REMEDIAL INVESTIGATION

BREWSTER WELL FIELD SITE
BREWSTER, NEW YORK

DETAILED WORK AND SITE OPERATIONS PLAN

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SECTION 1.00

1.00 INTRODUCTION

The Village of Brewster's Well Field is located on the northern bank of the East Branch Croton River, about three-quarters of a mile east of the village. The well field seves as a water supply for the entire village and adjacent areas east and west of Brewster. Normal average water production in 1977 was 297,000 gallons per day. Well Field No. 1 was developed in 1954 and taps the sand and gravel aquifer beneath the land surface. Well Field No. 2 was developed in 1967 and draws water from the same aquifer.

During the routine water quality survey in August 1978, the water supply was found to be contaminated with Volatile Halogenated Organics (VHOs) in excess of the 100 ppb total concentration limit set by the New York State Department of Heath (NYSDOH). Surveys and studies to determine contaminant sources have proved inconclusive. In the meantime, an alternate water source is in use and an air stripping column is being constructed to suppy the Village with treated water within Health Department standards.

The New York State Department of Environmental Conservation (NYSDEC) has retained GHR Engineering Associates, Inc. (GHR) and its subconsultants, Dunn Geoscience Corporation (DGC) and Hydroqual, Inc. (Hydroqual), to conduct a Remedial Investigation and Feasibility study of the well field and surrounding areas.

1.20 Objectives of the Remedial Investigation (RI)

The objectives of the RI are to determine the nature and extent of contamination at and emanating from the Site. Following the RI, a feasibility study will be conducted to identify, evaluate and select a cost-effective, environmentally sound, long-term remedial action. This work will be performed with funds allocated by the United States

Environmental Protection Agency (USEPA) through the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) under a Cooperative Agreement between the USEPA and the NYSDEC.

1.30 Scope of the Remedial Investigation

The RI will be conducted in the three phases as follows:

Phase I - Initial Project Activities
Phase II - Field Investigation
Phase III - Data Evaluation and Report Preparation

The Detailed Work and Site Operations Plan that follows is organized according to the three work phases and contains details of the tasks to be conducted and the procedures to be followed. The Work and Site Operation Plan will function as a master plan to ensure that proper project organization, planning and efficiency is maintained.

SECTION 2.00

2.00 INITIAL PROJECT ACTIVITIES

2.10 Safety Plan and QA/QC Plan

Site specific project plans will be designed for health and safety, and for quality assurance, chain of custody procedures and laboratory quality control. These plans will provide support documentation for the work plan, and will include procedures for the collection of representative samples, the decontamination of equipment, and the preservation, storage, handling and shipping of samples. The safety plan will include necessary measures for protection of project personnel. Both plans will be submitted to NYSDEC for review and approval.

2.20 Data Compilation and Review

All available geologic, hydrologic, engineering, environmental and chemical data will be reviewed and compiled. Sources will include the regional offices of the USGS, EPA, the N.Y.S. Geological Survey, the Corps of Engineers, FEMA, SCS, the National Weather Service, the Village of Brewster, the Putnam County Health Department, the central and regional office of the NYSDEC and the NYSDOT, Dunn Geoscience Corporation in-house files and records of the Town Engineers Nathan Jacobson and Associates. Local well drillers will also be contacted for available drilling records. Available historic and current topographic maps, aerial photographs, as well as satellite imagery will also be reviewed.

All information will be reviewed by the project team for the purpose of delineating geologic conditions and identifying possible contaminant sources.

2.30 Site Base Map

Prior to snowfall in the Fall of 1984, the project region will be flown to provide aerial photos sufficient for topographic and planimetric mapping. A topographic base map will be prepared for the project vicinity and planimetric maps will be prepared for the project region. Large scale aerial photos will be available for presentation purposes.

2.40 Inventory of Potential Contaminant Sources

This sub-task will follow up on the original Health Department surveys for verification and update.

2.50 Inventory of Existing Groundwater Wells

This sub-task will consist of an in-depth field and file research effort to fully document wells and well data in the project vicinity.

2.60 Site Reconnaissance

An initial site reconnaissance will be performed to familiarize key personnel with the Site. During this visit, air monitoring will be performed to determine ambient air conditions using portable equipment. Site access conditions will be determined for the subsequent geophysics and drilling phases of the project. Initial surveying will be performed to locate existing wells and obtain elevations for monitoring water levels in these wells. A staff gauge will be set up in the river and an elevation obtained.

Groundwater levels in existing wells and the elevation of the river will be measured. The slopes of adjacent hillside areas will also be examined for any seepage discharge points (one such point is mentioned in the Kernan Davis report). The reconnaissance will note any environmental/biological stress caused by contamination. Thes will provide imput to the initial groundwter modeling effort.

2.70 Initial Groundwater Modeling

A three dimensional groundwater flow model will be utilized during this project. (Based on the information to date, the U.S.G.S. - Modular Three-Dimensional Finite Difference Groundwater Flow Model is recommended.

The initial modeling effort will utilize a two-dimensional model due to the lack of data. This model will then be expanded to a three-dimensional model as data area obtained during subsequent project phases. The purpose of the model at the initial stage of the project will be to aid in the positioning of wells and to explore the potential recharge and discharge areas. (For instance, a recharge coefficient can be applied to water infiltrating the surface. If this does not give the model response that we estimate occurs seasonally, other recharge areas are necessary. This method also allows for the optimal positioning of the wells).

The groundwater model will be fully used during the project process and will be used for investigatory work as well as feasibility evaluations.

SECTION 3.00

3.00 FIELD INVESTIGATIONS

3.10 Geophysical Surveys

3.11 Purpose and Methods

A combination of seismic refraction (SR), electrical resistivity (ER), terrain conductivity (TC) surveys and magnetics will be conducted. The purpose of these surveys will be threefold. First, the surveys will be used to determine depth to bedrock and location of the ice-contact sand and gravel deposits. Since this is the primary aquifer, it is important to delineate its occurrence. The primary methods for this survey will be SR and TC using an EM-34 in a horizontal and vertical dipole mode in a 10, 20 and 40 meter spacings. Several ER soundings will be performed to augment the two major techniques. The combination is proposed because either method conducted by itself will not supply adequate information, but together they are complementary. The seismic refraction will adequately delineate depth to bedrock but probably will not differentiate the lake sediments from the ice-contact sand and gravel. The TC will be able to provide conductivity data but distinction between deep overburden and shallow bedrock will be difficult. Using the two methods together will provide the needed data. These surveys will be conducted parallel and perpendicular to the East Branch Croton River on both the north and south sides.

The second function of the geophysics surveys will be to examine potential land burial areas for conductive anomolies. These surveys will be performed in a traverse pattern south of the the River, near the Route 84 embankment and in the area south of Route 22 where a suspected landfill area was identified in 1960 air photos. Areas surveyed for the first objective will not have to be duplicated. The primary tool used for these surveys will be the EM-31 and magnetics. The third objective will be to aid in the selection of well locations by providing a good preliminary assessment of the distribution of geologic materials. It is not anticipated that contaminant plumes would be delineated using TC due to the nature of the contaminants involved, but should a plume-type pattern be identified, additional work in a latter phase will be performed.

The scope of the surveying will include 10,000 linear feet of seismic refraction surveying (forward and reverse profiling) and about 12,000 feet of TC surveying with periodic soundings of ER.

3.12 Seismic Refraction

Seismic refraction data will be obtained utilizing a 12-channel, signal enhanced seismic system consisting of a Geometrics Model ES-1210 F. Seismic spreads will be 300 feet in length with 150 foot off-sets and will be shot in an end-to-end manner. Seismic energy will be generated using a small explosive charge generated by a Betsy Seisgun industrial shotgun. The measurements made at each shot location will be used to determine the compressional wave velocities of overburden and bedrock material and to evaluate subsurface structure in terms of depth. Shooting at both ends of the seismic spread (reversed shooting) aids in the interpretation of apparent velocities as related to dipping interfaces.

3.13 Electrical Resistivity

Electrical resistivity measurements will be made using vertical and horizontal profiling procedures. The instrumentation used for the survey will be the Bison Earth Resistivity Meter, Model 2350-A. The Wenner electrode configuration will be used for point tests.

3.14 Terrain Conductivity

Terrain conductivity data will be obtained utilizing the model 34-3 in conjunction with the Model EM-31 terrain conductivity meters manufactured by Geonics. Measurements will be made along seismic lines. Lines will also be run in the vacant area adjacent to Albens Cleaners and in the salt storage area adjacent to Sodom Road.

3.15 Magnetics

A magnetometer survey will be conducted of the vacant lot adjacent to the cleaners and of a former gasoline station adjacent to Sodom Road. A Geometrics model G-856 proton procession magnetometer will be utilized for the survey.

Geophysical survey lines will be staked, flagged, mapped relative to existing wells, topography, and cultural features. Vertical control for the lines will be obtained from the Site plan map (2-foot contour interval). The survey lines will be later surveyed in order to confirm their location.

3.20 Surficial Geologic Mapping

Surficial geologic mapping will be performed in a 1 mile radius around the Site. Review of existing data indicates that this dimension will be sufficient. The surficial mapping will be performed concurrently with the geophysics program. A surficial geologic map will be provided following completion of the field effort. This data will also be incorporated into the local hydrogeologic evaluation.

3.30 Test Boring/Monitoring Well Installation Specifications

3.31 Objectives

The objectives of the test boring/monitoring well installation program are as follows:

1. Provide data to develop an understanding of the site geology and hydrogeology,
2. Provide water level data to determine groundwater gradients (horizontal and vertical) and the direction of groundwater movement, and
3. Provide sampling locations to determine the nature, extent and concentration levels of contaminants

3.32 Drilling Methodology

A total of forty-four monitoring wells will be installed during the drilling phase. One to two mud rotary rigs will be mobilized to perform the drilling. Water will be used as the drilling fluid wherever possible, with bentonite drilling fluid being employed if significant cving is encountered. Only wter that has been treated by the air stripping column will be used for drilling.

A Dunn Geoscience Corporation Geologist will be at each rig during all drilling. A GHR Geologist will be coordinating all drilling and sampling activities. Soil samples collected during drilling will be logged and screened for volatile halogenated organics by the on-site geologists. The on-site geologists will also be responsible for correct well construction, maintaining health and safety guidelines, and overall proper implementation of the work plan.

3.33 Soil Sample Collection

Two 24 inch (2 inch O.D.) split-spoon samplers will be used on each drilling rig to collect the soil samples following ASTM methods. The split-spoon barrels will be washed by the driller's helper before each sample to prevent cross-contamination. Three-5 gallon buckets with bucket dedicated brushes, the first containing dissolved tri-sodium phosphate and the second and third containing water, will be used for this purpose. The samples will be logged using the Modified Burmister Identification System and the Unified Soil Classification System. Duplicate samples will be stored in glass jars sealed with aluminum foil lined screw top lids. One sample will be retained for possible subsequent analysis including laboratory gradational analysis, while the other sample will undergo halogenated organic screening, at the drilling Site using an HNU Model PI-101 Photoionization Analyzer (HNU 101) and analysis via an HNU Model PI-301 in the field laboratory.

If clays are encountered during drilling, thin-walled, tube samples will be used to collect undisturbed samples. The soils will be recovered using three-inch diameter brass, open-tube samplers (Shelby Tubes) in accordance with ASTM standard methods.

Prior to collecting the tube samples, the borehole will be cleaned out to the desired sampling depth. While the water level in the boring is kept at the naturally occurring groundwater level, the tube is pushed 24 inches into the soil using a rapid continuous motion, then it will be rotated at least twice to shear the sample off at the bottom. Before the tube is pulled, it will remain in place a short time (typically 3-5 minutes) to allow for sample expansion. Upon removal of the tube, the sample recovery is measured and the disturbed material from the top of the tube and at least one inch of soil from the lower end of the tube are removed, described and then discarded. Both ends of the tube are then sealed with wax and fitted with end caps which are secured with tape. The taped end caps are then dipped in melted wax to prevent breaking the seals. Finally, the tube is labeled with the necessary informtion and placed vertically in a container designed to reduce shock, vibration and disturbance during storage and shipment.

3.33.1 Contaminant Screening

Jarred soil samples being tested by the HNU 101 will be heated to 40 degrees C. with a small portable heater. After 30 minutes, the sample is taken from the heater, the screw cap removed, and the metal foil pierced with the eight-inch extension to the photoionization probe. The headspace is tested for the presence of organic vapors and the results recorded in the field book. After testing, the cap will be replaced and the samples stored.

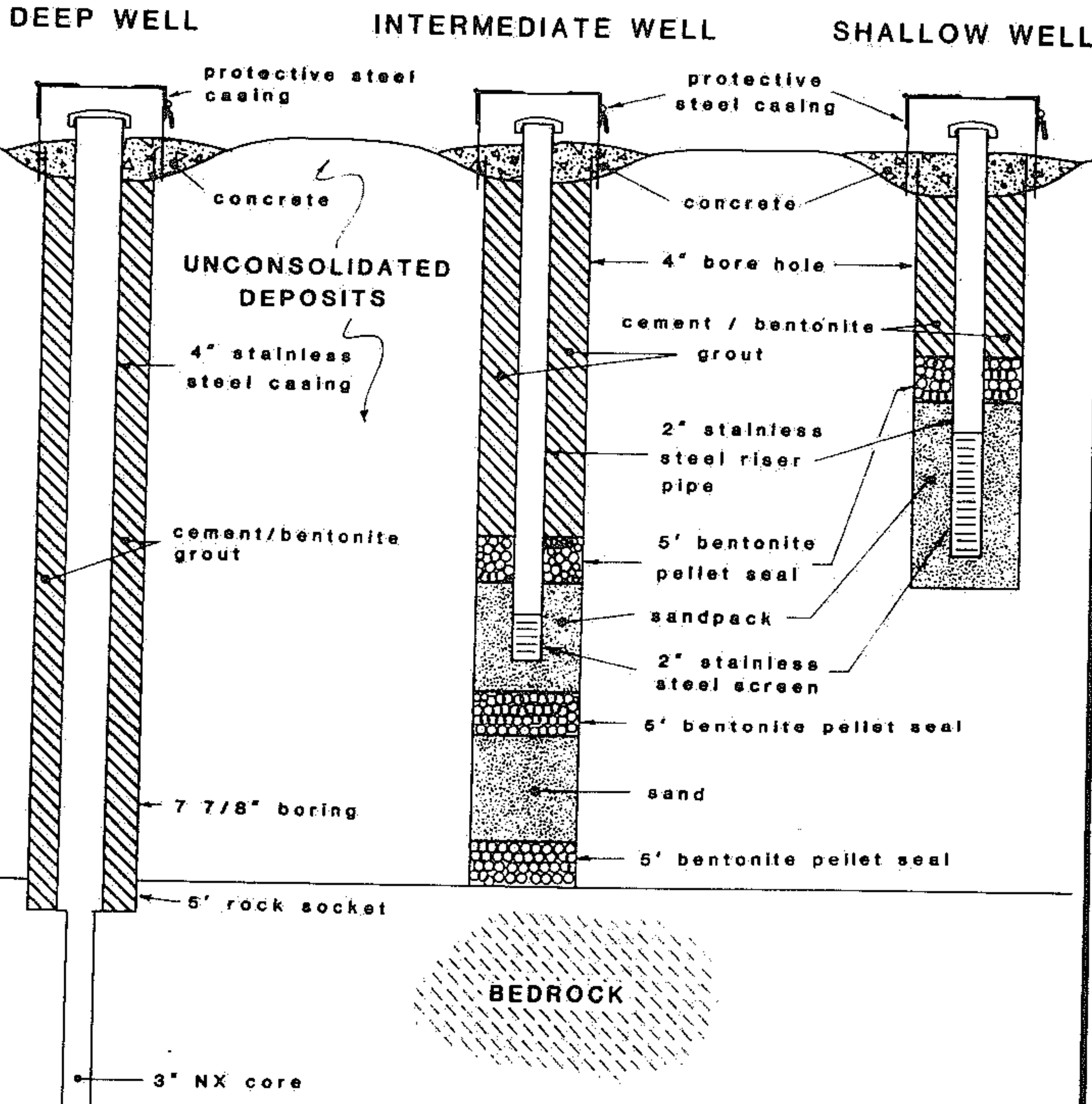
3.34 Well Cluster Installation

Six well clusters, each consisting of a shallow water table well, an intermediate depth well in the unconsolidated aquifer, and a bedrock well, will be installed. Proposed well construction details are shown on Figure 1.

3.34.1 Intermediate Well

The intermediate well will be installed first. A 4-3/4" roller bit will be used to advance the boring to refusal. Continuous split-spoon sampling will be performed in advance of the boring with the samples handled as previously described. Five inch casing will be driven the length of the hole using a 300 pound hammer with a 18 inch drop.

FIGURE 1
WELL CONSTRUCTION DETAILS



NOTE: FIGURES ARE NOT TO SCALE

The screen depth will be chosen on the basis of visual soil sample analyses and HNU 101 and 301 results. After drilling and casing to bedrock, the borehole will be thoroughly flushed clean of cuttings and drilling mud (if used). Immediately prior to placing bentonite pellets or sand into the borehole, the casing will be pulled just enough to expose the correct length of the borehole about to receive the construction material. Using this method, caving of the surrounding material will be kept at a minimum. The boring will be slowly backfilled with bentonite pellets to a depth five (5) feet above the top of bedrock to prevent the movement of water between the unconsolidted aquifer and the bedrock aquifer. Sand will then be backfilled to a depth within six feet of the proposed screen bottom. About five (5) feet of bentonite pellets will be added, to a depth one foot below the proposed screen bottom.

At this point, the well will be constructed, lowered into the borehole, and suspended at the proper depth. The well will consist of two inch flush joint schedule 5 stainless steel riser pipe and a two foot section of two inch no. 10 slot stainless steel screen with a stainless steel bottom cap. Teflon tape will be used on all riser pipe joints to prevent any leakage of groundwater to the well from the surrounding aquifer, other than the screened interval. A tremie pipe will then be introduced into the annulus between the well and the borehole until the bottom of the pipe is 2 1/2 feet above the bentonite pellets. Clean water will be pumped through the tremie pipe until a return flow is minimal. Morie 0 silica sand or an equivalent sand will then be backfilled, creating a sandpack extending from one foot below the screen to two feet above the screen. The upwardly flowing water aids in evenly distributing the sand around the well and preventing bridging of the sand. A five (5) foot bentonite pellet seal will then be installed above the Morie sandpack, effectively sealing off the screened interval from the rest of the aquifer. The remaining casing will be pulled and cement-bentonite grout pumped through a tremie pipe into the remainder of the annulus. To prevent unauthorized access into the monitoring well, a lockable steel, protective casing will be cemented over the stainless steel riser pipe extending above the land surface.

3.34.2 Shallow Well

The shallow well will be installed about five feet from the intermediate well. A 4-3/4 inch roller bit will be used to advance the boring, without sampling, to a depth six feet below the water table (as established by the intermediate well). Casing will again be driven the length of the boring. Well material specifications are identical to the intermediate well except that a ten foot section of screen will be employed rather than the two-foot section used for the intermediate well. The screened section will extend from five feet below the water table to five feet above the water table. The sandpack will extend from one foot below the screen to one foot above the screen. A five foot bentonite pellet seal will be installed above the sandpack and the remainder of the annulus grouted with a cement-bentonite grout. A lockable protective steel casing will be cemented into position over the exposed riser pipe. The well construction materials and method of installing the well are the same as those described for the intermediate well. On-site modifications to the shallow well construction plans will be necessary if a particularly high water table is encountered.

3.34.3 Deep Well

The deep well will be located approximately five feet from the intermediate well and at least five feet from the shallow well. The purpose of deep wells is to monitor the hydraulic and chemical properties of the upper zone of the bedrock aquifer. A 7-7/8 inch roller bit will be used to drill through the unconsolidated material and five feet into the bedrock. No sampling will take place during this drilling.

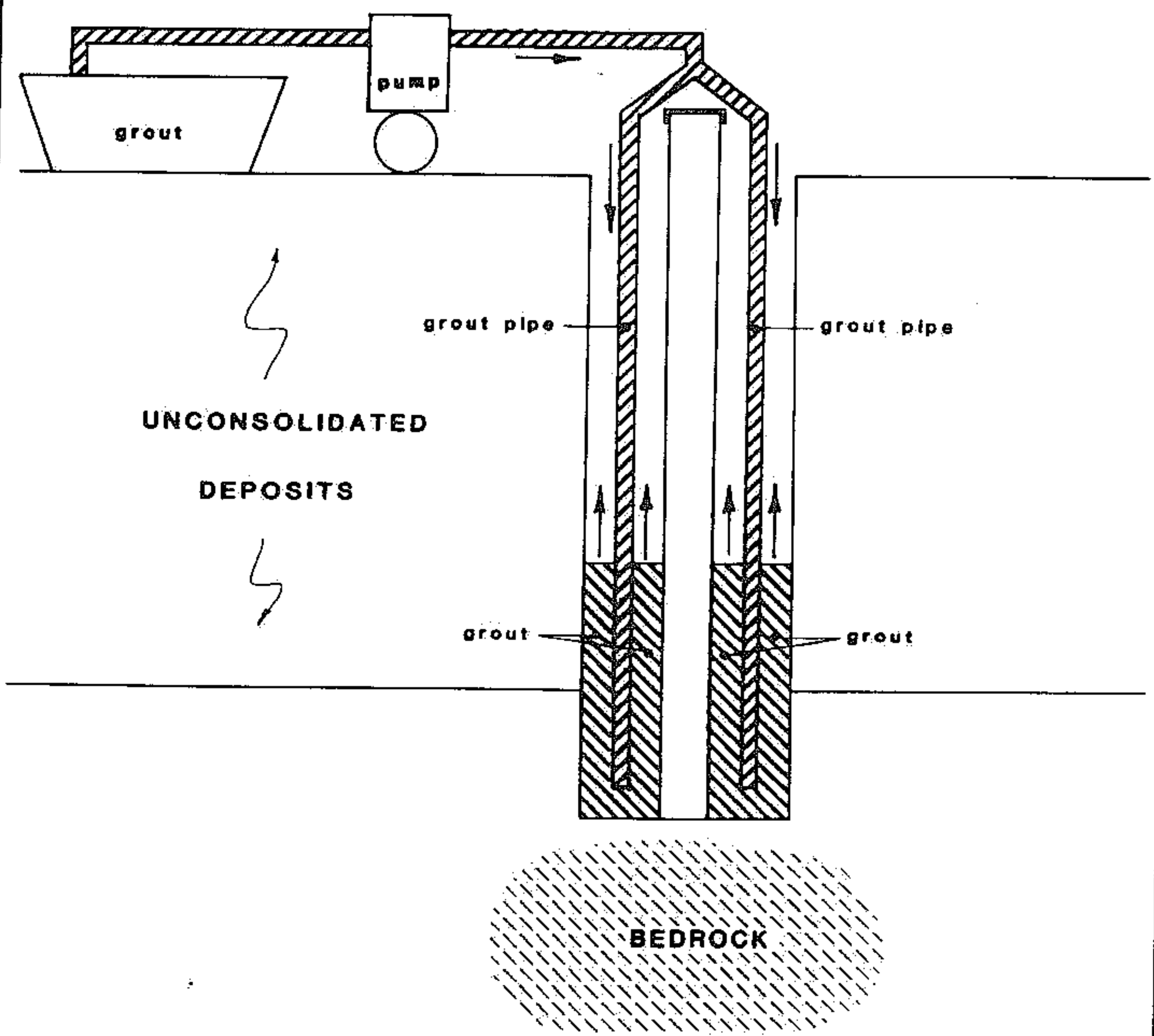
Four inch flush-joint schedule 5 stainless steel casing will be lowered into the boring until the bottom of the casing rests in the five-foot rock socket. Teflon tape will again be used on all joints. The casing will then be grouted in position using the technique depicted in Figure 2. Dual tremie pipes will be lowered on opposite sides of the casing to within one (1) foot of the bottom of the rock socket. Cement/bentonite grout will be pumped through the tremie pipes until return flow is observed at the surface. An airtight cap will be placed on the casing during this procedure to prevent the movement of grout into the casing.

After allowing the grout to set, NX core will be taken by drilling through the casing to a depth eight feet below the bottom of the rock socket. The core will be logged and retained for further analysis. The casing will be cemented in place at the surface and a lockable protective steel casing installed over the 4-inch well casing.

3.35 Well Pair Installation

Nine well pairs, each consisting of a shallow and an intermediate well, will be installed using the following procedure. A 4-3/4 inch roller bit will be utilized to advance the boring to a depth determined by the on-site geologist. Standard split-spoon sampling and HNU-101 and 301 analyses will again aid in selecting the best screen depth. The intermediate well borings will at most extend only a few feet below the screened interval; therefore, the bottom bentonite seal and overlying sand fill used in the well cluster intermediate wells will not be needed. Instead, a bentonite pellet

FIGURE 2
GROUTING PROCEDURE
DOUBLE TREMIE PIPE



NOTE: FIGURE IS NOT TO SCALE

seal will be installed to within one foot of the bottom of the screen and the rest of the installation performed as described under the well cluster-intermediate well installation description.

The shallow wells will be installed as outlined for the well cluster shallow wells at a distance of about five feet from the intermediate wells.

3.36 Single Well Installation

Eight single, shallow or intermediate wells will be installed. Standard sampling will be performed during drilling and the screen locations chosen by the on-site geologists. Well materials and method of installation will be identical to that previously described for the well pairs.

3.37 Drilling Equipment Decontamination

Prior to drilling the first boring, the equipment to be used in drilling and monitoring well installation will be cleaned to remove possible contaminants encountered during drilling at previous jobs. All equipment which is to come in contact with the soil and rock, as well as water tanks, drill tools, pumps and hoses will undergo the initial cleaning procedure. While working at the site, the drilling equipment will be decontaminated between wells to prevent cross-contamination.

Decontamination will take place either at the drilling location of the just completed well, or at a designated site selected by GHR Engineering and Dunn Geoscience personnel. The cleaning process will involve the use of a high pressure water rinse, a methonol spray and steam rinse.

3.38 Well Development

All monitoring wells will be developed using either a modified air-lift technique or bailing. Well development is necessary for the following reasons:

1. To remove residual drilling mud and formational silts and clays, thereby preventing turbidity during sampling that could potentially interfere with chemical analysis; and,

2. To increase the hydraulic conductivity immediately around the well, which in turn reduces the potential of the well yielding an insufficient volume of water during the sampling procedure.

A modified air-lift method will be used for all well development if possible. The basic air-lift method involves pumping compressed air into the well forcing out water containing the undesirable fine sand and silt. The modified air-lift method is an adaption of the basic air-lift method and provides the following advantages over the basic method:

1. No air enters the well;

2. Water is removed directly from the screened portion of the well,

3. The coalescer unit reduces any possibility of introducing foreign substances into the well, and,

4. Up to three wells may be developed simultaneously using one air compressor and one coalescer unit.

The actual modified air-lift method is described below.

Five-foot sections of one-inch diameter PVC pipe will be screwed together and lowered into the monitoring well until the end of the bottom-most section of pipe is positioned within the screened section of the well or within the cored section for the bedrock wells. Attached to the bottom of the pipe are two one-way check valves separated by about three inches of one-inch PVC pipe. Both check valves close in a downward direction. Two air compressor hoses are used. One connects the air compressor to the coalescer, and the other runs from the coalescer down the one-inch PVC pipe well development assembly unit to approximately five feet above the upper check valve. The orientation of the check valve allows the pipe to fill with water. Activation of the air compressor momentarily shuts the upper check valve and forces the trapped column of water up and out of the pipe. The release of the water lowers the pressure on the top of the check valve allowing water to again enter the pipe until the air pressure becomes sufficient to blow out the column of water. This process repeats itself if the water pressure (head) is capable of balancing the air pressure created by the compressor. In wells lacking adequately long water columns, the water pressure is incapable of reopening the check valve allowing a fresh column of water to enter. Manual control of the air pressure is necessary in these instances. The lower check valve assures that no air enters the monitoring well. To prevent cross-contamination between wells, the one-inch pipe is washed with water sprayed with methanol and again rinsed with water before introduction into each well.

In wells with short columns of water, the modified air-lift technique may prove ineffective, necessitating the alternate development method of hand-bailing. Stainless steel bailers, to be used later for groundwater sampling, will be utilized for development purposes. The bailers will serve both as a surge-block device loosening the fine-grained material from the well annulus, and as a mechanism to remove the water and sediment from the well. The surging is accomplished by rapidly raising and lowering the bailer within the screened section. Bailing will be continued until the water has sufficiently cleared or five well volumes of water have been removed.

3.39 On-Site Groundwater Analysis

A portable gas chromatograph will be used on-site during the drilling phase. Groundwater samples from newly constructed wells and existing wells along with surface-water samples, will be analyzed for volatile organic halogens as well as any other parameters deemed appropriate as the investigation progresses. Rapid analyzation of the water samples will aid in selecting sites for upcoming monitoring wells.

3.39.1 Instrumentation Used

The instrument selected for on-site groundwater analysis is an HNU Model 301 gas chromatograph equipped with a 10.2 eV photoionization detector (PID) and flame ionization detector (FID) in series. This combination allows for differentiation between aliphatic compounds and aromatic or other compounds containing carbon-carbon double bonds (i.e., methane vs. vinyl chloride). The GC column used for compound separation will be a 6-foot x 1/8-inch OD stainless steel column packed with either 1% SE-30 or its equivalent, Supelco SP2100.

A dual-pen Linsers strip-chart recorder will transcribe the detector's output. All charge recordings will be numbered sequentially and recorded in a log book. Daily charts will be separated and saved for subsequent analysis.

3.39.2 Analytical Procedure

Security procedures require that the GC equipment be disassembled and stored every evening. Therefore, a 1- to 2-hour warmup period will be necessary every day to permit the system to equilibrate. Air blanks and standards will be analyzed regularly.

Groundwater samples will be collected in 40 ml vials without any headspace, and kept refrigerated until the time for analyzation. Each vial will be opened, approximately 10 ml rapidly decanted, and the vial resealed. After temperature equilibration and one minute agitation, an air space sample will be removed with a syringe and analyzed by the GC.

3.39.3 Quality Control

A quality control program will be implemented during the on-site screening for the following purposes:

1. To determine the dialy response of the detectors to a known standard, typically a mixture of tetrachloroethylene, trichloethylene, and chloroform.

2. To observe the response of blank samples so as to establish a "zero" baseline.

3. To ensure that syringe contamination from samples with a high concentration of organics will be detected and corrected before the next sample was injected.

4. To ensure that water used for drilling fluid is contaminant-free.

The following presents a more detailed description of each of the above areas of concern.

3.39.4 Standards Analysis

Standards will be prepared by filling a 40 ml vial with 25 ml of organic-free water and capping with a teflon-lined silicone septum and hole cap. Measured volumes of stock solutions of organic compounds in methanol will then be injected through the septum. The concentration of the compound in the water will be calculated and the response of the GC detectors to equilibrium headspace samples will be observed.

It should be noted that this approach does not require knowing the actual concentration of a compound of interest in the air cap, as long as the total concentration of the compound in the vial is known, and a consistent volume of liquid is used. Standards will be prepared daily or when a deterioration of response is observed.

3.39.5 Air Blank Analysis

Samples of the field laboratory air and outside air will be tested regularly to eliminate the possibility of sample contamination by airborne compounds, which might get into a sample during preparation for analysis. Air blanks will also be run on samples being prepared for standards, after the water is introduced to the vial, but before injection of the stock solution.

3.39.6 Syringe Quality Control

After analysis of a highly concentrated sample, an air blank will be analyzed using the same syringe. If ghost peaks are observed, the syringe will be flushed several times with methanol and dried in the GC oven.

3.40 Monitoring Well Location

The final well locations will be determined after reviewing the results of the geophysical surveys, two dimensional groundwater model, surficial geologic mapping, and preliminary list of potential sources of contamination. Well locations will center around areas thought to contain highly permeable aquifer material, around areas appearing to be in the pathways from potential sources of contamination to the wellfield, areas defined during the two dimensional groundwater modeling as requiring additional input, and access considerations.

3.41 Monitoring Well Identification

Each cluster, pair, or single well location will be given a different number that will refer to all wells at that location. Individual wells at a location will be further identified as deep (D), intermediate (I), or shallow (S). For example, well cluster 3 would contain wells 3D, 3I, and 3S, and single well 12 might be 12I (or 12S). The well's identification number will be boldly painted on the outside of the casing of each well with black enamel paint.

3.42 In-Situ Permeability Testing. A series of slug tests will be performed on all the wells whose screens are totally below the groundwater level. In shallow wells, the permeability tests will be recovery tests. This change in testing procedure is necessary because published formulas for slug tests do no apply to groundwater table wells as the slug raises the water level into the unsaturated zone.

3.43 Water Level Measurements. A minimum of two rounds of full water level measurements at all existing wells on the same day will be taken.

3.44 Groundwater, Surface Water and Sediment Sampling

Groundwater samples will be collected for all newly installed wells and for those existing wells deemed to be suitable. The total number of groundwater samples to be collected is 50 per sampling event. Two rounds of samples will be taken. In addition, a total of 6 surface water samples, 18 soil samples and 6 sediment samples will be taken. The soil samples will be chosen from those indicated by the HNU to contain volatile organic constituents. The locations of surface water and sediment samples will be determined following the completion of initial project activities. One round of surface water, sediment and soil samples will be taken. Sampling procedures are detailed in Section 3.50.

3.45 Pump Testing of Existing Wells

A pump test will be performed using one of the existing groundwter supply wells. One or more of the available monitoring wells may be installed to function as a monitoring well for the collection of data during this pumping test. Groundwter drawdown and recovery will be monitored for 48 hours.

3.46 Groundwater Model

Data will be incorporated into the three dimensional model as it is received including aquifer characteristics, and piezometric head levels. The model will be used as a diagnostic tool as well as a key part of the evaluation.

3.47 Surveying

All installed wells will be surveyed to determine their location and top of casing elevation. Locations will be plotted on the base map.

3.48 Laboratory Analysis

All samples will be collected, stored, preserved and shipped to ETC according to the protocols developed in the Work Plan. In round one of the sampling program, all water samples will be analyzed in the field trailer for presence of volatile organics using a portable GC (HNU 301). Identical samples will be shipped to ETC for GC/MS volatile scans. During round two, a similar procedure will be used, with additional analysis of all priority pollutants for samples taken within areas of suspected pollutant sources.

3.50 SAMPLING AND ANALYSIS PROGRAM

3.51 Soil Sampling During Drilling

A portion of each split-spoon sample taken during drilling for monitoring well installation (as described in Section 4.00) will be field analyzed at the boring location for the presence of volatile organic constituents. Utilizing an HNU Model PI-101, samples showing levels of volatiles will be submitted to the on-Site field laboratory for analysis on an HNU Model PI-301.

3.51.1 Sampling Procedure

A portion of each split-spoon sample taken during the drilling process will be stored in a sealed container and field tested for the presence of volatile organic compounds using a portable organic vapor analyzer. The results of this screening process will be recorded on the drilling log.

3.51.2 Decontamination Procedure

The split-spoon sampler will be cleaned by the drillers before each sample is taken. The cleaning process is described in Section 4.00. The driller will have more than one split-spoon sampler so that time will not be lost during the cleaning process. The rinseate from the split-spoon cleaning will be collected and disposed of at the termination of each boring at the boring location.

3.51.3 Sample Preservation, Shipment and Chain-of-Custody

Soil samples selected for analysis on the HNU-301 shall be placed securely into an insulated cooler containing ice and shall be properly logged, packed, labeled and transferred to the field laboratory. Selected samples, not exceeding 18, will be selected according to the results of the HNU-301 analyses, and submitted to Environmental Testing and Certification Corporation (ETC) following EPA specified logging, packing and chain-of-custody procedures.

3.51.4 Analytical Parameters

Soil samples submitted to ETC will be analyzed via GC/MS for volatile organics.

3.52 Soil Sampling From Test Pits

Test pits will be excavated in the vacant lot east of Albens Cleaners (see Site Plan). This area is suspected as being a filled area and possibly an old landfill or disposal area. Additional test pits or shallow exploration holes may be excavated in an area north of Route 22 that is reported to have been used as a landfill area.

3.52.1 Sampling Procedure

If possible, test pits will be excavated below the water table. Logs of the soils encountered during excavations will be recorded by the field geologist. Soil samples will be screened with the HNU Model PI-101 during excavation. Organic levels will be recorded on the test pit log. Before the holes are backfilled, a 1.5-inch slotted PVC pipe or equivalent will be installed to allow future groundwater sampling and water table measurements. The locations and elevations of the pipes will be surveyed and plotted on the site plan.

Test pits will be refilled the same day as they are excavated. Excavated soils and debris will be screened with field instruments for organic vapors. If obviously contaminated areas are visually observed or detected by the field instruments, samples may be taken and submitted to the field laboratory for analysis. Should contamination be detected on the HNU Model PI-301, samples may be submitted to ETC for analysis.

3.52.2 Decontamination Procedures

At the completion of each test pit, the backhoe bucket will be decontaminated by a water rinse, a methanol spray, and a final water rinse. Decontamination will take place at the test pit location.

3.53 Groundwater Sampling

All monitoring wells installed during the RI/FS will be sampled. It is anticipated that a total of 50 samples per sampling event will be taken and sent to ETC for analysis. Two rounds of groundwater samples will be taken.

3.53.1 Sequence of Sampling

The monitoring wells will be sampled in an order from the least to most contaminated wells. Determination of the degree of contamination will be based upon field screening of soil and water samples during drilling of the wells.

3.53.2 Sampling Protocol

Monitoring wells will be sampled in accordance with EPA protocol as outlined in EPA/530/SW-611, Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities. The following sampling procedures will be exercised at each monitoring well:

1. Identify the well and record the well number on the Groundwater Sampling Record.

2. Put on a new pair of disposable gloves.

3. Open the well cap and measure organic vapor levels at the wellhead with the use of a portable organic vapor analyzer. Record levels detected.

4. Groundwater levels will be measured to the nearest 0.01 foot from the top of the protective casing using an electric water level indicator or acoustics sounding device. Water level indicators will be decontaminated between wells. Record water levels.

5. Hydraulic conductivity tests will be performed at this time. Rising head permeability tests, as described by Hvorslev, will be performed. Water pumped from the well to perform the test will be disposed at the well site. The sampler should record the appearance of the groundwater first removed from the well casing.

6. The volume of standing water in the well casing will be calculated and recorded. At least three well volumes will be purged by means of a stainless steel bailer or by a modified air-lift (refer to Section 3.38). If bailers are used, separate pre-cleaned bailers should be used in each well. If wells are purged by pump, separate pre-cleaned polypropylene tubing will be used in each well. The purge water from each well will be disposed of at the well site.

7. Samples will be collected using a stainless steel bailer. Samples will be transferred from the bailer and poured into containers provided by ETC. Samples to be analyzed for volatile organics will be collected in 40-milliliter glass vials with teflon/silicone rubber septa secured with bakelite caps. Samples taken during the second round for priority pollutant analyses will be taken in the following

containers: volatiles in 40 ml vials, acid extractables, base/neutrals and pesticides in 1-gallon amber bottles and metals in 2-liter polypropylene containers.

8. To prevent cross-contamination of groundwter samples, stainless steel boilers will decontaminated as follows: The bailers will be washed with tap water, sprayed with methanol, washed with tap water, then with distilled wter. Each batch of decontamination water will be checked via the HNU 301 for the presence of volatile contaminants. Decontamination of bailers will take place in the field laboratory. Upon completion of decontamination, each boiler will be wrapped in aluminum foil to keep it clean until it is used at the well Site.

9. Sample containers will be properly labeled with tags provided by ETC. Samples will be logged in on a sample log sheet and chain-of-custody form.

10. Upon completion of sampling, disposable equipment used during the sampling i.e., gloves, paper towels, etc., will be disposed of in a specified waste container near the site trailer.

3.53.3 Sample Preservation, Shipment, and Chain-of-Custody

Groundwater samples collected in accordance with the previously described instructions shall be placed securely into an insulated cooler containing ice and shall be properly logged, packed, labeled and shipped to ETC.

3.53.4 Analytical Parameters

The groundwater samples collected in the initial round will be analyzed for volatile organics via GC/MS. Wells identified from the first round of samples as being contaminated will be re-sampled and the water analyzed for priority pollutants during a subsequent round of sampling.

3.54 Surface Water Sampling

Surface water samples will be collected from the East Branch Croton River upstream and downstream from the Well Field in order to determine the potential net influx of contaminants from suspected sources into the river. A total of six (6) stations will be sampled.

3.54.1 Sampling Procedure

Samples will be collected in upstream order from the furthest station downstream of the site. The samples will be collected as follows:

1. Record general location of the station and describe stream characteristics including width, depth, streambed material, approximate flow rate, temperature, pH and dissolved oxygen concentration.

2. Collect water samples from as near midstream as possible by immersing a 2-gallon stainless steel bucket into the stream. Where the stream is too shallow to immerse the bucket, use a 500 ml stainless steel cup to fill the bucket. Transfer the sample from the bucket to all appropriate sample bottles, except the bottles for volatile organics. For volatile organics, the bottles are immersed directly in the stream in order to prevent loss of analyte through air stripping during sample handling.

3. Secure lids and attach sample labels which have been completely filled out. Place samples in coolers until shipment to ETC. Samples will be logged in on a sample log sheet and chain-of-custody form.

4. Mark the sample location with a numbered stake and note location on a site map.

5. Decontaminate the sampling bucket using methanol and distilled water.

3.54.2 Sample Analyses

All surface water samples will be analyzed for volatile organics.

3.55 Sediment Sampling

Concurrent with surface water sampling, sediment samples will also be collected. Results of sediment analyses will provide information on the accumulation of contaminants into the sediment and possible upward migration of contaminants into the surface water. Six (6) sediment samples will be collected at each of six surface water sampling in the Croton River. Samples will be collected using a piston-type corer or similar device. Grab samples will be collected where a rocky stream bed prohibits coring. All samples will be stored in glass sample jars and kept cool prior to shipment.

3.55.1 Sampling Procedure

Sediment samples will be collected from a station after all other sampling and measurement activities have been completed. The samples will be collected as follows:

1. Locate mid-channel and the leeward shore and record in log book. Leeward shore is defined as the shore line where current velocities are lowest or the shore furtherst from mid-channel.

2. Collect sediment core samples from mid-channel and two-thirds the distance from mid-channel to the leeward shore. Where rocky bottom substrate is encountered, a ponar dredge sample will be collected instead of cores.

3. At all stations the cores (where collected) will be mixed in a stainless steel tub and transferred into the appropriate containers.

4. Secure lids and attach sample labels which have been completely filled out. Place samples in a cooler packed with ice until shipment to the designated CLP. Samples will be logged in on a sample log sheet and chain-of-custody form.

5. Decontaminate sampling equipment by washing the equipment with water and a bristle brush, followed by methanol and distilled water rinses.

3.55.2 Sample Analyses

All sediment samples will be analyzed for volatile organics.

3.56 Other Sampling

Surface water, sediment and aqueous discharge samples will be taken from areas downstream or adjacent to potential sources of contamination to the well field. These areas include, but are not limited to, surface water drainage from the Fox Farm area, sediment and aqueous discharge from storm sewers, various pipes and surface water south of the well field in the vicinity of Albens Cleaners and Brady Stannard, and from other areas suspected to be contaminant sources. The samples will be analyzed in the field laboratory via the HNU Model PI-301 for the presence and identification of volatile constituents. Based on the results of the analyses, samples may be selected for a more sophisticated analysis by ETC. Sampling techniques for the various environmental media will adhere to the procedures described above.

SECTION 4.00

4.00 DATA EVALUATION AND REPORT PREARATION

Data evaluation will be conducted continuously during the field investigation with the most intensive efforts concentrated at the conclusion of the geophysics, the conclusion of the drilling and the receipt of the first and second rounds of laboratory analysis data. The key segments of evaluation and reporting follow.

4.10 Site and Local Geology

All geologic logs will be presented with sample descriptions using the Burmiester Identification System and the Unified Classification System as well as geologic interpretation. Geologic sections, isopacks and fence diagrams will be prepared as necessary to demonstrate the geology. The results of the geophysics program will be fully integrated, explained and documentation presented.

4.20 Aquifer Characteristics and Groundwatre Hydrology

The results of the monitoring of wells and piezometers will be incorporated into the three dimensional model. The results of the permeability testing and pumping testing will be presented, described and incorporated into the three dimensional model. The report text will focus on lateral and vertical gradients, the impact of these gradients on groundwater flow and contamination migration. The results will be to provide the reader with a full understanding of the site three dimensional groundwater flow system.

4.30 Contaminant Sources and Migration

Estimates of porosity and degree of heterogeniety will be used to estimate contaminant travel time and the degree of dispersion in the subsurface. Water quality results will be incorporated into this analysis and the results discussed. The geochemistry of the subsurface will be evaluated as it pertains to the particular contaminant mobility. The data will be fully integrated as an objective of determining the most likely source or sources of contaminant generation.

4.40 Report of Remedial Investigation

A full and detailed report will be prepared describing all the field activities conducted. The report will include full documentation of each phase of work, the objective sought, the methodology used, and the results obtained. Data presentation will include the results of three dimension groundwater modeling in map format and output if desired, geologic sections, isopacks and a fence diagram as appropriate. A surficial geologic map will be included as well as all boring and monitoring well installation logs. All chemical analysis will be tabulated and presented in plan view as appropriate. The text will clearly and concisely describe conclusions, and recommendations.

APPENDIX A

EMERGENCY TELEPHONE NUMBERS

APPENDIX A

1.00 EMERGENCY TELEPHONE NUMBERS

1.00 Immediate Emergencies

- Brewster Police Department — 914-279-4200
- Brewster Fire Department and Ambulance — 914-279-3678
- Putnam Hospital Center (Carmel, NY) — 914-279-5711
- Hudson Valley Poison Center (Nyack, NY) — 914-353-1000
- Brewster Water Department — 914-279-3760

STATE YOUR NAME, LOCATION, AND NATURE OF EMERGENCY (Do not hang-up phone receiver first).

For Hospital Victim:
-Name and phone of family or emergency physician.

-Description of incident - chemicals involved, symptoms, nature of injury, proposed treatment, plan of transportation.

1.20 Emergency Support

- NYSDEC Division of Solid and Hazardous Waste (James Ludlum, P.E.) — 518-457-5636
- U.S. EPA Region II (New York, NY) — 212-264-2525

1.30 County Officials

- Putnam County Environmental Health Department (Carmel, NY) — 914-225-3641
- Putnam County Nursing Health Department (Carmel, NY) — 914-225-2115

1.40 GHR Engineering Associates

GHR Office, New Bedford, MA (Allen Davis) — 617-995-5136

GHR Laboratory, Lakeville, MA (Daniel Ostrye) — 617-947-5077

GHR On-Site Trailer, Brewster, NY — 914-279-3303

APPENDIX B

RECORDING SHEETS FOR MEASUREMENTS AND FIELD OBSERVATIONS

BORING / MONITORING WELL LOG

GHR ENVIRONMENTAL

PROJECT ______________________

ADDRESS ______________________

CLIENT ______________________

GHR FIELD GEOLOGIST ______________________

BORING CONTRACTOR ______________________

FOREMAN ______________________

BORING No. ______________

LOCATION ______________

SHEET No. ____ OF ____

JOB No. ______________

DATE (S) ______________

GROUND ELEV.
= ______________

TOP OF CASING ELEV.
= ______________

CASING		SAMPLER	
SIZE:		TYPE:	
HAMMER:		HAMMER:	
FALL:		FALL:	

GROUNDWATER LEVEL READINGS

DATE	DEPTH

DEPTH	CAS. BL. /FT.	SAMPLE				GEN. STRATA DESC.	SAMPLE DESCRIPTION	FIELD TESTING	INSTALLATION LOG	NOTES
		No.	PEN./REC.	DEPTH	BLOWS/6"					

NOTES:

TEST PIT FIELD LOG

TEST PIT NO. ____________
JOB NO. ____________

PROJECT ____________
ADDRESS ____________
LOCATION ____________
CLIENT ____________
GHR GEOLOGIST ____________

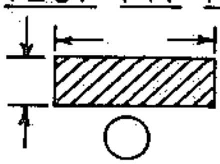
CONTRACTOR ____________
TIME STARTED ____________
TIME COMPLETED ____________
DATE ____________

GHR ENVIRONMENTAL

DEPTH	SOIL DESCRIPTION	EXCAV. EFFORT	BOULDER COUNT QTY. CLASS	FIELD TESTING	NOTES
0					
1'					
2'					
3'					
4'					
5'					
6'					
7'					
8'					
9'					
10'					
11'					
12'					
13'					
14'					

NOTES:

TEST PIT PLAN



VOLUME = ________ cu.yd.

LEGEND:

BOULDER COUNT

SIZE RANGE CLASSIFICATION	LETTER DESIGNATION
6" - 18"	A
18" - 36"	B
36" AND LARGER	C

PROPORTIONS USED

TRACE	(TR.)	0 - 10%
LITTLE	(LI.)	10 - 20%
SOME	(SO.)	20 - 35%
AND		35 - 50%

ABBREVIATIONS

F - FINE
M - MEDIUM
C - COARSE
F/M - FINE TO MEDIUM
F/C - FINE TO COARSE
V - VERY
GR. - GRAY
BN. - BROWN
YEL. - YELLOW

EXCAVATION EFFORT

E — EASY
M — MODERATE
D — DIFFICULT

GROUNDWATER

ELAPSED TIME TO READING (HRS.)	G.W.L.

GHR ENGINEERING CORPORATION

FIELD WORK PROGRESS LOG

TYPE OF WORK ____________________ CONTRACTOR ____________________

CLIENT/ LOCATION ____________________ FIELD GEOLOGIST ____________________

JOB NUMBER ____________________ WEEK OF ____________________

SEQUENCE NUMBER ____________________

DATE	TIME WORK STARTED	TIME WORK ENDED	FOOTAGE, WELLS, BORINGS, TESTPITS, ETC. COMPLETED	DETAIL DIFFICULTIES ENCOUNTERED DURING FIELD ACTIVITIES

NOTES:

GHR
ENGINEERING CORPORATION

FIELD SAMPLING LOG
CHAIN OF CUSTODY RECORD

CLIENT / PROJECT ____________________ CREW CHIEF/ SAMPLER ____________

ADDRESS ____________________ DATE (S) ____________

JOB NUMBER ____________________ SHEET ___ OF ____
SEQUENCE NUMBER ____________

FIELD SAMPLE NUMBER	SEQUENCE NUMBER	TIME	SAMPLE LOCATION	MEDIA SAMPLED	ANALYSES REQUIRED	REMARKS (SAMPLE APPERANCE) (INSTRUMENT READINGS)

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
1			2		
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
3			4		

ANALYTICAL LABORATORY: DATE/TIME NO. OF CONTAINERS TOTAL:

RETURNED TO:

REVIEWED BY: DATE:

GHR
ENGINEERING CORPORATION

MONITORING WELL SAMPLING LOG

CLIENT / LOCATION ______________________ DATE(S) ______________________

JOB NUMBER ____________________ MEASURING POINT

SAMPLER ____________________ GROUNDSURFACE OR T.O.C. ____________________

SHEET ___ OF ___ SEQUENCE NUMBER __________

WELL No.	ELEV. OF REF. PT. (Ft.)	TOTAL DEPTH OF WELL (Ft.)	DEPTH TO WATER (Ft.)	STANDING WATER HEIGHT (Ft.)	WATER TABLE ELEV. (Ft.)	STATIC * VOLUME (GAL.)	VOLUME PURGED (GAL.)	WATER TEMP. (°C / °F)	

NOTES:

* $V_{st} = \pi r^2 h \; (7.48)$

WHERE:

V = volume in gallons

r = inside well casing radius in feet

h = standing water height in feet

GHR ENGINEERING CORPORATION

AQUATIC FIELD SURVEY DATA SHEET

CLIENT/PROJECT NAME ____________________ DATE ____________________

JOB NUMBER ____________________ SHEET ____ OF ________

CREW CHIEF/SAMPLER ____________________ SEQUENCE NUMBER ________

SAMPLE LOCATION ____________________

STATION NUMBER ____________________

STATION DESCRIPTION ____________________

WEATHER CONDITIONS: ____________________

WATER QUALITY DATA

TIME (MILITARY)						
DEPTH (METERS)						
pH (UNITS)						
D.O. (mg/l)						
TEMP. (°C/°F)						

SAMPLE COLLECTION INFORMATION

TYPE OF SAMPLE	FIELD SAMPLE NUMBER	COLLECTION TIME	METHOD OF COLLECTION

SEE REVERSE SIDE FOR ADDITIONAL DATA AND COMMENTS

GHR

FIELD PERMEABILITY TEST REPORT

PROJECT ______________________________ JOB NO. __________

BORING NO. __________ TEST NO. __________ SHEET ______ OF ______

LOCATION ______________________________

COORDINATES __________ __________ TEST DATE __________

DRILLING CONTRACTOR __________ DRILLER __________

DRILLING FLUID __________ SUPERVISOR __________

TYPE OF TEST __________

TYPE OF CASING __________ I.D. ______

LENGTH OF CASING (FT.) __________

TEST SECTION LENGTH __________

I.D. ______ SOIL DESCRIPTION __________

____

DEPTH OF TEST (FT.) __________

ELEVATIONS (FT. AMSL):

SURFACE ELEVATION __________

TOP OF CASING ______ BOTTOM OF CASING ______

TOP OF TEST ______ BOTTOM OF TEST ______

STATIC WATER LEVEL __________

REMARKS / SKETCH

PERMEABILITY TEST DATA

CLOCK TIME (HOURS-MINS.)	ELAPSED TIME (MIN.)	METER READING	WATER QUANTITY (GALLONS)	DEPTH TO WATER (FEET)	REMARKS

MODIFIED BURMISTER SYSTEM

MAIN Features

+, -: Defines upper or lower third of proportion or fraction

Major Component: Spelled out in capital letters

Modifiers: Additional identification

Proportion: Identifies quantity; acts as a conjunction

Gr Br $m^{(-)}f$ S, $l^{(-)}m^{(+)}$ G; lyr; occ lns c S.

Color: As identified in the field. First letter of each color abbreviation capitalized.

Fractions: Identifies grain size(s)

Minor Component(s): Spelled out with only the first letter capitalized

Unabbreviated description of the above example

Gray Brown $medium^{(-)}$ to fine SAND, $little^{(-)}$ $medium^{(+)}$ Gravel; layered; occasional lens coarse Sand (SP).

Unified Soil Classification: Adequate for a generalized stratum description

Dunn Geoscience Corporation uses a modified Burmister System for detailed identification of soil components, fractions, and proportions. The Unified Soil Classification is also presented in an unabbreviated form and is based upon the Burmister System collected field data.

III. Glossary of Modifying Abbreviations

Category	Symbol	Term	Symbol	Term	Symbol	Term
A. Borings	U/D	Undisturbed	B	Exploratory	A	Auger
B. Samples	C	Casing	L	Lost	U	Undisturbed
	D	Denison	S	Spoon	W	Wash
	O.E.	Open End				
C. Colors	bk	black	gn	green	wh	white
	bl	blue	or	orange	yw	yellow
	br	brown	rd	red	dk	dark
	gr	gray	tn	tan	lt	light
D. Organic Soils	dec	decayed	o	organic	veg	vegetation
	dec'g	decaying	rts	roots	pt	peat
	lig	lignite	ts	topsoil		
E. Rocks	LS	Limestone	rk	rock	Shst	Schist
	Gns	Gneiss	SS	Sandstone	Sh	Shale
F. Fill and Miscellaneous Materials	bldr (s)	boulder (s)	cbl (s)	cobble(s)	gls	glass
	brk (s)	brick (s)	wd	wood	misc	miscellaneous
	cndr (s)	cinder (s)	dbr	debris	rbl	rubble
G. Miscellaneous Terms	do	ditto	pp	pocket penetrometer	ref	refusal
	el, El	elevation			sm	small
	fgmt (s)	fragment(s)	P. I.	Plasticity Index	W. L.	water level
	frqt	frequent			W. H.	weight of hammer
	lrg	large	P	pushed	W. R.	weight of rods
	mtld	mottled		pressed		
	no rec	no recovery	pc (s)	piece (s)		
	pen	penetration	rec or R	recovered		

Category	Symbol	Term	Description
H. Stratified Soils	alt	alternating	
	thk	thick	
	thn	thin	
	w	with	
	prt	parting	— 0 to 1/16" thickness
	seam	seam	— 1/16 to ½" thickness
	lyr	layer	— ½ to 12" thickness
	stra	stratum	— greater than 12" thickness
	vvd c	varved Clay	— alternating seams or layers of sand, silt and clay
	pkt	pocket	— small, erratic deposit, usually less than 1 foot
	lns	lens	— lenticular deposit
	occ	occasional	— one or less per foot of thickness
	freq	frequent	— more than one per foot of thickness

VISUAL IDENTIFICATION OF SAMPLES

The samples were identified in accordance with the American Society for Engineering Education System of Definition.

I. Definition of Soil Components and Fractions

Material	Symbol	Fraction	Sieve Size	Definition
Boulders	Bldr	—	9" +	Material retained on 9" sieve.
Cobbles	Cbl	—	3" to 9"	Material passing the 9" sieve and retained on the 3" sieve.
Gravel	G	coarse (c) medium (m) fine (f)	1" to 3" ⅜" to 1" No. 10 to ⅜"	Material passing the 3" sieve and retained on the No. 10 sieve.
Sand	S	coarse (c) medium (m) fine (f)	No. 30 to No. 10 No. 60 to No. 30 No. 200 to No. 60	Material passing the No. 10 sieve and retained on the No. 200 sieve.
Silt	$	—	Passing No. 200 (0.074 mm)	Material passing the No. 200 sieve that is non-plastic in character and exhibits little or no strength when air dried.

Organic Silt (O$)
Material passing the No. 200 sieve which exhibits plastic properties within a certain range of moisture content, and exhibits fine granular and organic characteristics.

		Plasticity	Plasticity Index
Clayey SILT	Cy$	Slight (Sl)	1 to 5
SILT & CLAY	$&C	Low (L)	5 to 10
CLAY & SILT	C&$	Medium (M)	10 to 20
Silty CLAY	$yC	High (H)	20 to 40
CLAY	C	Very High (VH)	40 plus

Clay-Soil
Material passing the No. 200 sieve which can be made to exhibit plasticity and clay qualities within a certain range of moisture content, and which exhibits considerable strength when air-dried.

II. Definition of Component Proportions

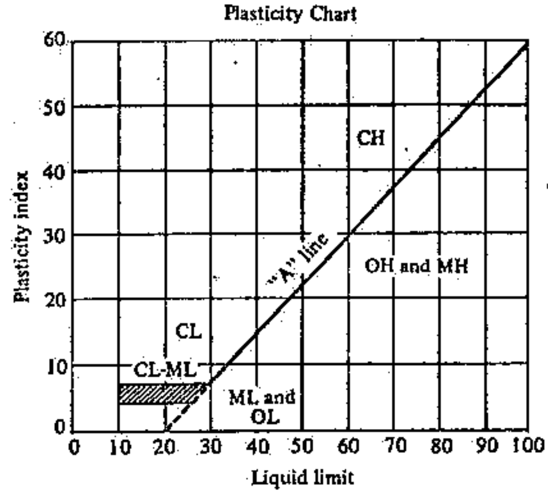
Component	Written	Proportions	Symbol	Percentage Range by Weight *
Principal	CAPITALS	—		50 or more
Minor	Lower Case	and	a.	35 to 50
		some	s.	20 to 35
		little	l.	10 to 20
		trace	t.	1 to 10

* Minus sign (—) lower limit, plus sign (+) upper limit, no sign middle range.

UNIFIED SOIL CLASSIFICATION SYSTEM. (ASTM D-2487)

Major Divisions			*Group Symbols*	*Typical Names*	*Laboratory Classification Criteria*		
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 per cent: GW, GP, SW, SP; More than 12 per cent: GM, GC, SM, SC; 5 to 12 per cent: *Borderline* cases requiring dual symbols[b]	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM[a] d / u	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits below "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines		$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM[a] d / u	Silty sands, sand-silt mixtures		Atterberg limits above "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	Plasticity Chart		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL	Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		Pt	Peat and other highly organic soils			

Plasticity Chart



[a]Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28.

[b]Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

ROCK LOG LEGEND

ROCK QUALITY PARAMETERS

Grades of Decomposition

D - 1 Fresh Rock

D - 2 Slightly Altered Rock (Joints Stained)

D - 3 Moderately Altered Rock (Matrix somewhat weakened)

D - 4 Highly Altered Rock (Matrix weak)

D - 5 Residual Soil (Soil-like saprolite)

Grades of Strength

S - 1 Strong (Metallic sound, breaks with difficulty with hammer)

S - 2 Moderately Strong (Dull sound; breaks with moderate hammer blow)

S - 3 Weak (Cuts easily with knife)

S - 4 Very Weak (Breaks with finger pressure)

Grades of Fracturing

F - 1 Massive (Fracture spacing greater than 3 feet)

F - 2 Moderately Jointed (Fracture spacing 8 inches to 3 feet)

F - 3 Very Jointed (Fracture spacing 4 inches to 8 inches)

F - 4 Extremely Jointed (Fracture spacing 2 inches to 4 inches)

F - 5 Crushed (Fracture spacing less than 2 inches)

RELATIVE HARDNESS SCALE

Very Hard - Cannot be scratched with steel blade.

Hard - Scratches with difficulty with steel blade.

Moderately Hard - Easily scratched with steel blade, but not with fingernail.

Soft - Scratches with fingernail.

ROCK QUALITY DESIGNATION (R.Q.D.) is based on a modified core logging procedure which, in turn, is based indirectly on the number of fractures and the amount of softening or alteration in the rock mass as observed in the rock cores. Instead of counting the fractures, an indirect measure is obtained by summing up the total length of core recovered - but counting only those pieces of core which are four inches (10 cm) in length or longer, and which are hard and sound.
This procedure obviously penalizes the rock where recovery is poor. This is appropriate, because poor core recovery usually indicates poor quality rock.
It has been found that there is a good relationship between the numerical values of the R.Q.D. and the general quality of the rock for engineering purposes. This relationship is as follows;

R.Q.D.	Description of Rock Quality
0 - 25%	Very Poor
25 - 50%	Poor
50 - 75%	Fair
75 - 90%	Good
90 - 100%	Excellent

REFERENCE:

D.U.DEERE, (1968) Rock Mechanics in Engineering Practice, Stagg & Zienkiewicz, ed., Wiley

ROCK COLOR SCALE

NEUTRAL SCALE

N-1 BLACK
N-2 GRAYISH BLACK
N-3 DARK GRAY
N-4 MED. DARK GRAY
N-5 MEDIUM GRAY
N-6 MED. LIGHT GRAY
N-7 LIGHT GRAY
N-8 VERY LIGHT GRAY
N-9 WHITE

See rock color chart
Geologic Society of America

DAILY FIELD REPORT

Dunn Geoscience Corporation

5 Northway Lane North

Latham, New York

PROJECT ______________________

JOB NO. ______________________

WEATHER ______________________

FIELD REPORT NO. ______________________

VISITORS:

DATE ______________________

ARRIVED AT SITE ______________________

LEFT SITE ______________________

CONTRACTORS HOURS ______________________

INSPECTOR ______________________

DUNN GEOSCIENCE CORP.

Dunn Geoscience Corporation
Core Log

Client ______________________
Project ______________________
____
Location ______________________
____

Logged by ______________ Date Logged ______________
Drilling Co. ______________________
Driller ______________________
Started ______________ Finished ______________

Hole ______________
Depth ______________
Elev. ______________
Core Dia. ______________

FORMATION	Member	Zone/Unit	Graphic Log 1" ___	Depth	**Descriptive Log** ROCK TYPE: color; grain size; texture, bedding; minerals; remarks, etc.	Angle of Bedding to Core	% Core Recovery

Hole No.
Sheet ______ of ______

DUNN GEOSCIENCE CORPORATION LATHAM, NEW YORK (518) 783-8102	TEST BORING LOG	BORING NO.
PROJECT		
CLIENT		SHEET 1 OF
DRILLING CONTRACTOR		JOB NO.
PURPOSE		ELEVATION

GROUNDWATER					CASING	SAMPLE	CORE	DATUM
DATE	TIME	DEPTH	CASING	TYPE				DATE STARTED
				DIAMETER				DATE FINISHED
				WEIGHT				DRILLER
				FALL				INSPECTOR

DEPTH FT.	CASING BLOWS	SAMPLE NUMBER	BLOWS ON SAMPLE SPOON PER 6"	UNIFIED CLASSI-FICATION	GRAPHIC LOG	IDENTIFICATION	REMARKS
5							
10							
15							
20							

SECTION 5.00

4.00 TEST BORING/MONITORING WELL INSTALLATION SPECIFICATIONS

4.10 Objectives

The objectives of the test boring/monitoring well installation program are as follows:

1. provide data to develop an understanding of the site geology and hydrogeology

2. provide water level data to determine groundwater gradients (horizontal and vertical) and the direction of groundwater movement

3. provide sampling locations to determine the nature, extent and concentration levels of contaminants

4.20 Drilling Methodology

A total of forty-four monitoring wells will be installed during the drilling phase. One to two med rotary rigs will be mobilized to perform the drilling. Water will be used as the drilling fluid wherever possible, with bentonite drilling fluid being employed if significant caving is encountered. Only water that has been treated by the air stripping column will be used for drilling.

A Dunn Geoscience Corporation Geologist will be at each rig during all drilling. A GHR Geologist will be coordinating all drilling and sampling activities. Soil samples collected during drilling will be logged and screened for volatile halogenated organics by the on-site geologists. The on-site geologists will also be responsible for correct well construction, maintaining health and safety guidelines, and overall proper implementation of the work plan.

4.30 Soil Sample Collection

Two 24 inch (2 inch O.D.) split-spoon samplers will be used on each drilling rig to collect the soil samples following ASTM methods. The split-spoon barrels will be washed by the driller's helper before each sample to prevent cross-contamination. three 5 gallon buckets with bucket dedicated brushes, the first containing dissolved tri-sodium phosphate and the second and third containing water, will be used for this purpose. The samples will be logged using the Modified Burmister Identification System and the Unified Soil Classification System. Duplicate samples will be stored in glass jars sealed with aluminum foil lined screw top lids. One sample will be retained for possible subsequent analysis including laboratory gradational analysis, while the other sample will undergo halogenated organic screening, at the drilling Site using an HNU Model PI-101 Photoionization Analyzer (HNU 101) and analysis via an HNU Model PI-301 in the field laboratory.

If clays are encountered during drilling, thin-walled, tube samples will be used to collect undisturbed samples. The soils will be recovered using three-inch diameter brass, open-tube samplers (Shelby Tubes) in accordance with ASTM standard methods.

Prior to collecting the tube samples, the borehole will be cleaned out to the desired sampling depth. While the water level in the boring is kept at the naturally occurring groundwater level, the tube is pushed 24 inches into the soil using a rapid continuous motion, then it will be rotated at least twice to shear the sample off at the bottom. Before the tube is pulled, it will remain in place a short time (typically 3-5 minutes) to allow for sample expansion. Upon removal of the tube, the sample recovery is measured and the disturbed material from the top of the tube and at least one inch of soil from the lower end of the tube are removed, described and then discarded. Both ends of the tube are then sealed with wax and fitted with end caps which are secured with tape. The taped end caps are then dipped in melted wax to prevent breaking the seals. Finally, the tube is labeled with the necessary informtion and placed vertically in a container designed to reduce shock, vibration and disturbance during storage and shipment.

4.31 Contaminant Screening

Jarred soil samples being tested by the HNU 101 will be heated to 40 degrees C. with a small portable heater. After 30 minutes, the sample is taken from the heater, the screw cap removed, and the metal foil pierced with the eight-inch extension to the photoionization probe. The headspace is tested for the presence of organic vapors and the results recorded in the field book. After testing, the cap will be replaced and the samples stored.

4.40 Well Cluster Installation

Six well clusters, each consisting of a shallow water table well, an intermediate depth well in the unconsolidated aquifer, and a bedrock well, will be installed. Proposed well construction details are shown on Figure 1.

4.41 Intermediate Well

The intermediate well will be installed first. A 4-3/4" roller bit will be used to advance the boring to refusal. Five inch casing will be driven the length of the hole using a 300 pound hammer with a 18 inch drop. Continuous split-spoon sampling will be performed with the samples handled as previously described.

The screen depth will be chosen on the basis of visual soil sample analyses and HNU 101 and 301 results. After drilling and casing to bedrock, the borehole will be thoroughly flushed clean of cuttings and drilling mud (if used). Immediately prior to placing bentonite pellets or sand into the borehole, the casing will be pulled just enough to expose the correct length of the borehole about to receive the construction material. Using this method, caving of the surrounding material will be kept at a minimum. The boring will be slowly backfilled with bentonite pellets to a depth five (5) feet above the top of bedrock to prevent the movement of wter between the unconsolidted aquifer and the bedrock aquifer. Sand will then be backfilled to a depth within six feet of the proposed screen bottom. About five (5) feet of bentonite pellets will be added, to a depth one foot below the proposed screen bottom.

At this point, the well will be constructed, lowered into the borehole, and suspended at the proper depth. The well will consist of two inch flush joint schedule 5 stainless steel riser pipe and a two foot section of two inch no. 10 slot stainless steel screen with a stainless steel bottom cap. Teflon tape will be used on all riser pipe joints to prevent any leakage of groundwater to the well from the surrounding aquifer, other than the screened interval. A tremie pipe will then be introduced into the annulus between the well and the borehole until the bottom of the pipe is 2 1/2 feet above the bentonite pellets. Clean water will be pumped through the tremie pipe until a return flow is minimal. Morie O silica sand or an equivalent sand will then be backfilled, creating a sandpack extending from one foot below the screen to two feet above the screen. The upwardly flowing water aids in evenly distributing the sand around the well and preventing bridging of the sand. A five (5) foot bentonite pellet seal will then be installed above the More sandpack, effectively sealing off the screened interval from the rest of the aquifer. The remaining casing will be pulled and cement-bentonite grout pumped through a tremie pipe into the remainder of the annulus. To prevent unauthorized access into the monitoring well, a lockable steel, protective casing will be cemented over the stainless stell riser pipe extending above the land surface.

4.42 Shallow Well

The shallow well will be installed about five feet from the intermediate well. A 4-3/4 inch roller bit will be used to advance the boring, without sampling, to a depth six feet below the water table (as established by the intermediate well). Casing will again be driven the length of the boring. Well material specifications are identical to the intermediate well except that a ten foot section of screen will be employed rather than the two-foot section used for the intermediate well. The screened section will extend from five feet below the water table to five feet above the water table. The sandpack will extend from one foot below the screen to one foot above the screen. A five foot bentonite pellet seal will be installed above the sandpack and the remainder of the annulus grouted with a cemtent-bentonite grout. A lockable protective steel casing will be cemented into position over the exposed riser pipe. The well construction materials and method of installing the well are the same as those described for the intermediate well. On-site modifications to the shallow well construction plans will be necessary if a particularly high water table is encountered.

4.43 Deep Well

The deep well will be located approximately five feet from the intermediate well and at least five feet from the shallow well. The purpose of deep wells is to monitor the hydraulic and chemical properties of the upper zone of the bedrock aquifer. A 7-7/8 inch roller bit will be used to drill through the unconsolidated material and five feet into the bedrock. No sampling will take place during this drilling.

Four inch flush-joint schedule 5 stainless steel casing will be lowered into the boring until the bottom of the casing rests in the five-foot rock socket. Teflon tape will again be used on all joints. The casing will then be grouted in position using the technique depicted in Figure 2. Dual tremie pipes will be lowered on opposite sides of the casing to within one (1) foot of the bottom of the rock socket. Cement/bentonite grout will be pumped through the tremie pipes until return flow is observed at the surface. An airtight cap will be placed on the casing during this procedure to prevent the movement of grout into the casing.

After allowing the grout to set, NX core will be taken by drilling through the casing to a depth eight feet below the bottom of the rock socket. The core will be logged and retained for further analysis. The casing will be cemented in place at the surface and a lockable protective steel casing installed over the 4-inch well casing.

4.50 Well Pair Installation

Nine well pairs, each consisting of a shallow and an intermediate well, will be installed using the following procedure. A 4-3/4 inch roller bit will be utilized to advance the boring to a depth determined by the on-site geologist. Standard split-spoon sampling and HNU-101 and 301 analyses will again aid in selecting the best screen depth. The intermediate well borings will at most extend only a few feet below the screened interval; therefore, the bottom bentonite seal and overlying sand fill used in the well cluster intermediate wells will not be needed. Instead, a bentonite pellet seal will be installed to within one foot of the bottom of the screen and the rest of the installation performed as described under the well cluster-intermediate well installation description.

The shallow wells will be installed as outlined for the well cluster shallow wells at a distance of about five feet from the intermediate wells.

4.60 Single Well Installation

Eight single, shallow or intermediate wells will be installed. Standard sampling will be performed during drilling and the screen locations chosen by the on-site geologists. Well materials and method of installation will be identical to that previously described for the well pairs.

4.70 Drilling Equipment Decontamination

Prior to drilling the first boring, the equipment to be used in drilling and monitoring well installation will be cleaned to remove possible contaminants encountered during drilling at previous jobs. All equipment which is to come in contact with the soil and rock, as well as water tanks, drill tools, pumps and hoses will undergo the initial cleaning procedure. While working at the site, the drilling equipment will be decontaminated between wells to prevent cross-contamination.

Decontamination will take place either at the drilling location of the just completed well, or at a designated site selected by GHR Engineering and Dunn Geoscience personnel. The cleaning process will involve the use of a high pressure water rinse, a method spray and steam rinse.

4.80 Well Development

All monitoring wells will be developed using either a modified air-lift technique or bailing. Well development is necessary for the following reasons:

1. To remove residual drilling mud and formational silts and clays, thereby preventing turbidity during sampling that could potentially interfere with chemical analysis; and,

2. To increase the hydraulic conductivity immediately around the well, which in turn reduces the potential of the well yielding an insufficient volume of water during the sampling procedure.

A modified air-lift method will be used for all well development if possible. The basic air-lift method involves pumping compressed air into the well forcing out water containing the undesirable fine sand and silt. The modified air-lift method is an adaption of the basic air-lift method and provides the following advantages over the basic method:

1. no air enters the well;

2. water is removed directly from the screened portion of the well;

3. the coalescer unit reduces any possibility of introducing foreign substances into the well; and,

4. up to three wells may be developed simultaneously using one air compressor and one coalescer unit.

The actual modified air-lift method is described below. Five-foot sections of one-inch diameter PVC pipe will be screwed together and lowered into the monitoring well until the end of the bottom-most section of pipe is positioned within the screened section of the well or within the cored section for the bedrock wells. Attached to the bottom of the pipe are two one-way check valves separated by about three inches of one-inch PVC pipe. Both check valves close in a downward direction. Two air compressor hoses are used. One connects the air compressor to the coalescer, and the other runs from the coalescer down the one-inch PVC pipe well development assembly unit to approximately five feet above the upper check valve. The orientation of the check valve allows the pipe to fill with water. Activation of the air compressor momentarily shuts the upper check valve and forces the trapped column of water up and out of the pipe. The release of the water lowers the pressure on the top of the check valve allowing water to again enter the pipe until the air pressure becomes sufficient to blow out the column of water. This process repeats itself if the water pressure (head) is capable of balancing the air pressure created by the compressor. In wells lacking adequately long water columns, the water pressure is incapable of reopening the check valve allowing a fresh column of water to enter. Manual control of the air pressure is necessary in these instances. The lower check valve assures that no air enters the monitoring well. To prevent cross-contamination between wells, the one-inch pipe is washed with water sprayed with methanol and again rinsed with water before introduction into each well.

In wells with short columns of water, the modified air-lift technique may prove ineffective, necessitating the alternate development method of hand-bailing. Dedicated stainless steel bailers, to be used later for groundwater sampling, will be utilized for development purposes. The bailers will serve both as a surge-block device loosening the fine-grained material from the well annulus, and as a mechanism to remove the water and sediment from the well. The surging is accomplished by rapidly raising and lowering the bailer within the screened section. Bailing will be continued until the water has sufficiently cleared or five well volumes of water have been removed.

4.90 On-Site Groundwater Analysis

A portable gas chromatograph will be used on-site during the drilling phase. Groundwater samples from newly constructed wells and existing wells along with surface-water samples, will be analyzed for volatile organic halogens as well as any other parameters deemed appropriate as the investigation progresses. Rapid analyzation of the water samples will aid in selecting sites for upcoming monitoring wells.

4.91 Instrumentation Used

The instrument selected for on-site groundwater analysis is an HNU Model 301 gas chromatograph equipped with a 10.2 eV photoionization detector (PID) and flame ionization detector (FID) in series. This combination allows for differentiation between aliphatic compounds and aromatic or other compounds containing carbon-carbon double bonds (i.e., methane vs. vinyl chloride). The GC column used for compound separation will be a 6-foot x 1/8-inch OD stainless steel column packed with either 1% SE-30 or its equivalent, Supelco SP2100.

A dual-pen Linsers strip-chart recorder will transcribe the detector's output. All charge recordings will be numbered sequentially and recorded in a log book. Daily charts will be separated and saved for subsequent analysis.

4.92 Analytical Procedure

Security procedures require that the GC equipment be disassembled and stored every evening. Therefore, a 1- to 2-hour warmup period will be necessary every day to permit the system to equilibrate. Air blanks and standards will be analyzed regularly.

Groundwater samples will be collected in 40 ml vials without any headspace, and kept refrigerated until the time for analyzation. Each vial will be opened, approximately 10 ml rapidly decanted, and the vial resealed. After temperature equilibration and one minute agitation, an air space sample will be removed with a syringe and analyzed by the GC.

4.93 Quality Control

A quality control program will be implemented during the on-site screening for the following purposes:

1. To determine the dialy response of the detectors to a known standard, typically a mixture of tetrachloroethylene, trichloethylene, and chloroform.

2. To observe the response of blank samples so as to establish a "zero" baseline.

3. To ensure that syringe contamination from samples with a high concentration of organics will be detected and corrected before the next sample was injected.

4. To ensure that water used for drilling fluid is contaminant-free.

The following presents a more detailed description of each of the above areas of concern.

4.93.1 Standards Analysis

Standards will be prepared by filling a 40 ml vial with 25 ml of organic-free water and capping with a teflon-lined silicone septum and hole cap. Measured volumes of stock solutions of organic compounds in methanol will then be injected through the septum. The concentration of the compound in the water will be calculated and the response of the GC detectors to equilibrium headspace samples will be observed.

It should be noted that this approach does not require knowing the actual concentration of a compound of interest in the air cap, as long as the total concentration of the compound in the vial is known, and a consistent volume of liquid is used. Standards will be prepared daily or when a deterioration of response is observed.

4.93.2 Air Blank Analysis

Samples of the field laboratory air and outside air will be tested regularly to eliminate the possibility of sample contamination by airborne compounds, which might get into a sample during preparation for analysis. Air blanks will also be run on samples being prepared for standards, after the water is introduced to the vial, but before injection of the stock solution.

4.93.3 Syringe Quality Control

After analysis of a highly concentrated sample, an air blank will be analyzed using the same syringe. If ghost peaks are observed, the syringe will be flushed several times with methanol and dried in the GC oven.

4.10.0 Monitoring Well Location

The final well locations will be determined after reviewing the results of the geophysical surveys, two dimensional groundwater model, surficial geologic mapping, and preliminary list of potential sources of contamination. Well locations will center around areas thought to contain highly permeable aquifer material, around areas appearing to be in the pathways from potential sources of contamination to the wellfield, areas defined during the two dimensional groundwater modeling as requiring additional input, and access considerations.

4.11.0 Monitoring Well Identification

Each cluster, pair, or single well location will be given a different number that will refer to all wells at that location. Individual wells at a location will be further identified as deep (D), intermediate (I), or shallow (S). For example, well cluster 3 would contain wells 3D, 3I, and 3S, and single well 12 might be 12I (or 12S). The well's identification number will be boldly painted on the outside of the casing of each well with black enamel paint.