EA Project No. 11242.06

STANDARD OPERATING PROCEDURES MANUAL FOR FIELD SAMPLING

Prepared for

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CONTENTS (Cont.)

CONTENTS (Cont.)

CONTENTS (Cont.)

CONTENTS (Cont.)

1.0 INTRODUCTION

This manual was prepared for the Rhode Island Department of Environmental Management (RI-DEM), Division of Air and Hazardous Materials (DAHM), by their technical assistance contractor (EA Engineering, Science, and Technology). The manual was prepared as a guidance document on field investigation techniques. Standardizing personnel sampling techniques and procedures will improve quality assurance/quality control for a more accurate and thorough field investigation.

It is the responsibility of the Project Manager and field personnel to read and implement the procedures outlined in this guidance document.

1.1 SCOPE OF WORK

The scope of work assigned to EA Engineering, Science, and Technology involved the design of a Standard Operating Procedures (SOP) manual for field sampling.

2.0 PRE-SAMPLING/FIELD ACTIVITY PREPARATION

2.1 PURPOSE

The purpose of the Standard Operating Procedure is to provide quality assurance guidance for properly completing a sampling project with a detailed "plan of action". As part of the pre-sampling/field activity preparation phase the following information should be reviewed: site history; topographic, geologic, and hydrogeologic features of the site; manufacturing operations and disposal practices; and potential health and safety issues. The gathering of this information will help avoid confusion at the site, protect worker health and safety, and insure that a courtroom defensible sample is collected.

2.2 FIELD PROCEDURE

While in the field it is necessary for field personnel to document site activities in a field notebook. All entries into the field notebook should be in ink. The field notebooks must be bound and should have numbered, water resistant pages. All pertinent information regarding the site and sampling procedures must be documented in the field notebook. A list of field notebook entries are outlined below. NOTE: this is only a guidance list, specific site activities may require additional field notebook entries.

- Name and exact location of the site
- Date, weather conditions, name of person making field notebook entries
- Identify by name the workers/visitors and the times of site arrivals/departures
- Purpose/objective of site visit
- Sketch of site: including north arrow, wind direction, appearance, roads, buildings, surface type, storm drains, any unusual site characteristics
- Visual/olfactory evidence of contamination
- Any hazardous conditions or follow up actions required
- Telephone calls to/from the site
- If more than one field notebook is used, reference the number of each field notebook in every field notebook used on that project
- Listing of all the samples taken, the time each sample was obtained, name of person collecting the samples, method of sample collection, a list of sample identification numbers, and the sample location
- Name, identification number, and calibration date of field monitoring equipment used
- Equipment needed for future site visits
- Activities on the site or in the immediate area which may impact the site
- List of photographs and direction from which the photographs were taken
- Field observations such as ground cover, surface water runoff direction, surface water color and sheen, the number of rusted drums, stained soils, etc.

Under this DAHM SOP, it will be normal operating procedures for the Project Manager to be in the field for all activities scheduled for their site. If the Project Manager is unable to directly supervise field activities, detailed and established contingency plans are necessary. RI-DEM field personnel should schedule a meeting with this Project Manager to become familiar with specific site conditions prior to the commencement of field activities.

As part of the pre-sampling and field activity preparation, it will be standard procedure to contact the DAHM laboratory liaison in order to determine the specific requirements necessary for sampling, such as type of containers, amount of sample necessary for the anticipated analysis, etc.

It is DAHM policy, no one should enter a site alone. The Project Manager will be responsible for all field activities and should be accompanied by another engineer, from DAHM, EPA, or the DAHM contractor at all times.

A "field kit" should be prepared for all DAHM personnel to utilize during sampling events. This "field kit" should contain the following at a minimum:

- camera with extra rolls of film;
- compass;
- watch/clock;
- extra water-proof pens;
- extra sampling containers/sample labels;
- cooler/ice;
- first aid kit;
- extra personal protection equipment;
- small tool kit;
- extra batteries for camera and flashlight;
- field notebook; and
- extra Chain-of-Custody records

2.3 DECONTAMINATION PROCEDURE

Decontamination procedures ensure cleanliness of equipment used in the field and the integrity of the sample obtained using sampling equipment. Without these procedures, field equipment could introduce contamination to an otherwise clean sample nullifying the validity of the sampling effort.

With the materials listed below, the DAHM field personnel will use these steps to decontaminate the equipment:

1) scrub the equipment off in a bucket of hot, soapy water with thick, bristled brushes;
2) rinse the equipment in a seperate bucket of distilled water;
3) spray the equipment with methanol;

4) rinse the equipment in another bucket of distilled water; and
5) air dry and return the equipment to a sanitary location (equipment case, etc.).

If a large amount of contamination is present, the buckets must be emptied and cleaned after each sample locations decontamination procedures are conducted at each sample location.

. Basic List of Decontamination Equipment

- three five-gallon buckets
- three thick bristled brushes
- methanol
- alconox
- distilled water
- paper towels
- spray bottles

3.0 PHOTOGRAPHIC RECORD

3.1 PURPOSE / RESPONSIBILITY

The purpose of this SOP is to provide quality assurance guidance for properly recording site activities and conditions in permanent, photographic record.

It is the responsibility of the representative on Site (Project Manager, Field Technician, Geologist, etc.) to record the events that occur on site and the site conditions by means of film. It is the responsibility of the Project Manager to explain the process of photographing the site and activities and recording the correct information on each photograph.

3.2 DOCUMENTATION PROCEDURE

These are the general, minimum guidelines to be followed when documenting Site information on film. Site conditions and activities warrant specific alterations to the format.

- Before entering the field, the site photographer should insure that photographic equipment is in working order and that the necessary supplies are available. In addition, RI-DEM personnel should be familiar with photographic documentation of site activities and conditions.
- The site photographer needs to be aware of situations which require Polaroid pictures, such as: imminent hazards where it is anticipated that an enforcement action will be necessary; major emergency response; etc.
- The site photographer should put some sort of measuring reference next to the subject matter, such as: hammer; shovel; tape measure; person; and truck.
- Take a photograph for every event in a sequenced activity (i.e., tank pull: area of unbroken ground, first sighting of tank, total uncovered tank, depth to the tank and to the bottom of the pit with a tape measure, any pipes leading to the tank, the removal of the tank, the machinery involved, the tank out of the pit and on the ground with a spray painted number and measuring tool beside it, empty pit and focus on any visibly contaminated soil, etc.)
- Include visible areas of direct environmental impact are from the site in the photographs.
- Possible off-site migration of contaminants.
- Keep a sketch of the site including: photograph locations; photograph numbers; photograph direction; area of activity; and building locations.
- A panoramic view photograph may be used to record a 360 degree view from any site location

3.3 PHOTOGRAPHIC ENTRIES TO FIELD NOTEBOOK

. Initially with the first photograph, record the following in the field notebook:

- number of the photograph;
- write the photographer's name, location, and date on the back of the picture;
- briefly describe reason for photographing the subject matter;
- location and direction (N,S,E,W) the photograph was taken;
- if the photograph is part of a process, describe what part (i.e., manufacturing, tank pull, well installation);
- name of persons included in photograph;
- time and weather conditions during photograph;
- names of any buildings, streets, bodies of water in the photograph; and
- approximate measurements of objects within the picture.

3.4 DECONTAMINATION PROCEDURES

N/A

3.5 ATTACHMENTS

N/A

4.0 EQUIPMENT USE AND CALIBRATION

4.1 PURPOSE / RESPONSIBILITY

The purpose of this SOP is to provide quality assurance of the samples taken and results recorded. By having a standard set of techniques to follow, the Project Manager can feel confident that the samples will be collected correctly and that the results will be commensurate with the sampling technique.

Field personnel are responsible for collecting accurate, quality information by the use of field screening devices. It is imperative that the personnel be familiar with the calibration, start-up and shut-down of each type of field screening equipment.

4.2 FIELD SCREENING EQUIPMENT

There are several different types of field screening equipment, all designed to achieve specific results. RI-DEM personnel utilize the following direct reading instruments on a regular basis: HNU photoionizer; detector tubes; and explosimeter. Some of the direct reading instruments may not detect particular toxic agents, including hydrogen cyanide and hydrogen sulfide. The limitations of the particular instrument should be identified, before entering the site. The HNU, deterctor tubes, and explosimeter applications are briefly outlined below.

HNU

The HNU portable photoionizer detects organic and some inorganic gases and vapors. A fan or pump draws the air containing these gases and vapors through a probe. The molecules in the gases and vapors are ionized by ultraviolet light emitted by either a 9.5, 10.2, or 11.7 electron volt lamp. A current is produced by the energized molecules, which will operate a readout dial on the instrument.

The HNU instrument should zero-out to background. To zero the instrument, turn the function switch to standby and rotate the zero potentiometer dial, until the meter is at zero. Then wait 15-to-20 seconds to ensure the zero adjustment is stable.

These are the limitations of the HNU:

* before and after each use the HNU should be recalibrated with isobutylene;
* does not detect methane;
* the instrument response is affected by high humidity; and
* does not detect compounds with ionization potentials greater than the energy produced by the lamp.

DETECTOR TUBES

The detector tubes are colorimetric tubes which consist of a glass tube impregnated with a specific indicating chemical. This detector tube is connected to a piston or bellows hand pump. A known volume of contaminated air is pulled by the piston or bellows hand pump into the detector at a predetermined rate. If this air sample is contaminated with the indicating chemical in this tube, a color change will be observed.

The detector tubes are delineated in either a percent range or in parts per million. The length of the color change is proportional to the contaminant concentration.

The limitations of the detector tubes are the following:

* poor accuracy and precision;
* affected by temperature and humidity;
* may respond to interfering chemicals; and
* shelf life is only one to three years.

EXPLOSIMETER

The combustible gas indicator/oxygen analyzer "Explosimeter" is used to measure the concentrations of combustible gases and vapors in the air to determine the potential for fire and explosion. The explosimeter will determine if adequate oxygen levels are present on the site to support life.

The method of detection for the combustible gases is based on the heating of a filament which burns the gases in the air sample. The result is an increase in temperature. This increase in temperature is displayed on a dial or LCD readout as the percentage of LEL. The oxygen concentration is detected by an electrochemical sensor measuring the partial pressure of O_2 in the air. This pressure is electronically converted and displayed as the O_2 concentration.

The limitations of the explosimeter are listed below:

* must be calibrated with propane prior to each use;
* not accurate in an oxygen deficient atmosphere;
* filament can be damaged by certain compounds, such as tetraethyl lead, silicones, and halides;
* accuracy is subject to changes in altitude and pressure;
* cannot differentiate between petroleum vapors and combustible gases unless a charcoal filter is utilized;
* accuracy is partially dependent on the chemical and physical differences between the calibration gas (propane) and the gas being sampled; and
* CO_2 poisons the O_2 cell.

4.3 FIELD SCREENING EQUIPMENT USE CHECKLIST

- Normal operating proceedures require the Project Manager to verify the condition and calibration of field equipment with the DAHM Equipment Manager prior to field activities.
- Date of last calibration must be within acceptable limits noted in the manual, otherwise recalibration will be necessary.
- Equipment is operational and that the batteries are charged.

4.4 SPECIFIC FIELD BOOK ENTRIES

- Note the type of equipment used and the model number.
- Note any equipment problems and what was done to try to remedy them.

4.5 DECONTAMINATION PROCEDURE

Each type of field screening equipment requires a specific decontamination procedure. Check with the proper equipment manual for the correct procedure.

4.6 ATTACHMENTS

To be supplied by RI-DEM

5.0 SOIL SAMPLING

5.1 PURPOSE / RESPONSIBILITY

The purpose of the standard operating procedure is to provide quality assurance of the samples taken. By having a standard set of techniques to follow, the Project Manager can feel confident that the samples will be collected correctly and that the results will be commensurate with the sampling technique.

5.2 PROCEDURES

There are several basic types of soil samples: at depths between the ground surface and six inches; at depths between six inches and three feet; at depths greater than three feet; test pits, and/or tank pulls, sediment, soil and/or sludge. Soil samples submitted for laboratory analysis to Alpha must be in an 8-ounce jar. If flashpoint and several parameters are being run on the soil sample, then two 8-ounce jars must be submitted to the laboratory.
(In addition to the specific entries, refer to the Attached Minimum Field Book Entries list)

5.3 SURFICIAL SOIL SAMPLING

5.3.1 Technique/Situation

- samples collected from a depth between ground surface and six inches
- a clean trowel, scoop or trier is used to retrieve the sample
- the sampling area should be clear of debris (leaves, sticks, rocks)
- the sampler should dig straight down, to get a representative sample of the soil
- rocks, twigs, or other debris should not be deposited into the sample container
- the sample is deposited, with the appropriate tool, into the sampling container
- the sample container should be correctly labeled

5.3.2 Specific Field Book Entries

- description of above-listed procedure
- depth of each sample (measured with tape measure)
- sketched location on the site of each sample (direction, depth)
- sample appearance: odor, color, texture, anything unusual
- problems encountered in the field, and how they were remedied
- field monitoring equipment readings

5.3.3 Equipment Lists for Sampling Soil/Sediments

- triers, trowels, scoops (and extras)
- hand corer, tulip-bulb planter (and extra parts)
- PPE
- sample containers (and extra), labels, (and extra), and water-proof pens
- plastic bags to hold sample jars in, to prevent cross-contamination
- cooler, filled with bags of ice
- measuring tape
- flagging tape (in case sampling points must be marked)
- wooden stakes (in case sampling points must be marked)
- decontamination supplies
- measuring tape/wheel (to measure off the sampling points; additional information to add to the sketch)
- map of the area and sampling points
- field book
- field monitoring equipment as specified by the Project Manager

5.4 SOIL SAMPLES (BETWEEN 6 INCHES AND 3 FEET)

5.4.1 Technique/Situation

- hand tools typically used: hand auger, tulip-bulb planter, or a soil coring device (i.e., post hole digger)
- samples taken at depths greater than three feet may require the use of a drill rig or similar equipment (a split-spoon sampler is typically the sampling tool)
- the sampling area should be clear of debris (leaves, sticks, rocks)
- the sampler should dig straight down to the desired depth, measure with tape measure, and then fill tool and raise to surface
- the samples should be retrieved from the device with a decontaminated trowel, scoop or trier and deposited into the proper sample container
- the sample container should be correctly labeled
- open the sampler and observe the soil sample
- note the type of soil present, the depth of the sample, and the amount of recovery

. If refusal is met either by hand coring or drill rig augering then relocate slightly to either side of the original hole and try again

5.4.2 Specific Field Book Entries

- drilling company and driller/helper names (if used)
- type of drill rig
- drilling method
- boring identification numbers

- boring diameter
- soil sampling method
- soil sample number and depth range
- blow counts per six inches
- type of sampling device and technique
- soil sample classification (i.e., Unified Soil Classification System or Burmister System)
- depth to groundwater
- sheen, odor, discoloration, rate of flow
- headspace background reading/headspace sample reading
- evidence of contamination (visual or olfactory)
- a description of the soil sampling procedure
- changes in work zone air quality
- changes in soil stratification
- depths to bottom of boring
- any special handling of soil samples
- sketched location on the site of each sample (direction, depth)
- sample appearance: odor, color, texture, anything unusual
- problems encountered in the field, and how they were remedied
- field monitoring equipment readings

5.4.3 Equipment Lists for Sampling Soil/Sediments

- cleaned post hole digger, hand auger, tulip-bulb planter, trier, and/or split-spoon sampler
- drill rig and related supplies (if used)
- shelby tubes (if they are being used)
- soil classification system chart (if necessary)
- soil boring logs
- protective gloves (PPE)
- sample containers (and extra), labels, (and extra), and water-proof pens
- plastic bags to hold sample jars in, to prevent cross-contamination
- cooler, filled with bags of ice
- measuring tape
- flagging tape (in case sampling points must be marked)
- wooden stakes (in case sampling points must be marked)
- paper towels, to clean off sample jars before putting them into plastic bags
- measuring tape/wheel (to measure off the sampling points; additional information to add to the sketch)
- map of the area and sampling points
- field book
- field monitoring equipment as specified by the Project Manager

5.5 SOIL SAMPLING - TEST PITS

5.5.1 Technique/Situation

- may require use of a Bobcat, backhoe, or excavator
- backhoe operator retrieves the soil in the bucket and raises it to the Sampler
- samples should be collected along walls and base of test pit (or in accordance with a Site-Specific Sampling Plan)
- sample is retrieved by using a hand tool (trier, trowel, scoop) to collect the sample from the bucket of the excavating equipment
- sample is transferred from hand tool to appropriate sample container
- the sample container should be correctly labeled
- rocks, twigs, or other debris should not be deposited into the sample containers

Note: Risks involved when sampling from a test pit:

- use of heavy equipment
- possibility of underground utilities
- presence of methane gas, flammable, or reactive containerized material (potential for fire or explosion)
- contaminants in the soil
- confined space hazards unless the test pit walls are secured according to OSHA Standards
- inhalation or dermal exposure to unknown contaminants

5.5.2 Specific Field Book Entries

- names and addresses of excavating company
- type of excavation equipment
- test pit locations
- soil description/stratification changes
- evidence and depth of contamination
- depth to groundwater
- sheen, odor, discoloration, rate of flow
- dimensions of completed test pit
- method and type of sampling
- sampling equipment used
- identification and location of samples collected
- soil stockpiling activities and methods
- sketched location on the site of each sample (direction, depth)
- sample appearance: odor, color, texture, anything unusual
- problems encountered in the field, and how they were remedied
- field monitoring equipment readings

Note: Additional Field Book Entries for Sampling During Tank Removals

- size and number of tanks to be removed
- size and number of tanks actually removed
- contents of tank(s)/amount
- documentation of the removal process
- tank/piping condition
- method of tank preparation for removal from site
- type of backfill material
- evidence of contamination (soil and/or groundwater)
- depth to groundwater (sheen, odor, discoloration, rate of flow)
- number of each tank, sprayed with orange spray paint
- stockpiled soil/material amount
- further remedial actions to be taken2

5.5.3 Equipment List

- cleaned post hole digger, hand auger, tulip-bulb planter, trier, and/or split-spoon sampler
- drill rig and related supplies (if used)
- shelby tubes (if they are being used)
- soil classification system chart (if necessary)
- soil boring logs
- protective gloves (PPE)
- sample containers (and extra), labels, (and extra), and water-proof pens
- plastic bags to hold sample jars in, to prevent cross-contamination
- cooler, filled with bags of ice
- measuring tape
- flagging tape (in case sampling points must be marked)
- wooden stakes (in case sampling points must be marked)
- paper towels, to clean off sample jars before putting them into plastic bags
- measuring tape/wheel (to measure off the sampling points; additional information to add to the sketch)
- map of the area and sampling points
- field book
- field monitoring equipment as specified by the Project Manager

5.6 SOIL SAMPLING - OFF-SHORE

5.6.1 Technique/Situation

Soil sampling off-shore can be accomplished by various means and methods. A common beginning to all soil sampling events off-shore is to create a sampling plan. Sampling plans are not generic and need to be developed using sound scientific judgements as there is no

"cookbook" procedures. The following is a list of possible observations that sampling personnel shall make in development of a Sampling Plan.

When creating a Sampling Plan, the following observations and considerations should be made:

- locate the potential source(s) of contamination
- in-flowing, out-flowing, and merging of waters may be sampled to characterize the waters in relation to contaminant level by comparing to the surrounding base levels
- areas of standing water may also be analyzed
- waters may also be segregated by location (i.e., river mouth, standing water, bridge, dam, etc.)
- with the water categorized, selection of soil sampling station can be made
- the number of samples to be taken will be site specific to be determined by the sample plan originator based on project manager's judgement and any other restrictions
- be sure to extract samples by strata not as a composite
- it is important to get adequate replication of the sediments from each sampling station; similar sediment types can be used for comparative relationships between stations
- be sure to consult the laboratory that is conducting the sample tests to ensure the correct volume of soil collected for analysis
- use a boat, barge, or a bridge (if needed)
- sampler should be situated downstream of the sample point
- use hand corers, dredges, or bottom sediment sampler to retrieve sample
- place sample in the appropriate container
- correctly label sample jar
- replicates shall be taken at each sampling station for QA/QC of analytical results and statistical calculations
- more information on QA/QC may be found in the 301 H program of the U.S. Clean Water Act.

5.6.2 Specific Field Book Entries

- drilling company and driller/helper names (if used)
- type of drill rig
- drilling method
- boring/well identification numbers
- boring diameter
- soil sampling method
- soil sample number and depth range
- blow counts per six inches
- type of sampling device and technique
- soil sample classification (i.e., Unified Soil Classification System or Burmister System)

- a description of the soil sampling procedure
- changes in soil stratification
- depths to bottom of boring
- any special handling of soil samples
- sketched location on the site of each sample (direction, depth)
- sample appearance: odor, color, texture, anything unusual
- problems encountered in the field, and how they were remedied
- field monitoring equipment readings

5.6.3 Equipment Lists for Sampling Soil/Sediments

- boat or barge (if necessary)
- all necessary Coast Guard regulatory safety boating devices/approvals
- sample containers (and extra), labels, (and extra), and water-proof pens
- plastic bags to hold sample jars in, to prevent cross-contamination
- cooler, filled with bags of ice
- paper towels, to clean off sample jars before putting them into plastic bags
- map of the area and sampling points
- field book
- field monitoring equipment as specified by the Project Manager

5.7 DECONTAMINATION PROCEDURE

The decontamination procedure ensures the cleanliness of the equipment and the integrity of the sample. Without this procedure, the equipment could introduce cross contamination, thus making void the entire sampling effort.

With the materials listed below, the Sampler will use these steps to decontaminate the equipment:

1. Scrub the equipment off in a bucket of soapy water with thick-bristled.
2. Rinse the equipment in another bucket of water
3. Spray the equipment down with methanol
4. Spray the equipment down with distilled water
5. Air dry and return the equipment to a sanitary location (equipment cast, etc.)

The buckets must be changed after every sample location decontamination procedure.

5.8 ATTACHMENTS

- Soil boring log
- Equipment list of sampling soil/sediments
- Log of soil boring explanation sheet

- Diagrams of: Scoop/Trowel, Bucket Auger, Soil Coring Device, Silver Bullet Sampler, Sampling Trier, Veihmeyer Soil Sampler, Ponar Dredge/Ponar Grab, Sludge Getter, Hand Corer,
- Minimum List of Field Book Entries

6.0 HEADSPACE SCREENING FOR VOLATILE ORGANIC COMPOUNDS

6.1 PURPOSE/RESPONSIBILITY

The purpose of this SOP is to insure the integrity of field sample data for headspace screening for volatile organic compounds.

Use of the field monitoring equipment shall be by an individual familiar with this SOP and the equipment manual. The Project Manager shall be responsible for insuring the sampler/user is familiar with the appropriate references as well as their applicability to the contaminants expected at the Site.

6.2 PROCEDURE

- Turn the instrument on (continue to follow procedure outlined in equipment manual).
- Attain a zero reading before collecting field screening data (note: if zero reading is not consistently detected, record the average background contentration).
- Samples shall be placed into a clean soil sample collection jar.
- The soil sample screening jar should be filled to a maximum of one half of the size of the sample jar. Aluminum foil should be placed to cover the mouth of the jar and the jar should be capped.
- This screening jar should remain undisturbed and out of direct sunlight for a minimum of 10 minutes.
- Then, shake the jar and remove the cap of the screening jar.
- The probe of the instrument is inserted through the aluminum foil and into the jar headspace.
- Record the reading noted on the instrument.
- Document any fluctuations/variances.
- Remove the probe from the sample headspace.
- Allow instrument to return to zero or background reading.
- Repeat same procedure for additional samples.

6.3 FIELD BOOK ENTRIES

- names and addresses of excavating company
- type of excavation equipment
- test pit locations
- soil description/stratification changes
- evidence and depth of contamination
- depth to groundwater
- sheen, odor, discoloration, rate of flow
- dimensions of completed test pit

- method and type of sampling
- sampling equipment used
- identification and location of samples collected
- soil stockpiling activities and methods
- sketched location on the site of each sample (direction, depth)
- sample appearance: odor, color, texture, anything unusual
- problems encountered in the field, and how they were remedied
- field monitoring equipment readings
- field monitoring equipment readings record lolitile organic compounds in parts per million (ppm) in the sample headspace

Note: Additional Field Book Entries for Sampling During Tank Removals

- size and number of tanks to be removed
- size and number of tanks actually removed
- contents of tank(s)/amount
- documentation of the removal process
- tank/piping condition
- method of tank preparation for removal from site
- type of backfill material
- evidence of contamination (soil and/or groundwater)
- depth to groundwater (sheen, odor, discoloration, rate of flow)
- number of each tank, sprayed with orange spray paint
- stockpiled soil/material amount
- further remedial actions to be taken

6.4 EQUIPMENT LIST

- cleaned post hole digger, hand auger, tulip-bulb planter, trier, and/or split-spoon sampler
- drill rig and related supplies (if used)
- shelby tubes (if they are being used)
- soil classification system chart (if necessary)
- soil boring logs
- protective gloves (PPE)
- sample containers (and extra), labels, (and extra), and water-proof pens
- plastic bags to hold sample jars in, to prevent cross-contamination
- cooler, filled with bags of ice
- measuring tape
- flagging tape (in case sampling points must be marked)
- wooden stakes (in case sampling points must be marked)
- paper towels, to clean off sample jars before putting them into plastic bags
- measuring tape/wheel (to measure off the sampling points; additional information to add to the sketch)
- map of the area and sampling points

- field book
- field monitoring equipment as specified by the Project Manager

6.5 DECONTAMINATION PROCEDURES

The decontamination procedure ensures the cleanliness of the equipment and the integrity of the sample. Without this procedure, the equipment could introduce cross contamination, thus making void the entire sampling effort.

With the materials listed below, the Sampler will use these steps to decontaminate the equipment:

1. Scrub the equipment off in a bucket of soapy water with thick-bristled.
2. Rinse the equipment in another bucket of water
3. Spray the equipment down with methanol
4. Spray the equipment down with distilled water
5. Air dry and return the equipment to a sanitary location (equipment cast, etc.)
6. Consult equipment manual for proper steps for probe decontamination

The buckets must be changed after every sample location decontamination procedure.

6.6 ATTACHMENTS

- minimum list of field book entries

6.7 TROUBLE SHOOTING

Use of an HNU photoionization detector in humid/wet conditions is not recommended as the HNU has the potential to photoionize water molecules.

MINIMUM FIELD BOOK ENTRIES

Initial Site Entry Notes: • your name, arrival time and date • purpose of your visit • report weather conditions • record names, titles and companies of all individuals on site; their arrival and departure times • attendance of Field Personnel briefing • H&S: - review of hospital route - decon station established - H&S Plan reviewed/signed • sketch Site (N arrow, roads, buildings, storm drains, sampling locations, source areas, etc.) • general Site description (relative to previous Site observations)	**General Sampling Entries:** • calibration date & serial # of instruments • record condition of sampling location • sample type (soil, GW, surface water) • sample number, location and brief description (color, odor) • sampling method (include grab or composite sample) • sample depths • time of sample collection • sample analyses & preservatives • number of jars for each sample • placed in ice chest • decon procedures • document sampling location was left upon completion of your work (ie, closed and locked monitoring well, backfilled and packed bore hole, etc)
Sampling Entires - GW: • log in chart format: - depth to groundwater - depth of well - depth to PVC from ground surface/ roadbox - volume of water to be removed - method of water removal - VOC screening - pH, temp., cond. readings - visual/olfactory contamination • disposal method of bailed water • groundwater recovery/recharge	**Sampling Entires - drilling:** • drillers' names, company, rig type • type of drilling and method • boring diameter, blow counts/6 inches • soil classification/class. system used • field screening results • visual/olfactory contamination • any other item to be included on boring log and well completion log • changes in work zone air quality • construction details of wells • method for checking for overhead and underground interferences (utilities)
Photograph Recordkeeping: • sketch items noted in photograph • draw direction photo was taken relative to permanent structures & N arrow • number of photograph • place some type of device to show scale (should use a measuring tape)	**Survey Notes:** • date and time of survey • purpose of survey • sketch of area to be surveyed • bench mark locations and elevations (record source for actual bench marks)
Misc. Entries/notes: • all entries shall be in waterproof black ink • draw a line through unused portions of pages (date and initial) • draw a single line through errors (date and initial) • note any remarks, telecons to/from the site • note all deviations & reasons for deviations from Scope of Work • note down time and lunch breaks • record any hazardous conditions and the action-taken in response to mitigate the hazard • note any actions near the site that could potentially impact the project	**Tank Removal Oversight:** • name and address of contractors • type of excavating equipment • safety precautions taken • size and number of tanks to be removed • contents removed • tank/piping condition (rusted, pitted, holes, patches) • method of tank preparation for removal • type of backfill material • soil/groundwater sample screening • stockpiled soil/material (amount) • excavation area filled or cordoned off • dimension of excavation(s)/tank(s) • evidence of contamination • further remedial measures warranted
Off-site Soil Disposal: • removal contractor name & address • loading time • manifest serial numbers • estimated volume/weight to be removed • field screening results • number and type of transport and removal equipment	**Departure notes:** • list equipment needed for future site visits • list specific tasks that should be performed on follow-up site visits • purpose for departing site • sign, and record time and date of departure

1) It is crucial that photocopies of field documentation are included directly into the project folder in the office (particularly in the event of loss of the field book). 2) It is assumed that the Field Personnel have already been familiarized with the specifics of the project.

7.0 TEST PIT / TANK REMOVAL PROCEDURE

7.1 PURPOSE / RESPONSIBILITY

The purpose of this Standard Operating Procedure is to ensure the integrity of the collected samples. It is also to impose a measure of control over the sample handling process.

It is the responsibility of the Project Manager, or equivalent, to perform and oversee test pit and tank removal operations. It is the responsibility of the Project Manager to designate the location for each activity and to explain any specific conditions to the Geologist, or equivalent.

7.2 PROCEDURE

. the following is a general procedure for performing a test pit:
- read the Pre-Sampling Plan and follow the instructions
- before proceeding with the activity, make sure all underground and overhead utilities have been marked and identified
- sketch a map of the area before any construction begins and indicate the area of the test pit
- direct the construction equipment accordingly
- keep an ongoing sketch of the activity; include dimensions, observations, problems, specific soil stratifications
- as the test pit work is being performed, describe the changing soil stratification; including the extent and depth of soil contamination and the location in the pit
- collect samples at prescribed locations
- constantly monitor, with a field monitoring apparatus, the soil headspace from the collected soil samples and record accurate descriptions of location of the soil in the test pit (complete with measurements and dimensions of the pit)
- description of sampling locations (include note on sketch)
- record the depth to groundwater and note any sheen, discoloration, rate of flow into pit
- record the completed dimensions of the test pit
- note the method and type of sampling
- note the stockpiling activities, method, location, what is planned for the soil, the company involved in any transport and disposal
- describe any filling operations; type of fill, whether or not the area was paved over

7.3 FIELD BOOK ENTRIES

. for a minimum list, see the Field Book Entries SOP
. note all of the above procedures in the field book

7.4 DECONTAMINATION PROCEDURE

The decontamination procedure ensures the cleanliness of the equipment and the integrity of the sample. Without this procedure, the equipment could introduce cross contamination, thus making void the entire sampling effort.

With the materials listed below, the Geologist will use these steps to decontaminate the equipment:

1. scrub the equipment off in a bucket of soapy water with thick-bristled brush
2. rinse the equipment in another bucket of water
3. spray the equipment down with methanol
4. spray the equipment down with distilled water
5. air dry and return the equipment to a sanitary location (equipment cast, etc.)

The buckets must be changed after every sample location decontamination procedure.

7.5 ATTACHMENTS

. Minimum list of field book entries

MINIMUM FIELD BOOK ENTRIES

Initial Site Entry Notes: • your name, arrival time and date • purpose of your visit • report weather conditions • record names, titles and companies of all individuals on site; their arrival and departure times • attendance of Field Personnel briefing • H&S: - review of hospital route - decon station established - H&S Plan reviewed/signed • sketch Site (N arrow, roads, buildings, storm drains, sampling locations, source areas, etc.) • general Site description (relative to previous Site observations)	**General Sampling Entries:** • calibration date & serial # of instruments • record condition of sampling location • sample type (soil, GW, surface water) • sample number, location and brief description (color, odor) • sampling method (include grab or composite sample) • sample depths • time of sample collection • sample analyses & preservatives • number of jars for each sample • placed in ice chest • decon procedures • document sampling location was left upon completion of your work (ie, closed and locked monitoring well, backfilled and packed bore hole, etc)
Sampling Entires - GW: • log in chart format: - depth to groundwater - depth of well - depth to PVC from ground surface/ roadbox - volume of water to be removed - method of water removal - VOC screening - pH, temp., cond. readings - visual/olfactory contamination • disposal method of bailed water • groundwater recovery/recharge	**Sampling Entires - drilling:** • drillers' names, company, rig type • type of drilling and method • boring diameter, blow counts/6 inches • soil classification/class. system used • field screening results • visual/olfactory contamination • any other item to be included on boring log and well completion log • changes in work zone air quality • construction details of wells • method for checking for overhead and underground interferences (utilities)
Photograph Recordkeeping: • sketch items noted in photograph • draw direction photo was taken relative to permanent structures & N arrow • number of photograph • place some type of device to show scale (should use a measuring tape)	**Survey Notes:** • date and time of survey • purpose of survey • sketch of area to be surveyed • bench mark locations and elevations (record source for actual bench marks)
Misc. Entries/notes: • all entries shall be in waterproof black ink • draw a line through unused portions of pages (date and initial) • draw a single line through errors (date and initial) • note any remarks, telecons to/from the site • note all deviations & reasons for deviations from Scope of Work • note down time and lunch breaks • record any hazardous conditions and the action taken in response to mitigate the hazard • note any actions near the site that could potentially impact the project	**Tank Removal Oversight:** • name and address of contractors • type of excavating equipment • safety precautions taken • size and number of tanks to be removed • contents removed • tank/piping condition (rusted, pitted, holes, patches) • method of tank preparation for removal • type of backfill material • soil/groundwater sample screening • stockpiled soil/material (amount) • excavation area filled or cordoned off • dimension of excavation(s)/tank(s) • evidence of contamination • further remedial measures warranted
Off-site Soil Disposal: • removal contractor name & address • loading time • manifest serial numbers • estimated volume/weight to be removed • field screening results • number and type of transport and removal equipment	**Departure notes:** • list equipment needed for future site visits • list specific tasks that should be performed on follow-up site visits • purpose for departing site • sign, and record time and date of departure

1) It is crucial that photocopies of field documentation are included directly into the project folder in the office (particularly in the event of loss of the field book). 2) It is assumed that the Field Personnel have already been familiarized with the specifics of the project.

8.0 WELL INSTALLATION

8.1 PURPOSE/RESPONSIBILITY

The purpose of this SOP is to ensure the integrety of the shallow groundwater monitoring well. These monitoring wells would be designed/constructed to evaluate possible floating (less dense than water) or dissolved-phase compounds.

If proper monitoring well design and construction techniques are not used during the installation activities, the integrity of the well may not be reliable. The construction of the monitoring well must be completed with consideration of the intended purpose of the well and the geologic and hydrologic conditions at the site, including tidal influences on groundwater levels.

Design, construction, and installation of monitoring wells other than the shallow groundwater monitoring well shall be considered a non-routine Standard Operating Procedure. Details for instructions to do this type of work are discussed in the Trouble-Shooting portion of this section. The DAHM personnel responsible for observing and evaluating the installation and development of the wells shall have the necessary education and/or experience to execute said duties.

8.2 PROCEDURE

This procedure shall be used to describe the steps for construction and installation of a shallow groundwater monitoring well. The design of the monitoring well must take into account the type of facility and the potential contaminants anticipated to be encountered at that site.

Two physical properties that dictate the source and destination of a compound to or with the groundwater are the relative solubility and density of the compound. Shallow groundwater monitoring wells are screened above, continued through and below the groundwater table. This type of well has the capacity to intercept contaminants in a fluctuating groundwater table.

During well construction, every precaution shall be taken to prevent the introduction of contaminants into the subsurface environment. There are several steps required in the construction and installation of shallow groundwater monitoring wells which are outlined below.

8.3 RI-DEM WELL CASING STANDARDS

- Typically, permanent groundwater monitoring wells are constructed of polyvinyl chloride (PVC) well casing material which meet the National Sanitation Foundation Standard 14 and ASTM D1785.
- Minimum inside diameter of two inches.
- Monitoring wells constructed in unconsolidated material at depths of less than 100 feet shall be constructed with a minimum schedule of 40-slot PVC.

- Monitoring wells constructed at depths greater than 100 feet shall be constructed with a minimum schedule of 80-slot PVC.
- Well casings shall be contructed of flush threaded joints or threaded coupling joints.
- Joints shall be filled with an "O" ring or wrapped with Teflon tape. Solvent welded joints are not permissible without prior written permission of the Project Manager.
- The Project Manager may allow alternate well casing material if the contaminant concentrations or geologic settings require an alternative construction. Alternative materials include but are not limited to:
  1) fluoropolymer materials, including polytetrafluoroethylene (PTFE), tetrafluoroethylene (TFE), fluorinated ethylene propylene (FEP), perfluoroalkoxy (PFA), and polyvinylidene fluoride (PVDF);
  2) metals materials, including carbon steel, low-carbon steel, galvanized steel and stainless-steel (304 and 316); and
  3) thermoplastic materials, including polyvinyl chloride (PVC) and acrylonitrile butadiene styrene (ABS).

8.3.1 Well Screens

- The well screens shall be factory slotted.
- The well screens shall be new, free of foreign matter, washed with appropriate decontamination materials or steam-cleaned prior to use.
- The well screen slot size shall be sized to retain at least 90 percent of the grain size of a filter pack or at least 60 percent of the grain size of the collapsed sidewalls of the soil boring.
- Well screens intercepting the groundwater table shall not exceed 15 feet in length.
- Well screens for piezometers shall not exceed 5 feet in length.
- The lower section of the well screen shall be placed no more than 3 feet above the bottom of the drilled borehole.
- Screen bottoms shall be securely fitted with a cap or plug composed of the same material as the screen.
- Screen bottom caps shall be placed within 6 inches of the slotted portion of the screen.
- Using a drill or a saw, a small opening is created through the well riser casing pipe, and is situated 3 to 6 inches below the top of the well. This small opening will allow for constant pressure equalization within the well.

8.3.2 Well Casings and Fittings

- Fittings shall not restrict the inside diameter of the casing at the joints.
- Casings and fittings shall be new, and free of foreign matter.
- Prior to the use of new casings and fittings, the pieces shall be washed with appropriate decontamination materials or steam cleaned.

8.3.3 Filter/Screen Pack

- The filter/screen pack shall be chemically inert, well rounded, and well sorted glass beads or silica based sand or gravel of uniform grain size, which is appropriate for the slot size of the screen and the host environment.
- The filter/screen pack must minimize the amount of fine material entering the well, it shall not inhibit the flow of water into the well.
- The filter/screen pack shall extend a minimum of two feet and a maximum of five feet above the well screen.
- The filter/screen pack shall not contaminate the groundwater.
- Prior to installation of the well screen, a minimum of 6 inches of filter/screen pack shall be placed in the bottom of the borehole.
- The top of the filter/screen pack shall be measured and packed until the depth complies with the Project Plan.
- The filter/screen pack should be no closer to the ground surface than 3 feet below the ground surface to allow space for the bentonite seal and cement seal.

8.3.4 Sealing Requirements

- Monitoring wells installed with a filter pack shall be constructed with a top of filter pack seal.
- Monitoring wells shall be installed with an annular space seal that has a permeability of 1 x 10-7 centimeters per second or less.
- Monitoring wells shall be constructed with a concrete, neat cement grout, or cement/bentonite grout ground surface seal.
- The ground surface seal shall extend to a minimum of 12 inches and to a maximum of 60 inches below the ground surface.
- The top of the ground surface seal shall be sloped away from the well casing, shall have a radius of approximately 1.5 feet, and shall be imprinted with the designation of the monitoring well.

. Bentonite Seal
- bentonite pellet seals shall be a minimum of 1 foot thick (measured immediately after placement, prior to swelling)
- bentonite should not be placed higher than 1 foot below the ground surface
- for bedrock wells a bentonite seal shall be placced at least 3 feet below the top of competent bedrock and the interval between the top of the bentonite seal and the ground surface shall be filled with a cement/bentonite grout

. Casing Seal
- bentonite seal
- neat cement grout
- cement-bentonite grout
- neither additives nor borehole cuttings shall be mixed with the casing seal

- casing seal shall be placed into the borehole to secure the protective casing from the bentonite seal to the ground surface

. Protective Casing
- protective casing shall be installed around each screened monitoring well within 24 hours
- prior to use, the protective casing shall be washed with the appropriate decontamination materials or steam cleaned
- prior to placement, the protective casing shall be free of extraneous openings, devoid of any asphaltic, bituminous, encrusting, and/or coating material (except the black paint or primer applied by the manufacturer)
- minimum elements of protection design for an above ground protective casing:
  * 5-foot minimum length of new, black steel pipe extending two feet above the ground surface
  * diameter of protective casing should be two inches larger than the diameter of the well riser casing
  * no greater than 0.3-foot difference in elevation between the top of the protective casing and the top of the well riser casing
  * a hinged cover or loose-fitting telescoping cap
  * protective casing secured to the well riser casing by a padlock
  * padlocks on the same site should have the same key
  * a grout collar sloped away from the well at the ground surface
- minimum elements of protection design for a flush-mount protective casing:
  * 1-foot minimum length of new, black steel pipe to enable the placement to be flush with the ground surface
  * diameter of protective casing should be 2 inches larger than the diameter of the well riser casing
  * no greater than 0.3-foot difference in elevation between the top of the protective casing and the top of the well riser casing
  * protective casing secured to the well riser casing by a padlock
  * padlocks on the same site should have the same key
  * protective casing lid with associated steel, wrench key
  * a grout collar sloped away from the well at the ground surface

8.4 SPECIFIC FIELD BOOK ENTRIES

- name of inspector
- refer to the attached Minimum Field Book Entries List
- drilling company and driller/helpers names, address drilling company
- date and time of boring/well start and finish
- type of drill rig
- well identification numbers
- boring diameter
- drilling method

- ground surface conditions
- recovered by spoon; soil sampler type
- evidence of contamination (field screening, visual, and/or olfactory)
- soil sampling method(s)
- soil sample description (Unified Soil Classification System or Burmister System)
- blow counts per 6 inches
- depth of casing through drilling
- auger/spoon refusal depths
- inches spoon is driven
- inches of soil
- depth to groundwater
- change(s) in soil stratification
- headspace reading of soil sample(s)
- note special handling of any soil samples
- depth to bottom of boring(s)/well(s)
- change(s) in work zone air quality (headspace reading of ambient air)
- length, diameter, and composition of well material(s)
- depth to screen pack(s) and bentonite seal(s), and cement/grout seal(s)
- amounts of materials (screen pack, bentonite, grout)
- type of protective casing
- measurement(s) of well riser casing and protective well riser casing above the ground surface

8.5 DECONTAMINATION PROCEDURE

The decontamination procedure ensures the cleanliness of the equipment and the integrity of the sample. Without adherence to this procedure, the equipment and/or material used could be a source of cross contamination, thus making void the entire sampling effort.

With the materials listed below, the Geologist shall use these steps to decontaminate the equipment used during test boring and monitoring well installation:

1. scrub the equipment in a bucket of soapy water with thick-bristled brushes
2. rinse the equipment in another bucket of water
3. spray the equipment with methanol
4. spray the equipment with distilled or de-ionized water
5. air dry and return the equipment to a sanitary location (equipment case, etc.)

The buckets shall be changed after every sample location decontamination procedure.

8.6 ATTACHMENTS

- boring log
- monitoring well construction diagram

. list of necessary equipment
. minimum list of field book entries

8.7 NECESSARY EQUIPMENT FOR WELL INSTALLATION

. field book
. measuring tape
. sample jars
. aluminum foil
. equipment for soil and/or water sampling
. cooler/ice
. disposable sampling gloves, PPE
. field screening instrument(s)
. tool box
. USCS chart
. boring logs
. monitoring well logs
. split-spoon sampler
. drill rig (steam cleaning)

LOG OF SOIL BORING

Co-ordinates: _____

_____

Surface Elevation: _____

Casing Above Surface: _____

Reference Elevation: _____

Reference Description: _____

Job No.	Client	Location

Drilling Method:	Boring No.
Sampling Method:	Sheet of
	Drilling Start Time / Finish Time

Water Level				Date / Date
Time				
Date				
Reference				

Surface Conditions:

Sampler Type	Inches Driven / Inches Recovered	Depth of Casing	Sample No. / Sample Depth		Blows/6 in. Sampler	Depth in Feet	USCS Log
						0	
						1	
						2	
						3	
						4	
						5	
						6	
						7	
						8	
						9	
						0	
						1	
						2	
						3	
						4	
						5	
						6	
						7	
						8	
						9	

Drilling Contractor: _____ Lic.No. _____

Driller: _____

Checked By: _____

2. LOG OF SOIL BORING

A Log of Soil Boring is completed for all test borings and borings advanced through soil for purposes of installing a well or piezometer. A Soil Boring Log is completed for the overburden portion of a boring advanced through soil and into bedrock. If rock core is obtained, a Core Boring Log is completed as appropriate (Section 4). In the event that no core of bedrock is obtained, the Log of Soil Boring form may be used to log drill cuttings from the bedrock portion of the boring. Refer to Figure 1 for the location of the following items. All items except Nos. 4, 5, 12, 13, and 16 as discussed below, are completed in the field by the geologist/engineer responsible for the boring.

1. The field geologist/engineer completing the log shall sign his full name on the first page of the log for each boring in a clear and legible fashion. Initials will suffice on succeeding pages of the log. The signature/initials are placed upon completion of each page of the log as certification of the accuracy and completeness of the log by the field geologist/engineer. In the event there is a personnel change prior to completion of the boring, the personnel involved, the date, and time (24-hour clock) of change shall be documented in the descriptive portion (29) of the log at the depth where the change occurred.

2. The full name (legal, business name) of the drilling company shall be placed on the first page of the log for each boring. Any change shall be documented as per item 1.

3. The full name of the driller shall be placed on the first page of the log for each boring. In states which require a licensed driller for the type of work in progress, the driller's license number shall also be placed on line 3 of the first page of the log for each boring. Any change shall be documented as per item 1.

4. Each boring log shall be checked for completeness and edited as appropriate by a qualified geologist or engineer to be assigned by the project manager or the Director of Geotechnical Services. Editing shall be completed prior to preparation of final boring logs in report format (cf. Project Plan). Editing of sample descriptions and soil classifications shall be performed as appropriate for all samples for which laboratory, physical testing (e.g., grain-size distribution by sieve and hydrometer) has been performed. Sample descriptions and soil classification shall also be checked by visual examination of jar samples. Typically, a minumum of 25 percent of the jar samples are checked by the editor (cf. Project Plan).

The editor shall initial line 4 of each edited page of the log he edits.

5. The editor shall indicate the date each page was edited on line 5 of the edited page.

6. EA's alpha-numeric job code shall be indicated on each page of each boring log.

7. The client's name shall be indicated on each page of each boring log.

8. The site name or other geographic designation of the drilling site as appropriate shall be indicated on each page of each boring log.

9. The boring number as per the Project Plan shall be indicated on each page of each boring log.

10. The page number and total number of pages for the log shall be indicated on each page of each boring log.

11. The time (24-hour clock) and date drilling operations begin and end, including grouting or completion of well installation, shall be indicated on the first page of each boring log. The time and date of completion of soil sampling activities shall be documented in the descriptive portion of the log at the depth of penetration of the last sample or sample attempt. For borings completed in more than 1 day, the time and date drilling operations stop and resume shall be indicated in the descriptive portion of the log at the appropriate depth.

12. Coordinates of latitude and longitude shall be indicated on the first page of the log for each surveyed boring. Surveyed information is generally added by the editor in the office. When surveyed by EA during the same mobilization, this information may be added in the field. If so, the editor shall confirm that all QA/QC for the survey data have been met. The use of a site datum shall be indicated on the log. If a site grid is utilized, the site grid coordinates shall be indicated on the field log and identified as such.

13. The elevation of the ground surface at the bore hole shall be indicated on the first page of each boring log. Surveyed information is added or checked by the editor as per item 12.

14. A reference point for determination of elevation and water levels shall be established as per the Project Plan for each monitoring well. The field geologist/engineer shall ensure that the reference point is permanently marked in a clearly visable fashion (cf. Project Plan). The reference point and its marking shall be described on the first page of each boring log (e.g., "top of PVC casing next to hack saw slot"). Unless otherwise stipulated in the Project Plan, the reference point shall be established on the well riser casing rather than the protective casing.

15. The field geologist/engineer shall determine the difference in elevation between the reference point (14) and the ground surface at the bore hole (13), and record this information on the first page of the boring log. Casing "stick up" is recorded as a positive number. For "man hole" type completions, where the reference point is below grade, a negative number is recorded and the type of surface completion described.

16. The elevation (± 0.01 ft) of the reference point shall be indicated on the first page of each boring log. Survey information is generally added or confirmed as per item 12 by the editor. The use of a datum other than mean sea level shall be indicated.

17. Surface conditions at the bore hole site shall be described on the first page of the log and continued on succeeding pages as necessary (e.g., "level, asphalt pavement-dry" or "grassy slope [± 3 percent], ground soft and wet"). Significant nearby features (outcrops, surface water bodies, etc.) should be noted.

18. The depth to water (± 0.01 ft) shall be determined and recorded as feasible during drilling and as per the Project Plan after well completion. The time (24-hour clock) and date for each determination shall be noted on the log. The point from which the depth was measured--either "surf" for ground surface (13), or "ref" for the established reference point (14)--shall also be indicated for each depth to water recorded.

19. The drilling equipment and methodology shall be summarized on the first page of each boring log (and continued on succeeding pages as necessary). Record the rig manufacturer and model. Note such information as rod size, bit type and size, internal and external diameter of hollow stem augers, pump type or compressor size, etc.

20. The method(s) for obtaining soil samples shall be identified on the first page of each boring log (and continued on succeeding pages as necessary). The citation of ASTM designations on this portion of the log constitutes the field geologist/engineer's certification that the ASTM standard was met.

21. All information in the descriptive portion of the log is placed with reference to the depth scale which is divided into 0.5-ft increments. The field geologist/engineer shall indicate "tens" units on the depth in feet scale as apprporiate. The sampler drive interval shall be indicated on the left side of the column as shown on Figure 4. The vertical location of samples (25) shall be indicated by shading on the scale as shown on Figure 4.

22. For each soil sampling attempt the type of sampler shall be indicated at the appropriate depth. The most commonly used samplers are:

SPT--Standard Penetration Test (ASTM D-1586-84) samples are obtained in soil by driving a split spoon sampler of 2-in. outside diameter/one and three-eights-in. inside diameter and a length of split barrel of 18 or 24 in. The sampler is driven into undisturbed soil by a 140-lb drop hammer free-falling 30 in. The number of "blows" (hammer drops) required to effect each successive 6 in. of penetration are recorded on the log (26). The sampler is advanced until one of the following occurs:

1. a total of 50 blows have been applied during any one of the first, second, or third 6-in. increment,

2. a cumulative total of 100 blows have been applied,

3. there is no observed advance of the sampler during the application of 10 successive blows of the hammer, or

4. the sampler is advanced a total of 18 in. without the limiting blow counts, as described above, occurring.

SS--When Standard Penetration Test data (blow counts) are not required the above described split spoon sampler may be driven 24 in. rather than 18 in. Larger diameter and/or length split spoon samplers may be used. Heavier hammer weights and different drop lengths may be used with larger split spoons. All of which must be in accordance with the Project Plan. Sampler dimension, hammer weight and length of hammer drop shall be described under item 20. Blow counts are also recorded on the log (26).

SH--Cohesive and plastic soils may be sampled with the Shelby Tube sampler which utilizes a brass or steel, thin wall tube of 3-in. outer diameter and 30 in length (typical). Tube dimensions shall be recorded in item 20. The sampler is pushed into undisturbed soil by one continuous drive using a hydraulic piston.

DEN--The Denison Core Barrel Sampler may be used to sample stiff and hard clay, non-cohesive soil or soft, weathered rock. Sawtooth, carbide or diamond coring bits may be utilized (cf. Project Plan). Sampling tube dimensions shall be recorded in item 20. The Denison sampler is advanced by rotary and continuous drive using a hydraulic piston.

OST--The Osterberg Piston Sampler advances a thin wall sampling tube with a down-hole hydraulic piston. Tube dimensions shall be recorded in item 20. The sampler is lowered into a drilled and cleaned-out hole. Reaction to pushing is accomplished by clamping drill rod to either casing or drill rig. Water pressure, applied through rod, pushes piston and its attached thin-walled sampling tube out of sampler's pressure cylinder and into soil. A fixed piston, at bottom of sampler, is connected to sampler head by a hollow piston rod. A vent hole in piston rod relieves air pressure through piston rod and ball check in sampler head. When full stroke of piston is reached, water pressure is also relieved through vent hole, piston rod and ball check. Sampler is then turned 1-1/2 revolutions to shear off bottom of sample. A friction clutch holds sampling tube to sampler.

23. The total number of inches the sampler is advanced (actual penetration) into undisturbed soil and the total number of inches of actual sample recovered shall be recorded for each sampling attempt.

24. The total depth (± 0.1 ft) of penetration of casing or hollow stem auger at the time of the sampling attempt shall be recorded for each sampling attempt. Casing depth shall be no greater than the shallowest portion of the attempted sample interval.

25. Samples which are retained in jars and/or tubes (or other appropriate containers as per the Project Plan) shall be numbered sequentially down the bore hole. Unsuccessful sampling attempts shall not be numbered. Individual samples from one sampler drive shall be numbered individually. The sample number and depth (± 0.5 ft) of the top of that portion of the sample which is retained shall be recorded for each sample. The vertical location of the containerized sample shall be indicated by shading on the depth scale (21).

Each sample container shall be labeled. The label shall be permanently marked (e.g. Sharpie) and shall identify the following:

Client:	as per item 7
Project:	as per item 6
Location:	as per item 8
Station:	Boring No. as per item 9, Sample No. and sample depth as per item 25
Collected by:	name of field geologist/engineer
Date:	of sample collection

Chain-of-custody requirements may also apply as per the Project Plan. Containerization and handling of soil samples scheduled for chemical analysis is defined in the Project Plan.

26. The number of hammer blows required to advance a split spoon sampler shall be recorded for each 0.5-ft advance for each sampling attempt. The number of blows and the number of inches penetrated for an incompleted 0.5-ft interval shall be recorded (e.g., 75/3 in.). The letter "P" shall indicate that the sampler was advanced by the weight of the drill stem or the weight of the drill stem and hammer without driving. For the Standard Penetration Test (and only for the Standard Penetration Test), when less than 18 in. (but greater than 12 in.) are penetrated by a total (maximum allowable) of 100 blows, the number of

blows for the last 12 in. of penetration (N) shall also be recorded (e.g., N = 63).

27. A number of field determinations of properties of soil samples may be made in the field as per the Project Plan. These include but are not limited to:

    - pocket penetrometer readings
    - screening for organic vapors with a photoionozation detector (PID) or flame-ionization detector (FID)
    - pH
    - specific conductance

    Protocols are established in the Project Plan. The protocol shall be identified in item 20 and the data recorded in column 27 with reference to the depth scale (21).

28. The depth of each significant lithologic change shall be drawn to scale (± 0.1 ft) on the graphic log. Lithology shall be designated by the appropriate Unified Soil Classification System symbol. Changes observed in samples shall be indicated with a solid line. Changes inferred on the basis of cuttings or action of the drill rig shall be indicated with a dashed line on the graphic log and described in the narrative log (29). Gradational changes shall be indicated by a dashed, diagonal line extending over the depth of the gradational interval.

29. Each soil sample recovered shall be fully described on the log. The descriptions of intact samples shall include in sequence the following:

    Color--e.g., "gray" or "reddish brown." Some project plans may specify the use of the Munsell Soil Color Chart or the Geological Society of America Rock Color Chart. If so, the chart shall be identified in item 20 and both narrative and numerical descriptions of color shall be recorded in the log.

    Moisture Content--"dry," "moist," or "wet." Below the water table, moisture content is noted only for samples less than completely saturated.

    Unified Soil Classification--e.g., "sandy clay." Appendix D summarizes the Unified Soil Classification System. Additional guidance is provided in Tables 1 and 2.

ASTM designations D-2487 and D-2488 define standard engineering practice.

Secondary Components--e.g., "with some silt." Descriptive terms for relative proportions of secondary components are provided in Table 1.

Unified Soil Classificatin Symbol--e.g., "CL." Refer to Appendix D.

Density (noncohesive soil)--e.g., "medium dense." Refer to Table 1.

Consistency (cohesive soil)--e.g., "stiff." Refer to Table 1.

Between sampling attempts wash samples, drill or auger cuttings shall be described as to color and grain size, along with a description of drill action and water losses/gains for the corresponding depth.

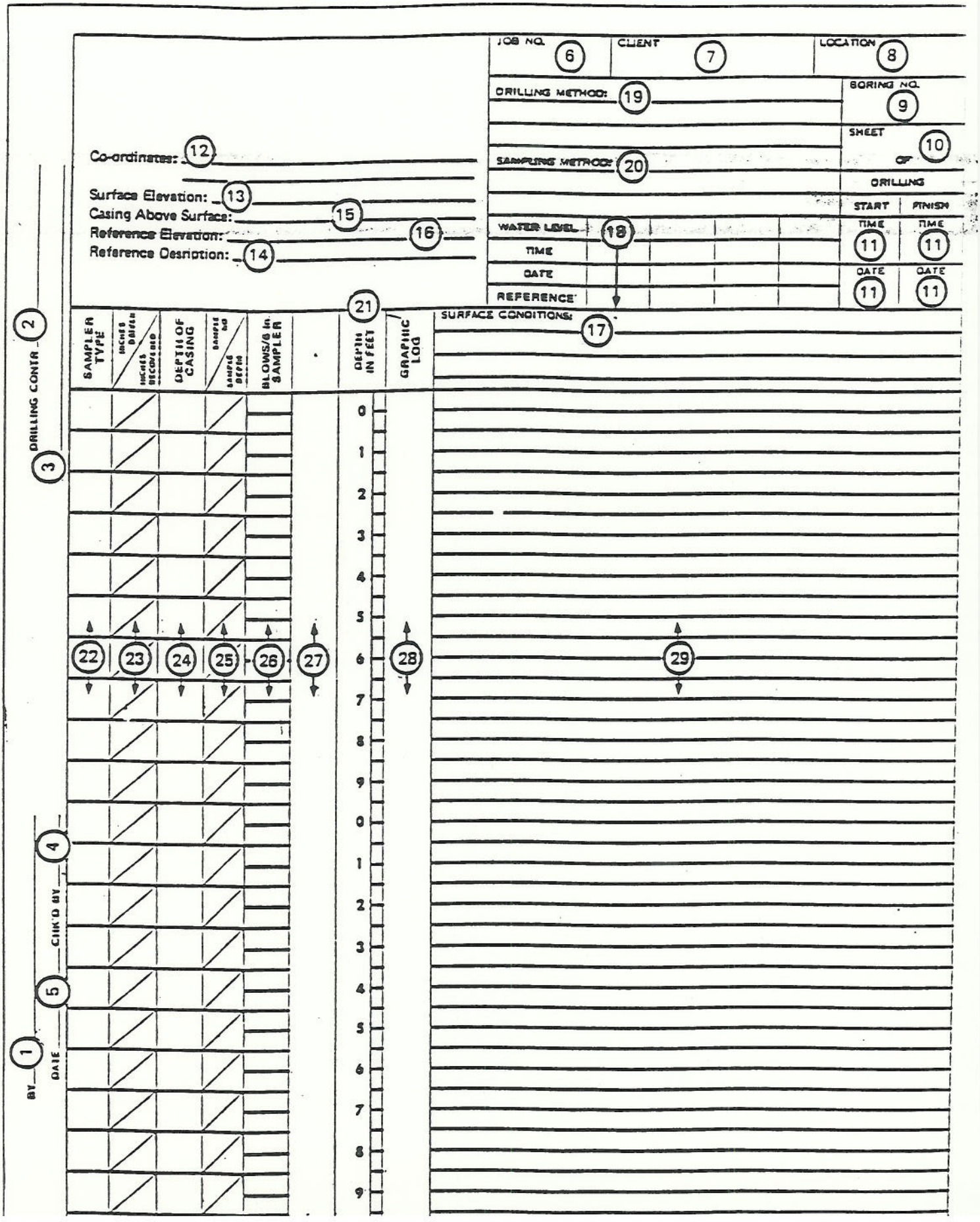
The brand name and amount (lb) of any bentonite used for each boring, the reason for use and start (by depth) of this use shall be recorded.

A narrative description of all special problems and their resolutions shall be recorded on the boring log, e.g., hole caving, "running sands," recurring problems at a particular depth, excessive grout takes, unrecovered tools, casing or screens, etc.

A narrative description of the grouting of the bore hole or the installation of the monitoring well shall be recorded on the boring log (below the depth of completion and/or on succeeding pages). For monitoring wells, the following shall be recorded:

- Depths of screened interval, screen composition, diameter and slot size
- Composition and diameter of riser casing
- Depths of screen pack placement, size gradation of screen pack or commercial designation thereof (e.g., Morie No. 2)
- Depths of bentonite seal placement
- Composition and depths of placement of casing seal
- Description of protective casing
- Composition and placement of surficial grout

A Well Completion Diagram shall also be completed as described in Section 3. However, since the Well Completion Diagram may not be prepared in the field, the above information shall be recorded on the Log of Boring at the time of well completion.


JOB NO. 6
CLIENT 7
LOCATION 8
DRILLING METHOD: 19
BORING NO. 9
SHEET 10 OF
SAMPLING METHOD: 20
DRILLING
START
FINISH
Co-ordinates: 12
Surface Elevation: 13
Casing Above Surface: 15
Reference Elevation: 16
Reference Description: 14
WATER LEVEL 18
TIME
DATE
REFERENCE
TIME 11
TIME 11
DATE 11
DATE 11
21
SURFACE CONDITIONS: 17
DRILLING CONTR 2
3
SAMPLER TYPE
INCHES DRIVEN
INCHES RECOVERED
DEPTH OF CASING
SAMPLE NO.
SAMPLE DEPTH
BLOWS/6 in. SAMPLER
DEPTH IN FEET
GRAPHIC LOG
22
23
24
25
26
27
28
29
4
CHK'D BY
5
1
BY
DATE
0
1
2
3
4
5
6
7
8
9
0
1
2
3
4
5
6
7
8
9

EQUIPMENT LIST

ACTUAL SAMPLING SUPPLIES

- bailers
- twine/string
- knife/scissors
- well key/well lock key
- disposable gloves (PPE)
- sample jars/labels (extras of both)
- 5-gallon buckets (at least 1 for sampling, 2 for decontamination)
- pen
- duck or electrical tape
- cooler/ice
- zip-lock plastic baggies
- field book

DECONTAMINATION SUPPLIES

- methanol
- distilled water (at least 2 gallons)
- spray bottles for both
- alconox
- strong bristled brushes
- paper towels
- hot water wash buckets

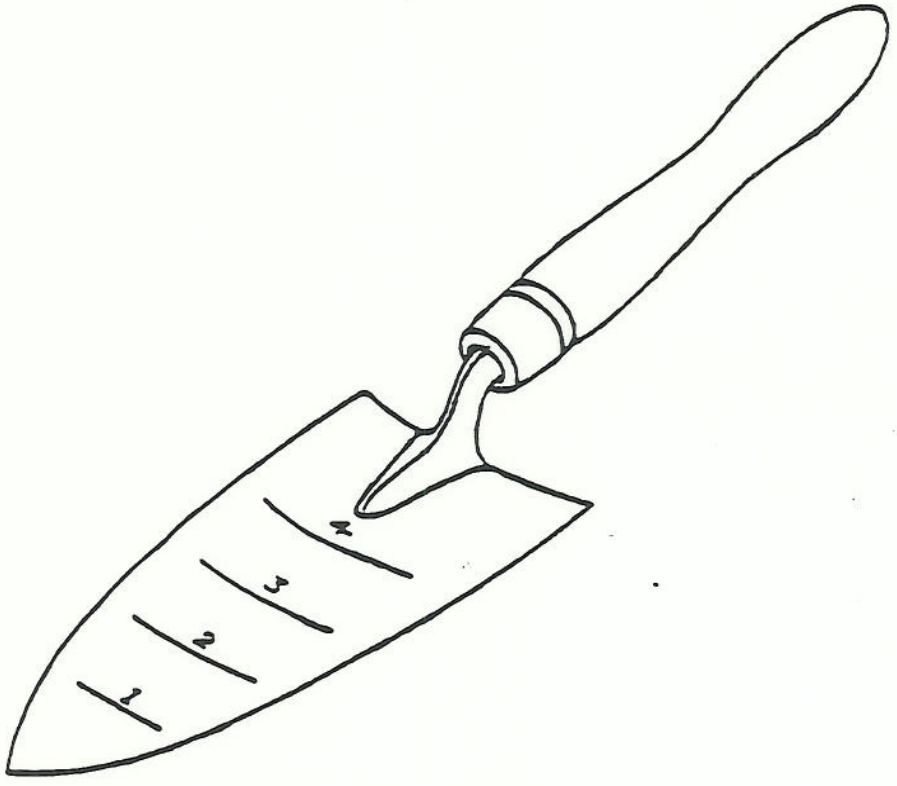
OTHER EQUIPMENT

- field screening equipment (HNU, OVA, pH meter, temperature meter, specific conductivity meter)
- pH, temperature, conductivity meters (and an extra jar)
- mobile phone
- well gauging instrument (interface probe, water level indicator)
- flashlight
- camera
- watch

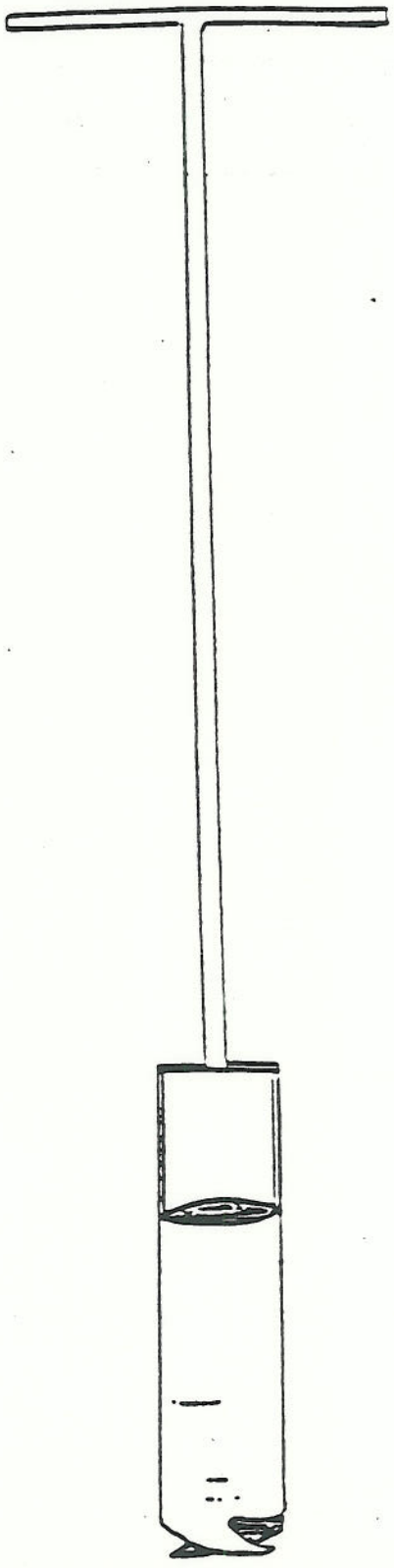
SAFETY EQUIPMENT

- tool box
- map of site
- project proposal
- traffic cones, reflective vests, raincoat, safety signs

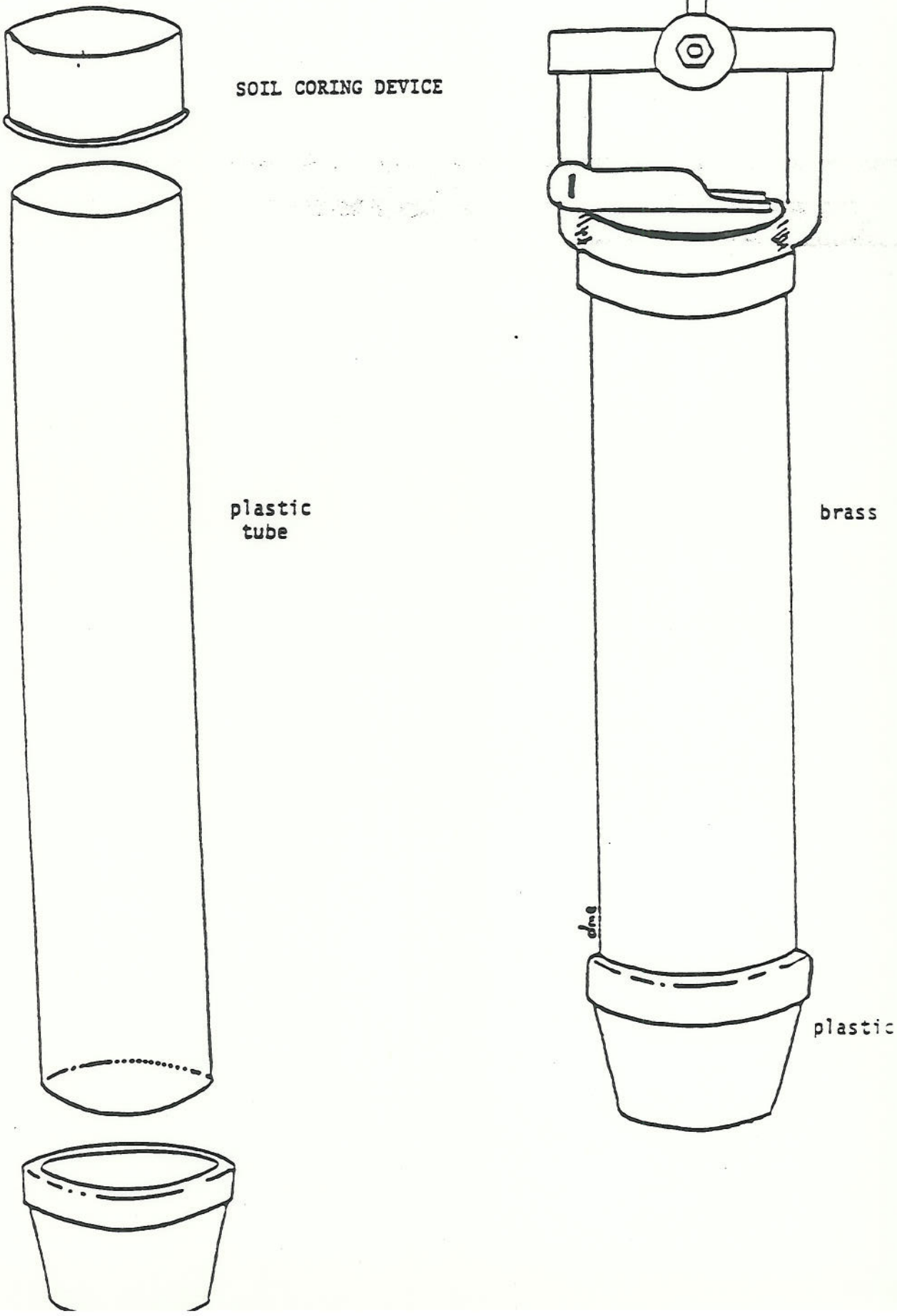
SCOOP/TROWEL



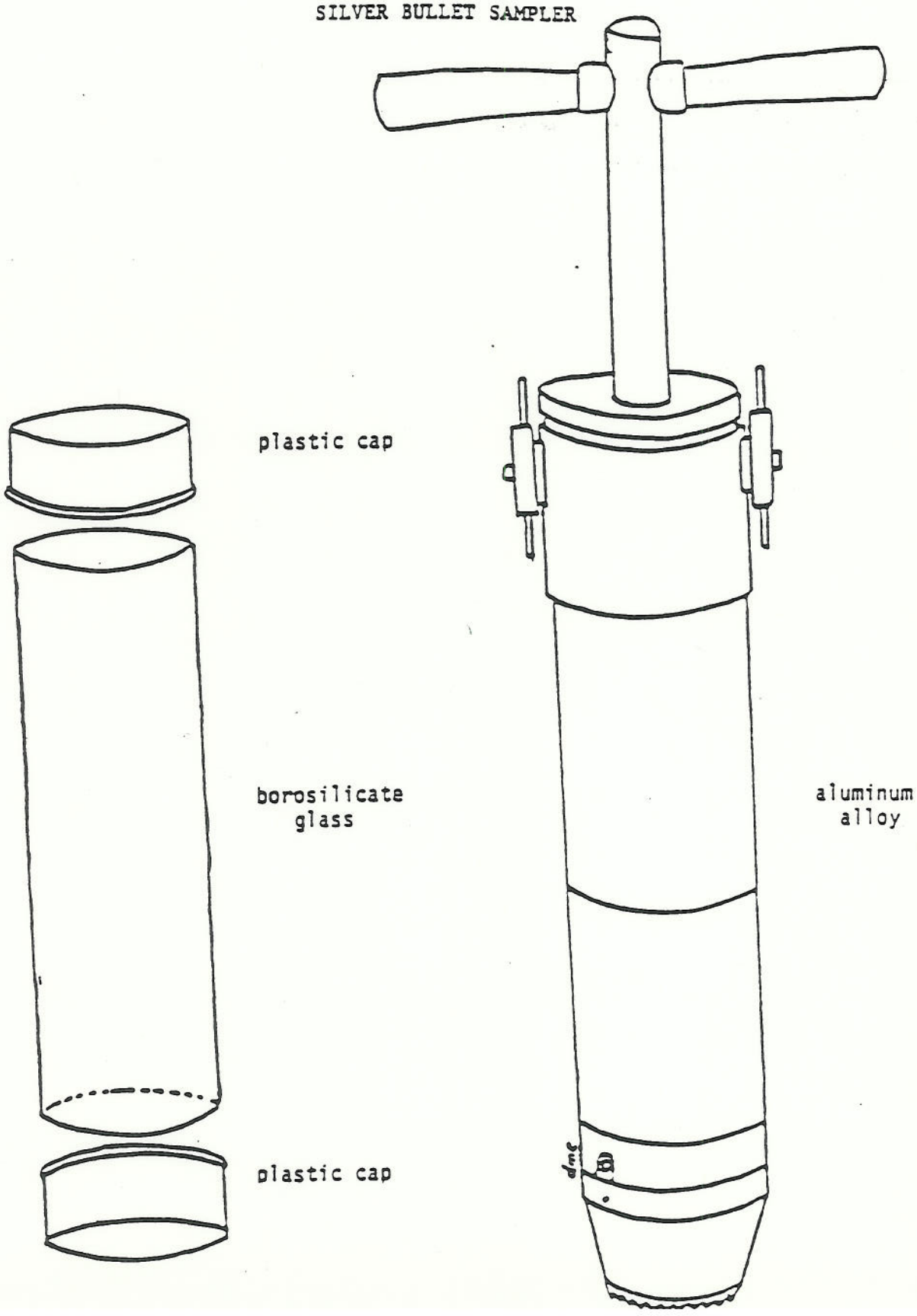
BUCKET AUGER



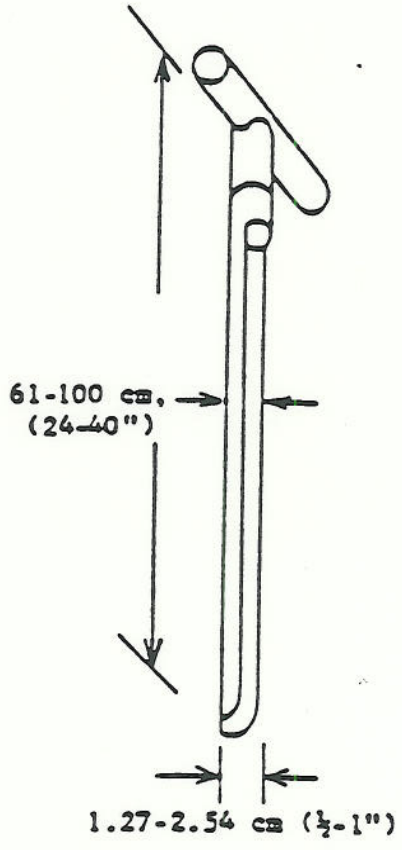
SOIL CORING DEVICE



SILVER BULLET SAMPLER



SAMPLING TRIER



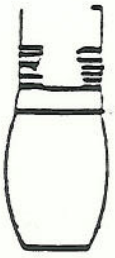
VEIHMEYER SOIL SAMPLER

drive hammer

head

tube

point



standard point

constricted point

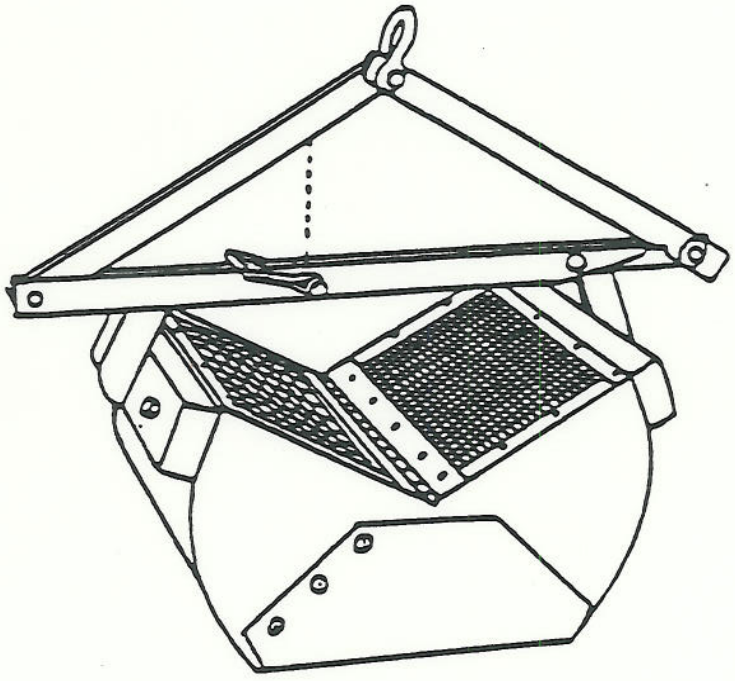
bulge point

special point

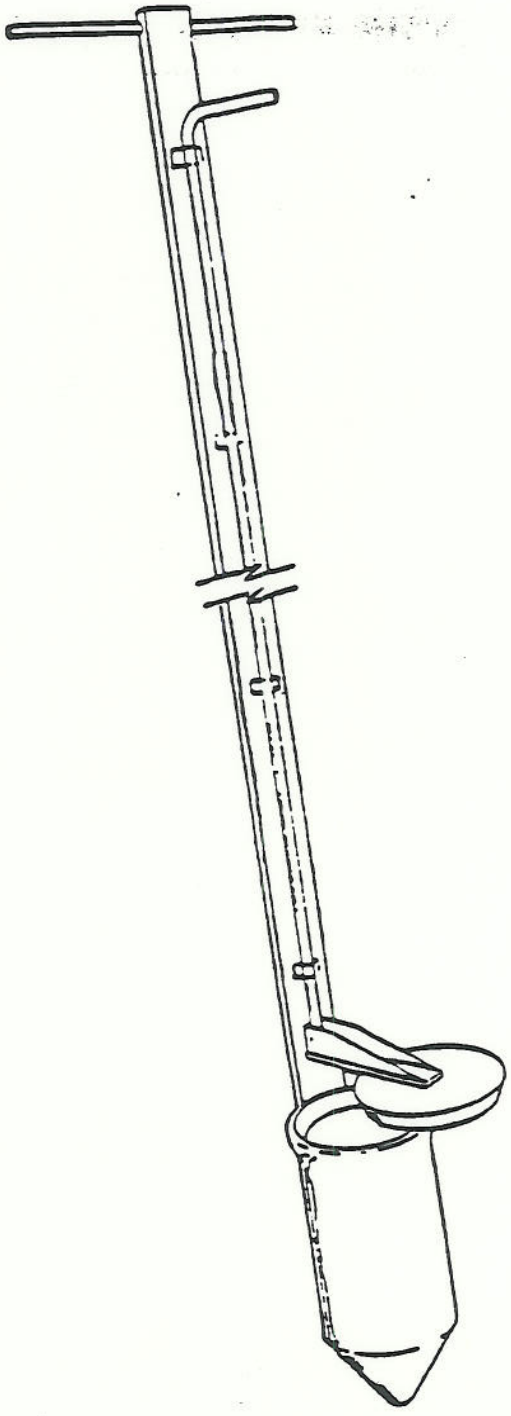
Point Types

puller jack and grip

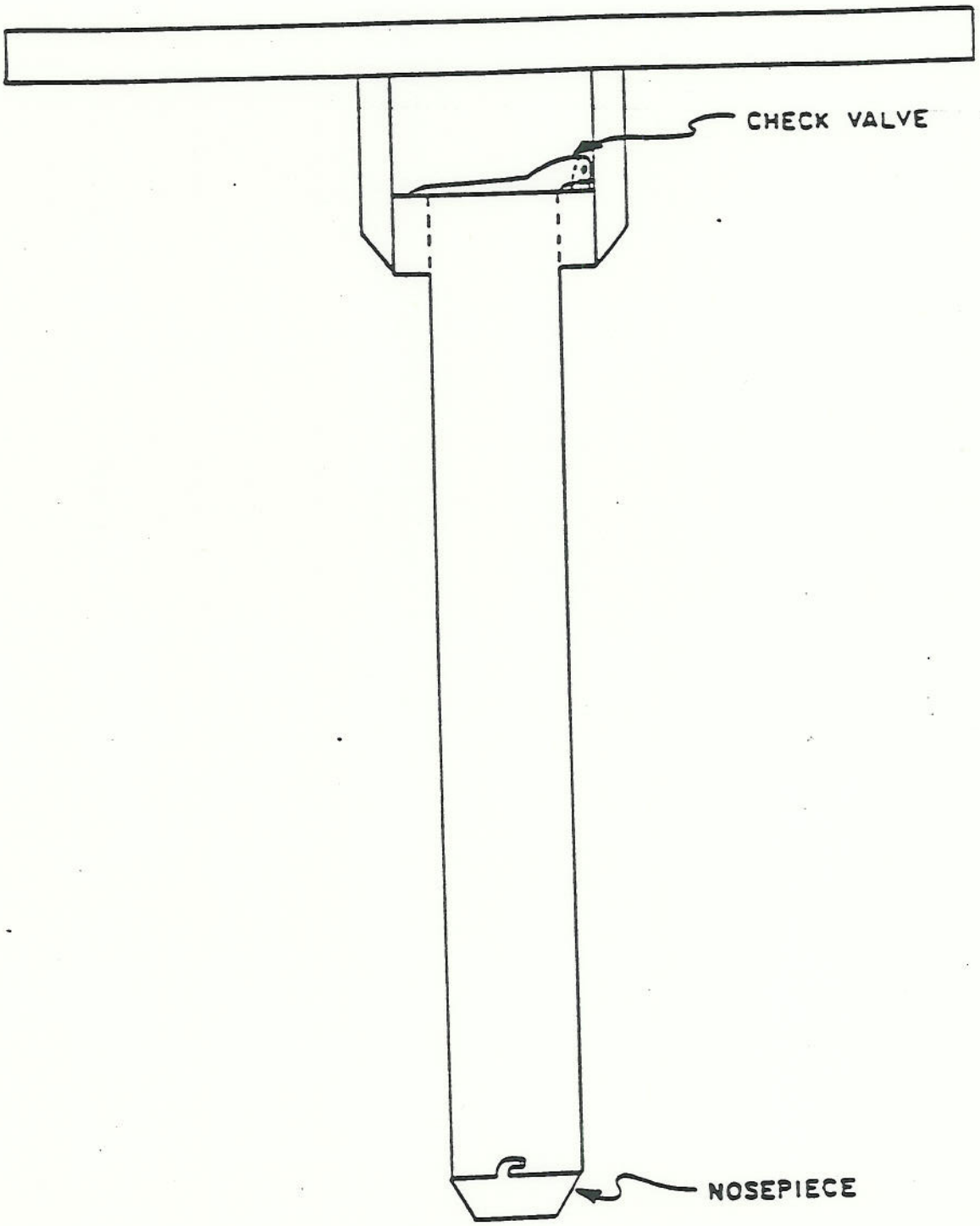
PONAR DREDGE/PONAR GRAB



PACS SLUDGE GETTER



HAND CORER



MINIMUM FIELD BOOK ENTRIES

Initial Site Entry Notes: • your name, arrival time and date • purpose of your visit • report weather conditions • record names, titles and companies of all individuals on site; their arrival and departure times • attendance of Field Personnel briefing • H&S: - review of hospital route - decon station established - H&S Plan reviewed/signed • sketch Site (N arrow, roads, buildings, storm drains, sampling locations, source areas, etc.) • general Site description (relative to previous Site observations)	**General Sampling Entries:** • calibration date & serial # of instruments • record condition of sampling location • sample type (soil, GW, surface water) • sample number, location and brief description (color, odor) • sampling method (include grab or composite sample) • sample depths • time of sample collection • sample analyses & preservatives • number of jars for each sample • placed in ice chest • decon procedures • document sampling location was left upon completion of your work (ie, closed and locked monitoring well, backfilled and packed bore hole, etc)
Sampling Entires - GW: • log in chart format: - depth to groundwater - depth of well - depth to PVC from ground surface/ roadbox - volume of water to be removed - method of water removal - VOC screening - pH, temp., cond. readings - visual/olfactory contamination • disposal method of bailed water • groundwater recovery/recharge	**Sampling Entires - drilling:** • drillers' names, company, rig type • type of drilling and method • boring diameter, blow counts/6 inches • soil classification/class. system used • field screening results • visual/olfactory contamination • any other item to be included on boring log and well completion log • changes in work zone air quality • construction details of wells • method for checking for overhead and underground interferences (utilities)
Photograph Recordkeeping: • sketch items noted in photograph • draw direction photo was taken relative to permanent structures & N arrow • number of photograph • place some type of device to show scale (should use a measuring tape)	**Survey Notes:** • date and time of survey • purpose of survey • sketch of area to be surveyed • bench mark locations and elevations (record source for actual bench marks)
Misc. Entries/notes: • all entries shall be in waterproof black ink • draw a line through unused portions of pages (date and initial) • draw a single line through errors (date and initial) • note any remarks, telecons to/from the site • note all deviations & reasons for deviations from Scope of Work • note down time and lunch breaks • record any hazardous conditions and the action taken in response to mitigate the hazard • note any actions near the site that could potentially impact the project	**Tank Removal Oversight:** • name and address of contractors • type of excavating equipment • safety precautions taken • size and number of tanks to be removed • contents removed • tank/piping condition (rusted, pitted, holes, patches) • method of tank preparation for removal • type of backfill material • soil/groundwater sample screening • stockpiled soil/material (amount) • excavation area filled or cordoned off • dimension of excavation(s)/tank(s) • evidence of contamination • further remedial measures warranted
Off-site Soil Disposal: • removal contractor name & address • loading time • manifest serial numbers • estimated volume/weight to be removed • field screening results • number and type of transport and removal equipment	**Departure notes:** • list equipment needed for future site visits • list specific tasks that should be performed on follow-up site visits • purpose for departing site • sign, and record time and date of departure

1) It is crucial that photocopies of field documentation are included directly into the project folder in the office (particularly in the event of loss of the field book). 2) It is assumed that the Field Personnel have already been familiarized with the specifics of the project.

LOG OF SOIL BORING

Co-ordinates: _____

_____

Surface Elevation: _____

Casing Above Surface: _____

Reference Elevation: _____

Reference Description: _____

Job No.	Client	Location

Drilling Method:

Sampling Method:

Boring No.

Sheet _____ of _____

Drilling

				Start Time	Finish Time
Water Level					
Time					
Date				Date	Date
Reference					

Surface Conditions:

Sampler Type	Inches Driven / Inches Recovered	Depth of Casing	Sample No. / Sample Depth		Blows/6 In Sampler	Depth in Feet	USCS Log
						0	
						1	
						2	
						3	
						4	
						5	
						6	
						7	
						8	
						9	
						0	
						1	
						2	
						3	
						4	
						5	
						6	
						7	
						8	
						9	
						0	

Drilling Contractor: _____ Lic.No. _____

Driller: _____

Checked By: _____

Date: _____

2. LOG OF SOIL BORING

A Log of Soil Boring is completed for all test borings and borings advanced through soil for purposes of installing a well or piezometer. A Soil Boring Log is completed for the overburden portion of a boring advanced through soil and into bedrock. If rock core is obtained, a Core Boring Log is completed as appropriate (Section 4). In the event that no core of bedrock is obtained, the Log of Soil Boring form may be used to log drill cuttings from the bedrock portion of the boring. Refer to Figure 1 for the location of the following items. All items except Nos. 4, 5, 12, 13, and 16 as discussed below, are completed in the field by the geologist/engineer responsible for the boring.

1. The field geologist/engineer completing the log shall sign his full name on the first page of the log for each boring in a clear and legible fashion. Initials will suffice on succeeding pages of the log. The signature/initials are placed upon completion of each page of the log as certification of the accuracy and completeness of the log by the field geologist/engineer. In the event there is a personnel change prior to completion of the boring, the personnel involved, the date, and time (24-hour clock) of change shall be documented in the descriptive portion (29) of the log at the depth where the change occurred.

2. The full name (legal, business name) of the drilling company shall be placed on the first page of the log for each boring. Any change shall be documented as per item 1.

3. The full name of the driller shall be placed on the first page of the log for each boring. In states which require a licensed driller for the type of work in progress, the driller's license number shall also be placed on line 3 of the first page of the log for each boring. Any change shall be documented as per item 1.

4. Each boring log shall be checked for completeness and edited as appropriate by a qualified geologist or engineer to be assigned by the project manager or the Director of Geotechnical Services. Editing shall be completed prior to preparation of final boring logs in report format (cf. Project Plan). Editing of sample descriptions and soil classifications shall be performed as appropriate for all samples for which laboratory, physical testing (e.g., grain-size distribution by sieve and hydrometer) has been performed. Sample descriptions and soil classification shall also be checked by visual examination of jar samples. Typically, a minumum of 25 percent of the jar samples are checked by the editor (cf. Project Plan).

The editor shall initial line 4 of each edited page of the log he edits.

5. The editor shall indicate the date each page was edited on line 5 of the edited page.

6. EA's alpha-numeric job code shall be indicated on each page of each boring log.

7. The client's name shall be indicated on each page of each boring log.

8. The site name or other geographic designation of the drilling site as appropriate shall be indicated on each page of each boring log.

9. The boring number as per the Project Plan shall be indicated on each page of each boring log.

10. The page number and total number of pages for the log shall be indicated on each page of each boring log.

11. The time (24-hour clock) and date drilling operations begin and end, including grouting or completion of well installation, shall be indicated on the first page of each boring log. The time and date of completion of soil sampling activities shall be documented in the descriptive portion of the log at the depth of penetration of the last sample or sample attempt. For borings completed in more than 1 day, the time and date drilling operations stop and resume shall be indicated in the descriptive portion of the log at the appropriate depth.

12. Coordinates of latitude and longitude shall be indicated on the first page of the log for each surveyed boring. Surveyed information is generally added by the editor in the office. When surveyed by EA during the same mobilization, this information may be added in the field. If so, the editor shall confirm that all QA/QC for the survey data have been met. The use of a site datum shall be indicated on the log. If a site grid is utilized, the site grid coordinates shall be indicated on the field log and identified as such.

13. The elevation of the ground surface at the bore hole shall be indicated on the first page of each boring log. Surveyed information is added or checked by the editor as per item 12.

14. A reference point for determination of elevation and water levels shall be established as per the Project Plan for each monitoring well. The field geologist/engineer shall ensure that the reference point is permanently marked in a clearly visable fashion (cf. Project Plan). The reference point and its marking shall be described on the first page of each boring log (e.g., "top of PVC casing next to hack saw slot"). Unless otherwise stipulated in the Project Plan, the reference point shall be established on the well riser casing rather than the protective casing.

15. The field geologist/engineer shall determine the difference in elevation between the reference point (14) and the ground surface at the bore hole (13), and record this information on the first page of the boring log. Casing "stick up" is recorded as a positive number. For "man hole" type completions, where the reference point is below grade, a negative number is recorded and the type of surface completion described.

16. The elevation (± 0.01 ft) of the reference point shall be indicated on the first page of each boring log. Survey information is generally added or confirmed as per item 12 by the editor. The use of a datum other than mean sea level shall be indicated.

17. Surface conditions at the bore hole site shall be described on the first page of the log and continued on succeeding pages as necessary (e.g., "level, asphalt pavement-dry" or "grassy slope [± 3 percent], ground soft and wet"). Significant nearby features (outcrops, surface water bodies, etc.) should be noted.

18. The depth to water (± 0.01 ft) shall be determined and recorded as feasible during drilling and as per the Project Plan after well completion. The time (24-hour clock) and date for each determination shall be noted on the log. The point from which the depth was measured--either "surf" for ground surface (13), or "ref" for the established reference point (14)--shall also be indicated for each depth to water recorded.

19. The drilling equipment and methodology shall be summarized on the first page of each boring log (and continued on succeeding pages as necessary). Record the rig manufacturer and model. Note such information as rod size, bit type and size, internal and external diameter of hollow stem augers, pump type or compressor size, etc.

20. The method(s) for obtaining soil samples shall be identified on the first page of each boring log (and continued on succeeding pages as necessary). The citation of ASTM designations on this portion of the log constitutes the field geologist/engineer's certification that the ASTM standard was met.

21. All information in the descriptive portion of the log is placed with reference to the depth scale which is divided into 0.5-ft increments. The field geologist/engineer shall indicate "tens" units on the depth in feet scale as apprporiate. The sampler drive interval shall be indicated on the left side of the column as shown on Figure 4. The vertical location of samples (25) shall be indicated by shading on the scale as shown on Figure 4.

22. For each soil sampling attempt the type of sampler shall be indicated at the appropriate depth. The most commonly used samplers are:

SPT--Standard Penetration Test (ASTM D-1586-84) samples are obtained in soil by driving a split spoon sampler of 2-in. outside diameter/one and three-eights-in. inside diameter and a length of split barrel of 18 or 24 in. The sampler is driven into undisturbed soil by a 140-lb drop hammer free-falling 30 in. The number of "blows" (hammer drops) required to effect each successive 6 in. of penetration are recorded on the log (26). The sampler is advanced until one of the following occurs:

1. a total of 50 blows have been applied during any one of the first, second, or third 6-in. increment,

2. a cumulative total of 100 blows have been applied,

3. there is no observed advance of the sampler during the application of 10 successive blows of the hammer, or

4. the sampler is advanced a total of 18 in. without the limiting blow counts, as described above, occurring.

SS--When Standard Penetration Test data (blow counts) are not required the above described split spoon sampler may be driven 24 in. rather than 18 in. Larger diameter and/or length split spoon samplers may be used. Heavier hammer weights and different drop lengths may be used with larger split spoons. All of which must be in accordance with the Project Plan. Sampler dimension, hammer weight and length of hammer drop shall be described under item 20. Blow counts are also recorded on the log (26).

SH--Cohesive and plastic soils may be sampled with the Shelby Tube sampler which utilizes a brass or steel, thin wall tube of 3-in. outer diameter and 30 in length (typical). Tube dimensions shall be recorded in item 20. The sampler is pushed into undisturbed soil by one continuous drive using a hydraulic piston.

DEN--The Denison Core Barrel Sampler may be used to sample stiff and hard clay, non-cohesive soil or soft, weathered rock. Sawtooth, carbide or diamond coring bits may be utilized (cf. Project Plan). Sampling tube dimensions shall be recorded in item 20. The Denison sampler is advanced by rotary and continuous drive using a hydraulic piston.

OST--The Osterberg Piston Sampler advances a thin wall sampling tube with a down-hole hydraulic piston. Tube dimensions shall be recorded in item 20. The sampler is lowered into a drilled and cleaned-out hole. Reaction to pushing is accomplished by clamping drill rod to either casing or drill rig. Water pressure, applied through rod, pushes piston and its attached thin-walled sampling tube out of sampler's pressure cylinder and into soil. A fixed piston, at bottom of sampler, is connected to sampler head by a hollow piston rod. A vent hole in piston rod relieves air pressure through piston rod and ball check in sampler head. When full stroke of piston is reached, water pressure is also relieved through vent hole, piston rod and ball check. Sampler is then turned 1-1/2 revolutions to shear off bottom of sample. A friction clutch holds sampling tube to sampler.

23. The total number of inches the sampler is advanced (actual penetration) into undisturbed soil and the total number of inches of actual sample recovered shall be recorded for each sampling attempt.

24. The total depth (± 0.1 ft) of penetration of casing or hollow stem auger at the time of the sampling attempt shall be recorded for each sampling attempt. Casing depth shall be no greater than the shallowest portion of the attempted sample interval.

25. Samples which are retained in jars and/or tubes (or other appropriate containers as per the Project Plan) shall be numbered sequentially down the bore hole. Unsuccessful sampling attempts shall not be numbered. Individual samples from one sampler drive shall be numbered individually. The sample number and depth (± 0.5 ft) of the top of that portion of the sample which is retained shall be recorded for each sample. The vertical location of the containerized sample shall be indicated by shading on the depth scale (21).

Each sample container shall be labeled. The label shall be permanently marked (e.g. Sharpie) and shall identify the following:

Client:	as per item 7
Project:	as per item 6
Location:	as per item 8
Station:	Boring No. as per item 9, Sample No. and sample depth as per item 25
Collected by:	name of field geologist/engineer
Date:	of sample collection

Chain-of-custody requirements may also apply as per the Project Plan. Containerization and handling of soil samples scheduled for chemical analysis is defined in the Project Plan.

26. The number of hammer blows required to advance a split spoon sampler shall be recorded for each 0.5-ft advance for each sampling attempt. The number of blows and the number of inches penetrated for an incompleted 0.5-ft interval shall be recorded (e.g., 75/3 in.). The letter "P" shall indicate that the sampler was advanced by the weight of the drill stem or the weight of the drill stem and hammer without driving. For the Standard Penetration Test (and only for the Standard Penetration Test), when less than 18 in. (but greater than 12 in.) are penetrated by a total (maximum allowable) of 100 blows, the number of

blows for the last 12 in. of penetration (N) shall also be recorded (e.g., N = 63).

27. A number of field determinations of properties of soil samples may be made in the field as per the Project Plan. These include but are not limited to:

- pocket penetrometer readings
- screening for organic vapors with a photoionozation detector (PID) or flame-ionization detector (FID)
- pH
- specific conductance

Protocols are established in the Project Plan. The protocol shall be identified in item 20 and the data recorded in column 27 with reference to the depth scale (21).

28. The depth of each significant lithologic change shall be drawn to scale (± 0.1 ft) on the graphic log. Lithology shall be designated by the appropriate Unified Soil Classification System symbol. Changes observed in samples shall be indicated with a solid line. Changes inferred on the basis of cuttings or action of the drill rig shall be indicated with a dashed line on the graphic log and described in the narrative log (29). Gradational changes shall be indicated by a dashed, diagonal line extending over the depth of the gradational interval.

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ASTM designations D-2487 and D-2488 define standard engineering practice.

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Density (noncohesive soil)--e.g., "medium dense." Refer to Table 1.

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Between sampling attempts wash samples, drill or auger cuttings shall be described as to color and grain size, along with a description of drill action and water losses/gains for the corresponding depth.

The brand name and amount (lb) of any bentonite used for each boring, the reason for use and start (by depth) of this use shall be recorded.

A narrative description of all special problems and their resolutions shall be recorded on the boring log, e.g., hole caving, "running sands," recurring problems at a particular depth, excessive grout takes, unrecovered tools, casing or screens, etc.

A narrative description of the grouting of the bore hole or the installation of the monitoring well shall be recorded on the boring log (below the depth of completion and/or on succeeding pages). For monitoring wells, the following shall be recorded:

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- Composition and depths of placement of casing seal
- Description of protective casing
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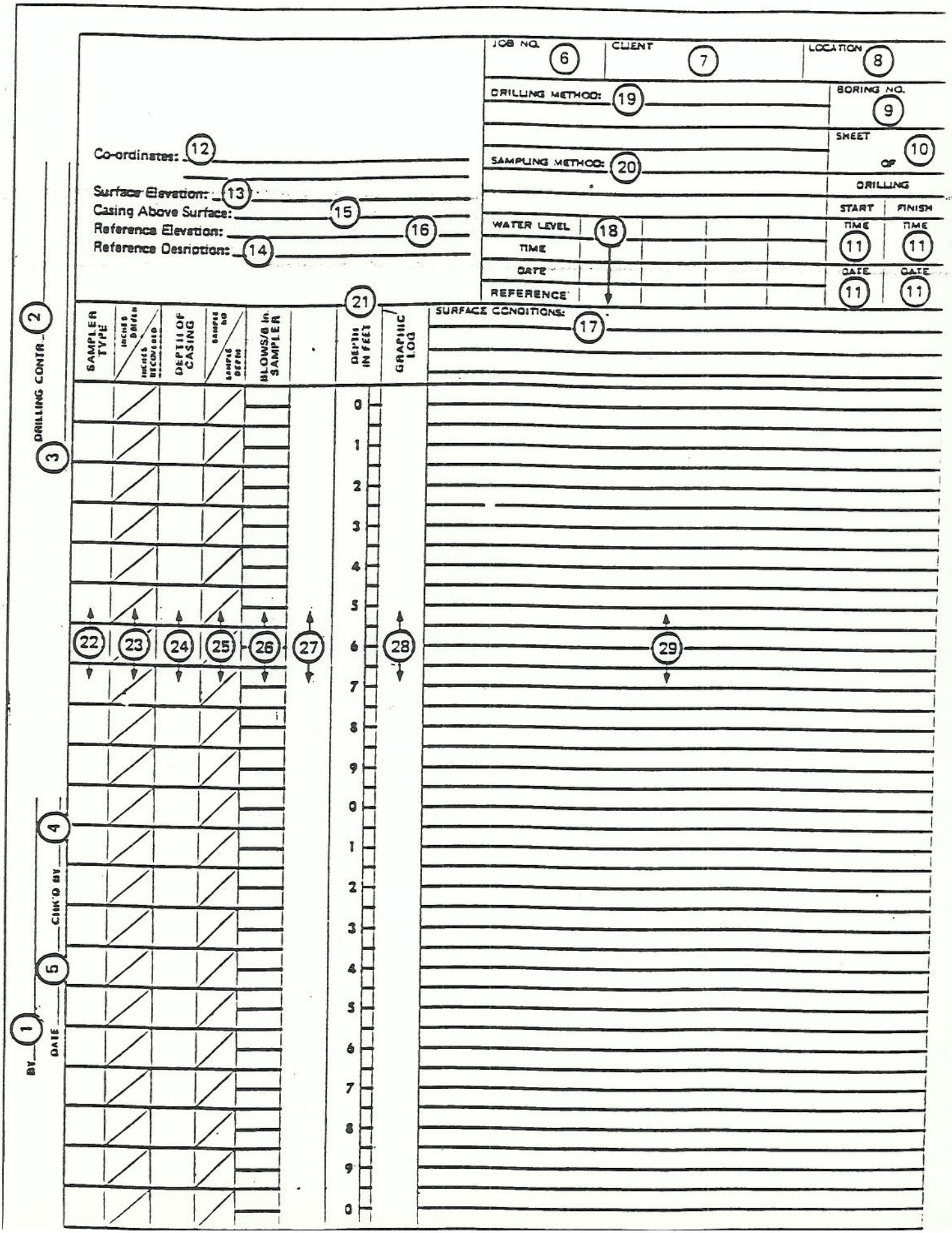

JOB NO. 6
CLIENT 7
LOCATION 8
DRILLING METHOD: 19
BORING NO. 9
SHEET 10
OF
SAMPLING METHOD: 20
DRILLING
START
FINISH
Co-ordinates: 12
Surface Elevation: 13
Casing Above Surface: 15
Reference Elevation: 16
Reference Description: 14
WATER LEVEL 18
TIME
DATE
REFERENCE
TIME 11
TIME 11
DATE 11
DATE 11
21
SURFACE CONDITIONS: 17
DRILLING CONTR. 2
3
SAMPLER TYPE
INCHES DRIVEN / INCHES RECOVERED
DEPTH OF CASING
SAMPLE NO / SAMPLE DEPTH
BLOWS/6 in. SAMPLER
DEPTH IN FEET
GRAPHIC LOG
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0
22 23 24 25 26 27 28 29
4
CHK'D BY
5
1
BY
DATE

MONITORING WELL CONSTRUCTION DIAGRAM
(Flush Surface Completion)

Monitoring Well No:_____
EA Job No:_____
Client Job No:_____

Project:_____

Client:_____

Address:_____

Form completed by: Date:

Well completion data:
Date of commencement:_____
Date of completion:_____
Drilling inspector:_____
Driller:_____
Drilling contractor:_____
Contractors address:_____
Boring diameter:_____
Boring total depth:_____
Refusal encountered:_____
Monitoring well total depth:_____
Depth reference point:_____
Vertical datum:_____
Horizontal datum:_____
Survey coordinates:_____
Casing above/below ground:_____
Casing rim elevation:_____
Surface elevation:_____

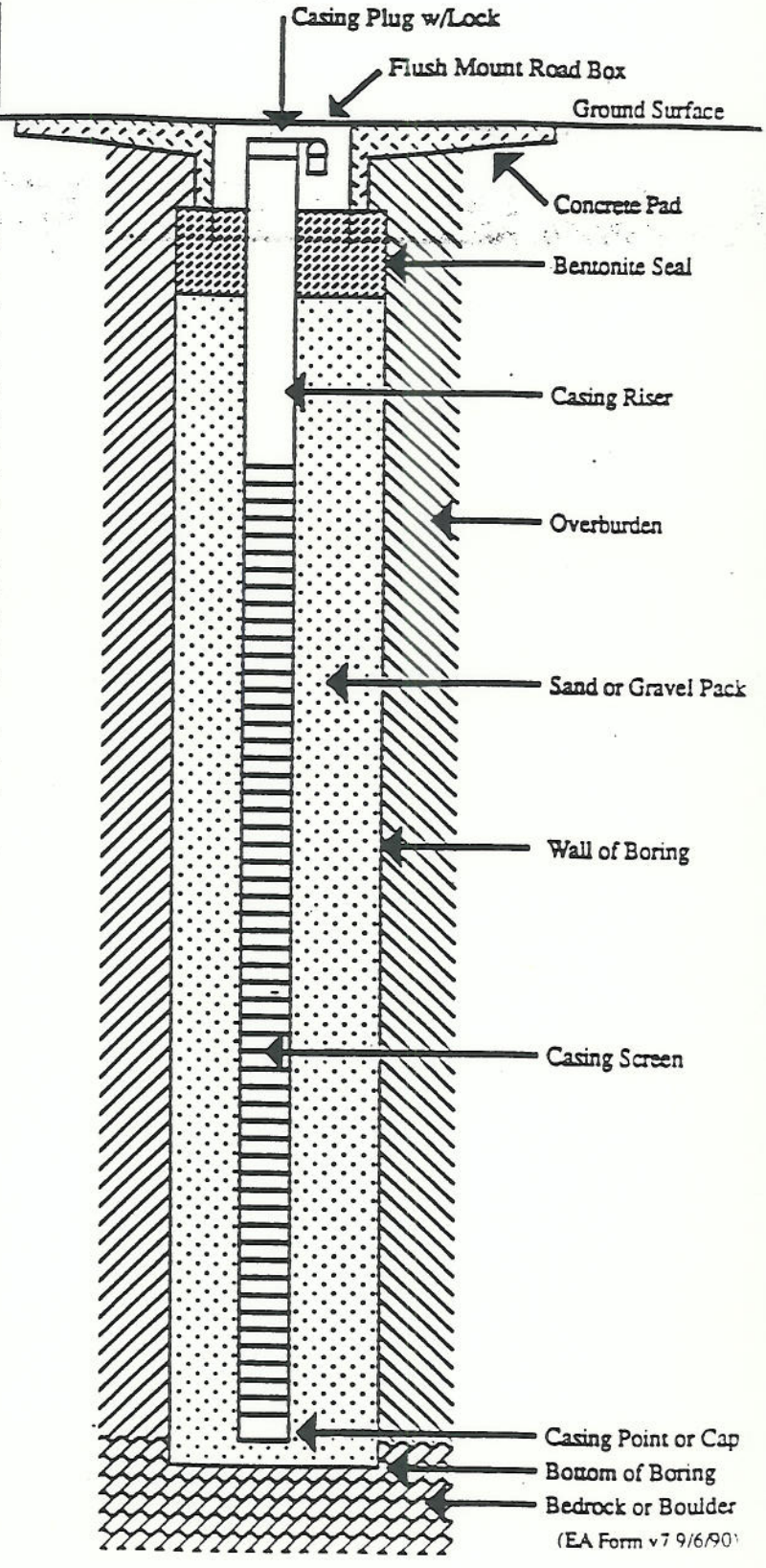
Bentonite seal:
Bentonite type:_____
Interval:_____
Amount used:_____

Sand or gravel pack:
Sand or Gravel Type:_____
Interval:_____
Amount used:_____

Well casing specifications:
Riser type:_____
Riser interval:_____
Riser feet used:_____
Screen type:_____
Screen interval:_____
Screen feet used:_____
Point type:_____

Well development:
Date:_____
By:_____
Development method:_____
Depth to water, initial:_____
Depth to water, post development:_____
Gallons purged during development:_____
Approximate yield (gpm):_____

Notes and Comments:



(EA Form v7 9/6/90)

MINIMUM FIELD BOOK ENTRIES

Initial Site Entry Notes: • your name, arrival time and date • purpose of your visit • report weather conditions • record names, titles and companies of all individuals on site; their arrival and departure times • attendance of Field Personnel briefing • H&S: - review of hospital route - decon station established - H&S Plan reviewed/signed • sketch Site (N arrow, roads, buildings, storm drains, sampling locations, source areas, etc.) • general Site description (relative to previous Site observations)	**General Sampling Entries:** • calibration date & serial # of instruments • record condition of sampling location • sample type (soil, GW, surface water) • sample number, location and brief description (color, odor) • sampling method (include grab or composite sample) • sample depths • time of sample collection • sample analyses & preservatives • number of jars for each sample • placed in ice chest • decon procedures • document sampling location was left upon completion of your work (ie, closed and locked monitoring well, backfilled and packed bore hole, etc)
Sampling Entires - GW: • log in chart format: - depth to groundwater - depth of well - depth to PVC from ground surface/ roadbox - volume of water to be removed - method of water removal - VOC screening - pH, temp., cond. readings - visual/olfactory contamination • disposal method of bailed water • groundwater recovery/recharge	**Sampling Entires - drilling:** • drillers' names, company, rig type • type of drilling and method • boring diameter, blow counts/6 inches • soil classification/class. system used • field screening results • visual/olfactory contamination • any other item to be included on boring log and well completion log • changes in work zone air quality • construction details of wells • method for checking for overhead and underground interferences (utilities)
Photograph Recordkeeping: • sketch items noted in photograph • draw direction photo was taken relative to permanent structures & N arrow • number of photograph • place some type of device to show scale (should use a measuring tape)	**Survey Notes:** • date and time of survey • purpose of survey • sketch of area to be surveyed • bench mark locations and elevations (record source for actual bench marks)
Misc. Entries/notes: • all entries shall be in waterproof black ink • draw a line through unused portions of pages (date and initial) • draw a single line through errors (date and initial) • note any remarks, telecons to/from the site • note all deviations & reasons for deviations from Scope of Work • note down time and lunch breaks • record any hazardous conditions and the action taken in response to mitigate the hazard • note any actions near the site that could potentially impact the project	**Tank Removal Oversight:** • name and address of contractors • type of excavating equipment • safety precautions taken • size and number of tanks to be removed • contents removed • tank/piping condition (rusted, pitted, holes, patches) • method of tank preparation for removal • type of backfill material • soil/groundwater sample screening • stockpiled soil/material (amount) • excavation area filled or cordoned off • dimension of excavation(s)/tank(s) • evidence of contamination • further remedial measures warranted
Off-site Soil Disposal: • removal contractor name & address • loading time • manifest serial numbers • estimated volume/weight to be removed • field screening results • number and type of transport and removal equipment	**Departure notes:** • list equipment needed for future site visits • list specific tasks that should be performed on follow-up site visits • purpose for departing site • sign, and record time and date of departure

1) It is crucial that photocopies of field documentation are included directly into the project folder in the office (particularly in the event of loss of the field book). 2) It is assumed that the Field Personnel have already been familiarized with the specifics of the project.

EQUIPMENT LIST

ACTUAL SAMPLING SUPPLIES

- bailers
- twine/string
- knife/scissors
- well key/well lock key
- disposable gloves (PPE)
- sample jars/labels (extras of both)
- 5-gallon buckets (at least 1 for sampling, 2 for decontamination)
- pen
- duck or electrical tape
- cooler/ice
- zip-lock plastic baggies
- field book

DECONTAMINATION SUPPLIES

- methanol
- distilled water (at least 2 gallons)
- spray bottles for both
- alconox
- strong bristled brushes
- paper towels
- hot water wash buckets

OTHER EQUIPMENT

- field screening equipment (HNU, OVA, pH meter, temperature meter, specific conductivity meter)
- pH, temperature, conductivity meters (and an extra jar)
- mobile phone
- well gauging instrument (interface probe, water level indicator)
- flashlight
- camera
- watch

SAFETY EQUIPMENT

- tool box
- map of site
- project proposal
- traffic cones, reflective vests, raincoat, safety signs

9.0 MONITORING WELL ABANDONMENT

9.1 PURPOSE/RESPONSIBILITY

The purpose of this SOP is to ensure proper abandonment of a groundwater monitoring well.

9.2 PROCEDURE

- All monitoring wells no longer used to gather information on geologic or groundwater properties shall be abandoned within 60 days after its use has been discontinued, unless written approval is received from the Project Manager for continued use.
- The monitoring well shall be checked from the land surface through the entire depth of the well before it is sealed to ensure against the presence of any obstructions that will interfere with sealing operations.
- Wells constructed with an annular seal shall be abandoned by cutting off the casing a minimum of 4-ft below land surface. The remaining casing shall be completely filled with a neat cement grout or bentonite-cement grout applied under pressure.
- Wells not known to be constructed with an impermeable annular seal shall be abandoned by completely removing the well casing and sealing with neat cement or bentonite-cement grout. If the casing cannot be removed during the abandonment of a well, the casing shall be thoroughly ripped or perforated from top to bottom, except that perforations will not be required over intervals of the well that are sealed with cement. The screened portion of the well and the annular space between the casing and the drillhole wall shall be effectively and completely filled with cement or bentonite-cement grout applied under pressure.

9.3 SPECIFIC FIELD BOOK ENTRIES

- refer to the attached minimum field book entries list
- drilling company (if used)
- personnel performing abandonment activities
- date and time of abandonment
- method of abandonment
- using fill materials
- depth to groundwater
- depth of well
- depth to screen

10.0 WELL DEVELOPMENT

10.1 PURPOSE / RESPONSIBILITY

The purpose of this SOP is to provide quality assurance guidance for properly developing a monitoring well.

10.2 PROCEDURE

Monitoring wells shall be developed at least 24 hours after installation and before the initial water quality samples are taken. The goal of well development is repair damage done to the boring sidewalls by the drilling operation so that the natural hydraulic properties are restored. The development of monitoring wells shall be performed as soon as practical after the well installation. Well development serves two main purposes:

1) to remove fine sand, silt, and clay that may have entered an overburden well through the screen, and
2) to achieve turbidity-free groundwater to assure effective future uses of the well.

Development is accomplished by agitating the water column by forcing water back and forth through the well screen to release silt, clay, and fine sand from the screen and surrounding screen pack. This material from the well is removed from the well by pumping.

Development continues until each of the following occurs:

- the well water is clear to the unaided eye
- the sediment thickness remaining within the well is less than 5% of the screen length

10.3 DEVELOPMENT BY SURGING WITH COMPRESSED AIR

- generally, a 100- to 150-cubic-foot-per-minute air compressor will be sufficient
- there must be at least 20% submergence of the air discharge line
- the compressed air discharge line of the air compressor should include a functioning oil/air separator filter
- a new length of flexible polyethylene pipe should be used as the air discharge line for each well
- the high pressure hose should not be placed inside a well (as they are probably contaminated)
- connections must be secured and tight
- development should begin at the bottom of the well, and working up to the top of the screen, and back down again at 5-foot intervals

10.4 MANUAL DEVELOPMENT

- consists of flexible polyethylene pipe, washer for surging and a foot valve, placed inside the well (the foot valve keeps the water from flowing out)
- by quickly raising and lowering the pipe by hand, the water is forced up and out the other end
- new, flexible pipe must be used for each well and the foot valve must be properly decontaminated, if not replaced

10.5 TROUBLE SHOOTING

10.5.1 What if the Water Does Not Clear up with an Adequate Amount of Development?

- the soil formation may not permit clear water to the unaided eye
- check with Project Manager and the boring logs of the Geologist

10.5.2 What if There is not Enough Water in the Well to Completely Develop?

- could be a problem with the well installation, check with the Project Manager and the boring logs of the Geologist

10.5.3 Developer Should Check with the Project Manager as to What Type of Development Device Should be Used.

10.6 SPECIFIC FIELD BOOK ENTRIES

. refer to the attached minimum list of field book entries
. development method used and why
. field screening results, if any
. groundwater levels, before and after purging
. is the water entering the vent hole?
. condition of the well
. any repairs needed?
. casing elevation
. surface elevation
. depth to fluid
. depth to water
. gallons of water removed (Attachment)
. time started
. time ended
. fluid depth at the end
. water depth at the end
. amount of water drawndown
. description of each photograph taken

10.7 DECONTAMINATION PROCEDURE

The decontamination procedure ensures the cleanliness of the equipment and the integrity of the sample.

With the materials listed below, the Sampler shall use these steps to decontaminate the equipment:

1) scrub the equipment in a bucket of soapy potable water with a thick-bristled brush (hot water when available)
2) rinse the equipment in another bucket of potable water
3) spray the equipment with methanol
4) spray the equipment with distilled or de-ionized water
5) air dry the equipment and return it to a sanitary location (equipment case, etc.)

The buckets must be changed after every sample location decontamination procedure.

. Basic list of decontamination equipment
  - three, 5-gallon buckets
  - three thick-bristled brushes
  - methanol
  - alconox
  - distilled water
  - paper towels
  - spray bottles

10.8 ATTACHMENTS

. well development form
. minimum field book entries

FIELD RECORD OF WELL GAUGING, PURGING AND SAMPLING

Site: _____

Well No: _____ Gauge Date: _____ Time: _____

Weather: _____

Well Condition: _____

_____

Well Diameter (inches): _____

Odor (describe): _____

Sounding Method: _____ Measurement Reference: _____

Stick up/down (ft): _____

(1) Well Depth (ft): _____ Purge Date: _____ Time: _____

(2) Depth to Liquid (ft): _____ Purge Method: _____

(3) Depth to Water (ft): _____ Purge Rate (gpm): _____

(4) Liquid Depth [(1)-(2)]: _____ Purge Time (min): _____

(5) Liquid Volume [(4)xF] (gal): _____ Purge Volume (gal): _____

Did Well Pump Dry? Describe: _____

_____

Samplers: _____

Sampling Date: _____ Time: _____

Sample Type: _____ Split? _____ With Whom: _____

Comments and Observations: _____

_____

_____

MINIMUM FIELD BOOK ENTRIES

Initial Site Entry Notes: • your name, arrival time and date • purpose of your visit • report weather conditions • record names, titles and companies of all individuals on site; their arrival and departure times • attendance of Field Personnel briefing • H&S: - review of hospital route - decon station established - H&S Plan reviewed/signed • sketch Site (N arrow, roads, buildings, storm drains, sampling locations, source areas, etc.) • general Site description (relative to previous Site observations)	**General Sampling Entries:** • calibration date & serial # of instruments • record condition of sampling location • sample type (soil, GW, surface water) • sample number, location and brief description (color, odor) • sampling method (include grab or composite sample) • sample depths • time of sample collection • sample analyses & preservatives • number of jars for each sample • placed in ice chest • decon procedures • document sampling location was left upon completion of your work (ie, closed and locked monitoring well, backfilled and packed bore hole, etc)
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11.0 GROUNDWATER SAMPLING

11.1 PURPOSE / RESPONSIBILITY

The purpose of this standard operating procedure is to ensure the integrity of the collected samples. It is also to impose a measure of control over the sample handling process.

Part of the responsibility of the Sampler shall be to collect and handle the samples properly; failure to do this may result in generation of erroneous or misleading data. Also review the equipment list with Project Manager to see if anything additional is necessary. It is also the responsibility of the Sampler to follow the guidelines of the Site Health and Safety Plan and Project Plan. If there are any discrepancies, deficiencies, or inaccurate information in either of these plans, immediately notify the Project Manager and/or Health and Safety Officer.

11.2 PROCEDURE

11.2.1 Preliminary Sampling Strategy

- coordinate with the Project Manager to order the proper amount and type of sampling containers necessary for the job
- check on the type of blanks required (see QA/QC section for an explanation)
- refer to the Pre-Sampling Plan SOP for full list of directions
- all information should be recorded in the field book

11.2.2 Determination of Water Level

- upon arrival, unlock the well
- a well sounder should be used to determine the water level
  * slowly lower the pre-cleaned electronic sounder into the well
  * after positive water penetration has been achieved (solid tone) a measurement should be taken to determine the depth
  * measurements should be relative to the rim of the well casing; place a flat edge over the central portion of the casing rim; align the measuring cord of the well sounder perpendicular with the flat edge; record reading
- water level determination should be made to the nearest 0.01 feet
- after water level is determined, the depth to the well bottom should be taken in the same manner
- the least-contaminated wells should be gauged first; proceed to more contaminated wells
- the well sounder and measuring cord should be decontaminated

11.2.3 Sampling With Bailers

- begin sampling after water level has recharged to original level
- use new disposable gloves for handling the sampling gear
- the bailer is used to fill the sample containers
- a pre-cleaned bailer of appropriate size is chosen and fitted with an appropriate length of line (the line is securely knotted to the bailer on a clean, stationary object outside of the well to prevent dropping the bailer into the well)
- three volumes of water are emptied into a container (as specified in the Project Plan) before the sampling process
- the bailer is lowered into the well, allowed to fill, and pulled up
- upon retrieval of the bailer from the well, the bailer and line should not come into contact with the ground surface or any other potentially contaminated sources
- the sample containers are appropriately labeled and put on ice in a cooler
- after the sampling procedure, the bailer is decontaminated (see Decontamination section)
- lock the well after sampling

11.2.4 Sampling From a Well

- industrial wells are typically sampled from a well head, domestic wells are typically sampled from a tap
- use new disposable gloves for handling the sampling gear
- sampling municipal or industrial wells
  * take sample directly from the well head if possible
  * let the tap run for 15 minutes before sampling, so to clean out the stagnant water in the pipes from the well to the faucet
  * prior notification is often necessary for access to the well
- sampling domestic wells
  * need to know whether the well is overburden or bedrock
  * need to know whether the well was installed by drill rig or manual operation
  * want to sample as close to the pumping well as possible
  * basement or outside faucets are preferable
  * well owner should be questioned about any treatment equipment on the system (such as softeners, iron removers, filters, turbidity removers, etc.)
  * if the sample must be taken from a treatment system, note the type, size, and purpose of the unit
  * remove any screen from the tap before sampling
- want to label all containers appropriately and store on ice until shipment to the laboratory

11.3 TROUBLE SHOOTING

11.3.1 What If the Owner Is Not at Home?

- call and make appointment for another time
- should have an appointment before visiting, and should call that day before arrival

11.3.2 What if There is Not Enough Water in the Well to Bail Three Volumes Before Sampling?

- call Project Manager
- if the Project Manager is not available, remove small amount and sample the remaining water

11.3.3 The Groundwater in a Well With Separate-Phase Floating Product Should Not be Sampled

- contact the Project Manager immediately
- attempt to identify the type of product
- measure thickness of product layer
- use extra caution in decontaminating equipment

11.4 SPECIFIC FIELD BOOK ENTRIES

. see the minimum field book entries (Attachment)
. completely fill out groundwater sampling form (Attachment)
. is the well overburden or bedrock
. was the well installed by drill rig or manual operation
. the approximate amount of liquid in the well
. was the sampled liquid translucent, transparent, or sludgy?

11.5 DECONTAMINATION PROCEDURE

The decontamination procedure ensures the cleanliness of the equipment and the integrity of the sample.

The Sampler shall use the proper list of decontamination equipment (Attachment) to complete the following process.

The Sampler shall use these steps to decontaminate the equipment:

1) scrub the equipment off in a bucket of hot, soapy water with thick-bristled brushes
2) rinse the equipment in another bucket of water
3) spray the equipment down with methanol

4) rinse the equipment in another bucket of water
5) rinse the equipment with distilled water
6) air dry and return the equipment to a sanitary location (equipment case, etc.).

The buckets should be changed after every sample location decontamination procedure.

. Basic List of Decontamination Equipment
  - three 5-gallon buckets
  - three thick-bristled brushes
  - methanol
  - alconox
  - distilled water
  - paper towels
  - spray bottles

11.6 ATTACHMENTS

. groundwater sampling record
. minimum field book entries
. equipment list

GROUNDWATER SAMPLING RECORD

SITE NAME / PROJECT NUMBER:

DATE:

ARRIVAL TIME:

DEPARTURE TIME:

WEATHER:

SAMPLERS PRESENT:

WELL CONDITION:

- Was the well locked?
- Surface condition of well?
- Is there standing water evident around the well? (if yes, how much?)
- Other comments-

ODORS FROM WELL:

FIELD MONITORING EQUIPMENT:

- Type-
- Time of reading-
- Reading-

WATER LEVEL DETERMINATION METHOD:

MEASUREMENT REFERENCE:

WATER LEVEL FROM CENTER OF CASING:

WELL DEPTH FROM CENTER OF CASING:

ANY PROBLEMS ENCOUNTERED DURING SAMPLING:

FIELD RECORD OF WELL GAUGING, PURGING AND SAMPLING

Site: _____

Well No: _____ Gauge Date: _____ Time: _____

Weather: _____

Well Condition: _____

_____

Well Diameter (inches): _____

Odor (describe): _____

Sounding Method: _____ Measurement Reference: _____

Stick up/down (ft): _____

(1) Well Depth (ft): _____ Purge Date: _____ Time: _____

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(5) Liquid Volume [(4)xF] (gal): _____ Purge Volume (gal): _____

Did Well Pump Dry? Describe: _____

_____

Samplers: _____

Sampling Date: _____ Time: _____

Sample Type: _____ Split? _____ With Whom: _____

Comments and Observations: _____

_____

_____

MINIMUM LIST OF FIELD BOOK ENTRIES

- time of arrival and departure from the site of workers and visitors
- name(s) of the support engineers
- purpose/objective of site visit
- date and weather conditions
- sketch of site: including north arrow, wind direction, appearance, roads, buildings, surface type, storm drains, any unusual characteristics, sample locations/numbers
- list of photographs take and from where
- name(s) of the samplers
- the analyses requested
- the conditions of the wells investigated
- an identification of the wells sampled
- field screening/visual/olfactory evidence of contamination
- number of samples taken
- volume of the samples taken
- name and identification number of field monitoring equipment used
- calibration date of field monitoring equipment
- telephone calls to/from the site
- if more than one field book is used, reference its number
- activities on the site or in the immediate site area which may impact the project
- any hazardous conditions or follow up actions
- equipment needed for future site visits

MINIMUM FIELD BOOK ENTRIES

Initial Site Entry Notes: • your name, arrival time and date • purpose of your visit • report weather conditions • record names, titles and companies of all individuals on site; their arrival and departure times • attendance of Field Personnel briefing • H&S: - review of hospital route - decon station established - H&S Plan reviewed/signed • sketch Site (N arrow, roads, buildings, storm drains, sampling locations, source areas, etc.) • general Site description (relative to previous Site observations)	**General Sampling Entries:** • calibration date & serial # of instruments • record condition of sampling location • sample type (soil, GW, surface water) • sample number, location and brief description (color, odor) • sampling method (include grab or composite sample) • sample depths • time of sample collection • sample analyses & preservatives • number of jars for each sample • placed in ice chest • decon procedures • document sampling location was left upon completion of your work (ie, closed and locked monitoring well, backfilled and packed bore hole, etc)
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SLW/MAC: Min. FB entries checklist
QA/QC disk, rev. 0, 6-18-91

EQUIPMENT LIST

ACTUAL SAMPLING SUPPLIES

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- twine/string
- knife/scissors
- well key/well lock key
- disposable gloves (PPE)
- sample jars/labels (extras of both)
- 5-gallon buckets (at least 1 for sampling, 2 for decontamination)
- pen
- duck or electrical tape
- cooler/ice
- zip-lock plastic baggies
- field book

DECONTAMINATION SUPPLIES

- methanol
- distilled water (at least 2 gallons)
- spray bottles for both
- alconox
- strong bristled brushes
- paper towels
- hot water wash buckets

OTHER EQUIPMENT

- field screening equipment (HNU, OVA, pH meter, temperature meter, specific conductivity meter)
- pH, temperature, conductivity meters (and an extra jar)
- mobile phone
- well gauging instrument (interface probe, water level indicator)
- flashlight
- camera
- watch

SAFETY EQUIPMENT

- tool box
- map of site
- project proposal
- traffic cones, reflective vests, raincoat, safety signs

12.0 SURFACE WATER SAMPLING

12.1 PURPOSE / RESPONSIBILITY

The purpose of this Standard Operation Procedure is to provide quality assurance guidance for properly collecting surface water samples.

A Field Technician or equivalent should be responsible for collecting surface water samples. It is also the responsibility of the Sampler to follow the guidelines of the Site Health and Safety Plan and Project Plan. If there are any discrepancies, or deficiencies or inaccurate information in either of these plans, immediately notify the Project Manager and/or Health and Safety Officer.

12.2 PROCEDURE

There are two procedures for sampling surface water from lakes, ponds, streams, rivers: on-shore (includes sewers) and off-shore.

Factors that will influence the selection of a sampler include: the width, depth, and flow of the sampling location and any tidal influence. If the flow is too fast, it may be impossible to obtain a mid-channel sample. The Sampler should than find a location where flow is obstructed, dig a small hole, and sample the water that collects in the pool.

12.2.1 On-shore

- depending on the protocol, the sample may be collected directly into the sample container
- any part of the Sampler's body that may come into contact with the sample container and the sample matrix must be protected according to the Site Safety and Health Plan
- if the sample can not be reached by body extension, a pond sampler may be used
  * if a pond sampler is used, be sure the extension is adequate to reach the sample without jeopardizing the Sampler
- for a stream or river, collect the sample at mid-depth
- for a standing liquid, collect the sample 6 inches below the surface
- withdraw the sample from the liquid, cap, label, and store on ice
- container should be correctly labeled

12.2.2 Off-shore

- samples taken from over the side of a boat or the side of a bridge
- depending on the protocol, the sample may be collected directly into the sample container
- a pond sampler should be used as necessary

- if the liquid is stratified, a sample of each strata should be obtained
  * proper use of the equipment listed will allow for this representative sample to be obtained (Attachment)

12.3 SPECIFIC FIELD BOOK ENTRIES

. see the attached minimum list of entries
. record the flow of water (rapid, moderate, slow, stagnant)
. water conditions
. description of the area that the sample was collected
. description of the methodology used in the sample process
. any complications during the sample collection process?
. the approximate amount of liquid in the container
. was the sampled liquid translucent, transparent, or sludgy?

12.4 DECONTAMINATION PROCEDURE

The decontamination procedure ensures the cleanliness of the equipment and the integrity of the sample.

The Sampler shall use the proper list of decontamination equipment (Attachment) to complete the following process.

With the materials listed below, the Sampler shall decontaminate the equipment:

1) scrub the equipment off in a bucket of hot, soapy water with thick-bristled brushes
2) rinse the equipment in another bucket of water
3) spray the equipment with methanol
4) rinse the equipment in another bucket of water
5) rinse the equipment with distilled water
6) air dry and return the equipment to a sanitary location (equipment case, etc.).

The bucket water should be changed after every sample location decontamination procedure.

12.5 ATTACHMENTS

. equipment list
. diagrams of possible water sampling devices: Weighted Bottle Sampler, Wheaton Dip Sampler, Kemmerer Depth Sampler, Bacon Bomb (Tank Tester) Sampler, Pond Sampler

EQUIPMENT LIST

ACTUAL SAMPLING SUPPLIES

- bailers
- twine/string
- knife/scissors
- well key/well lock key
- disposable gloves (PPE)
- sample jars/labels (extras of both)
- 5-gallon buckets (at least 1 for sampling, 2 for decontamination)
- pen
- duck or electrical tape
- cooler/ice
- zip-lock plastic baggies
- field book

DECONTAMINATION SUPPLIES

- methanol
- distilled water (at least 2 gallons)
- spray bottles for both
- alconox
- strong bristled brushes
- paper towels
- hot water wash buckets

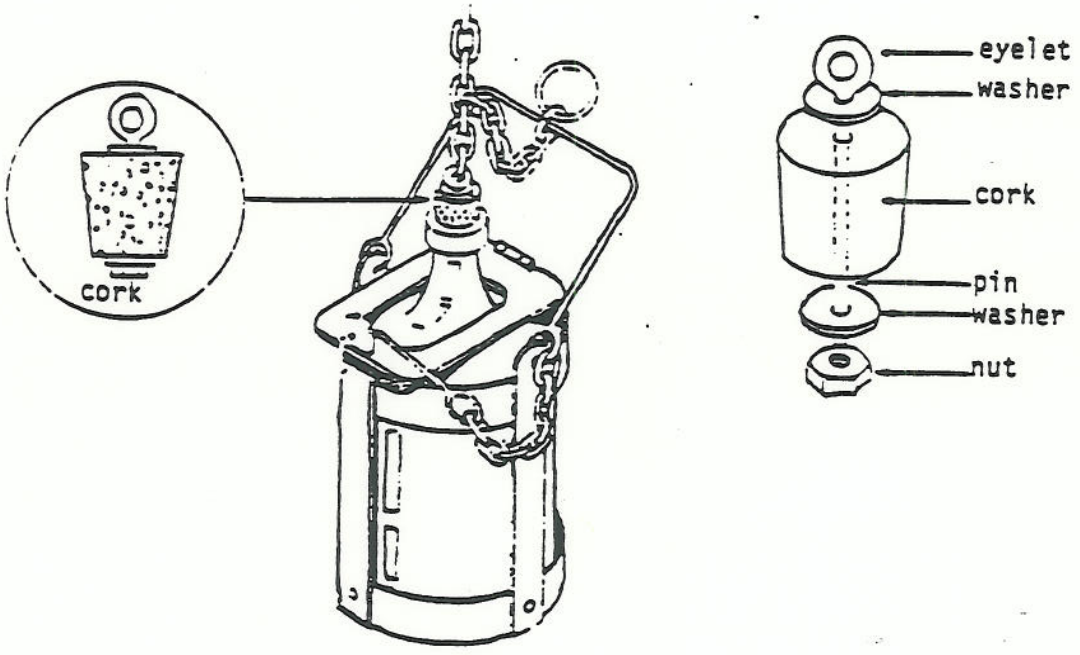
OTHER EQUIPMENT

- field screening equipment (HNU, OVA, pH meter, temperature meter, specific conductivity meter)
- pH, temperature, conductivity meters (and an extra jar)
- mobile phone
- well gauging instrument (interface probe, water level indicator)
- flashlight
- camera
- watch

SAFETY EQUIPMENT

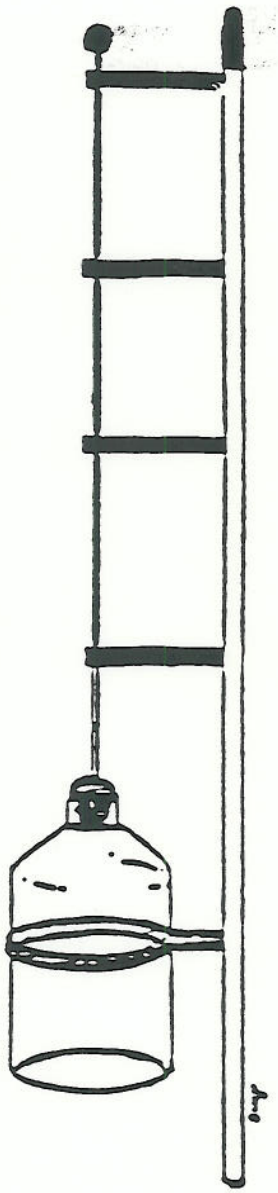
- tool box
- map of site
- project proposal
- traffic cones, reflective vests, raincoat, safety signs

WEIGHTED BOTTLE SAMPLER

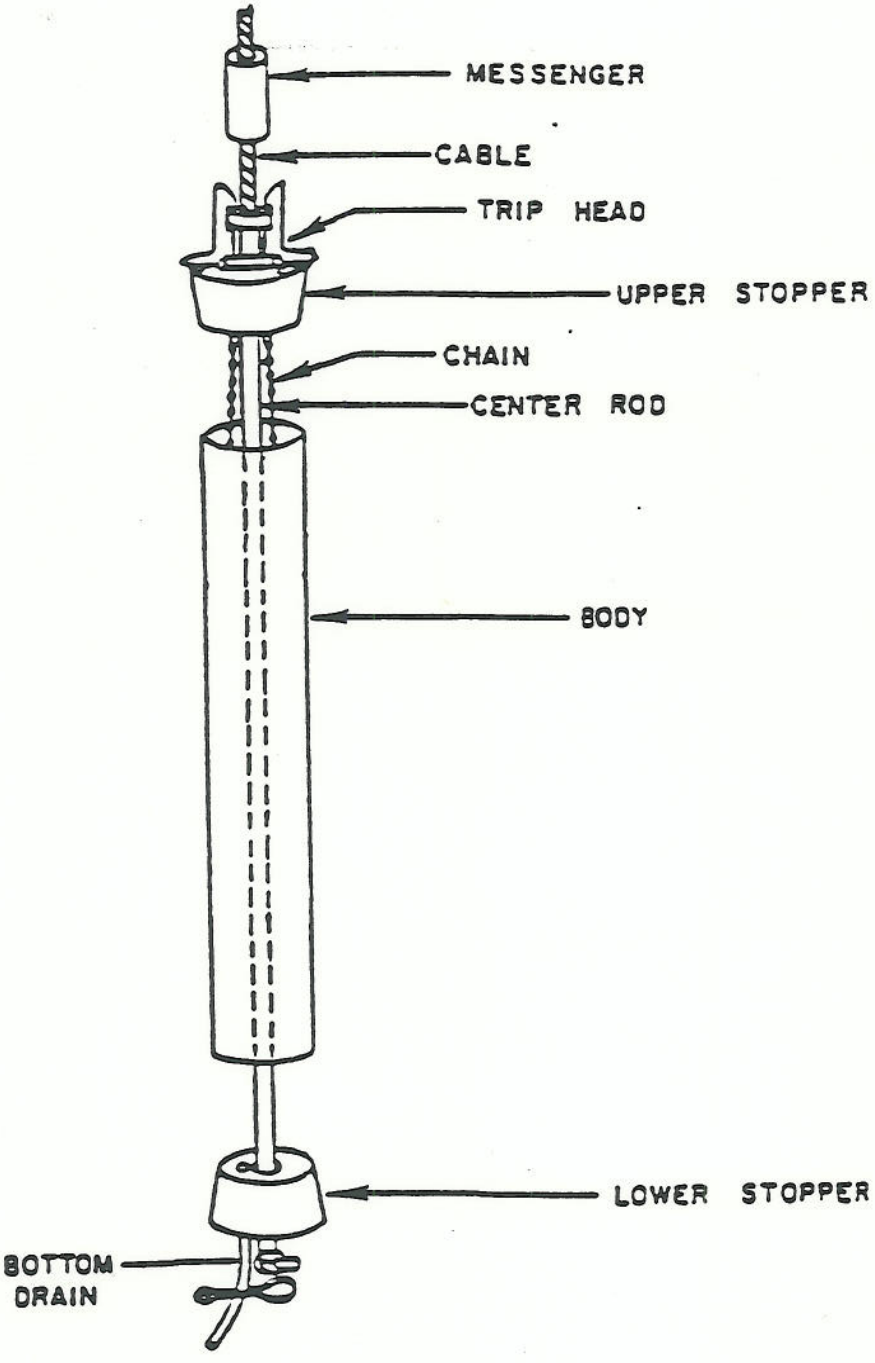


1000 ml (1 quart)
weighted bottle sampler

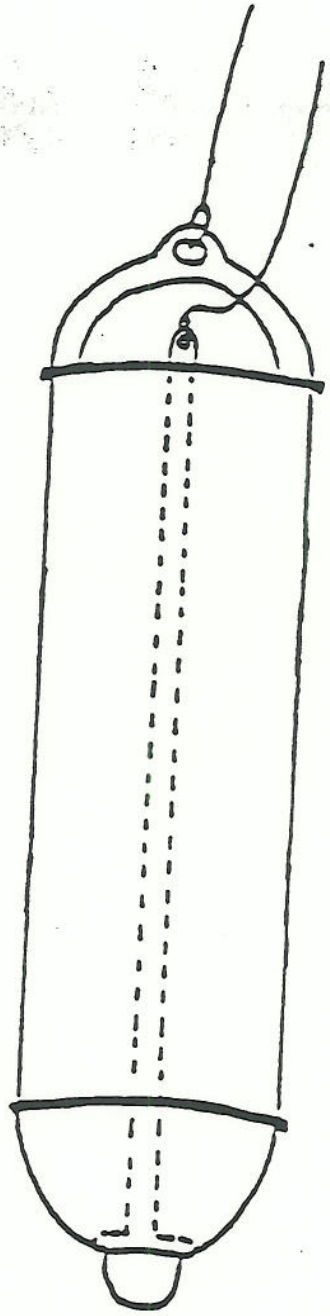
WHEATON DIP SAMPLER



KEMMERER DEPTH SAMPLER

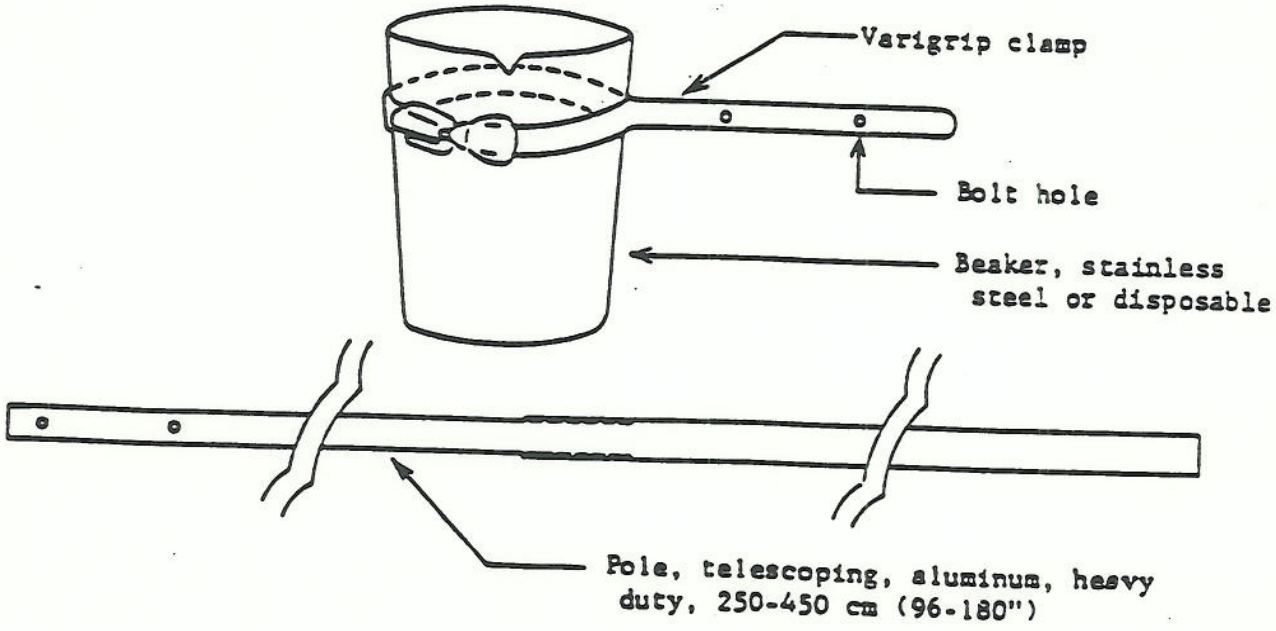


BACON BOMB SAMPLER



BASIC PARTS OF A POND SAMPLER

QUANTITY	ITEM	SUPPLIER
1	Clamp, adjustable, 6.4 to 8.9 cm (2 1/2 to 3 1/2 in.) for 250 to 600 ml (1/2 to 1 1/4 pt.) beakers	Laboratory supply houses
1	Tube, aluminum, heavy duty, telescoping extends 2.5 to 4.5 m (8 to 15 ft.) with joint cam locking mechanism. Pole diameters 2.54 cm (1 in.) in diameter and 3.18 cm (1 1/4 in.) in diameter	Olympic Swimming Pool Co., 807 Buena Vista St., Almadea, CA 94501 or other general swimming pool supply houses
1	Beaker, tetrafluoropolyethylene or stainless steel, 250 ml (1/2 pt.)	Laboratory supply houses
1	Bolts 6.35 by 0.64 cm (2 1/4 by 1/4 in.) NC	Hardware Stores
1	Nuts, 0.64 cm (1/4 in.) NC	Hardware Stores



13.0 OTHER LIQUID SAMPLING

13.1 PURPOSE / RESPONSIBILITY

The purpose of the Standard Operating Procedure is to provide quality assurance guidance for properly sampling containerized liquids.

It is the responsibility of the Project Manager to investigate as much as possible the potential dangers associated with the containerized liquids before the Sampler enters the field. A Field Technician or equivalent should be responsible for collecting the liquid samples. It is also the responsibility of the Field Technician to follow the guidelines of the Site Health and Safety Plan and Project Plan. If there are any discrepancies, deficiencies, or inaccurate information in either of these plans, immediately notify the Project Manager and/or the Health and Safety Officer.

13.2 PROCEDURE

. Drums and small containers
. Sampling of containerized liquids is accomplished by one of the following samplers:
- COLIWASA
- open tube sampler
- stratified sample thief
- bacon bomb sampler

. General sampling procedure
- mark each container, preferably with spray paint or indelable ink, with an identification number
- photograph each numbered container (as a permanent record)
- open the container to be sampled in accordance with the Project Plan
- insert the sampling device into the center of the liquid
- collect a cross-sectional portion of the contents
- immediately transfer the sample into the sample container
- each container should be sampled separately
- if composite samples are requested, collect the samples separately then either laboratory composite or field composite after compatibility is determined
- close the container that was opened to be sampled

13.3 DRUM OPENING

There are three techniques for opening drums:

1) Manual opening with non-sparking bung or plug wrenches (non-sparking alloys are bronze/manganese, aluminum, molybdenum)
2) Drum deheading

3) Remote drum puncturing or drum removal

Which technique to use depends on the number of drums to be opened, the types of waste (if known), and their physical condition.

13.3.1. Manual Opening

Manual opening should only be performed on drums in sound condition. Once opened, the drum can be sampled with a glass tube or a composite liquid sampler. If there is any evidence of incompatible chemical reactions, site personnel should immediately leave the area. Resume opening by remote methods.

13.3.2 Drum Deheading

Drum deheading is the complete removal of the top of the drum. It is best to do this procedure when a small number of drums need to be opened. It is generally not practical because it is time consuming and requires workers to be close to the drums for a long period of time.

13.3.3 Remote Opening

Remote sampling provides the most protection to site workers. If you see signs of heavy corrosion, or pressure buildup, use a remote sampler. There are two tools currently available for remote sampling: remote bung remover (an air impact wrench) and the hydraulic drum plunger which forces a penetrator into the drum, withdraws a sample, and seals the resulting hole.

Highly toxic, explosive, or reactive drums should be opened in a bunker - an isolated area surrounded by sandbags, earthen dikes, or cinder blocks lined with plastic or concrete.

Opening procedures cited from Student Manual HWSWBH&SC.

. Tanks, Vacuum Trucks, Similar Large Containers
- containers should be inventoried and all information recorded (see Minimum Field Book section)
- mark each container, preferably with spray paint or indelable ink, with an identification number
- photograph each numbered container (as a permanent record)
- the opening procedure varies by container type
- it is most desirable to collect the sample from the top of the container:
  * integrity of the valves at the bottom can not be assured
  * the valve being sampled from may jam or break open
  * collecting from the bottom will not result in a stratified sample
- check for a pressure gauge; the release valve should be opened slowly
- measure releases into the atmosphere with the appropriate field instrument and record findings

- if there is no release valve, then loosen the bolts from the valve to relieve the pressure
- once the tank has been stabilized, the sample procedure continues as stated above

. Special risks associated with sampling large containers:
- often, the Sampler must climb on top of the container to sample
- at least two persons must perform the sampling: one to open the hatch and collect the samples; and the other to standby for any necessary assistance
- the pressure must be released slowly, in order to prevent a sudden release

13.4 TROUBLE SHOOTING

. If the sampling device is not disposable, follow the decontamination procedure in the decontamination section
. If the liquid being sampled has an acidic pH, avoid using glass sample containers and sampling equipment (it is possible that the liquid might contain hydrofluoric acid - a glass etching acid)
. It may be necessary to collect samples from several points of the container, due to layering within the liquid
. If the liquid is viscous, collect the sample slowly to assure the sample is representative of the material in the container
. If the liquid is flammable, use non-sparking tools, equipment and personal protective equipment

13.5 SPECIFIC FIELD BOOK ENTRIES

. in addition to the attached Minimum List of Field Book entries
. type of container being sampled
. capacity, markings, labels, color, origin, and condition of container
. color, odor, and other features (layering) of the liquid that was sampled
. does the sample seem to represent the contents of the container?
. the approximate amount of liquid in the container
. was the sampled liquid translucent, transparent, or sludgy?

13.6 DECONTAMINATION PROCEDURE

The decontamination procedure ensures the cleanliness of the equipment and the integrity of the sample. Without this procedure, the equipment could serve as a source for cross contamination, thus making void the entire sampling effort.

The Sampler should use the proper list of decontamination equipment to complete the following process.

With the materials listed below, the Sampler shall use three steps to decontaminate the equipment:

1) scrub the equipment off in a bucket of hot, soapy water with thick-bristled brushes
2) rinse the equipment in another bucket of water
3) spray the equipment down with methanol
4) rinse the equipment in another bucket of water
5) rinse the equipment with distilled water
6) air dry and return the equipment to a sanitary location (equipment case, etc.).

The buckets must be changed after every sample location decontamination procedure.

. Basic List of Decontamination Equipment
  - three 5-gallon buckets
  - three thick-bristled brushes
  - methanol
  - Alconox
  - distilled water
  - paper towels
  - spray bottle

13.7 ATTACHMENT

. list of specific sampling equipment
  - non-sparking bung opener
  - non-sparking tools (i.e., wrench)
. diagrams of the following: VACSAM, Stratified Sample Thief, Syringe Sampler, COLIWASA, Grab Sampler
. Minimum List of Field Book Entries

EQUIPMENT LIST

ACTUAL SAMPLING SUPPLIES

- bailers
- twine/string
- knife/scissors
- well key/well lock key
- disposable gloves (PPE)
- sample jars/labels (extras of both)
- 5-gallon buckets (at least 1 for sampling, 2 for decontamination)
- pen
- duck or electrical tape
- cooler/ice
- zip-lock plastic baggies
- field book

DECONTAMINATION SUPPLIES

- methanol
- distilled water (at least 2 gallons)
- spray bottles for both
- alconox
- strong bristled brushes
- paper towels
- hot water wash buckets

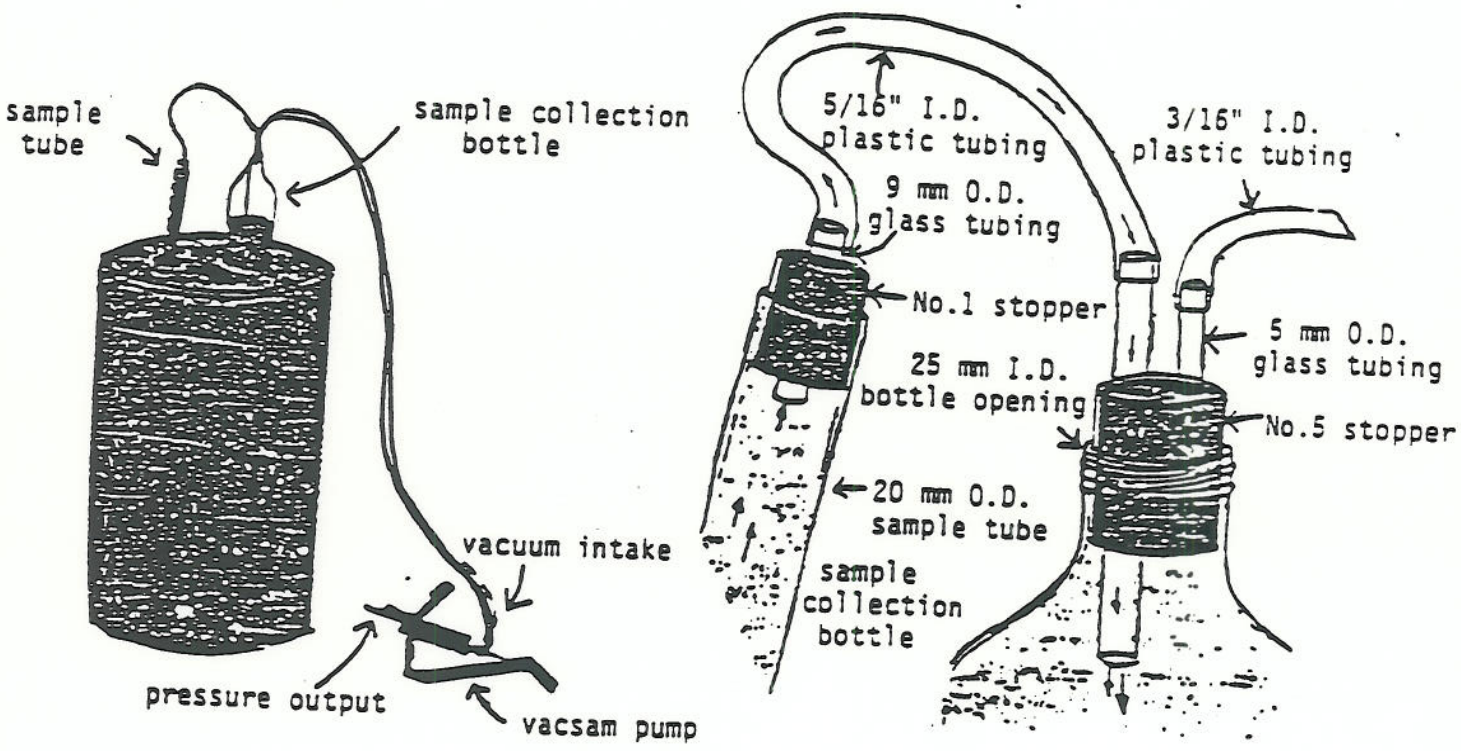
OTHER EQUIPMENT

- field screening equipment (HNU, OVA, pH meter, temperature meter, specific conductivity meter)
- pH, temperature, conductivity meters (and an extra jar)
- mobile phone
- well gauging instrument (interface probe, water level indicator)
- flashlight
- camera
- watch

SAFETY EQUIPMENT

- tool box
- map of site
- project proposal
- traffic cones, reflective vests, raincoat, safety signs

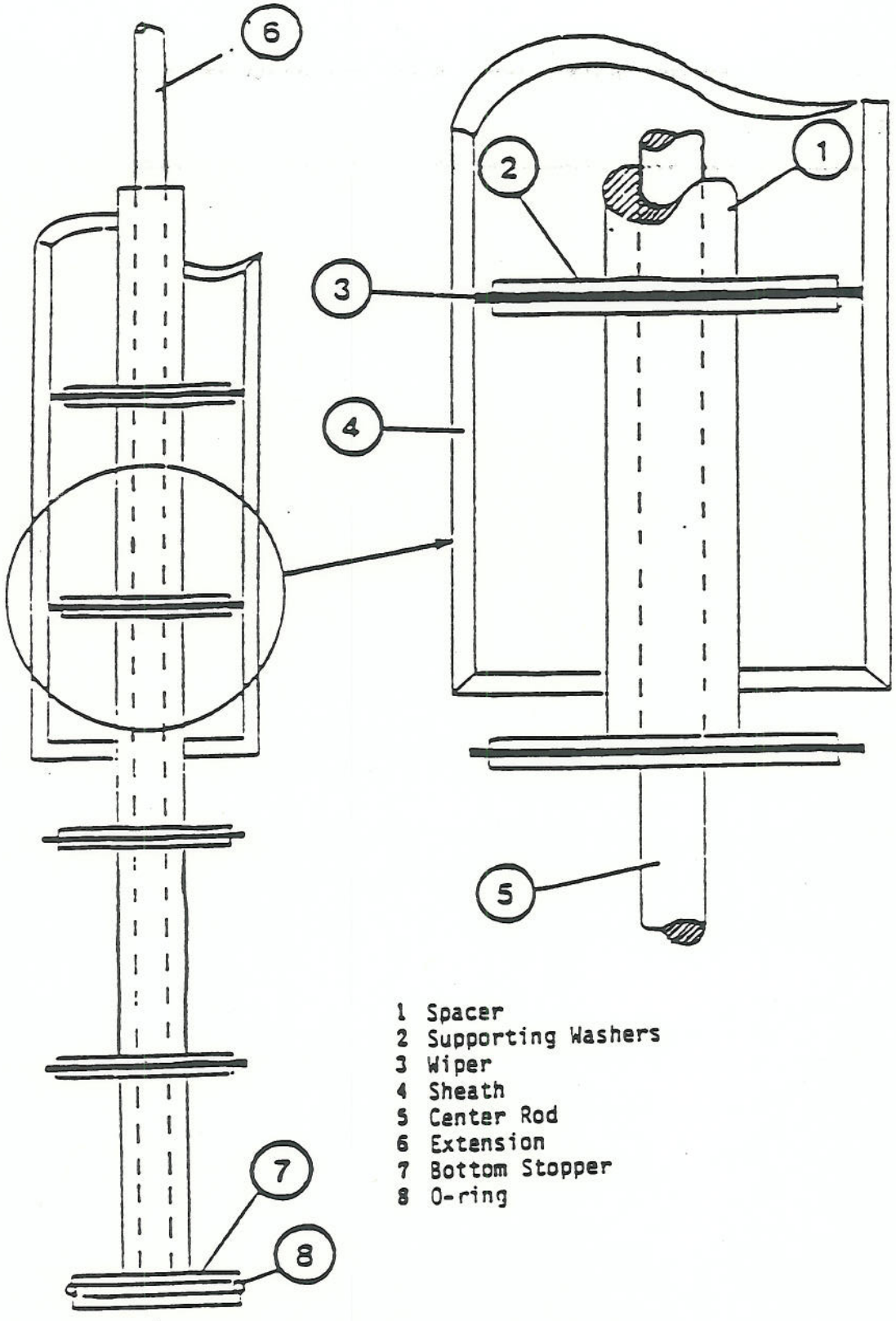
VACSAM



Close-up of sample tube and sample collection bottle.

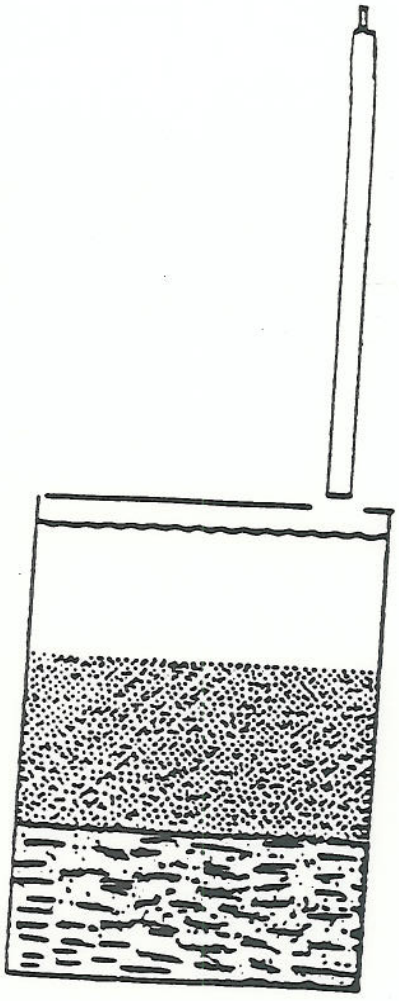
(Hazardous Materials & Waste Management Magazine/May-June 1984)

STRATIFIED SAMPLE THIEF



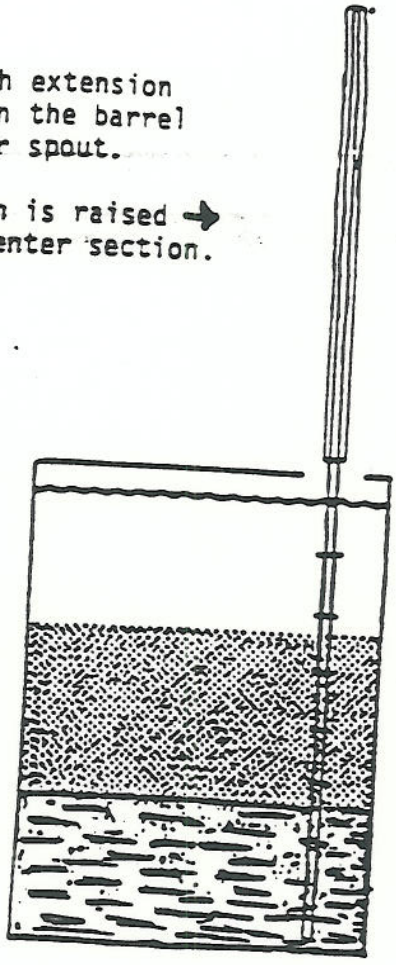
1 Spacer
2 Supporting Washers
3 Wiper
4 Sheath
5 Center Rod
6 Extension
7 Bottom Stopper
8 O-ring

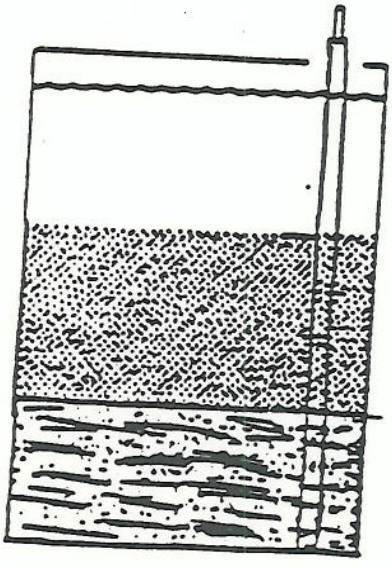
STRATIFIED SAMPLE THIEF



A. The sampler with extension rod is placed in the barrel through the pour spout.

B. The outer sheath is raised to expose the center section.

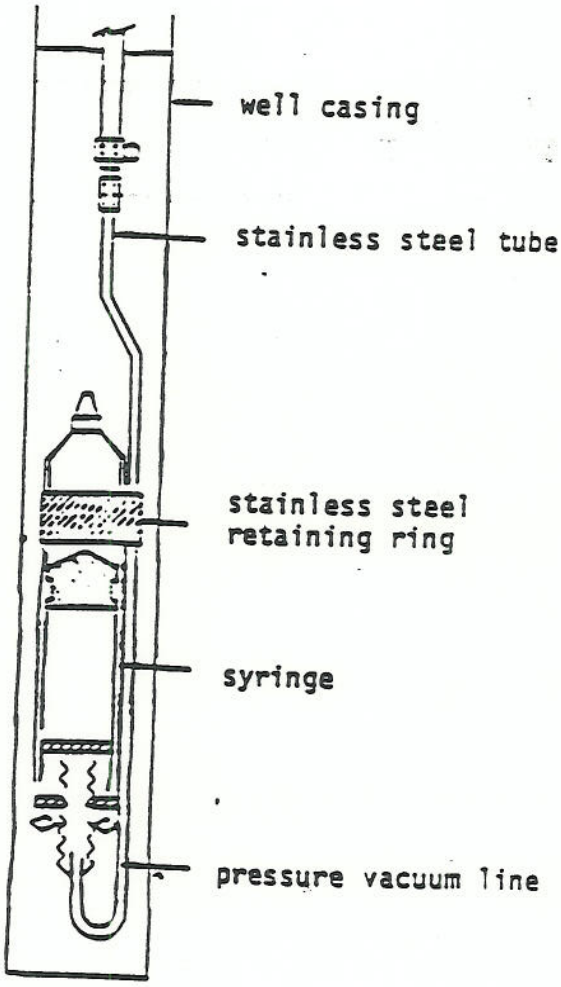




C. The outer sheath is slid down the center section, trapping the liquid.

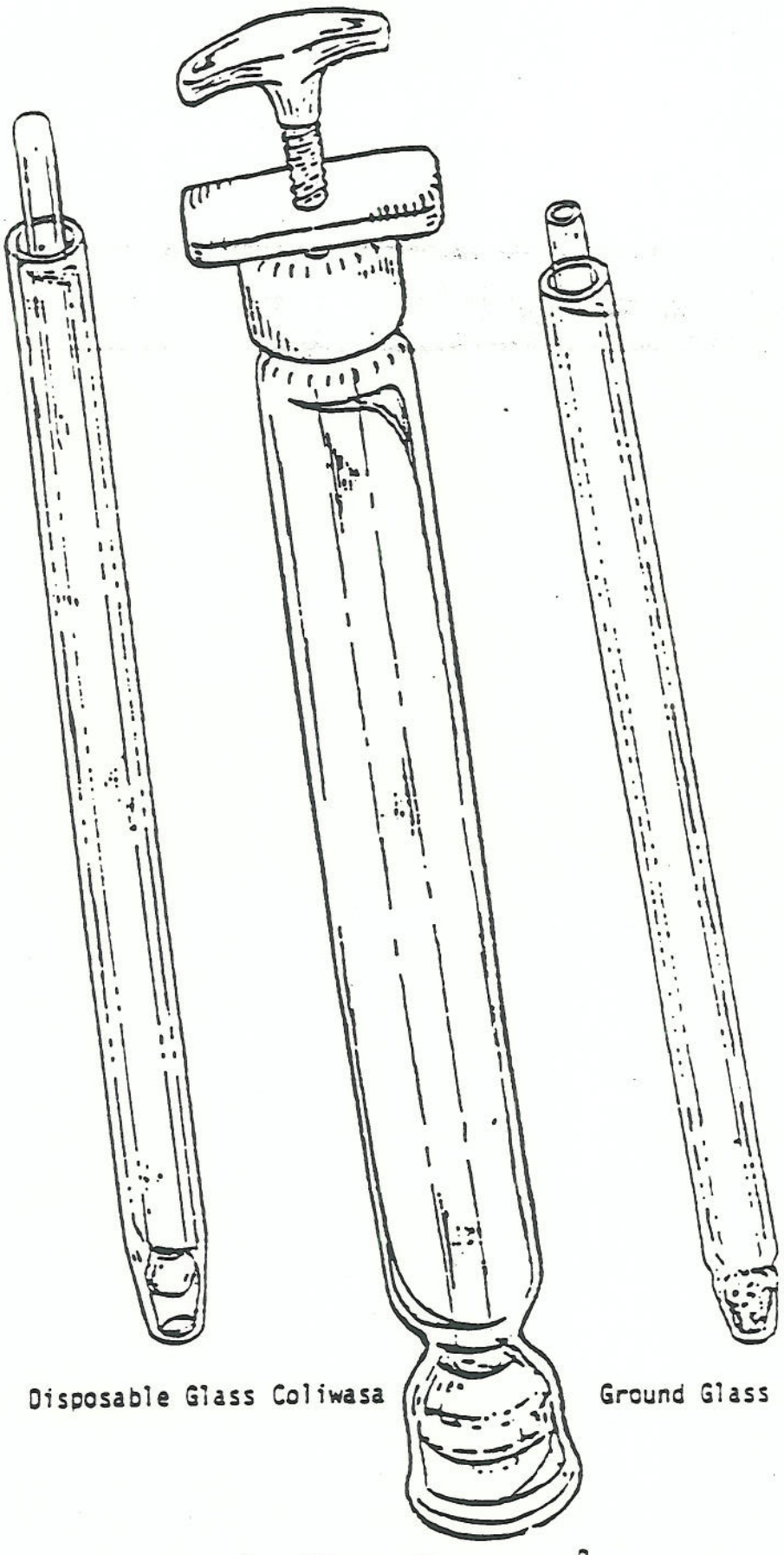
D. The entire sampler is withdrawn from the drum with a representative sample enclosed.

SYRINGE SAMPLER



Reproduced from R. Gillham
GROUND WATER MONITORING
REVIEW Volume 2:21. 1982

COLIWASA

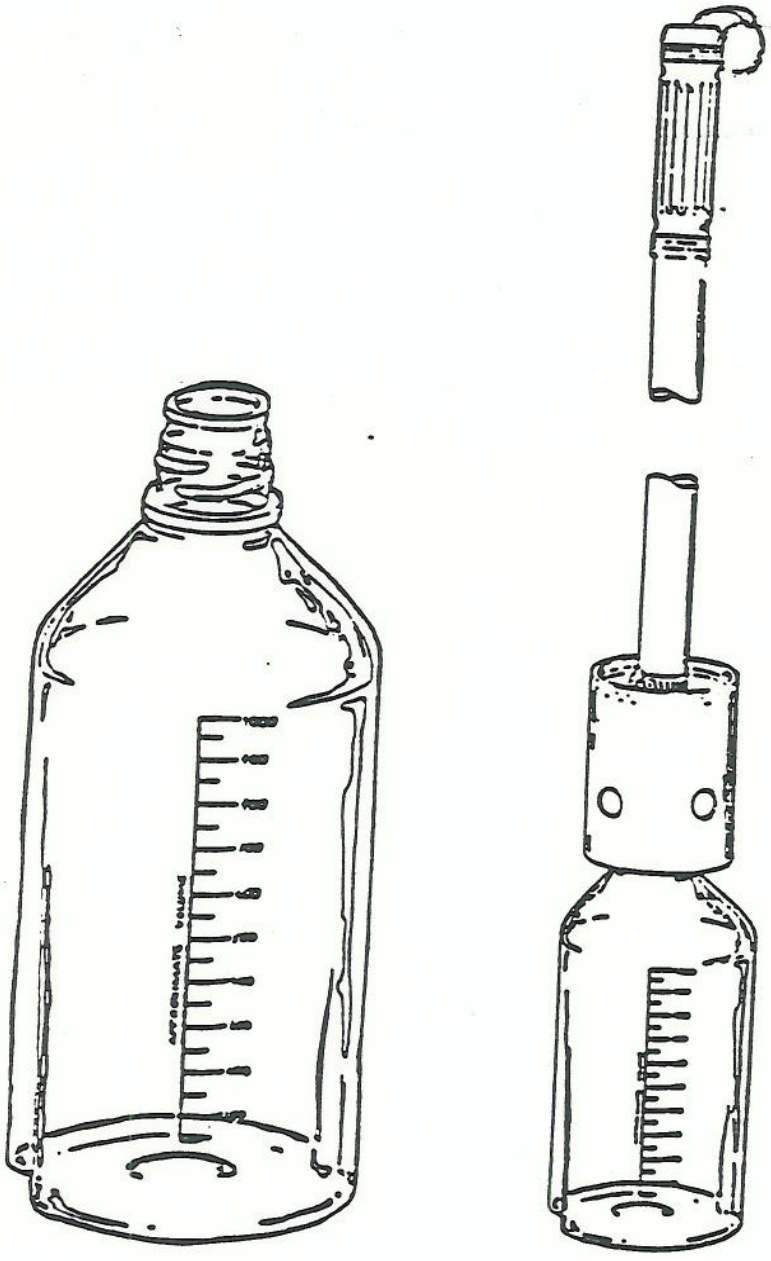


Disposable Glass Coliwasa

Ground Glass Coliwasa

Borsilicate Glass/Teflon[R] Coliwasa

PACS GRAB SAMPLER



MINIMUM FIELD BOOK ENTRIES

Initial Site Entry Notes: • your name, arrival time and date • purpose of your visit • report weather conditions • record names, titles and companies of all individuals on site; their arrival and departure times • attendance of Field Personnel briefing • H&S: - review of hospital route - decon station established - H&S Plan reviewed/signed • sketch Site (N arrow, roads, buildings, storm drains, sampling locations, source areas, etc.) • general Site description (relative to previous Site observations)	**General Sampling Entries:** • calibration date & serial # of instruments • record condition of sampling location • sample type (soil, GW, surface water) • sample number, location and brief description (color, odor) • sampling method (include grab or composite sample) • sample depths • time of sample collection • sample analyses & preservatives • number of jars for each sample • placed in ice chest • decon procedures • document sampling location was left upon completion of your work (ie, closed and locked monitoring well, backfilled and packed bore hole, etc)
Sampling Entires - GW: • log in chart format: - depth to groundwater - depth of well - depth to PVC from ground surface/ roadbox - volume of water to be removed - method of water removal - VOC screening - pH, temp., cond. readings - visual/olfactory contamination • disposal method of bailed water • groundwater recovery/recharge	**Sampling Entires - drilling:** • drillers' names, company, rig type • type of drilling and method • boring diameter, blow counts/6 inches • soil classification/class. system used • field screening results • visual/olfactory contamination • any other item to be included on boring log and well completion log • changes in work zone air quality • construction details of wells • method for checking for overhead and underground interferences (utilities)
Photograph Recordkeeping: • sketch items noted in photograph • draw direction photo was taken relative to permanent structures & N arrow • number of photograph • place some type of device to show scale (should use a measuring tape)	**Survey Notes:** • date and time of survey • purpose of survey • sketch of area to be surveyed • bench mark locations and elevations (record source for actual bench marks)
Misc. Entries/notes: • all entries shall be in waterproof black ink • draw a line through unused portions of pages (date and initial) • draw a single line through errors (date and initial) • note any remarks, telecons to/from the site • note all deviations & reasons for deviations from Scope of Work • note down time and lunch breaks • record any hazardous conditions and the action taken in response to mitigate the hazard • note any actions near the site that could potentially impact the project	**Tank Removal Oversight:** • name and address of contractors • type of excavating equipment • safety precautions taken • size and number of tanks to be removed • contents removed • tank/piping condition (rusted, pitted, holes, patches) • method of tank preparation for removal • type of backfill material • soil/groundwater sample screening • stockpiled soil/material (amount) • excavation area filled or cordoned off • dimension of excavation(s)/tank(s) • evidence of contamination • further remedial measures warranted
Off-site Soil Disposal: • removal contractor name & address • loading time • manifest serial numbers • estimated volume/weight to be removed • field screening results • number and type of transport and removal equipment	**Departure notes:** • list equipment needed for future site visits • list specific tasks that should be performed on follow-up site visits • purpose for departing site • sign, and record time and date of departure

1) It is crucial that photocopies of field documentation are included directly into the project folder in the office (particularly in the event of loss of the field book). 2) It is assumed that the Field Personnel have already been familiarized with the specifics of the project.

14.0 ASBESTOS SAMPLING

14.1 PURPOSE / RESPONSIBILITY

The purpose of this Standard Operating Procedure is to ensure the integrity of the collected samples. It is also to impose a measure of control over the sample handling process.

It is the responsibility of the Project Manager to ensure that only an Industrial Hygienist or an Asbestos Technician trained in identification, sampling, and interpretation perform the asbestos survey.

14.2 PROCEDURE

- a floor plan is used during the survey to locate accessible areas of the building
- locations and types of asbestos-containing materials should be noted and described on these plans
- the most common materials which should be assumed to have asbestos-containing materials are:
  - pipe and boiler insulation, liner sections, elbows, and joints
  - asbestos cement sheets in boiler rooms, garage ceilings, walls/ceilings where excessive heat can occur
  - ceiling tiles
  - vinyl floor tiles
  - sprayed-on insulation and fire-proofing on ceilings, steel support structures, and roof trusses
  - roofing tars and materials
  - mastic-floor and roofing
  - fire brick
  - oven/furnace caulking
- bulk samples of any suspect asbestos-containing materials shall be collected to determine if the material actually contains asbestos fibers
- the location of suspect asbestos-containing materials if first marked on the floor plan and an assessment of friability, if made
- any inaccessible spaces where asbestos-containing materials may be present shall be identified on the floor plan
- three samples are collected from each distinct homogenous area of suspected material
- at least one duplicate/quality control sample should be collected for every 20 samples
- air sampling should be conducted following confirmation of the presence of asbestos-containing materials in the building

14.3 FIELD BOOK ENTRIES

. See the Pre-Sampling Plan for a minimum list of entries and procedures
. to complete the floor plans with location, time, description, etc..

14.4 DECONTAMINATION PROCEDURES

. See the Pre-Sampling Plan for a minimum list of equipment and basic procedures

14.5 ATTACHMENTS

. Equipment list
. Minimum List of Field Book Entries

14.6 SPECIFIC EQUIPMENT LIST FOR ASBESTOS SAMPLING

. asbestos sample containers
. proper tools for collecting the asbestos samples (trier, corer)
. ladder for difficult to reach locations
. proper personal protective equipment (respirator/cartridge, Tyvek, gloves, etc.)
. Minimum List of Field Book Entries

EQUIPMENT LIST

ACTUAL SAMPLING SUPPLIES

- bailers
- twine/string
- knife/scissors
- well key/well lock key
- disposable gloves (PPE)
- sample jars/labels (extras of both)
- 5-gallon buckets (at least 1 for sampling, 2 for decontamination)
- pen
- duck or electrical tape
- cooler/ice
- zip-lock plastic baggies
- field book

DECONTAMINATION SUPPLIES

- methanol
- distilled water (at least 2 gallons)
- spray bottles for both
- alconox
- strong bristled brushes
- paper towels
- hot water wash buckets

OTHER EQUIPMENT

- field screening equipment (HNU, OVA, pH meter, temperature meter, specific conductivity meter)
- pH, temperature, conductivity meters (and an extra jar)
- mobile phone
- well gauging instrument (interface probe, water level indicator)
- flashlight
- camera
- watch

SAFETY EQUIPMENT

- tool box
- map of site
- project proposal
- traffic cones, reflective vests, raincoat, safety signs

MINIMUM FIELD BOOK ENTRIES

Initial Site Entry Notes:
- your name, arrival time and date
- purpose of your visit
- report weather conditions
- record names, titles and companies of all individuals on site; their arrival and departure times
- attendance of Field Personnel briefing
- H&S:
  - review of hospital route
  - decon station established
  - H&S Plan reviewed/signed
- sketch Site (N arrow, roads, buildings, storm drains, sampling locations, source areas, etc.)
- general Site description (relative to previous Site observations)

General Sampling Entries:
- calibration date & serial # of instruments
- record condition of sampling location
- sample type (soil, GW, surface water)
- sample number, location and brief description (color, odor)
- sampling method (include grab or composite sample)
- sample depths
- time of sample collection
- sample analyses & preservatives
- number of jars for each sample
- placed in ice chest
- decon procedures
- document sampling location was left upon completion of your work (ie, closed and locked monitoring well, backfilled and packed bore hole, etc)

Sampling Entires - GW:
- log in chart format:
  - depth to groundwater
  - depth of well
  - depth to PVC from ground surface/ roadbox
  - volume of water to be removed
  - method of water removal
  - VOC screening
  - pH, temp., cond. readings
  - visual/olfactory contamination
- disposal method of bailed water
- groundwater recovery/recharge

Sampling Entires - drilling:
- drillers' names, company, rig type
- type of drilling and method
- boring diameter, blow counts/6 inches
- soil classification/class. system used
- field screening results
- visual/olfactory contamination
- any other item to be included on boring log and well completion log
- changes in work zone air quality
- construction details of wells
- method for checking for overhead and underground interferences (utilities)

Photograph Recordkeeping:
- sketch items noted in photograph
- draw direction photo was taken relative to permanent structures & N arrow
- number of photograph
- place some type of device to show scale (should use a measuring tape)

Survey Notes:
- date and time of survey
- purpose of survey
- sketch of area to be surveyed
- bench mark locations and elevations (record source for actual bench marks)

Misc. Entries/notes:
- all entries shall be in waterproof black ink
- draw a line through unused portions of pages (date and initial)
- draw a single line through errors (date and initial)
- note any remarks, telecons to/from the site
- note all deviations & reasons for deviations from Scope of Work
- note down time and lunch breaks
- record any hazardous conditions and the action taken in response to mitigate the hazard
- note any actions near the site that could potentially impact the project

Tank Removal Oversight:
- name and address of contractors
- type of excavating equipment
- safety precautions taken
- size and number of tanks to be removed
- contents removed
- tank/piping condition (rusted, pitted, holes, patches)
- method of tank preparation for removal
- type of backfill material
- soil/groundwater sample screening
- stockpiled soil/material (amount)
- excavation area filled or cordoned off
- dimension of excavation(s)/tank(s)
- evidence of contamination
- further remedial measures warranted

Off-site Soil Disposal:
- removal contractor name & address
- loading time
- manifest serial numbers
- estimated volume/weight to be removed
- field screening results
- number and type of transport and removal equipment

Departure notes:
- list equipment needed for future site visits
- list specific tasks that should be performed on follow-up site visits
- purpose for departing site
- sign, and record time and date of departure

1) It is crucial that photocopies of field documentation are included directly into the project folder in the office (particularly in the event of loss of the field book). 2) It is assumed that the Field Personnel have already been familiarized with the specifics of the project.

15.0 QUALITY ASSURANCE

15.1 PURPOSE / RESPONSIBILITY

The purpose of this Standard Operating Procedure is to ensure the sample integrity by maintaining the physical and chemical form of the collected samples and to prevent cross contamination. It is also to impose a measure of control over the sample handling process. The sample blanks are established to provide control over the collection of the samples and the data generated as a result.

It is the responsibility of the Project Manager to consult with the DAHM laboratory liaison on sampling issues. It is the Project Manager who shall convene with the Samplers to explain and enforce the Quality Assurance program. Together with the laboratory, the Project Manager shall decide on the following conditions: reactivity of container material with samples, volume of container, type of container, container closures, decontamination of sample containers, preservatives, and sample bottle storage and transport.

The Samplers should adhere to the stipulated Quality Assurance protocol.

15.2 PROCEDURE

. shall assure that samples were representative of the site characteristics, and contain an adequate amount of material to sample correctly

15.2.1 Trip Blanks

- a trip blank is typically a container of reagent-free laboratory water
- the trip blanks should be handled, transported, and analyzed in the containers themselves, and not opened in the field
- purpose is to place a mechanism of control of sample bottle preparation and sample handling
- purpose is to detect sources of contamination from the following:
  * laboratory reagent-free water
  * sample containers
  * during shipment
  * ambient air
  * contact with analytical instrumentation during preparation and analysis at the laboratory
  * laboratory reagents used in analytical procedure
- the trip blanks should be handled, transported, and analyzed in the same manner as the accompanying sample set

- the trip blank remains with the other sample containers for the project until the samples are returned to the laboratory
- the number of trip blanks should be 10% of the total number of samples collected
- the trip blanks should be freshly prepared the same day of sampling by the analyzing laboratory
- if a positive reading is detected in the trip blank, when the results of the duplicate samples are not within a reasonable margin of error, then:
  * first, the results should be double checked with the laboratory for accuracy
  * second, report the findings to the Project Manager, it is likely that the samples of that corresponding set were subjected to the same conditions; the results of the samples may require: adjustment to compensate for the trip blank readings, discarding, and/or resampling

15.2.2 Field Blanks

- the purpose is to provide a QA/QC check on the sampling and sampling equipment cleaning techniques
- field blanks shall be collected upon decontamination procedures of the sampling equipment using distilled water
- a field blank of non-aqueous samples can be collected by sampling an area similar to the sampling area, but in an area suspected of least contamination; this sample can also be labeled a "Background Sample" (i.e., when collecting a field blank soil sample, the Sampler should consider collecting the sample from another area on the site suspected of least contamination)
- the procedures are as follows:
  * bring two duplicate laboratory-cleaned bottles into the field
  * one bottle shall be filled with analyte-free water from the contents of the other bottle
  * at the most contaminated location in the field, the analyte-free water should be passed through cleaned sampling equipment and into the empty sample container.
  * for example: pour the water over/through the sampling device and into the sample bottle; filter the water through a peristaltic pump and into the sample bottle
- the field blanks should be handled, transported, and analyzed in the same manner as the other samples collected that day
- if positive reading is detected in the field blank, when the results of the duplicate samples are not within a reasonable margin of error, then:
  * first, the results should be double checked with the laboratory for accuracy
  * second, report the findings to the Project Manager, it is likely that the samples of that corresponding set were subjected to the same conditions; the results of the samples may require: adjustment to compensate for the trip blank readings, discarding, and/or resampling
- the number of field blanks should be 10% of the total number of samples collected

15.2.3 Duplicate Samples

- the duplicate consists of two samples taken at the same location and labeled similarly
- the purpose of a duplicate sample is to give the laboratory an extra sample to run to check the integrity of their equipment and sample preparation and analysis techniques
- the sampling team shall collect duplicate samples at the direction of the Project Manager
- a minimum of one duplicate per 10 samples per matrix is required

15.3 FIELD BOOK ENTRIES

. See the attached Minimum List of Field Book Entries, and see each section for more specific and expanded lists and procedures.

15.4 DECONTAMINATION PROCEDURES

. See the Pre-Sampling Plan for a minimum list of equipment and basic procedures, and see each section for more specific and expanded lists and procedures.

15.5 ATTACHMENTS

. Minimum List of Field Book Entries

MINIMUM FIELD BOOK ENTRIES

Initial Site Entry Notes: • your name, arrival time and date • purpose of your visit • report weather conditions • record names, titles and companies of all individuals on site; their arrival and departure times • attendance of Field Personnel briefing • H&S: - review of hospital route - decon station established - H&S Plan reviewed/signed • sketch Site (N arrow, roads, buildings, storm drains, sampling locations, source areas, etc.) • general Site description (relative to previous Site observations)	**General Sampling Entries:** • calibration date & serial # of instruments • record condition of sampling location • sample type (soil, GW, surface water) • sample number, location and brief description (color, odor) • sampling method (include grab or composite sample) • sample depths • time of sample collection • sample analyses & preservatives • number of jars for each sample • placed in ice chest • decon procedures • document sampling location was left upon completion of your work (ie, closed and locked monitoring well, backfilled and packed bore hole, etc)
Sampling Entires - GW: • log in chart format: - depth to groundwater - depth of well - depth to PVC from ground surface/ roadbox - volume of water to be removed - method of water removal - VOC screening - pH, temp., cond. readings - visual/olfactory contamination • disposal method of bailed water • groundwater recovery/recharge	**Sampling Entires - drilling:** • drillers' names, company, rig type • type of drilling and method • boring diameter, blow counts/6 inches • soil classification/class. system used • field screening results • visual/olfactory contamination • any other item to be included on boring log and well completion log • changes in work zone air quality • construction details of wells • method for checking for overhead and underground interferences (utilities)
Photograph Recordkeeping: • sketch items noted in photograph • draw direction photo was taken relative to permanent structures & N arrow • number of photograph • place some type of device to show scale (should use a measuring tape)	**Survey Notes:** • date and time of survey • purpose of survey • sketch of area to be surveyed • bench mark locations and elevations (record source for actual bench marks)
Misc. Entries/notes: • all entries shall be in waterproof black ink • draw a line through unused portions of pages (date and initial) • draw a single line through errors (date and initial) • note any remarks, telecons to/from the site • note all deviations & reasons for deviations from Scope of Work • note down time and lunch breaks • record any hazardous conditions and the action taken in response to mitigate the hazard • note any actions near the site that could potentially impact the project	**Tank Removal Oversight:** • name and address of contractors • type of excavating equipment • safety precautions taken • size and number of tanks to be removed • contents removed • tank/piping condition (rusted, pitted, holes, patches) • method of tank preparation for removal • type of backfill material • soil/groundwater sample screening • stockpiled soil/material (amount) • excavation area filled or cordoned off • dimension of excavation(s)/tank(s) • evidence of contamination • further remedial measures warranted
Off-site Soil Disposal: • removal contractor name & address • loading time • manifest serial numbers • estimated volume/weight to be removed • field screening results • number and type of transport and removal equipment	**Departure notes:** • list equipment needed for future site visits • list specific tasks that should be performed on follow-up site visits • purpose for departing site • sign, and record time and date of departure

1) It is crucial that photocopies of field documentation are included directly into the project folder in the office (particularly in the event of loss of the field book). 2) It is assumed that the Field Personnel have already been familiarized with the specifics of the project.

16.0 WIPE SAMPLING

16.1 PURPOSE AND RESPONSIBILITY

The purpose of this SOP is to ensure the integrity of field sampling data for wipe sampling for polychlorinated biphenyl compounds.

This section describes the minimum requirements for appropriate wipe test sampling. Wipe test procedures to follow will focus on PCB spills on solid, relatively non-porous surfaces.

16.2 PROCEDURE

A square test area is generally delineated and recorded as the sample area. The sample area needs to be delineated through use of a pre-measured template. Templates should be made of stainless steel shim stock or 1/8-inch Teflon sheeting. Three templates recommended are: 1-10 cm x 10 cm square hole; 1-5 cm x 20 cm rectangular hole; and 1-11.3 cm diameter circular hole. Shape of the sample area is variable. The area should be large enough to yield a sufficient amount (weight) of sediment required for the desired laboratory analysis. An area of 100 square centimeter area is used as a standard-sized template; however, the standard template may not yield a sufficient amount of sediment required for a given analysis. Consultation with the laboratory performing the analysis prior to sampling is recommend to ensure the proper sample weight is obtained. The sampler shall also review the Health and Safety Plan to ensure proper handling of the sample.

The wiping media selected for sample collection is limited. Glass fiber filters (37mm), gauze pad, filter paper, or cotton swabs may be used as sample collection media. Sample collection media should be saturated with a solvent, in most cases, to enhance sample collection. Consult an analytical laboratory for the appropriate filter media and solvents to be used for the individual sampling event. Hexane is typically used for PCB sampling, however, acetone may also be used. The sampling media should be prepared before going into the field. Prepare the media by placing it in pre-cleaned glass jar(s) and partially fill the jar(s) with solvent (hexane), and place a Teflon-lined lid on the jar. The filter media is then prepared for transport to the sampling area. The sampling media should be handled by using stainless-steel forceps or appropriate gloves. Consultation with the laboratory performing the analysis prior to sampling is recommend to ensure the proper Personal Protective Equipment is used during the sampling event. At least one blank sample media prepared as specified, should be submitted for each sample area.

To collect a sample place the template on the area to be sampled. Open the jar containing the sample collection media. Using the stainless-steel forceps or appropriate gloves, remove the media from the jar. Quickly, using firm uniform pressure, wipe the area within the template with the wet media. Wiping should begin at the outer limits of the template and work towards the center. The media is to then be placed into a pre-cleaned, empty glass jar, and the jar sealed

with a Teflon-liner lid. Clearly and carefully label the jar and affix with a yellow TSCA PCB mark, and place into an ice chest. The sample collection data are entered into the field book and on the Chain-of-Custody form. All samples should be shipped to the laboratory as soon as possible, but not more than 24 hours after being collected.

The template and forceps should be rinsed with solvent and wiped with a disposable wiping cloth. The gloves worn and wiping clothes should be placed into a plastic bag for disposal as PCB-contaminated materials.

16.3 SPECIFIC FIELD BOOK ENTRIES

- Minimum List of Field Book entries
- size, shape, and composition of the template
- wipe sampling media
- media preparation
- device for handling media (forceps, gloves)
- solvent used
- manner of wiping (from left to right, top to bottom, ect.)
- containment of the sample
- labeling for specific sample locations
- date and time sample collected
- date and time of sample shipment
- analysis to be conducted
- laboratory used
- method of shipment
- background sample sampling techniques
- decontamination procedures

16.4 DECONTAMINATION

Areas exposed to PCB spills, in most cases, shall be areas of remediation and shall not be part of the sampling activities. Materials used during the sampling event, that are to be saved, should be thoroughly rinsed with solvent and wiped with a disposable cloth. All disposable items need to be contained into a plastic bag and disposed as PCB-contaminated materials.

APPENDIX A
GLOSSARY OF TERMS

absorb:	to take in through or pass through pores or interstices; soak in or up
absorption:	the act or process of absorbing
ACM:	asbestos-containing materials
adsorption:	a physical or chemical attachment to an exterior surface of a solid
alkalinity:	the ability of a solution to neutralize an acid
alluvial deposits:	a deposit of silt or silty clay made by streams on river beds, flood plains and alluvial fans, laid down during a time of flood
alluvial fan:	an outspread, gently sloping mass of alluvium deposited by a stream or river bed
aqueous:	relating to or resembling water
aquifer:	a formation that contains sufficient saturated permeable material which can yield significant quantities of water
area of influence:	the horizontal region influenced by groundwater pumping activities
areal:	a term typically used to describe the vertical and horizontal area surrounding a Site
assess:	to evaluate, investigate, or estimate the quality or likelihood of a thing or event
bacon bomb:	a device designed for sampling petroleum products and/or multi-phase liquids
bailer:	a thin, cylindrical device used to collect groundwater samples from monitoring wells
bedrock:	a body of rock beneath which there is no overburden
bituminous concrete:	asphalt pavement including aggregate

BNA:	base neutral and acid extractable organic compounds
borehole:	a hole drilled into the ground from the surface of underground workings, to secure geological information; also used for the extraction of water
bottom sediment sampler:	sampling equipment designed to collect solid material from a stream bed, catch basin, sewer drain, drainage ditch, etc.
brook:	a small, natural stream of fresh water
bung cap:	the stopper (or plug) that fits in the opening of a drum or container
bung cap opener:	a device needed to remove a bung cap from a drum or container
CERCLA:	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERCLIS:	comprehensive environmental response, compensation and liability information system (OSWER)
Chain-of-Custody form:	a legal document that is used to record and track the submittal of field samples for laboratory analysis
COLIWASA:	a Composite Liquid Waste Sampler, made of plastic or glass
cone of depression:	the area of a lowered groundwater level around a pumping well caused by withdrawal of groundwater from the well
contour line:	a line on a map connecting points of equal value; for example, a groundwater contour line connects points of equal groundwater elevation
DOH:	Department of Health
DIGSAFE:	a public service provided free of charge to contractors, which notifies utility companies to mark underground equipment (wires, cables, pipes, natural gas lines) in the site area, usually with spray paint
dissolved metals:	an analysis that is performed on an acidified, filtered groundwater sample that measures the dissolved metals in the water sample
dissolved-phase:	a substance that is soluble in water under normal atmospheric conditions

downgradient:	in the direction of decreasing hydrostatic head used to describe groundwater flow direction
downstream:	occurring or located down slope from a point used to describe surface water flow direction
drawdown:	the amount the groundwater level lowered either in a well or aquifer because of withdrawal of groundwater from pumping a well
drilling:	the act of boring holes into the ground in order to assess subsurface conditions and/or to install groundwater monitoring wells
duplicate sample:	a second sample, collected at pre-set intervals by the Project Manager, which is collected at the same location, in the same manner as another sample, and can be used by the laboratory to check the integrity of their analysis method and equipment
EPA:	The United States Environmental Protection Agency
EPA Method 8240:	an EPA-approved testing method for quantitative and qualitative identification of volatile organic compounds in a solid medium; this method identifies, at a minimum, the volatile organic compounds listed by the EPA as Priority Pollutants
EPA Method 8010:	an EPA-approved testing method for quantitative and qualitative identification of Priority Pollutant chlorinated solvents in only a solid medium
EPA Method 8020:	an EPA-approved testing method for quantitative and qualitative identification of aromatic Priority Pollutant volatile organic compounds in a solid medium
EPA Method 624:	an EPA-approved testing method for quantitative and qualitative identification of volatile organic compounds in a liquid medium; this method identifies the volatile organic compounds listed by the EPA as Priority Pollutants
EPA Method 601:	an EPA-approved testing method for quantitative and qualitative identification of Priority Pollutant chlorinated solvents in a liquid medium
EPA Method 602:	an EPA-approved testing method for quantitative and qualitative identification of Priority Pollutant aromatic volatile organic compounds in a liquid medium

E.P. Toxicity: an analysis that is performed on solids to test the leachability of metals under acidic conditions (see T.C.L.P. metals)

field blank: a sample collected upon decontamination procedures of the sampling equipment using distilled water; to provide a QA/QC check on the sampling equipment cleaning techniques

flame-ionization detector: a portable field instrument typically used to screen samples for the presence of volatile organic compounds in the vapor (i.e., OVA)

gas chromatography: a technique used for separating volatile and semi-volatile organic compounds by percolating a gaseous stream over a stationary phase

granular deposit: a deposit which consists mainly of incompressible granular soil particles and generally exhibits moderate to high permeability characteristics

groundwater: subsurface water that is in the zone of saturation

groundwater table: the upper most surface of the groundwater, saturated zone, in the aquifer

hazardous material: any substance becuase of its quantity, concentration, chemical, corrosive, flammable, reactive, toxic, infectious or radioactive characteristics, either separately or in combination with any substance or substances may be harmful to humans, animals, crops, water systems or to other elements of the environment.

H & S Plan: Health and Safety Plan

homogeneous: uniform in composition

HNU meter: a type of photoionization detector

hydraulic gradient: the rate of change in an aquifer of total head per unit of distance of flow at a given point in a given direction

hydrogeologic: the distribution, circulation, and properties of the groundwater in subsurface soils

hydrologic: the distribution, circulation, and properties of the water bodies of the earth

hydrocarbon: an organic compound consisting solely of carbon and hydrogen

IDLH: Immediately Dangerous to Life and Health

igneous rock:	a rock that is formed as a result of solidification of molten or partly molten material
impervious:	rock, sediment, or soil that is incapable of transmitting fluids under pressure; synonym is impermeable
intermittent stream:	a stream that is dry during part of the year
lake:	a body of fresh or salt water of considerable size, completely surrounded by land
metamorphic rock:	a rock derived from pre-existing rocks by mineralogical, chemical, and/or structural changes
migratory pathway:	a pathway by which an oil or hazardous material is transported at or from a disposal site
mitigation:	techniques which may be used to lessen the negative results of a release in the surrounding environment
monitoring well:	a well primarily used to observe fluctuations in groundwater elevation and/or to evaluate the presence of chemical contamination (also known as an observation well)
MSDS:	Material Safety Data Sheet
MSL:	Mean Sea Level, a USGS means of measuring elevation
NAPL:	non-aqueous phase liquid
NGVD:	National Geodetic Vertical Datum, a USGS means of measuring elevation
NIOSH:	National Institute of Occupational Safety and Health
OSHA:	Occupational Safety and Health Administration
outcrop:	exposure of bedrock at the land surface
OVA:	organic vapor analyzer
OVM:	organic vapor monitor
parameter:	a constant with variable quantity or quality

particulate:	a tiny fragment
PCB:	polychlorinated biphenyl compounds
PEL:	Permissible Exposure Limit
permeability:	the capacity of a porous rock, sediment, or soil for transmitting a fluid
perennial stream:	a stream that flows continuously throughout the year
petroleum hydrocarbon oil and grease:	a petroleum-based oil and grease (i.e., gasoline, fuel, and some lubricating oils) which is different from a non-petroleum-based oil and grease (i.e., animal, vegetable and synthetic oils such as some lubricating oils)
photoionization detector:	a portable field instrument used to screen the vapor content of samples for volatile organic compounds (i.e., HNU, OVM)
plume:	the area of a pathway or flow of direction/pattern that contaminants will likely follow
porosity:	the ratio of volume of voids in a rock or soil to the total volume
porous:	containing voids, pores or interstices, which may be interconnected
pond:	a body of water smaller than a lake, sometimes artifically formed
ppb:	parts per billion
PPE:	personal protective equipment
ppm:	parts per million
Priority Pollutant:	a list of Priority Pollutant compounds identified defined by the EPA as being of greatest environmental priority
Project Plan:	a detailed method, written by the Project Manager, by which the entire scope of the project is carried out
Quality Assurance/ Quality Control QA/QC:	pre-set methods to ensure the integrity of sampling collection and analysis

RCRA:	Resource Conservation and Recovery Act (of 1976)
recharge:	water that is added to the groundwater or replaced by the groundwater table in the saturated zone
recovery well:	a groundwater well typically used to recover separate-phase product and/or dissolved-phase contaminants in the groundwater
remedial:	providing a remedy for a deficiency such as an environmental hazard
RI-DEM:	The Rhode Island Department of Environmental Management
risk assessment:	the evaluation of chemical hazards to human and non-human receptors at a given site
river:	a stream of water flowing in a natural open channel towards the ocean, lake, or another river
saturated zone:	a subsurface zone in which all open spaces are filled with water
sedimentary rock:	a layered rock resulting from the consolidation of sediment
separate-phase:	a discrete homogeneous part of a material system that is mechanically separable from the rest under normal atmospheric conditions also known as non-aqueous phase liquid product (NAPL)
solvent:	a liquid used for dissolving
sorbent:	a material which can be used to remove toxic gases and vapors from the air and other media
split-spoon sampler:	a hollow, metal cylinder comprised of two semi-circular pieces used to sample undisturbed subsurface soils when completing test borings; typically using a drill rig it is advanced by a 140-pound hammer falling a vertical distance of 30 inches
stratified deposit:	a structure produced by the deposition of sediments in beds or layers, laminae, lenses or wedges
stream:	a general term for water flowing in an open channel
subsurface:	the zone below the ground surface

surface water runoff: water that flows over the land surface and discharges to nearby streams or lakes; water that is collected in catch basins and storm drains and discharges into nearby streams or lakes

suspect ACM: potential asbestos-containing material

TCLP metals: Toxicity Characteristic Leaching Procedure (for metals)

TSCA: Toxic Substances Control Act (1976) federal law authorizing EPA to gather information on chemical risks

till: unstratified and unsorted sediment deposited directly by a glacier without reworking by meltwater; consists of clay, silt, sand, gravel and boulders ranging widely in shape and size

theives: a sampling rod designed to extract containerized liquid samples; in stratified form if so desired

topography: the physical features of a district or region

total and petroleum hydrocarbon oil and grease: the total concentration of oil and grease is the sum of the concentrations of petroleum hydrocarbon and non-petroleum oil hydrocarbon and grease

total metals: an analysis performed on soil and unfiltered water to measure the total concentration of metals

toxicity: a measure of the toxic level of a given substance referring to its ability to poison humans, animals or the environment

transmissivity: the rate at which water is transmitted through a unit width of an aquifer under a hydraulic gradient

trip blank: typically a sample container, similar to the ones in use by the sampler, filled with reagent-free laboratory water that accompanies the sampler throughout the entire sampling process; to place a mechanism of control on the sample bottle preparation and sample handling

USCS: Unified Soil Classification System

USGS: the United States Geologic Survey; responsible for topographic, geologic, and hydrologic research

unsaturated zone:	the subsurface strata that occurs above the groundwater table
volatile organic compound:	an organic compound which under normal atmospheric conditions vaporizes
upgradient:	in the direction of increasing hydrostatic head used to describe groundwater flow direction
upstream:	occurring or located up-slope from a point used to describe surface water flow direction
well screen:	the slotted section of a well, usually at the bottom or below the well riser through which groundwater or soil vapor can enter the well
well riser:	the solid section of a well, usually above the well screen through which no water or soil vapor can enter the well
wetland:	a lowland area that is saturated with moisture and is characterized and delineated as a special ecosystem