MAIROLL, INC.

MAIN PLANT SITE

FARMINGDALE, NEW YORK

1-52-130

REMEDIAL DESIGN WORK PLAN

October 1999

MAC CONSULTANTS, INC.
515 Route 111
Hauppauge, New York 11788
tel 516-265-7700
fax 516-265-9073

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

The March 1998 Record of Decision (ROD) prepared by the New York State Department of Environmental Conservation (NYSDEC) for the Mairoll Main Plant Site (MPS) calls for a groundwater remedy that includes a groundwater capture, treatment and recharge (pump & treat) component, a plume tracking / groundwater modeling component and a public supply wellhead protection component. The ROD selected a groundwater remedy that is protective of human health and the environment and describes this remedy conceptually, based on the available data presented in the Remedial Investigation and Feasibility Study (RI/FS). The MPS Remedial Investigation / Feasibility Study (RI/FS) screened six remedial alternatives and selected an alternative using the available data collected through completion of the RI/FS.

The primary elements of the selected remedy are summarized as follows and are described in more detail or listed in Section 8 of the MPS ROD:

1. Groundwater extraction to capture the 1000 ppb total volatile organic compound (TVOC) plume to the south of the MPS. The extraction system conceptually described in the ROD consists of two wells pumping at a combined rate 500 gallons per minute (gpm) or a comparable technology.

2. A predesign investigation to determine the number of location and depth of the extraction wells. The investigation includes development of a groundwater model of the aquifer, plume tracking and plume tracking updates, and periodic updates of the model over time. Predesign investigation field work and groundwater modeling will begin within 30 days of approval by NYSDEC.

3. A design program to verify the components of the design and to provide the details necessary to construct, operate, maintain and monitor the remedy.

4. Long term monitoring of the extraction system. Specific elements of the monitoring program are described in Section 7.

5. Installation and quarterly monitoring of outpost monitoring wells for VOCs for the East Farmingdale Water District Wells S-66556 and S-79105; the Suffolk County Water Authority Albany Avenue Wells S-34595, S-47886 and S-63205; and the Suffolk County Water Authority Tenety Avenue Wells S-20460 and S-37681. Outpost monitoring wells may be added over time for the Suffolk County Water Authority North Fifth Street Well S-29491 and/or Lambert Avenue Well S-22351 and/or Great Neck Road Wells S-51214 and S-54568, if necessary.

6. A wellhead treatment contingency plan to design, construct, operate and maintain wellhead treatment systems, if necessary. Implementation of the outpost well monitoring program and wellhead treatment contingency is described in Section 5.

7. Monthly sampling of the East Farmingdale Route 109 and Tenety and Albany Avenue Wellfields for VOCs. The water utilities have implemented monthly sampling.

8. Connection of any additional private drinking water well users within and around an area between Route 110 and Great Neck Road, Wellwood Avenue and Sunrise Highway to the public water supply, if necessary.

NYSDEC and Mairoll recognize that additional information will be necessary to design the remedy as required by the consent order between NYSDEC and Mairoll for the groundwater remedy specified in the Record of Decision (ROD). A predesign investigation to gather this additional information is described in the Remedial Design Workplan.

This Remedial Design Work Plan (RDWP) describes the scope of the remedial design tasks and the information that will be obtained to design, construct, operate and monitor the MPS remedy. The RDWP includes a Remedial Design Site Plan (Figure 1) and a Study Area Map (Figure 2) depicting the areas referenced in the various sections of this workplan. Additional maps will be developed as part of the project scope, depending on the output and scale required by specific tasks, such as modeling.

The following components are included in the RDWP as outlined in **MAC CONSULTANTS, INC. (MAC)** September, 1998 letter to NYSDEC:

- **Groundwater Modeling-** Mathematical modeling of the groundwater system will be used to predict the most likely path of the MPS plume and the potential impact to public supply wells under a variety of pumping scenarios. The model results will be used to assist the placement of the recovery wells. A description of the model is provided in the RDWP.

- **Aquifer Pump and Recharge Tests-** The pumping tests to be done to confirm estimates of the capture zone extent and modeling results will be described. These tests will be necessary to confirm the location, depth and size of the recovery wells. The Recharge tests will determine the extent of mounding of recharged groundwater. The RDWP describes the type and duration of the tests that will be conducted to design the groundwater recharge component of the remedy to design the location, depth, size of the recharge system.

- **Drilling and Test Well Construction-** Plans for locating, installing and developing test and monitoring wells will be prepared. Specifications will be provided to prospective well installation contractors to scope the extent of well construction necessary to test and monitor groundwater during the aquifer test phase.

- **Outpost Monitoring Well system-** An outpost monitoring well system is required by the ROD for the MPS. Plans for the outpost monitoring system will include site selection, well design, well permits and access restrictions and implementation scheduling.

- **Treatment Testing and Analysis -** The scope of water quality analysis and the pilot scale tests will be specified to evaluate alternative technologies and to design the groundwater treatment system.

- **Sampling and Analysis Plan** - The details for sampling, analysis and monitoring activities of Mairoll monitoring wells on airport and property and USGS or County observation wells south of the airport will be specified. The sampling results will be used to update the information on plume location and concentrations and to track the plume over time.

- **Plans and Specifications** - The RDWP presents the scope and percent completion of the preliminary and final design documents to be submitted for DEC review.

- **Project Deliverables** - The scope of the remedial design project tasks and deliverable documents are summarized. The work plan will include the remedial design project schedule.

- **Health and Safety Plan (HASP)** - Emergency response procedures, and actual and potential physical and chemical hazards at the work site are addressed in the RDWP HASP.

1.1 Project Schedule

The Remedial Design Workplan tasks are summarized on Table 1, Project Schedule. Please note that the schedule includes assumptions of times to complete field tasks, laboratory turnaround and regulatory review, in depicting the time line. Delays attributable to weather, access problems, labor actions or force majeure cannot be predicted and are therefore not reflected in the time line.

The project schedule (Table 1) shows a number of tasks beginning simultaneously, the Monitoring Well Sampling, the Conceptual Model and the Well Design / Specifications. The above three tasks must be completed before drilling and well installation, because the 1994 groundwater monitoring data from the RI are the most recent data on the MPS plume. Drilling site selections should be optimized with new groundwater data depicting the plume's current location, otherwise, "guesswork"selection of drilling locations would likely result in additional drilling and a needlessly extended schedule.

2.0 GROUNDWATER MODELING

2.1 General

The ROD for the MPS requires a groundwater model to simulate the MPS groundwater plume over time and to assess the impact, if any, to the downgradient public supply well fields. The ROD also calls for the model to simulate and assess the operation of a groundwater pump and treat remedy scenario and to assist in selecting outpost monitoring well locations.

2.2 Purpose and Scope

The model is intended to serve a number of purposes during the groundwater remedy design, implementation and long-term operation as described below:

- To provide an operating simulation of the aquifer system that is to be remediated. Historical and current groundwater data, superimposed on the model, will be used to optimize selection of aquifer test wells, observation wells (piezometers) and outpost wells.

- To simulate plume fate and transport with no assumed aquifer stress due to pumping, and under several groundwater pump & treat scenarios.

- To estimate the plume travel path and travel time with respect to downgradient public water supply well fields. The model will be able to address likely changes in the pumpage of individual wells or well fields, causing shifts in aquifer pumping stress.

- To re-evaluate the groundwater pump & treat remedy after several years of operation and to recheck the model parameters, The model predictions can be compared to field data and the model parameters adjusted, if necessary, to better simulate the aquifer system.

- To help predict the impact of changes to the pump & treat system operation over time. As the plume is remediated, it may be beneficial to adjust the pumping stress to maximize the contaminant removal per unit of groundwater extracted and treated.

- To simulate the outcome of shutting down the pump & treat system, once the ROD objectives have been met. The data collected over the active life of the pump & treat would be used along with the model to simulate the movement of plume residuals.

- To assess the possible impact of plumes from other sites on the groundwater pump & treat remedy and the downgradient public water supply wells.

The model will be run initially to help plan remedial design elements such as aquifer testing and well placement. A second modeling run will be made after the aquifer testing and new well installation, and will include the new data collected to support the design and will simulate the effects of the active groundwater remediation on the MPS Plume. Additional model runs are anticipated at remediation milestones to track the effectiveness of the pump and treat system and to predict the impact, if any on the public supply wells.

2.3 Model Development

The model will be developed in several phases as described below.

2.3.1 Phase I

Before proceeding with a numerical groundwater model, a Phase I conceptual model will be constructed and presented to NYSDEC and Suffolk County Department of Health Services (SCDHS) for review. The following information will be researched and evaluated to develop the Phase I conceptual model.

- delineation of the physical flow system including geometry, lithology and extent (boundaries).
- aquifer hydraulic coefficients including hydraulic conductivity, transmissivity, storage and leakage.
- designation of model boundary types and conditions.
- aquifer recharge estimates.
- three dimensional groundwater levels (heads) and flow directions.
- identifying significant centers of aquifer stress, such as pumpage and artificial recharge, including a proposed recharge system that will be needed for a pump & treat remediation.

These data will be obtained from published reports, regional groundwater studies by the USGS and the Mairoll RI/FS reports. The SCDHS DYNFLOW regional groundwater flow model, by Camp, Dresser & McKee (CDM) will be reviewed for technical information on aquifer parameters, geologic and hydrologic data and boundary conditions. The SCDHS has provided a copy of a MODFLOW compatible DYNFLOW output to facilitate this comparison. The data and model assumptions will be applied in accord with the MODFLOW software and consistent with USEPA and USGS reference materials. Construction of the Phase I Conceptual Model is essential to the Phase II numerical modeling described below, and it is important to have technical agreement on the conceptual model if NYSDEC and Mairoll are to have confidence in the numerical modeling results.

2.3.2 Phase II

Phase II will be the construction of a numerical groundwater flow and advective transport model. The numerical model construction will be based on the Phase I conceptual model and conceptual model components will be incorporated into the numerical model during the Phase I model development. The Phase I and Phase II modeling efforts will therefore overlap, but, Phase I will have to be completed before an initial Phase II modeling run can be made. Constructing and running the

Phase II numerical model without an adequate representation of the aquifer system in a conceptual model would most likely result in erroneous model predictions and time-consuming reconstruction of the numerical model.

For the numerical flow model, the USGS Modular Groundwater Flow Model developed by McDonald and Harbaugh (1988), known as MODFLOW will be used. Long term plume tracking, using the USGS MODPATH code developed by Pollock (1989) will be used. The numerical model will be a three-dimensional simulation of the unconfined, Upper Glacial aquifer and the confined/semi-confined upper Magothy aquifer through which the MPS plume flows.

2.3.2.1 Model Base Map and Grid Development

The first task in Phase II will be to set up a model base map and finite difference grid that covers the study area in sufficient detail to allow realistic simulation of the plume, remediation effects, recharge system effects and the impact of a number of public supply well pumping scenarios. The general study area that will be covered by the modeling is shown on Figure 1. MODFLOW will accommodate a variable and spacing, to gain sufficient detail around areas of aquifer stress while keeping the overall grid spacing reasonable.

2.3.2.2 Model Test Run and Initial Calibration

The second task will be to run the model without simulating a remedial pump & treat system and keeping known aquifer stresses, such as the operation of supply wells, at present status. The results of the first step will be a baseline for comparison with the most recent plume and hydraulic head data (calibration).

2.3.2.3 Remedial Aquifer Simulation

A third task will be a simulation of the operation of the proposed pump & treat system. It is likely that more than one run will be made, while varying the remedial pumping well locations to optimize plume capture or to study the effects of moving the remedial wells and / or recharge system due to institutional access constraints. Once the model has produced a simulation of a remedial system that meets the ROD objectives and it is feasible to implement such a system, the model output will be compiled and a report issued recommending field testing on a pilot scale.

2.3.2.4 Plume Fate and Transport Modeling

The ROD requires that fate and transport of unremediated portions of the MPS plume be studied and this will be addressed using a solute transport model. The purpose of this effort would be to track contaminants related to the MPS plume in relation to the East Farmingdale Route 109 well field and the Suffolk County Water Authority (SCWA) Well fields (Albany Avenue and Tenety Avenue). SCWA has an additional wellfield at Great Neck Road that appears to be sidegradient of the MPS plume flowpath based on the 1994 plume delineation and regional groundwater flow, but the potential impact of increased pumping at Great Neck Road will be evaluated, in accord with the

ROD. This approach could also be used to predict the movement of VOCs from other off-site sources and the likely effects of these plumes on the MPS groundwater remediation and on the public supply well fields.

The combination of MODFLOW and MODPATH would provide a conservative assessment of the potential impact to the above well fields via advective transport as an alternative to solute transport. An advective transport model offers a technically sound alternative to solute transport modeling by avoiding the complicating effects and uncertainties of quantifying dispersion, adsorption and chemical reactions while still allowing solute transport paths, travel times and discharge points to be calculated. Moreover, advective transport modeling is used to delineate capture zone (an objective of the ROD) and wellhead protection areas based on travel time criteria (United States Environmental Protection Agency, 1987 and Anderson and Woessner, 1992). Therefore, if under maximum foreseeable pumping stress, a well field does not intercept a contaminant plume, solute transport modeling would not be needed.

A special MODFLOW run with MODPATH particle tracking would be run after other model tasks have been completed and there is concurrence with NYSDEC on a groundwater remedial design. The model would track the movement of MPS plume residuals at ten year time steps beginning with the known plume extent (present time) to fifty years into the future. The model results would provide a basis for predicting whether each of the potentially affected well fields is at significant risk and when such risk is likely to occur, at the earliest. These predictions would be used to help select outpost well locations, to track the plume over time, and to provide early warning of the need to implement wellhead treatment, as provided for in the ROD. The model will be re-run at minimum five-year intervals and will be compared to long-term groundwater monitoring data and revised, if necessary.

2.3.3 Phase III Solute Transport Modeling

If the advective transport modeling reveals an unavoidable MPS plume impact to one or more public supply well fields, a solute transport model could be run to estimate the magnitude of the impact to the supply. In addition to groundwater flow, solute transport modeling must also include aquifer properties of dispersion, adsorption and chemical reaction. The complicating properties and uncertainties of dispersion, adsorption and chemical reaction must be addressed (Anderson and Woessner, 1992). The data required on these properties for solute transport modeling would be obtained from published hydrogeologic studies conducted on Long Island and at similar locations elsewhere. A comprehensive list of data needs for solute transport modeling would be provided if Phase III is undertaken.

A conceptual solute transport model will be prepared for NYSDEC and SCDHS to review before proceeding with the solute transport model.

2.4 Modeling QA/QC

2.4.1 MODFLOW QA/QC Capability

MODFLOW is one of the most widely used and accepted numerical flow models and current versions are generally packaged with Microsoft Windows driven pre and post processors. Data entry via PC is guided by the software so that errors are avoided and are easy to correct. Current MODFLOW software is bundled with graphic output programs that do not require separate running of the model and importing output to graphics programs for display or printing. The model can be reviewed graphically at various stages of completion, and obvious inconsistencies with the assumptions and / or data can be resolved.

2.5 Modeling Deliverables

Each phase of model development and successive model runs would be documented in a report with graphics depicting the model output. The deliverables would become a part of the remedial design. Model runs conducted after design approval and system installation will also be provided to the department.

2.6 Schedule

The conceptual model will take 4 weeks to prepare in draft form for regulatory review. A final conceptual model will be prepared two weeks after comments are received from the reviewing parties.

The numerical model will be started immediately following approval of the conceptual model. An Initial MODFLOW run will be completed 12 weeks afterward and results will be presented showing non-pumping conditions and a comparison with field data (calibration).

3.0 AQUIFER TEST DESIGN WORKPLAN

3.1 General

The ROD requires a groundwater remedy that includes a groundwater capture, treatment and recharge (pump & treat) component and the design must be based on site-specific data that can only be collected by conducting a controlled aquifer test. The aquifer test can be coordinated with aquifer recharge testing and groundwater treatability testing.

The MPS groundwater plume remedy selected in the ROD requires that the 1000 part per billion (ppb) TVOC contour be captured and contained from further downgradient migration. This remedy is conceptually based on two capture wells pumping a combined total of 500 gallons per minute (gpm) as shown on attached Figure of the ROD. The actual locations and depth of these wells would be selected after running a controlled aquifer test with distance / drawdown and time / drawdown data collection.

3.2 Purpose and Scope

The aquifer test results would provide a site-specific confirmation of the regional aquifer characteristics that were used in the MODFLOW simulation and the three-dimensional picture of groundwater flow in the zone of desired plume capture simulated in the Phase 1 conceptual model. Running a MODFLOW simulation of the aquifer test would add a second level of model calibration in the zone of tightest grid spacing where groundwater flow in response to pumping stress is most complicated. This information will be valuable in assessing the risk to deep, high capacity pumping wells such as the public water supply wells that tap deeper aquifer zones than the Upper Glacial / Upper Magothy where the plume is located.

3.3 Methodology.

The controlled aquifer test would be conducted on or south of Republic Airport after the predesign groundwater data are collected and the initial MODFLOW groundwater model run has been completed. The aquifer test data would be used together with the modeling results to design a permanent plume remediation well system. Additionally, water quality and flow data collected during the aquifer test would be used to design a groundwater VOC treatment unit and a groundwater recharge system.

The groundwater remediation system as described in the ROD, would use conventional pumping wells for plume capture, an air stripping VOC removal treatment unit and unsaturated zone leaching pools for recharge. An artificial recharge pilot system would be used and monitored during the aquifer test to determine the best design and land area requirements for a recharge system and to ascertain any impact of this recharge to the plume capture.

3.4 Test Results and Innovative Remedial Technologies

The ROD allows Mairoll to consider innovative remedial technologies for remediating the MPS plume. Innovative technologies such as in-situ air stripping, enhanced biological remediation, reactive barriers and chemical treatments are being developed or have been implemented on a limited basis. At present there are limited data on the application, cost and predicted success of these technologies and it is not possible to design an aquifer testing program that would address the feasibility requirements of each technology, however promising. As additional data on such technologies become available, Mairoll may propose further study and/or testing of one or more innovative technologies as a separate task and a supplemental remedial design workplan component would be submitted to the Department for review.

3.5 Aquifer Testing Methods

The aquifer test results would be used to calculate site specific aquifer parameters of hydraulic conductivity (horizontal and vertical) and storativity, and there would be sufficient pre-test data collected to detect the effects of pumpage and barometric efficiency. Aquifer test methodologies are published by the U. S. Geological Survey (USGS) (Lohman, 1972 and Ferris, et. al. 1962). The USGS has also published results of controlled aquifer tests of the same Long Island hydrogeologic units that are to be tested by Mairoll and these results will be reviewed for consistency with Mairoll aquifer tests.

3.5.1 Test Well Design

A test pumping well will be drilled at a location that will maximize the chance of the well being useful as part of the final remediation system. This well may be located on the Republic Airport or Babylon Town property. The final well location may be a compromise between hydrogeologic and airport safety / management factors. Operating a drilling rig large enough to install a large diameter well will require special precautions to avoid interference with aircraft and airport operations. Any such activities will be coordinated with airport management. Details on Test Well Design and Construction are included in Section 4.1.

3.5.2 Observation Wells

Groundwater elevations will be monitored in observation wells to determine the impact of pumping at various distances from the pumping well. The locations of the observation wells will be selected to reflect optimum distances for drawdown measurement and aquifer test analysis, taking into account institutional access constraints. The observation wells may also be used for groundwater sample collection to verify information on the plume before aquifer testing and for long term monitoring after remediation is underway.

Soil samples collected during the installation of the observation wells will provide geologic data that will be used to confirm the geologic cross-sections prepared for the RI report. The south end of Republic Airport is close to the northern limit of the Gardiners Clay, as mapped by the USGS.

The presence of the Gardiners Clay may affect the proposed remediation well design and the fate and transport assessment with respect to the downgradient public supply well fields.

The observation wells will be designed to ensure efficient response to drawdown during the aquifer test. Keeping the observation well diameter small is an advantage because it minimizes the effects of well bore storage on water level changes in response to pumping well drawdown. A mathematical pumping test simulation will be run before final selection of the observation well locations and depths. The simulation results will enable prediction of the radius from the pumping well required to eliminate partial penetration effects so that single or cluster observation wells may be selected as needed. Observation well design details are given in Section 4.3.

3.5.3 Pre-Test Data Collection

Pre-test calculations of aquifer response to pumping will be used to predict the minimum pumping rate and duration needed to collect the capture well system design data. This effort will help to limit the size of the groundwater treatment and recharge pilot facilities that will be used during the aquifer testing. There is a substantial volume of published aquifer characteristics data from the Long Island aquifers on which to make reliable calculations and will be used to establish the remediation system's pumping rates.

3.5.4 Aquifer Test Design

There are considerable data on Long Island aquifers that suggest that a 48 hour to 72 hour pumping test should be adequate to provide sufficient site-specific data on which to base a remedial well system design. This is because of the exceptionally high aquifer transmissivity that results in many aquifer tests reaching virtual steady-state in 48 hours or less. The test may be run for up to 72 hours or longer, if it is evident that transient conditions such as nearby pumpage, recharge or weather conditions are affecting the data. The additional testing would be intended to help quantify these transient conditions and eliminate them from the aquifer test analysis.

A temporary pumping system for the pumping well will be specified to ensure an uninterrupted aquifer test. A secure wellhead arrangement will be provided for safe and easily controlled operation using an appropriate number and type of valves, redundant flow measurement devices, a pumping well water level measurement access and a leak-free pump discharge line from the wellhead to the discharge point. It is anticipated that the aquifer test pumpage will be piped to temporary treatment before discharge to a pilot scale aquifer recharge system. The recharge system will be situated far enough away from the pumping well to avoid interference with collecting representative test data.

3.5.5 Aquifer Test Analysis

The data from the aquifer test will be reduced and analyzed to determine the site specific aquifer coefficients of transmissivity, storativity and leakance. Graphical methods will be used to analyze time / drawdown and distance / drawdown data while the aquifer test is in progress. This type of analysis can be done with commercially available software that includes the most popular analytical methods such as the Cooper-Jacob and Theis methods. These same methods can be applied manually with graph paper and a calculator, but this is generally more labor intensive and the data must be graphed separately for each analysis. The analytical methods will be selected to best represent the aquifer conditions encountered when installing the test and observation wells.

Analyzing the same aquifer test data by different methods may reach different results and it is often desirable to analyze both time / drawdown and distance / drawdown data to determine consistency of results. As a further check of results, collecting and analyzing water level recovery data should also yield results that are consistent with drawdown data. These data and analytical results would be compared to published data on Long island aquifers.

3.5.6 Aquifer Test QA/QC

Quality assurance and quality control (QA/QC) of the aquifer testing and analysis will cover the planning process, the field testing program and the data reduction and analysis. The QA/QC objective is to minimize the uncertainty of aquifer testing output that could in turn, adversely affect the groundwater modeling and the remedial design.

Planning the aquifer test and in particular, running a mathematical test simulation will enhance the selection of testing parameters and analytical methods. The simulation is essentially a "dry run" of the aquifer test that will help to avoid problems during the actual test, such as too high or low pumping rates, inappropriate observation well spacing, recharge interference and partial aquifer penetration effects.

Field QA/QC during the aquifer test will be maintained by using trained personnel with extensive aquifer testing experience and by adhering to flow and water level measuring procedures. The drilling contractor will be required to control the well pump output at a constant rate and to prevent pump shutdown due to mechanical failure. If automated water level recording devices such as transducers and data loggers are used, they will be checked periodically by manual measurement. A permanent record of all field measurements, data logger files, data plots and field notes will be retained.

Aquifer test analysis QA/QC will consist of data management and adherence to analytical procedures selected for the analysis. Data will be reviewed for obvious errors and reasonableness by checking against pre-test simulations and wherever possible, data will be electronically input to the analytical programs to prevent manual data transcription errors. The analytical results will also be checked for reasonableness with respect to historically documented aquifer parameters and by comparison of results between several analytical techniques. If there appears to be excessive variation in analytical results, input parameters will be rechecked and purposely adjusted as a "sensitivity analysis". If the sensitivity of any method is determined to be too high under the project circumstances for reliability, it will be rejected in favor of another method or methods.

3.5.7 Aquifer Test Deliverables

The aquifer test data, field logs, field and laboratory water quality data will be compiled for analysis after the field testing is completed. The results of the aquifer test analysis along with graphics depicting distance and time vs. drawdown, will be presented in a concise report with conclusions as to the well capture radius.

The aquifer test report will also comment on the comparison between the aquifer test results and the MODFOW simulation. Based on this comparison, the report may recommend adjustment of the model input data to more realistically reflect site-specific pumping stress.

3.6 Schedule

An aquifer test design will be submitted four weeks after the initial MODFLOW report is approved by NYSDEC, as shown on Table 1. The design will include aquifer testing procedures, specified testing equipment, test pumping well and observation well design.

4.0 DRILLING AND WELL CONSTRUCTION

4.1 Test Well Design

To achieve the ROD objective, the capture well system must be designed to have the correct depth, pumping rate and spacing between wells, otherwise the system may have an inadequate capture radius or may allow plume segments to pass uncaptured between the wells. In addition to running mathematical simulations, it is advisable to run a controlled aquifer test and conclusively determine the optimum well design. A test well is needed to run a controlled aquifer test that produces sufficient aquifer stress for confident determination of well design parameters.

A test well would be designed to be converted to a permanent capture well, if the test results prove favorable. In this case, a second pumping well would be installed, creating a two well system having the capture characteristics stated in the ROD. In the event that an additional well or wells is required, the aquifer test results would be relied upon to select the depth and placement of these wells.

4.2 Test Well Construction

The drilling and construction of the test well will be the same as for a permanent well. Well construction standards by the USEPA and the National Groundwater Association (NGWA) will be followed and referenced in design specifications / bidding documents, where applicable. Well construction oversight will be by a qualified hydrogeologist or engineer with appropriate well drilling experience.

Detailed well drilling and construction specifications will be prepared in the Remedial Design and are not included in this workplan, however the items to be covered in the Remedial Design are given below. Construction details for the test wells and piezometers are presented in Figures 3 and 4.

4.2.1 Drilling Contractor General Requirements

4.2.1.1 Site Visit

Prospective bidders will be invited to visit and inspect the worksite(s) and to review and ask questions on the specifications / contract documents to ensure familiarity with the work requirements and field conditions.

4.2.1.2 Drilling and Construction Permits

The contractor will obtain any and all required drilling, construction and other permits as may be required by Federal, State or local law and maintain these permits for the duration of the work.

4.2.1.3 Drilling Methods

The drilling contractor must provide a drilling rig capable of installing an 8 inch diameter well, 250 feet deep in a minimum 12 inch diameter borehole, to allow for installation of gravel packing and grout seal. The well will be plumb and have proper alignment to allow for unobstructed installing of pumping equipment. A test well schematic is shown on Figure 3.

The depth and diameter effectively eliminates auger drilling and cable tool drilling would be too slow to be acceptable, especially near the airport. Mud rotary or cased rotary methods are effective and locally available. Reverse rotary requires too much water and results in a large volume of cuttings, however, dual pipe reverse rotary has been used successfully for similar work.
All drilling equipment that comes in contact with the borehole will be steam-cleaned prior to mobilization and after completion of each well.

4.2.1.4 Geologic Log

Subsurface lithology will be logged and classified by the site hydrogeologist. Samples will be collected at 5 foot intervals using a 2-inch diameter, 24-inch long split spoon sampler. Samples will be retained in sealed glass containers. Standard penetration tests will be carried out and recorded in the field log notebook for each split spoon sample taken.

4.2.1.5 Geophysical Log

A geophysical borehole log will be run to determine the optimum placement of the well screen and to accurately establish the depth of clay strata that may affect the movement of groundwater near the recovery well. Geophysical logs are valuable in correlating geologic data from existing wells drilled for the RI/FS and new wells to be drilled during the design phase. A set of resistivity and spontaneous potential logs will be run to indicate relative formation permeability and a natural gamma log will be run to detect clay layers.

4.2.1.6 Test Well Construction

The test well will consist of 8 inch diameter steel casing and stainless steel screen for durability. The screen will be long enough to capture the full vertical extent of the 1000 ppb plume and a geophysical log will be run before any casings or screens are installed to aid in accurate screen placement. The final screen / gravel pack design will be based on site-specific geologic conditions and multiple screens may be required if the aquifer plume interval is divided by confining beds. Commercial gravel pack will be installed for the full length of the screen, plus an additional 20 feet above the top of the screen. The screen opening size and the gravel pack grain size will be selected based on formation sieve analyses.

The test well will be finished at grade in a manner that allows of easy installation and removal of well development, pumping and treating equipment. If the test well is to be converted to a permanent plume remediation well, the top of the well may be modified to conform to permanent remediation well specifications.

4.2.1.7 Surveying

Well locations will be surveyed to the nearest 0. 01 of a foot and elevation measurements will be made at the well casing and ground surface to the nearest one hundredth of a foot with reference to a USGS datum by a licensed surveyor. The well identification number and survey point will be permanently marked on the well.

4.2.1.8 Well Development and Testing

The well will be developed to maximum yield by the drilling contractor. The development method(s) may be selected form NGWA acceptable methods and will be applied by the contractor until drilling mud, formation "fines" and natural clays are removed and the well is at maximum efficiency. A test pump will be provided by the contractor and a "step test" will be run to establish specific capacity prior to aquifer testing.

4.2.1.9 Containment and Disposal of Potentially Contaminated Materials

Because of the nature of the project, there is a potential for drilling mud, formation water and cuttings to be contaminated with VOCs. Drilling equipment, tools, pumps, etc. that come in contact with the above may also be potentially contaminated. The contractor will be required to control and limit access to the drilling equipment, slurry pit(s), mud tank and the like pending analytical results. Likewise, the drilling equipment and tools will be decontaminated at the site and the washwater, if any, retained for analysis to determine handling and disposal. Any materials determined to require special handling will be containerized and properly disposed of.

4.3 Monitoring Wells and Piezometers

4.3.1 Monitoring Well and Piezometer Design

The remedial design will include monitoring wells and piezometers that will be used for groundwater sampling and water level measurements. These wells will be drilled at specific locations and depths determined by the available groundwater data and the results of groundwater modeling. The Outpost Monitoring Wells discussed in Section 4 are to be constructed according to the same methods and specifications described below.

The monitoring wells and piezometers may be shallow or deep, depending on their specific uses. The deep monitoring wells will range from approximately 100 feet to 300 feet deep and the shallow wells will range from about 25 feet (water table) to 75 feet deep.

The purpose of the monitoring wells is to provide groundwater samples from specific aquifer depths and locations. These wells may be used to establish plume boundaries, monitor water quality trends during and after aquifer testing and during long term monitoring. Piezometers are monitoring wells dedicated to water level measurements. Shallow and deep piezometers will provide water table elevations and piezometric head data at different depths of the aquifer system.

4.3.2 Drilling Methods

Shallow piezometers (less than 100 feet deep) may be drilled with a 6-inch inside diameter hollow stem auger. Deep piezometers (more than 100 feet deep) will be drilled by small diameter mud rotary. Multiple depth monitoring wells and piezometers (clusters) may be installed in a single, large diameter borehole with individual screen zones separated by grout seals, depending on the depth, number and diameter requirements of a particular installation.

All drilling equipment that comes in contact with the borehole will be steam cleaned prior to mobilization and after completion of each well.

4.3.2.1 Geologic Log

Subsurface lithology will be logged and classified by the site hydrogeologist. Samples will be collected continuously at 5 foot intervals using a 2-inch diameter, 24-inch long split spoon sampler. Samples will be retained in sealed glass containers. Standard penetration test will be carried out and recorded in the field log notebook for each split spoon sample taken. If more than one borehole is drilled at a particular location, only the deepest hole will have split spoon samples collected.

4.3.2.2 Geophysical Logs

Deep monitoring wells and piezometer boreholes will be geophysically logged to determine correct screen depths and for geologic correlation with other borehole logs form the study area. A natural gamma log will be run for lithologic interpretation and comparison with formation samples.

4.3.2.3 Monitoring Well and Piezometer Construction

The monitoring wells and piezometers will be constructed to allow easy access and installation of sampling and water level measuring equipment, such as pumps, bailers, sounding devices and automated water level recording equipment.

4.3.2.4 Well Casings and Screens

The monitoring well or piezometer assembly will be 2-inch or 4-inch diameter flush joined, internally threaded PVC riser pipe attached to 10 feet of machine perforated flush joined PVC well screen with a slot size of 0.02 inches (20 slot). The well diameter and screen length may be varied to accommodate site-specific aquifer conditions and /or special intended uses. A typical monitoring well / piezometer schematic is shown on Figure 4.

4.3.2.5 Filter Pack

A clean silica sand filter pack will be installed around the piezometer screen by gravity placement, and extend 3 feet above the well screen. A one-foot layer of fine sand will be placed over the filter pack to limit the downward migration of bentonite.

4.3.2.6 Bentonite Seal and Surface Protection

A two-foot layer of bentonite pellets will be installed by gravity placement to seal the filter pack. A bentonite/cement grout will be installed by tremie to seal the borehole annulus, and will terminate three feet from grade.

A three-foot deep concrete collar will be installed above the grout, and a protective locking surface casing will be placed over the piezometer. The surface casing will extend 2-3 feet into the concrete to prevent frost heaving. An above grade surface casing will be used in wooded, off-road areas and will be at least 2 feet high and painted for visibility. Installations in roadways, parking areas or other areas not to be obstructed above grade, will be in an approved , water-tight road box and will be clearly marked "Monitoring Well".

4.3.2.7 Development

The monitoring wells and piezometers will be developed after 7 days, but not less than 14 days of completion by pumping to remove traces of drilling fluid and formation "fines". The change in water level in response to pumping will be recorded to document adequate interaction between the piezometer and the aquifer.

4.3.2.8 Surveying

Piezometer locations will be surveyed and elevation measurements will be made at the well casing and ground surface to the nearest one-hundredth of a foot with reference to the USGS mean sea level datum by a licensed New York surveyor. The piezometer identification number and survey point will be permanently marked on the piezometer.

4.4 Schedule

Installation and development of test wells, monitoring wells and piezometers, geophysical logging and surveying will be completed within 16 weeks of drilling contractor's notice to proceed with the work, as shown on Table 1. The contractor may be required to mobilize more than one drilling rig to complete the work on schedule.

5.0 OUTPOST MONITORING WELL SYSTEM

5.1 General

The MPS ROD requires installing monitoring wells between the MPS plume and the three nearest public supply well fields, East Farmingdale Route 109, SCWA Albany Avenue and SCWA Tenety Avenue. There are three additional wellfields that do not appear to be threatened by the MPS plume at this time, SCWA North 5th Street, SCWA Lambert Avenue and SCWA Great Neck Road. Nevertheless, these wellfields may be recommended for outpost well monitoring in the future, if the results of long-term groundwater monitoring and modeling indicate such a threat. Installing dedicated outpost wells at these wellfields is not necessary at this time, because SCWA Albany Avenue and Tenety Avenue are directly upgradient of SCWA Lambert Avenue and North 5th Street, respectively, and Great Neck Road reportedly has outpost wells.

The objective of this task is to place these monitoring wells, called "outpost wells," at locations that would give an early warning of a contaminant plume migrating toward a well field. The outpost wells would be drilled to a depth that would intercept a plume in the aquifer zone tapped by public water wells. The site selection would consider groundwater travel time to give a minimum of three years warning before corrective action, such as wellhead treatment, would have to be implemented.

5.2 Site Selection

The site selection process is complicated by a number of factors that will be addressed in the Remedial Design. These factors will be studied and resolved to the extent practical by additional groundwater sampling, aquifer testing, modeling and gathering information on regional water quality from site investigations by others in the study area. Without this additional information, outpost well site selection would become a "hit or miss" proposition and there would be no assurance that the wells would provide the intended early warning function.

The outpost well design and site selection will take place after the MODFLOW model is constructed and calibrated and after the aquifer testing is completed. The final site selection may have to be determined after additional modeling runs are completed and future public supply well pumping distributions are addressed.

5.2.1 Site Selection Criteria

The study area will include the Mairoll site and the downgradient area covering the three well fields plus an additional area beyond as shown on Figure 2, Study Area Map. Detailed geologic and geophysical data are available for the MPS and Republic Airport and were reported in the RI/FS. Geologic and geophysical logs are generally available for deep public supply wells and some industrial wells and these will be obtained for the study area for correlation with the MPS data. The USGS will also be consulted for information on the Gardiners Clay that occurs just south of Republic Airport, based on published information. A special effort will be made to obtain aquifer profiling data from other remedial investigations or from special investigations, such as the SCDHS Miller Avenue study.

5.2.1.1 Regional Geologic Analysis

Geologic cross-sections of the study area will be drawn to depict aquifer lithology between the MPS and the public well fields. Existing wells will be depicted on the cross-sections along with screen depths and available water quality data. If one or more of the existing wells would serve as effective outpost monitoring wells, Mairoll may request access for sampling and possibly long-term monitoring. The purpose of the cross-sections is to delineate as accurately as possible, the groundwater flow paths in the aquifer units that could potentially be affected by the MPS plume and to make sure that these flow paths are adequately covered by the outpost well network. These cross sections will also be used in groundwater model development.

5.2.1.2 Regional Groundwater Flow Analysis

Regional water table and potentiometric contour maps are published by the USGS and by Nassau and Suffolk Counties. Site-specific groundwater contour maps were prepared as part of the MPS RI/FS and the elevations and flow directions depicted on these maps were consistent with the regional maps. A new set of groundwater contour maps will be prepared for the study area using data from the Mairoll monitoring wells and available USGS and SCDHS observation wells. The water level data will be obtained from wells screened in the various hydrogeologic units so that both horizontal and vertical data will be represented. These data will be used to determine the potential for groundwater flow and contaminant transport between hydrgeologic units. This is particularly important with respect to the East Farmingdale Route 109 well field, because although the pumping wells are over 700 feet deep, this well field is closest to the MPS plume of the three well fields under consideration.

5.3 Outpost Monitoring Well Design

The outpost monitoring wells are to be drilled at strategic locations and depths to allow periodic screening of groundwater quality along the groundwater flowpaths between the MPS plume and the public supply well fields. The design will address the need to monitor intervals of the aquifer that are similar to those tapped by the public supply wells as opposed to monitoring narrow, discrete intervals. The design objective is to maximize the chances of a detection in a saturated interval up to 300 feet thick.

The outpost well system will consist of well clusters covering the range of depths required at each location. Each cluster will be designed individually because geologic and groundwater flow conditions may vary between locations. The design will be based on site-specific borehole data, including geologic formation samples, geophysical logs, and water quality profiling. These data will also provide an indication whether contamination is already present at a proposed outpost well site, as well as a preliminary characterization of the contamination.

The outpost wells will be designed in accord with USEPA and NYSDEC monitoring well design criteria as described in Section 4.0. The well drilling technique and construction materials will be compatible with the constituents to be monitored in the groundwater. Mairoll may consider using a multi-level groundwater monitoring well system as an alternative to standard well clusters if this will provide representative groundwater samples and water levels and the system is acceptable to the Department. Some of the recently developed multi-level monitoring devices are reported to yield representative groundwater samples while minimizing purging water volumes and sampling time, while maintaining QA/QC equal to or exceeding that of a standard monitoring well.

5.4 Well Permits and Access

The outpost wells should be drilled on public rights-of-way, to avoid complicating delays in obtaining easements and access agreements from private parties. Requirements for well and street opening permits, easements, etc. will be determined as part of the design.

5.5 Outpost Well Design Deliverables

The hydrogeologic database and the MODFLOW and MODPATH modeling of future plume travel will be reviewed and three outpost well candidate areas will be delineated. The areas will be generally defined as meeting the three year early plume warning criterion and will be further defined to individual sites as soon as access can be determined.

An outpost well design report will be prepared containing the compiled hydrogeologic database, the modeling output and recommended outpost well locations. The report may include alternative locations pending access resolution. Design information will include the well drilling and installation methods, construction materials, manufacturers information, sampling procedures and operations and maintenance (O&M) requirements. The design will also include well security protective measures appropriate to each outpost well site.

5.6 Outpost Monitoring

The outpost monitoring wells will be sampled quarterly for the first year to determine a water quality baseline. Long term monitoring will be on a schedule acceptable to the Department and Mairoll. If the outpost monitoring detects unremediated MPS plume residuals, the following actions will be taken:

- NYSDEC, SCDHS and the water utility will be notified of the detection.
- The affected outpost well(s) will be resampled more frequently for verification.
- If a plume impact is verified, the minimum time for implementing wellhead treatment will be estimated.
- Wellhead treatment or other strategy acceptable to the utility, SCDHS and NYSDEC will be selected and implemented in sufficient time considering groundwater travel time.

5.7 Schedule

The outpost well design will take 4 weeks to complete, as shown on Table 1. A report will be submitted at the same time as the groundwater remediation design report. The design and placement of the outpost wells is linked to the design and operation of the groundwater remediation system because the system will affect the future downgradient movement of plume residuals. An additional MODFLOW run depicting the operation of the final groundwater remedial design is recommended before the outpost well locations are finalized.

6.0 GROUNDWATER TREATMENT TESTING AND ANALYSIS

6.1 General

Air stripping VOC contaminated groundwater is a proven remedial technology and an air stripping treatability study will not be necessary as part of the remedial design process. Air stripping has been used extensively and has been documented to perform consistently and reliably over a large range of flow rates and conditions. Vendors indicate that VOCs can be consistently removed to below 1 ppb. and removal rates as high as 99.9% are readily achievable. There are no unusual conditions or contaminants at the site that are expected to negatively affect groundwater treatment for VOCs by air stripping.

There are other aqueous phase treatment technologies available, including granular activated carbon (GAC), but these are not commonly used to treat high flow rates and / or high VOC concentrations. GAC will be considered for vapor phase treatment in conjunction with air stripping if it is indicated by pilot test results.

6.2 Purpose and Scope

The purpose of the treatment testing is to determine the optimum design and capacity of an air stripping unit that would be capable of treating the groundwater from the Mairoll MPS plume at the concentrations and flow rates anticipated in the ROD. The groundwater quality data collected during the RI indicate that halogenated VOCs, notably tetrachloroethene, trichloroethene and dichloroethene are the main contaminants that must be treated. There may be some other VOCs present in the groundwater due to breakdown of the above compounds or from sources other than the Mairoll MPS plume. Nevertheless, air stripping is effective in removing such VOCs and their presence would not adversely affect the application of this treatment technology. The data derived from the testing will be provided to treatment equipment vendors as a basis for specifying an optimally sized treatment unit.

There may be constituents present in groundwater that could affect Mairoll's treatment system for VOCs and the quality of the effluent to be recharged to the aquifer. These constituents, such as iron and manganese, may be unrelated to the Mairoll MPS plume but could affect the treatment efficiency or the equipment operation and maintenance. The need for pre-treatment or post- treatment to maintain proper VOC treatment and/or to meet State groundwater discharge limits, will be evaluated.

6.3 Treatment Sampling and Analysis

Groundwater samples will be collected from the aquifer test wells analyzed analyzed for VOCs, SVOCs total and dissolved solids and priority pollutant metals and iron and manganese. The samples will be analyzed for iron and manganese, because these metals may precipitate and increase suspended solids concentrations when the groundwater is aerated during the air stripping process.

A treatment pilot test will be run in conjunction with the aquifer test and recharge test. The treatment pilot test will use a temporary air stripping or GAC unit that will be needed to remove VOCs from the test well discharge. The treated water could then be used for the recharge test in conformance with New York State discharge standards. If the test results indicate that the treated groundwater contains high concentrations of suspended solids, additional tests may be performed to determine the need for pretreatment. The analyses will be used as a guide to determine the type of applicable pretreatment processes, the design of the pretreatment system and to provide estimates of the O&M requirements implied by the pretreatment system.

6.4 Treatment Assessment

The results of the treatment testing and groundwater analyses will be reviewed and evaluated as a basis for a treatment system design. The evaluation will consider the following criteria.

- Effectiveness of air stripping as the remedial treatment technology
- Type and size of the treatment system
- Ability of the system to treat varying VOC concentrations
- Effect of other groundwater constituents on air stripper and recharge system O&M
- Need for pre- or post-treatment to maintain long term operation

6.5 Case Studies

Available reports and data on similar systems operating on Long Island will be sought and reviewed. Groundwater pump & treat systems tapping the same aquifer units, possibly near the Mairoll Study Area, would have to address the same water quality problems that could potentially affect the proposed system.

6.6 Treatment Testing and Analysis Report

The results of the treatment testing and analysis will be compiled and report will be prepared on the effectiveness of the proposed treatment technology. The report will include recommendations for the design of a full-scale treatment system.

6.6 Schedule

The treatment testing would be conducted in conjunction with the aquifer test and the recharge test. The Treatment Testing and Analysis Report would be submitted at the same time as the Aquifer Test report. Field testing, laboratory analyses and engineering evaluation would take an estimated 8 weeks , as shown on Table 1.

7.0 SAMPLING AND ANALYSIS PLAN

7.1 Scope of Sampling and Analysis Activities

This section details the sampling, analysis and monitoring activities and procedures that will be performed at the site during the remedial design phase. Sampling protocols are presented in Section 7.7 and the existing monitoring well sampling locations are shown on Figure 1. Sample collection and analysis protocols are described in Sections 7.7 and 7.8.

7.1.1 Groundwater Sampling

Groundwater samples will be collected from all existing and new Mairoll monitoring wells to track the concentrations of VOCs in the shallow and deep groundwater aquifers. The samples will be collected quarterly for the first year and analyzed for VOCs. Groundwater samples will also be collected and analyzed for iron, manganese and total dissolved solids as a basis for predicting possible clogging of the proposed groundwater treatment and recharge systems..

A group of wells will be selected for monitoring of natural attenuation parameters. The wells will be selected to represent aquifer conditions at a number of locations and depths within and outside the plume. The sampling procedures and analytes will be based on the USEPA document EPA/600/R-98/128 "Technical Protocol For Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water", September 1998.

7.2 Pilot-Scale Testing

The groundwater data collected during the RI/FS indicate that the VOCs present in the MPS plume would be treatable by readily available treatment technologies, notably by air stripping and granular activated carbon (GAC) absorption. The purpose of the pilot-scale tests is to determine the optimum treatment unit sizing, to evaluate the need for pretreatment, and to assess the need of using granular activated carbon (GAC) filters in conjunction with an air stripping tower in the groundwater treatment system. The pilot-scale tests will also serve to determine the operation and maintenance requirements of a full scale system. A detailed description of the pilot-scale tests is included in the Treatability Study Work Plan (TSWP), which is presented in Section 6.0.

7.3 Aquifer Characteristics Evaluation

Pump tests will be conducted to determine capture zones, and recharge and mounding characteristics. A recovery well will be drilled at the location of one of the proposed capture wells described in the ROD . This well will be used to conduct pumping tests and may also be part of the pump and treat remedy. Recharge and mounding will be evaluated by installing a temporary test leaching pit and recharging at various flow rates for a period of one to five days. Existing wells and temporary piezometers will be used to evaluate capture zones and mounding effects. A detailed description of the design and implementation of the pump tests is included in the Aquifer Test Work Plan (ATWP), which is presented in Section 3.0.

7.4 Quality Assurance/Quality Control (QA/QC)

All QA/QC procedures for sampling, testing, monitoring and treatability study activities conducted during the remedial design work are described in each section. QA/QC procedures will also be included in design components dealing with long term monitoring, operation and maintenance.

7.5 Health and Safety

Health and safety procedures for all activities conducted during the remedial design work are included in the Health and Safety Plan (HASP) , which is presented in Section 9.0.

7.6 Project Schedule

Table 3 presents the estimated remedial design schedule. The work tasks outlined in the schedule would proceed upon approval of this RDWP by NYSDEC.

7.7 Sampling Procedures

7.7.1 Groundwater

(1) Enter well identification in field log notebook.

(2) Place new plastic sheeting over and around the monitoring well so that a 5 x 5 foot clean surface is created for the sampling equipment. All materials, tools and equipment will be cleaned prior to placement on the plastic.

(3) Clean the top of the well, remove well cap and place it on the plastic sheeting.

(4) Measure the depth to water below the reference point (top of casing) using a chalked, steel tape to the nearest 0.01 foot. The steel tape will be cleaned with phosphate-free detergent and rinsed with distilled water between measurements.

(5) Refer to the well depth and calculate the volume of standing water by multiplying the appropriate gallons per linear feet of 4-inch (or 2 inch) diameter pipe times height of standing water.

(6) Purge well with submersible pump until at least in accord with USEPA and NYSDEC protocols. Record the physical appearance and temperature of the purged groundwater. Measure specific conductance and pH a minimum of two times and record a final measurement immediately

following sample collection.

(7) Prepare sample bottles to receive samples.

(8) Immediately pour the sample into the respective sample bottles. Vials used for VOC samples must be filled to overflow so that no air bubbles are visible once capped. Seal all sample containers according to laboratory directions.

(9) Replace well cap and lock.

(10) Discard plastic sheeting, and other expendable materials.

7.7.2 Supply Wells

(1) Enter well identification in the field log notebook. Also note the use of the well (public supply, irrigation, air conditioning, etc.).

(2) Determine the water sample discharge point (sampling tap, hydrant, hose bib, etc.) and note in log.

(3) Ask the well owner / operator if there is any treatment being added to the water (chlorine, pH adjustment, polyphosphate, etc.). Ask to have treatment turned off, if possible.

(4) Determine the pumping rate and the length of time the well has been pumping before sampling, allowing sufficient time for full evacuation of any standing water. (Note: information on the well depth, diameter, screen zone and pumping rate should be obtained before sampling).

(5) Prepare sample bottles to receive samples.

(6) Immediately pour samples into respective sample bottles. VOC sample bottles should be completely filled, without any headspace or air bubbles. Seal all containers according to laboratory directions and place in cooler.

(7) Make sure well and sampling tap are secure and left in good order.

7.8 Analysis Plan

Groundwater samples will be collected during the test well and monitoring well installation task, the aquifer, treatability and recharge tests, and during ongoing groundwater monitoring of the monitoring and outpost wells.

Monitoring wells, outpost wells and supply wells will be sampled and analyzed for VOCs. The test wells will be sampled and analyzed for VOCs, SVOCs, total and dissolved solids, priority pollutant metals and iron and manganese. Analytical constituents and, USEPA / New York State laboratory method numbers are listed below.

• VOCs	Method #8260 (GC/MS)
• SVOCs	Method #8270 (GC/MS)
• Priority Pollutant metals	Method #6010 (ICP)
• Iron	Method #6010
• Manganese	Method #6010
• Total Dissolved Solids	SW846
• Total Suspended Solids	SW846

A New York State certified laboratory will be selected for the analytical services to be performed under this plan. The laboratory will be required to submit copies of certifications for the required analyses and QA/QC procedures.

7.9 Schedule

The sampling and analytical work to be done under this task will be included in a number of the design tasks, at different times over the project schedule. Therefore, no specific reference is made to this task on Table 1, Project Schedule.

8.0 DESCRIPTION OF REMEDIAL DESIGN TASKS

8.1 Remedial Design Report

The following remedial design reports shall be prepared pursuant this RDWP:

- Preliminary Design Report (35% completion)
- Pre-Final Design Report (90% completion)
- Final Design Report (100% completion) following:

Each design report will include the following:

1. Discussion of design criteria and objectives with emphasis on the capacity and ability to meet design objectives.

2. Plans and Specifications that have been completed.

3. The rationale for the Plans and Specifications, including supporting calculations and documentation of how these Plans and Specifications will meet the design requirements.

4. Sampling, Analysis and Monitoring Plan for sampling, analysis and monitoring to be performed during the remedial construction phase of the work.

5. A Quality Assurance Project Plan (QAPP) for sampling, analysis, testing and monitoring to be performed during the remedial construction phase of the Work.

The QAPP shall also address quality assurance requirements and standards relating to construction operations. Quality assurance items to be addressed include, at a minimum, the following:

- Inspection and certification of the Work;

- Measurement and daily logging;

- Field performance and testing;

- As-built drawings and logs; and

- Testing of the work to establish whether the design specifications are attained.

6. A report describing those efforts to secure access and obtain other approvals and of the results of those efforts. Legal descriptions of property or easements to be acquired shall be provided.

7. Federal and State environmental permit applications, if necessary.

8. A plan for photographic documentation of the remedial construction work.

9. A preliminary operation and maintenance (O&M) plan, for the O&M phase of the work.

10. A plan for site restoration and regrading.

11. Discussion on the post-remediation groundwater monitoring program.

12. A schedule for Remedial Construction activities, and a draft schedule for O&M activities and Post-Remediation Monitoring activities.

8.2 Preliminary Design Report: Additional Requirements

The Preliminary Design Report shall also include:

1. Results of all sampling and testing performed as part of the Remedial Design work.

2. Process flow diagrams and preliminary construction drawings showing general arrangement of all work proposed.

3. Table of Contents for the specifications, including a listing of specifications items from the Construction Specifications Institute master format expected to be included in the construction specifications. This master format is presented in the Construction Specifications Institute's "Manual of Practice", latest edition.

4. Engineering plans representing an accurate identification of existing site conditions, and an illustration of the work proposed. Typical items to be provided on such drawings, at a minimum, include the following:

- Title sheet including at least the title of the project, a key map, the name of the designer, date prepared, sheet index, and project identification.

- All property data including owners of record for all properties within 200 feet of the Site. The distance and bearing of all property lines that identify and define the project Site.

- All easements, rights-of-way and reservations.

- All buildings, structures, wells, facilities, controls, equipment and features, existing and proposed at the Site.

- A topographic survey, including existing and proposed contours and spot elevations, based on U.S. Geological Survey data.

- All site utilities, existing and proposed.
- Location and identification of all significant natural features including, wooded areas, water courses, wetlands, flood hazard areas and depressions at the site.
- North arrow, scale, sheet numbers and the person responsible for preparing each sheet.
- Decontamination areas, staging areas, borrow areas and stockpiling areas. Miscellaneous detail sheets.
- Definitions of all symbols and abbreviations.
- Items not typically required in the preliminary phase of design drawings include: electrical drawings; mechanical drawings; HVAC (heating, ventilation and air conditioning) drawings; structural drawings; and miscellaneous construction details.

8.3 Pre-Final Design Report: Additional Requirements

The Pre-Final Design Report shall also include:

Survey work that is appropriately marked, recorded and interpreted for mapping, property easements and design completion.

Construction drawings of all proposed facilities, equipment, improvements# details and all other construction and installation items shall be developed in accordance with the current standards and guidelines of the New York State Board of Professional Engineers and Land Surveyors. Drawings shall be of standard size, approximately 24" x 36". A list of drawing sheet titles will be provided.

Engineering Plans indicating, at a minimum the following: site security measures. Roadways. Electrical, mechanical and structural drawings.

An operations and maintenance (O&M) manual that will cover the long term system operation, monitoring, scheduled maintenance and repairs will be prepared with the final design.

8.4 Remedial Design Schedule

Table 1 shows the implementation schedule for the remedial design tasks outlined in this report.

9.0 HEALTH AND SAFETY PLAN

A Health and Safety Plan (HASP) for the remedial construction work shall be developed to address the protection of MAC workers and public health and safety; and respond to contingencies that could impact public health, safety and the environment during the remedial construction period. The HASP shall satisfy the requirements of the "Occupational Safety and Health Guidance for Hazardous Waste Site Activities", (October 1985, DHH 5 NIOSH Publication No. 85-115), and the Occupational Safety and Health Administration, U.S. Department of Labor ("OSHA") requirements cited below.

Site activities such as inspections, investigations and remedial activities shall be performed to ensure the safety and health of personnel and shall be conducted in accordance with the pertinent general industry (29 CFR 1910) and construction (29 CFR 1926) OSHA standards, as well as any other applicable State and municipal codes or ordinances. All site activities shall comply with those requirements set forth in OSHA's March 6, 1989 Final Rule entitled "Hazardous Waste Operations and Emergency Response", 29 CFR 1910.120, Subpart H.

The HASP is included in Appendix A.

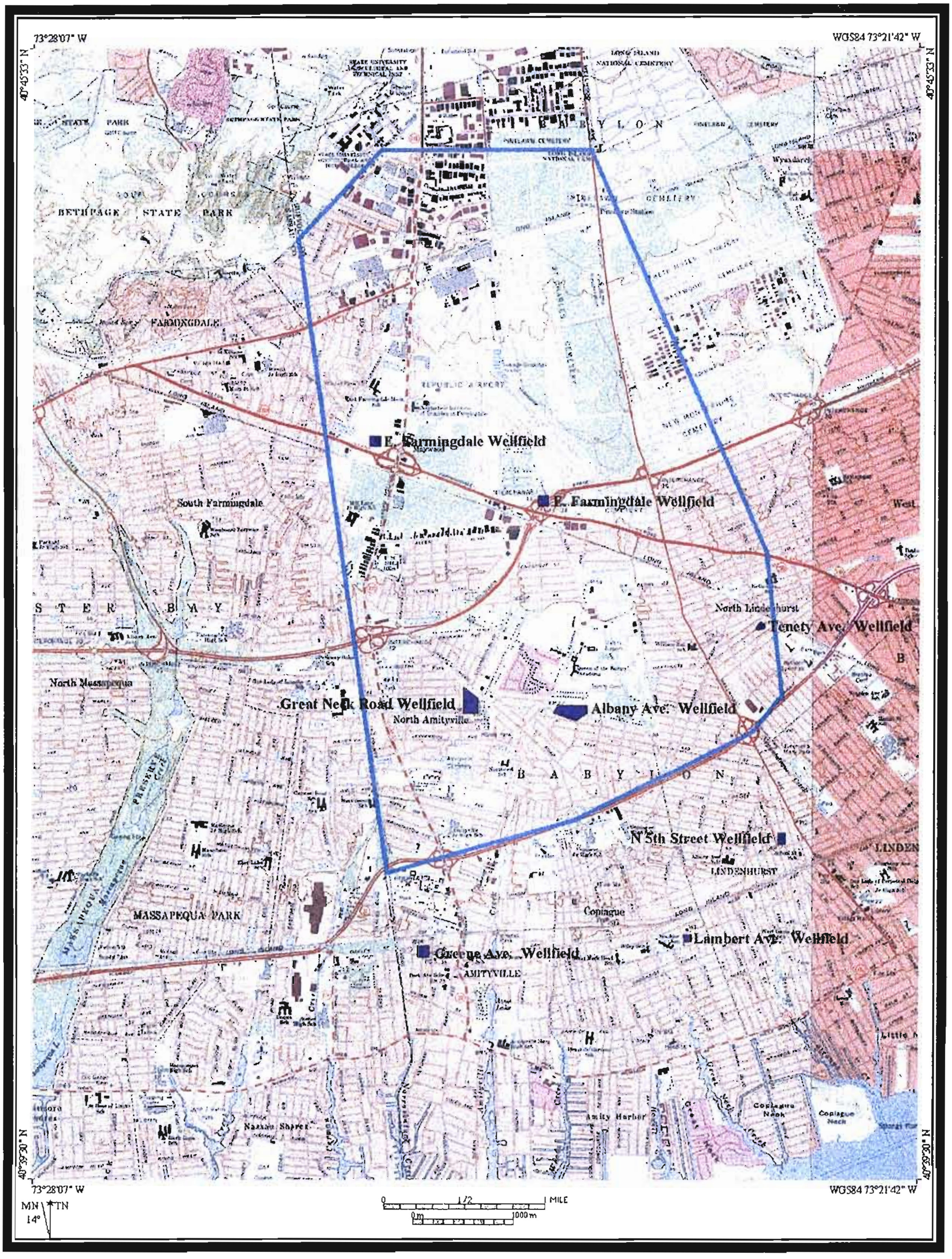
TABLE 1

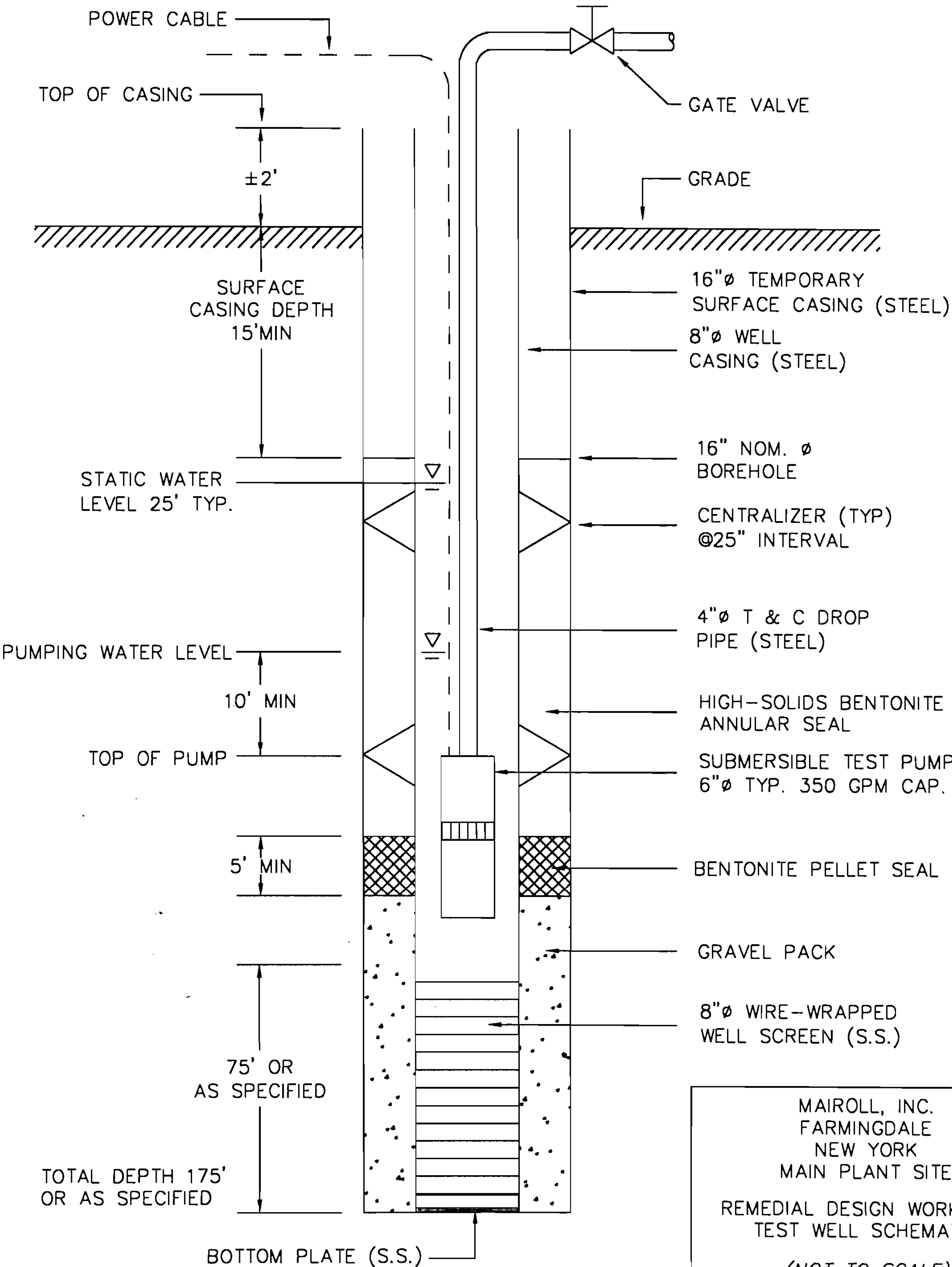
MAIROLL GROUNDWATER REMEDIATION Project Schedule: 1999 - 2000

				1999					2000										
Task	Start	Wks	Done	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November
Conceptual Model	Aug 15	4	0%																
NYSDEC Review	Sept 15	4	0%																
Numerical Modeling	Sep 1	12	0%																
Sample/Analyze Existing Monitoring Wells	Aug 15	4	0%																
Aquifer Test Design	Dec 15	8	0%																
Well Design, Specs	Aug 15	12	0%																
NYSDEC Review	Nov 15	4	0%																
Contractor Bids	Dec 15	4	0%																
Install Wells/Piezometers	Jan 15	16	0%																
Aquifer Test/Analysis	May 15	4	0%																
Outpost Well Design	Jun 15	4	0%																
Treatability Study	May 15	8	0%																
Preliminary Design	May 15	8	0%																
NYSDEC Review	Jul 15	4	0%																
Pre-Final Design	May 15	16	0%																
NYSDEC Review	Sep 15	4	0%																
Final Design	Oct 15	4	0%																

Note: The project schedule assumes reasonable times to complete various work tasks. Wherever possible, times will be compressed and the schedule will be updated accordingly.

Figure 2
Mairoll Groundwater Study Area





MAIROLL, INC.
FARMINGDALE
NEW YORK
MAIN PLANT SITE

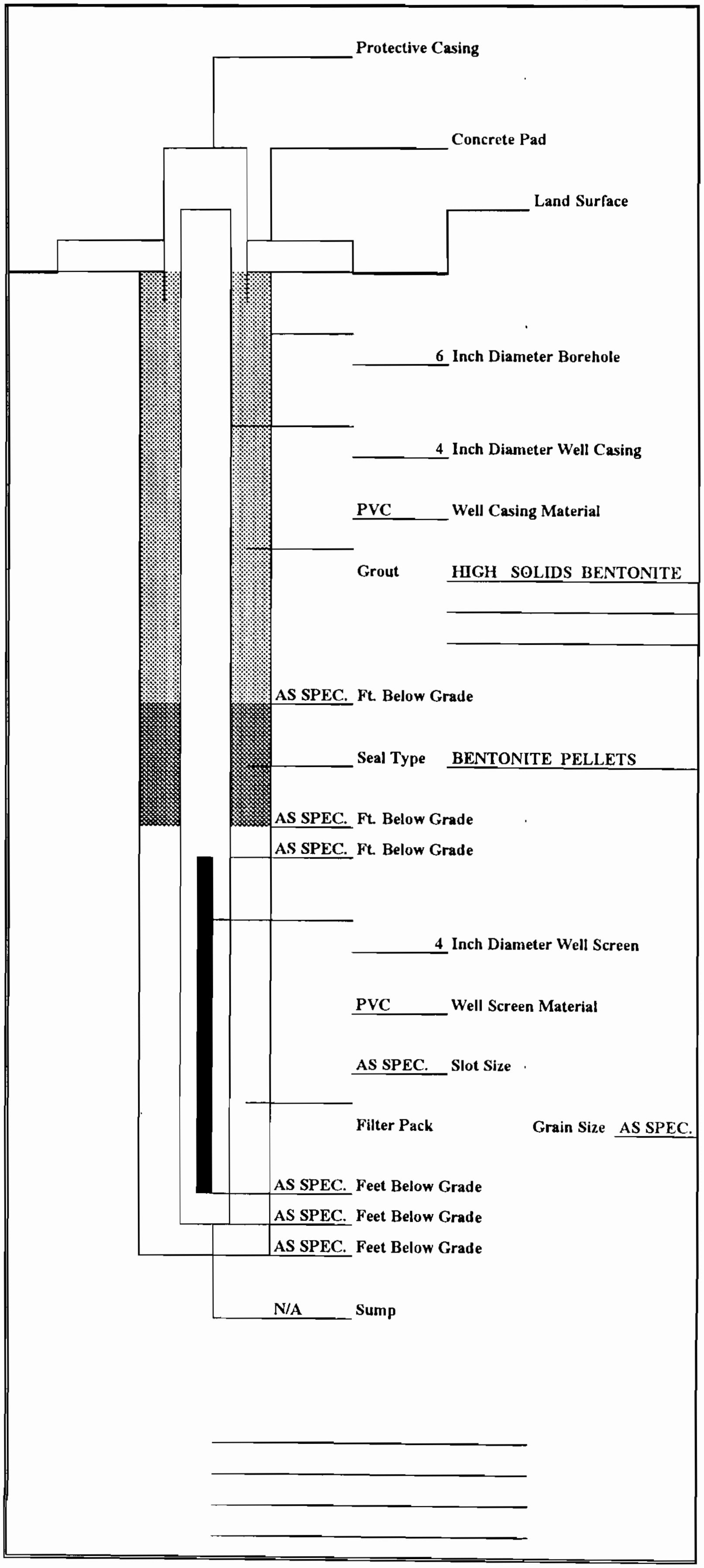
REMEDIAL DESIGN WORKPLAN
TEST WELL SCHEMATIC

(NOT TO SCALE)

FIGURE 3

MAC CONSULTANTS, INC.

FIGURE 4
MONITORING WELL / PIEZOMETER SCHEMATIC



MAIROLL, INC.

MAIN PLANT SITE

FARMINGDALE, NEW YORK

HEALTH AND SAFETY PLAN

April 1999

MAC CONSULTANTS, INC.
515 Route 111
Hauppauge, New York 11788
tel 516-265-7700
fax 516-265-9073

TABLE OF CONTENTS

ATTACHMENTS

1.0 INTRODUCTION

Mairoll Inc., East Farmingdale, New York has requested that MAC CONSULTANTS, INC. **(MAC)** perform groundwater monitoring and collect the information needed to design the groundwater remediation system at the Main Plant Site. This Health and Safety Plan (HASP) has been developed to address the potential physical and chemical hazards that **MAC** employees may face while performing the planned field activities. This HASP establishes procedures to minimize worker's exposures through personal protective equipment and safe work practices. This HASP has been developed to meet the requirements of the Occupational Safety and Health Administration (OSHA) regulation, Title 29, Code of Federal Regulations, Part 1910.120 (20 CAR 1910.120), "Hazardous Waste Operations and Emergency Response" (OSHA 1989). It is intended for the protection of **MAC** employees. Anyone else, such as subcontractors, client, and visitors may review **MAC**'s HASP and follow its procedures if they so decide. Subcontractors and others working on the site must provide their own HASP to be followed by their personnel.

2.0 RESPONSIBILITIES

Kevin McHale has been designated as the Site Safety Officer (SSO) for **MAC**. He will be responsible for implementing the procedures and safe work practices established in this HASP. In the event that the SSO must leave the site while the work is in progress, an alternate SSO will be designated to ensure that the HASP will continue to be followed. The SSO will report all health and safety matters to the project manager, Michael McEachern, who has responsibility for overseeing the planned activities. Christopher Creed, a MAC principal, will also be available on an as needed basis. Subcontractors and others that may be involved in the work must designate an SSO for their firm and the SSO shall enforce compliance with the subcontractors HASP.

3.0 SITE DESCRIPTION

The Mairoll Main Plant Site is located on the east side of Route 110, north and south of Conklin Street (Route 24). The multi-building facility had been in operation since the 1930s and was closed in 1988. During this period, the facility was used for aircraft manufacturing and included processes such as metal forming, machining, and milling. Various raw materials and chemicals were used for manufacturing purposes. The industrial buildings have been demolished and the property is being redeveloped as the Airport Plaza Shopping Center.

The off-site work will occur on Republic Airport property, which is adjacent (south) to the Mairoll facility. It is an active airport with strict safety regulations. These safety regulations have been incorporated into this HASP.

4.0 PLANNED FIELD ACTIVITIES

The following is a brief description of the planned field activities by task:

Task 1. Inspection, repair, redevelopment and sampling of existing monitoring wells.

Task 2. Soil Borings will be drilled as necessary to collect data for the remedial design.

Task 3. Installation of outpost monitoring wells.

Task 4. Collection of ground-water samples. Upon completion of the outpost wells, ground-water samples will be collected from the new and existing wells for analysis.

Task 5. Depth to water measurements will be collected at all new and existing wells. including public water supply wells.

Additional details of each of planned field activity are provided in the work plan developed for this remedial investigation.

5.0 HAZARD EVALUATION

The potential physical and chemical hazards associated with the planned field activities for this site have been evaluated in this document. Existing information such as past site experience, site history, and soil and ground-water sampling results, are all used in this evaluation process.

The physical hazards associated with the planned field activities include the following: potential for being struck by flying and falling objects while working near the drill rig; being splashed with potentially contaminated liquids during well installation and well sampling; and slips and falls due to wet or uneven surfaces. Additional potential hazards will be present when the field activities are moved off-site to Republic Airport, which will be active.

The chemical hazards associated with this site are based on the soil and groundwater sampling results obtained from the RI/FS. Volatile organic compounds (VOCs) such as vinyl chloride, tetrachloroethylene, and trichloroethylene were detected in the groundwater during this study. Based on this information, the following exposure pathways have been identified in order to minimize potential worker's exposure:

- Inhalation of vapors and gasses.
- Direct skin contact with and absorption of vapors, liquids, soil, and sediments.
- Accidental ingestion of contaminants.

Measuring the depth to water in public water supply wells may be classified as a confined space entry. Therefore, additional preventative measures will be taken to ensure the safety of the personnel entering the well pits.

6.0 AIR MONITORING

Air monitoring will be conducted at this site during all planned field activities in order to ensure that the workers are appropriately protected from inhalation of organic vapors. A Photo Ionization Detector (PID) will be used. This instrument is designed to measure trace quantities of VOCs in air. This instrument will be calibrated each morning before field use.1

A combination meter for measuring oxygen deficiency and the presence of flammable/explosive gases and vapors will be used if confined space entry is necessary during any of the tasks.

7.0 ACTION LEVEL

To evaluate whether actual field conditions will require an upgrade in the level of protection, the following action level procedure base upon the existing data based has been established for all planned field activities. Air monitoring will be conducted using an PID instrument during each task. A 1 part per million (ppm) reading for a sustained period of 5 minutes in the worker's breathing zone has been selected as an action level based on the presence of vinyl chloride. If this occurs, a second screening step using a Draeger tube specific for vinyl chloride will be done to confirm whether vinyl chloride concentrations exceed 1 ppm in the worker's breathing zone. If the action level is exceeded, work will be discontinued, the work area will be permitted to vent while the workers move to an area upwind. Work will not resume until the vinyl chloride concentrations fall below 1 ppm. If after 30 minutes, the concentration of vinyl chloride does not fall below the action level, then the work will resume with the level of protection upgraded to Level C using a full-face air purifying respirator equipped with an organic vapor canister. MSA manufactures vinyl chloride canisters that are approved by NIOSH and OSHA for concentrations less than or equal to 25 ppm and is rated to last 4 hours. Once in Level C, vinyl chloride tubes will be drawn every 30 minutes to monitor its presence. When this monitoring indicates that the concentration is below the action level, then downgrading to Level D is possible. If the monitoring indicates that the vinyl chloride concentration exceeds 10 ppm, all work will be discontinued, and workers will move to an area upwind. Work will not be resumed until air monitoring results confirm that the levels are less than 10 ppm.

In addition to the above set action level for vinyl chloride, any confined space entry activities will require measurements for oxygen deficiency and the presence of flammable/explosive gases and vapors. No entry will be permitted, or work will be discontinued, in the event that oxygen levels in the pit are less than 19.5% or greater than 22%. For flammable/explosive gases and vapors, no entry will be permitted, or work discontinued, in the event meter readings meet or exceed 20% of the Lower Explosive Limit (LEL).

8.0 LEVELS OF PROTECTION

Based upon the hazard evaluation results, Task 1 through 5 will be performed in Level D protection. In the event that the established vinyl chloride action level is exceeded, the level of protection will be upgraded to Level C. The following is a description of the personal protective equipment required for each level:

Level D

- Hard hat (optional for all tasks except well drilling).
- Disposable coveralls (optional).
- Safety glasses, goggles, or face shield.
- Steel-toe and shank, chemical-resistant boots.
- Chemical-resistant gloves (optional except when handling soil, sediment or surface water).
- Shoulder harness and lifeline (only required for confined space entry).
- Hearing protection, NRR of 35 decibels (optional).

Level C

- Hard hat (optional for all tasks except well drilling).
- Disposable coveralls (optional).
- Safety glasses, goggles, or face shield.
- Steel-toe and shank, chemical-resistant boots.
- Chemical-resistant gloves (optional except when handling soil, sediment or ground water).
- Shoulder harness and lifeline (only required for confined space entry).
- Hearing protection, NRR of 35 decibels (optional).
- Full face air purifying respirator equipped with organic vapor cartridges.

9.0 SITE CONTROL

Prior to the start of the field activities, the SSO will be responsible for the designation of the work zone, support zone, and clean zone. The work zone will be an area surrounding the immediate work being performed, where the greatest potential hazards exist. Only the necessary workers required to perform the work will be permitted in this zone. A support zone will be established for the storage of equipment.

10.0 EQUIPMENT DECONTAMINATION

The drill casings, samplers, tools, rig and any piece of equipment that comes in contact (directly or indirectly) with the formation, will be steam cleaned on-site prior to drilling. Equipment will be steam cleaned at a specific decontamination area, between each borehole, and prior to leaving the site. All on-site steam cleaning activities will be monitored by the field hydrogeologist. In addition to the drilling and sampling equipment, the following equipment will be used during the drilling and sampling of boreholes.

- Alconox Laboratory Grade Detergent
- Brushes
- Plastic Buckets
- Distilled Water
- Potable Water
- Photo-ionization detector (PID)
- Health & Safety Equipment (As discussed in the Health & Safety Plan)
- Sample Containers

The split spoon sampler will be decontaminated prior to collecting each sample. Disposable gloves will be worn while equipment is cleaned to avoid contamination, and the gloves will be changed frequently. The procedure for cleaning sampling equipment is as follows:

1. A solution of Alconox and potable water will be prepared in a bucket
2. The split spoon sampler will be disassembled and all parts and the spatula will be immersed in the Alconox solution.
3. All equipment will be scrubbed with a brush to remove any adhering particles.
4. All equipment will be rinsed with potable water.
5. The clean split spoon sampler will be reassembled and placed on clean plastic sheeting until it is needed. The split spoon sampler will be handled by the field hydrogeologist or the drilling crew only when clean gloves are being worn.

The decontamination procedures for the submersible pump are as follows:

1. Personnel will wear disposable gloves at all times during the decontamination procedure and will change gloves as necessary.
2. The pump will be removed from the well and placed, with the electrical cord, into a clean bucket. The equipment will be rinsed with clean potable water.

3. The interior and exterior of the pump will be rinsed with an Alconox solution. A brush will be used to scrub the pump and cord clean using the Alconox solution.

4. The pump and cord will be placed in a clean bucket. The interior of the bucket will be rinsed with potable water.

5. The clean pump and cord will be placed in a clean plastic bag.

Disposal of Drill Cuttings

Cuttings generated during drilling that are contaminated and cannot be left in place because they will pose a threat to life and health will be placed in drums or stockpiled under plastic sheeting until they can be removed from the drilling area for disposal. The method of disposal will be determined after the nature of contamination in the cuttings has been determined.

11.0 SAFE WORK PRACTICES

A pre-entry, tailgate safety meeting will be conducted prior to the start of each task to discuss the associated hazards. Attendees will be recorded on the Tailgate Safety Meeting Form (Attachment 2).

- All utilities and structures will be cleared and marked out prior to the start of any ground intrusive work. Attachment 4 will be used to record this information.

- The SSO will inform all subcontractors of the potential hazards associated with the site and the planned field activities. A copy of the HASP will be made available for their review.

- No eating, drinking, or smoking will be permitted in the work and support zones.

- No sources of ignition, such as matches or lighters will be permitted in the work and support zones.

- For Task 5, classified as a confined space entry, all air monitoring procedures as described in the air monitoring and action level sections will be conducted prior to and continuously during the entry into the well pits.

- A buddy will be stationed outside the well pits, at all times, to monitor the worker and the instruments used to monitor the environment inside the pit.

- No one will be permitted to enter the well pits, other than the worker, for any reason, including rescue.

- In the event a rescue is required, the worker will be removed from the pit through the use of the lifeline.

- Calls for help will be made via the cellular phone.

- The buddy system will be used in the work zone.

- During hazardous weather conditions, such as lightning and thunder storms, work will cease immediately.

Safe Work Practices- While on Republic Airport Property

Before working on Republic Airport, at least 2 weeks advance notice must be provided. Notification should be made to Mr. John Lauth, Operations Manager, American Port Services, Inc., 7150 Republic Airport, Suite 216, East Farmingdale, New York, 11735; (516) 752-7707 ext. 113. During the remedial work, activities on the airport will include the following: drilling and installation of monitoring wells, surveying, the collection of ground-water samples, and the collection of water-level data from monitoring wells.

Upon arrival, a meeting will be held with Mr. Lauth, MAC, and the subcontractor (driller or surveyor) to review airport safety procedures and for the designation of an escort. A copy of the HASP will be provided to Mr. Lauth. Potential hazards associated with the planned field activities will be discussed with all parties involved. All items discussed and attendees of the meeting will be recorded on the Tailgate Safety Meeting form, Attachment 2. Material safety data sheets will be also given to Mr. Lauth for any hazardous chemicals that may be brought on-site.

- In the event that the escort must leave the field crew for any reason, the crew will remain in the designated location until the escort returns. No one will be allowed to move from this location without permission from the escort or until permission is received after calling (516) 752-7707 ext. 113.

- A cellular telephone will be brought on-site for communication purposes.

- All emergencies such as injuries and fire will be reported immediately to the designated escort. The escort will then establish contact with the proper authorities. If the escort is not available, then the SSO will use the cellular phone to call (516) 752-7707 for notification and further instructions.

- Hearing protection will be used while on airport property as per the instructions of the escort.

- No ignition sources such as open flames, lighters, cigarette smoking will be permitted while on airport property.

- The escort will be situated at a safe distance from the Field crew so as to properly monitor their activities.

- All underground utilities such as water, high voltage electrical, and airport lighting systems must be cleared and marked out prior to the beginning of any ground intrusive work. The clearing of underground utilities will be conducted by a contractor who is equipped with toning equipment.

- All vehicles and moving equipment shall be clearly and visibly marked with orange and white checkered flags. These flags must be no less than 20 by 20 inches.

- Vehicles and moving equipment shall be equipped with back up signals and alarms. If this is not available, then a crew member will serve as a traffic guide.

- Airplanes have the right of way at all times.

- Fire extinguishers, Class B (carbon dioxide), will be available during any welding operations that may be required.

- All generated waste will be disposed at the end of each day.

- Daily safety inspections of the equipment and work environment will be made by the SSO and safety escort.

12.0 EMERGENCY PLAN

On-site verbal communications should not be a problem since all tasks will be performed in Level D protection. In the event that the action level is exceeded and personnel are upgraded to Level C protection, verbal communications may become difficult. A universal set of hand signals will then be used. They are as follows:

Hand gripping throat:	Can't breathe.
Grip partner's wrist or place hands around waist:	Leave work area immediately.
Hand on top of head:	Need assistance.
Thumbs up:	OK, I'm all right.
Thumbs down:	No, negative.

Communications from the site will be though a cellular telephone which will be brought to the site.

All job-related injuries and illnesses will be reported to the SSO. If medical attention is needed, the injured worker will be decontaminated, if possible, prior to leaving the site. The SSO will investigate the cause of the accident and corrective measures will be taken before the work can resume. It will be the responsibility of the SSO to complete the accident reporting form, OSHA 101, included in this report for all injuries. The completed OSHA 101 (Attachment 3) should be forwarded to the office health and safety manager within six days for recording into the OSHA 200 log. If there is a fatality, or if 5 or more workers are hospitalized as a result of a single incident, the SSO will contact the office health and safety manager immediately for OSHA reporting purposes.

EMERGENCY TELEPHONE NUMBERS

Police	911
Fire	911
Hospital Emergency Room	789-7258

HOSPITAL

The closest hospital to the site is Brunswick Hospital Center, Amityville, New York. To get to the hospital, go south on Route 110 to just south of Route 27 (Sunrise Highway). Brunswick hospital is on the right or west side of Route 110.

ATTACHMENT 1

SITE VISITORS LOG

SITE VISITORS LOG

THE UNDERSIGNED VISITORS REQUIRE ENTRANCE TO THE EXCLUSION ZONE AND HAVE THOROUGHLY READ THE HEALTH AND SAFETY PLANS. I UNDERSTAND THE POTENTIAL HAZARDS AT THE SITE AND THE PROCEDURES TO MINIMIZE EXPOSURE TO THE HAZARDS, WILL FOLLOW THE DIRECTION OF THE SITE HEALTH AND SAFETY MANAGER, AND WILL ABIDE BY THE HEALTH AND SAFETY PLAN.

NAME	COMPANY	DATE	SIGNATURE

ATTACHMENT 2
TAILGATE SAFETY MEETING FORM

TAILGATE SAFETY MEETING

Prepared by ____________________

Client ____________________ Project ____________________

Date ____________________ Project Number ____________________

Work Location ____

Type of Work to be Done ____

SAFETY TOPICS PRESENTED

Chemical Hazards ____

____

Physical Hazards/Underground Utilities ____________________

____

Protective Clothing/Equipment ____________________

____

Special Equipment ____

Emergency Procedures ____

____

Hospital/Clinic ____________________ Phone ( )____________

Paramedic Phone ( )____________________

Hospital Address ____

Other ____

ATTENDEES

NAME PRINTED	SIGNATURE

ATTACHMENT 3

ACCIDENT REPORTING FORM, OSHA 101

OSHA FORM 101

SUPPLEMENTARY RECORD OF OCCUPATIONAL INJURIES AND ILLNESSES

EMPLOYER

1. Name ______________________________
2. Mail Address ______________________________
   (No. and street) (City or town) (State)
3. Location, if different from mail address ______________________________

INJURED OR ILL EMPLOYEE

4. Name ______________________________ Social Security No. ______________
   (First name) (Middle name) (Last name)
5. Home Address ______________________________
   (No. and street) (City or town) (State)
6. Age ________ 7. Sex: Male________ Female________ (Check one)
8. Occupation ______________________________
   (Enter regular job title, not the specific activity he was performing at time of injury.)
9. Department ______________________________
   (Enter name of department or division in which the injured person is regularly employed, even though he may have been temporarily working in another department at the time of injury.)

THE ACCIDENT OR EXPOSURE TO OCCUPATIONAL ILLNESS

10. Place of accident or exposure ______________________________
    (No. and street) (City or town) (State)
    If accident or exposure occurred on employer's premises, give address of plant or establishment in which it occurred. Do not indicate department or division within the plant or establishment. If accident occurred outside employer's premises at an identifiable address, give that address. If it occurred on a public highway or at any other place which cannot be identified by number and street, please provide place references locating the place of injury as accurately as possible.
11. Was place of accident or exposure on employer's premises? __________ (Yes or No)
12. What was the employee doing when injured? ______________________________
    (Be specific. If he was using tools or equipment or handling material, name them and tell what he was doing with them.)
13. How did the accident occur? ______________________________
    (Describe fully the events which resulted in the injury or occupational illness. Tell what happened and how it happened. Name any objects or substances involved and tell how they were involved. Give full details on all factors which led or contributed to the accident. Use separate sheet for additional space.)

OCCUPATIONAL INJURY OR OCCUPATIONAL ILLNESS

14. Describe the injury or illness in detail and indicate the part of body affected ______________________________
    (e.g: amputation of right index finger at second joint; fracture of ribs; lead poisoning; dermatitis of left hand, etc.)
15. Name the object or substance which directly injured the employee. (For example, the machine or thing he struck against or which struck him; the vapor or poison he inhaled or swallowed; the chemical or radiation which irritated his skin; or in cases of strains, hernias, etc., the thing he was lifting, pulling, etc.)
    ____
16. Date of injury or initial diagnosis of occupational illness ______________________________
    (Date)
17. Did employee die? __________ (Yes or No)

OTHER

18. Name and address of physician ______________________________
19. If hospitalized, name and address of hospital ______________________________

Date of report ________________ Prepared by ______________________________

Official position ________________

IA.OSHA101.FRM

ATTACHMENT 4

UTILITIES AND STRUCTURES CHECKLIST

UTILITIES AND STRUCTURES CHECKLIST

Project: ______________________ **Prepared by:** ______________

Location: ______________________ **Date:** ______________

Instructions. This checklist has to be completed by a *MAC* staff member as a safety measure to insure that all underground utility lines, other underground structures as well as above-ground power lines are clearly marked out in the area selected for boring or excavation. **DRILLING OR EXCAVATION WORK MAY NOT PROCEED UNTIL LINES ARE MARKED AND THIS CHECKLIST HAS BEEN COMPLETED.** Arrangements for underground utility markouts are best made at the time of the preliminary site visit to allow client and/or utility company sufficient time. Keep completed checklist and maps onsite send copy to Project Manager.

Assignment of Responsibility. Client is responsible for having underground utilities and structures located and marked Preferably, the utilities themselves should mark out the lines.

Drilling or Excavation Sites. Attach a map of the property showing the proposed drilling or excavation site (or if sites are widely separated, several maps) clearly indicating the area(s) checked for underground utilities or underground structures and the location of above-ground power lines.

Utilities and Structures

Type	Not Present	Present	How Marked?[1]
Petroleum products line			
Natural gas line			
Steam line			
Water line			
Sewer line			
Storm drain			
Telephone cable			
Electric power line			
Product tank			
Septic tank/drain field			
Overhead power line			

1) Flags, paint on pavement, wooden stakes, etc.

Name and affiliation of person who marked out underground lines or structures.

______________ ______________ ______________
NAME ORGANIZATION PHONE

Emergency Procedures

Persons at site or facility to contact in case of emergency

1. ______________________ Phone ______________

2. ______________________ Phone ______________

Fire Dept.: Phone ______________ Ambulance: Phone ______________

Utility: Phone ______________ Utility: Phone ______________

Utility: Phone ______________ Utility: Phone ______________

Directions to nearest hospital (describe or attach map).