right)\left(\frac{1\ L}{0.2642\ gal}\right)\left(\frac{1x10^{-6}\ g}{1\ ug}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{2.2x10^{-3}\ lb}{1\ g}\right) = 0.035\ \frac{lb}{day}$$

Toluene:

$$\left(10.5\frac{ug}{L}\right)\left(170\frac{gal}{min}\right)\left(\frac{1\ L}{0.2642\ gal}\right)\left(\frac{1x10^{-6}\ g}{1\ ug}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{2.2x10^{-3}\ lb}{1\ g}\right) = 0.021\ \frac{lb}{day}$$

1,1,1-Trichloroethane:

$$\left(13.8\frac{ug}{L}\right)\left(170\frac{gal}{min}\right)\left(\frac{1\ L}{0.2642\ gal}\right)\left(\frac{1x10^{-6}\ g}{1\ ug}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{2.2x10^{-3}\ lb}{1\ g}\right) = 0.028\ \frac{lb}{day}$$

Trichloroethene:

$$\left(386\frac{ug}{L}\right)\left(170\frac{gal}{min}\right)\left(\frac{1\ L}{0.2642\ gal}\right)\left(\frac{1x10^{-6}\ g}{1\ ug}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{2.2x10^{-3}\ lb}{1\ g}\right) = 0.787\ \frac{lb}{day}$$

Trichlorofluoromethane:

$$\left(0.8\frac{ug}{L}\right)\left(170\frac{gal}{min}\right)\left(\frac{1\ L}{0.2642\ gal}\right)\left(\frac{1x10^{-6}\ g}{1\ ug}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{2.2x10^{-3}\ lb}{1\ g}\right) = 0.002\ \frac{lb}{day}$$

Vinyl Chloride:

$$\left(42.4\frac{ug}{L}\right)\left(170\frac{gal}{min}\right)\left(\frac{1\ L}{0.2642\ gal}\right)\left(\frac{1x10^{-6}\ g}{1\ ug}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{2.2x10^{-3}\ lb}{1\ g}\right) = 0.086\ \frac{lb}{day}$$

Appendix B. Air Emissions Calculations, Preliminary Interim Measures Work Plan, Harrison Division - GMC, Moraine, Ohio.

Xylenes:

$$\left(70.6\frac{ug}{L}\right)\left(170\frac{gal}{min}\right)\left(\frac{1\ L}{0.2642\ gal}\right)\left(\frac{1x10^{-6}\ g}{1\ ug}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{2.2x10^{-3}\ lb}{1\ g}\right) = 0.14\ \frac{lb}{day}$$

Chloroethane:

$$\left(77.2\frac{ug}{L}\right)\left(170\frac{gal}{min}\right)\left(\frac{1\ L}{0.2642\ gal}\right)\left(\frac{1x10^{-6}\ g}{1\ ug}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{2.2x10^{-3}\ lb}{1\ g}\right) = 0.16\ \frac{lb}{day}$$

Ethyl Benzene:

$$\left(191\frac{ug}{L}\right)\left(170\frac{gal}{min}\right)\left(\frac{1\ L}{0.2642\ gal}\right)\left(\frac{1x10^{-6}\ g}{1\ ug}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{2.2x10^{-3}\ lb}{1\ g}\right) = 0.39\ \frac{lb}{day}$$

Tetrachloroethene:

$$\left(10.6\frac{ug}{L}\right)\left(170\frac{gal}{min}\right)\left(\frac{1\ L}{0.2642\ gal}\right)\left(\frac{1x10^{-6}\ g}{1\ ug}\right)\left(\frac{60\ min}{hr}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{2.2x10^{-3}\ lb}{1\ g}\right) = 0.022\ \frac{lb}{day}$$

Total Air Emissions = $2.06\ \frac{lb}{day}$

HARRISON.PIMWP\WKPLN\APPENDB.WPS