FIELD SAMPLING PLAN
FOCUSED REMEDIAL INVESTIGATION/ FEASIBILITY STUDY
D.C. ROLLFORMS/INGERSOLL-RAND SITE
JAMESTOWN, NEW YORK

August 1996

Prepared for

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TABLE OF CONTENTS

APPENDICES

FIELD SAMPLING PLAN
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FEASIBILITY STUDY
D.C. ROLLFORMS/INGERSOLL-RAND SITE
JAMESTOWN, NEW YORK

1.0 INTRODUCTION

As authorized by the Ingersoll-Rand Company, Geraghty & Miller, Inc. has prepared this Field Sampling Plan (FSP) for the focused Remedial Investigation/Feasibility Study (RI/FS) to be conducted at the D.C. Rollforms/Ingersoll-Rand site in Jamestown, New York. The focused RI/FS will be performed in accordance with the scope of work contained in the work plan (Geraghty & Miller, Inc. May 1996). The FSP in conjunction with the Quality Assurance Project Plan (QAPP) comprise the Sampling and Analysis Plan (SAP) for the Site.

The FSP provides the framework for field work of the RI sampling methodology and data collection activities. Included in the FSP are Standard Operating Protocols & Procedures (SOPs) which detail the elements of the various RI field tasks; drilling and installation of monitoring wells; field measurements; sample collection; and chain of custody of sample from collection through shipment to the analytical laboratory subcontractor. The FSP incorporates accepted and standard methodology for New York State and federal environmental programs. The format and contents of the FSP have been prepared in accordance with the following U.S. Environmental Protection Agency (USEPA) guidance documents:

- USEPA. October 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. Interim Final. EPA/540/G-89/004.

- USEPA. December 1987. Compendium of Superfund Field Operations Methods. EPA/P-87/001.

- USEPA. May 1978, revised May 1986. NEIC Policies and Procedures.

EPA-330/9-78-001-R.

The RI/FS work plan contains the site history and scope of work, and the FSP serves as a supplement for provision of the detailed SOPs. Information which is incorporated in the RI/FS work plan is not repeated herein. The applicable parts of the FSP will be provided to and followed by the RI field team.

2.0 SAMPLE LOCATIONS AND FREQUENCY

The environmental media which will be sampled for laboratory analyses include:

- Groundwater
- Surface-water/Sediment
- Subsurface soils
- Surface soils

The designated locations and anticipated number of these samples are specified in the RI/FS work plan. Groundwater and surface-water samples will be collected from the designated monitoring well, soil boring (using Geoprobe™ methods), and surface-water locations; soil samples will be collected from the monitoring well and soil borings; and sediment and surface-water samples will be collected from designated sampling locations. In addition to the soil samples collected for laboratory analyses, split-spoon and Geoprobe™ samples will also be collected for geologic characterization from the monitoring well and soil borings.

3.0 DATA COLLECTION PROTOCOLS AND PROCEDURES

The equipment, protocols and procedures for the RI data collection activities are described in detail in the appended SOPs. Equipment decontamination procedures are also included in the SOPs.

The following SOPs are included as appendices to the FSP:

FSP Appendix	Title
A	Geoprobe™ Groundwater and Soil Sampling Procedures
B	Borehole Drilling, Subsurface Soil Sampling Protocol and Monitoring Well Specifications and Installation Protocol
C	Groundwater Sampling Protocol
D	Surface-Water and Sediment Sampling Protocol
E	Surface Soil Sampling Protocol
F	Water-Level Measurement and Hydraulic Conductivity Testing Protocol
G	Field Instrumentation Operating Procedures
H	Chain-of Custody Procedures
I	Quality Assurance/Quality Control Forms

4.0 RI-GENERATED WASTES

Drill cuttings generated during the field investigation will be handled in an appropriate manner that complies with all federal, state and local regulations. At the end of the RI data collection activities, any hazardous waste will be transported and disposed in a proper manner in compliance with all federal, state and local regulations at an approved off-site facility.

FIELD SAMPLING PLAN

APPENDIX A

GEOPROBE™ GROUNDWATER AND SOIL SAMPLING PROCEDURES

GEOPROBE™ GROUNDWATER AND SOIL SAMPLING PROCEDURES

Preliminary soils and groundwater investigations for the focused remedial investigation will be conducted using the Geoprobe™ sampling method. Geoprobe™ is a sampling method that uses a truck mounted fold away sampling unit. The sampling unit obtains soil and groundwater samples using a hydraulically powered hammer to drive stainless steel sampling devices into the subsurface. This technique is most suitable for shallow subsurface soil and groundwater sampling.

SUBSURFACE SOIL SAMPLING

All Geoprobe™ down hole equipment will be steam cleaned prior to arrival at the site and between all boring locations. All decontamination rinsate will be containerized and stored on site awaiting proper disposal.

Soil samples will be collected continuously to the total depth of the borehole at each designated Geoprobe™ location. A clean two-inch inside diameter by 48-inch long stainless steel, macro sampler will be used to collect samples continuously to 12 feet below land surface. The macro sampler is an open tube design sampler that is fitted with a removable cutting shoe and acetate liner. After the soil sample is collected the shoe is removed and the sample is extruded from the acetate liner. A large bore stainless steel drive point sampler will be used for depths greater than 12 feet. The large bore sampler, approximately 1.2-inch inside diameter by 24-inch long, will be used to collect samples continuously for the remaining depth of the borehole. The closed large bore sampler will be driven to two feet above the selected interval where it is then opened and then driven to the desired sample interval. The sampler is opened by releasing a stop pin from the surface. Releasing the stop pin allows a piston to retract inside the sampling tube as it is displaced by the soil core. Samplers are fitted with new acetate liners prior to each use.

Soil samples will be described noting color, grain size, moisture content and compactness using the USCS Classification system. Samples of Geraghty & Miller soil/core logs can be found in Appendix I. After the samples have been described, they will be removed from the acetate liners, placed into sample containers, covered with aluminum foil and capped for volatile organic compound (VOC) head space analysis. Samples will be allowed to equilibrate for 15 minutes before head space is measured. Head space analysis will be measured using a photoionization detector (PID). After 15 minutes, the cap will be removed from the container and the foil pierced with the tip of the PID. The PID will be calibrated daily according to procedures outlined in Appendix G. VOC concentrations will be recorded with soil classification information on the soil core logs.

GROUNDWATER SAMPLING

Groundwater samples will be collected from discrete intervals within the designated Geoprobe™ soil boring locations. Groundwater samples are collected using a standard Geoprobe™ screen point sampler. A clean sampler will be driven to the desired sample interval and then retracted approximately two feet. The stainless steel screen is inserted into the hollow rods and then pushed into the resulting void via chase rods from the surface. The screen remains retracted within the probe rods until the desired interval is reached. The screen is not exposed to the formation until it is pushed from its protective sheath. Once the screen is exposed, new polyethylene tubing fitted with a stainless steel check valve is inserted into the rods. The tubing is then attached to a peristaltic pump and the groundwater sample is collected. In an attempt to minimize turbidity, every effort will be made to remove a minimum of one gallon of groundwater before the analytical sample is collected. In low yielding formations (till), this amount may not be achievable. When collecting groundwater samples within the lower till formation, a "closed" type Geoprobe™ sampler will be driven through the upper fill materials and into the lower unit. The screen will not be exposed until it has penetrated the till unit, thus minimizing the risks of cross contamination from the upper unit. Groundwater samples will be collected in laboratory containers, labeled and placed in an

ice filled cooler. Samples will be collected according to volitazation sensitivities. Sample shipment and chain-of-custody procedures will be followed according to procedures outlined in Appendix H.

FIELD SAMPLING PLAN

APPENDIX B

BOREHOLE DRILLING, SUBSURFACE SOIL SAMPLING AND MONITORING WELL SPECIFICATIONS AND INSTALLATION PROTOCOL

BOREHOLE DRILLING, SUBSURSFACE SOIL SAMPLING AND MONITORING WELL SPECIFICATIONS AND INSTALLATION PROTOCOL

BOREHOLE DRILLING

The hollow-stem auger drilling method will be utilized for the drilling of soil borings and the installation of monitoring wells. A Geraghty & Miller hydrogeologist will be present at the operating drill rig and will be responsible for the collection and logging of soil samples, monitoring of drilling decontamination operations, recording of ground-water data, deciding on final drilling depths and screen intervals (in consultation with the project manager), preparing the boring logs and well completion diagrams, and recording the well installation procedures. Additionally, the hydrogeologist will maintain a log recording daily events, including arrivals and departures at the site by any and all personnel and equipment, and times of work start-up and stoppage. The forms to be used by the hydrogeologist as part of the Quality Assurance/Quality Control (QA/QC) measures of the project are included in Appendix G.

If any problems are encountered or questions arise during the field investigation that are beyond the scope of expertise/responsibility of the hydrogeologist, she/he will temporarily halt all field activities in order to confer with the project manager and/or the project officer. In this way, a technically sound decision will be made by several experienced individuals. The project team will also draw, as needed, from Geraghty & Miller's highly qualified and diverse technical staff.

AUGER DRILLING TECHNIQUE

The soil borings and monitoring wells will be drilled using hollow-stem auger techniques. This technique involves rotating a drill bit into the subsurface on a string of auger flights. Soil cuttings are continuously lifted to land surface along the outside of the flights, while drill rods and a plug are used inside the flights to keep the soil out. The plug is removable for split-spoon sampling and well installation inside the flights.

Potable water will be used during drilling if required to keep loose sand from heaving inside the auger flights (due to differential hydrostatic pressure). Sand heaving would prevent collection of representative split-spoon samples and proper installation of well casing and screen. If water is added, the volume used will be carefully documented so that at a minimum, an equivalent volume will be removed during well development. The water used will be from a potable source and will be sampled and analyzed for the same suite of analytes included in the ground-water sampling program.

DECONTAMINATION

The drilling casings, rods, samplers, tools, water tanks, drilling rig, and any piece of equipment that can come into contact (directly or indirectly) with the formation will be steam cleaned on-site prior to set up for drilling. Steam cleaning protocols will also be followed between boreholes (at a fixed on-site location) and before leaving the site at the end of the project. The on-site steam cleaning activities will be monitored by the Geraghty & Miller hydrogeologist.

Equipment used to sample unconsolidated sediments (e.g. split-spoon samplers, stainless-steel spatulas) will be decontaminated prior to each sample collection. Disposable gloves will be worn while equipment is cleaned to avoid contamination and the gloves will be changed frequently. The procedure for cleaning this equipment is as follows:

1. Prepare a 2-percent solution of Micro™ and distilled water in a bucket.

2. Disassemble the split-spoon sampler and immerse the parts and spatula in the Micro™ solution.

3. Scrub equipment in the bucket with a brush to remove any adhering particles.

4. Rinse the equipment with copious amounts of distilled water.

5. Place clean equipment on a clean polyethylene sheet.

6. Reassemble the cleaned split-spoon sampler.

7. Transfer the split-spoon sampler to the driller (or helper) and make sure that this individual is wearing clean, disposable gloves.

FORMATION SAMPLING

SPLIT-SPOON SAMPLING

Split-spoon soil samples of unconsolidated sediments will be collected in two foot intervals from land surface to the total depth of drilling. These samples will be collected through the auger flights. A standard split-spoon sampler, which is 24 inches long and 2 inches in diameter, will be used for sampling. Drill cuttings will be examined in two foot intervals throughout the entire depth of the hole.

The collected split-spoon soil samples will be described, cataloged and retained by the on-site hydrogeologist. It is the responsibility of the hydrogeologist to ensure that between sample collections, the sampling device is cleaned according to the protocol outlined previously. In this way, if contamination is encountered at one elevation in the borehole, it will not be transferred to lower elevations in the borehole. A detailed soil sampling protocol is as follows:

1. The cleaned split-spoon sampler will be given to the driller (or helper), by the Geraghty & Miller hydrogeologist who will make sure that the individual is wearing clean, disposable gloves.

2. The split-spoon sample will then be collected by the driller using the standard penetration test. (ASTM D1586).

3. The Geraghty & Miller hydrogeologist will obtain the split-spoon sampling device from the driller and will place it on clean polyethylene sheeting.

4. The end cap will be unscrewed and the spoon opened to expose the sample.

5. The sample will be screened for volatile organic compounds (VOCs) as discussed below.

6. The Geraghty & Miller Sample/Core Log will be filled out as discussed below.

7. The sampling equipment will be cleaned as previously described.

After collection, split-spoon samples of unconsolidated material will be visually identified by the field hydrogeologist using the Unified Soil Classification System. Standard identification practices detailed in ASTM D 2488 will be followed. The information recorded on the sample/core log by the field hydrogeologist will include:

- Soil sample interval
- Sampling hammer weight and distance of fall
- Blow count (per 6-inch interval)
- Amount of sample recovered

- Sample color
- Sample texture
- Sample moisture content
- Organic vapor readings
- Unusual characteristics
- Depth to water
- Drill rig behavior and penetration rate

An example sample/core log is presented in Appendix I. Representative soil samples from each sampled interval will be placed in clean glass jars with screw-type lids for future reference. Each sample container will be labeled with the site name and the boring and sample number.

ANALYTICAL SAMPLING

HEADSPACE ANALYSIS

For each split-spoon soil sample collected, head space analysis for VOCS will be determined using a PID. The sample jar will be covered with aluminum foil and allowed to equilibrate for 15 minutes; the aluminum foil will be pierced; and the headspace vapor reading taken. The information will then be recorded on the Geraghty & Miller Sample/Core Log. Calibration procedures for the PID are presented in Appendix G.

BLANKS

A field blank (equipment blank) will be collected to access the decontamination procedures used during soil sample collection. The blank will be prepared by pouring organic-free water over a decontaminated split-spoon sampler and into the sampling container(s). One field blank will be collected for each day of soil sampling and will be analyzed for the parameters identified on Table 2 of the QAPP. Blank analyses are discussed in more detail in the QAPP.

RECORD KEEPING

All Geraghty & Miller personnel involved in sample collection will carefully document the handling history of all soil samples and blanks collected. Standard Geraghty & Miller forms (see Appendix I) will be completed to document the integrity of each sample from the time the sampling team enters the site through sample collection and shipment.

SAMPLE LABELS AND CHAIN-OF-CUSTODY FORM

Sample labels are necessary for proper sample identification. The labels will be affixed to the sample containers prior to the time of sampling and will not be affixed to lids or caps. To track QA/QC handling protocols the labels will be filled out by sampling personnel, and the Geraghty & Miller Chain-of-Custody form (see Appendix H) will be completed in the field before the sampling team leaves the site. Labels will include sample identification, project number, date and time collected,

and analyses to be performed.

The sampling team will be responsible for maintaining custody of the samples until they are delivered to the carrier or the laboratory. The Chain-of-Custody form will then be signed and custody formally relinquished. The containers (bearing custody seals) will be in view at all times or will be stored in a secure place restricted to authorized personnel. Chain-of-Custody procedures are discussed in more detail in Appendix H.

MONITORING WELL INSTALLATION AND DEVELOPMENT

MONITORING WELL INSTALLATION

The installation of each monitoring well will begin immediately after borehole completion, or as directed by the Project Manager. Once monitoring well installation has begun, breaks will not be taken until the well has been completed and secured against unauthorized access. In cases of unscheduled delays, such as personal injury, equipment breakdowns, or sudden inclement weather, installation will be resumed as soon as practical.

WELL CONSTRUCTION

Monitoring wells will be constructed of 2-inch diameter Schedule 40 PVC casing and screen. The well screens will be fabricated and have an inside diameter equal to the well casing. Fittings

(couplings) will not restrict the inside well diameter as joints will be internally threaded. Glues, solvents, or chemical cleaners will not be used to join the casing and screen lengths. All screens, casings, and fittings will be new material. The lengths of casing and screen will be measured and recorded by the hydrogeologist prior to installation. All casing and screens will be decontaminated prior to installation.

Monitoring well depths and screen zones will be determined following a review, by all technical project personnel, of all available borehole data, including the hydrogeologist's and driller's sample logs.

Monitoring well screen depths will be calculated by the hydrogeologist by maintaining accurate measurements of screen and casing placed in the borehole. Upon well completion, the hydrogeologist will verify the screen length by sounding the well for total depth and comparing this value to the total measured length of the well materials that were lowered into the borehole.

GRAVEL PACK

A gravel pack will be installed in the borehole annulus around the screen. Clean silica sand backfill, suitable for the formation and screen slot size, will be placed around the screen; a weighted steel tape will be placed down the annulus periodically to measure the depth to the gravel pack to be sure it is not bridging and that it is at least 2 feet above the top of the screen.

A representative sample of the gravel pack material will be supplied by the driller prior to use.

In this way, the gravel pack material can be described, in writing, using the following general guidelines: lithology, grain-size distribution, trade name (if any) and source (including company and location), and its suitability for use will be determined in advance of well construction.

BENTONITE SEAL

A bentonite seal (polymer-free, 100-percent bentonite) approximately 2 to 3 feet thick will be emplaced through a tremie pipe on the top of the gravel pack. The thickness of the seal will be verified by field measurements of the depth to the gravel pack and depth to the top of the seal.

BENTONITE/CEMENT GROUT

A slurry of bentonite (5 percent)/cement (95 percent) will be emplaced though a tremie pipe in the annulus between the borehole and/or surface casing and the well casing. The bentonite/cement grout will be placed from the top of the bentonite seal to approximately 2 feet below grade.

PROTECTIVE CASING

A locking steel protective casing will be set over each well head and cemented in place to a minimum depth of 2 feet below land surface. Each protective pipe will be painted to increase visibility.

The top of the well casing will serve as the measuring point for the groundwater level

measurements. The well location will be surveyed to the nearest 0.1 foot and the measuring point will be marked on the well casing and surveyed to the nearest 0.01 foot (relative to mean sea level) by a professional surveyor, licensed in New York State.

MONITORING WELL CONSTRUCTION DIAGRAM

A well construction diagram will be prepared by the on-site hydrogeologist for each well and will show the following items:

1. The bottom of the borehole (that part of the borehole most deeply penetrated by drilling and/or sampling).

2. The screen setting depth.

3. The gravel pack interval.

4. The bentonite seal interval.

5. The grout interval.

6. The borehole and well casing diameters.

7. The height of the well casing (without cap/plug) above ground surface.

8. The protective casing.

Each well construction diagram will be included as part of the QA/QC procedures. An example of a well construction diagram is provided in Appendix I.

MONITORING WELL DEVELOPMENT

A record of well development will be maintained along with the other pertinent well data as part of the QA/QC procedures. Well development will not be attempted until at least 24 hours after installation. Well development will be accomplished using an appropriate technique(s), such as pumping with a centrifugal pump, low-flow submersible pump, surging with air, mechanical surging of the well, or any combination of the above. Development will continue until the well responds to water-level changes in the formation, and the well produces clear, sediment-free water to the extent possible. The wells will be developed with the goal of producing water with a turbidity of 50 nephelometric turbidity units (NTUs) or less. A portable nephelometer will be used in the field to document turbidity levels. Development water will be collected and disposed of properly.

Dispersing agents, acids, disinfectants, or other additives will not be used during development nor will they be introduced into the well at any other time. During development, water will be removed from the entire column of water standing in the well by periodically lowering and raising the

pump intake.

Well development will include the rinsing of the interior well casing above the water column in the well using only water from that well. The well will be covered with a clean well cap which will be rinsed with distilled water prior to installation. The result of this operation will be a well casing free of extraneous materials (grout, bentonite, sand, etc.).

The following data will be recorded as part of development and QA/QC procedures:

1. The static water-level measured from the top of the well casing before and after development is completed.

2. The calculated quantity of fluid standing in the well prior to development.

3. The sounded well depth before and after development to determine if siltation has occurred inside the well.

4. The physical character (e.g., clarity, color, particulates, and odor) of water removed, including changes during development.

5. The type and size/capacity of pump used.

6. The surging technique used.

7. The quantity of fluid/water removed and the time of removal (both incremental and total values).

FIELD SAMPLING PLAN

APPENDIX C

GROUNDWATER SAMPLING PROTOCOL

GROUNDWATER SAMPLING PROTOCOL

INTRODUCTION

Valid water-chemistry data are integral to hydrogeologic investigations that characterize groundwater quality conditions. The data will be confirmed by quality-control measures instituted during sampling, sample handling, and analysis. Without checks on the procedures, contradictory results are possible, and incomplete or incorrect conclusions may result.

Quality control includes proper sampling procedures for well purging prior to sampling, sample-removal methods that utilize acceptable materials for all equipment and supplies, sample processing (including filtration, preservation, labeling, and bottle filling), and sample shipment. The Geraghty & Miller project manager and field hydrogeologist will work closely with the analytical laboratory to assure that samples reach the laboratory in proper condition.

The reported data will be assessed for internal consistency, and the results will be interpreted in light of constituents expected from previous land use and from chemical and biochemical transformations that may have occurred in the subsurface. Water-quality data will be scrutinized according to Geraghty & Miller's Quality Assurance/Quality Control (QA/QC) protocols for data validation as discussed in the Quality Assurance Project Plan (QAPP).

Geraghty & Miller's groundwater sampling protocol is based on standard practices as published in, "Manual of Ground-Water Sampling Procedures", by Scalf and others, NWWA/EPA, 1981 and

"Handbook for Sampling and Sample Preservation of Water and Wastewater", EPA, 1982, as well as on Geraghty & Miller's own extensive experience.

Pertinent information regarding groundwater sampling procedures will be recorded on Geraghty & Miller's daily and sampling logs. Copies of these forms are included in Appendix I.

PREPARATION FOR SAMPLING

A written sampling fact sheet containing the information needed by the field team will be prepared by the project manager. The fact sheet will be reviewed and verified by a qualified Geraghty & Miller chemist and will include the protocol (standard or non-standard) to be followed. Information on the types and nature of hazardous chemicals that may be encountered will be provided along with a list of special precautions for sampling, handling, storage, and transportation.

PREPARATION OF SAMPLING EQUIPMENT

The sampling equipment will be thoroughly cleaned before each use. Any supplies, such as tubing or rope that cannot be properly cleaned after each use will be discarded in an appropriate manner. Water level measuring equipment will be cleaned with a laboratory-grade detergent solution, and rinsed with distilled water prior to use. A new length of polypropylene cord will be attached to a new dedicated bailer prior to the collection of each sample. Equipment, such as specific conductance, turbidity and pH meters, will be calibrated daily according to manufacturer's instructions.

SAMPLING EQUIPMENT

The equipment needed for sampling groundwater is listed below:

Measuring tape and chalk or electric probe (M-Scope)

Clean rags

Distilled water

Plastic sheeting

Polypropylene rope

Bailers, Teflon™

Micro™ laboratory cleaner

Buckets, graduated

Gloves (Latex, Nitrile, or equivalent)

pH Meter and buffers

Specific Conductance meter

Thermometers

Sample bottles

Indelible marking pens

Brushes

Pump

½-inch Polyethylene tubing

Clear tape

12 volt battery

Beakers

Nephelometer

ARRIVAL AT THE SITE

Upon arrival at the site, sampling personnel will check in with the appropriate personnel to coordinate sampling team activities and to obtain necessary clearances.

PREPARATION OF WELL FOR SAMPLING

Opening the Well

Upon arrival at the well site, sampling personnel will check the well for aboveground damage, record the well designation, wipe the top of the well clean, and then remove the cap and wipe the top of the well casing with a clean cloth. Plastic sheeting will be placed around the well to protect sampling equipment from potential contamination.

Sounding the Well

The total depth of the wells will be measured (sounded) prior to sampling. With this information, the sampling team can calculate the volume to water in the well and determine if formation material has accumulated in the well. The well depth will be measured to an accuracy of 0.01 feet below the measuring point.

Measuring Well Stick-Up

The height of the measuring point above ground surface (the stick-up) will be measured to determine whether the well has been disturbed since installation. The stick-up will be measured to an accuracy of 0.01 feet.

Measuring the Water Level

Prior to purging and sampling, the static water level in the well will be measured and the volume of standing water in the well will be calculated. A full round of water levels will be taken prior to water sampling. The date and time of each measurement will be recorded. Each measurement will be made to an accuracy of 0.01 feet below the measuring point. Care will be taken to avoid cross contamination of the wells by thoroughly cleaning the measuring instrument between well sampling events.

Water levels will be measured in monitoring wells by using a chalked steel tape or an electric probe (M-scope). The measuring point, which is permanently marked on each well, will be used to assure consistent water-level readings. The procedure will be as follows:

1. The well will be identified and its number recorded.

2. The top of the well will be wiped with a clean cloth.

3. Plastic sheeting will be placed around the well.

4. The well cap or plug will be removed; the inside of the casing will be wiped with a clean cloth; and the cap will be placed down in a manner so as to keep it clean. Personnel will wait approximately 10 minutes prior to measuring the water level to

allow the water to stabilize.

5. The air within the well will be analyzed for VOCs by using a photoionization detector.

6. The first 5 feet of the steel measuring tape or electric probe will be cleaned as described above and then the depth to water will be measured from the top of the well casing.

7. The volume of water in the well will be calculated.

Purging the Well

Standing water will be removed from the well casing prior to collecting groundwater samples; a centrifugal pump, low-flow submersible pump or disposable Teflon ™ bailer will be used. The tubing from the pump will be set just below the anticipated dynamic (pumping) water level. New tubing will be dedicated to each well sampled.

The water level in the pumped well will be monitored in the event that it drops enough to make it necessary to reduce the discharge rate and/or lower the tubing. It is important that the entire water column be evacuated prior to sampling. The tubing will be set at the pumping water level and just prior to completion of the evacuation, the tubing will be lifted or the discharge increased so that suction is broken. The entire column of water will thus be removed from the well.

Three to five times the calculated volume of water in the well will be removed so that the sample subsequently collected will be representative of the zone screened. The volume of standing water in each well will be calculated by subtracting the depth to water from the sounded depth of the well. This number will then be multiplied by a coefficient which relates the diameter of the well to gallons per linear foot to obtain the volume of standing water in the well.

Collection of Groundwater Sample

After a well has been evacuated, a groundwater sample will be collected with a disposable, bottom-filling Teflon™ bailer. The bailer will be lowered slowly so that the water surface is minimally disturbed. Water will enter the bailer through a hole in the bottom end plug and will be prevented from draining out by an inert ball check-valve. A polypropylene rope will be used to raise and lower the bailer, and the cord will be discarded after each well sampling event. The bailer will not come in contact with any surfaces outside of the well casing. Sampling personnel will wear a new pair of disposable gloves for each well sampled and when handling a clean bailer.

Filling the Containers

The containers will be inspected to ensure that they are the correct type and number, and if required, have the correct preservative. The labels will then be properly filled out and affixed to the containers. Water samples will be carefully poured into the containers, avoiding agitation or turbulence, which might result in loss of VOCs and/or excessive oxygenation of the samples. Care will

also be exercised to avoid breakage and to eliminate the entry or contact of, any substance with the interior surface of the bottles, vials, or caps, other than the water sample being collected. Caps will not be removed until the actual sampling time and then just long enough to fill the container. The containers for volatile organic analyses will be topped off to eliminate any headspace or air bubbles and will be tightly closed with Teflon™-lined septums held in place by open-top screw caps. The sample bottles will be prepared with appropriate preservatives prior to sampling, and the sample containers will be kept cool, dust-free, and out of the sun. The procedures that Geraghty & Miller personnel will follow to collect groundwater samples are described below:

1. All containers will be labeled, marked according to project, well, date, etc., and wrapped with clear tape.

2. Clean gloves will be worn by personnel when they are handling a clean bailer.

3. The bailer will be placed on clean plastic sheeting. An appropriate length of new polypropylene cord will be attached to the bailer using a secure knot.

4. The bailer will be lowered into the well and into the water column gradually to minimize turbulence. The bailer will be allowed to sink and become fully submerged. Water from the first bailer will be discarded as a final rinse prior to sampling.

5. The 40 milliliter (ml) vials for VOCs will then be filled in such a manner as to ensure that there are no air bubbles.

6. After volatile organic samples have been collected, field parameters will be analyzed from the next water sample. The remaining sample containers will be filled in the order of the parameter's volatilization sensitivity.

7. The pH, specific conductance, turbidity, Eh, dissolved oxygen, and temperature measurements will be taken after the meters have been calibrated, as necessary.

8.. The well cap will be closed and the well will be locked.

9. Groundwater samples will be packed on ice in a cooler. The Geraghty & Miller Water Sampling Log form and Geraghty & Miller Chain-of-Custody form will be completed. Samples will be delivered or shipped to the laboratory within 24 hours after sample collection and the receiver's signature will be obtained on the Chain-of Custody form.

10. The cord, gloves, bailer and sheeting will be discarded in a proper matter.

FIELD ANALYSES

Measurements for temperature, pH, turbidity, Eh, dissolved oxygen, and specific conductance will be made in the field at the time of groundwater sampling because these properties change during

storage. Field measurements will be recorded on the Geraghty & Miller Water Sampling Log (see Appendix I) to track QA/QC protocols.

QUALITY CONTROL

Quality-control (QC) samples will be used to monitor sampling and laboratory performance. The types of QC samples that will be included in this investigation are replicates and blanks. To ensure unbiased handling and analysis by the laboratory, the identity of QC samples will be disguised by means of coding so that the laboratory does not know which samples are included for QC purposes. Detailed QC procedures are outlined in the Quality Assurance Project Plan (QAPP).

Replicate Analyses

Replicate samples are samples collected from the same well and are identical within the limits of normal concentration fluctuations. Collection and analysis of such samples allow a check to be made on laboratory reproducibility. Five percent of all groundwater samples collected at this site will be replicated. The procedures to be used for taking replicate samples is discussed below.

When collecting samples for volatile organic compound (VOC) analysis, the water from the bailer will be distributed first to fill one VOC container and then to fill the second VOC container. Adequate water will be available to fill the bottles completely before they are capped. For other analytes, the bailer of water will be split to fill portions of each sample container until the containers are

filled. Replicate analyses are discussed in more detail in the QAPP.

Blanks

Trip blanks will be incorporated into this field investigation. A trip blank is a sample composed of organic-free water (prepared by the laboratory) which is filled in the laboratory and travels unopened with the sample bottles. It is analyzed along with the field samples for the constituents of interest. Analysis of trip blanks detects whether samples have been contaminated by VOCs as a result of handling in the field, during shipment, or in the laboratory. One trip blank will accompany each day's shipment of water samples to the laboratory for VOC analysis.

RECORD KEEPING

All Geraghty & Miller personnel involved in sample collection will carefully document the handling history of all groundwater samples and blanks collected. Standard Geraghty & Miller forms (see Appendix I) will be completed to document the integrity of each sample from the time the sampling team enters the site through sample collection and shipment.

Daily Log

Daily logs will be used by the field team for QA/QC purposes to record all sampling events and field observations. Entries in the daily logs will be dated by the person making the entry, and the logs will be kept in a secure, dry place. The following types of information will be included on the log

forms:

1. Date and time of arrival at site.

2. Client identification number.

3. Location.

4. Weather.

5. Sampling team members.

6. Work progress.

7. QC samples.

8. Departure time.

9. Delays.

10. Unusual situations.

11. Well damage.

12. Departure from established QA/QC field procedures.

13. Instrument problems.

14. Accidents.

Water Sampling Log

The sampling team will prepare a Geraghty & Miller Water Sampling Log for QA/QC purposes (see Appendix I) at the time of sampling to record information about each sample collected. In addition to project information and well evacuation data, the log includes the following information on sampling:

1. Date and time of sampling.

2. Well evacuation data.

3. Physical appearance of samples.

4. Field observations.

5. Results of field analyses.

6. Sampling method and material.

7. Sample parameters.

8. Sample container and preservation.

9. Sampling personnel.

Sample Labels and Chain-of-Custody Form

Sample labels are necessary for proper sample identification. The labels will be affixed to the sample containers prior to the time of sampling and will not be affixed to lids or caps. To track QA/QC handling protocols the labels will be filled out by sampling personnel, and the Geraghty & Miller Chain-of-Custody form (see Appendix I) will be completed in the field before the sampling team leaves the site. Labels will include sample identification, project number, date and time collected, analyses to be performed, and pH adjustment information where required.

The sampling team will be responsible for maintaining custody of the samples until they are delivered to the carrier or the laboratory. The Chain-of-Custody form will then be signed and custody formally relinquished. The containers (bearing custody seals) will be in view at all times

or will be stored in a secure place restricted to authorized personnel. Chain-of-Custody procedures are discussed in more detail in Appendix H.

FIELD SAMPLING PLAN

APPENDIX D

SURFACE-WATER & SEDIMENT SAMPLING PROTOCOL

SURFACE-WATER & SEDIMENT SAMPLING PROTOCOL

SAMPLE COLLECTION - GENERAL

Sampling will not be conducted under adverse weather conditions, specifically during precipitation. The sampling stations will initially be evaluated by the sampling team to determine access and field conditions at the time of sampling. Any conditions which will interfere with the execution of sampling the manner described herein will be reported to the Project Manager.

Surface-water and sediment sampling will be carried out concurrently. At a given station, the surface-water sample will be collected first, followed by the collection of the sediment sample. Sampling will proceed from downstream locations to upstream locations. A suitable work area will be set up as close to the sampling station as possible. Plastic sheeting will be spread on the ground as a work surface for the sampling equipment.

The sampling team will be supplied with water-proof outer garments. Personnel will wear neoprene, nitrile or rubber boots which have been thoroughly decontaminated. Decontamination will consist of a Micro™ solution scrub, potable water rinse and final rinse with distilled water. The location of the sampling station and the sample designations will be described on the Geraghty & Miller, Inc. Water Sampling Log (surface-water) and Sample/Core Log (sediment). Other pertinent data including weather conditions and flow conditions will be recorded.

SURFACE-WATER SAMPLING

SAMPLING PROCEDURE

The station number where the sample is to be taken and sample designation will be recorded on the Water Sampling Log. Dedicated disposable pre-washed glass flasks supplied by the laboratory will be used to obtain the water samples. Care will be taken to avoid contact of the flask with any potential contaminants after its protective wrapping is removed. If enough water is present, the surface water will be sampled by lowering the flask from the surface to the bottom at an even speed, so that water enters the bottle from each depth yielding an integrated sample. Otherwise, as much water as possible will be collected into the flask by positioning the mouth of the flask in the upstream direction. Sampling team members will always position themselves downstream of the sample point, and will take care not to stir up sediment or soils when collecting the water samples. The sample will be transferred from the flask directly into the sample containers.

Sample shipment and documentation will be in accordance with FSP Appendix H Chain-of-Custody Procedures.

FIELD ANALYSES

After the laboratory containers are filled, an additional sample will be collected in a clean, unpreserved glass container and its color, odor and appearance will be noted. The pH, temperature, turbidity, and specific conductance of the sample will be measured. Temperature will be measured

immediately after collection of the sample with a mercury filled thermometer in order to calibrate the pH and specific conductance meters.

pH will be measured with a glass hydrogen-ion electrode compared against a reference electrode of known potential by means of a pH meter. Calibration of the pH meter will be completed before analysis with two buffer solution standards bracketing the sample pH (nominal values of 4 and 7 or 7 and 11). Before a measurement is made, the probe will be completely rinsed with deionized or distilled water. The probe will be lowered into the sample and gently stirred and allowed to equilibrate. The pH will be recorded as soon as the reading on the meter equilibrates. Between measurements the probe will be rinsed with deionized or distilled water. The pH meter will be calibrated frequently during the sampling round to ensure accurate and precise measurements.

Turbidity will be measured with a battery-powered nephelometer. The sample tube will be filled with sample, placed in the sample chamber, and the measurement will be taken when the meter reading stabilizes. The nephelometer will be calibrated periodically to ensure accurate and precise measurement. The reading will be recorded on a Geraghty & Miller, Inc. Water Sampling Log.

Specific conductance will be measured with a battery-powered specific conductance meter. The instrument will be adjusted to the temperature of the sample. The probe will be lowered into the sample and the reading taken within seconds after immersion. Before each sampling event, the probe will be rinsed with deionized or distilled water. The specific conductance meter will be calibrated frequently to ensure accurate and precise measurements. The field analyses and sample descriptions will be recorded on a Geraghty & Miller, Inc. Water Sampling Log.

SEDIMENT SAMPLING

SAMPLING PROCEDURE

Sediment samples will be collected at the surface water locations. Sediment samples will be collected with a hand-operated core sampler or with stainless steel trowels. The sampling team will be adequately supplied with liner tubes, eggshell core catchers, and PVC end caps for the core sampler. Non-dedicated sampling equipment will be decontaminated initially and between samples as follows: scrub with Micro™ solution, rinse with distilled or deionized water. Tools used to trim and pack the sample will be similarly decontaminated.

Sampling personnel will wear disposable plastic gloves during handling of sampling equipment and containers. The gloves will be disposed after sampling is completed at each station.

FIELD SAMPLING PLAN

APPENDIX E

SURFACE SOIL SAMPLING PROTOCOL

SURFACE SOIL SAMPLING PROTOCOL

Surficial soil samples will be collected from a three-by three-foot area, two inches in depth. Using a pre-cleaned trowel or spade all vegetation and sod will be removed from the designated sampling area. A sufficient number of discrete grab samples will be collected for the required sample volume.

Sampling personnel will wear disposable gloves during the handling of sampling equipment and sample containers. Sampling equipment will be decontaminated before use and between sample locations.

Samples for chemical analysis will be packaged as efficiently and expeditiously as possible. If sample recovery is insufficient, a second core or trowel will be retrieved as close to the original location as possible. Samples will be transferred directly to the sample containers.

A representative sample will be retained and examined by the field hydrogeologist. The description will be recorded along with the other pertinent sampling information on a Geraghty & Miller, Inc. Sample/Core Log. The sample will be screened with a photoionization detector at the time of examination. The meter will be calibrated and used in accordance with FSP Appendix G, Field Instrumentation Operating Procedures.

An equipment blank will be collected to assess the decontamination procedures used during sample collection. The sample will be prepared by pouring organic-free water over the trowel (which

has been decontaminated and is ready for sampling) and then into the sampling container(s). One equipment blank will be incorporated into the sampling program for each day's collection of groundwater samples and will be analyzed for the same suite of constituents as the groundwater. Blank analyses are discussed in more detail in the QAPP.

The sampling team will be responsible for maintaining custody of the samples until they are delivered to the carrier or the laboratory. The Chain-of-Custody form will then be signed and custody formally relinquished. The containers (bearing custody seals) will be in view at all times or will be stored in a secure place restricted to authorized personnel. Chain-of-Custody procedures are discussed in more detail in Appendix H.

FIELD SAMPLING PLAN

APPENDIX F

WATER-LEVEL MEASUREMENT

AND HYDRAULIC CONDUCTIVITY TESTING PROTOCOL

WATER-LEVEL MEASUREMENT AND HYDRAULIC CONDUCTIVITY TESTING PROTOCOL

Depth to ground water in the monitoring wells will be measured during scheduled field activities. These data will be converted to water-level elevations using surveyed vertical measuring points on individual well casings.

MEASURING WATER LEVELS IN WELLS

A weighted steel tape graduated in tenths of a foot will be the primary instrument of measuring the depth to ground water. Prior to insertion, the measuring tape will be rinsed with a laboratory-grade detergent solution (Micro™ or equivalent), rinsed with distilled water and dried with a clean cloth. Blue carpenter chalk will then be applied to the bottom five feet of tape. The weighted tape will be slowly lowered down the center of the casing. After water is encountered in the well, the tape will be held at the closest even-foot marker (which will be recorded as the "held" measurement) at the pre-marked surveyed measuring point at the top of the well. The steel tape will then be removed from the well and a record made of the measurement where the tape became wet. The wet measurement will be subtracted from the "held" measurement. This difference, or depth to water, will be recorded on a Geraghty & Miller Water-Level Record (Appendix I).

In certain circumstances, when frequent, repeated water-level measurements are necessary, an electronic (M-scope) instrument will be used.

HYDRAULIC CONDUCTIVITY TESTING

SLUG TESTS

A rising head slug test will be performed on each of the wells in order to determine the hydraulic conductivity of the formation material around the screened interval of each well. The slug test method involves the "instantaneous" removal of a slug of known volume from the well and monitoring water level recovery. An initial static water level of the well is taken. A slug of water is quickly removed using a clean bailer at which time an elapsed time count begins. Water levels are then repeatedly taken at close elapsed time intervals until the water level in the well has risen to not less than 90 percent of the original static level. Alternatively, a solid (displacer) slug may be used. A closed-end pipe or rod is inserted into the well and lowered below the static water level. Sufficient time is then allowed to elapse for the water level in the well to return to its original static level, and then the solid slug is instantaneously removed. An electronic water-level sensing device or pressure transducer will be used to monitor water-level recovery.

FIELD SAMPLING PLAN

APPENDIX G

FIELD INSTRUMENTATION OPERATING PROCEDURES

FIELD INSTRUMENTATION OPERATING PROCEDURES

Field instruments used during the investigation will be calibrated and operated in accordance with the following standard operating procedures and with the manufacturers' instructions.

AIR MONITORING EQUIPMENT

1. A photoionization detector (PID) with a 10.6 electronvolt (eV) lamp will be used on a semi-continuous basis during intrusive field operations (drilling, sampling, etc.).

2. Calibration of the instrument shall be performed on-site prior to use on a daily basis. The calibration gas will consist of a supply of zero air and mixture of 100 parts per million (ppm) isobutylene and air. The calibration procedure is detailed in the manufacturer's instructions.

FIELD ANALYSIS INSTRUMENTS

Field analysis of groundwater will consist of measurements of pH, temperature, turbidity, Eh, dissolved oxygen, and specific conductance. Field instruments for the measurement of pH and specific conductance will be calibrated with standard solutions prior to sampling.

FIELD SAMPLING PLAN

APPENDIX H

CHAIN-OF-CUSTODY PROCEDURES

CHAIN-OF-CUSTODY PROCEDURES

CHAIN-OF-CUSTODY

1. The field hydrogeologist will be responsible for maintaining custody of the samples until the are delivered to the overnight common carrier or courier for shipment to the laboratory. All samples shipped to a laboratory will be accompanied by the Geraghty & Miller, Inc. Chain-of-Custody Record (see Appendix H). The Chain-of-Custody Record will be completed in the field; the original form will accompany the shipment, and a copy will be retained by the field hydrogeologist in the field project file. The Chain-of-Custody form will list each of the individual sample containers and will be signed by each of the sampling team members who participated in collecting the samples.

2. A separate Chain-of-Custody Record will be filled out for the contents of each shipment container (cooler). The form will be placed in a plastic bag and taped to the underside of the lid of the cooler.

3. To provide a means of detecting any potential tampering during shipment, all shipment containers (coolers) will be affixed with signed Geraghty & Miller, Inc. sample seals. Two seals will be affixed to each cooler on opposite ends. In addition, a 2-inch wide transparent tape will be wrapped entirely around the cooler.

4. If the shipment is sent by common courier, an air bill or bill of lading will be used. Receipts from courier, air bills, and bills of lading will be retained in the field project file.

FIELD SAMPLING PLAN

APPENDIX I

QUALITY ASSURANCE/QUALITY CONTROL FORMS

AGI & MILLER, INC.
Environmental Services
a heidemij company

Laboratory Task Order No.________

CHAIN-OF-CUSTODY RECORD

Page______ of______

Project Number ______________________

Project Location ______________________

Laboratory ______________________

Sampler(s)/Affiliation ______________________

SAMPLE IDENTITY	Code	Date/Time Sampled	Lab ID	SAMPLE BOTTLE / CONTAINER DESCRIPTION									TOTAL

Sample Code: L = Liquid; S = Solid; A = Air

Total No. of Bottles/ Containers ______

Relinquished by: ______	Organization: ______	Date __/__/__	Time ______	Seal Intact?
Received by: ______	Organization: ______	Date __/__/__	Time ______	Yes No N/A
Relinquished by: ______	Organization: ______	Date __/__/__	Time ______	Seal Intact?
Received by: ______	Organization: ______	Date __/__/__	Time ______	Yes No N/A

Special Instructions/Remarks: ______________________

Delivery Method: ☐ In Person ☐ Common Carrier ______ (SPECIFY) ☐ Lab Courier ☐ Other ______ (SPECIFY)

G&M Form 09-9-91

Southprint 95-0533

GERAGHTY & MILLER, INC.
Environmental Services
a heidemij company

DAILY LOG

Well(s)_____ Project/No. _____ Page_____ of_____

Site Location _____

Prepared By _____

Date/Time	Description of Activities

GERAGHTY & MILLER, INC.
Ground-Water Consultants

SAMPLING OF MONITORING WELLS
DAILY CHECKLIST

PROJECT: _____ WELL(S): _____

LOCATION: _____ DATE: _____

G&M PERSONNEL ON SITE: _____ TIME: _____

CHECKED BY: _____

ITEMS	OK/NA	COMMENTS
PRIOR TO DRILLING: Health & safety precautions (HASP) received; equipment ready.		
Sample containers, coolers, received from laboratory; ice or ice packs ready.		
Sampling equipment and supplies inventoried, clean and operational.		
Check in with client at site.		
Integrity of well noted.		
Well area prepared for sampling; plastic placed around well; gasoline-powered pumps placed downwind.		
Well and water-level measurements made and recorded along with other pertinent field information on water sampling log.		
Field instruments calibrated.		
Sample containers labelled; preservatives added, if necessary.		
DURING AND AFTER SAMPLING: Well purged three to five times its volume.		
Sample collected using a bailer or pump as per sampling plan.		
Measurement of field parameters recorded on sampling log.		
Sample containers filled according to collection protocol of analyses.		
Field and trip blanks collected; replicates or split samples collected as per sampling plan.		
Samples stored at 4°C in coolers for transport to lab.		
Water sampling log and chain-of-custody form completed.		
Reusable equipment decontaminated; non-reusable equipment disposed of in appropriate manner.		
Well secured and locked.		
Laboratory contacted to confirm receipt and condition of samples.		

Additional Comments:

Instructions: Original to Field Project File; copy to Project Manager and to QA Representative.

GERAGHTY & MILLER, INC.
Environmental Services

WATER LEVEL/PUMPING TEST RECORD

PROJECT __________ WELL __________ SITE __________

SCREEN SETTING __________ MEASURING POINT DESCRIPTION __________ HEIGHT ABOVE GROUND SURFACE __________

STATIC WATER LEVEL __________ MEASURED WITH __________ DATE/TIME __________

DRAWDOWN ☐ START OF TEST __________ PUMPING WELL __________

RECOVERY ☐ END OF TEST __________

DISTANCE FROM WELL MEASURED TO PUMPING WELL (r) __________ DISCHARGE RATE __________ ORIFICE __________

DATE & TIME	WELL OR t (mins)	HELD (ft)	WET (ft)	DEPTH TO WATER (ft)	s (ft)	DEW.[1] CORR. (ft)	ART.[2] s′ (ft)		Q (gpm)	MANO-METER (in)	REMARKS[3]

1) Dewatering Correction 2) Equivalent Artesian Drawdown 3) pH, Spec. Cond., Temp., Weather, Sand, Turbidity, etc.

G&M Form 10 6-86

Southprint 89-1249

GERAGHTY & MILLER, INC.
Environmental Services
A **Heidemij** Company

WATER SAMPLING LOG

Project/No. _____ Page _____ of _____

Site Location _____

Site/Well No. _____ Coded/ Replicate No. _____ Date _____

Weather _____ Time Sampling Began _____ Time Sampling Completed _____

EVACUATION DATA

Description of Measuring Point (MP) _____

Height of MP Above/Below Land Surface _____ MP Elevation _____

Total Sounded Depth of Well Below MP _____ Water-Level Elevation _____

Held _____ Depth to Water Below MP _____ Diameter of Casing _____

Wet _____ Water Column in Well _____ Gallons Pumped/Bailed Prior to Sampling _____

Gallons per Foot _____

Gallons in Well _____ Sampling Pump Intake Setting (feet below land surface) _____

Evacuation Method _____

SAMPLING DATA/FIELD PARAMETERS

Color _____ Odor _____ Appearance _____ Temperature _____ °F/°C

Other (specific ion; OVA; HNU; etc.) _____

_____

Specific Conductance, umhos/cm _____ pH _____

Sampling Method and Material _____

Constituents Sampled	Container Description From Lab ____ or G&M ____	Preservative

Remarks _____

Sampling Personnel _____

WELL CASING VOLUMES

GAL./FT.							
	1-¼"	= 0.06	2"	= 0.16	3"	= 0.37	4" = 0.65
	1-½"	= 0.09	2-½"	= 0.26	3-½"	= 0.50	6" = 1.47

Southprint 94-1261

GERAGHTY & MILLER, INC.
Environmental Services

SAMPLE/CORE LOG

Boring/Well _____ Project/No. _____ Page _____ of _____

Site Location _____ Drilling Started _____ Drilling Completed _____

Total Depth Drilled _____ feet Hole Diameter _____ inches Type of Sample/ Coring Device _____

Length and Diameter of Coring Device _____ Sampling Interval _____ feet

Land-Surface Elev. _____ feet ☐ Surveyed ☐ Estimated Datum _____

Drilling Fluid Used _____ Drilling Method _____

Drilling Contractor _____ Driller _____ Helper _____

Prepared By _____ Hammer Weight _____ Hammer Drop _____ inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description

Southprint 89-1257

GERAGHTY & MILLER, INC.
Environmental Services

SAMPLE/CORE LOG (Cont.d)

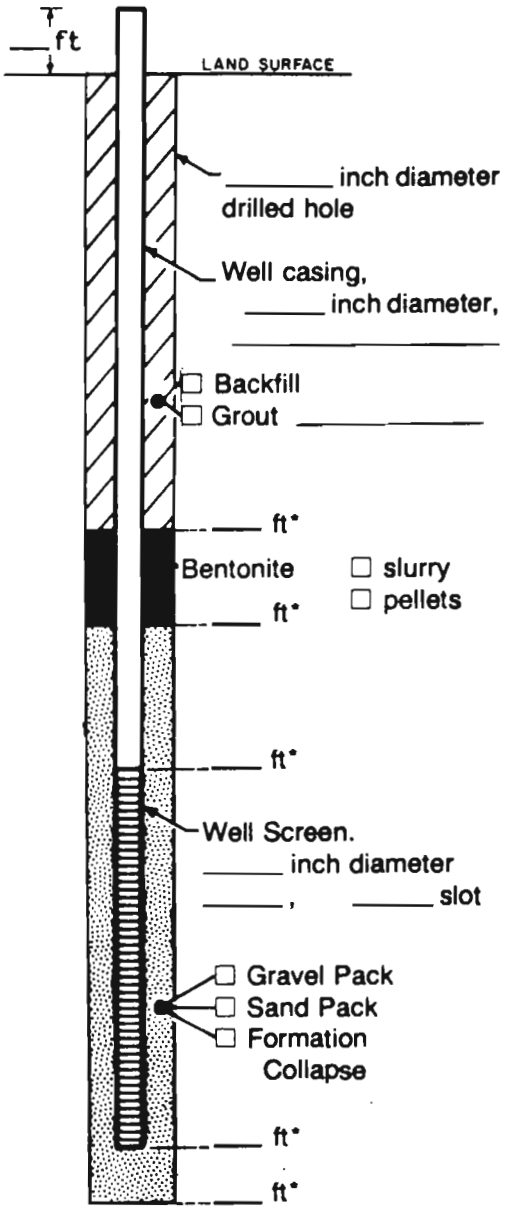
Boring/Well_____ Page_____ of_____

Prepared By_____

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description

GERAGHTY & MILLER, INC.
Ground-Water Consultants

WELL CONSTRUCTION LOG



Measuring Point is Top of Well Casing Unless Otherwise Noted.

*Depth Below Land Surface

Project _____ Well _____

Town/City _____

County _____ State _____

Permit No. _____

Land-Surface Elevation

and Datum _____ feet ☐ surveyed

_____ ☐ estimated

Installation Dates(s) _____

Drilling Method _____

Drilling Contractor _____

Drilling Fluid _____

_____

Development Techniques(s) and Date(s)

_____

_____

_____

Fluid Loss During Drilling _____ gallons

Water Removed During Development _____ gallons

Static Depth to Water _____ feet below M.P.

Pumping Depth to Water _____ feet below M.P.

Pumping Duration _____ hours

Yield _____ gpm Date _____

Specific Capacity _____ gpm/ft

Well Purpose _____

_____

_____

Remarks _____

_____

_____

_____

_____

_____

Prepared by _____