REPORT PREPARED FOR
IBM, POUGHKEEPSIE

ENVIRONMENTAL ASSESSMENT

OF

BUILDINGS 001 AND 004 AREA

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CHAPTER 1.0

INTRODUCTION

1.1 OBJECTIVES

IBM (at Poughkeepsie) has recently undertaken several studies of the soil, bedrock, and groundwater. This report is one of a series and describes studies conducted in late 1980 and early 1981 in the vicinity of Buildings 001 and 004. The study area is illustrated on Figure 1.0-1.

The proximity of the sampling locations, continuity of the water table in this area, and the common underdrain and storm sewer system in the vicinity of Buildings 001 and 004 lend themselves to a combined discussion of the hydrogeology (Chapter 2.0). The chemicals found in the area are limited in extent to small areas, and were found in only a few wells.

Building 001 has been used by IBM since 1941. It was initially used for the manufacture of munitions and, later, electronic components. Computers now occupy most of the building. Building 004 was constructed in 1952 and was used primarily for the manufacture of typewriters and bombing and navigational systems. It housed electroplating processes and metal cleaning facilities, as well as other processes. Building 004 continues to be used for various processes and there are chemical storage tanks near the northwest corner of the building.

Dames and Moore (1979) sampled groundwater north of Building 004; 1,1,1-trichloroethane and trace amounts of other volatile organics were found. Near Building 001 trichloroethylene, 1,1,1 trichloroethane, tetrahydrofuran, and trichlorotrifluoroethane were found.

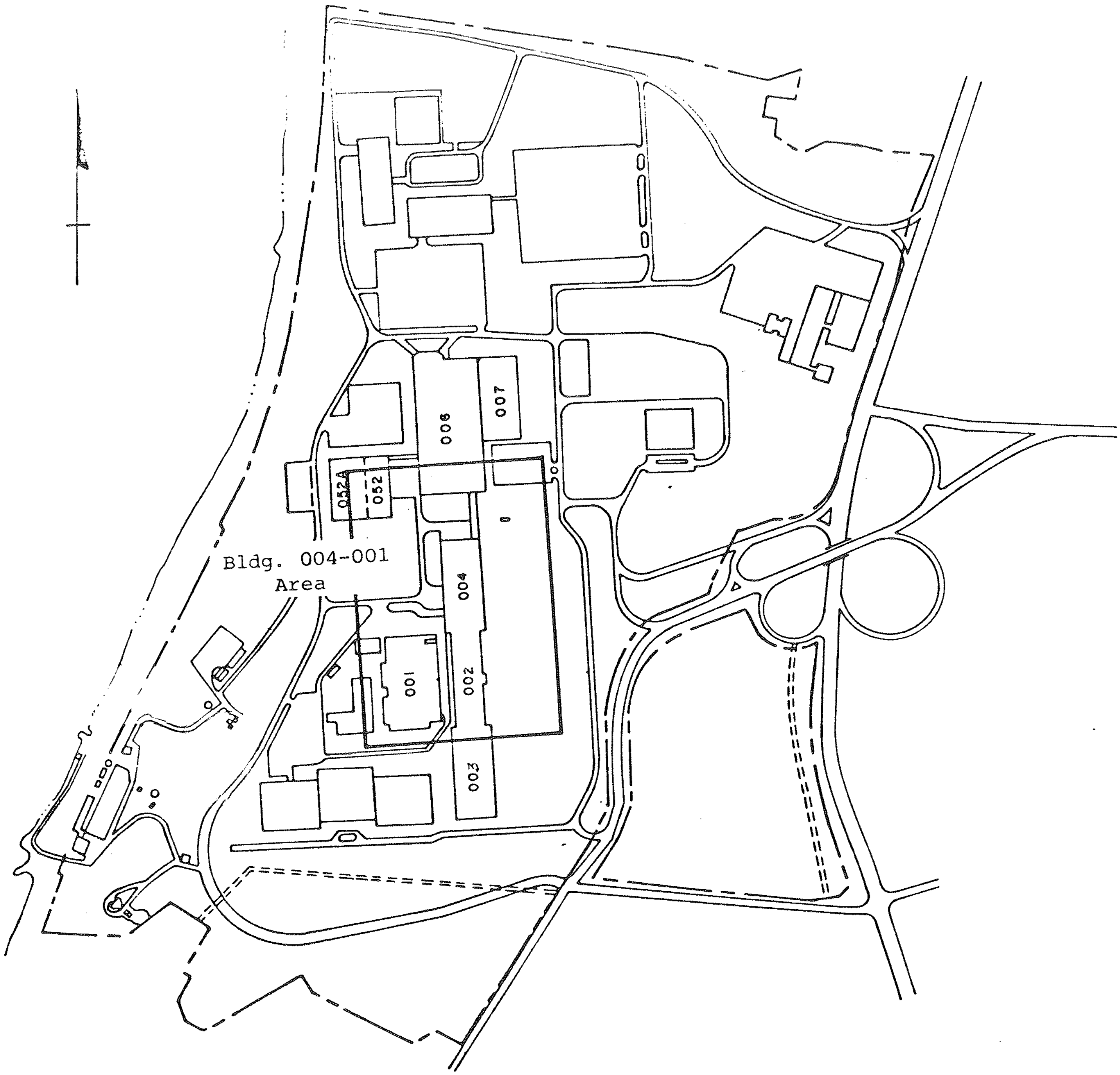


Figure 1.0-1

Main Plant Site
IBM - Poughkeepsie
Study Areas Covered by
This Report

The specific objectives of the current investigation were to determine:

1. Soil materials and their characteristics
2. The groundwater hydrology, including water table elevations, surface and bedrock aquifer characteristics, and other relevant features of groundwater hydrology in the area
3. The presence, extent, and concentration of any chemicals in the area

Investigation of this area began in November 1980, and was done in three phases, ending in March 1981. In the first phase, water samples were collected from the existing wells to confirm previous results reported by Dames and Moore (1979). New borings were drilled in the second phase to provide sampling locations in the area. After the results from these borings were obtained, three additional ones were drilled in the third phase to provide supplemental sampling locations.

This report integrates the data collected and evaluated in the three phases. Each task is described in order. Chapter 2.0 describes the drilling program, soil investigations, and conclusions regarding hydrogeology. Procedures are described in Appendix A; boring profiles are provided in Appendix B; summaries of field and laboratory soil observations appear in Appendix C. Appendix D provides the calculations of permeability and aquifer flow rates for the area. Chapter 3.0 describes the sampling and chemical analysis programs. Appendix E describes the sampling methodology, while Appendices F and G present temperature measurements and chemical analysis results, respectively.

CHAPTER 2.0

HYDROGEOLOGIC ANALYSIS*

2.1 INTRODUCTION

This study was concentrated in the location of Buildings 004 and 001 with the following purposes in mind:

1. To examine the configuration of the subsurface geology and to determine the direction and rate of groundwater flow.
2. To provide soil and rock samples for grain size and chemical analyses.
3. To install sampling points from which groundwater samples could be efficiently collected.

2.2 LOCATION OF MONITORING WELLS

Informal discussions were held throughout the investigation with IBM personnel who have knowledge of the history of the area in question. Drawings and plans held by IBM were searched and reviewed for any clues as to the historic use of these areas and for specific information relating to the nature and extent of chemicals. Compilation and study of existing maps, aerial photos, and boring logs are presented on Plate 1 with new data collected by REWAI. The existing information was thoroughly reviewed before any new borings were drilled.

*Material for this chapter was prepared by R.E. Wright Associates, Inc. (REWAI) under subcontract to LMS.

During a previous study conducted by Dames and Moore (1979), chemicals were identified in boring ST-1 located at the northwest corner of Building 004. With the purpose of identifying the extent and movement of these substances, additional borings were drilled. Seven locations (T-1, T-2A, T-3, T-4, T-5, T-6, and T-7) were intended to effectively bracket the area of ST-1 and to determine the extent of any subsurface migration. One sampling location (T-17) was located upgradient with the intent of providing background information, while three borings (T-23S, T-23R, and T-24) were later located to the east to confirm assumed bedrock geology and to investigate the possibility of chemicals near the bedrock-soil interface.

During the above Dames and Moore study several volatile organics were found in the groundwater. In order to evaluate the groundwater quality, both a shallow soil aquifer boring and a deep boring (T-9 and T-8, respectively) were located in this area.

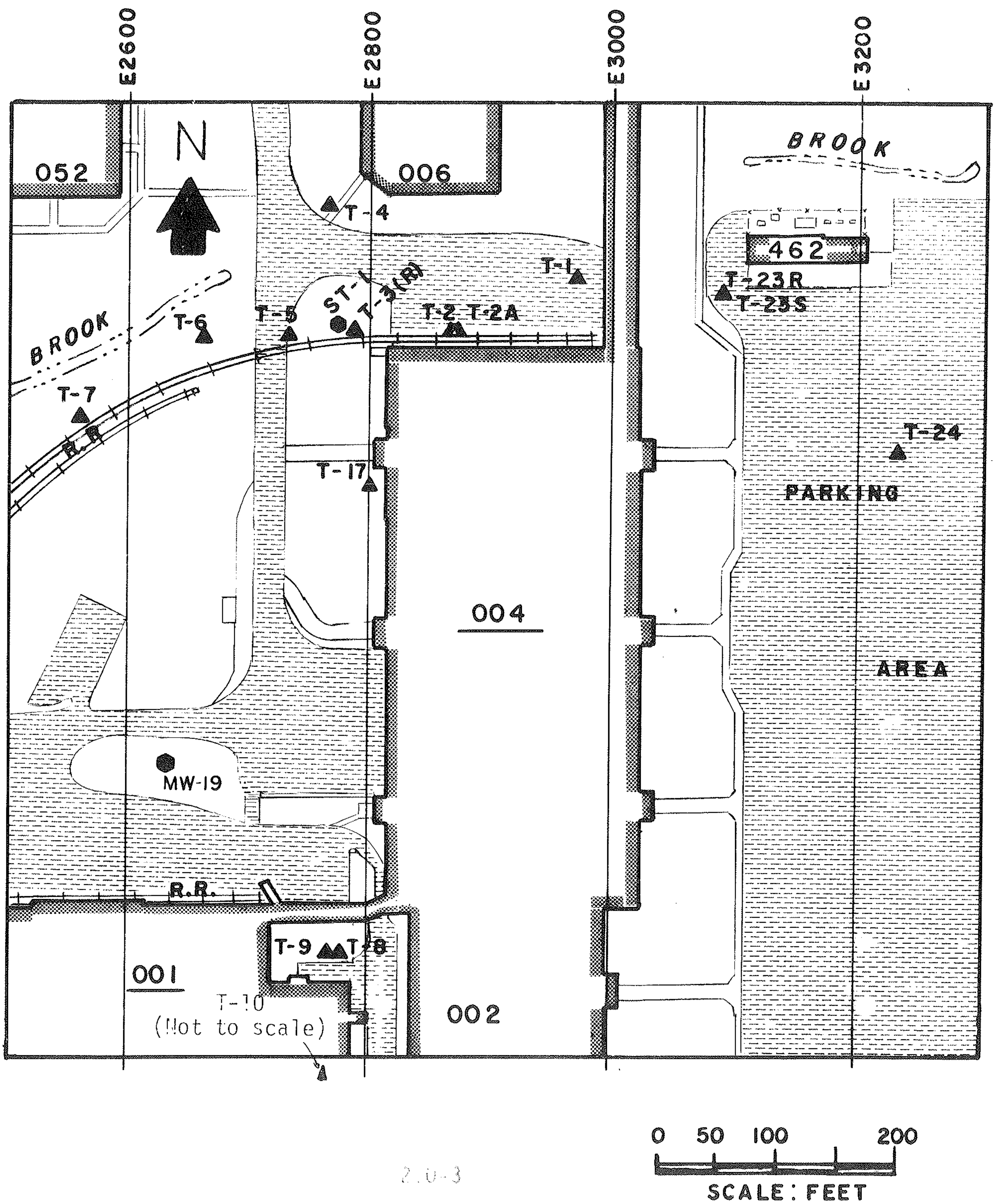
Boring T-10, located between Buildings 001 and 002, was drilled to establish whether or not a bedrock trough predicted by the Dames and Moore study exists in this area. The locations of borings near Buildings 001 and 004 are illustrated on Figure 2.0-1.

The procedures for drilling, sampling soil, construction of the monitoring and sampling point, and development are described in detail in Appendix A. Geologic logs of each boring and specific construction details on the well points are located in Appendix B. Appendix C summarizes field observations made during drilling.

Upon collection of the field data, soil samples were examined in the laboratory to verify field observations and to note any obvious

FIGURE 2.0-1

BUILDING 004 AND 001 BASE MAP



odors and textures. During this examination, representative samples were selected for sieve analysis to assist in permeability determinations. The remaining samples were then provided to LMS for various chemical testing procedures.

2.3 GEOLOGIC FRAMEWORK

Published reports of regional geology of Dutchess County indicate that the IBM Plant is underlain by unconsolidated glacial deposits of silts, sands, and clays overlying shale or slate of the Hudson River Formation. Simmons et al. (1961) identified the geology near the IBM Poughkeepsie plant as primarily stratified, fine-grained lacustrine deposits and sand and gravel deposits of glacial origin. Deposition of lacustrine deposits occurred in relatively quiet parts of glacial lakes and typically contained layers of silt and clay. Local sand and gravel deposits are also of glacial origin and are reported to range from clean sand to mixtures of sand and gravel.

2.3.1 Bedrock

The study area of Building 004 lies approximately 70 to 90 ft above the Hudson River. Bedrock underlying the study area consists of gray to black shale of the Hudson River Formation.

Elevation contours on the top of the bedrock are shown on Plate 2. These contours are based on the analysis of 14 borings drilled during this study, logs of borings drilled during the Dames and Moore study (1979), bedrock outcrop mapping, and available test boring logs from various IBM construction projects. These contours reveal an irregular undulating surface. A bedrock high located beneath Building 004 and bedrock lows southeast of Building 004 dominate the general topography. North of Building 004 an east-sloping bedrock surface is bracketed by borings T-3, T-2A, and T-4. Local depressions accentuating the irregular nature of the surface are located near T-4, T-17, and T-23R.

Cores of bedrock were taken at 10 locations, with depths of penetration ranging from 5 to 22 ft. Inspection of the rock cores indicated that the top few feet of bedrock are highly weathered, fractured, and considerably more permeable to groundwater flow than deeper, unweathered bedrock. The few inches of sediment overlying the bedrock subsurface often contained shale fragments.

2.3.2 Unconsolidated Material

Generally, two types of unconsolidated material, silts and sands, are found in this study area. The silt layer most often occurs directly overlying the Hudson River Formation and in turn is overlain by a sequence of increasingly coarser sands. Coarse, unsaturated fill material consisting of sands and gravel is located nearest the ground surface. A description of these unconsolidated units and local variations is given below.

2.3.2.1 Silt. A gray to brown silt layer ranging from 3 to 42 ft in thickness occurs east of location T-5, as seen in cross section G-G' (Plate 3) and pinches out to the south of location T-17 against the Hudson River Formation, as seen on cross section F-F' (Plate 3). The silt layer occurs again west of Building 002 in the vicinity of T-8, but is interlayered with a coarser sand as well as sand and gravel farther to the south. This unit continues to thin to the south, eventually pinching out in the vicinity of T-10.

It is important to note that this silt layer, which is up to 42 ft in thickness, overlies most of the bedrock north of Building 004. As will be discussed later, the lower permeability of this unit indicates that it acts primarily as a confining layer between water in the lower bedrock and the shallow sandy units located near the surface.

2.3.2.2 Sands and Gravels. To the north of Building 004, silty sand commonly overlies the finer grained silt layer. In this area, a thin layer of silty humus (ranging from 1 to 3 inches thick) occurs at a uniform depth in borings T-1, T-2, T-5, T-6, and T-7. It is speculated that an old pond, previously located in this area (Plate 1), was responsible for deposition of this organic material. Examination of a 1941 topographic map of the area substantiates that the elevation of the pond bottom would correspond to this layer. Because the pond existed prior to expansion of the plant, it is likely that the sands and gravels which overlie this humus layer are fill materials put into place during construction.

A pebbly sand overlies the silt in borings T-3 and T-4. These borings are located close to underground drains and storm sewers, with the bottom of the pebbly sand corresponding to the invert elevations of the pipes.

Many possibilities exist, both natural and man-made, to explain why this area would contain coarse-grained materials. Among these are that this material represents backfill used in the construction of underdrains or general construction of the Building 004 area; that backfill material was used to fill in and regrade the old pond area; and that an old stream, located in this area before the pond was drained, may have deposited coarse-grained material. The location of this coarse material, as discussed later, acts as a preferred channel for groundwater flow, lowering the water table in this area.

In borings T-8 and T-10, located east of Building 001, coarser grained sand and gravel occur both beneath and above the silt layer. It is possible that these units represent deposits related to glacial events which interrupted the lacustrine deposition. These units are poorly sorted sands with a permeability intermediate between the silt and gravels. In boring T-10, where the pebbly sand units are most predominant, a silty sand and silt layer overlies these pebbly sand units. The material above the bedrock in T-8 is significantly coarser, and therefore more permeable, than any other naturally occurring unit found in this program.

Fill material consisting of poorly sorted silt, pebbly sand, and gravel overlies the top 3 to 9 ft in the area of Buildings 004 and 001. This material does not influence the movement of groundwater because the water table is located below the bottom of this zone except near locations T-1, T-3, and T-6. During periods of increased rainfall and elevated water table conditions, underdrains generally located at an elevation below this unit would also keep this fill material from becoming saturated.

2.4 HYDROGEOLOGY

2.4.1 Hydrologic Properties

Water in the ground occurs in interstices between soil particles and in fractures and discontinuities in bedrock. The source of water in the ground is precipitation which percolates into the ground from the surface. Groundwater responds to the force of gravity and flows downgradient, i.e., toward a lower head potential, and can be considered constantly moving.

Plate 1 shows the elevation with respect to mean sea level (msl) of water levels for the shallow observation wells, except T-17 and T-1, as measured on 28 January 1981. On that date T-17 was partially blocked, and the water level could not be obtained. A reading on 5 January was thus used and is considered valid because of the insignificant change in elevation observed in other wells during this period. Boring T-1 penetrates both the bedrock and soil aquifers. As such, it represents an integrated value of both shallow and confined aquifers. Because the head potential is higher in the bedrock aquifer which T-1 penetrates, the static water level measured is slightly higher than it would be for the soil aquifer alone. To correct this condition, the measured value of T-1 was reduced by 1.1 ft, proportionate to the head differential seen between the rock and soil boring pairs in the area (ST-1 and T-3, and T-23S and T-23R).

Observed values of water levels in borings penetrating the silt and measuring hydraulic pressures in the rock, as in T-23R and T-3, have higher head potentials than the shallower borings in the area immediately north of Building 004. In this situation, the silt layer acts as a confining layer between the two zones, an expected condition because of the low permeability of the silt, hydrologically separating the lower bedrock aquifer from the shallow soil aquifer.

In the deep boring, T-8, located northeast of Building 001, the observed static water level was lower than that in the adjacent soil aquifer boring, T-9. These results are a reversal of the trend observed north of Building 004, and indicate a downward gradient. During the drilling of T-8 surface coarse sand and then a silty layer were found, followed by an extremely permeable layer of gravel, pebbles, and cobbles which produced large volumes of water. This gravel layer, which directly overlies bedrock, has a "draining" tendency, produced by its lowered hydrostatic head.

It is important to note that in spite of the downward hydrostatic gradient, a silt layer occurs between the top of the gravel and the coarser sands at the ground surface. The silt tends to retard the shallow water from percolation to the lower gravel aquifer.

The dominant feature in the shallow water table map (Plate 1) is a trough parallel to the north edge of Building 004 and plunging approximately due west toward Spring Brook. The condition is caused by manipulation of the water table by underdrains which occur under and north of Building 004 and by bedding surrounding the storm drain which runs parallel to the railroad tracks through the center of the paved area between Buildings 004 and 006. Utility conduits in the area also may serve as groundwater drains. Borings T-3, T-4, and T-5 also indicate that fill material, which makes up the top 5 to 10 ft of soil, is composed of coarse sand and gravel, which is more permeable than surrounding silts and silty sands and would act as an underdrain.

The significance of this groundwater trough is that liquid or water-soluble chemicals introduced into the ground will migrate toward the axis of the trough and then due west toward Spring Brook. It should be noted that this study was conducted during the low rainfall conditions of the winter of 1980-1981, when the water table was naturally lowered. With increased rain and subsequent rise in the water table, the underdrains will continue to control the configuration of the shallow groundwater, directing the flow above the drains into storm sewers or through the fill surrounding them and eventually into Spring Brook.

The buried conduit of Spring Brook north of Building 004 is not exerting a controlling influence on the groundwater flow. Evidence for this can be seen at T-4, a soil-aquifer boring, located directly beside the culvert. The measured static water level in this well is nearly 6 ft above the invert elevation of the 72-inch reinforced concrete pipe (72-inch RCP).

The gradient or slope of the water table near the north corner of Building 004 is relatively uniform, with an average slope of 2% along the south side of the trough and a slightly higher value (5%) to the north of the trough. The central axis of this trough has the shallowest gradient, being less than 1%.

Farther to the south, in the vicinity of Building 001, the gradient becomes flatter still, but continues to flow toward the west and north. Underdrains occur under all of Building 004 and probably control the water table under the southwest portion of the building as well as the northern corner of the building. Underdrains are not shown underlying Buildings 002 or 001.

2.4.2 Calculation of Groundwater Flow

Plate 1 shows the elevation (m.s.l.) of water levels in the observation wells as measured on 28 January 1981. Groundwater flows perpendicular to these contours and in a downgradient direction. The rate of flow is dependent on the slope or gradient of the water table.

The rate at which groundwater moves is also related to the permeability of the soil or rock. Permeability is defined as the capacity for transmitting fluids, which is dependent on the size and shape of pores or discontinuities and the size, shape, and extent of interconnections of these pores.

The quantity of groundwater which flows through an area can be calculated using Darcy's law, which is expressed as the following formula:

$Q = K I A$

where:

Q = the quantity of water passing through an area

K = the permeability of the soil or rock through which the groundwater is moving as defined above

I = the actual gradient or head potential on the water table

A = the area through which the groundwater passes

In examining the groundwater contours north of Building 004 (Plate 1), it becomes apparent that water in the soil aquifer will migrate to the trough north of Building 004. It is important to quantify the groundwater flow in this immediate area (see Figure 2.0-2).

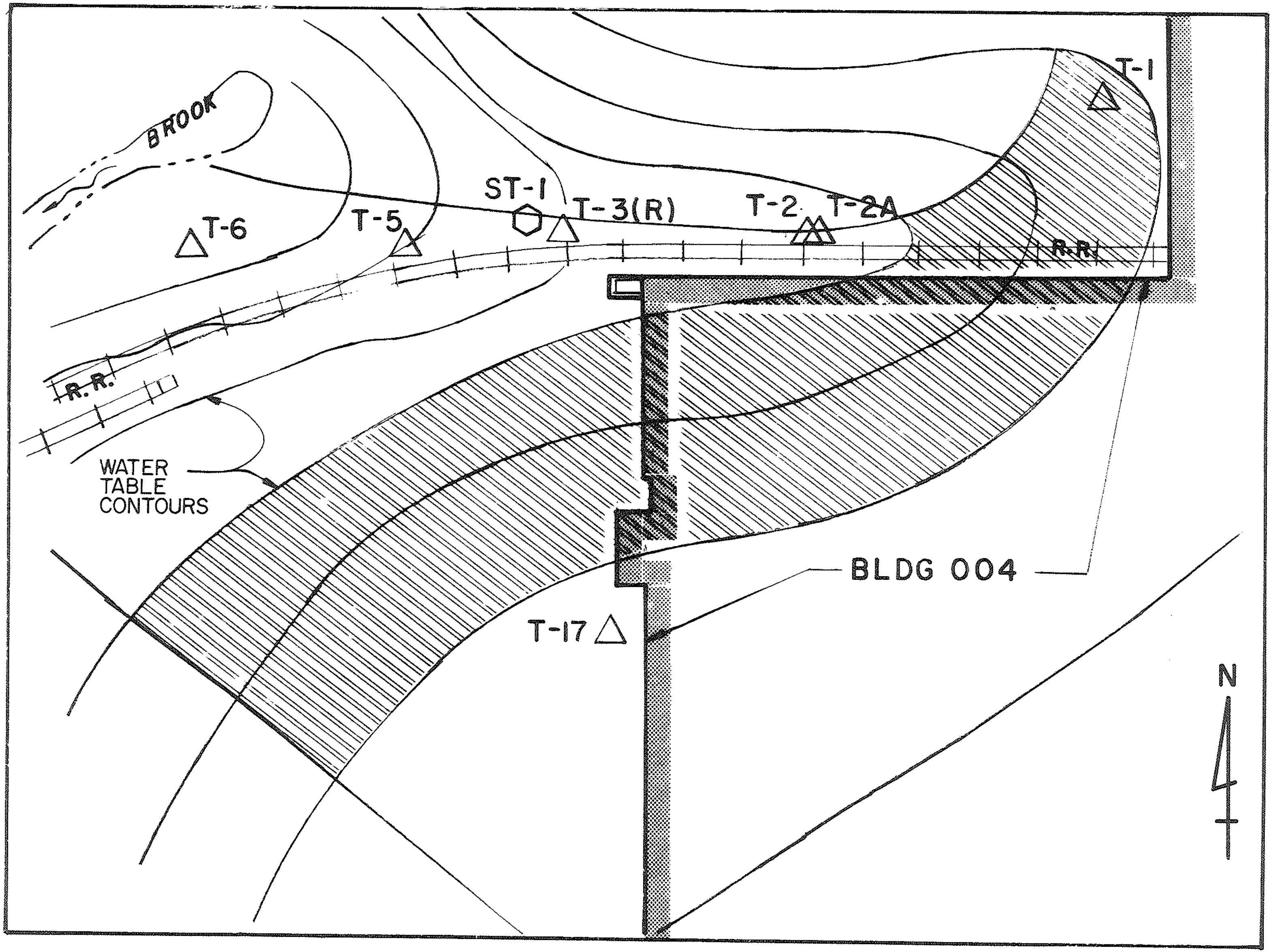
Darcy's law was used for this calculation and an explanation of terms follows. However, the presence of underdrains and the potential for channelized flow along the storm drain make calculations of total groundwater flow imprecise. The top of the water table is intercepted by the underdrains and the water that travels in these pipes is unaccounted for using this method.

The shaded region on Figure 2.0-2 shows the surface area used for the determination of the variables K, I, and A in the above equation. "A," the cross sectional area, is the length of the section h-h' times the depth from the top of the water table to the lowest point of interest.

Because both the saturated thickness and permeability change in this area, it is necessary to appoximate the contribution from each unit

FIGURE 2.0-2

CALCULATION OF FLOW-THROUGH AT NORTHWEST CORNER OF BUILDING 004



separately. To do this, four subdivisions of the aquifer were selected based on the geologic logs and estimates of permeability from sieve and hydrometer analysis (Appendix D). These units generally correspond to the geologic logs illustrated in Appendix B and described in Appendix C.

The description, average saturated thickness, permeability, gradient, and flow rate of each of these units are summarized in Table 2.0-1. Details are provided in Appendix D. The length of the area used is 358 ft. The gradient of 0.027 for Units 1, 2, and 3 is the average water table slope, whereas the gradient of the fourth unit is 0.016 based on the two rock borings in the area, T-3R and T-23R. In an area such as the upper plant, where various materials with different permeabilities are transmitting water, the total flow is determined by summing the calculated flow in each of these units.

As can be seen from comparison of these quantities, approximately 65% of the total flow-through occurs on top of the Hudson River Formation. A 16% flow occurs through the thin (average saturated thickness of 1 ft), coarse-grained material close to the ground surface. The permeability of this upper unit is approximately 15 times greater than the finer sands directly below it and nearly 25 times more permeable than the silt overlying the bedrock.

Groundwater contours from borings T-9 and T-10 indicate that there is a very gradual slope of the groundwater table in the Building 001 area to the northwest, toward Spring Brook. Water levels in existing borings MW-12, 18, and 19 located to the south of Building 001 suggest groundwater flow almost due west from Building 001. The gradient in the area of T-8, T-9, and T-10 is flatter than that occurring north of Building 004 and the thickness of the silt layer decreases to the south, while coarser materials increase. The saturated thickness thus consists of a more permeable material in this area.

TABLE 2.0-1

CALCULATED FLOW RATES NORTH OF BUILDING 004[a]

UNIT	DESCRIPTION	SATURATED THICKNESS (ft)	PERMEABILITY (ft/day)	GRADIENT (ft/ft)	FLOW RATE (gal/d)
1	Coarse-grained fill, sand, and gravel.	1	5	0.027	72
2.	Finer, deeper materials, primarily silty sand.	5.4	0.07	0.027	27
3.	Silt.	14.7	0.045	0.027	48
4.	Weathered shale (top 5 ft of the Hudson River Formation)	5	1.4	0.016	300
TOTAL					447

[a]Uses a section 358 ft long parallel to water table contour (see Figure 2.0-3).

Gravel which occurs overlying the bedrock below boring T-8 has an estimated permeability of 2.21 x 10^{-3} cm/sec (6.26 ft/day) and will conduct groundwater more rapidly than adjacent sediments. The absence of this coarse gravel elsewhere, the lack of detailed information on the extremely changeable subsurface conditions, and the extremely low measured groundwater gradient prevent calculation of lateral flow in this gravel layer or pocket.

2.5 LOCATION OF CHEMICALS BASED ON FIELD OBSERVATIONS

The purpose of this section is to present information which may be useful in interpreting quantitative results from analytical studies of soil and water samples. Obviously, senses of sight, touch, and smell cannot detect significant levels of some chemicals which could potentially exist in this area. However, the threshold of detectability of some oils and common hydrocarbon compounds such as gasoline is very close to or within the levels of significance for drinking water quality and health requirements.

Visual appearance, touch, and odor of the soil and water during drilling were noted by the drilling inspector. It is admitted that detecting odor under the very cold field conditions could have caused some insensitivity and inaccuracy to that particular sense. It is likely, however, that an odor would have been missed as opposed to sensed when it was not really there. This, therefore, must be considered a conservative approach to the location of chemicals in the soil and water. All samples were subsequently inspected in the laboratory by a geochemist who noted texture, odor, and visual appearance of the soil sample. These results are presented in Appendix C. In general, a sour smell at the water table and above was noted at T-1, T-2A, T-3, T-5, T-8, and T-23. Some field reports include hydrocarbon odor, but these were not verified in the laboratory.

CHAPTER 3.0

GROUNDWATER AND SOIL SAMPLING AND ANALYSIS PROGRAM

3.1 GENERAL

This chapter will discuss in turn the program of water sampling and that of soil sampling. The water sampling will be discussed generically because the sampling approach was used in the initial problem identification screening and also was applied to other areas in the overall environmental assessment; it is also discussed as applied specifically to the Buildings 001 and 004 area investigation. The soil sampling and analysis are discussed specifically for the area because they were done to investigate an identified potential problem.

3.2 GROUNDWATER SAMPLING AND ANALYSIS PROCEDURE

3.2.1 Objectives

The objectives of the groundwater sampling and analysis program were:

- Obtain samples representative of the full depth of water in the aquifer being sampled.
- Avoid contamination of the sample, which is of prime importance when sampling for trace constituents as in this program.
- Avoid loss of volatile constituents and gases.
- Analyze contributory physicochemical parameters, i.e., those which might affect the movement of the chemical constituents in the given soils, as well as the chemical constituents themselves.

3.2.2 General Methodology

Sampling of this nature, i.e., groundwater sampling for primarily trace constituents, is a relatively recent undertaking, and some published methods for sampling are not appropriate for investigation of trace levels of materials. Our procedure was initially based on past IBM, LMS, and literature experience, but as experience was gained, some modifications were made in the methodology, particularly with regard to the depth compositing method.

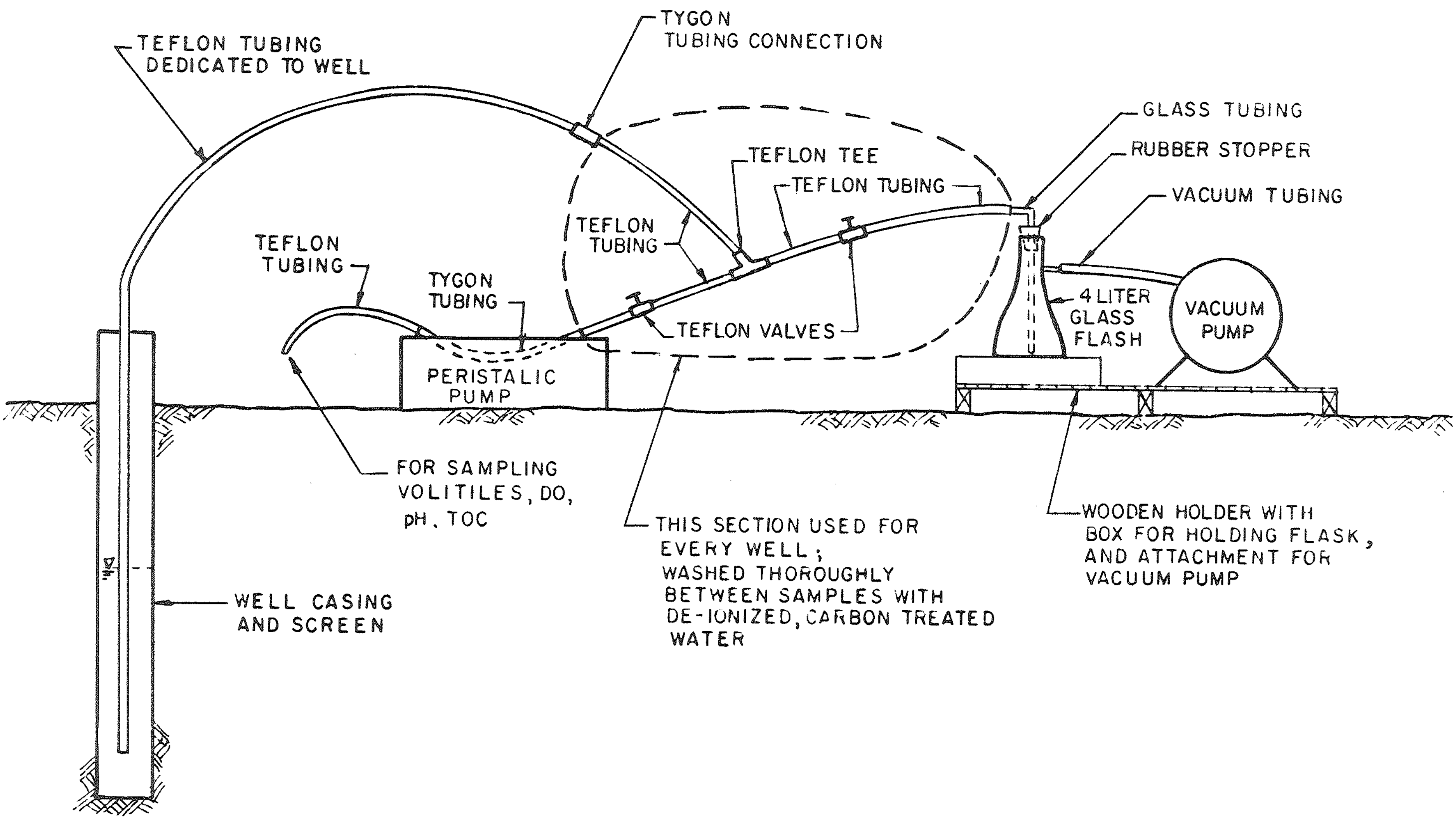
All wells sampled in this program had groundwater table within 20 ft of the surface; therefore, all sampling was based on the suction lift principle. This meant that suction tubing only, not a pump, had to be lowered into the well. The two methods of suction lift sampling commonly used are peristaltic and vacuum pumps. The peristaltic pump has the advantage of sampling without any air contact and therefore is ideal for avoiding loss of volatile or gaseous constituents from the sample. The vacuum pump has the advantage of a much higher rate of sampling than the peristaltic pump, but can lose volatile and gaseous constituents in the vacuum flask. Use of the high volume pump is attractive when sampling many wells because of the need to reduce field time, and thus cost, to a minumum. Based on these considerations, LMS designed a sampling train which took advantage of the beneficial characteristics of each sampling pump. Figure 3.0-1 shows the sampling arrangement used. This apparatus was used for all sampling runs except on days when the vacuum tubing line froze; on those days the peristaltic pump was used for all sampling.

As shown on Figure 3.0-1, Teflon tubing was used for the entire sampling train except the short piece of Tygon tubing in the peristaltic pump itself and the glass tubing at the vacuum flask. Teflon is the least reactive material in which flexible tubing is available. In order to prevent any cross-contamination between wells, each well had its own Teflon suction tube dedicated to it; tubing was kept in marked plastic bags at the LMS warehouse. Also shown on Figure 3.0-1 is the short section of Teflon tubing used for all wells, i.e., non-dedicated. This was done because of the expense of the Teflon valves. This section of the Teflon tubing was rinsed with deionized water before each well was sampled.

The method of compositing the sample over the depth of the aquifer was subject to some development during the project. Initially, we followed a procedure of sampling near the bottom of the well. This procedure assumes that because the water table is drawn down by the sample pumping, the sample taken near the bottom of the well is vertically mixed. As the project proceeded, and IBM, LMS, and REWAI developed a better understanding of the techniques and the local groundwater hydraulics involved, we identified certain shortcomings

FIGURE 3.0-1

EQUIPMENT ARRANGEMENT FOR SAMPLING IBM WELLS FOR PRIORITY AND CONVENTIONAL POLLUTANTS



with this procedure. Sampling a highly permeable aquifer in this fashion, i.e., one with little drawdown, would sample with a bias toward the lower water; conversely, sampling a poorly permeable aquifer, i.e., one with large drawdown, would sample with a bias to the upper water. In addition, there are some constituents of the water that tend to float, for example, free oil and grease, and others that tend to settle, i.e., those associated with silt particles which penetrate the sand and well screen. It is clear that no compositing method is perfect, given the variations from well to well which can occur in the permeability and chemical constituents. However, based on the above shortcomings, we decided that the best compromise solution would be to sample at three depths: near the top, at mid-depth, and near the bottom. For most chemical parameters, a composite was obtained by drawing equal volumes of sample at each depth into the vacuum flask. For the volatiles, taken with the peristaltic pump, separate samples were taken at each depth and shipped to the laboratory for compositing there; the laboratory withdraws equal aliquots from each vial through the vial cap into the syringe just prior to injection into the purge and trap system. Thus the sample is composited without contact with air. TOC and pH analyses were performed on composite peristaltic pump samples. DO was done on a peristaltic pump grab sample from mid-depth.

Before beginning the sampling program, a brief literature search was conducted to determine what contributory environmental factors might affect the movement of contaminants through the soil and their affinity for the soil. As was expected, although little detailed work has been reported on this topic, the primary factors were found to be temperature, pH, dissolved oxygen, specific conductance, and oxidation-reduction potential (redox). Some of these parameters, e.g., temperature, pH, and specific conductance, can also be indirect indicators of a chemical substance itself: for example, sodium hydroxide or a high temperature waste. Therefore, these analyses were performed on each well at each sampling, except where freezing conditions precluded the field determination of dissolved oxygen.

Appendix E contains a reproduction of the field instructions given to the sampling crews, which explains in detail the sequence in which sampling was performed. After taking the temperature profile and recording the static water level, the well was bailed three times its volume. The reason for bailing is to make sure that the water being sampled is representative of the water in the ground, not water that might have been in the well for a period of time with an opportunity to change characteristics because of evolution of constituents.

3.2.3 Sample Handling and Analytical Methods

It is important that standard and approved methods of sample handling and analysis be adhered to, especially when dealing with trace constituents, as in this program. Tables 3.0-1 and 3.0-2 summarize the protocol for this project.

All analyses for priority pollutants, including the EPA priority pollutants and the expanded IBM list, were performed by Recra Research, Inc., of Tonawanda, New York. In order to meet requisite holding times, samples were shipped via Federal Express immediately upon completion of a day's sampling. These were in all cases received by Recra the following morning, therefore meeting the required holding times. Chain of custody was established and adhered to on all sample shipments. The remainder of the analyses were performed mainly by LMS at its laboratory in

TABLE 3.0-1

CHEMICAL ANALYSES INFORMATION

PARAMETER	CONTAINER[a]	PRESERVATIVE[a]	HOLDING[a] TIME	ANALYTICAL[a] METHOD	DETECTION[b] LIMIT
Dissolved Oxygen	G bottle & top	Fix on site	8 hrs	Winkler (Azide Modification)	-
Ammonia Nitrogen	P,G	H_2SO_4 to pH<2 Cool, 4°C	28 days	Electrode	0.03 mg/l
pH	P,G	Determine on site	2 hrs	Electrometric Measurement	-
Specific Conductance	P,G	Cool, 4°C	28 days	Wheatstone Bridge Conductimetry	-
TOC	P,G	H_2SO_4 to pH<2 Cool, 4°C	28 days	Combustion Infra-red Method	1 mg/l
Oil and Grease	G	Cool, 4°C H_2SO_4 to pH<2	28 days	Liquid-Liquid extraction with trichlorotrifluoroethane-gravimetric	5 mg/l
Redox[c]	P,G	Cool, 4°C	-	Electrode	-
Cyanides	P,G	Cool, 4°C NaOH to pH>12 0.008% $Na_2S_2O_3$[d]	14 days	Colorimetric	20-30 μg/l[e]
Phenols	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days	Manual 4AAP with distillation	0.01-0.02 μg/l[e]
Mercury	P,G	HNO_3 to pH<2 0.05% $K_2Cr_2O_7$	28 days	0.45 μm filtration-flameless atomic absorption	0.8 μg/l
Metals (except above)	P,G	HNO_3 to pH<2	6 mos.	0.45 μm filtration-digestion - atomic absorption	Given in Table 3.0-2
Volatile Organics (Except Acrolein and Acrylonitrile)	G, Teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$[d]	14 days	GC/MS	Given in Table 3.0-2
Acrolein and Acrylonitrile	G, Teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$[d]	3 days	GC/MS	Given in Table 3.0-2
Base neutral Extractables	G, Teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$[d]	7 days (until extraction) 30 days (after extraction)	GS/MS	Given in Table 3.0-2
Acid Extractables	G, Teflon-lined cap	Cool, 4°C H_2SO_4 to pH<2 0.008% $Na_2S_2O_3$[d]	7 days (until extraction) 30 days (after extraction)	GC/MS	Given in Table 3.0-2
Pesticide/PCB's	G, Teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$[d]	7 days (until extraction) 30 days (after extraction)	GC	Given in Table 3.0-2

[a] From 40 CFR Part 136, Fed Reg., Dec. 18, 1979.
[b] Detection limit varies depending on sample and instrument. Range given where differences occur.
[c] No information given in 40 CFR Part 136.
[d] Should only be used in presence of residual chlorine.
[e] Detection limit varies depending on volume of sample available for analysis.

TABLE 3.0-2 (Page 1 of 4)

DETECTION LIMITS OF METALS AND ORGANICS

PARAMETER	DETECTION LIMIT (μg/l)[a]
Aluminum[b]	100
Antimony	100-500
Arsenic	1-3
Beryllium	3-5
Cadmium	3-5
Chromium	4-6
Copper	4-6
Iron[b]	20
Lead	20
Mercury	0.8-2
Nickel	20-30
Selenium	2-4
Silver	5-10
Thallium	20-200
Tin[b]	200-800
Zinc	4
2-chlorophenol	2
2,4-dichlorophenol	2
2,4-dimethylphenol	2
4,6 dinitro-o-cresol	20
2,4-dinitrophenol	50
2-nitrophenol	5
4-nitrophenol	10
p-chloro-m-cresol	2
Pentachlorophenol	5
Phenol	2
2,4,6-trichloro-phenol	2
Acentaphthene	2
Acentraphthylene	2
Anthacene	2
Benzidine	25
Benzo (a) anthracene	5
Benzo (a) pyrene	10
Benzo (b) fluoranthracene	5
Benzo (g,h,i) perylene	25
Benzo (k) fluoranthene	5
Bis (2-chloroethyl) ether	10
Bis (2-chloroethoxy) methane	10
Bis (2-chloroisopropyl) ether	10

TABLE 3.0-2 (Page 2 of 4)

DETECTION LIMITS OF METALS AND ORGANICS

PARAMETER	DETECTION LIMIT (μg/l)[a]
Bis (2-ethylhexyl) phthalate	10
4-bromophenyl phenyl ether	10
Butyl benzlphthalate	10
2-chloronaphthalene	3
4-chloro-phenyl phenyl ether	25
Chrysene	5
Dibenzo (a,h) anthracene	25
1,2-dichlorobenzene	4
1,3-dichlorobenzene	4
1,4-dichlorobenzene	4
3,3'-dichlorobenzidine	25
Diethylphthalate	10
Dimethylphthalate	10
Di-n-butylphthalate	10
2,6-dinitrotoluene	25
2,4-dinitrotoluene	25
di-n-octyl-phthalate	10
1,2-diphenylhydrazine	25
Fluoranthene	2
Fluorene	2
Hexachlorobenzene	5
Hexachlorobutadiene	5
Hexachlorocylcopentadiene	25
Hexachloroethane	10
Indeno (1,2,3-cd) pyrene	25
Isophorone	25
Naphthalene	2
Nitrobenzene	10
N-Nitrosodimethylamine	25
N-Nitrosodi-n-propylamine	25
N-Nitrosodiphenylamine	10
Phenathrene	2
Pyrene	2
2,3,7,8-tetrachloro-dibenzo-p-dioxin	10
1,2,4-trichlorobenzene	4
Acrolein	1
Acrylonitrile	2
Benzene	1-20
Bis-chloromethyl ether	3
Bromodichloromethane	5-10

TABLE 3.0-2 (Page 3 of 4)

DETECTION LIMITS OF METALS AND ORGANICS

PARAMETER	DETECTION LIMIT (μg/l)[a]
Bromoform	10-20
Bromomethane	5-10
Carbontetrachloride	2-5
Chlorobenzene	2-5
Chloroethane	5
2-chloroethylvinyl ether	10
Chloroform	3-5
Chloromethane	5
Dibromochloromethane	4-5
Dichlorodifluoromethane	5
1,1-dichloroethane	3-5
1,2-dichloroethane	1-5
1,1-dichloroethylene	1-5
Trans-1,2-dichloroethylene	1-5
1,2-dichloropropane	5
Cis-1,3-dichloropropane	5
Trans-1,3-dichloropropane	5
Ethylbenzene	1-5
Methylene chloride	3-5
1,1,2,2-tetrachloroethane	1-5
Tetrachloroethylene	1-20
Toluene	1-20
1,1,1-trichloroethane	2-5
1,1,2-trichloroethane	2-5
Trichloroethylene	5
Trichlorofluoromethane	1-5
Vinyl chloride	5
Aldrin	0.05-0.06
α-BHC	0.05
β-BHC	0.05-0.2
δ-BHC	0.05-0.1
γ-BHC	0.05-0.06
Chlordane	0.1-1
4,4'-DDD	0.05
4,4'-DDE	0.05-0.06
4,4'-DDT	0.05
Diepdrin	0.05
α-Endosulfan	0.05-0.1
β-Endosulfan	0.05
Endosulfan sulfate	0.05-0.2
Endrin	0.05

TABLE 3.0-2 (Page 4 of 4)

DETECTION LIMITS OF METALS AND ORGANICS

PARAMETER	DETECTION LIMIT (μg/l)[a]
Endrin aldehyde	0.05
Heptachlor	0.05-0.1
Heptachlor epoxide	0.05-0.06
PCB-1016	1
PCB-1221	1-2
PCB-1232	1
PCB-1242	1
PCB-1248	0.5-10
PCB-1254	0.5-1
PCB-1260	0.5-1
Toxaphene	0.1-0.7
Acetone[b]	10
1,2-dibromo-3-chloropropane[b]	15
Epichlorohydrin[b]	50
Ethyleneimine[b]	20
Isopropanol[b]	25
Methylethylketone[b]	10
Methylisopropylketone[b]	10
-propiolactone[b]	30
Tetrahydrofuran[b]	10
1,1,2-trichloro-1,2,2-trifluoroethane[b]	10
Xylene[b]	10
2-acetamidofluoroene[b]	10
4-aminobiphenyl[b]	10-15
t-butylbenzene[b]	10-20
4-dimethylaminoazobenzene[b]	10-20
Methylene (bis)2-chloroaniline[b]	20
α-naphthylamine[b]	5
β-naphthylamine[b]	5
4-nitrobiphenyl[b]	10-20
Pyridine[b]	15
Hydroquinone[b]	10
Methoxychlor[b]	0.1-0.2

[a]Detection limit may vary depending on sample and machine variability. Range given where differences occur.

[b]Not on EPA priority pollutant list.

Nyack, New York. Standard in-house procedures of sample custody were used. One sample for ammonia was split and analyzed by Camo, Inc., of Hyde Park, New York, as a quality control check against the LMS ammonia analysis.

In general, LMS used either Standard Methods or EPA-approved techniques for its field and laboratory analyses. Recra used the EPA April 1977 Protocol for Priority Pollutant Determination. Oil and grease analyses were done by gravimetric method, with a detection limit of 5 mg/l.

3.3 SOIL EXTRACTIONS

Based on early results of water analyses, some attention was focused on heavy metals in the area: it appeared that the metal concentrations found might be caused by the presence of elevated levels of metals in the soils. Heavy metals generally adsorb to a fair degree on soils (with a degree of dependence on pH and redox potential), and, therefore, soil analysis is necessary for determining the total amount available for potential leaching.

The analytical technique used is that described in Castellano (1973), Isaac and Johnson (1974), and Ritter et al. (1978). It consists of dry ash digestion at 550°C, followed by acid leaching with HCl at 120°C. The sample thus treated is filtered, and the filtrate analyzed by flame atomic absorption.

Samples were chosen to be representative of the various soil lenses in 8 of the 12 borings in the 004 area. Samples were taken in the unsaturated zone, as well as the saturated. A total of 15 different samples were analyzed.

Metals tested were antimony, chromium, cadmium, nickel, and lead. This choice was based on a review of the groundwater data available at the time, which indicated that these were the metals most likely to exhibit elevated concentrations.

3.4 RESULTS

Tables 3.0-3 and 3.0-4 are summaries of the field data collected in the 001 and 004 areas, respectively. Included on these tables are the well depth; static water levels before and after bailing, and after sampling; bailing volume; sampling depths; and comments on unusual occurrences. Refer to Section 3.2.2 for the rationale for sampling at various depths.

Appendix F contains the temperature profiles obtained on the wells in the field. Tables 3.0-5 and 3.0-6 summarize all the chemical data collected from the groundwater in the 001 and 004 areas, respectively. It should be noted that for analyses of the conventional constituents, all results are reported, i.e., even if a constituent was not detected. For the analyses listed under organics and metals, those compounds or metals not detected are not listed. Complete results of these analyses are in Appendix G.

It should also be noted that not all organics or metals were analyzed each time. Initial samples were analyzed for all EPA priority pollutants plus the additional organics and metals commonly used by IBM. These initial samplings showed no base neutrals or acid extractables and very low concentrations of pesticides/PCB.

TABLE 3.0-4 (Page 1 of 2)

FIELD DATA SHEET
BUILDING 004

STATION	DATE	TIME	WELL DEPTH (ft)[a]	STATIC WATER LEVEL (ft)[a]	WELL CAPACITY (gal)	BAILED VOLUME (gal)	STATIC WATER LEVEL AFTER BAILING (ft)[a]	SAMPLING DEPTH (ft)[a]	STATIC WATER LEVEL AFTER SAMPLING (ft)[a]	NOTES
ST-1	10/24/80	1200	14'0"	7'6-1/2"	0.6	2.5	9'0"	12'0"	8'1"	
	11/25/80	1430	14'0"	7'5"	0.6	1.8	8'0"	12'0"	8'0"	
	12/10/80	1530	14'0"	7'7"	0.6	1.8	7'9"	11'0" and surface	8'2"	
	1/13/81	1040	14'0"	7'7"	0.6	1.8	8'6"	9'0", 10'6", 12'0"	8'10"	
2A	1/13/81	1240	26'4"	6'4"	1.8	5.5	7'8"	8'0", 16'0", 24'0"	7'3"	
	2/12/81	0841	26'4"	6'6"	1.8	5.1	11'8"	8'0", 16'0", 24'0"	7'6"	
4	1/13/81	1400	28'0"	8'2"	1.8	5.5	14'4"	12'0", 19'0", 26'0"	13'7"	Let well recover to 13'0" before sampling
5	1/13/81	1630	19'4"	10'8"	0.8	-	-	-	-	Could only get total of 1 gallon from well - used this for sample; (sample silty).
	3/18/81	1600	19'4"	10'3"	0.8					Kept bailed volume as part of sample well drawn down
6	1/14/81	0847	18'6"	12'5"	0.55	1.65	13'6"	14'6", 15'6", 16'6"	12'3"	
7	1/14/81	0857	13'3"	10'1"	0.27	-	-	-	-	Little water available sampled at one depth only; well ran dry quickly.
17	1/14/81	1100	34'6"	17'3"	1.6	4.75	17'3"	18'0", 25'0", 32'0"	17'3"	-

[a]All measurements from top of casing.

TABLE 3.0-4 (Page 2 of 2)

FIELD DATA SHEET
BUILDING 004

STATION	DATE	TIME	WELL DEPTH (ft)[a]	STATIC WATER LEVEL (ft)[a]	WELL CAPACITY (gal)	BAILED VOLUME (gal)	STATIC WATER LEVEL AFTER BAILING (ft)[a]	SAMPLING DEPTH (ft)[a]	STATIC WATER LEVEL AFTER SAMPLING (ft)[a]	NOTES
1	2/12/81	1215	43'8"	2'11"	3.8	11.41	11'8"	12'0", 27'0", 42'0"	4'6"	
23R	2/13/81	0930	49'0"	9'1"	3.73	11.18	9'6"	11'0", 29'0", 47'0"	9'4"	
23S	2/13/81	1045	15'6"	11'11"	0.32	9.7	11'11"	12'6", 13'6", 14'6"	11'11"	
24	2/13/81	1215	56'1"	7'10"	4.42	13.27	8'1"	9'0", 31'6", 54'0"	7'10"	
3	3/18/81	1100	41'8"	6'9"	3.2	9.7	7'6"	8'6", 24'0", 40'0"	7'0"	

[a]All measurements from top of casing.

TABLE 3.0-5 (Page 1 of 2)

ENVIRONMENTAL ASSESSMENT OF
WELL SAMPLING RESULTS BUILDING 001

STATION	DATE	DO (mg/l)	NH_3-N (mg/l)	pH[a]	SPEC. COND. (μmhos/cm)	TOC (mg/l)	OIL AND GREASE (mg/l)	REDOX (MV)	ORGANICS (μg/l)[b]	METALS[b] (mg/l)
MW-19	10/24/80[c]	NR	0.11	/7.2	NR	NR	NR	NR	Trans-1,2-dichloroethylene - 68 Tetrachloroethylene - 31 1,1,1-trichloroethane - 65 Trichloroethylene - 350 α-BHC - 0.05[f] Phenols - 10	Al - 1.0 Zn - 0.046 Cr - 0.010 Pb - 0.04
	2/4/81[d]	2.1	0.025	6.8/	1110	5.7	32.8	340	Trans-1,2-dichloroethylene - 49 Tetrachloroethylene - 120 1,1,1-trichloroethane - 14 Trichloroethylene - 520 β-BHC - 0.05[f] Cyanides - 16	Zn - 0.01
8	2/4/81[d]	3.3	4.2	7.2/	1051	4.5	<5	370	1,1-dichloroethylene - ≤2 Trans-1,2-dichloroethylene - 12 1,1,1-trichloroethane - 6 Trichloroethylene - 1800 Trichlorofluoromethane - 2 Vinyl Chloride - 18 α-BHC - 0.03[f] δ-BHC - 0.13[f] Heptachlor - 0.06[f]	Sb - 0.2 Zn - 0.005
9	2/4/81[d]	NR	0.063	7.3/	1178	17.5	<5	330	Chloroethane - ≤5 Chloroform -4 Dichlorodifluoromethane - 7 1,1-dichloroethane - 120 1,1-dichloroethylene - 46 Trans-1,2-dichloroethylene - 160 1,2-dichloropropane - 460 Tetrachloroethylene - ≤ 2 1,1,1-trichloroethane - 1700 Trichloroethylene - 1100 Trichlorofluoromethane - 700 Vinyl Chloride - 40 Aldrin - 0.05[f] α-BHC - 0.08[f] β-BHC - 0.13[f] δ-BHC - 0.14[f] γ-BHC - 0.08[f] Heptachlor epoxide - ≤ 0.01 4,4'-DDE - ≤ 0.01 Cyanides - 76	Cu - 0.01 Pb - 0.03 Zn - 0.016

TABLE 3.0-5 (Page 2 of 2)

ENVIRONMENTAL ASSESSMENT OF
WELL SAMPLING RESULTS BUILDING 001

STATION	DATE	DO (mg/l)	NH_3-N (mg/l)	pH[a]	SPEC. COND. (μmhos/cm)	TOC (mg/l)	OIL AND GREASE (mg/l)	REDOX (MV)	ORGANICS (μg/l)[b]	METALS (mg/l)[b]
10	2/4/81[d]	4.5	0.154	7.5/	1234	4.7	<5	360	1,1,1-trichloroethane - 4 Trichlorofluoromethane - ≤ 2 -BHC - 0.05[f] -BHC - 0.02[f]	Cr - 0.006 Pb - 0.04 Zn - 0.016

[a] First value done in field, 2nd value done in lab.
[b] Compounds or metals not listed were less than the detection limit.
[c] Full scan performed including additional organics and metals.
[d] Volatile scan and pesticide/PCB scan performed plus phenols and cyanides; metals scan
[e] Full scan performed.
[f] Compound indicated but level too low for GC/MS confirmation.

TABLE 3.0-6 (Page 1 of 2)

ENVIRONMENTAL ASSESSMENT
WELL SAMPLING RESULTS BUILDING 004

STATION	DATE	DO (mg/l)	NH_3-N[a] (mg/l)	pH[b]	SPEC. COND. (µmhos/cm)	TOC (mg/l)	OIL AND GREASE (mg/l)	REDOX (MV)	ORGANICS (µg/l)[c]	METALS (mg/l)[c]
ST-1	10/24/80[d]	NR	72.3/	/7.05	NR	NR	NR	NR	Chloroethane - 10 Chloroform - <u><</u>3 1,1-dichloroethylene - 1 1,1-dichloroethane - 35 1,1,1-trichloroethane - 150 Trichloroethylene - 5 Phenols - 10 α-BHC - <u><</u>0.05[g] β-BHC - 0.2[g] Endosulfan sulfate <u><</u> 0.05[g]	Al - 0.4 Cu - 0.138 Fe - 0.22 Ni - 0.39 Zn - 0.052
	11/25/80	0.95	39.9/31.5	5.6/6.4	1060	24.0	31.2 (?)	240	None detected - only Selected Volatiles analyzed	Cu - 0.016 Fe - 0.22 Ni - 0.18 Zn - 0.109
	12/10/80	0.85	<0.03/	6.8/6.6	1186	11.5	<5	250	NR	NR
	1/13/81[e]	NR	25.2/	/5.9	1412	13.4	<5	290	1,1-dichloroethane - 26 1,1,1-trichloroethane - 11 Trichloroethylene - 4	Sb - 0.1 Cr - 0.004 Cu - 0.056 Ni - 0.03 Zn - 0.069
2A	1/13/81[e]	NR	0.812/	/10.7	429	9.7	<5	230	None detected	Sb - 0.2
	2/12/81[f]	2.15	0.178/	8.3/	426	3.3	<5	230	Trichlorofluoromethane - 3	Sb - 0.2 As - 0.005 Zn - 0.060
4	1/13/81[e]	NR	0.35	/5.7	927	8.7	<5	280	None detected	Zn - 0.013
5	1/13/81	NR	0.798	/11.6	5980	7.5		130	NR	NR
	3/18/81[e]	3.5	0.70	/11.9	1797	8.0	<5	150	None detected	Ca - 120 Na - 54 Cr - 0.066 Ag - 0.015 Zn - 0.051
6	1/14/81[e]	NR	0.90	/6.5	503	8.5	<5	230	Trichlorofluoromethane - 5	Sb - 0.1 Be - 0.005 Cd - 0.007 Cu - 0.008 Zn - 0.028

TABLE 3.0-6 (Page 2 of 2)

ENVIRONMENTAL ASSESSMENT
WELL SAMPLING RESULTS BUILDING 004

STATION	DATE	DO (mg/l)	NH_3-N[a] (mg/l)	pH[b]	SPEC. COND. (µmhos/cm)	TOC (mg/l)	OIL AND GREASE (mg/l)	REDOX (MV)	ORGANICS (µg/l)[c]	METALS (mg/l)[c]
7	1/14/81[e]	NR	0.067	/6.2	549	3.5	10.0	210	Trichlorofluoromethane - 5	Cd - 0.011 Cr - 0.008 Cu - 0.014 Pb - 0.8 Zn - 0.026
17	1/14/81[e]	NR	0.108	/6.2	578	4.0	<5	230	Trichlorofluoromethane - 5	Cd - 0.008 Pb - 0.06 Zn - 0.012
1	2/18/81[e]	0.35	0.161/		738	4.2	16.3 (?)	310	Trichlorofluoromethane - 3	Sb - 0.3 Cu - 0.024 Zn - 0.047
23S	2/13/81[f]	1.3	0.168/	6.9/	710	3.5	<5	370	α-BHC - 0.03 γ-BHC - 0.02 Endosulfan sulfate - 0.17 α-Endosulfan - ≤ 0.01	Cr - 0.012 Cu - 0.008 Zn - 0.007
23R	2/13/81[f]	0.4	0.252/	8.1/	445	4.5	<5	363	Methylene chloride - 33 Trichlorofluoromethane - 31 α-BHC - 0.02 γ-BHC - ≤ 0.01	Sb - 0.2
24	2/13/81[e]	0.6	0.102/	7.8/	726	3.5	<5	362		Sb - 0.2 Cr - 0.010
D-13	2/13/81[f]	2.2	6.72/	8.8/	1187	7.5	<5	371	1,1-dichloroethane - 72 1,1-dichloroethylene - ≤ 5 1,2-dichloropropane - 8.7 Methylene chloride - 12 1,1,1-trichloroethane - 33 Trichloroethylene - 140 α-BHC - 0.06 γ-BHC - ≤ 0.01	Cu - 0.078 Zn - 0.016
3	3/18/81[e]	0.5	0.32	/7.4	748	6.5	<5	200	Trichloroethylene - 6	Zn - 0.076

Notes: NR - not run.

[a] First value done by LMS; 2nd value done by Camo.
[b] First value done in field; 2nd value done in lab.
[c] Compounds or metals not listed were less than detection limit (refer to footnote by date for groups of cpds run).
[d] Full scan performed including additional organics and metals.
[e] Volatile scan performed plus phenols plus cyanides.
[f] Volatile scan and pesticide/PCB scan performed plus phenols plus cyanides.
[g] Compound indicated but too low for GC/MS confirmation.

The additional IBM organics and metals were also not found. Therefore, additional samplings for organics on the wells in the 001/004 area were mainly for the volatile priority pollutants, cyanides, and phenols only. Each sampling date in Tables 3.0-5 and 3.0-6 is footnoted to show which scans were performed on that date.

Table 3.0-7 contains the data collected on the soil extractions. Included on the table are the grade elevations, depth of the sample, percentage of dry solids, and the mg/kg of each metal found.

TABLE 3.0-7

SOIL EXTRACTION RESULTS
METALS IN BUILDING 004 AREA

TEST BORING NUMBER	SOIL SAMPLE NUMBER	DEPTH OF SAMPLE (FEET BELOW GRADE)	CONCENTRATION (mg/kg)[a]				
			Sb	Cr	Cd	Pb	Ni
T-2A	3-A	4-6	<5	14.3	<0.125	3.82	15.25
T-3	4	3-4	<5	22.2	<0.125	9.42	20.42
T-3	6-A	5-7	7.2	20.8	<0.125	2.50	16.32
T-3	12-A	17-19	<5	14.5	<0.125	5.82	18.42
T-4	3	3-3.5	<5	20.3	<0.125	10.18	23.25
T-6	3-A	4-6	<5	24.2	<0.125	11.25	26.75
T-6	5-A	8-10	<5	24.1	<0.125	12.58	27.58
T-6	7-A	12-14	<5	14.8	<0.125	7.08	16.50
T-7	3-B	4-6	13.4	17.0	<0.125	10.15	16.42
T-7	3-B	4-6	6.2	14.3	<0.125	13.50	14.88
T-17	5	4-5	<5	19.1	<0.125	12.68	24.32
T-17	12-A	16-18	5.4	18.3	<0.125	6.42	21.25
T-23	5-A	4-6	10.5	12.1	0.232	23.58	12.08
T-23	10-A	14-15	<5	15.6	<0.125	7.00	14.32
T-23	23-D	42-44	10.4	14.5	<0.125	5.42	17.68
T-24	28-A	50-52	<5	16.7	<0.125	4.18	20.75
T-24	28-A	50-52	<5	17.4	<0.125	7.18	21.82
MEAN			<5	17.6	<0.125	8.98	19.3

[a] Sb - Antimony
Cr - Chromium
Cd - Cadmium
Pb - Lead
Ni - Nickel

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APPENDIX A

SOIL SAMPLING, DRILLING, AND WELL POINT INSTALLATION

APPENDIX A

SOIL SAMPLING, DRILLING, AND WELL POINT INSTALLATION

DRILLING AND SAMPLING PROCEDURES

All drilling equipment and operators were provided by Empire Soils Investigations Inc. One supervisor, provided by REWAI, was assigned to each drilling crew.

Two truck-mounted, hollow-stem auger drilling rigs were used during the drilling procedures. One was a Central Mining Equipment (CME) Model 55 and the other an Acker Model AD-2. Both units were powered by Ford industrial engines and used 140-pound hammers to drive the split-spoon samplers. Both rigs were capable of coring with either compressed air or water and used the same sized hollow-stem augers. Similarities between these rigs thus assured that a uniform drilling procedure was followed.

Continuous split-spoon sampling of the overlying soils was conducted with a 2-inch O.D., 2-foot split-spoon sampler. After being advanced 2 feet, the spoon and sample were removed and the augers advanced through the same 2-foot interval. In this way, only undisturbed soil samples were collected. Acker hollow-stem augers with a 6-inch O.D. and 3-3/8-inch I.D. were used during the drilling procedures.

An NX roller bit was used to clean the hole at the top of bedrock and an NX core barrel with a 2.97-inch O.D. and a 2.16-inch I.D. were used to collect rock samples.

Soil samples were logged in the field prior to removal from the spoon and the amount of recovery was measured. Once logged, the samples were transferred to unused 8-ounce glass jars with metal screw caps. The soil samples were then transported to REWAI's

Harrisburg office where each sample jar was examined for any conspicuous odor. Samples which were considered to be representative of the principal aquifer units were selected for sieve and hydrometer analysis. The remainder were returned to LMS for chemical analysis.

Rock cores were measured for recovery while still in the NX barrel. After measurement, the cores were placed in properly labeled boxes and returned to the possession of IBM, where they were stored in Building 077.

PIEZOMETER AND STANDPIPE CONSTRUCTION PROCEDURES

In the construction of all wells a basic design was followed in order that uniformity be maintained. The controlling feature which necessitated variations was the elevation of the static water level (SWL) with regard to the local stratigraphy and the top of bedrock.

Variations of this basic design will be discussed later.

Except in cases where a shallow soil aquifer boring was located adjacent to a deep boring, the following procedures were followed. A continuous split-spoon sample was collected, followed by advancement of the auger to bedrock. After cleaning the hole with an NX sized roller bit, an NX core barrel was used to collect rock samples.

Schedule 80 flush joint, threaded 10-slot screen was installed either within or above the bedrock unit. Threaded Schedule 80 flush joint, solid PVC pipe was fitted to the screen and extended to 2 feet above ground surface.

As the augers were withdrawn, Morie OON sand was poured into the annular space to a level 1 foot above the top of the screen. One foot of bentonite was then placed above the sand. A mixture of sand-cement mix and 2% bentonite was then used to grout the remainder of the hole to the ground surface. A 4-foot length of 4-inch diameter threaded steel protector pipe was then placed around the PVC riser pipe. In appropriate locations such as railroad sidings, a curb box was used instead of the steel protector pipe and finished flush to the ground surface.

Three variations upon this basic design were utilized. The first is a rock piezometer. As seen on Figure I-1, the static water level is in the soil zone and the screened interval located in the bedrock. This configuration permits measurement of the hydrostatic pressure in the rock aquifer since it is sealed from the upper units. Continuous soil samples, depth to bedrock, a sampling point for collecting waters in the bedrock aquifer, and hydrostatic head in the lower aquifer are provided with this design.

A second variation is the rock aquifer standpipe. In this configuration, (Figure I-2) the screened interval is placed above the static water level, both of which are located in the bedrock. This design was utilized when bedrock was encountered above the water table. Such a design provided soil samples, elevation to the top of bedrock, the static water level, and a sampling point to collect water samples which may contain free product.

A third variation is the soil aquifer standpipe. In this configuration, the top of the screen is located above the static water level, both of which occur in the soil above the top of the bedrock. This boring was designed to provide soil samples, elevations to the top of bedrock and the water table, and an interval for collecting water samples representative of the entire soil column. At refusal, the NX core was advanced 5 feet to insure that bedrock had been properly located and to collect a sample of the bedrock unit. This bottom 5 feet was then grouted back to the top of bedrock and allowed to cure before placement of the screen and riser pipe.

One additional variation not visually depicted includes the soil boring located beside a rock piezometer. This design is identical to the soil standpipe except that soil samples were not collected since this would duplicate the efforts of the adjacent rock piezometer. For the same reason, the boring did not extend to bedrock.

QUALITY CONTROL

In order to reduce the potential of contamination of soil and water samples from drilling procedures and materials used in well construction, several precautions lested below were taken.

The first precaution was to use sanitized flush joint threaded PVC pipe in all borings. This PVC pipe processed by Timco of Prairie du Sac, Wisconsin, was slotted, sanitized, and packed in plastic prior to shipment. The PVC remained in this protective packaging until actually placed in the boring. Furthermore, this pipe did not come into contact with equipment or personnel during the installation process. Threaded male and female ends on the pipe eliminated the need for solvent welding of PVC riser pipes which might have otherwise have contaminated water samples.

The drilling rigs and tools were thoroughly steam-cleaned both prior to mobilization to IBM's property and during drilling operations when equipment was moved from one area of the plant site to another. In addition, the split-spoon sampler was cleaned on site with a portable steam jenny before each sample was taken. Both of these procedures helped reduce sampling errors that may otherwise be assigned to cross-contamination.

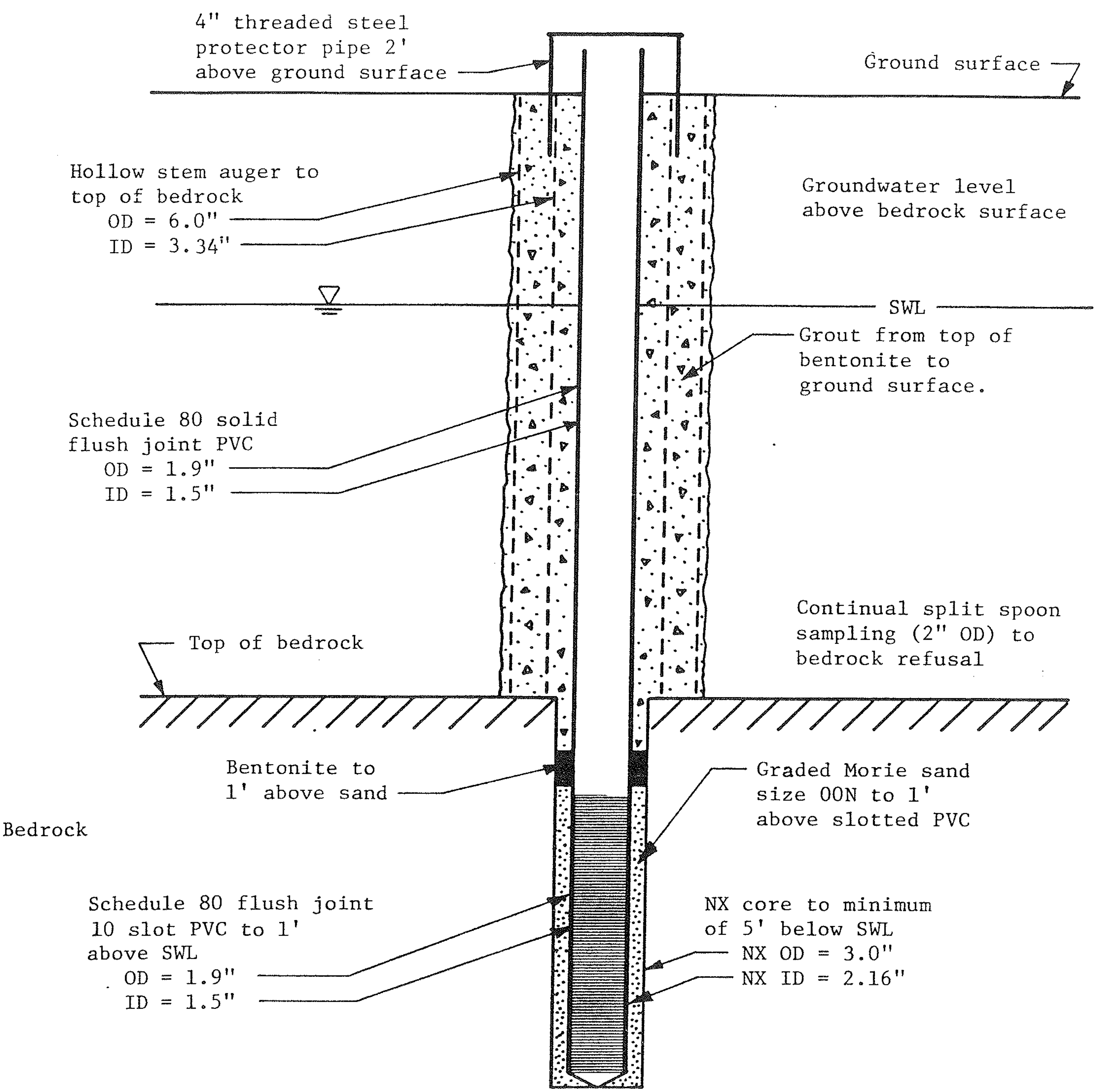
Precautions were also exercised when coring bedrock. If a water coring process was chosen, only clean tap water was introduced to the hole during this operation and recirculated. This method was chosen over the standard procedure of utilizing a local surface water source. During air coring operations, only properly filtered compressed air was used. Manufacturer's specifications stated that oil content inherent in compressed air was reduced to less than 1 part per million.

Each two-man crew of drilling operators was supervised by one REWAI inspector. Both the drillers and supervisors maintained separate records of the blow counts required to drive the spoon. In addition, separate field logs of the soil samples were maintained. The primary responsibility of the REWAI supervisor was to select an appropriate boring design, and insure that the well was constructed to agreed-upon specifications. Additional responsibilities included: measurements of static water levels; field logging of soil samples with respect to odor, color, and texture; insuring that the boring be maintained as free as possible from any contamination; insuring that sampling spoons and drilling equipment be thoroughly cleaned when necessary; that sample containers for both soil samples and bedrock cores be properly labeled and stored; and assurance that records taken by the drillers and the supervisor were in agreement.

Two types of sand were used in construction. The first was a sanitized play sand, which because of its small grain size was discontinued early in the drilling procedure. The second, Morie OON sand, proved to be superior due to a larger grain size and improved sorting.

FIGURE I-1

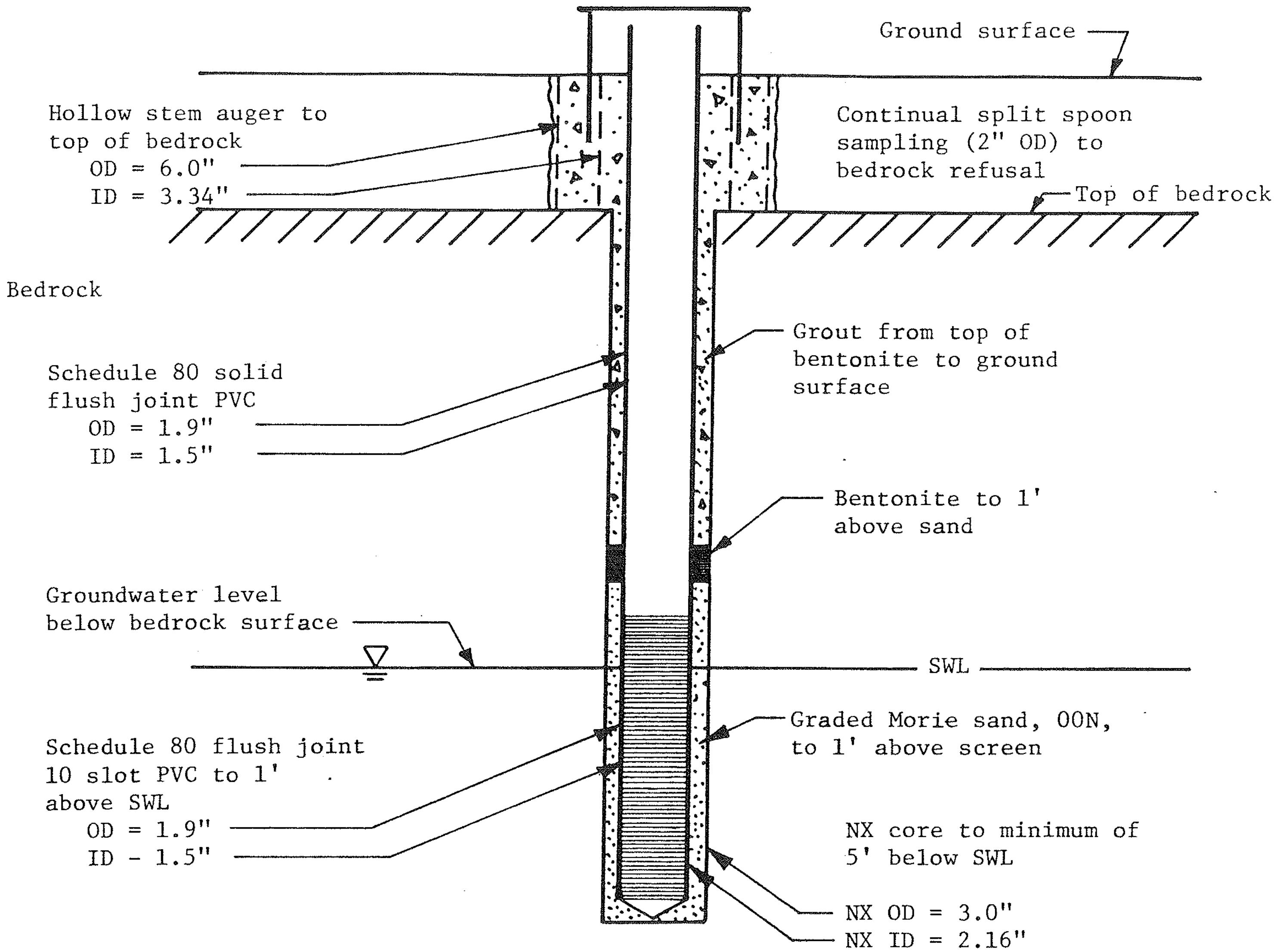
ROCK AQUIFER PIEZOMETER



No vertical or
horizontal scale

FIGURE I-2

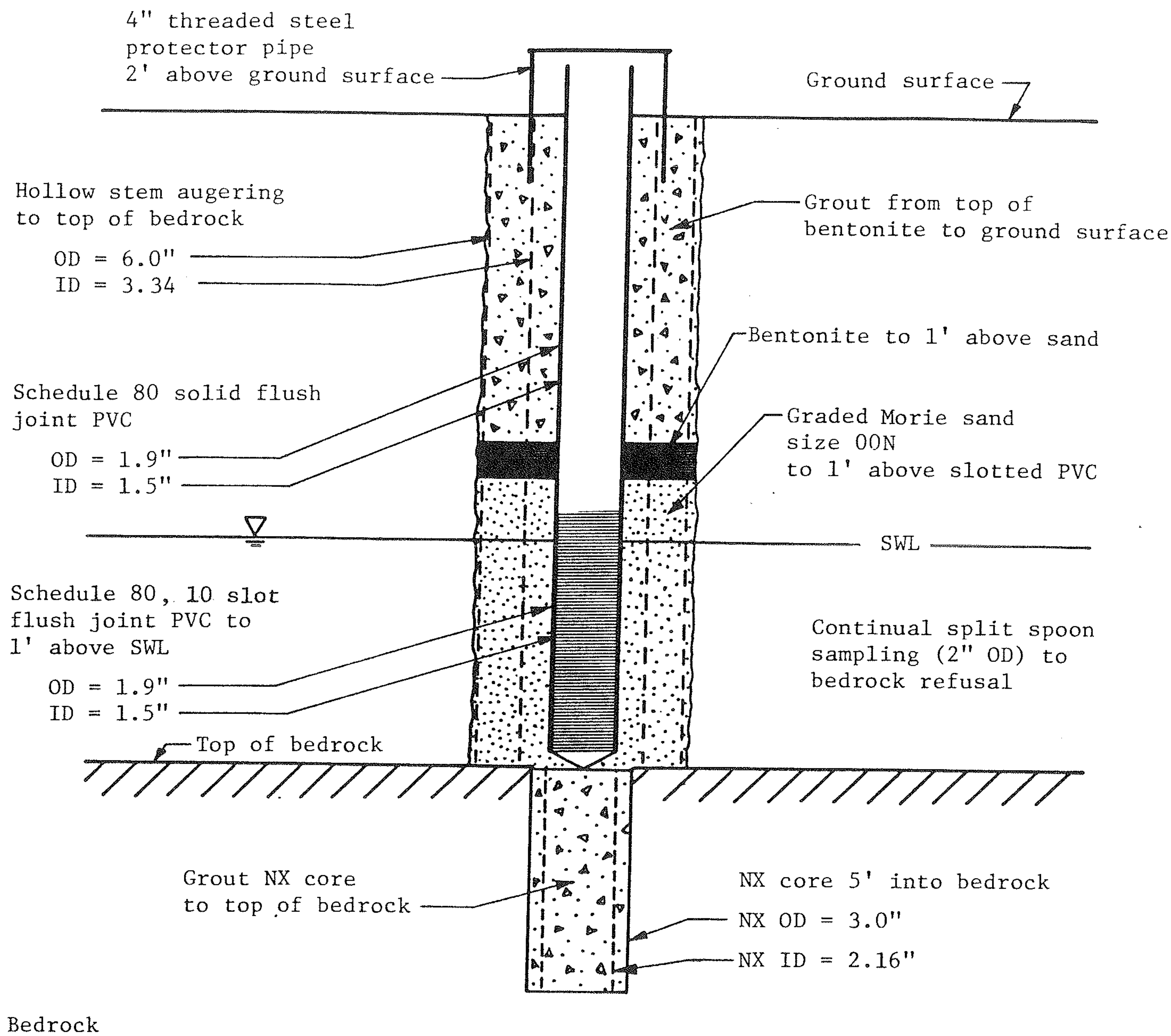
ROCK AQUIFER STANDPIPE



No vertical or horizontal scale

FIGURE I-3

SOIL AQUIFER STANDPIPE



No vertical or
horizontal scale

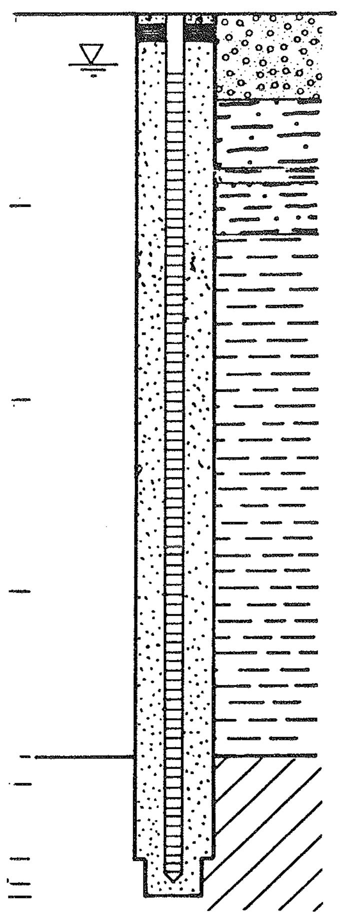
APPENDIX B

DRILLING LOGS AND WELL POINT CONSTRUCTION
BUILDINGS 001-004 AREA

APPENDIX B

BORING NO. T-1

Depth in Feet	Blow Ct. / Recovery	Sample # / Run #	Descriptions
0			
	Hand Dug	S1-4	Brown sand and gravel
	9-6-6-5	S-5	Brown and gray sand and silt
	4-2-4-9	S-6	Brown organic material
10	7-18-13-9	S-7	Gray sand and silt
	8-10-10-8	S-8	
	2-5-5-6	S-9	
	1-4-4-4	S-10	
	W/R-5-2-3	S-11	Gray silt to very fine grained sand
20	2-5-7-6	S-12	
	10-10-12-9	S-13	
	9-7-5-5	S-14	
	7-11-13-13	S-15	
	8-7-10-13	S-16	
30	3-4-7-10	S-17	
	4-4-3-5	S-18	
	W/R-11-10-8	S-19	
	W/R-3-3-4	S-20	
	W/R-7-11-100/.4	S-21	Gray weathered shale, Hudson River Formation
40	100%	R-1	
	32%	R-2	
	0%	R-3 Roller Bit	
50			

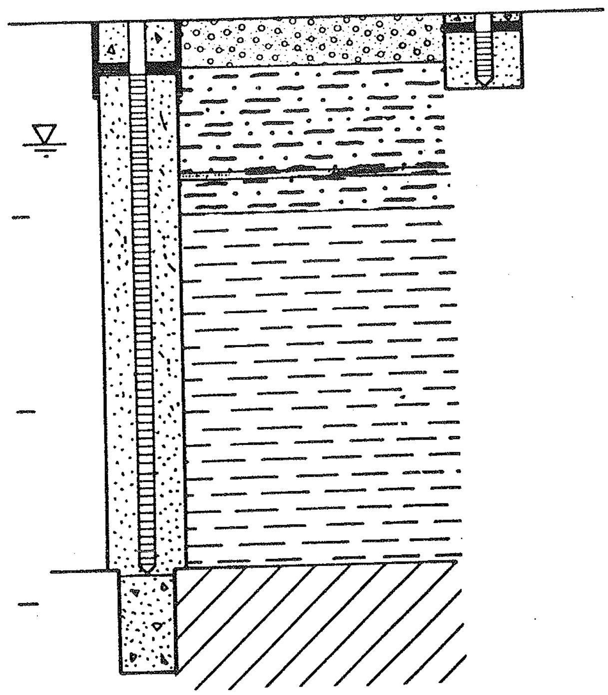


Drilling Began	1/5/81	SWL (date)	78.01' (1/28/81)
Drilling Completed	1/15/81	Screened Interval	3.1-45.1'
Development Completed	1/15/81	Aquifer	Soil-Rock
Total Depth	45.9'	Elevation, Ground Surface	80.75'
Depth to Refusal	38.6'	Elevation, Top of Casing	80.75'

W/R = Weight of Drilling Tools

BORING NOS. T-2A AND T-2

Depth in Feet	Blow Ct. / Recovery	Sample # / Run #
0	Hand	S-1
	Dug	S-2
	1-2-2-5	S-3
	4-4-4-2	S-4
	5-8-12-12	S-5
10		
	5-11-12-11	S-6
	7-6-5-4	S-7
	3-7-3-4	S-8
	W/R-W/R-2-1	S-9
	W/RW/RW/R-3	S-10
20		
	4-5-7-6	S-11
	8-8-9-6	S-12
	W/R-3-2-5	S-13
	14-25-37-62	S-14
	100/.4	S-15
30	100%	R-1
	100%	R-2
40		



Descriptions

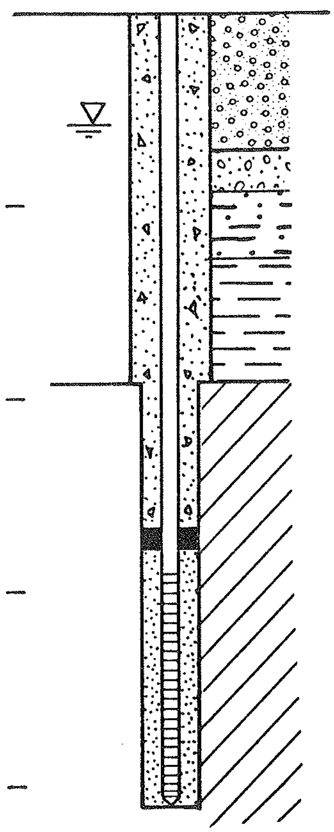
- Brown sand and gravel
- Gray pebbly sand and silt
- Brown organic material
- Gray silt and fine grained sand
- Gray silt to very fine grained sand
- Gray weathered shale, Hudson River Formation

	T-2A	T-2
Drilling Began	12/17/80	12/10/80
Drilling Completed	12/18/80	12/11/80
Development Completed	12/19/80	--
Total Depth	33.8'	3.3'
Depth to Refusal	28.4'	NA
SWL (date)	74.58' (1/28/81)	77.9' (1/28/81)
Screened Interval	3.7-28.7'	1.3-3.3'
Aquifer	Soil	Soil
Elevation, Ground Surface	81.00'	80.98'
Elevation, Top of Casing	81.00'	80.98'

W/R = Weight of Drilling Tools

BORING NO. T-3

Depth in Feet	Blow Ct. / Recovery	Sample # / Run #
0		
	Hand Dug	S1-5
	1-3-5-11	S-6
	8-7-5-3	S-7
10	2-6-10-14	S-8
	7-8-8-11	S-9
	3-7-7-5	S-10
	W/R-3-3-4	S-11
	1-11-14-100/.8	S-12
20		R-1
		R-2
30	86%	R-3
40		



Descriptions

Brown sand and gravel

Brown to gray sand and gravel

Brown sand and silt

Gray silt to very fine grainded sand

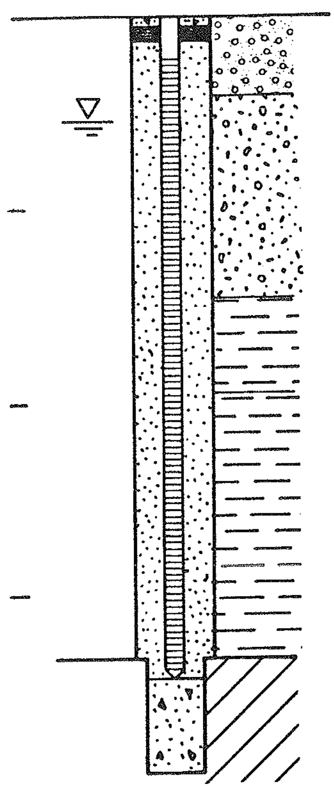
Gray shale, Hudson River Formation

Drilling Began	12/23/80	SWL (date)	74.82' (1/28/81)
Drilling Completed	12/29/80	Screened Interval	29.2-41.2'
Development Completed	1/15/81	Aquifer	Rock
Total Depth	41.2'	Elevation, Ground Surface	80.97'
Depth to Refusal	19.2'	Elevation, Top of Casing	81.78'

W/R = Weight of Drilling Tools

BORING NO. T-4

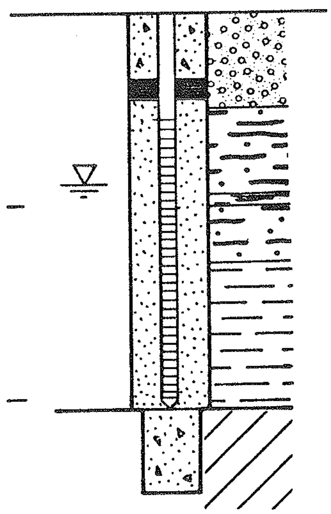
Depth in Feet	Blow Ct. / Recovery	Sample # / Run #	Descriptions
0		S-1	
	Hand Dug	S-2	Brown sand and gravel
		S-3	
		S-4	
	2-1-2-1	S-5	
	2-1-1-1	S-6	Brown pebbly sand
	2-1-1-1	S-7	
10	3-1-1-2	S-8	
	6-12-7-7	S-9	
	10-6-6-10	S-10	
	9-8-9-13	S-11	Brown silt
20	8-7-6-6	S-12	
		S-13	
		S-14	Gray Silt
		S-15	
30			
	Roller Bit		
		R-1	Gray weathered shale, Hudson River Formation
40			



Drilling Began	12/1/80	SWL (date)	78.20' (1/28/81)
Drilling Completed	12/16/80	Screened Interval	2.2-34.2'
Development Completed	12/19/80	Aquifer	Soil
Total Depth	39.2'	Elevation, Ground Surface	83.84'
Depth to Refusal	34.2'	Elevation, Top of Casing	85.78'

BORING NO. T-5

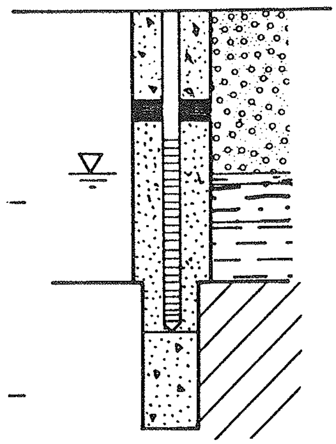
Depth in Feet	Blow Ct. / Recovery	Sample # / Run #	Descriptions
0		S-1	Brown sand and gravel, cinders, sandy loam
		S-2	
		S-3	
	Hand Dug	S-4	
		S-5	
		S-6	
		S-7	Gray silty sand
	1-2-3-3	S-8	
10	2-1-5-8	S-9	Brown organic material
	6-10-13-9	S-10	Gray silt to fine grained sand
	9-10-9-7	S-11	
	3-3-3-3	S-12	Gray clay to silt
	3-2-3-4	S-13	
20	Roller Bit		
		R-1	Gray weathered shale Hudson River Formation
		R-2	
30			



Drilling Began	12/1/80	SWL (date)	72.40'(1/28/81)
Drilling Completed	12/10/80	Screened Interval	5.5-20.5'
Development Completed	12/30/80	Aquifer	Soil
Total Depth	24.9'	Elevation, Ground Surface	81.20'
Depth to Refusal	20.5'	Elevation, Top of Casing	82.83'

BORING NO. T-6

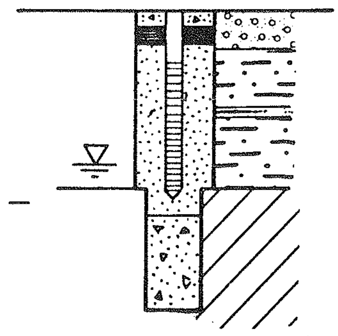
Depth in Feet	Blow Ct. / Recovery	Sample # / Run #	Descriptions
0	2-5-12-15	S-1	Brown to gray silt and shale fragments
	25-17-19-7	S-2	
	10-12-73-31	S-3	
	13-11-12-4	S-4	Brown organic material
10	10-5-3-2	S-5	Gray silt to coarse sand
	1-3-6-4	S-6	Gray silt to very fine grained sand
	6-4-12-8	S-7	
	100/.2	S-8	Gray weathered shale
	Roller Bit		Hudson River Formation
20	100%	R-1	
30			



Drilling Began	12/18/80	SWL (date)	71.59'(1/28/81)
Drilling Completed	12/19/80	Screened Interval	6.8-16.8'
Development Completed	1/6/81	Aquifer	Rock-Soil
Total Depth	21.8'	Elevation, Ground Surface	80.08'
Depth to Refusal	14.1'	Elevation, Top of Casing	82.40'

BORING NO. T-7

Depth in Feet	Blow Ct. / Recovery	Sample # / Run #
0		
	6-8-12-12	S-1
	8-7-5-5	S-2
	3-2-7-6	S-3
	4-6-6-6	S-4
	4-5-100/.2	S-5
10	Roller Bit	
	100%	R-1
20		



Descriptions

Brown silt and sand
Gray silt to fine sand

Black to brown organic material
Gray silt to sand

Gray weathered shale
Hudson River Formation

Drilling Began	12/23/80	SWL (date)	73.10'(1/28/81)
Drilling Completed	12/23/80	Screened Interval	2.8-9.8'
Development Completed	1/6/81	Aquifer	Soil
Total Depth	15.5'	Elevation, Ground Surface	81.19'
Depth to Refusal	9.2'	Elevation, Top of Casing	83.08'

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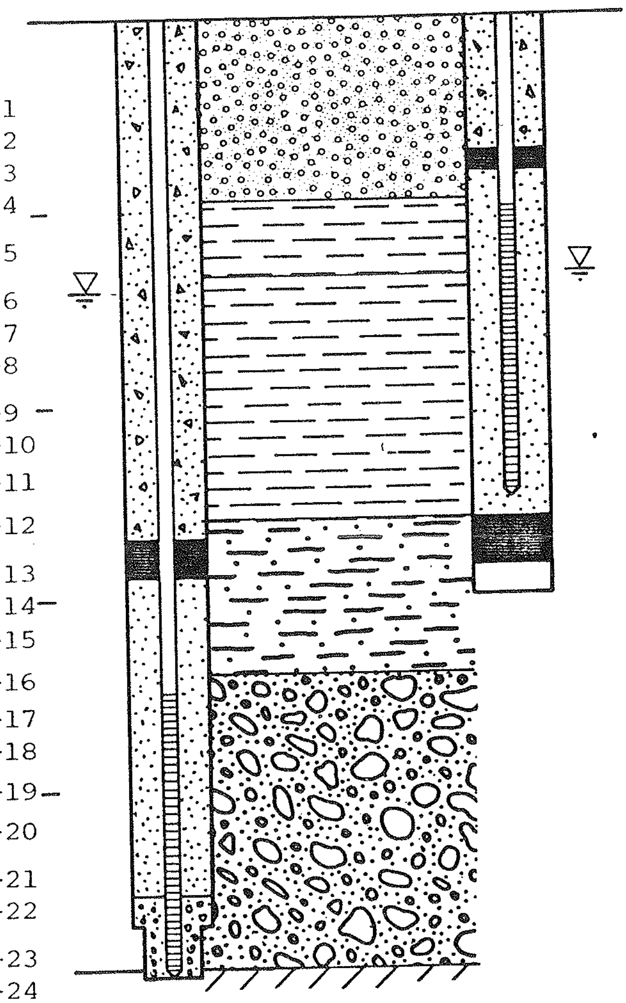
BORING NOS. T-8 AND T-9

Depth in Feet	Blow Ct. / Recovery	Sample # / Run #
0		
	Hand Dug	
	Augered	S-1
	3-4-5-5	S-2
	5-5-4-6	S-3
10	5-8-10-8	S-4
	7-5-5-6	S-5
	9-8-6-4	S-6
	2-5-4-3	S-7
	W/R-3-4-5	S-8
20	3-2-2-2	S-9
	4-5-2-3	S-10
	2-5-4-2	S-11
	2-3-4-7	S-12
	6-12-14-12	S-13
30	5-3-11-18	S-14
	8-8-10-13	S-15
	5-17-36-31	S-16
	7-6-9-18	S-17
	11-14-14-18	S-18
40	4-10-9-11	S-19
	4-11-17-23	S-20
	95-32-28-26	S-21
	14-18-19-22	S-22
		S-23
50	100/.5	S-24



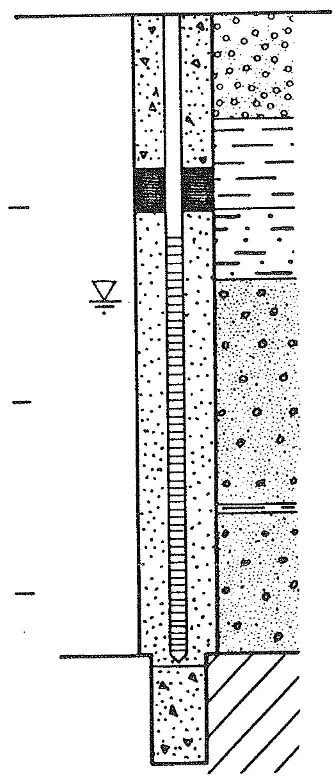
Descriptions
Brown sand and pebbles
Brown silt
Gray clay to silt
Gray silt to pebbly sand
Brown coarse grained sand to gravel

	T-8	T-9
Drilling Began	1/16/81	1/22/81
Drilling Completed	1/22/81	1/22/81
Development Completed	1/26/81	1/26/81
Total Depth	49.8'	30.0'
Depth to Refusal	49.4'	NA
SWL (date)	76.70 (1/28/81)	78.97 (1/28/81)
Screened Interval	34.8-49.8'	10.1-25.1'
Aquifer	Soil	Soil
Elevation, Ground Surface	91.7'	91.7'
Elevation, Top of Casing	93.45'	94.24'

W/R = Weight of Drilling Tools

BORING NO. T-10

Depth in Feet	Blow Ct. / Recovery	Sample # / Run #
0	Hand Dug	S-1
	4-6-6-7	S-2
	7-9-9-11	S-3
	4-7-9-10	S-4
10		
	5-7-8-7	S-5
	10-12-11-15	S-6
	13-15-10-10	S-7
	14-12-12-12	S-8
20	8-9-8-8	S-9
	10-15-13-15	S-10
	21-28-14-13	S-11
	6-9-11-17	S-12
	19-14-14-19	S-13
30	18-22-22-26	S-14
	14-20-20-21	S-15
	12-19-100/.4	S-16
	Roller Bit	R-1
		R-2



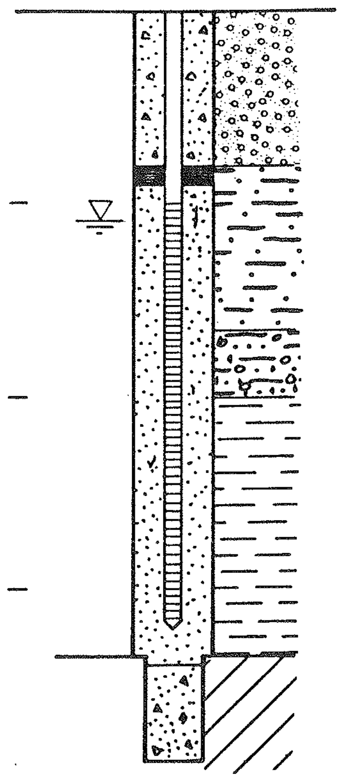
Descriptions

- Brown silt and sand
- Brown clay and silt
- Brown silt to sand
- Brown medium grained sand to gravel
- Gray silt
- Gray medium grained sand to gravel
- Gray weathered shale Hudson River Formation

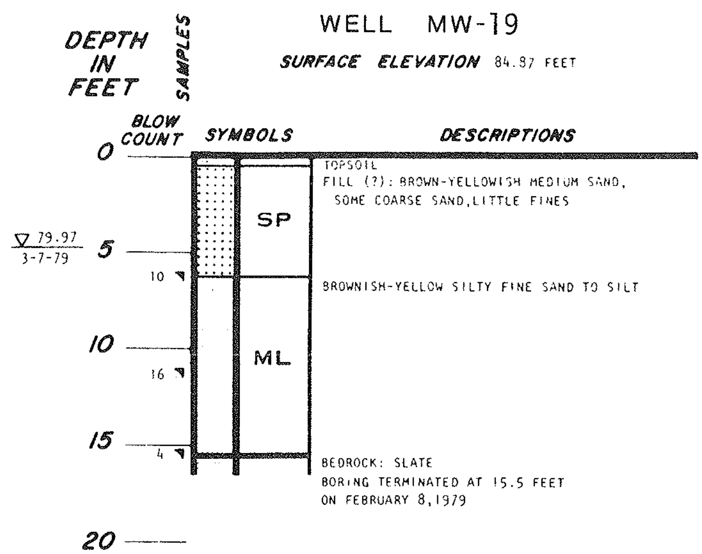
Drilling Began	1/22/81	SWL (date)	78.29' (1/28/81)
Drilling Completed	1/23/81	Screened Interval	11.7-33.7'
Development Completed	1/27/81	Aquifer	Soil
Total Depth	38.8'	Elevation, Ground Surface	93.10'
Depth to Refusal	33.4'	Elevation, Top of Casing	93.10'

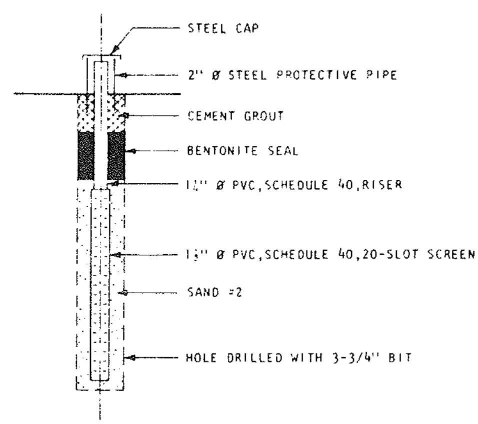
BORING NO. T-17

Depth in Feet	Blow Ct. / Recovery	Sample # / Run #	Descriptions
0		S-1	
		S-2	Brown medium to coarse grained pebbly sand
		S-3	
		S-4	
		S-5	
		S-6	
	4-5-4-5	S-7	
	6-4-3-2	S-8	
10	6-5-3-3	S-9	Brown silt to coarse sand and gravel
	8-6-5-4	S-10	
	10-16-13-13	S-11	
	14-10-15-15	S-12	Gray silt to pebbly sand
	13-12-14-10	S-13	
20	1-2-1-2	S-14	
	0-3-1-2	S-15	
	0-3-4-3	S-16	Gray silt
	2-4-4-5	S-17	
30	0-2-2-4	S-18	
	3-4-4-3	S-19	
	0-5-100/.5	S-20	
	93%	R-1	Gray weathered shale Hudson River Formation
40	100%	R-2	
50			



Drilling Began	12/23/80	SWL (date)	77.65 (1/5/81)
Drilling Completed	12/29/80	Screened Interval	10.0-32.0'
Development Completed	1/6/81	Aquifer	Soil
Total Depth	39.9'	Elevation, Ground Surface	88.49'
Depth to Refusal	33.9'	Elevation, Top of Casing	91.28'



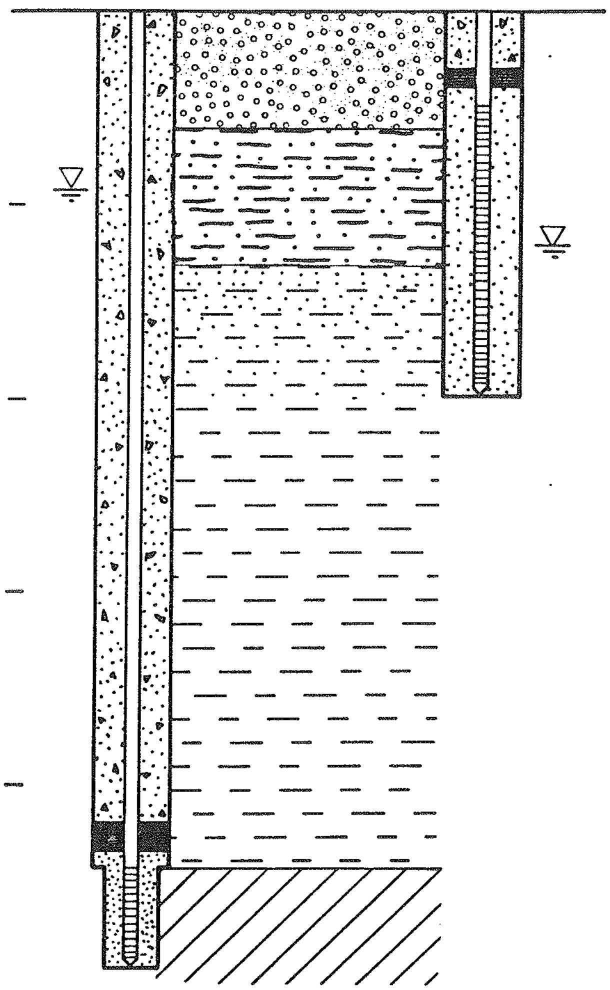


LOG AND MONITORING WELL DETAILS

DAMES & MOORE

BORING NOS. T-23R and T-23S

Depth in Feet	Blow Ct. / Recovery	Sample # / Run #
0		S-1
	Hand	S-2
		S-3
	Dug	S-4
	6-5-3-3	S-5
	7-5-6-6	S-6
10	6-5-6-5	S-7
	11-8-6-6	S-8
	1-3-4-8	S-9
	6-8	S-10
	7-6-6	S-11
20	1-3	S-12
	2-2-3-2	S-13
	0-2-8-4	S-14
	6-6-2-7	S-16
30	8-8-7-5	S-17
	6-2-4-6	S-18
	6-14-12-10	S-19
	1-5-7-9	S-20
40	3-4-4-7	S-21
	3-4-5-8	S-22
	0-5-4-7	S-23
	100/.4	
		R-1



Brown silt to pebbly sand and gravel

Brown medium to coarse grained silty sand

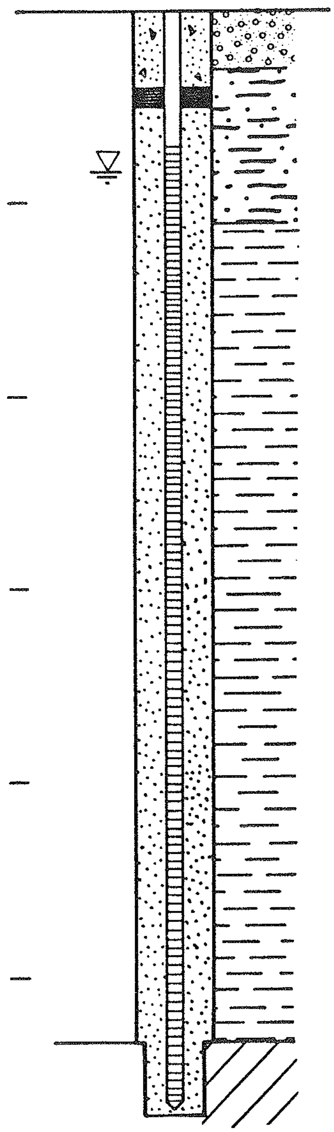
Gray silt to very fine grained sand

Gray weathered shale Hudson River Formation

	T-23R	T-23S
Drilling Began	1/21/81	1/21/81
Drilling Completed	1/21/81	1/22/81
Development Completed	1/28/81	1/28/81
Total Depth	49.5'	20.0'
Depth to Refusal	44.4'	N.A.
SWL (date)	80.39' (1/28/81)	77.57' (1/28/81)
Screened Interval	44.4-49.4'	5.0-20.0'
Aquifer	Rock	Soil
Elevation, Ground Surface	89.7'	89.7'
Elevation, Top of Casing	89.7'	89.74'

BORING NO. T-24

Depth in Feet	Blow Ct. / Recovery	Sample # / Run #
0		S-1
	Hand Dug	S-2
		S-3
		S-4
	6-5-6-8	S-5
	10-12-11-10	S-6
10	23-10-13-9	S-7
	9-11-14-2	S-8
	11-7-6-7	S-9
	6-4-3-3	S-10
	3-2-3-3	S-11
20	3-3-4-3	S-12
	2-2-1-2	S-13
	3-7-5-5	S-14
	4-2-3-3	S-15
	5-8-5-4	S-16
30	3-4-3-3	S-17
	W/R-W/R-W/R-W/R	S-18
	2-4-9-6	S-19
	1-2-5-4	S-20
	6-9-11-10	S-21
40	8-10-10-10	S-22
	5-6-5-7	S-23
	9-7-8-8	S-24
	3-4-6-5	S-25
	10-9-7-3	S-26
50	W/R-W/R-4-3	S-27
	W/R-4-6-10	S-28
	8-34-100/.3	S-29
		R-1



Drilling Began	1/23/81	SWL (date)	83.65' (1/28/81)
Drilling Completed	1/23/81	Screened Interval	7.0-57.0'
Development Completed	1/28/81	Aquifer	Rock-Soil
Total Depth	57.3'	Elevation, Ground Surface	92.0'
Depth to Refusal	53.5'	Elevation, Top of Casing	92.03'

W/R = Weight of Drilling Tools

APPENDIX C

FIELD AND LABORATORY SOIL OBSERVATIONS

APPENDIX C

FIELD AND LABORATORY SOIL OBSERVATIONS

Boring T-1

No odor or visible recognition of any chemical was noted during the drilling operation. A slight sour odor was detected in the laboratory in samples collected between 4.8 and 5.0 ft.

Boring T-2

Construction of boring T-2 was halted at 4 ft when a strong acid odor was detected in the shallow hand-dug hole. In the laboratory, samples between 2.5 and 3.5 ft had a detectable sour odor.

Boring T-2A

No chemical was noted during drilling. A slight sour odor was identified in the laboratory in samples between 4.0 and 6.0 ft.

Boring T-3R

No chemical odor was detected during drilling. A slight sour odor was identified in the laboratory in samples taken between 5.0 and 7.0 ft.

Boring T-4

No odor was detected in soil samples collected during drilling. Samples from 5 to 14 ft were unavailable for laboratory inspection. No other soil samples had a detectable odor.

Boring T-5

An odor at 3.5 ft was detected during drilling. In the laboratory, soils collected between 3.0 and 3.5 ft also had a slight sour odor. A sour odor in the soil samples between 5.0 and 7.0 ft was also detected.

Boring T-6

No odor was detected during drilling or in the laboratory.

Boring T-7

No odor was detected in the soil samples during drilling, although oil was visible in drilling water throughout the coring operation. Soil samples examined in the laboratory did not have any detectable odors.

Boring T-8

During drilling, a hydrocarbon odor and irridescent sheen were detected in soil samples collected at 11 and 13 ft. Also, an oil sheen was noticed on the effluent evacuated from the borehole in gravel between depths of 38 and 50 ft. In the laboratory, hydrocarbon odors were detected in soils between 11 and 15 ft, with the strongest odors occurring in samples collected at 13 ft. A slight sour odor was also detected in soil collected between 7 and 9 ft. No other soil samples had a detectable odor in the laboratory.

Boring T-9

Boring T-9 was installed as a soil aquifer well and did not penetrate bedrock. No odor was detected during drilling. Soil samples were not collected from this boring because of its close proximity to boring T-8.

Boring T-10

During rock coring between 34 and 36 ft, a small oil sheen was identified on the drilling effluent. Between 37 and 38 ft a sewage odor was identified. In the laboratory, no odor was detected in soil samples collected.

Boring T-17

No odor was detected either during drilling or in the laboratory.

Boring T-23S

Boring T-23S was installed as a soil aquifer well and did not penetrate bedrock. No odor was detectable during drilling. Soil samples were not collected from this boring because of its close proximity to boring T-23R.

Boring T-23R

No odor was identified during drilling. Investigation of samples in the laboratory indicated that soils collected between 12 and 15 ft had a detectable hydrocarbon odor. Also in the laboratory, samples between 4 and 6 ft had a detectable sour odor.

Boring T-24

During drilling, black streaks were noted in the water collected with the soil samples between 24 and 26 ft. In the laboratory, no soil samples had a detectable odor.

APPENDIX D

CALCULATIONS OF GROUNDWATER FLOW-THROUGH AT THE NORTHERN END OF BUILDING 004

APPENDIX D

CALCULATION OF GROUNDWATER FLOW-THROUGH UNDER THE NORTHERN END OF BUILDING 004

TABLE 1

CALCULATION OF THE AVERAGE THICKNESSES OF MATERIALS
WITH DIFFERENT PERMEABILITIES
NORTH OF BUILDING 004

Representative Aquifers	Representative Wells					Average Aquifer Thickness
	T-1	T-2	T-3	T-5	T-17	
K_1 = fill	2'	0	3'	0	0	1'
K_2 = sand and silt	7'	3.5'	3.5'	4'	9'	5.4'
K_3 = gray silt	27'	18.5'	6.5'	8'	13.5'	14.7'
K_4 = soil-rock interface and top of bedrock	5'	5'	5'	5'	5'	5'

TABLE 2

CALCULATION OF GROUNDWATER FLOW
UNDERLYING THE NORTHERN CORNER
OF BUILDING 004

Calculation of flow through K_1

$$Q = K_1 \quad I \quad A$$
$$= 1 \text{ fpd} \times 0.0269 \times 358 \times 1 \text{ ft}^2$$
$$= 9.6 \text{ ft}^3/\text{day} = 72 \text{ gpd}$$

Calculation of flow through K_2

$$Q = K_2 \quad I \quad A$$
$$= 0.07 \text{ fpd} \times 0.0269 \times 358 \text{ ft} \times 5.4 \text{ ft}$$
$$= 3.64 \text{ ft}^3/\text{day} = 27.2 \text{ gpd}$$

Calculation of flow through K_3

$$Q = K_3 \quad I \quad A$$
$$= 0.045 \text{ fpd} \times 0.0269 \times 358 \text{ ft} \times 14.7 \text{ ft}$$
$$= 6.37 \text{ ft}^3/\text{day} = 47.6 \text{ gpd}$$

Calculation of flow through K_4

$$Q = K_4 \quad I \quad A$$
$$= 1.4 \text{ ft/day} \times 0.016 \times 358 \text{ ft} \times 5 \text{ ft}$$
$$= 40.1 \text{ ft}^3/\text{day} = 300 \text{ gpd}$$

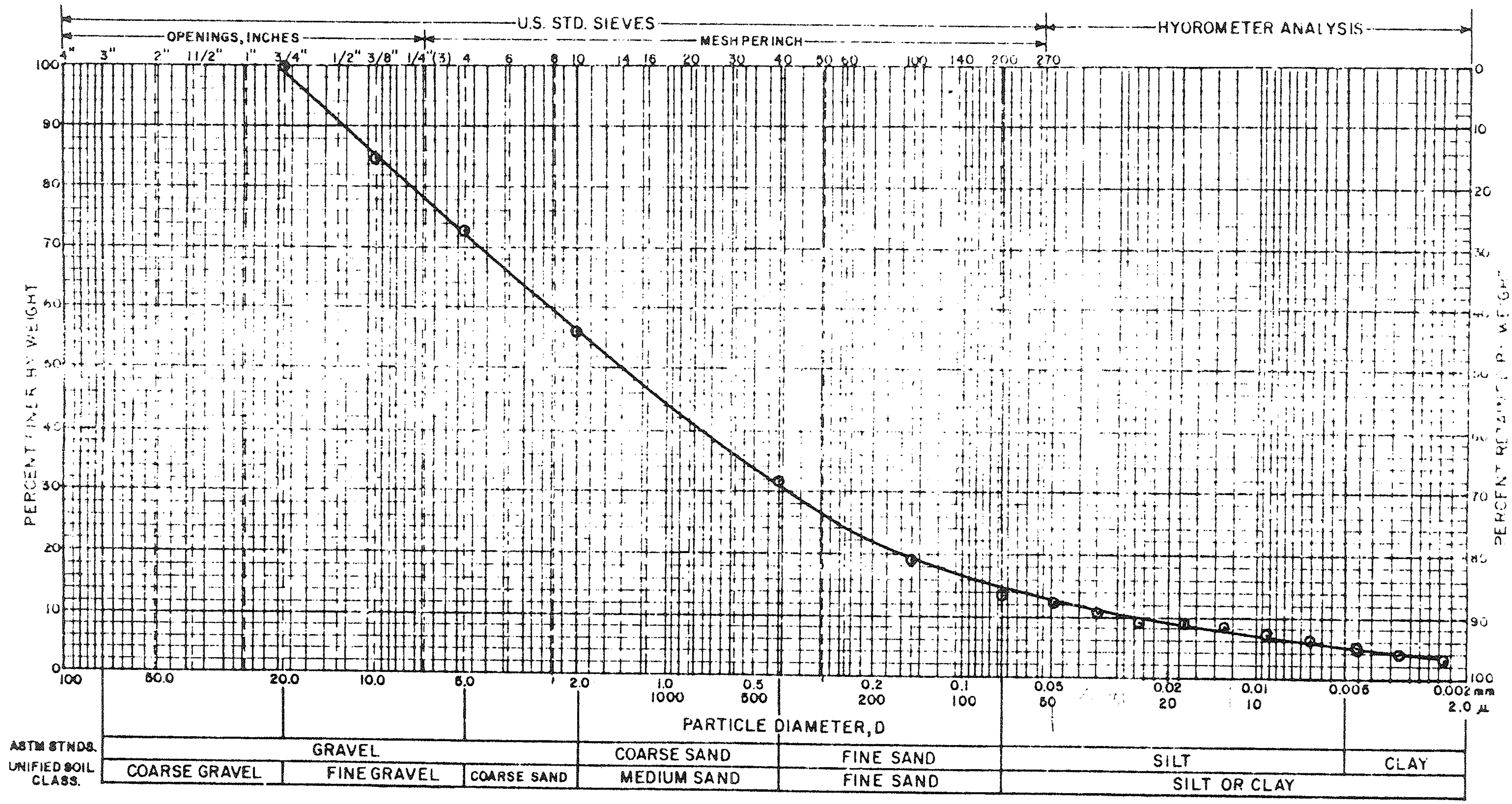
Total flow through = 447 gpd

TABLE 3

CALCULATION OF PERMEABILITY
HAZEN'S APPROXIMATION

Sample No.	Material	D_{10}	cm/sec	ft/day
B-1 S5A	Brown and gray sand and silt natural	.00375mm = .000375cm	$1.41x10^{-5}$	0.040
B-3 S7B	Brown to gray sand and gravel	.006 mm = .0006 cm	$3.6x10^{-5}$	0.1
B5A S10B	Gray silt to fine sand	.0043mm = .00043 cm	$1.85x10^{-5}$	0.05
B8 S13A	Gray silt to pebbly sand	.002 mm = .0002 cm	$4.00x10^{-6}$	0.011
B8 S18, 19B	Coarse sand and gravel	.047 mm = .0047 cm	$2.21x10^{-3}$	6.26
B10 S10A	Medium sand and gravel	.028 mm = .0028 cm	$7.84x10^{-4}$	2.2
B17 S17B	Gray silt	.0023 mm = .00023 cm	$5.29x10^{-6}$	0.015
B23 S14B	Gray silt	.005 mm = .0005 cm	$2.5x10^{-5}$	0.071

GRAIN SIZE DISTRIBUTION CURVE



SAMPLE INFORMATION: B10 S10A
Brown fine to coarse Sand and Gravel, trace silt, trace clay
Moisture content (as received)-7.8%

EMPIRE SOILS INVESTIGATIONS, INC.

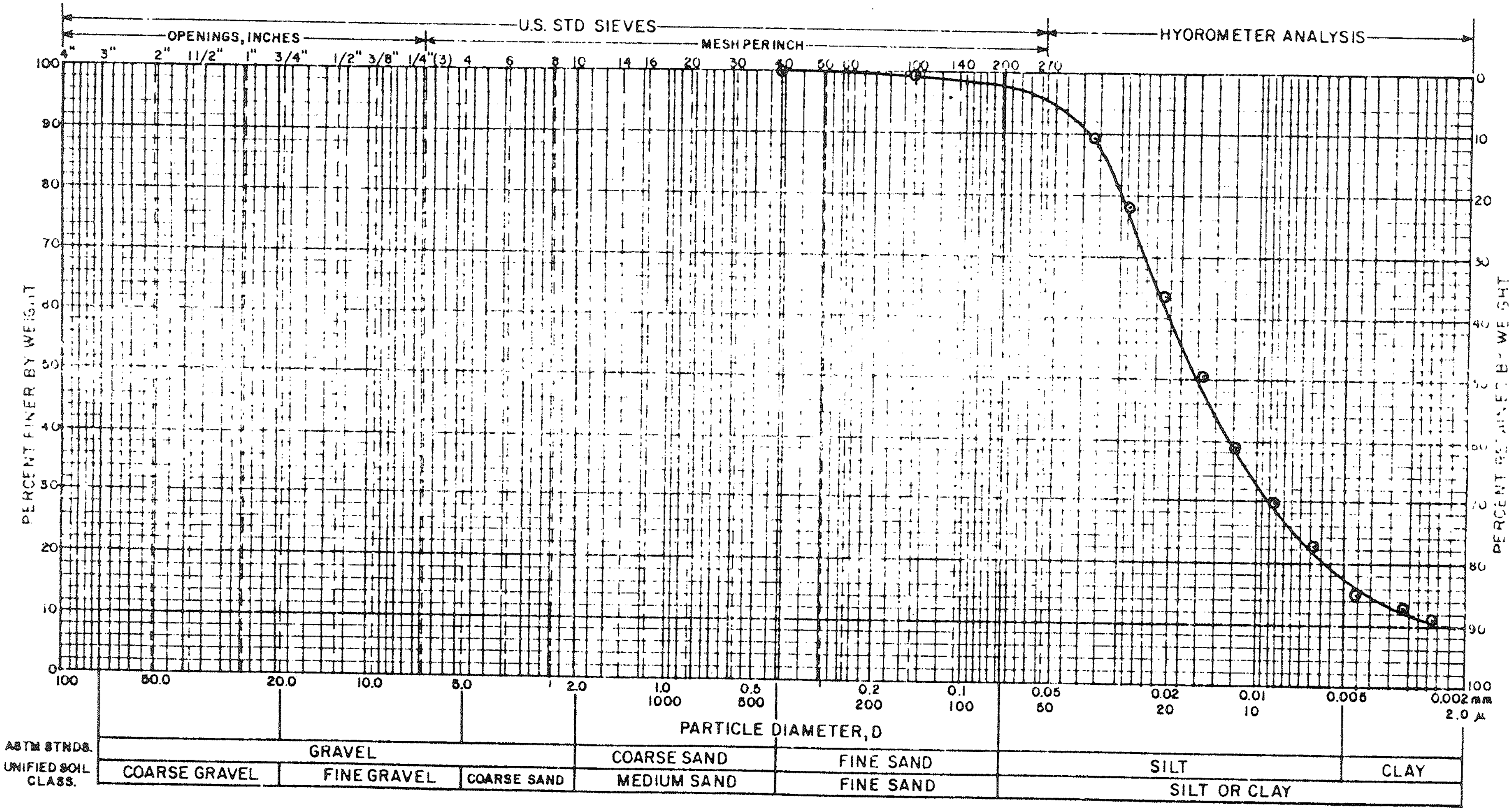
MECHANICAL ANALYSIS

IBM Installation
Poughkeepsie, NY

DR. BY: DJG	CK'D. DFG	DATE: 2/26/81	PROJ. NO. AD-80-93

NOTE: VISUAL SOIL CLASSIFICATIONS ON E.S.I. SUBSURFACE LOGS ARE BASED ON THE UNIFIED SOIL CLASSIFICATION SYSTEM.

GRAIN SIZE DISTRIBUTION CURVE



SAMPLE INFORMATION: B17 S17B

Grey Silt, little clay trace fine sand

Moisture content (as received)-21.4%

NOTE: VISUAL SOIL CLASSIFICATIONS ON E.S.I. SUBSURFACE LOGS ARE BASED ON THE UNIFIED SOIL CLASSIFICATION SYSTEM.

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MECHANICAL ANALYSIS

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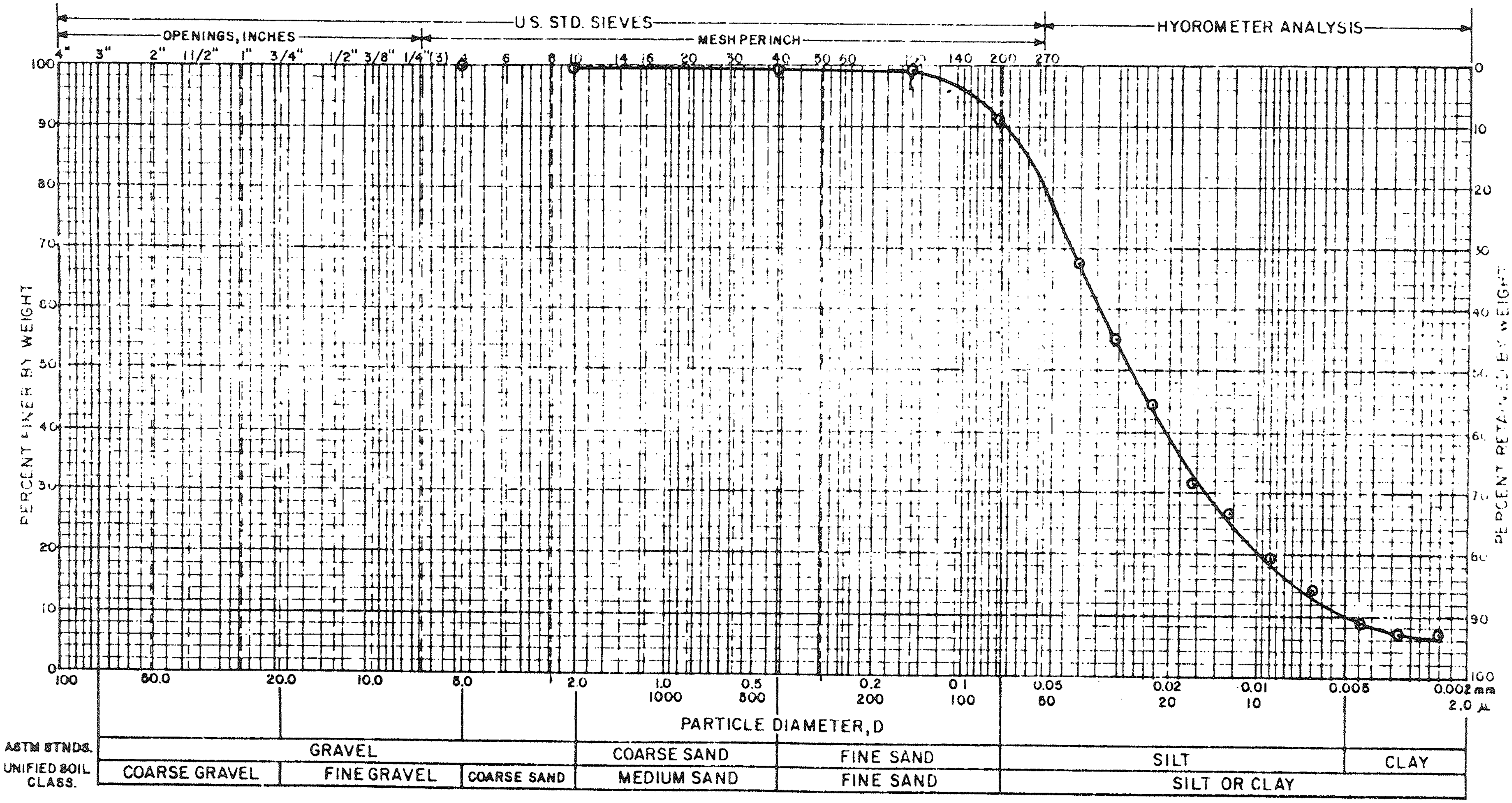


SAMPLE INFORMATION: B23 S14B

Grey Silt, trace fine to coarse sand, trace clay

Moisture content (as received)-19.2%

NOTE: VISUAL SOIL CLASSIFICATIONS ON E.S.I. SUBSURFACE LOGS ARE BASED ON THE UNIFIED SOIL CLASSIFICATION SYSTEM.

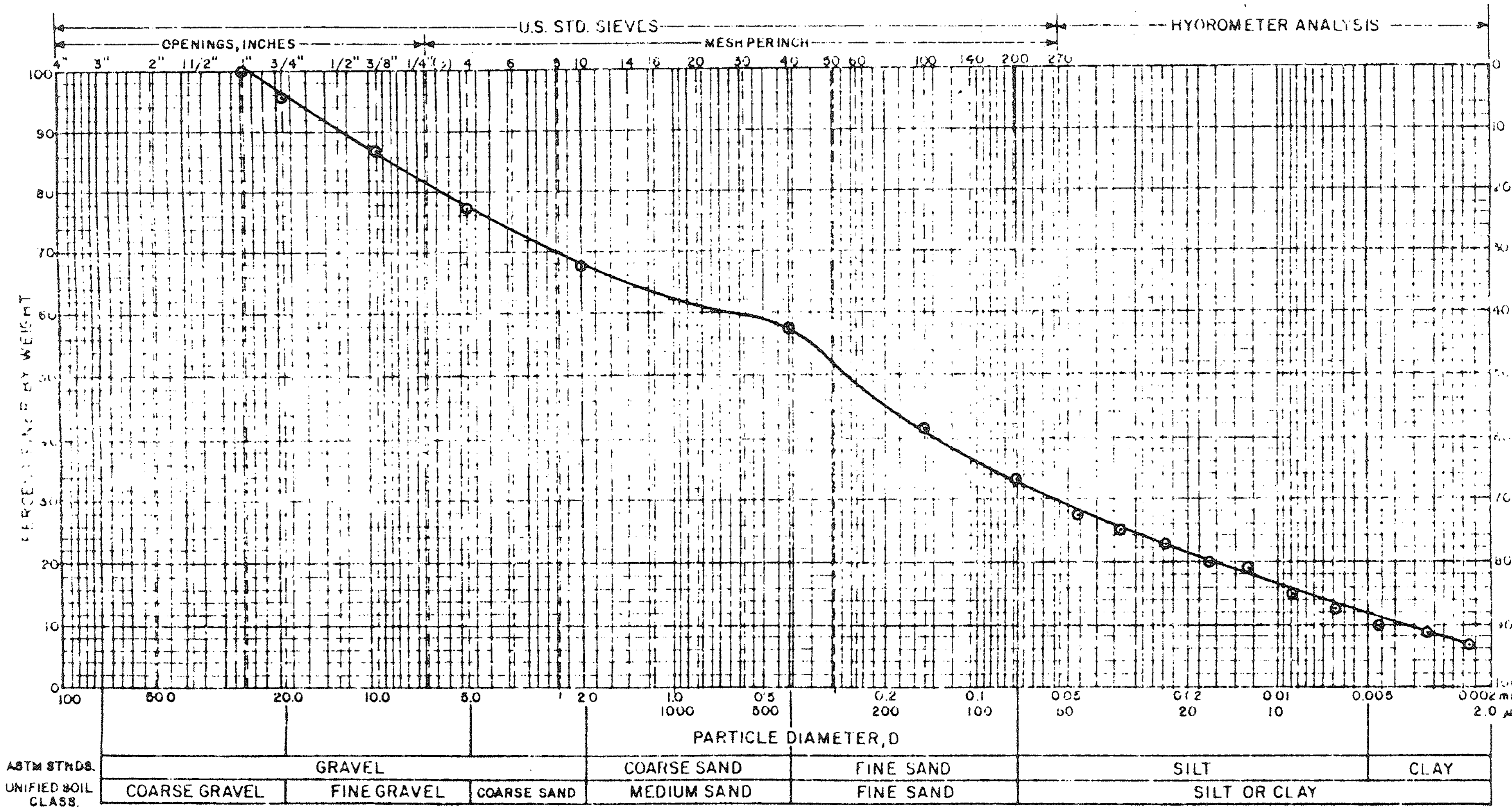
EMPIRE SOILS INVESTIGATIONS, INC.

MECHANICAL ANALYSIS

IBM Installation
Poughkeepsie, NY

DR. BY:	CK'D.	DATE:	PROJ. NO.
DJG	DFG	2/26/81	AD-80-93

GRAIN SIZE DISTRIBUTION CURVE



SAMPLE INFORMATION: B1 S5A

Grey fine to coarse Sand & Gravel, Some Silt, trace clay, trace organics.

Moisture content (as received)-20.8%

NOTE: VISUAL SOIL CLASSIFICATIONS ON E.S.I. SUBSURFACE LOGS ARE BASED ON THE UNIFIED SOIL CLASSIFICATION SYSTEM.

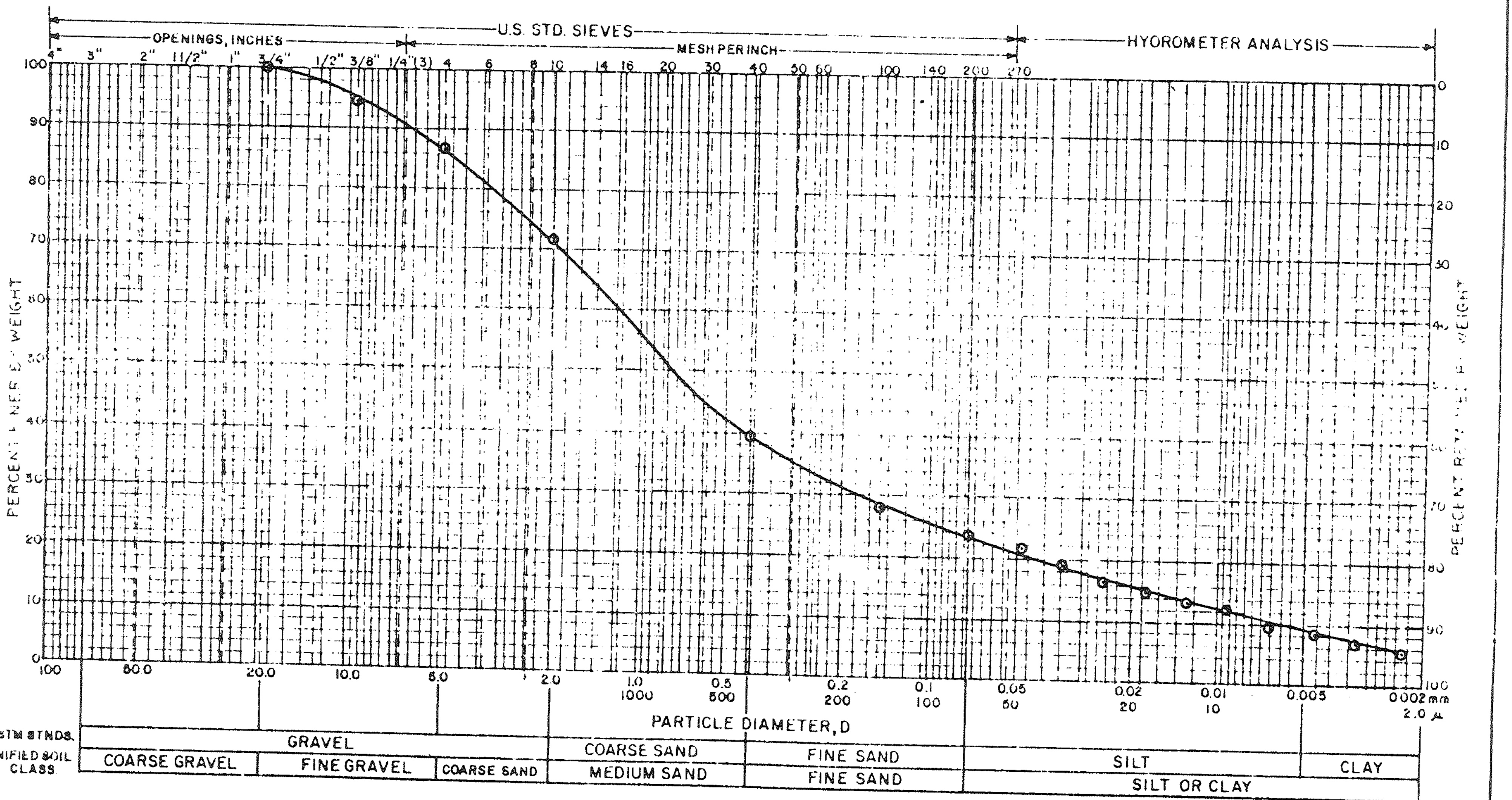
EMPIRE SOILS INVESTIGATIONS, INC.

MECHANICAL ANALYSIS

IBM Installation
Poughkeepsie, NY

DR. BY: DJG	CK'D: DFG	DATE: 2/26/81	PROJ. NO. AD-80-93

GRAIN SIZE DISTRIBUTION CURVE



SAMPLE INFORMATION: B3 S7B

Brown fine to coarse Sand, Some Gravel, ~~little silt~~, ~~trace clay~~

Moisture Content (as received)-16.4%

NOTE: VISUAL SOIL CLASSIFICATIONS ON E.S.I. SUBSURFACE LOGS ARE BASED ON THE UNIFIED SOIL CLASSIFICATION SYSTEM.

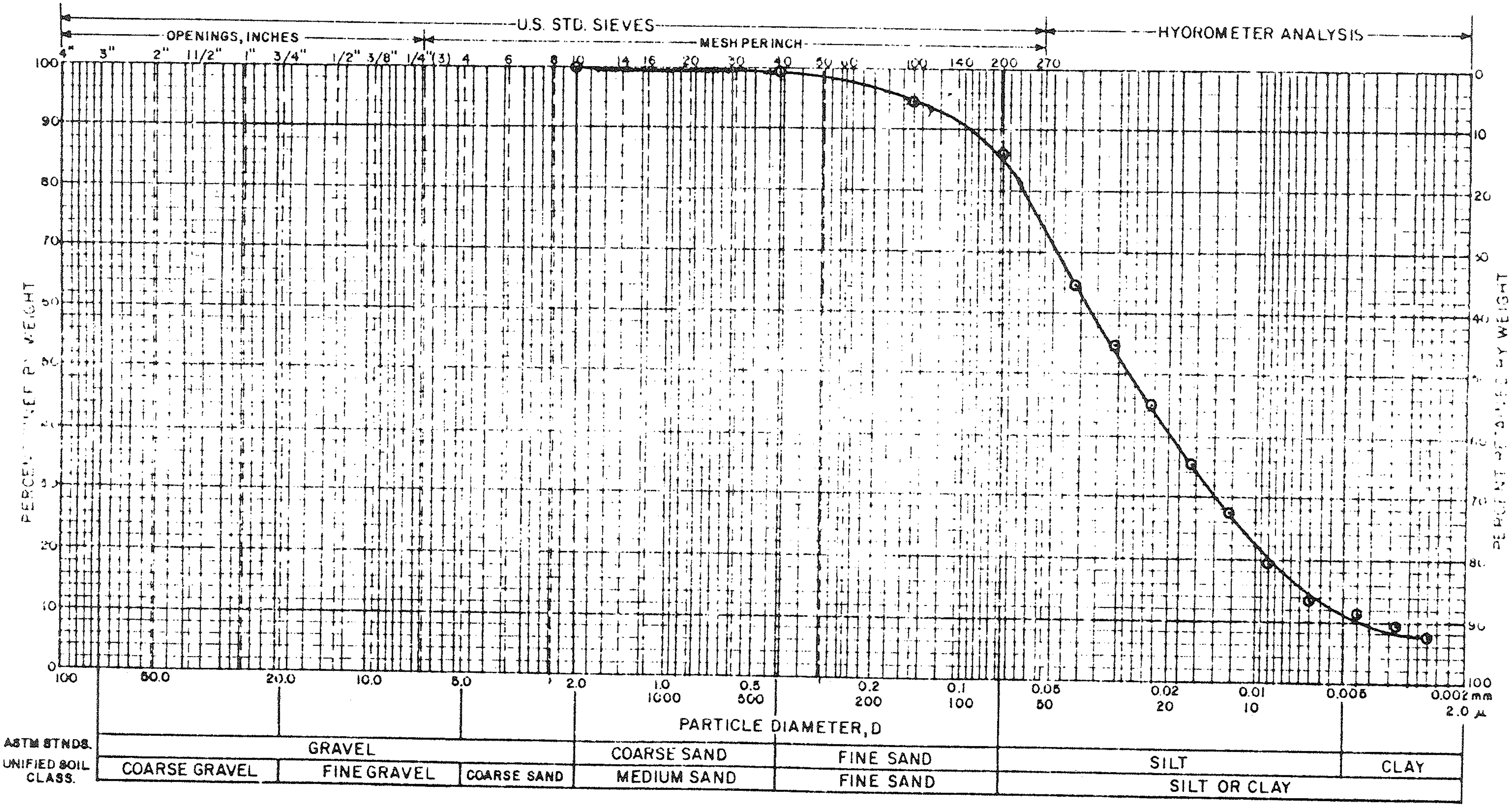
EMPIRE SOILS INVESTIGATIONS, INC.

MECHANICAL ANALYSIS

IBM Installation
Poughkeepsie, NY

DR BY	CK'D	DATE	PROJ. NO.
DJG	DFG	2/26/81	AD-80-93

GRAIN SIZE DISTRIBUTION CURVE



SAMPLE INFORMATION: B5A S10B
grey Silt, little fine sand, little clay
Moisture content (as received)-18.6%

NOTE. VISUAL SOIL CLASSIFICATIONS ON E.S.I. SUBSURFACE LOGS ARE BASED ON THE UNIFIED SOIL CLASSIFICATION SYSTEM

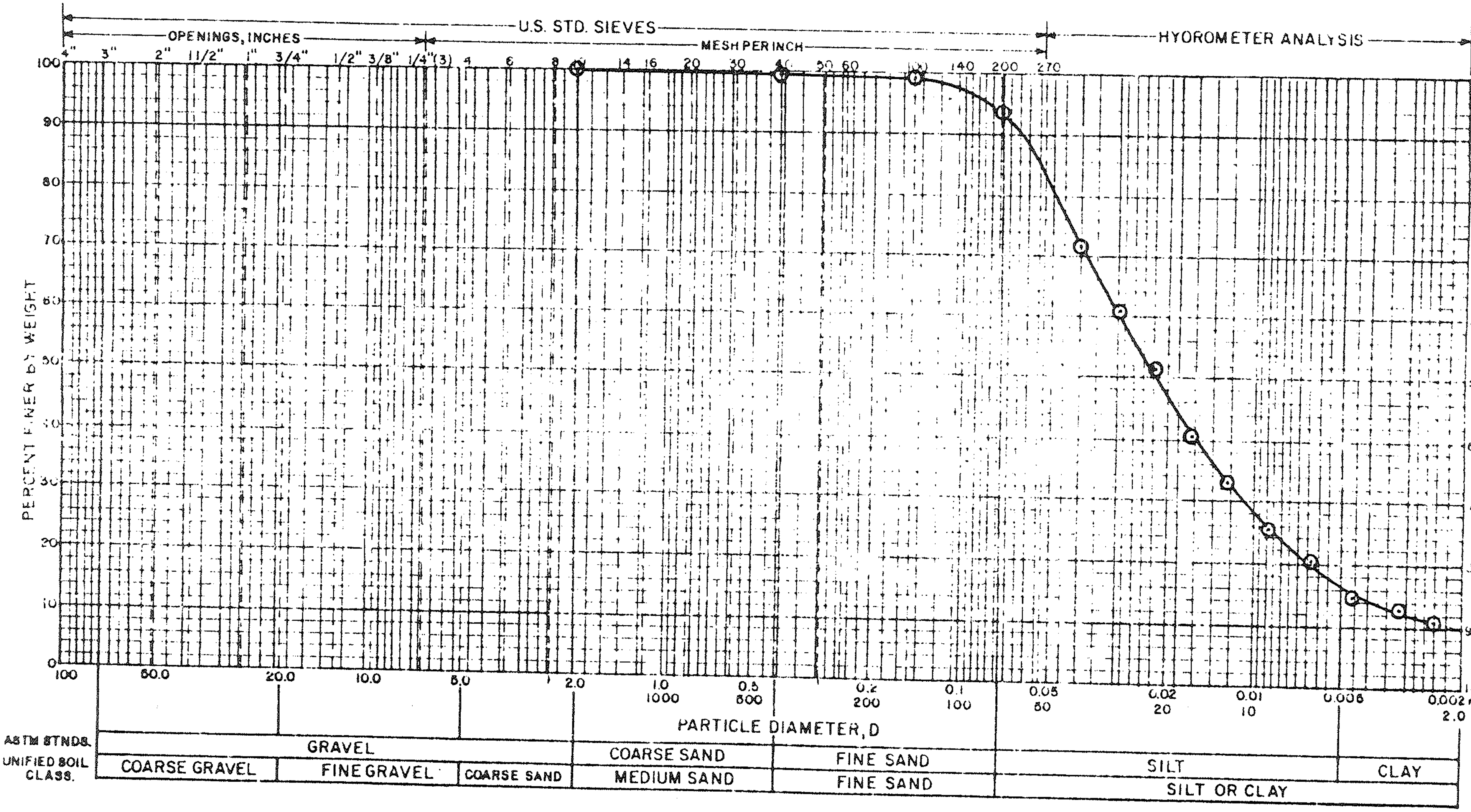
EMPIRE SOILS INVESTIGATIONS, INC.

MECHANICAL ANALYSIS

IBM Installation
Poughkeepsie, NY

DR. BY: DJG	CK'D. DFG	DATE: 2/26/81	PROJ. NO. AD-80-93

GRAIN SIZE DISTRIBUTION CURVE



SAMPLE INFORMATION: B8 S13A
Grey silt, little clay, trace fine sand
Moisture content (as received)-20.6%

NOTE: VISUAL SOIL CLASSIFICATIONS ON E.S.I. SUBSURFACE LOGS ARE BASED ON THE UNIFIED SOIL CLASSIFICATION SYSTEM.

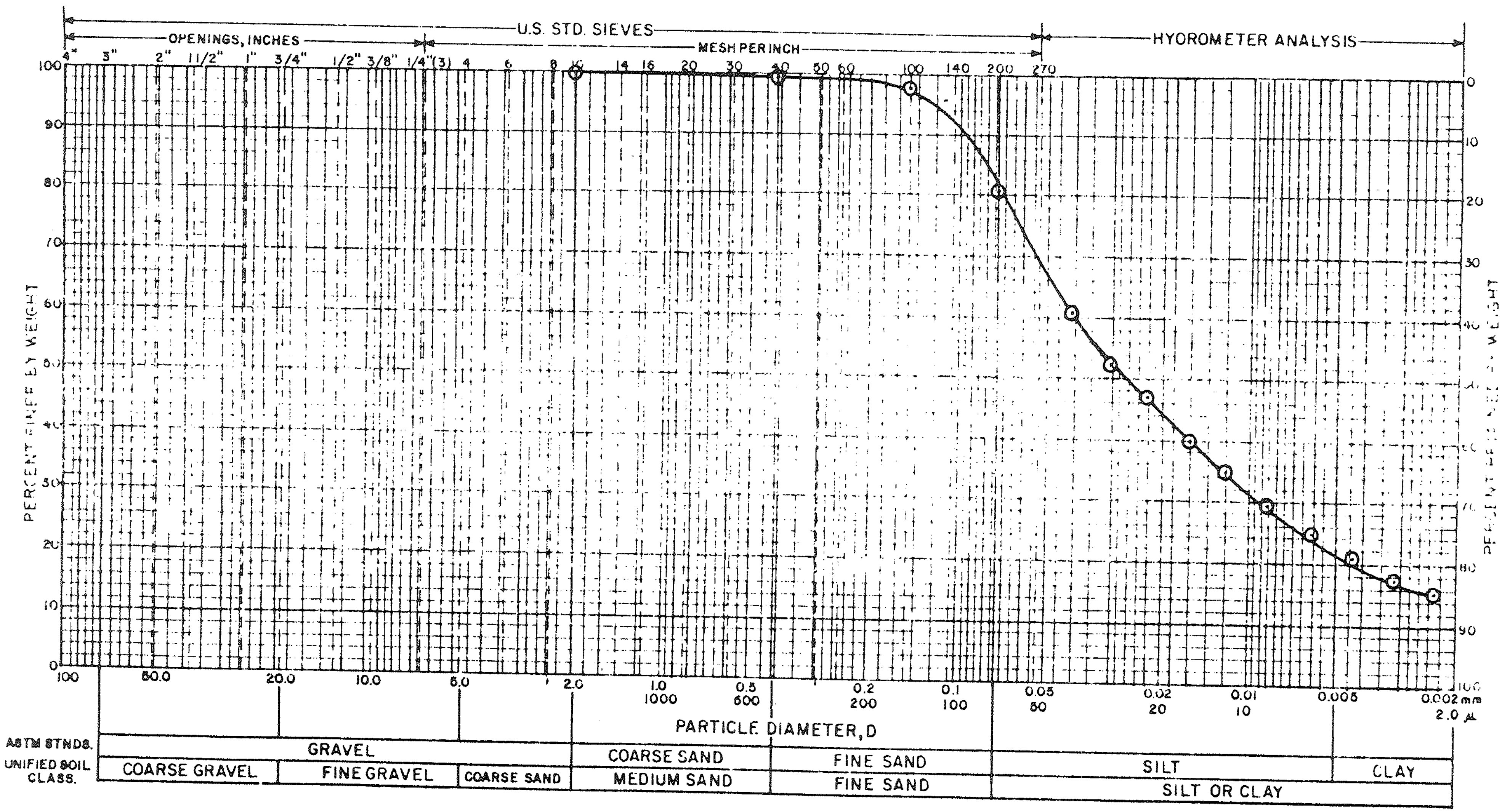
EMPIRE SOILS INVESTIGATIONS, INC.

MECHANICAL ANALYSIS

IBM Installation
Poughkeepsie, NY

DR BY: DJG	CK'D: DFG	DATE: 2/26/81	PROJ. NO. AD-80-93

GRAIN SIZE DISTRIBUTION CURVE



SAMPLE INFORMATION: B8 S13A
Brown Silt, little fine sand, little clay
Moisture content (as received)-23.6%

NOTE. VISUAL SOIL CLASSIFICATIONS ON E.S.I. SUBSURFACE LOGS ARE BASED ON THE UNIFIED SOIL CLASSIFICATION SYSTEM.

EMPIRE SOILS INVESTIGATIONS, INC.

MECHANICAL ANALYSIS

IBM Installation
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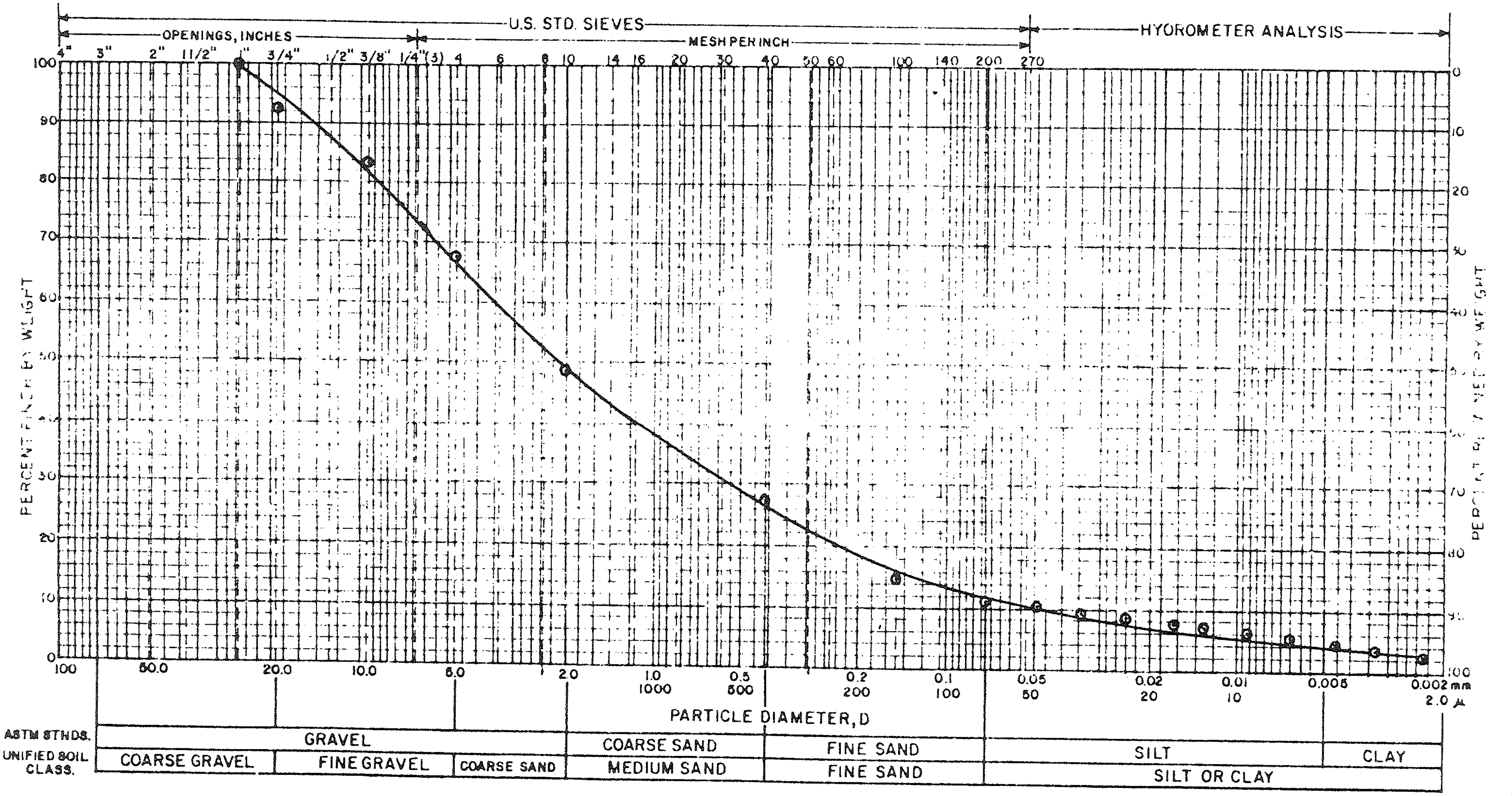
GRAIN SIZE DISTRIBUTION CURVE



SAMPLE INFORMATION: B8, S18, 19B (Combined)
Brown fine to coarse sand and Gravel, trace silt, trace clay
Moisture content (as received)-13.2%

NOTE: VISUAL SOIL CLASSIFICATIONS ON E.S.I. SUBSURFACE LOGS ARE BASED ON THE UNIFIED SOIL CLASSIFICATION SYSTEM.

EMPIRE SOILS INVESTIGATIONS, INC.

MECHANICAL ANALYSIS

IBM Installation
Poughkeepsie, NY

DR. BY	CK'D.	DATE:	PROJ. NO.
DJG	DFG	2/26/81	AD-80-93

APPENDIX E

MONITORING WELL SAMPLING PROCEDURE

APPENDIX E

MONITORING WELL SAMPLING PROCEDURE

Appendix E is the instructions given to the field sampling crews. As explained in Chapter 3.0, the method of compositing underwent some development during the project: Appendix E is the final method, used for most of the sampling. The extremely cold weather on some of the sampling days, with temperatures as low as -10°F, precluded use of the vacuum pump and DO analyses.

1. Determine static water level with a static water level indicator and record depth to water. Record reference point, i.e., well casing, ground, etc.

2. Take temperature readings with depth, using thermistor fitted with a glass probe. Record temperature every 1/2 ft. Thermistor will take about 4.2 seconds to respond and stabilize.

3. When thermistor hits bottom of well, record bottom depth in feet. Also record reference point.

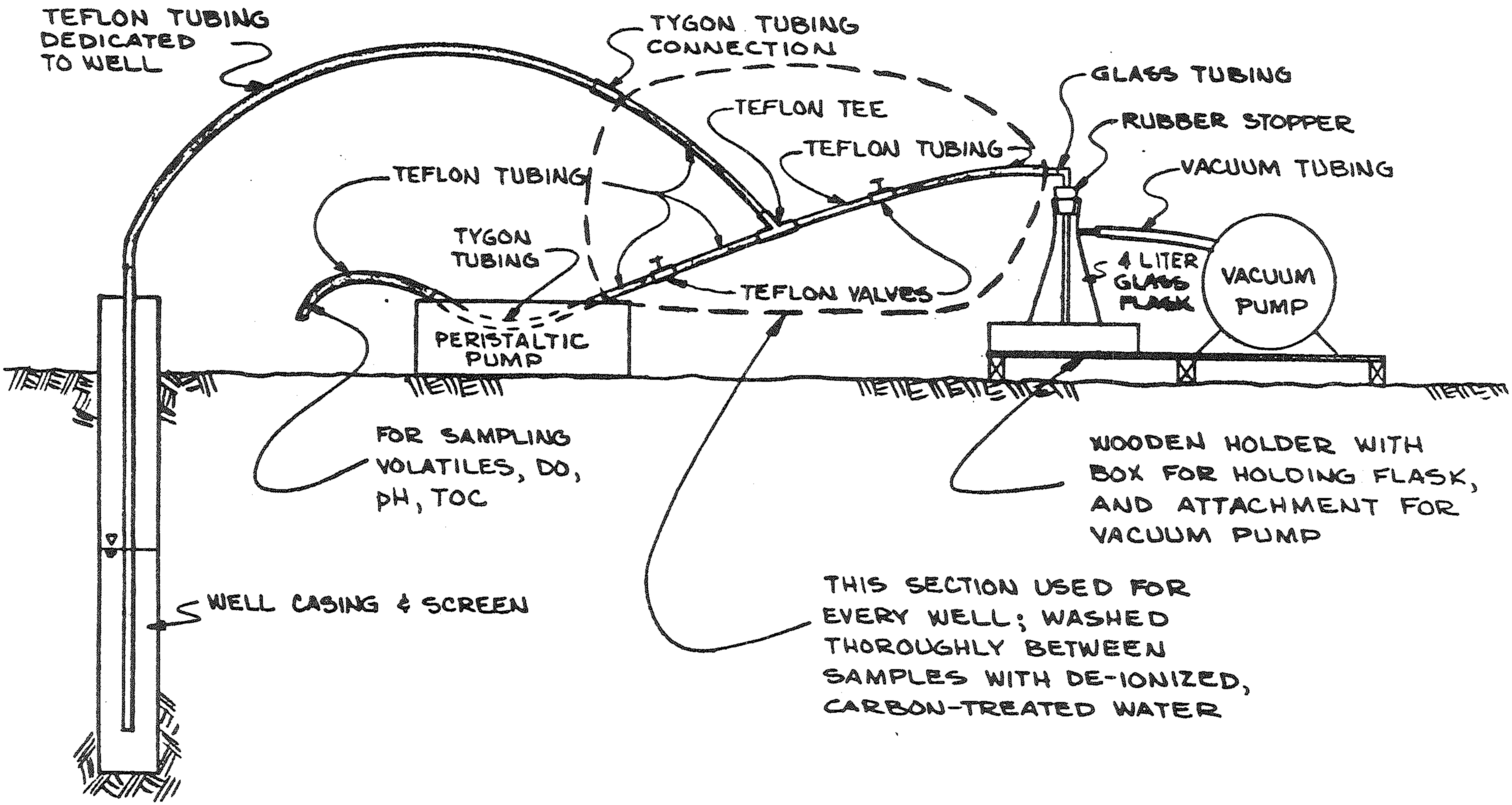
4. Set up vacuum pump and flask using holder. Also set up peristaltic pump. Connect pumps with Teflon valves as shown in Figure C-1.

5. Attach Teflon tubing (designated for that well) and start bailing well, using vacuum pump.

6. Bail three (3) volumes of well as determined by diameter of well and difference between static water level and bottom level.

FIGURE E-1

EQUIPMENT ARRANGEMENT FOR SAMPLING IBM WELLS FOR PRIORITY AND CONVENTIONAL POLLUTANTS



7. After bailing, determine and record static water level. Allow well to recover to original level or to >75% of original water column depth. If refilling appears to be slow, go on to next well and come back later to sample.

8. Once well has refilled, start taking sample from 1/2 to 1 ft from bottom, using vacuum pump. Record sample depth.

9. Use vacuum pump to bring water to surface. Then, by switching valves, use peristaltic pump to take volatiles sample.

10. If DOs are to be done in the field, use peristaltic pump for sampling and sample after taking volatiles. Fill up BOD bottle and preserve in field. Also take sample for pH, using peristaltic pump, and analyze in field. Save for TOC analyses.

11. After sampling for volatiles, DO, pH, and TOC, use vacuum pump to sample for the remaining parameters.

12. Switching the valves, use the vacuum pump to fill a 4-l vacuum flask. Turn off pump, disconnect rubber stopper, and pour contents into large (5-gal) glass compositor, recording sample volume.

13. Repeat Steps 9-12 for mid-depth and surface samples. Record sample depth and sample volume. Volumes for all three depths should be equal.

14. Mix contents of glass compositor and, using a glass funnel, fill up all sample bottles. Cap sample bottles securely and keep on ice. Add preservative as needed.

15. Determine and record static water level after sampling.

16. When finished, place Teflon tubing into large plastic bag labeled for the particular well.

17. Redox potential, pH, conductivity, DO, TOC, NH_3-N and oil and grease should be done on samples after return to lab.

APPENDIX F

TEMPERATURE PROFILES

TEMPERATURE PROFILES
STATION: ST-1

DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C
11/25/80	14'0"	16.7	12/10/80	13'6"	15.1	1/13/81	14'0"	12.9
	13'6"	16.7		13'0"	15.1		13'6"	12.8
	13'0"	16.8		12'6"	15.1		13'0"	12.8
	12'6"	16.7		12'0"	15.1		12'6"	12.8
	12'0"	16.6		11'6"	15.0		12'0"	12.7
	11'6"	16.4		11'0"	14.9		11'6"	12.5
	11'0"	16.3		10'6"	14.8		11'0"	12.4
	10'6"	16.1		10'0"	14.7		10'6"	12.3
	10'0"	16.0		9'6"	14.5		10'0"	12.2
	9'6"	16.0		9'0"	14.3		9'6"	12.0
	9'0"	15.9		8'6"	14.2		9'0"	11.9
	8'6"	15.8					8'6"	11.8
	8'0"	15.7		8'0"	14.1		8'0"	11.4
	7'6"	15.5		7'6"	13.8		7'6"	11.0

TEMPERATURE PROFILES
STATION: 2A

DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C
1/13/81	26'0"	16.1	2/12/81	26'0"	16.1			
	25'0"	16.1		25'0"	16.1			
	24'0"	16.1		24'0"	16.1			
	23'0"	16.2		23'0"	16.2			
	22'0"	16.2		22'0"	16.2			
	21'0"	16.2		21'0"	16.2			
	20'0"	16.3		20'0"	16.3			
	19'0"	16.2		19'0"	16.2			
	18'0"	16.2		18'0"	16.2			
	17'0"	16.1		17'0"	16.1			
	16'0"	16.0		16'0"	16.0			
	15'0"	15.9		15'0"	15.9			
	14'0"	15.8		14'0"	15.8			
	13'0"	15.6		13'0"	15.6			
	12'0"	15.2		12'0"	15.2			
	11'0"	14.8		11'0"	14.8			
	10'0"	14.4		10'0"	14.4			
	9'0"	14.2		9'0'	14.2			
	8'0"	13.8		8'0"	13.8			
	7'0"	12.9		7'0"	12.9			

TEMPERATURE PROFILES
STATION: 3

DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C
3/18/81	34'0"	21.3	3/18/81	11'0"	10.2			
	33'0"	21.3		10'0"	10.0			
	32'0"	21.3		9'0"	9.5			
	31'0"	21.1		8'0"	9.4			
	30'0"	20.3		7'0"	9.0			
	29'0"	19.5						
	28'0"	19.0						
	27'0"	18.0						
	26'0"	17.1						
	25'0"	15.2						
	24'0"	14.5						
	23'0"	14.2						
	22'0"	14.1						
	21'0"	13.9						
	20'0"	13.7						
	19'0"	13.4						
	18'0"	13.1						
	17'0"	12.8						
	16'0"	12.1						
	15'0"	11.8						
	14'0"	11.2						
	13'0"	11.0						
	12'0"	10.8						

TEMPERATURE PROFILES
STATION: 4

DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C
1/13/81	28'0"	15.0						
	27'0"	15.0						
	26'0"	14.9						
	25'0"	14.9						
	24'0"	14.9						
	23'0"	14.8						
	22'0"	14.8						
	21'0"	14.5						
	20'0"	14.2						
	19'0"	14.0						
	18'0"	13.8						
	17'0"	13.6						
	16'0"	13.2						
	15'0"	13.0						
	14'0"	13.0						
	13'0"	12.2						
	12'0"	11.5						
	11'0"	11.0						
	10'0"	10.2						
	9'0"	10.0						
	8'6"	9.0						

TEMPERATURE PROFILES
STATION: 5

DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C
1/31/81	19'0"	14.9	3/18/81	16'0"	13.6			
	18'6"	14.8		15'6"	13.3			
	18'0"	14.8		15'0'	12.9			
	17'6"	14.8		14'6"	12.2			
	17'0"	14.7		14'0"	12.1			
	16'6"	14.5		13'6"	12.0			
	16'0"	14.3		12'6"	11.1			
	15'6"	14.1		12'0"	9.8			
	15'0"	14.0		11'6"	9.6			
	14'6"	13.7		11'0"	9.1			
	14'0"	13.2		10'6"	9.0			
	13'6"	13.0						
	13'0"	12.9						
	12'6"	12.5						
	12'0"	12.3						
	11'6"	12.0						
	11'0"	12.0						

TEMPERATURE PROFILES
STATION: 6

DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C
1/14/81	18'6"	13.3						
	18'0"	13.3						
	17'6"	13.3						
	17'0"	13.3						
	16'6"	13.3						
	16'0"	13.2						
	15'6"	12.8						
	15'0"	12.7						
	14'6"	12.3						
	14'0"	11.9						
	13'6"	11.8						
	13'0"	11.8						
	12'6"	11.5						

TEMPERATURE PROFILES
STATION: 7

DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C
1/31/81	12'0"	10.7						
	11'6"	10.6						
	11'0"	10.4						
	10'6"	10.2						
	10'1"	10.1						

TEMPERATURE PROFILES
STATION: 8

DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C
2/4/81	50'0"	17.3						
	49'0"	17.3						
	48'0"	17.3						
	47'0"	17.3						
	46'0"	17.3						
	45'0"	17.7						
	44'0"	17.7						
	43'0"	17.8						
	42'0"	17.8						
	41'0"	17.8						
	40'0"	17.6						
	39'0"	17.8						
	38'0"	17.8						
	37'0"	17.8						
	36'0"	17.8						
	35'0"	17.8						
	34'0"	17.8						
	33'0"	17.7						
	32'0"	17.7						
	31'0"	17.5						
	30'0"	17.4						
	29'0"	17.3						
	28'0"	17.2						
	27'0"	17.2						
	26'0"	17.1						
	25'0"	17.0						
	24'0"	17.0						
	23'0"	16.9						
	22'0"	16.9						
	21'0"	16.8						
	20'0"	16.2						
	19'0"	16.0						
	18'0"	15.8						
	17'0"	15.8						

TEMPERATURE PROFILES
STATION: 9

DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C
2/4/81	23'0"	16.7						
	22'6"	16.2						
	22'0"	16.0						
	21'6"	15.9						
	21'0"	15.8						
	20'6"	15.7						
	20'0"	15.6						
	19'6"	15.4						
	19'0"	15.2						
	18'6"	15.1						
	18'0"	15.0						
	17'6"	14.9						
	17'0"	14.8						
	16'6"	14.6						
	16'0"	14.2						
	15'6"	14.1						

TEMPERATURE PROFILES
STATION: 10

DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C
2/4/81	32'0"	14.9						
	31'0"	14.9						
	30'0"	14.9						
	29'0"	14.9						
	28'0"	15.0						
	27'0"	15.0						
	26'0"	15.0						
	25'0"	15.4						
	24'0"	15.5						
	23'0"	15.7						
	22'0"	15.7						
	21'0"	15.7						
	20'0"	15.8						
	19'0"	15.8						
	18'0"	15.9						
	17'0"	15.9						
	16'0"	15.7						
	15'0"	15.5						

TEMPERATURE PROFILES
STATION: 17

DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C
1/14/81	34'0"	17.2						
	33'0"	17.2						
	32'0"	17.2						
	31'0"	17.2						
	30'0"	17.2						
	29'0"	17.2						
	28'0"	17.2						
	27'0"	17.2						
	26'0"	17.2						
	25'0"	17.2						
	24'0"	17.2						
	23'0"	17.2						
	22'0"	17.1						
	21'0"	17.0						
	20'0"	17.0						
	19'0"	16.9						
	18'0"	16.9						
	17'6"	16.9						

TEMPERATURE PROFILES
STATION: MW-19

DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C	DATE	DEPTH FT.	TEMP °C
2/4/81	16'6"	12.8						
	16'0"	12.8						
	15'6"	12.8						
	15'0"	12.0						
	14'6"	11.7						
	14'0"	11.5						
	13'6"	11.4						
	13'0"	11.2						
	12'6"	11.1						
	12'0"	11.0						
	11'6"	10.8						
	11'0"	10.5						
	10'6"	10.2						
	10'0"	10.1						
	9'6"	9.9						
	9.0"	9.8						

APPENDIX G

ANALYTICAL RESULTS FROM RECRA RESEARCH, INC.

272-008

ANALYTICAL REPORT

LAWLER, MATUSKY & SKELLY ENGINEERS

Prepared For:

Lawler, Matusky & Skelly Engineers
One Blue Hill Plaza
Pearl River, New York 10965

Prepared By:

Recra Research, Inc.
P.O. Box 448
Tonawanda, New York 14150

Report Date: 11/4/80

RECRA RESEARCH, INC. P.O. Box 448 / Tonawanda, New York 14150 / (716) 838-6200
TOTAL CHEMICAL WASTE MANAGEMENT THROUGH APPLIED RESEARCH

ANALYTICAL REPORT

LAWLER, MATUSKY & SKELLY ENGINEERS

Report Date: 11/4/80

INTRODUCTION:

On October 25, 1980 three samples were received at Recra Research, Inc. A request was made by Lawler, Matusky & Skelly Engineers to have the samples analyzed for Environmental Protection Agency decreed organic priority pollutants, the miscellaneous priority pollutants, total cyanides and total recoverable phenolics, an additional list of twenty-two organic parameters, and sixteen metals. The samples were identified as ST-1, ST-9, and ST-19.

This report will address the results of those analyses.

METHODS:

Organic priority pollutants were analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) according to Environmental Protection Agency (EPA) methodologies. Pesticide priority pollutants were screened by Gas Chromatography.

The GC/MS analyses were performed on a Model 3321 Finnigan GC/MS system operated in the electron impact mode and interfaced with an INCOS data system.

Prior to injection of the sample, perfluorotributylamine was introduced for calibration of the mass spectrometer and the INCOS data system.

GC/MS Conditions Included:

Carrier Gas: High purity Helium, 30 ml/min.

Multiplier Voltage: 1.8 KV

Source Voltage: 70 eV

Filament Current: 0.5 ma

Injector Temperature: 250°C

Separator Temperature: 250°C

Transfer Line Temperature: 225°C

Base/Neutrals:

Column: 183 cm long x 2 mm I.D. 1% SP-2250 on 100/120 mesh Supelcoport

Temperatures: Oven: Initial: 50°C, hold 4 mins.

Final: 250°C

Rate: 10°C/min.

Acid/Phenolics:

Column: 152.4 cm long x 2 mm I.D. 1% SP-1240 DA on 100/120 mesh Supelcoport

Temperatures: Oven: Initial: 85°C, hold 1 min.

Final: 210°C

Rate: 10°C/min.

Volatiles:

Column: 152.4 cm long x 2 mm I.D. 0.2% Carbowax 1500 on 80/100 mesh Carbopak C

Temperatures: Oven: Initial: 40°C, hold 7 mins.

Final: 160°C

Rate: 8°C/min.

Volatile organics were extracted from the sample with a Tekmar Liquid Sample Concentrator (LSC-2).

Pesticides/PCB's:

For the pesticide extracts, analytical results are quantified using data obtained from a Gas-Liquid Chromatograph (GLC) equipped with an Electron Capture Detector (GC/ECD).

Column: 4 mm I.D. x 6 ft. 1.5% SP-2250/1.95% SP-2401 on 100/120 mesh Supelcoport

Carrier Gas: High purity Ar/CH_4 (95%/5%), 60 ml/min.

Temperatures: Oven: 200°C, 30 mins.

Detector: 225°C

Injector: 225°C

Miscellaneous Analyses:

The miscellaneous priority pollutants, total cyanides and total recoverable phenolics were analyzed by wet chemical techniques.

Metals:

The metal priority pollutants and the additional metals were analyzed on a Perkin-Elmer 603 Atomic Absorption Spectrophotometer. At the request of the client these analyses were performed on filtered samples using a 0.45 micron filter.

RESULTS AND DISCUSSION:

The results of the analyses for Acid/Phenolic and Base/Neutral priority pollutants are listed in Tables I and II, respectively.

The results of the Volatile priority pollutant analyses are listed in Table III. The Volatile priority pollutant dichlorodifluoromethane cannot be analyzed by this method. Values for this compound are not reported.

The possible presence of vinyl chloride was indicated in Sample ST-1 at a level below the detection limit. Benzene was indicated in ST-9 at a level below the detection limit. Compounds which are "indicated" as being present fulfill some, but not all, of the requirements for positive identification. Trichloroethylene was noted in the field blank at a level that is trace relative to the detection limit.

The results of the Gas Chromatography (GC) screening for Pesticides/PCB's are listed in Table IV. Compounds indicated by these analyses are at a level that is too low for GC/MS confirmation.

The results of the analysis for Miscellaneous priority pollutants are listed in Table V. Analysis for asbestos was not requested.

The results of the analyses for the additional organic parameters are listed in Table VI. The compounds designated as Group A: Volatiles, Base/Neutrals, Acid/Phenolic, and Pesticide were analyzed as a part of the analyses for the appropriate priority pollutant fractions.

The results of the analyses for metal priority pollutants, aluminum, iron, and tin are listed in Table VII. Analysis for hexavalent chromium was not performed since the soluble chromium analyses indicated that hexavalent chromium could not be present at levels above the detection limit for that analysis.

Values reported as "less than" (<) indicate the working detection limit for the given sample and/or parameter. Values reported as "less than or equal to" (≤) indicate the presence of a compound at a level below the working detection limit and, therefore, not subject to accurate quantification. All detection limits were determined by analysis of standard compounds.

Respectfully submitted,

RECRA RESEARCH, INC.

Timothy R. Baker

Timothy R. Baker
GC/MS Specialist

TRB/skb

TABLE I

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Sample Received: 10/25/80
Report Date: 11/4/80

ACID/PHENOLICS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION		
		ST-1	ST-9	ST-19
2-chlorophenol	μg/l	<2	<2	<2
2,4-dichlorophenol	μg/l	<2	<2	<2
2,4-dimethylphenol	μg/l	<2	<2	<2
4,6-dinitro-o-cresol	μg/l	<20	<20	<20
2,4-dinitrophenol	μg/l	<50	<50	<50
2-nitrophenol	μg/l	<5	<5	<5
4-nitrophenol	μg/l	<10	<10	<10
p-chloro-m-cresol	μg/l	<2	<2	<2
pentachlorophenol	μg/l	<5	<5	<5
phenol	μg/l	<2	<2	<2
2,4,6-trichlorophenol	μg/l	<2	<2	<2

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Timothy R Baker

DATE 11/4/80

TABLE II

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 10/25/80
Report Date: 11/4/80

BASE/NEUTRALS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION		
		ST-1	ST-9	ST-19
acenaphthene	μg/l	<2	<2	<2
acenaphthylene	μg/l	<2	<2	<2
anthracene	μg/l	<2	<2	<2
benzidine	μg/l	<25	<25	<25
benzo(a)anthracene	μg/l	<5	<5	<5
benzo(a)pyrene	μg/l	<10	<10	<10
benzo(b)fluoranthene	μg/l	<5	<5	<5
benzo(g,h,i)perylene	μg/l	<25	<25	<25
benzo(k)fluoranthene	μg/l	<5	<5	<5
bis(2-chloroethoxy)methane	μg/l	<10	<10	<10
bis(2-chloroethyl)ether	μg/l	<10	<10	<10
bis(2-chloroisopropyl) ether	μg/l	<10	<10	<10
bis(2-ethylhexyl)phthalate	μg/l	<10	<10	<10
4-bromophenyl phenyl ether	μg/l	<10	<10	<10
butyl benzylphthalate	μg/l	<10	<10	<10
2-chloronaphthalene	μg/l	<3	<3	<3
4-chloro-phenyl phenyl ether	μg/l	<25	<25	<25
chrysene	μg/l	<5	<5	<5
dibenzo(a,h)anthracene	μg/l	<25	<25	<25
1,2-dichlorobenzene	μg/l	<4	<4	<4
1,3-dichlorobenzene	μg/l	<4	<4	<4
1,4-dichlorobenzene	μg/l	<4	<4	<4
3,3'-dichlorobenzidine	μg/l	<25	<25	<25
diethylphthalate	μg/l	<10	<10	<10
dimethylphthalate	μg/l	<10	<10	<10
di-n-butylphthalate	μg/l	<10	<10	<10

(Continued)

RECRA RESEARCH, INC.
I.D.#1025

TABLE II (cont.'d)

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 10/25/80
Report Date: 11/4/80

BASE/NEUTRALS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION		
		ST-1	ST-9	ST-19
2,6-dinitrotoluene	μg/l	<25	<25	<25
2,4-dinitrotoluene	μg/l	<25	<25	<25
di-n-octyl-phthalate	μg/l	<10	<10	<10
1,2-diphenylhydrazine	μg/l	<25	<25	<25
fluoranthene	μg/l	<2	<2	<2
fluorene	μg/l	<2	<2	<2
hexachlorobenzene	μg/l	<5	<5	<5
hexachlorobutadiene	μg/l	<5	<5	<5
hexachlorocyclopentadiene	μg/l	<25	<25	<25
hexachloroethane	μg/l	<10	<10	<10
indeno(1,2,3-cd)pyrene	μg/l	<25	<25	<25
isophorone	μg/l	<25	<25	<25
naphthalene	μg/l	<2	<2	<2
nitrobenzene	μg/l	<10	<10	<10
N-nitrosodimethylamine	μg/l	<25	<25	<25
N-nitrosodi-n-propylamine	μg/l	<25	<25	<25
N-nitrosodiphenylamine	μg/l	<10	<10	<10
phenanthrene	μg/l	<2	<2	<2
pyrene	μg/l	<2	<2	<2
2,3,7,8-tetrachlorodibenzo-p-dioxin	μg/l	<10	<10	<10
1,2,4-trichlorobenzene	μg/l	<4	<4	<4

COMMENTS: Refer to text.

FOR RECRA RESEARCH, INC. Timothy R Baker

DATE 11/4/80

TABLE III

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Sample Received: 10/25/80
Report Date: 11/4/80

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION ST-1	ST-9	ST-19
acrolein	mg/1	<1	<1	<1
acrylonitrile	mg/1	<2	<2	<2
benzene	μg/1	<1	<1	<1
bis-chloromethyl ether	μg/1	<3	<3	<3
bromodichloromethane	μg/1	<5	<5	<5
bromoform	μg/1	<10	<10	<10
bromomethane	μg/1	<5	<5	<5
carbon tetrachloride	μg/1	<3	<3	<3
chlorobenzene	μg/1	<2	<2	<2
chloroethane	μg/1	10	<5	<5
2-chloroethylvinyl ether	μg/1	<10	<10	<10
chloroform	μg/1	≤3	<3	<3
chloromethane	μg/1	<5	<5	<5
dibromochloromethane	μg/1	<5	<5	<5
dichlorodifluoromethane	μg/1	-	-	-
1,1-dichloroethane	μg/1	35	<5	<5
1,2-dichloroethane	μg/1	<1	<1	<1
1,1-dichloroethylene	μg/1	1	<1	<1
trans-1,2-dichloroethylene	μg/1	<1	<1	68
1,2-dichloropropane	μg/1	<2	<2	<2
cis-1,3-dichloropropene	μg/1	<5	<5	<5
trans-1,3-dichloropropene	μg/1	<5	<5	<5
ethylbenzene	μg/1	<1	<1	<1
methylene chloride	μg/1	<3	<3	<3

(Continued)

TABLE III (Cont.'d)

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 10/25/80
Report Date: 11/4/80

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION		
		ST-1	ST-9	ST-19
1,1,2,2-tetrachloroethane	μg/l	<1	<1	<1
tetrachloroethylene	μg/l	<1	<1	31
toluene	μg/l	<1	<1	<1
1,1,1-trichloroethane	μg/l	150	<2	65
1,1,2-trichloroethane	μg/l	<2	<2	<2
trichloroethylene	μg/l	5	<1	350
trichlorofluoromethane	μg/l	<1	<1	<1
vinyl chloride	μg/l	<5	<5	<5

COMMENTS: Refer to text.

FOR RECRA RESEARCH, INC. Timothy R Baker

DATE 11/4/80

TABLE IV

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY
PRIORITY POLLUTANT ANALYSES

Sample Received: 10/25/80
Report Date: 11/4/80

PESTICIDES/PCB'S

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION		
		ST-1	ST-9	ST-19
Aldrin	μg/l	<0.05	<0.05	<0.05
α-BHC	μg/l	≤0.05	<0.05	0.05
β-BHC	μg/l	0.2	0.14	<0.05
δ-BHC	μg/l	<0.05	<0.05	<0.05
γ-BHC	μg/l	<0.05	<0.05	<0.05
Chlordane	μg/l	<0.1	<0.1	<0.1
4,4'-DDD	μg/l	<0.05	<0.05	<0.05
4,4'-DDE	μg/l	<0.05	<0.05	<0.05
4,4'-DDT	μg/l	<0.05	<0.05	<0.05
Dieldrin	μg/l	<0.05	<0.05	<0.05
α-Endosulfan	μg/l	<0.05	<0.05	<0.05
β-Endosulfan	μg/l	<0.05	<0.05	<0.05
Endosulfan sulfate	μg/l	≤0.05	<0.05	<0.05
Endrin	μg/l	<0.05	<0.05	<0.05
Endrin aldehyde	μg/l	<0.05	<0.05	<0.05
Heptachlor	μg/l	<0.05	<0.05	<0.05
Heptachlor epoxide	μg/l	<0.05	<0.05	<0.05
PCB-1016	μg/l	<1	<1	<1
PCB-1221	μg/l	<2	<2	<2
PCB-1232	μg/l	<1	<1	<1
PCB-1242	μg/l	<1	<1	<1
PCB-1248	μg/l	<0.5	<0.5	<0.5
PCB-1254	μg/l	<0.5	<0.5	<0.5
PCB-1260	μg/l	<0.5	<0.5	<0.5
Toxaphene	μg/l	<0.1	<0.1	<0.1

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Larry E. Rosengrant / TRB

DATE 11/4/80

RECRA RESEARCH, INC.
I.D.#1025

TABLE V

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES

Sample Received: 10/25/80
Report Date: 11/4/80

MISCELLANEOUS ANALYSIS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION ST-1	ST-9	ST-19
total cyanides	µg/1	<20	<30	<20
total recoverable phenolics	mg/1	0.01	0.03	0.01

COMMENTS: Refer to text.

FOR RECRA RESEARCH, INC. R. V. Finn

DATE 11/4/80

TABLE VI

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
ADDITIONAL ORGANICS

Samples Received: 10/25/80
Report Date: 11/4/80

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION ST-1	ST-9	ST-19
GROUP A VOLATILES				
acetone	μg/1	<10	<10	<10
1,2-dibromo-3-chloropropane	μg/1	<15	<15	<15
epichlorohydrin	μg/1	<50	<50	<50
ethyleneimine	μg/1	<20	<20	<20
isopropanol	μg/1	<25	<25	<25
methylethylketone	μg/1	<10	<10	<10
methylisopropylketone	μg/1	<10	<10	<10
B-propiolactone	μg/1	<30	<30	<30
tetrahydrofuran	μg/1	<10	<10	<10
1,1,2-trichloro-1,2,2-trifluoroethane	μg/1	<10	<10	<10
xylene	μg/1	<10	<10	<10
GROUP A BASE/NEUTRALS				
2-acetamidofluoroene	μg/1	<10	<10	<10
4-aminobiphenyl	μg/1	<15	<15	<15
t-butylbenzene	μg/1	<10	<10	<10
4-dimethylaminoazo-benzene	μg/1	<20	<20	<20
methylene(bis)-2-chloroaniline	μg/1	<20	<20	<20
α-naphthylamine	μg/1	<5	<5	<5
β-naphthylamine	μg/1	<5	<5	<5
4-nitrobiphenyl	μg/1	<20	<20	<20
pyridine	μg/1	<15	<15	<15
GROUP A ACID/PHENOLIC				
hydroquinone	μg/1	<10	<10	<10
GROUP A PESTICIDE				
methoxychlor	μg/1	<0.1	<0.1	<0.1

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Timothy R Bber

DATE 11/4/80

RECRA RESEARCH, INC.
I.D.#1025

TABLE VII

LAWLER, MATUSKY & SKELLY ENGINEERS
ATOMIC ABSORPTION

Sample Received: 10/25/80
Report Date: 11/4/80

METALS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION ST-1	ST-9	ST-19
Soluble aluminum	mg/l	0.4	0.3	1.0
Soluble antimony	mg/l	<0.5	<0.5	<0.5
Soluble arsenic	μg/l	<1	<1	<1
Soluble beryllium	mg/l	<0.003	<0.003	<0.003
Soluble cadmium	mg/l	<0.004	<0.004	<0.004
Soluble chromium	mg/l	<0.005	<0.005	0.010
Soluble copper	mg/l	0.138	<0.006	<0.006
Soluble iron	mg/l	0.22	1.7	<0.02
Soluble lead	mg/l	<0.02	0.03	0.04
Soluble mercury	μg/l	<0.8	<0.8	<0.8
Soluble nickel	mg/l	0.39	<0.02	<0.02
Soluble selenium	μg/l	<4	<4	<4
Soluble silver	mg/l	<0.005	<0.005	<0.005
Soluble thallium	mg/l	<0.2	<0.2	<0.2
Soluble tin	mg/l	<0.2	<0.2	<0.2
Soluble zinc	mg/l	0.052	0.013	0.046

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. R. V. Finn

DATE 11/4/80

December 11, 1980

Ms. Karen A. Wright
Lawler, Matusky & Skelly Engineers
One Blue Hill Plaza
Pearl River, NY 10965

Re: Analytical Results

Dear Ms. Wright:

Please find enclosed Recra Research, Inc.'s results of the analyses of a water sample received at our laboratories on November 26, 1980.

If you have any questions concerning these data, do not hesitate to contact the undersigned.

Sincerely,

RECRA RESEARCH, INC.

James A. Ploscyca
Laboratory Manager

RVF/JAP/skb
Enclosure

I.D.#1110

RECRA RESEARCH, INC. P.O. Box 448 / Tonawanda, New York 14150 / (716) 838-6200
TOTAL CHEMICAL WASTE MANAGEMENT THROUGH APPLIED RESEARCH

ANALYTICAL RESULTS

LAWLER, MATUSKY & SKELLY ENGINEERS

Report Date: 12/11/80
Date Received: 11/26/80

PARAMETER	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) ST-1 (11/25/80)
Soluble Aluminum	mg/1	<0.1
Soluble Copper	mg/1	0.016
Soluble Iron	mg/1	0.22
Soluble Nickel	mg/1	0.18
Soluble Zinc	mg/1	0.109
Chloroethane	μg/1	<3
1,1-Dichloroethane	μg/1	<1
1,1,1-Trichloroethane	μg/1	<2
1,1-Dichloroethylene	μg/1	<1
Trichloroethylene	μg/1	<1

COMMENTS: Sample was received at Recra on 11/26/80. Analyses were performed according to U.S. Environmental Protection Agency methodologies where applicable. Values reported as "less than" (<) indicate the working detection limit for the particular sample or parameter. Results for specific organic compounds are based upon retention time matches of sample and standard chromatograms. Confirmational analyses have not been performed.

FOR RECRA RESEARCH, INC. [signature]

DATE 12/12/80

RECRA RESEARCH, INC.
I.D.#1110

REC'D
2/11/81

February 6, 1981

Ms. Karen A. Wright
Lawler, Matusky & Skelly Engineers
One Blue Hill Plaza
Pearl River, NY 10465

Re: Analytical Report

Dear Ms. Wright:

Please find enclosed Recra Research, Inc.'s results of the analyses of the eleven samples received at our laboratories on January 14, 15 and 16 of 1981.

If you have any questions concerning these data, do not hesitate to contact the undersigned.

Sincerely,

RECRA RESEARCH, INC.

James A. Ploscyca

James A. Ploscyca
Laboratory Manager

TRB/JAP/pcb
Enclosure

I.D. #81-25
81-35
81-37

RECRA RESEARCH, INC. P.O. Box 448 / Tonawanda, New York 14150 / (716) 838-6200
TOTAL CHEMICAL WASTE MANAGEMENT THROUGH APPLIED RESEARCH

ANALYTICAL REPORT

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES

Prepared For:

Lawler, Matusky & Skelly Engineers
One Blue Hill Plaza
Pearl River, NY 10465

Prepared By:

Recra Research, Inc.
P.O. Box 448
Tonawanda, NY 14150

Report Date: February 6, 1981

RECRA RESEARCH, INC. P.O. Box 448 / Tonawanda, New York 14150 / (716) 838-6200
TOTAL CHEMICAL WASTE MANAGEMENT THROUGH APPLIED RESEARCH

ANALYTICAL REPORT

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES

Report Date: 2/6/81

INTRODUCTION:

In January of 1981, eleven samples were received at Recra Research, Inc. A request was made by Lawler, Matusky & Skelly Engineers to have the samples analyzed for Environmental Protection Agency decreed Volatile, Metal, and Miscellaneous priority pollutants.

The sample identifications and dates are as follows:

ST-1 (Composite of top, middle, and bottom, for volatiles)
2A (Composite of top, middle, and bottom, for volatiles) - 1/14/81
4 (Composite of middle and bottom, for volatiles)

The vial identified as 4-top, for Volatile analysis, was received broken. A composite of the middle and bottom vials for sample 4 was analyzed for Volatiles, as requested.

6 (Composite of top, middle, and bottom, for volatiles)
7 (A single vial for volatiles)
12 (Composite of top, middle, and bottom, for volatiles) - 1/15/81
13 (Composite of top, middle, and bottom, for volatiles)
17 (Composite of top, middle, and bottom, for volatiles)

14 (Composite of top, middle, and bottom, for volatiles)
15R (Composite of top, middle, and bottom, for volatiles) - 1/16/81
15S (Composite of top, middle, and bottom, for volatiles)

Analysis for priority pollutant Metals was not requested for samples 12, 13, and 14.

This report will address the results of those analyses.

METHODS:

Priority pollutant analyses were conducted according to Environmental Protection Agency (EPA) methodologies. Volatile priority pollutants were analyzed by Gas Chromatography/Mass Spectrometry (GC/MS).

The GC/MS analyses were performed on a Model 3321 Finnigan GC/MS system operated in the electron impact mode and interfaced with an INCOS data system.

Prior to injection of the sample, perfluorotributylamine was introduced for calibration of the mass spectrometer and the INCOS data system.

GC/MS Conditions Included:

Carrier Gas: High purity Helium, 30 ml/min.

Multiplier Voltage: 1.8 KV

Source Voltage: 70 eV

Filament Current: 0.5 ma

Injector Temperature: 250°C

Separator Temperature: 250°C

Transfer Line Temperature: 225°C

Column: 152.4 cm long x 2 mm I.D. 0.2% Carbowax 1500 on 80/100 mesh
Carbopak C

Temperatures: Oven: Initial: 45°C, hold 7 mins.
Final: 160°C
Rate: 8°C/min.

Volatile organics were extracted from the sample with a Tekmar Liquid Sample Concentrator (LSC-2).

METHODS (Continued):

Metals:

The metal priority pollutant analyses were performed on a Perkin-Elmer 603 Atomic Absorption Spectrophotometer. Metal samples were filtered (0.45 micron) at the request of the client. This is a deviation from the priority pollutant methodology.

Miscellaneous Analyses:

The miscellaneous priority pollutants, total cyanide, and total recoverable phenolics were analyzed by wet chemical techniques.

RESULTS AND DISCUSSION:

The results of the Volatile priority pollutant analyses are listed in Tables I through III.

There was some indication of the possible presence of 1,1-dichloroethane in Sample 4 at a level below the detection limit. Chloroethane and 1,1-dichloroethane were indicated in ST-1 at levels below the detection limit. The field blank provided with the first sample set (Table I) did not contain any compounds above the level of the detection limits.

The Volatile priority pollutant 1,1-dichloroethane was indicated in 12 at a level below the detection limit. A field blank was not received with the second sample set (Table II).

Note that the value for vinyl chloride in 15S (600 μg/l, Table III) is reported with one significant figure. The amount indicated by this analysis was outside the standard range for vinyl chloride. Normal procedure would dictate duplicate analysis using a smaller sample volume. However, in the absence of a replicate sample, this was not possible.

RESULTS AND DISCUSSION (Continued):

The results of the Metal priority pollutant analyses are listed in Tables IV through VI.

Miscellaneous priority pollutant results are listed in Tables VII through IX.

Values reported as "less than" (<) indicate the working detection limit for the given sample and/or parameter. Values reported as "less than or equal to" (≤) indicate the presence of a compound at a level below the working detection limit and, therefore, not subject to accurate quantification.

Compounds which are "indicated" fulfill some, but not all, of the requirements for positive identification.

Respectfully submitted,

RECRA RESEARCH, INC.

Timothy R Baker

Timothy R. Baker
GC/MS Specialist

TRB/pcb

TABLE I

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 1/14/81
Report Date: 2/6/81

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) ST-1 (1/13/81)	2A (1/13/81)	4 (1/13/81)
acrolein	mg/l	<1	<1	<1
acrylonitrile	mg/l	<2	<2	<2
benzene	µg/l	<20	<20	<20
bis-chloromethyl ether	µg/l	<3	<3	<3
bromodichloromethane	µg/l	<5	<5	<5
bromoform	µg/l	<10	<10	<10
bromomethane	µg/l	<5	<5	<5
carbon tetrachloride	µg/l	<3	<3	<3
chlorobenzene	µg/l	<2	<2	<2
chloroethane	µg/l	<5	<5	<5
2-chloroethylvinyl ether	µg/l	<10	<10	<10
chloroform	µg/l	<5	<5	<5
chloromethane	µg/l	<5	<5	<5
dibromochloromethane	µg/l	<5	<5	<5
dichlorodifluoromethane	µg/l	<5	<5	<5
1,1-dichloroethane	µg/l	26	<5	<5
1,2-dichloroethane	µg/l	<1	<1	<1
1,1-dichloroethylene	µg/l	<1	<1	<1
trans-1,2-dichloroethylene	µg/l	<1	<1	<1
1,2-dichloropropane	µg/l	<2	<2	<2
cis-1,3-dichloropropene	µg/l	<5	<5	<5
trans-1,3-dichloropropene	µg/l	<5	<5	<5
ethylbenzene	µg/l	<1	<1	<1
methylene chloride	µg/l	<3	<3	<3

(Continued)

TABLE I (cont'd.)

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 1/14/81
Report Date: 2/6/81

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE)		
		ST-1 (1/13/81)	2A (1/13/81)	4 (1/13/81)
1,1,2,2-tetrachloroethane	μg/l	<1	<1	<1
tetrachloroethylene	μg/l	<1	<1	<1
toluene	μg/l	<20	<20	<20
1,1,1-trichloroethane	μg/l	11	<2	<2
1,1,2-trichloroethane	μg/l	<2	<2	<2
trichloroethylene	μg/l	4	<1	<1
trichlorofluoromethane	μg/l	<1	<1	<1
vinyl chloride	μg/l	<5	<5	<5

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Timothy R [illegible]

DATE 2/9/81

TABLE II

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 1/15/81
Report Date: 2/6/81

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE)				
		6 (1/14/81)	7 (1/14/81)	12 (1/14/81)	13 (1/14/81)	17 (1/14/81)
acrolein	mg/l	<1	<1	<1	<1	<1
acrylonitrile	mg/l	<2	<2	<2	<2	<2
benzene	µg/l	<20	<20	<20	<20	<20
bis-chloromethyl ether	µg/l	<3	<3	<3	<3	<3
bromodichloromethane	µg/l	<5	<5	<5	<5	<5
bromoform	µg/l	<10	<10	<10	<10	<10
bromomethane	µg/l	<5	<5	<5	<5	<5
carbon tetrachloride	µg/l	<3	<3	<3	<3	<3
chlorobenzene	µg/l	<2	<2	<2	<2	<2
chloroethane	µg/l	<5	<5	<5	<5	<5
2-chloroethylvinyl ether	µg/l	<10	<10	<10	<10	<10
chloroform	µg/l	<5	<5	<5	<5	<5
chloromethane	µg/l	<5	<5	<5	<5	<5
dibromochloromethane	µg/l	<5	<5	<5	<5	<5
dichlorodifluoromethane	µg/l	<5	<5	<5	<5	<5
1,1-dichloroethane	µg/l	<5	<5	<5	<5	<5
1,2-dichloroethane	µg/l	<1	<1	<1	<1	<1
1,1-dichloroethylene	µg/l	<1	<1	<1	<1	<1
trans-1,2-dichloroethylene	µg/l	<1	<1	<1	2	<1
1,2-dichloropropane	µg/l	<2	<2	<2	<2	<2
cis-1,3-dichloropropene	µg/l	<5	<5	<5	<5	<5
trans-1,3-dichloropropene	µg/l	<5	<5	<5	<5	<5
ethylbenzene	µg/l	<1	<1	<1	<1	<1
methylene chloride	µg/l	<3	<3	<3	<3	<3

(Continued)

TABLE II (cont'd.)

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 1/15/81
Report Date: 2/6/81

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE)				
		6 (1/14/81)	7 (1/14/81)	12 (1/14/81)	13 (1/14/81)	17 (1/14/81)
1,1,2,2-tetrachloroethane	μg/l	<1	<1	<1	<1	<1
tetrachloroethylene	μg/l	<1	<1	<1	<1	<1
toluene	μg/l	<20	<20	<20	<20	<20
1,1,1-trichloroethane	μg/l	<2	<2	<2	<2	<2
1,1,2-trichloroethane	μg/l	<2	<2	<2	<2	<2
trichloroethylene	μg/l	<1	<1	1	5	<1
trichlorofluoromethane	μg/l	≤1	≤1	<1	<1	≤1
vinyl chloride	μg/l	<5	<5	<5	8	<5

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Timothy R Babel

DATE 2/9/81

TABLE III

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 1/16/81
Report Date: 2/6/81

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) 14 (1/15/81)	15R (1/15/81)	15S (1/15/81)
acrolein	mg/l	<1	<1	<1
acrylonitrile	mg/l	<2	<2	<2
benzene	μg/l	<20	<20	<20
bis-chloromethyl ether	μg/l	<3	<3	<3
bromodichloromethane	μg/l	<5	<5	<5
bromoform	μg/l	<10	<10	<10
bromomethane	μg/l	<5	<5	<5
carbon tetrachloride	μg/l	<3	<3	<3
chlorobenzene	μg/l	<2	<2	<2
chloroethane	μg/l	<5	<5	<5
2-chloroethylvinyl ether	μg/l	<10	<10	<10
chloroform	μg/l	<5	<5	<5
chloromethane	μg/l	<5	<5	<5
dibromochloromethane	μg/l	<5	<5	<5
dichlorodifluoromethane	μg/l	<5	<5	<5
1,1-dichloroethane	μg/l	12	<5	5
1,2-dichloroethane	μg/l	<1	<1	<1
1,1-dichloroethylene	μg/l	<1	≤1	<1
trans-1,2-dichloroethylene	μg/l	8.3	14	37
1,2-dichloropropane	μg/l	<2	<2	11
cis-1,3-dichloropropene	μg/l	<5	<5	<5
trans-1,3-dichloropropene	μg/l	<5	<5	<5
ethylbenzene	μg/l	<1	<1	<1
methylene chloride	μg/l	<3	<3	<3

(Continued)

TABLE III (cont'd.)

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 1/16/81
Report Date: 2/6/81

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) 14 (1/15/81)	15R (1/15/81)	15S (1/15/81)
1,1,2,2-tetrachloroethane	μg/1	<1	<1	<1
tetrachloroethylene	μg/1	<1	<1	<1
toluene	μg/1	<20	<20	<20
1,1,1-trichloroethane	μg/1	4	<2	<2
1,1,2-trichloroethane	μg/1	<2	<2	<2
trichloroethylene	μg/1	14	23	1
trichlorofluoromethane	μg/1	<1	5	<1
vinyl chloride	μg/1	50	19	600

COMMENTS: Refer to text.

FOR RECRA RESEARCH, INC. Timothy R Baker

DATE 2/9/81

TABLE IV

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES
ATOMIC ABSORPTION

Samples Received: 1/14/81
Report Date: 2/6/81

METALS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) ST-1 (1/13/81)	2A (1/13/81)	4 (1/13/81)
Soluble antimony	mg/l	0.1	0.2	<0.1
Soluble arsenic	µg/l	<2	<2	<2
Soluble beryllium	mg/l	<0.005	<0.005	<0.005
Soluble cadmium	mg/l	<0.005	<0.005	<0.005
Soluble chromium	mg/l	0.004	<0.004	<0.004
Soluble copper	mg/l	0.056	<0.004	<0.004
Soluble lead	mg/l	<0.03	<0.03	<0.03
Soluble mercury	µg/l	<2	<2	<2
Soluble nickel	mg/l	0.03	<0.03	<0.03
Soluble selenium	µg/l	<3	<3	<3
Soluble silver	mg/l	<0.01	<0.01	<0.01
Soluble thallium	mg/l	<0.1	<0.1	<0.1
Soluble zinc	mg/l	0.069	<0.004	0.013

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. R. V. Finn

DATE 2/9/81

TABLE V

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES
ATOMIC ABSORPTION

Samples Received: 1/15/81
Report Date: 2/6/81

METALS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) 6 (1/14/81)	7 (1/14/81)	17 (1/14/81)
Soluble antimony	mg/l	0.1	<0.1	<0.1
Soluble arsenic	μg/l	<4	<4	<4
Soluble beryllium	mg/l	0.005	<0.005	<0.005
Soluble cadmium	mg/l	0.007	0.011	0.008
Soluble chromium	mg/l	<0.004	0.008	<0.004
Soluble copper	mg/l	0.008	0.014	<0.004
Soluble lead	mg/l	<0.03	0.8	0.06
Soluble mercury	μg/l	<2	<2	<2
Soluble nickel	mg/l	<0.03	<0.03	<0.03
Soluble selenium	μg/l	<3	<3	<3
Soluble silver	mg/l	<0.01	<0.01	<0.01
Soluble thallium	mg/l	<0.1	<0.1	<0.1
Soluble zinc	mg/l	0.028	0.026	0.012

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. R. V. F[illegible]

DATE 2/9/81

TABLE VI

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES
ATOMIC ABSORPTION

Samples Received: 1/16/81
Report Date: 2/6/81

METALS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) 15R (1/15/81)	15S (1/15/81)
Soluble antimony	mg/1	<0.1	<0.1
Soluble arsenic	μg/1	<3	<3
Soluble beryllium	mg/1	<0.005	<0.005
Soluble cadmium	mg/1	<0.005	<0.005
Soluble chromium	mg/1	<0.005	<0.005
Soluble copper	mg/1	0.006	0.032
Soluble lead	mg/1	0.05	0.18
Soluble mercury	μg/1	<2	<2
Soluble nickel	mg/1	<0.03	0.04
Soluble selenium	μg/1	<3	<3
Soluble silver	mg/1	<0.01	<0.01
Soluble thallium	mg/1	<0.1	<0.1
Soluble zinc	mg/1	0.031	0.030

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. R. V. Fin[illegible]

DATE 2/9/81

TABLE VII

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES

Samples Received: 1/14/81
Report Date: 2/6/81

MISCELLANEOUS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) ST-1 (1/13/81)	2A (1/13/81)	4 (1/13/81)
Total cyanide	µg/l	<10	<10	<10
Total recoverable phenolics	mg/l	<0.01	<0.01	<0.01

COMMENTS: Refer to text.

FOR RECRA RESEARCH, INC. R. V. Firm

DATE 2/9/81

TABLE VIII

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES

Samples Received: 1/15/81
Report Date: 2/6/81

MISCELLANEOUS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE)				
		6 (1/14/81)	7 (1/14/81)	12 (1/14/81)	13 (1/14/81)	17 (1/14/81)
Total cyanide	µg/1	<20	<20	<20	<20	<20
Total recoverable phenolics	mg/1	<0.01	<0.01	<0.01	<0.01	<0.01

COMMENTS: Refer to text.

FOR RECRA RESEARCH, INC. R. V. Finn

DATE 2/9/81

TABLE IX

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES

Samples Received: 1/16/81
Report Date: 2/6/81

MISCELLANEOUS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE)		
		14 (1/15/81)	15R (1/15/81)	15S (1/15/81)
Total cyanide	μg/l	36	<20	<20
Total recoverable phenolics	mg/l	<0.01	<0.02	<0.02

COMMENTS: Refer to text.

FOR RECRA RESEARCH, INC. R. V. Finn

DATE 2/9/81

RECEIVED

MAR 16 '81

LAWLER, MATUSKY & SKELLY
ENGINEERS

March 11, 1981

Ms. Karen A. Wright
Lawler, Matusky & Skelly Engineers
One Blue Hill Plaza
Pearl River, NY 10965

Re: Analytical Report

Dear Ms. Wright:

Please find enclosed Recra Research, Inc.'s results of the analyses of five samples received at our laboratories on February 5, 1981.

If you have any questions concerning these data, do not hesitate to contact the undersigned.

Sincerely,

RECRA RESEARCH, INC.

James A. Ploscyca

James A. Ploscyca
Laboratory Manager

TRB/JAP/pcb
Enclosure

I.D. #81-85

RECRA RESEARCH, INC. P.O. Box 448 / Tonawanda, New York 14150 / (716) 838-6200
TOTAL CHEMICAL WASTE MANAGEMENT THROUGH APPLIED RESEARCH

ANALYTICAL REPORT

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES

Prepared For:

Lawler, Matusky & Skelly Engineers
One Blue Hill Plaza
Pearl River, NY 10965

Prepared By:

Recra Research, Inc.
P.O. Box 448
Tonawanda, NY 14150

Report Date: March 11, 1981

RECRA RESEARCH, INC. P.O. Box 448 / Tonawanda, New York 14150 / (716) 838-6200
TOTAL CHEMICAL WASTE MANAGEMENT THROUGH APPLIED RESEARCH

ANALYTICAL REPORT

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES

Report Date: 3/11/81

INTRODUCTION:

On February 5, 1981, five aqueous samples were received at Recra Research, Inc. A request was made by Lawler, Matusky & Skelly Engineers to have one sample, identified as 22, analyzed for Environmental Protection Agency decreed priority pollutants. Analysis for Asbestos was not requested. The remaining four samples were to be analyzed for Volatile, Pesticide/PCB, Metal, and Miscellaneous priority pollutants. These samples were identified as: 8, 9, 10, and MW-19. Field blanks and duplicates were provided for Volatile analysis. Each Volatile sample was a composite of three vials labelled TOP, MID, and BOT. Chain of custody procedures were followed.

This report will address the results of those analyses.

METHODS:

Priority pollutant analyses were conducted according to Environmental Protection Agency (EPA) methodologies.

Organic priority pollutants were analyzed by Gas Chromatography/Mass Spectrometry (GC/MS). Pesticide priority pollutants were screened by Gas Chromatography.

The GC/MS analyses were performed on a Model 3221 Finnigan GC/MS system operated in the electron impact mode and interfaced with an INCOS data system.

Prior to injection of the samples, perfluorotributylamine was introduced for calibration of the mass spectrometer and the INCOS data system.

METHODS (cont'd.):

GC/MS Conditions Included:

Carrier Gas: High purity Helium, 30 ml/min.

Multiplier Voltage: 2.0 KV

Source Voltage: 70 eV

Filament Current: 0.5 ma

Injector Temperature: 250°C

Separator Temperature: 250°C

Transfer Line Temperature: 225°C

Acid/Phenolics:

Column: 152.4 cm long x 2 mm I.D. 1% SP-1240 DA on 100/120 mesh Supelcoport

Temperatures: Oven: Initial: 85°C, hold 1 min.

Final: 210°C

Rate: 10°C/min.

Base/Neutrals:

Column: 183 cm long x 2 mm I.D. 1% SP-2250 on 100/120 mesh Supelcoport

Temperatures: Oven: Initial: 50°C, hold 4 mins.

Final: 250°C

Rate: 10°C/min.

Volatiles:

Column: 152.4 cm long x 2 mm I.D. 0.2% Carbowax 1500 on 80/100 mesh Carbopak C

Temperatures: Oven: Initial: 45°C, hold 7 mins.

Final: 160°C

Rate: 8°C/min.

Volatile organics were extracted from the sample with a Tekmar Liquid Sample Concentrator (LSC-2).

METHODS (cont'd.):

Pesticides/PCB's:

For the pesticide extracts, analytical results are quantified using data obtained from a Gas-Liquid Chromatograph (GLC) equipped with an Electron Capture Detector (GC/ECD).

Column: 183 mc long x 4 mm I.D. 1.5% SP-2250/1.95% SP-2401 on 100/120 mesh Supelcoport

Carrier Gas: High purity Ar/CH_4 (95%/5%), 60 ml/min.

Temperatures: Oven: 200°C, 30 mins.

Detector: 225°C

Injector: 225°C

Metals:

The metal priority pollutant analyses were performed on a Perkin-Elmer 603 Atomic Absorption Spectrophotometer. At the request of the client, all Metal analyses were performed on filtered samples. This is a deviation from the priority pollutant methodology.

Miscellaneous Analyses:

The Miscellaneous priority pollutants, Total cyanide, and Total recoverable phenolics were analyzed by wet chemical techniques.

RESULTS AND DISCUSSION:

Results of the priority pollutant analyses are listed in Tables I through VI.

RESULTS AND DISCUSSION (cont'd.):

The following Volatile compounds were indicated in the listed samples at levels below the detection limit.

8 - 1,1-dichloroethane

MW-19 - 1,1-dichloroethane
trichlorofluoromethane
vinyl chloride

22 - vinyl chloride

Chloroform was found in the field blank at a level less than 1 μg/1.

Compounds indicated by the Gas Chromatography screening for Pesticides/ PCB's (Table IV) are at levels too low for GC/MS confirmation.

Table VII lists the results of a Volatile recovery analysis of sample 10. Recoveries may be affected by sample matrix (interferences).

Values reported as "less than" (<) indicate the working detection limit for the given sample and/or parameter. Values reported as "less than or equal to" (≤) indicate the presence of a compound at a level below the working detection limit and, therefore, not subject to accurate identification.

Compounds which are "indicated" fulfill some, but not all, of the requirements for positive identification.

Respectfully submitted,

RECRA RESEARCH, INC.

Timothy R Baker

Timothy R. Baker
GC/MS Specialist

TRB/pcb

TABLE I

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/5/81
Report Date: 3/11/81

ACID/PHENOLICS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) 22 (2/4/81)
2-chlorophenol	μg/l	<5
2,4-dichlorophenol	μg/l	<5
2,4-dimethylphenol	μg/l	<5
4,6-dinitro-o-cresol	μg/l	<50
2,4-dinitrophenol	μg/l	<50
2-nitrophenol	μg/l	<5
4-nitrophenol	μg/l	<50
p-chloro-m-cresol	μg/l	<10
pentachlorophenol	μg/l	<10
phenol	μg/l	<5
2,4,6-trichlorophenol	μg/l	<10

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Timothy R Balsar

DATE 3/12/81

TABLE II

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/5/81
Report Date: 3/11/81

BASE/NEUTRALS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) 22 (2/4/81)
acenaphthene	µg/l	<2
acenaphthylene	µg/l	<2
anthracene	µg/l	<2
benzidine	µg/l	<25
benzo(a)anthracene	µg/l	<5
benzo(a)pyrene	µg/l	<10
benzo(b)fluoranthene	µg/l	<5
benzo(g,h,i)perylene	µg/l	<25
benzo(k)fluoranthene	µg/l	<5
bis(2-chloroethoxy)methane	µg/l	<10
bis(2-chloroethyl)ether	µg/l	<10
bis(2-chloroisopropyl) ether	µg/l	<10
bis(2-ethylhexyl)phthalate	µg/l	<10
4-bromophenylphenylether	µg/l	<10
butylbenzylphthalate	µg/l	<10
2-chloronaphthalene	µg/l	<3
4-chlorophenylphenylether	µg/l	<25
chrysene	µg/l	<5
dibenzo(a,h)anthracene	µg/l	<25
1,2-dichlorobenzene	µg/l	<5
1,3-dichlorobenzene	µg/l	<5
1,4-dichlorobenzene	µg/l	<5
3,3'-dichlorobenzidine	µg/l	<25
diethylphthalate	µg/l	<10
dimethylphthalate	µg/l	<10
di-n-butylphthalate	µg/l	<10

(Continued)

TABLE II (cont'd.)

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/5/81
Report Date: 3/11/81

BASE/NEUTRALS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) 22 (2/4/81)
2,6-dinitrotoluene	µg/l	<25
2,4-dinitrotoluene	µg/l	<25
di-n-octylphthalate	µg/l	<10
1,2-diphenylhydrazine	µg/l	<25
fluoranthene	µg/l	<2
fluorene	µg/l	<2
hexachlorobenzene	µg/l	<5
hexachlorobutadiene	µg/l	<5
hexachlorocyclopentadiene	µg/l	<25
hexachloroethane	µg/l	<10
indeno(1,2,3-cd)pyrene	µg/l	<25
isophorone	µg/l	<25
naphthalene	µg/l	<2
nitrobenzene	µg/l	<10
N-nitrosodimethylamine	µg/l	<25
N-nitrosodi-n-propylamine	µg/l	<25
N-nitrosodiphenylamine	µg/l	<10
phenanthrene	µg/l	<2
pyrene	µg/l	<2
2,3,7,8-tetrachlorodibenzo-p-dioxin	µg/l	<10
1,2,4-trichlorobenzene	µg/l	<5

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Timothy R Baker

DATE 3/12/81

RECRA RESEARCH, INC.
I.D. #81-85

TABLE III

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/5/81
Report Date: 3/11/81

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE)				
		8 (2/4/81)	9 (2/4/81)	10 (2/4/81)	MW-19 (2/4/81)	22 (2/4/81)
acrolein	mg/l	<1	<1	<1	<1	<1
acrylonitrile	mg/l	<2	<2	<2	<2	<2
benzene	μg/l	<30	<30	<30	<30	<30
bromodichloromethane	μg/l	<10	<10	<10	<10	<10
bromoform	μg/l	<10	<10	<10	<10	<10
bromomethane	μg/l	<10	<10	<10	<10	<10
carbon tetrachloride	μg/l	<2	<2	<2	<2	<2
chlorobenzene	μg/l	<2	<2	<2	<2	<2
chloroethane	μg/l	<5	≤5	<5	<5	<5
2-chloroethylvinyl ether	μg/l	<10	<10	<10	<10	<10
chloroform	μg/l	<3	4	<3	<3	<3
chloromethane	μg/l	<5	<5	<5	<5	<5
dibromochloromethane	μg/l	<5	<5	<5	<5	<5
dichlorodifluoromethane	μg/l	<5	7	<5	<5	<5
1,1-dichloroethane	μg/l	<3	120	<3	<3	<3
1,2-dichloroethane	μg/l	<2	<2	<2	<2	<2
1,1-dichloroethylene	μg/l	≤2	46	<2	<2	≤2
trans-1,2-dichloroethylene	μg/l	12	160	<2	49	31
1,2-dichloropropane	μg/l	<2	460	<2	<2	<2
cis-1,3-dichloropropene	μg/l	<5	<5	<5	<5	<5
trans-1,3-dichloropropene	μg/l	<5	<5	<5	<5	<5
ethylbenzene	μg/l	<2	<2	<2	<2	<2
methylene chloride	μg/l	<5	<5	<5	<5	<5

(Continued)

TABLE III (cont'd.)

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/5/81
Report Date: 3/11/81

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE)				
		8 (2/4/81)	9 (2/4/81)	10 (2/4/81)	MW-19 (2/4/81)	22 (2/4/81)
1,1,2,2-tetrachloroethane	µg/l	<2	<2	<2	<2	<2
tetrachloroethylene	µg/l	<2	≤2	<2	120	9
toluene	µg/l	<5	<5	<5	<5	<5
1,1,1-trichloroethane	µg/l	6	1,700	4	14	5
1,1,2-trichloroethane	µg/l	<3	<3	<3	<3	<3
trichloroethylene	µg/l	1,800	1,100	<2	520	1,600
trichlorofluoromethane	µg/l	2	700	≤2	<2	≤2
vinyl chloride	µg/l	18	40	<5	<5	<5

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Timothy R Baker

DATE 3/12/81

TABLE IV

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/5/81
Report Date: 3/11/81

PESTICIDES/PCB'S

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) 8 (2/4/81)	9 (2/4/81)	10 (2/4/81)	MW-19 (2/4/81)	22 (2/4/81)
Aldrin	μg/l	<0.05	0.05	<0.01	<0.02	<0.01
α-BHC	μg/l	0.03	0.08	<0.02	<0.01	≤0.01
β-BHC	μg/l	<0.1	0.13	0.05	0.05	<0.02
δ-BHC	μg/l	0.13	0.14	<0.02	<0.05	<0.01
γ-BHC	μg/l	<0.02	0.08	0.02	<0.02	<0.01
Chlordane	μg/l	<1	<1	<1	<1	<1
4,4'-DDD	μg/l	<0.01	<0.02	<0.01	<0.01	<0.01
4,4'-DDE	μg/l	<0.01	≤0.01	<0.01	<0.01	<0.01
4,4'-DDT	μg/l	<0.02	<0.1	<0.02	<0.01	<0.01
Dieldrin	μg/l	<0.01	<0.02	<0.01	<0.01	<0.01
α-Endosulfan	μg/l	<0.01	<0.01	<0.01	<0.01	<0.01
β-Endosulfan	μg/l	<0.01	<0.02	<0.01	<0.01	<0.01
Endosulfan sulfate	μg/l	<0.1	<0.6	<0.02	<0.01	<0.1
Endrin	μg/l	<0.01	<0.02	<0.01	<0.01	<0.01
Endrin aldehyde	μg/l	<0.02	<0.2	<0.02	<0.01	<0.01
Heptachlor	μg/l	0.06	<0.1	<0.02	<0.05	<0.01
Heptachlor epoxide	μg/l	<0.01	≤0.01	<0.01	<0.01	<0.01
PCB-1016	μg/l	<1	<2	<1	<1	<1
PCB-1221	μg/l	<2	<5	<2	<2	<2
PCB-1232	μg/l	<1	<2	<1	<1	<1
PCB-1242	μg/l	<1	<2	<1	<1	<1
PCB-1248	μg/l	<0.5	<0.5	<0.5	<0.5	<0.5
PCB-1254	μg/l	<0.5	<0.5	<0.5	<0.5	<0.5
PCB-1260	μg/l	<0.5	<0.5	<0.5	<0.5	<0.5
Toxaphene	μg/l	<1	<1	<1	<1	<1

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Larry E Rosengrant

DATE 3/11/81

RECRA RESEARCH, INC.
I.D. #81-85

TABLE V

LAWLER, MATUSKY & SKELLY ENGINEERS
ATOMIC ABSORPTION
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/5/81
Report Date: 3/11/81

METALS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) 8 (2/4/81)	9 (2/4/81)	10 (2/4/81)	MW-19 (2/4/81)	22 (2/4/81)
Soluble antimony	mg/l	0.2	<0.1	<0.1	<0.1	<0.1
Soluble arsenic	μg/l	<3	<3	<3	<3	<3
Soluble beryllium	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005
Soluble cadmium	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005
Soluble chromium	mg/l	<0.005	<0.005	0.006	<0.005	<0.005
Soluble copper	mg/l	<0.005	0.010	<0.005	<0.005	<0.005
Soluble lead	mg/l	<0.02	0.03	0.04	<0.02	<0.02
Soluble mercury	μg/l	<3	<3	<3	<3	<3
Soluble nickel	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02
Soluble selenium	μg/l	<3	<3	<3	<3	<3
Soluble silver	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003
Soluble thallium	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1
Soluble zinc	mg/l	0.005	0.016	0.016	0.010	0.028

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. R. V. Flynn

DATE 3/12/81

RECRA RESEARCH, INC.
I.D. #81-85

TABLE VI

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/5/81
Report Date: 3/11/81

MISCELLANEOUS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE)				
		8 (2/4/81)	9 (2/4/81)	10 (2/4/81)	MW-19 (2/4/81)	22 (2/4/81)
Total cyanide	μg/l	<10	76	<10	16	26
Total recoverable phenolics	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. R. V. F[illegible]

DATE 3/12/81

TABLE VII

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/5/81
Report Date: 3/11/81

VOLATILE RECOVERY ANALYSIS OF
SAMPLE 10

COMPOUND IDENTIFICATION	ng OF SPIKE	ng RECOVERED	% RECOVERY
trans-1,2-dichloroethylene	400	310	78
ethylbenzene	400	210	53
1,1,1-trichloroethane	400	280	71
trichlorofluoromethane	400	340	84

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Timothy R Baker
DATE 3/12/81

RECEIVED

MAR 23 '81

LAWLER, MATUSKY & SKELLY ENGINEERS

March 16, 1981

Ms. Karen A. Wright
Lawler, Matusky & Skelly Engineers
One Blue Hill Plaza
Pearl River, NY 10965

Re: Analytical Report

Dear Ms. Wright:

Please find enclosed Recra Research, Inc.'s results of the analyses of the six samples received at our laboratories on February 13 and 14 of 1981.

If you have any questions concerning these data, do not hesitate to contact the undersigned.

Sincerely,

RECRA RESEARCH, INC.

James A. Ploscyca
Laboratory Manager

TRB/JAP/pcb
Enclosure

I.D. #81-112
81-112A

RECRA RESEARCH, INC. P.O. Box 448 / Tonawanda, New York 14150 / (716) 838-6200
TOTAL CHEMICAL WASTE MANAGEMENT THROUGH APPLIED RESEARCH

ANALYTICAL REPORT

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES

Prepared For:

Lawler, Matusky & Skelly Engineers
One Blue Hill Plaza
Pearl River, NY 10965

Prepared By:

Recra Research, Inc.
P.O. Box 448
Tonawanda, NY 14150

Report Date: March 16, 1981

ANALYTICAL REPORT

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES

Report Date: 3/16/81

INTRODUCTION:

On February 13 and 14, six aqueous samples were received by Recra Research, Inc. A request was made by Lawler, Matusky & Skelly Engineers to have the samples analyzed for Environmental Protection Agency decreed Volatile, Pesticide/PCB, Metal, and Miscellaneous priority pollutants. The sample identifications and the date they were received is as follows:

ST-1 T-1	-	2/13/81
D-13 23-R 23-S 24	-	2/14/81

Pesticide/PCB analysis was not requested for samples T-1 and 24. Volatile analyses were composites of three vials for each sample (TOP, MID, BOT) except for D-13, which was a single sample.

A volatile field blank was not received with the first sample set. A request was made for Soluble metals analysis on the second sample set. No such request was made for ST-1 and T-1.

This report will address the results of those analyses.

METHODS:

Priority pollutant analyses were conducted according to Environmental Protection Agency (EPA) methodologies.

Organic priority pollutants were analyzed by Gas Chromatography/Mass

METHODS (cont'd.):

Spectrometry (GC/MS). Pesticide priority pollutants were screened by Gas Chromatography.

The GC/MS analyses were performed on a Model 3221 Finnigan GC/MS system operated in the electron impact mode and interfaced with an INCOS data system.

Prior to injection of the samples, perfluorotributylamine was introduced for calibration of the mass spectrometer and the INCOS data system.

GC/MS Conditions Included:

Carrier Gas: High purity Helium, 30 ml/min.

Multiplier Voltage: 2.0 KV

Source Voltage: 70 eV

Filament Current: 0.5 ma

Injector Temperature: 250°C

Separator Temperature: 250°C

Transfer Line Temperature: 225°C

Column: 152.4 cm long x 2 mm I.D. 0.2% Carbowax 1500 on 80/100 mesh Carbopak C

Temperatures: Oven: Initial: 40°C, hold 7 mins.
Final: 160°C
Rate: 8°c/min.

Volatile organics were extracted from the sample with a Tekmar Liquid Sample Concentrator (LSC-2).

Pesticides/PCB's:

For the pesticide extracts, analytical results are quantified using data obtained from a Gas-Liquid Chromatograph (GLC) equipped with an Electron Capture Detector (GC/ECD).

METHODS (cont'd.):

Column: 183 cm long x 4 mm I.D. 1.5% SP-2250/1.95% SP-2401 on 100/120 mesh Supelcoport

Carrier Gas: High purity Ar/CH_4 (95%/5%), 60 ml/min.

Temperatures: Oven: 200°C, 30 mins.

Detector: 225°C

Injector: 225°C

Metals:

The metal priority pollutant analyses were performed on a Perkin-Elmer 603 Atomic Absorption Spectrophotometer. Soluble metals analysis was performed on four samples as requested. This is a deviation from the priority pollutant methodology.

Miscellaneous Analyses:

The miscellaneous priority pollutants, Total cyanide, and Total recoverable phenolics, were analyzed by wet chemical techniques.

RESULTS AND DISCUSSION:

The results of the Volatile priority pollutant analyses are listed in Tables I and II. Chloroform (62 µg/1) and trichlorofluoromethane (1 µg/1) were found in the field blank. The following compounds were indicated in sample D-13 at levels below the detection limit.

chloromethane
tetrachloroethylene
vinyl chloride

The results of the Gas Chromatography screening for Pesticides/PCB's are listed in Tables III and IV. Compounds indicated by those analyses were at levels too low for GC/MS confirmation.

Metals results are presented in Tables V and VI.

RESULTS AND DISCUSSION (cont'd.):

Miscellaneous priority pollutant results are listed in Tables VII and VIII.

Results of the recovery analysis of the five Volatiles in sample 23-S are displayed in Table IX.

Values reported as "less than" (<) indicate the working detection limit for the given sample and/or parameter. Values reported as "less than or equal to" (≤) indicate the presence of a compound at a level below the working detection limit and, therefore, not subject to accurate quantification.

Compounds which are "indicated" fulfill some, but not all, of the requirements for positive identification.

Respectfully submitted,

RECRA RESEARCH, INC.

Timothy R. Baker

Timothy R. Baker
GC/MS Specialist

TRB/pcb
Enclosure

TABLE I

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/13/81
Report Date: 3/16/81

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) ST-1 (2/12/81)	T-1 (2/12/81)
acrolein	mg/l	<1	<1
acrylonitrile	mg/l	<2	<2
benzene	μg/l	<10	<10
bromodichloromethane	μg/l	<10	<10
bromoform	μg/l	<10	<10
bromomethane	μg/l	<5	<5
carbon tetrachloride	μg/l	<5	<5
chlorobenzene	μg/l	<5	<5
chloroethane	μg/l	<5	<5
2-chloroethylvinyl ether	μg/l	<10	<10
chloroform	μg/l	<10	<10
chloromethane	μg/l	<5	<5
dibromochloromethane	μg/l	<5	<5
dichlorodifluoromethane	μg/l	<5	<5
1,1-dichloroethane	μg/l	<5	<5
1,2-dichloroethane	μg/l	<5	<5
1,1-dichloroethylene	μg/l	<5	<5
trans-1,2-dichloroethylene	μg/l	<5	<5
1,2-dichloropropane	μg/l	<5	<5
cis-1,3-dichloropropene	μg/l	<5	<5
trans-1,3-dichloropropene	μg/l	<5	<5
ethylbenzene	μg/l	<5	<5
methylene chloride	μg/l	<5	<5

(Continued)

TABLE I (cont'd.)

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/13/81
Report Date: 3/16/81

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) ST-1 (2/12/81)	T-1 (2/12/81)
1,1,2,2-tetrachloroethane	µg/l	<5	<5
tetrachloroethylene	µg/l	<5	<5
toluene	µg/l	<10	<10
1,1,1-trichloroethane	µg/l	<5	<5
1,1,2-trichloroethane	µg/l	<5	<5
trichloroethylene	µg/l	<5	<5
trichlorofluoromethane	µg/l	3	3
vinyl chloride	µg/l	<5	<5

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Timothy R Baker

DATE 3/17/81

TABLE II

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/14/81
Report Date: 3/16/81

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) D-13 (2/13/81)	23-R (2/13/81)	23-S (2/13/81)	24 (2/13/81)
acrolein	mg/l	<1	<1	<1	<1
acrylonitrile	mg/l	<2	<2	<2	<2
benzene	µg/l	<10	<10	<10	<10
bromodichloromethane	µg/l	<10	<10	<10	<10
bromoform	µg/l	<10	<10	<10	<10
bromomethane	µg/l	<5	<5	<5	<5
carbon tetrachloride	µg/l	<5	<5	<5	<5
chlorobenzene	µg/l	<5	<5	<5	<5
chloroethane	µg/l	<5	<5	<5	<5
2-chloroethylvinyl ether	µg/l	<10	<10	<10	<10
chloroform	µg/l	<10	<10	<10	<10
chloromethane	µg/l	<5	<5	<5	<5
dibromochloromethane	µg/l	<5	<5	<5	<5
dichlorodifluoromethane	µg/l	<5	<5	<5	<5
1,1-dichloroethane	µg/l	72	<5	<5	<5
1,2-dichloroethane	µg/l	<5	<5	<5	<5
1,1-dichloroethylene	µg/l	≤5	<5	<5	<5
trans-1,2-dichloroethylene	µg/l	<5	<5	<5	<5
1,2-dichloropropane	µg/l	8.7	<5	<5	<5
cis-1,3-dichloropropene	µg/l	<5	<5	<5	<5
trans-1,3-dichloropropene	µg/l	<5	<5	<5	<5
ethylbenzene	µg/l	<5	<5	<5	<5
methylene chloride	µg/l	12	33	<5	<5

(Continued)

TABLE II (cont'd.)

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/14/81
Report Date: 3/16/81

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) D-13 (2/13/81)	23-R (2/13/81)	23-S (2/13/81)	24 (2/13/81)
1,1,2,2-tetrachloroethane	μg/l	<5	<5	<5	<5
tetrachloroethylene	μg/l	<5	<5	<5	<5
toluene	μg/l	<10	<10	<10	<10
1,1,1-trichloroethane	μg/l	33	<5	<5	<5
1,1,2-trichloroethane	μg/l	<5	<5	<5	<5
trichloroethylene	μg/l	140	<5	<5	<5
trichlorofluoromethane	μg/l	<3	31	<3	<3
vinyl chloride	μg/l	<5	<5	<5	<5

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Timothy R Baker

DATE 3/17/81

TABLE III

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY
PRIORITY POLLUTANT ANALYSES

Sample Received: 2/13/81
Report Date: 3/16/81

PESTICIDES/PCB'S

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) ST-1 (2/12/81)
Aldrin	μg/1	<0.01
α-BHC	μg/1	<0.01
β-BHC	μg/1	<0.01
δ-BHC	μg/1	<0.01
γ-BHC	μg/1	<0.01
Chlordane	μg/1	<0.5
4,4'-DDD	μg/1	<0.01
4,4'-DDE	μg/1	<0.01
4,4'-DDT	μg/1	<0.01
Dieldrin	μg/1	<0.01
α-Endosulfan	μg/1	<0.01
β-Endosulfan	μg/1	<0.01
Endosulfan sulfate	μg/1	<0.02
Endrin	μg/1	<0.01
Endrin aldehyde	μg/1	<0.01
Heptachlor	μg/1	<0.01
Heptachlor epoxide	μg/1	<0.01
PCB-1016	μg/1	<0.5
PCB-1221	μg/1	<1
PCB-1232	μg/1	<0.5
PCB-1242	μg/1	<0.5
PCB-1248	μg/1	<0.1
PCB-1254	μg/1	<0.1
PCB-1260	μg/1	<0.1
Toxaphene	μg/1	<0.5

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Larry C Rosengrant

DATE 3/16/81

RECRA RESEARCH, INC.
I.D. #81-112

TABLE IV

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/14/81
Report Date: 3/16/81

PESTICIDES/PCB'S

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE)		
		D-13 (2/13/81)	23-R (2/13/81)	23-S (2/13/81)
Aldrin	µg/l	<0.05	<0.01	<0.05
α-BHC	µg/l	0.06	0.02	0.03
β-BHC	µg/l	<0.05	<0.01	<0.05
δ-BHC	µg/l	<0.05	<0.01	<0.05
γ-BHC	µg/l	≤0.01	≤0.01	0.02
Chlordane	µg/l	<0.5	<0.5	<0.5
4,4'-DDD	µg/l	<0.01	<0.01	<0.01
4,4'-DDE	µg/l	<0.01	<0.01	<0.01
4,4'-DDT	µg/l	<0.02	<0.01	<0.01
Dieldrin	µg/l	<0.01	<0.01	<0.01
α-Endosulfan	µg/l	<0.01	<0.01	≤0.01
β-Endosulfan	µg/l	<0.01	<0.01	<0.01
Endosulfan sulfate	µg/l	<0.02	<0.01	0.17
Endrin	µg/l	<0.01	<0.01	<0.01
Endrin aldehyde	µg/l	<0.01	<0.01	<0.01
Heptachlor	µg/l	<0.01	<0.01	<0.01
Heptachlor epoxide	µg/l	<0.05	<0.01	<0.01
PCB-1016	µg/l	<1	<0.5	<0.5
PCB-1221	µg/l	<2	<1	<1
PCB-1232	µg/l	<1	<0.5	<0.5
PCB-1242	µg/l	<1	<0.5	<0.5
PCB-1248	µg/l	<0.5	<0.1	<0.1
PCB-1254	µg/l	<0.5	<0.1	<0.1
PCB-1260	µg/l	<0.5	<0.1	<0.1
Toxaphene	µg/l	<0.5	<0.5	<0.5

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. ____________________

DATE 3/16/81

RECRA RESEARCH, INC.
I.D. #81-112

TABLE V

LAWLER, MATUSKY & SKELLY ENGINEERS
ATOMIC ABSORPTION
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/13/81
Report Date: 3/16/81

METALS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) ST-1 (2/12/81)	T-1 (2/12/81)
Total antimony	mg/l	0.2	0.3
Total arsenic	μg/l	5	<3
Total beryllium	mg/l	<0.003	<0.003
Total cadmium	mg/l	<0.005	<0.005
Total chromium	mg/l	<0.01	<0.01
Total copper	mg/l	<0.005	0.024
Total lead	mg/l	<0.04	<0.04
Total mercury	μg/l	<3	<3
Total nickel	mg/l	<0.02	<0.02
Total selenium	μg/l	<3	<3
Total silver	mg/l	<0.003	<0.003
Total thallium	mg/l	<0.1	<0.1
Total zinc	mg/l	0.060	0.047

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. R. J. Finn

DATE 3/18/81

RECRA RESEARCH, INC.

I.D. #81-112

TABLE VI

LAWLER, MATUSKY & SKELLY ENGINEERS
ATOMIC ABSORPTION
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/14/81
Report Date: 3/16/81

METALS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE)			
		D-13 (2/13/81)	23-R (2/13/81)	23-S (2/13/81)	24 (2/13/81)
Soluble antimony	mg/l	<0.1	0.2	<0.1	0.2
Soluble arsenic	µg/l	<3	<3	<3	<3
Soluble beryllium	mg/l	<0.003	<0.003	<0.003	<0.003
Soluble cadmium	mg/l	<0.005	<0.005	<0.005	<0.005
Soluble chromium	mg/l	<0.01	<0.01	0.012	0.010
Soluble copper	mg/l	0.078	<0.005	0.008	<0.005
Soluble lead	mg/l	<0.04	<0.04	<0.04	<0.04
Soluble mercury	µg/l	<3	<3	<3	<3
Soluble nickel	mg/l	<0.02	<0.02	<0.02	<0.02
Soluble selenium	µg/l	<3	<3	<3	<3
Soluble silver	mg/l	<0.005	<0.005	<0.005	<0.005
Soluble thallium	mg/l	<0.1	<0.1	<0.1	<0.1
Soluble zinc	mg/l	0.016	<0.004	0.007	<0.004

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. [illegible]

DATE 3/18/81

TABLE VII

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/13/81
Report Date: 3/16/81

MISCELLANEOUS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) ST-1 (2/12/81)	T-1 (2/12/81)
Total cyanide	μg/l	<10	<10
Total recoverable phenolics	mg/l	<0.01	<0.01

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. R. V. Fin[illegible]

DATE 3/18/81

TABLE VIII

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES

Samples Received: 2/14/81
Report Date: 3/16/81

MISCELLANEOUS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) D-13 (2/13/81)	23-R (2/13/81)	23-S (2/13/81)	24 (2/13/81)
Total cyanide	µg/1	<10	<10	<10	<10
Total recoverable phenolics	mg/1	<0.01	<0.01	<0.01	<0.01

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC.

DATE 3/18/81

TABLE IX

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Sample Received: 2/14/81
Report Date: 3/16/81

VOLATILE RECOVERY ANALYSIS OF
SAMPLE 23-S

COMPOUND IDENTIFICATION	ng OF SPIKE	ng RECOVERED	% RECOVERY
bromomethane	2,000	1,500	77
chloroethane	2,000	1,700	84
chloromethane	2,000	1,500	75
dichlorodifluoromethane	2,000	1,800	88
vinyl chloride	2,000	1,800	90

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Timothy R Baker

DATE 3/17/81

RECEIVED

APR 20 '81

LAWLER, MATUSKY & SKELLY ENGINEERS

April 15, 1981

Ms. Karen A. Wright
Lawler, Matusky & Skelly Engineers
One Blue Hill Plaza
Pearl River, NY 10965

Re: Analytical Report

Dear Ms. Wright:

Please find enclosed Recra Research, Inc.'s results of the analyses of five samples received at our laboratories on March 19, 1981.

If you have any questions concerning these data, do not hesitate to contact the undersigned.

Sincerely,

RECRA RESEARCH, INC.

James A. Ploscyca
Laboratory Manager

TRB/JAP/skb
Enclosure

I.D. #81-203

RECRA RESEARCH, INC. P.O. Box 448 / Tonawanda, New York 14150 / (716) 838-6200
TOTAL CHEMICAL WASTE MANAGEMENT THROUGH APPLIED RESEARCH

RECRA RESEARCH, INC.

ABBREVIATED CAPABILITIES

WASTE MANAGEMENT

EPA Waste Criteria Tests

Hazardous Waste Assessments

Treatment/Recovery Feasibility Studies

Waste Management Audits

Process Design and Development

ENVIRONMENTAL SERVICES

Environmental Assessments

Geologic/Hydrogeologic Services

Environmental Permits

Field Services/Monitoring

Mathematical Modeling

ANALYTICAL/BIOLOGICAL LABORATORIES

Priority Pollutants (GC/MS)

Organic and Inorganic Analysis (including HPLC)

Bioassays

Mutagenic Screening Assays

Aquatic Toxicology

TRAINING SERVICES

Training Needs Assessments

Hazardous Materials and Incident Response Training

Regulatory Compliance

EPA RCRA Training

OSHA Training

RECRA RESEARCH, INC. P.O. Box 448 / Tonawanda, New York 14150 / (716) 838-6200
TOTAL CHEMICAL WASTE MANAGEMENT THROUGH APPLIED RESEARCH

ANALYTICAL REPORT

LAWLER, MATUSKY & SKELLY ENGINEERS

Prepared For:

Lawler, Matusky & Skelly Engineers
One Blue Hill Plaza
Pearl River, NY 10965

Prepared By:

Recra Research, Inc.
P.O. Box 448
Tonawanda, NY 14150

Report Date: April 15, 1981

RECRA RESEARCH, INC. P.O. Box 448 / Tonawanda, New York 14150 / (716) 838-6200
TOTAL CHEMICAL WASTE MANAGEMENT THROUGH APPLIED RESEARCH

ANALYTICAL REPORT

LAWLER, MATUSKY & SKELLY ENGINEERS

Report Date: 4/15/81

INTRODUCTION:

On March 19, 1981 five samples were received at Recra Research, Inc. A request was made by Lawler, Matusky & Skelly Engineers to have the samples analyzed for Environmental Protection Agency decreed Volatile and Miscellaneous priority pollutants. These samples were identified as 3, 5, 19, 20R, and 20S. Volatile samples were an equal composite of three vials labelled Top, Mid, and Bottom. Field blanks were not received for Volatile analysis.

Additional requests were made for analysis for priority pollutant Metals in Samples 3 and 5. Calcium and sodium analyses were also to be performed on Sample 5.

This report will address the results of those analyses.

METHODS:

Priority pollutant analyses were conducted according to Environmental Protection Agency (EPA) methodologies.

Volatile priority pollutants were analyzed by Gas Chromatography/Mass Spectrometry (GC/MS).

RESULTS AND DISCUSSION:

The results of the Volatile priority pollutant analyses are listed in Table I. The following compounds were indicated in the listed samples at levels below the detection limit:

19 - 1,1,1-trichloroethane

20S - 1,1,1-trichloroethane
trichlorofluoromethane

Results of the priority pollutant Metals analyses of Samples 3 and 5 are listed in Table II.

Results of the Miscellaneous priority pollutant analyses are listed in Table III.

Results of the calcium and sodium analyses of Sample 5 are listed in Table IV.

Results of the replicate Volatile analysis of Sample 19 are listed in Table V.

Values reported as "less than" (<) indicate the working detection limit for the given sample and/or parameter. Values reported as "less than or equal to" (≤) indicate the presence of a compound at a level below the working detection limit and, therefore, not subject to accurate quantification.

Compounds which are "indicated" fulfill some, but not all, of the requirements for positive identification.

Respectfully submitted,

RECRA RESEARCH, INC.

Timothy R. Baker

Timothy R. Baker
GC/MS Specialist

TRB/skb

TABLE I

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 3/19/81
Report Date: 4/15/81

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) 3 (3/18/81)	5 (3/18/81)	19 (3/18/81)	20R (3/18/81)	20S (3/18/81)
acrolein	mg/l	<1	<1	<1	<1	<1
acrylonitrile	mg/l	<2	<2	<2	<2	<2
benzene	μg/l	<10	<10	<10	<10	<10
bromodichloromethane	μg/l	<10	<10	<10	<10	<10
bromoform	μg/l	<10	<10	<10	<10	<10
bromomethane	μg/l	<5	<5	<5	<5	<5
carbon tetrachloride	μg/l	<5	<5	<5	<5	<5
chlorobenzene	μg/l	<5	<5	<5	<5	<5
chloroethane	μg/l	<5	<5	<5	<5	<5
2-chloroethylvinyl ether	μg/l	<10	<10	<10	<10	<10
chloroform	μg/l	<5	<5	<5	<5	<5
chloromethane	μg/l	<5	<5	<5	<5	<5
dibromochloromethane	μg/l	<5	<5	<5	<5	<5
dichlorodifluoromethane	μg/l	<5	<5	<5	<5	<5
1,1-dichloroethane	μg/l	<5	<5	15	11	19
1,2-dichloroethane	μg/l	<5	<5	<5	<5	<5
1,1-dichloroethylene	μg/l	<5	<5	<5	<5	<5
trans-1,2-dichloroethylene	μg/l	<5	<5	<5	≤5	<5
1,2-dichloropropane	μg/l	<5	<5	22	<5	26
cis-1,3-dichloropropene	μg/l	<5	<5	<5	<5	<5
trans-1,3-dichloropropene	μg/l	<5	<5	<5	<5	<5
ethylbenzene	μg/l	<5	<5	<5	<5	<5
methylene chloride	μg/l	<5	<5	<5	<5	<5

(Continued)

TABLE I (cont'd.)

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Samples Received: 3/19/81
Report Date: 4/15/81

VOLATILES

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE)				
		3 (3/18/81)	5 (3/18/81)	19 (3/18/81)	20R (3/18/81)	20S (3/18/81)
1,1,2,2-tetrachloroethane	µg/1	<5	<5	<5	<5	<5
tetrachloroethylene	µg/1	<20	<20	<20	<20	<20
toluene	µg/1	<20	<20	<20	<20	<20
1,1,1-trichloroethane	µg/1	<5	<5	<5	150	<5
1,1,2-trichloroethane	µg/1	<5	<5	<5	<5	<5
trichloroethylene	µg/1	6	<5	26	52	26
trichlorofluoromethane	µg/1	<5	<5	<5	<5	<5
vinyl chloride	µg/1	<5	<5	≤5	5	18

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Timothy R Baker

DATE 4/15/81

TABLE II

LAWLER, MATUSKY & SKELLY ENGINEERS
ATOMIC ABSORPTION
PRIORITY POLLUTANT ANALYSES

Samples Received: 3/19/81
Report Date: 4/15/81

METALS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE)	
		3 (3/18/81)	5 (3/18/81)
Soluble antimony	mg/l	<0.2	<0.2
Soluble arsenic	µg/l	<5	<5
Soluble beryllium	mg/l	<0.004	<0.004
Soluble cadmium	mg/l	<0.005	<0.005
Soluble chromium	mg/l	<0.005	<0.005
Soluble copper	mg/l	<0.004	<0.004
Soluble lead	mg/l	<0.03	<0.03
Soluble mercury	µg/l	<0.5	<0.5
Soluble nickel	mg/l	<0.03	<0.03
Soluble selenium	µg/l	<3	<3
Soluble silver	mg/l	<0.005	0.015
Soluble thallium	mg/l	<0.1	<0.1
Soluble zinc	mg/l	0.076	0.051

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. R. V. Finn

DATE 4/16/81

TABLE III

LAWLER, MATUSKY & SKELLY ENGINEERS
PRIORITY POLLUTANT ANALYSES

Samples Received: 3/19/81
Report Date: 4/15/81

MISCELLANEOUS

COMPOUND	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE)				
		3 (3/18/81)	5 (3/18/81)	19 (3/18/81)	20R (3/18/81)	20S (3/18/81)
Total cyanide	µg/1	<10	<10	<10	<10	55
Total recoverable phenolics	mg/1	<0.01	<0.01	<0.01	<0.01	<0.01

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. R. J. Flynn

DATE 4/15/81

TABLE IV

LAWLER, MATUSKY & SKELLY ENGINEERS
ADDITIONAL PARAMETERS

Sample Received: 3/19/81
Report Date: 4/15/81

PARAMETER	UNITS OF MEASURE	SAMPLE IDENTIFICATION (DATE) 5 (3/18/81)
Soluble calcium	mg/l	120
Soluble sodium	mg/l	54

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. R V. Finn
DATE 4/16/81

TABLE V

LAWLER, MATUSKY & SKELLY ENGINEERS
GAS CHROMATOGRAPHY/MASS SPECTROMETRY
PRIORITY POLLUTANT ANALYSES

Sample Received: 3/19/81
Report Date: 4/15/81

REPLICATE VOLATILE ANALYSIS OF
SAMPLE 19

COMPOUND IDENTIFICATION	UNITS OF MEASURE	VALUE 1	VALUE 2	MEAN	STANDARD DEVIATION	PERCENT COEFFICIENT OF VARIATION
chloroethene	μg/1	3.1	2.9	3.0	0.14	4.7
1,1-dichloroethane	μg/1	17	13	15	2.8	19
1,2-dichloropropane	μg/1	19	24	22	3.5	16
trichloroethylene	μg/1	25	27	26	1.4	5.4

COMMENTS: Refer to text

FOR RECRA RESEARCH, INC. Timothy R Baker

DATE 4/15/81

November 20, 1980

Mr. Pat Lawler
Lawler, Matusky & Skelly Engineers
One Blue Hill Plaza
Pearl River, NY 10965

Dear Mr. Lawler:

As per your request, please find enclosed information concerning quality control procedures related to the analyses performed on three samples received on October 25, 1980. The following information is incomplete due to the time constraints of your request. In the future I would suggest requesting that quality control information be gathered on your specific samples. There would, however, be an additional charge for such a request.

It is the policy of Recra Research, Inc. to maintain a level of Quality Control at 20% of all analyses. The quality control procedures are performed on random samples. Since no specific request was made for quality control to be performed on these particular samples, the information available is somewhat limited.

Although most of the quality control procedures were performed on samples other than those in question, the information is provided to assess general data quality. The quality control data provided was gathered on the same day that the above samples were analyzed.

Replicate analyses were performed on the Base/Neutral and Acid/Phenolic fractions of Sample ST-1; however, since no compounds were detected, no quality assurance statements can be made.

The information provided in Table I represents precision data for samples analyzed for volatiles on the same date as the above samples. The actual quality control information was not obtained on the specific samples in question.

Replicate analyses were performed on the PCB fraction of Sample ST-1; however, since no compounds were detected, no quality assurance statement can be made.

RECRA RESEARCH, INC. P.O. Box 448 / Tonawanda, New York 14150 / (716) 838-6200
TOTAL CHEMICAL WASTE MANAGEMENT THROUGH APPLIED RESEARCH

REC'D 11/21/80

Table I also contains quality control data concerning the miscellaneous analyses of Total Cyanide and Total Phenol.

Total Cyanide precision was determined on Sample ST-1 while Total Phenols precision was performed on Sample ST-19.

Precision data concerning metals analysis is provided in Table II. This data was not generated on the particular samples in question; however, it does reflect normal analytical variation.

If you have any questions, do not hesitate to contact the undersigned.

Sincerely,

RECRA RESEARCH, INC.

James A. Ploscyca
Laboratory Manager

JAP/skb
Enclosure

TABLE I

GENERAL PRECISION DATA - VOLATILES, CYANIDE AND PHENOL

PARAMETER	UNITS OF MEASURE	REPLICATE COMPARISON				
		VALUE 1	VALUE 2	MEAN	STANDARD DEVIATION	PERCENT COEFFICIENT OF VARIATION
carbon tetrachloride	µg/l	37	29	33	5.6	17%
chloroform	µg/l	200	190	200	7.1	3.6%
trans-1,2-dichloroethylene	µg/l	82	64	73	13	17%
methylene chloride	µg/l	97	55	76	30	39%
1,1,2,2-tetrachloroethane	µg/l	210	200	200	7.1	3.4%
tetrachloroethylene	µg/l	1,200	990	1,100	150	14%
1,1,1-trichloroethane	µg/l	2.3	2.0	2	0.21	9.9%
trichloroethylene	µg/l	1,800	1,500	1,600	210	13%

FOR RECRA RESEARCH, INC. [signature]

DATE 11/20/80

Total Cyanide < 20 < 20

Total Phenol < 0.01 0.02

RECRA RESEARCH, INC.

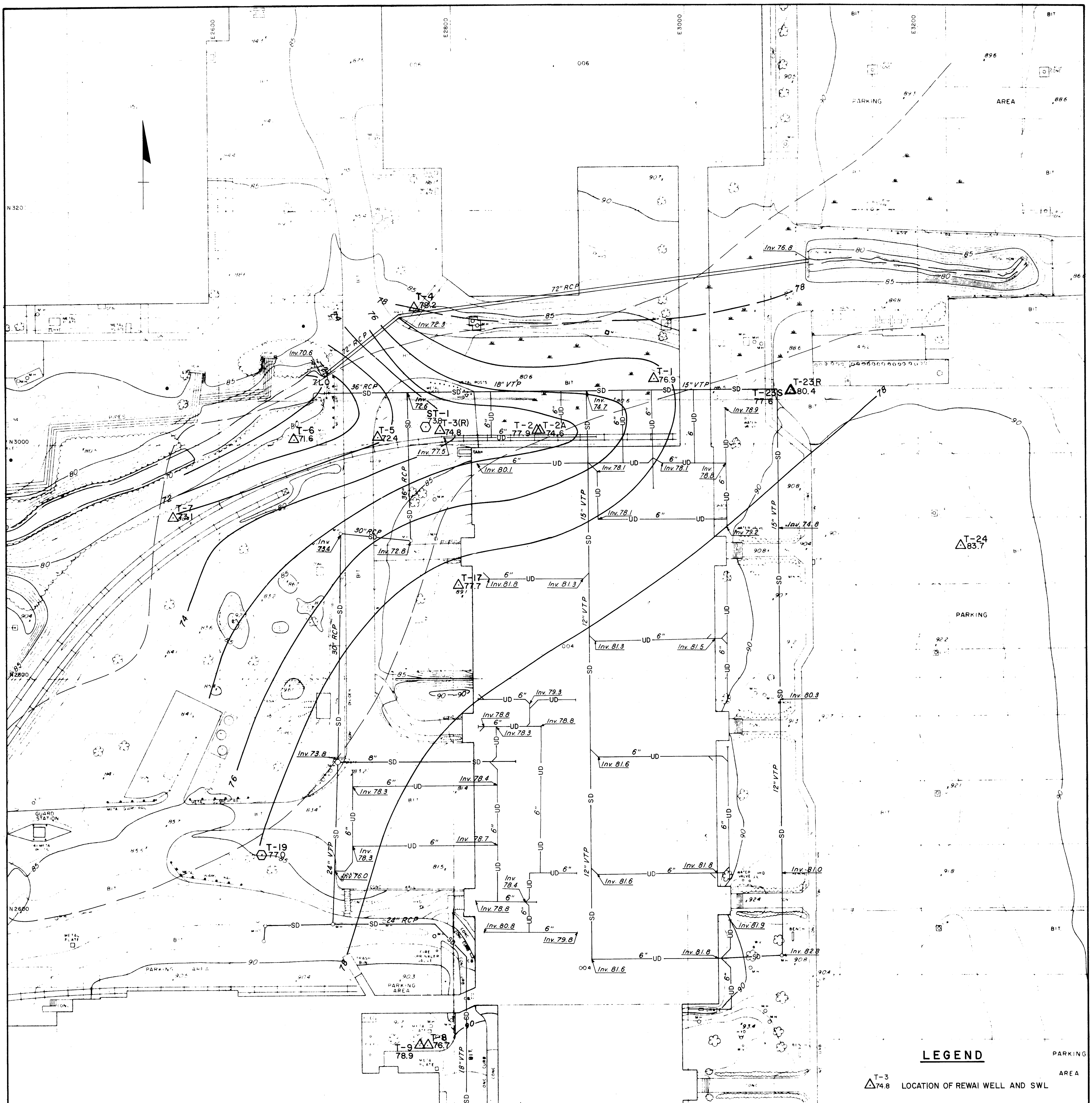
TABLE II

GENERAL PRECISION DATA - METAL ANALYSIS

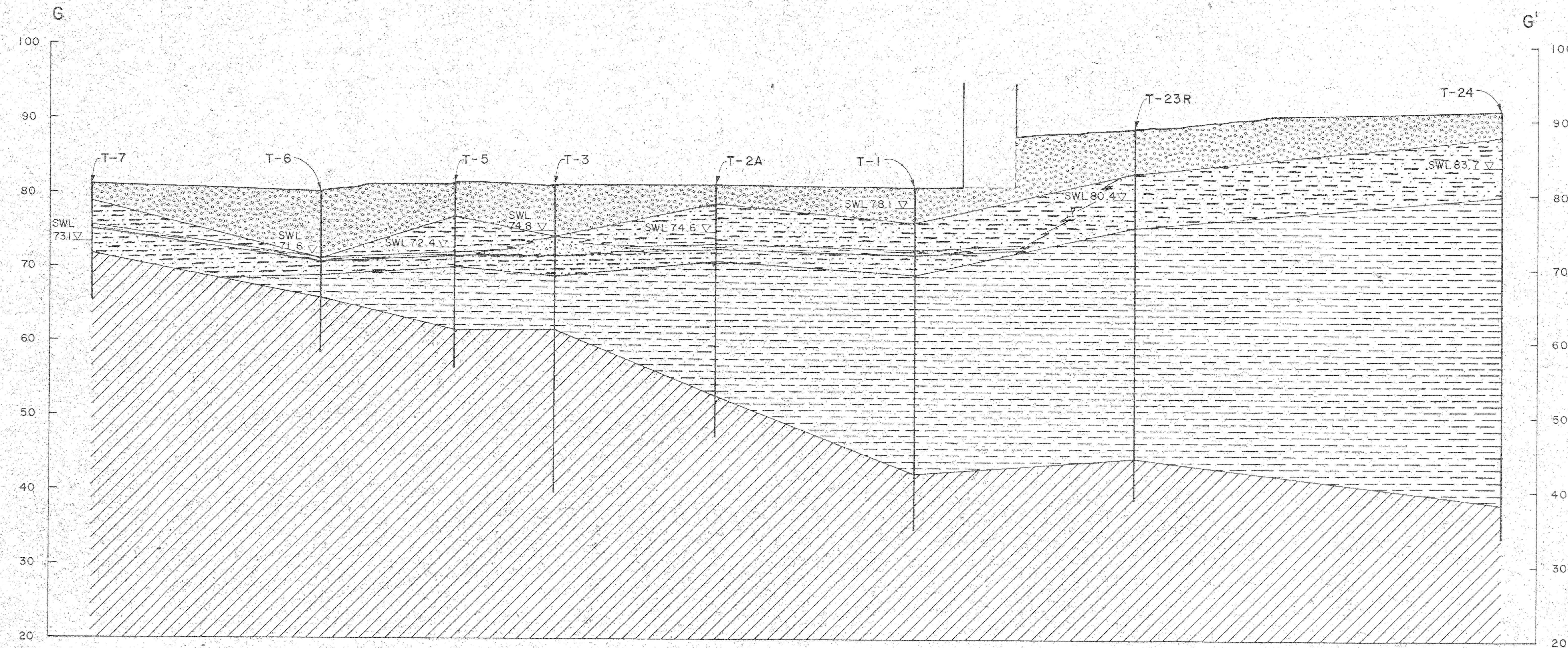
PARAMETER	UNITS OF MEASURE	REPLICATE COMPARISON				
		VALUE 1	VALUE 2	MEAN	STANDARD DEVIATION	PERCENT COEFFICIENT OF VARIATION
Total Zinc	mg/l	0.236	0.245	.241	0.006	2.6
Total Nickel	mg/l	0.57	0.60	0.59	0.021	3.6
Total Mercury	µg/l	1.0	0.6	.8	0.28	35
Total Arsenic	µg/l	11	15	13	2.8	22
Total Iron	mg/l	0.21	0.20	0.21	0.007	3.4
Total t-Chromium	mg/l	0.068	0.070	0.069	.001	2.0

FOR RECRA RESEARCH, INC. [signature]

DATE 11/20/90

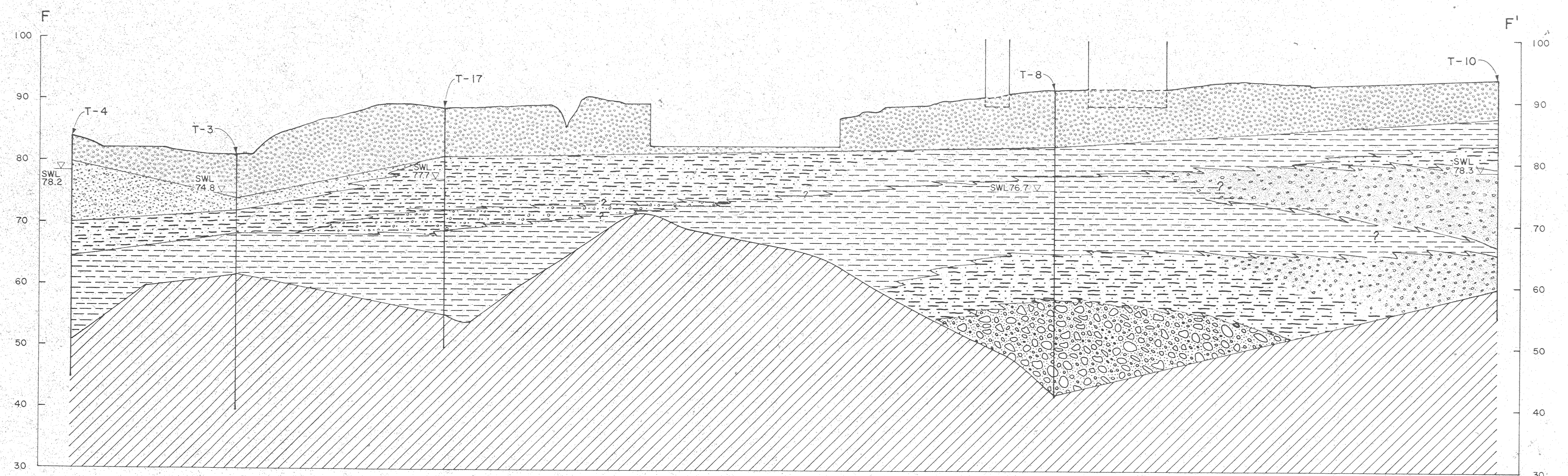

LEGEND
T-3 74.8 LOCATION OF REWAI WELL AND SWL
ST-1 73.8 LOCATION OF DAME AND MOORE WELL AND SWL
UD UNDERDRAINS
SD STORM DRAIN
12" VTP PIPE SIZE AND TYPE
76 1' CONTOURS ON WATER TABLE
OUTLINE OF OLD POND
MARSHY AREA
40' 20' 0 40' 80'
SCALE IN FEET
IBM CORPORATION
POUGHKEEPSIE, NEW YORK
LAWLER, MATUSKY AND SKELLY ENGINEERS
BUILDINGS 004 AND 001 BASE MAP
HYDROGEOLOGIC DATA
drawn RAM
approved
checked
date
drawing no.
PLATE 1
r. e. wright associates, inc.
earth resources consultants
harrisburg pennsylvania

IBM CORPORATION
POUGHKEEPSIE, NEW YORK
LAWLER, MATUSKY AND SKELLY ENGINEERS
BUILDINGS 004 AND 001 BASE MAP
GEOLOGIC FRAMEWORK
drawn RAM
approved
checked
date
drawing no.
PLATE 2
r. e. wright associates, inc.
earth resources consultants
harrisburg
pennsylvania
SCALE IN FEET
PARKING AREA



LEGEND

- SILT, PEBBLY SAND AND GRAVEL (FILL)
- PEBBLY SAND
- SILT AND SAND
- SILT
- SAND AND GRAVEL
- COARSE GRAINED SAND AND GRAVEL
- BEDROCK (HUDSON RIVER FORMATION)
- ORGANIC LAYER



SCALE Horiz.: 1" = 40'
Vert.: 1" = 10'

IBM CORPORATION POUGHKEEPSIE, NEW YORK	LAWLER, MATUSKY AND SKELLY ENGINEERS
BUILDINGS 004 AND 001 CROSS SECTIONS	
drawn RAM / approved	drawing no.
checked / date	PLATE 3

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