Included in 1st dft

GEOSCIENCE CORP.

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January 15, 1985

Mr. Dave Sands
GHR Engineering
75 Tarkiln Hill Road
New Bedford, MA 02745

Dear Dave:

Enclosed you will find the completed text portion to date of the Brewster Well Field RI. I have also included several maps, in various states of completion, to accompany the text. Below is the status of our portion of the writing as we understand it:

Section	Subject	Completed	Progress
3.10	General	X	
3.40	Surficial Geol. Mapping		Complete by 1/20/86
3.50	Geophysics		Completed except for discussion of results
3.60	Drilling	X	
3.70	K Testing	X	
3.110	Pumping Test		?
3.130	Grain Size Dist.	X	
4.11	Regional Bedrock Geol.	X	
4.12	Regional Surficial Geol.		Complete by 1/20/86
4.21	Site Bedrock Geol.	X	
4.22	Site Surficial Geol.	X	
5.10	Climate & Water Budget		Written - waiting for OK

Section	Subject	Completed	Progress
5.20	Conceptual Aquifer System		Written - waiting for OK
5.30	Aquifer Hydraulic Properties		Complete by 1/20/86
5.50	Response of System to Geol.		Complete by 1/20/86
6.00	Nature & Extent of contamination (w/GHR)		None
8.00	Conclusions & Recommendations (w/GHR)		None

I have also enclosed spread sheets on DGC well information, "old" well information, water level information and HNU-301 soil boring results. Please look them over and see if our data matches yours.

Other topics:

1. Do you have a map with the locations of Brady Stannard, Alben Cleaners, and Henry Van's wells?

2. We may have a problem with the numbering of wells B-2, B-3, & B-4. I thought we straightend it out months ago - something about the survey crew only locating 2 of the 3. On our maps we have B-4 in the north, B-2 in the east and B-3 in the west.

3. Let us know as soon as possible about the 2nd sampling round - week of the 27th is now best for us (Monday and Tuesday - 27th and 28th) if possible. We also need to discuss what wells should be analyzed with HNU-301.

Please give me a call to discuss the above topics.

Sincerely,

Rod

Rodney Sutch

RS/cm

Enclosures:

3.10 General

All aspects of the remedial investigation were conducted using standard or accepted methods. Techniques and methods utilized during the field investigation and laboratory testing are described within this section. Specific analytical and numerical techniques used to interpret the geohydrologic data are addressed within the respective sections of the report.

3.130 GRAIN SIZE DISTRIBUTION ANALYSES

Grain size distribution analyses were conducted on ten samples collected during the soil boring/monitoring well drilling phase. Samples selected for analysis represent a wide range of locations and depths within the unconsolidated geologic material. In addition, three samples of the East Branch Croton Riverbed were obtained from locations shown in figure _____. All samples were analyzed according to the ASTM test C-136 and where appropriate, the ASTM test C-117.

The grain size distribution analysis method separates the soil particles into size groups. Results of these groupings were used to check the descriptions of the soil samples as described in the field and to estimate hydraulic conductivity values of the unconsolidated aquifer. Mechanical separation was performed by sieving the samples through graded sieves ranging down to a particle diameter of about 0.07 mm (ASTM test C-136). A wash loss (ASTM test C-117) was performed on those samples containing major amounts of clay and silt particles. Using this method, the finer material is separated from larger particles by wet sieving. The material remaining on the sieves is then dried and sieved according to test C-136. The grain size distributions of the tested samples are included in ___________

3.5.1 INTRODUCTION

A reconnaissance surface geophysical investigation was completed in the site area by Dunn Geoscience prior to the drilling of test borings and installation of monitoring wells. The investigation consisted of terrain conductivity (TC), electrical resistivity (ER), magnetic, and seismic refraction (SR) surveying in the three general areas shown on Plate ___.

- Area 1 - includes the Brewster well field, adjacent East Branch Croton River, and adjacent valley and uplands north of Old Route 22.

- Area 2 - includes the vacant lots immediately east of Alben Cleaners.

- Area 3 - includes the site of a former gas station and the existing County road salt storage facility southeast of Area 1. Three NYS DOT monitoring wells are installed in this area.

The following discussion describes the purpose, scope, limitations, methodology, and findings of the investigation.

3.5.2 PURPOSE AND SCOPE

The principal purpose of the geophysical investigation was to provide subsurface information to assist with the planning of direct data gathering activities such as drilling, test pit excavation, and monitoring well installations and to complement the subsurface information gathered from these activities. Different purposes and work plans were applicable to each of the three main areas of the site investigated as described below.

In Area 1, terrain conductivity profiling, electrical resistivity sounding, and seismic refraction surveys were conducted to define the bedrock topography, to help delineate sand and gravel deposits that comprise the principal aquifer in the area, and to ultimately aid in the selection of monitoring well locations and help interpolate subsurface conditions between boreholes. _____ lineal feet of terrain conductivity profiling, ____ resistivity soundings and 10,410 lineal feet of seismic line were completed.

In Area 2, terrain conductivity and magnetic profiling were completed to investigate the nature of fill to assess the potential presence of conductive wastes or buried steel chemical waste drums and thereby provide a basis for selecting test pit locations. ____lineal feet of TC and ____ feet of magnetic profiling were completed.

In Area 3, terrain conductivity profiling was performed at GHR's request, as a supplement to the original scope of work, to investigate the possible presence of conductive contaminant plumes and abandoned buried steel storage tanks. Approximately ____ lineal feet of profiling were completed with EM-31 and EM-34 terrain conductivity meters.

The scope of work included preliminary selection of locations for geophysical traverses based on available maps; modifications to the preliminary locations based on an onsite site review of inaccessible marshy areas, topographic irregularities, utility locations and property line restrictions; clearing of vegetation with machetes and chain saws and layout of reference stakes along traverse lines with Brunton Compass and measuring tapes; performance of the geophysical survey; data plotting, reduction and preliminary interpretation; incorporation of the geophysical data into the selection process for choosing monitoring well locations; reevaluation of the geophysical data after the completion of drilling; and preparation of this report.

3.5.3 LIMITATIONS

Geophysical investigation is an indirect method of subsurface exploration whereby subsurface characteristics are inferred or interpreted from the measurement of electromagnetic, electrical, magnetic and seismic parameters at the ground surface. Many variables may affect the measurements including those not of primary interest. Due to the indirect, interpretive nature of geophysics, findings should be considered preliminary and should be verified by more direct methods of investigation such as test borings, monitoring wells and test pits. Reinterpretation of the data after the collection of direct data frequently improved the geophysical interpretations. The following general limitations should be considered when evaluating the geophysical data.

- Subsurface features can be identified by the appropriate geophysical methods only insofar as they produce a discernible geophysical signature. They must have adequate uniformity and size, appropriate physical or chemical properties, sufficient contrast with the surrounding medium and reasonable proximity to the sensors. Their signature must be distinguishable from and not masked by background noise, undesireable variables, or interference. An attempt was made to minimize these limitations where possible or at least note them so that they could be taken into account during data interpretation.

- Stratigraphic units inferred on the basis of geophysical data may not correspond exactly with geologic or hydrogeologic strata.

- Complex geologic conditions may be impossible to resolve with surface geophysical methods.

- Seismic interpretations may omit thin layers or strata with a lower seismic velocity than overlying layers. Such conditions may result in an underestimate or overestimate, respectively, of the depth to deeper strata.

- Terrain conductivity and resistivity interpretations are non-unique i.e. identical geophysical signatures may be produced by different subsurface conditions. The use of multiple geophysical methods and incorporation of direct subsurface information minimizes this limitation.

3.5.4 SURVEY METHODS

The geophysical surveys were conducted in accordance with the investigation work plans prepared by Dunn Geoscience and submitted to GHR prior to the start of work. The only geophysical method employed in all three Areas was terrain conductivity. Resistivity, magnetics, and seismic were used in only one area each, depending upon the survey objectives. The rationale; application areas; equipment; field techniques; and data reduction; interpretation and presentation methods for each geophysical method are described below.

3.5.4.1 Terrain Conductivity

Terrain conductivity surveys were used to define lateral variations in conductivity that may be attributable to changes in soil thickness, texture, moisture, and groundwater quality, i.e. specific conductance. The presence of near-surface buried conductors such as metal tanks and steel drums was also investigated.

Model EM-31 and EM-34-3 terrain conductivity meters manufactured by Geonics Limited were employed for the survey. The EM-31 measures terrain conductivity continuously and has a maximum depth of investigation of approximately 6 meters. EM-31 measurements were taken at a 20-foot interval along selected traverses in the south part of Area 1 to investigate the presence of possible contaminant plumes or buried metal such as concentrations of steel drums. In Area 2, EM-31 measurements were made at a 10-foot interval along two near-perpendicular transects to characterize fill areas, locate possible buried steel drums or tanks, and identify areas of conductive contaminants. Two readings were made at each station with the boom oriented, first parallel, then perpendicular to the traverse, to enhance the detectability of buried discrete conductors. In addition to the two perpendicular traverses, the entire open area of Area 2 was scanned with the EM-31 for buried metal objects. In Area 3, EM-31 measurements were made at approximate 20-foot intervals to locate shallow contaminant plumes.

The maximum depth of investigation by the EM-34 varied depending upon the intercoil spacing and coil orientation mode selected. In Area 1, the EM-34 was used with a 20 meter intercoil spacing to identify subsurface geologic characteristics. Measurements were made at a 50-foot station spacing using both the horizontal (maximum depth of investigation 50 feet) and vertical (maximum depth of investigation 100 feet) dipole mode. The EM-34 was not utilized in Area 2 because the suspected search targets were judged to be shallow enough to warrant use of only the EM-31.

In Area 3, the EM-34 was used with a 10 meter intercoil spacing to identify possible contaminant plumes. Measurements were made at a 25-foot station spacing in both the horizontal (maximum depth of investigation 25 feet) and vertical (maximum depth of investigation 50 feet) modes.

In all three Areas, the terrain conductivity data were plotted in a profile or plan format, compared with borehole and seismic available data, and interpreted qualitatively to identify the possible presence of the search targets. This information was used to help select drilling locations and evaluate site conditions.

3.5.4.2 Electrical Resistivity Soundings

Electrical resistivity soundings were performed in Area 1 to identify depth variations in the electrical properties of subsurface materials. These variations could be caused by changes in soil texture, porosity, moisture content, or salinity and groundwater quality, i.e. specific conductance.

A Bison Model 2350 earth resistivity meter was used with a Wenner electrode array to make the four soundings. Sounding locations were selected on the basis of terrain conductivity data, accessibility and site geometry. Electrode spacings generally varied from 1 to 300 feet, or less if geometric or electric current constraints prevailed. Data curves were plotted immediately in the field on log/log graphs to identify potential spurious data points and enable corrections or verifications to be made as necessary.

The data were interpreted initially using a semi-empirical Barnes Layer method whereby electrode spacings are assumed to be equal to the depth of investigation. The Barnes Layer Models developed with use of a computer, were used to interpret geo-electric sections to assess the thickness, apparent resistivity and electrical complexity of the subsurface layers at each sounding centerpoint. This information was used to help evaluate the terrain conductivity data for the entire area and to estimate the stratigraphy at the sounding locations.

3.5.4.3 Magnetic Survey

A magnetic survey was performed in Area 2 to identify concentrations of buried ferrous metal such as steel chemical waste containers. Such containers, if present and leaking, may be a source of groundwater contaminants. The magnetic survey was not included in the original work plan and was employed as a supplement to the EM-31 in Area 2.

A Geometrics Model G-856 proton precession magnetometer was employed to make measurements of total magnetic field intensity at a 20 foot station interval along the same two traverse lines occupied by the EM-31. The objective was to determine the presence of concentrations of buried ferrous metal that perturb or create detectible anomalies in the local magnetic field. The magnetic sensor was mounted in a backpack approximately 4.5 feet above the ground. In addition to the two traverse lines, short north-south traverses were made using a 10 foot station spacing across each of the eight terrain conductivity anomalies suspected to be caused by buried metal.

Magnetic measurements were plotted in plan and profile were interpreted to identify areas of suspected buried metal along the traverse lines.

3.5.4.4 Seismic Refraction Surveying

A seismic refraction survey was conducted in Area 1 to determine bedrock topography and investigate stratigraphic characteristics of the soil overburden.

A Geometrics Model ES-1210F 12 channel signal enhancement seismograph was used with a "Betsy Seisgun" energy source. Geophone spacings were typically 15 and 30 feet, but ranged down to 5 feet in special situations. Individual seismic spreads were typically 300 feet long with a range from 130 to 360 feet. Each spread typically consisted of five shotpoints, one offset from each end, two end shots and a midshot. Occassionally one or two offset shots had to be omitted because of accessibility restrictions (marsh, property lines, river, topography, dense vegetation, utilities, or inadequate signal to noise ratio.) The pattern of five shotpoints provided for a fully "reversed" profile with adequate redundancy to identify refractors under the entire spread.

Typically, shots were repeated or stacked and the signal enhanced until a good record of the seismic traces were obtained for each of the twelve geophones. Under good conditions one or two shots were adequate to provide a good seismogram on the strip chart recorder. However, in some areas where the surface soils were expecially dry and/or organic, topography was extreme, or traffic vibrations from nearby Interstate 84 were troublesome, even ten to twenty shots combined with various instrument filter combinations were not adequate to produce satisfactory sharp first arrivals along the entire spread. The resulting data deficiencies were evaluated and subsequent seismic interpretation given less weight than in other areas.

Data reduction included selection of first arrivals on the seismograms, plotting time-distance graphs, computer analysis and display of the interpreted seismic model and evaluation. The computer program used for the analysis was adopted by Dunn Geoscience from Scott, Tibbets and Burdick (Computer Analysis of Seismic Refraction Data, U.S. Bureau of Mines RI 7595, 1972) which is based on an iterative delay time and ray-tracing method to develop a two-dimensional layered earth model.

3.60 DRILLING PROGRAM

3.61 GENERAL

All aspects of the remedial investigation were conducted using standard or accepted methods. Techniques and methods utilized during the drilling portion of the field investigation are described within this section. Specific analytical and numerical techniques used to interpret the hydrogeologic data are addressed within the respective sections of the report.

3.62 PURPOSE AND SCOPE

During July 30, 1985 to October 22, 1985, a total of two test borings and forty-three monitoring wells were installed at locations surrounding the Brewster Well Field. The final well locations were determined after reviewing the results of the geophysical surveys, a two dimensional groundwater model, surficial geologic mapping, and a preliminary list of potential sources of contamination. Well locations were selected to investigate areas thought to contain highly permeable aquifer material, areas appearing to be pathways from potential sources of contamination, and areas defined during the two dimensional groundwater modeling as requiring additional input. Physical access was also a consideration. Table ______ provides a brief rationale for the location of each well location.

Wells were positioned as either well clusters consisting of a shallow(S), intermediate (I) and deep (D) well; well pairs consisting of a shallow and intermediate well; or individual wells, usually intermediate, depending on the information required at each location. Wells were numbered sequentially, based on the order of their location selection. The locations of the wells are shown on Plate _____.

Monitoring Well Location Rationale

Well I.D.	Location Rationale
DGC-1	(a) address potential of contamination arriving from the east (b) geologic and hydrogeologic information on the eastern portion of the well field
DGC-2	(a) address potential of contamination arriving from the west (I-84 road fill) (b) geologic and hydrogeologic information on the western portion of the well field
DGC-3	(a) address potential of contamination emanating from the Alben Cleaners area (b) geologic/hydrogeologic information
DGC-4	(a) address potential of contamination arriving from the north (Fox Farm) (b) geophysics indicated a low conductivity zone - possible coarse deposit (c) geologic/hydrogeologic information
DGC-5	(a) address potential of contamination arriving from the north (b) useful for seismic interpretation (intersection of 2 seismic lines) (c) geologic/ hydrogeologic information
DGC-6	(a) address Brady Stannard and Alben Cleaners as potential contaminant sources (b) geologic/ hydrogeologic information
DGC-7	(a) address Alben Cleaners and Brady Stannard as potential contaminant sources (b) geophysics indicated a low conductivity zone at this location (possible coarse deposits) (c) geologic/hydrogeologic information

Well I.D.	Location Rationale
DGC-8	(a) aid in determining the extent of the aquifer river hydraulic interconnection (b) geologic/ hydrogeologic information
DGC-9	(a) address Alben Cleaners and Brady Stannard as potential contamination sources (b) geologic/ hydrogeologic information
DGC-10	(a) address potential of contamination arriving from the north (b) only accessible location in the wetlands area north of the well field (c) geologic/ hydrogeologic information
DGC-11	(a) address potential of contamination arriving from the north (b) geophysics indicated a low conductivity zone at this location (possible coarse deposits) (c) geologic/hydrogeologic information
DGC-12	(a) address potential of contamination source to the east (b) useful for seismic interpretation (intersection of 2 seismic lines) (c) geologic/ hydrogeologic information
DGC-13	(a) aid in determining the aquifer-river hydraulic interconnection (b) geologic/hydrogeologic information
DGC-14	(a) define the limits of the contamination (b) geologic/hydrogeologic information (c) obtain background water quality data
DGC-15	(a) address potential of contamination source to the east (b) geologic/hydrogeologic information

End of Phase 1 Wells

Well I.D.	Location Rationale
DGC-16	(a) define the limits of the contamination (b) aid in determining the direction of groundwater movement (c) geologic/hydrogeologic information
DGC-17	(a) aid in defining the cross section of the plume (b) geologic/hydrogeologic information
DGC-18	(a) define the limits of the contamination (b) geologic/hydrogeologic information
DGC-19	(a) determine if the contamination is emanating from south of Brady Stannard (b) geologic/ hydrogeologic information
DGC-20	(a) define the limits of the contamination (b) obtain background water quality data (c) geologic/ hydrogeologic information

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

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

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

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

3.63 DRILLING METHODS

Drilling was performed using one or more of the following techniques:

A. standard wash rotary within a 5 inch casing
B. bentonite mud rotary using a nominal 8 inch bit and no casing
C. hollow stem auger
D. NX coring

Geotechnical Drilling & Testing, Inc. of Castleton, New York and subcontracted drilling firms, Boyd Artesian Drilling of Carmel, New York, Deliz - Elise Co. of East Syracuse, New York, and Kendrick Enterprises Ltd. of Monroe, New York performed all the drilling and monitoring well installations under the supervision of a Dunn Geoscience or GHR Engineering geologist/hydrogeologist. Only water that was treated by the air stripping column was used for drilling. A CME-55 soil boring rig utilizing 4 1/4 inch ID, hollow-stem auger and a Mobile B-61 soil boring rig utilizing 6 1/4 inch ID, hollow-stem auger were used to install eleven of the shallow wells. A Driltech D40K air rotary rig was used to install three shallow wells and six bedrock wells. A Joy HD-22 soil boring rig utilizing 5 inch casing was used to install nineteen intermediate wells, four shallow wells and two test borings. The CME-55 rig and Joy HD-22 rig were also used to core the bedrock. The drilling methodology employed for specific wells may be found in the soil boring logs (Appendix _____).

3.64 SOIL SAMPLING AND CLASSIFICATION

Soil samples were collected at each well location during drilling, using either a 2 or 3 inch OD split-spoon barrel sampler, following ASTM methods. The split-spoon barrels were washed before obtaining each sample to prevent cross-contamination. Three 5 gallon buckets with dedicated brushes, the first containing a non-phosphate detergent and the second and third containing clean water, were used for this purpose. Each split-spoon sample was cut open, using a clean knife and logged, using the Modified Burmister Identification System and the Unified Soil Classification System (see ___________ for explanation). These soil boring logs, describing subsurface materials encountered in the test borings, are located in Appendix ____________. Immediately after describing the sample, a representative soil sample was taken from the center of the spoon and placed in a 40 ml "VOA" vial (approximately two-thirds full) and two 16 oz. glass jars sealed with aluminum foil lined screw top lids. The 40 ml vial sample was labeled and placed on ice until it was transported to the on-site portable laboratory to undergo screening by the HNU-301 GC. The two remaining 16 oz. jars were labeled and retained by Dunn Geoscience Corporation for laboratory gradational analysis and future referral.

3.66 MONITORING WELL INSTALLATION

3.66.1 Three Well Cluster Installation

Six well clusters, each consisting of a shallow well screened at the water table, an intermediate well screened within the unconsolidated aquifer, and a bedrock well, were installed at locations DGC-1, DGC-2, DGC-7, DGC-10, DGC-14 and DGC-15 (see _____).

Intermediate Well

The intermediate well was installed first, with the exception of DGC-1, where the bedrock well installation preceeded the intermediate well for logistical reasons. A nominal 5 inch roller bit was used to advance the boring to refusal at presumed bedrock. Continuous split-spoon sampling was performed in advance of the boring with the samples handled as previously described. Five inch flush-joint casing was driven the length of the boring using a 300 pound hammer with an 18 inch drop.

The screen depth was chosen on the basis of visual examination of the soil sample and the results of the HNU-301 GC analysis. If a particular zone demonstrated unusually high contaminant concentrations on the chromatagraph, that zone was screened. In borings where no peaks were observed, the zone appearing to be most permeable was screened. Two and one half, five or ten foot screened lengths were employed depending on the decision of the on-site geologist. Care was taken as to not place the screen in a fashion that would bridge an existing confining or semi-confining unit.

After drilling and casing to refusal, the borehole was thoroughly flushed clean of cuttings. Immediately prior to placing bentonite pellets or sand into the borehole, the casing was retracted just enough to expose the correct length of the borehole about to receive the construction material. Caving of the surrounding geologic material was kept at a minimum using this method. The boring was then slowly backfilled with five linear feet of bentonite pellets. This precaution was taken to preclude the movement of water between the unconsolidated aquifer and the underlying bedrock aquifer. An exception to this procedure took place at DGC-1I where the boring was terminated 15 feet above bedrock within the till unit. Clean filler sand was then backfilled to a depth approximately six feet below the proposed screen bottom. A second bentonite pellet seal was installed above the filler sand to a depth one foot below the proposed screen bottom.

At this point the well was constructed, as it was lowered into the borehole, and suspended at the proper depth. The well consisted of two inch flush-joint schedule 5 stainless steel riser pipe and two inch no. 10 slot stainless steel screen with a stainless steel bottom cap. Teflon tape was used on all riser pipe joints to prevent any leakage of groundwater into the well from the surrounding aquifer. Whitehead #0 sand (see grain size distribution analysis ________) was used to backfill the hole creating a sandpack extending from approximately one foot below the screen to approximately two feet above the screen. A two to five foot bentonite pellet seal was installed above the sandpack, effectively sealing off the screened interval from the rest of the aquifer. The remaining casing was pulled and cement-bentonite grout pumped through a tremie pipe into the remainder of the annulus. To prevent unauthorized access into the monitoring well, a lockable, protective steel casing was cemented over the stainless steel riser pipe extending above the land surface. The protective casings were then primed and numbered. Well construction diagrams are shown in Appendix ____.

Shallow Well

The shallow well was installed approximately five feet from the intermediate well. The boring was advanced without sampling to a depth six feet below the water table (as established by the intermediate well). Drilling techniques were either standard wash rotary within a 5 inch casing as previously described, hollow stem auger (4 1/4" or 6 1/4" ID), or air rotary using a nominal 8 inch bit. Well material specifications were identical to the intermediate well, using five or ten foot sections of screen. The screened section extended from at least three feet below the water table to two feet above the water table. The sandpack extended from approximately one foot below the screen to approximately one foot above the screen. A one to four foot bentonite pellet seal was installed above the sandpack and the remainder of the annulus grouted with a cement-bentonite grout. A lockable, protective steel casing was cemented into position over the exposed riser pipe. The well construction materials and method of installing the well were the same as those described for the intermediate well.

Deep Well

The deep well was located approximately five feet from one of the existing wells. The purpose of the deep wells was to monitor the hydraulic and chemical properties of the upper zone of the bedrock aquifer. A nominal 8 inch roller bit was used to drill through the unconsolidated material and a minimum of five feet into the bedrock. Bentonite based drilling fluid was employed to support the walls of the boring during drilling and well installation.

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

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

3.66.2 Well Pair Installation

Twelve well pairs, each consisting of a shallow and an intermediate well, were installed at locations DGC-3, 5, 6, 8, 9, 11, 12, 13, 16, 17, 18, and 19. A nominal 5 inch roller bit was utilized to advance the boring to a depth determined by the on-site geologist. Visual examination of continuous and standard split-spoon sampling, and HNU-301 analyses, again aided in selecting the optimum screen depth. The intermediate well borings generally extended only a few feet below the screened interval, therefore, in several cases the bottom bentonite seal and overlying sand fill used in the well cluster intermediate wells were not needed. Instead, a bentonite pellet seal was installed to within approximately one foot of the bottom of the screen and the rest of the installation was performed as previously described for the well cluster intermediate wells.

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

3.66.3 Single Well Installation

One single intermediate well was installed at location DGC-20I. Standard sampling was performed during drilling and the screen location was chosen by the on-site geologist based on visual examination of soil samples and an estimation of the depth to the water table. Well materials and method of installation were identical to that previously described for the well pair intermediate wells.

3.66.4 Test Borings

Two test borings were drilled at locations DGC-4 and DGC-12I. The evaluation of the soil conditions in this area indicated that a well at location DGC-4 was not necessary. A monitoring well at DGC-12I was not installed because a 10 foot section of casing broke off at approximately 46 feet. DGC-12I was grouted to the surface and a second boring redrilled as DGC-12IA a few feet away.

3.37 DRILLING EQUIPMENT DECONTAMINATION

Prior to drilling the first boring, all drilling and monitoring well installation equipment was thoroughly cleaned on site. All equipment which came in contact with the soil and/or rock, as well as water tanks, drill tools, pumps and hoses, underwent the initial cleaning procedure. While working at the site, the drilling equipment was also decontaminated between wells to prevent cross-contamination.

Decontamination took place at a designated area next to the site trailer selected by GHR Engineering and Dunn Geoscience personnel. The cleaning process involved the use of a high pressure steam rinse and a methonol spray, followed by a final steam rinse.

3.67 WELL DEVELOPMENT

All monitoring wells were developed using a modified air-lift technique, except for DGC-1S, 2S, 14S, and 16S, which were developed by bailing and/or a hand operated suction lift "guzzler" pump. Well development is necessary for the following reasons:

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

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

The basic air-lift method involved pumping compressed air into the well forcing out water containing the undesirable fine sand and silt. The modified air-lift method is an adaptation of the basic air-lift method and provides the following advantages over the basic method:

1. No air enters the well;

2 Water is removed directly from the screened portion of the well;

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

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

The actual modified air-lift method is as follows: five foot sections of one inch diameter PVC pipe were screwed together and lowered into the monitoring well until the end of the bottom-most section of pipe was positioned within the screened section of the well or within the cored section of the bedrock wells. Attached to the bottom of the pipe were two one-way check valves separated by about three inches of one inch PVC pipe. Both check valves closed in a downward direction. Two air compressor hoses were used. One connected the air compressor to the coalescer, and the other ran from the coalescer down the one inch PVC pipe well development assembly unit to approximately five feet above the upper check valve. The orientation of the check valve allowed the pipe to fill with water. Activation of the air compressor momentarily shut the upper check valve and forced the trapped column of water up and out of the pipe. The release of the water lowered the pressure on the top of the check valve allowing water to again enter the pipe until the air pressure became sufficient to blow out the column of water. The process repeated itself if the water pressure (head) was capable of balancing the air pressure created by the compressor. In wells lacking adequately long water columns, the water pressure was incapable of reopening the check valve allowing a fresh column of water to enter. Manual control of the air pressure was necessary in these instances. The lower check valve assured that no air entered the monitoring well. To prevent cross-contamination between wells, the one inch pipe was washed with water, sprayed with methanol and again rinsed with water before introduction into each well.

In wells with short columns of water, the modified air-lift method proved ineffective, necessitating the alternate development methods of hand-bailing and/or pumping. Stainless steel bailers, that were used later for groundwater sampling, were utilized for development purposes. The bailers served both as a surge-block device loosening the fine-grained material from the well annulus, and as a mechanism to remove the water and sediment from the well. The surging was accomplished by rapidly raising and lowering the bailer within the screened section. The hand operated "guzzler" pump was employed to rapidly remove the turbid water from the well. Bailing and pumping were continued until the water had sufficiently cleared or until five well volumes of water have been removed.

3.70 HYDRAULIC CONDUCTIVITY TESTING

The results of field and laboratory hydraulic conductivity testing indicate the following: The hydraulic conductivity of the bedrock and the unconsolidated deposits were found to range from 10^{-9} to 10^{-3} cm/sec for the gneiss bedrock, from 10^{-4} to 10^{-3} cm/sec for the marble bedrock, from 10^{-5} to 10^{-2} cm/sec for the glacial till, and from 10^{-5} to 10^{-1} cm/sec for the unconsolidated deposits above the till. Horizontal and vertical hydraulic conductivity tests, along with the results of grain size analyses, provided this quantitative information on the characteristics of the aquifers within the study area.

Vertical hydraulic conductivity (K_v) tests were performed in several soil borings during drilling. Three tests were performed within the glacial till and three above the glacial till in the unconsolidated materials. Test preparation included driving five inch casing to the selected depth. A tricone bit was used to carefully clean out the casing, leaving two feet of undisturbed soil within the casing. The hole was then flushed by pumping clean water through the drill rods until the return flow was clear. Finally, the rods were withdrawn and the casing refilled to the top with clean water. The actual test was run by measuring the drop in the water level within the casing over a period of time, usually 15 minutes. The difference in water levels with respect to time was used to calculate the vertical hydraulic conductivity. Results are shown in Appendix _____.

Calculations of vertical hydraulic conductivity (Kv) were based on the following equation (Design manual 7.1, Soil Mechanics, May 1982, Dept. of the Navy, Naval Facilities Engineering Command):

$$K_v = \frac{2\pi R + 11L}{11\,(t_2 - t_1)} \ln (H_1/H_2)$$

Where K_v = vertical hydraulic conductivity
R = radius of the casing
L = length of the soil column in the casing
$t_2 - t_1$ = time between any two recovery observations
H_1 = depth reading of first recovery observation minus baselevel depth value
H_2 = depth reading of second recovery observation minus baselevel depth value

This method, which assumes that vertical seepage forces are negligible (i.e. there is a good seal between soil and casing), is especially useful in anisotropic soils because horizontal flow in more permeable layers is not allowed.

Horizontal hydraulic conductivity (K_h) tests were performed through the screens of all of the monitoring wells. These tests, which include a slug and/or bail test, involve observing the recovery of water levels toward an equilibrium level after a volume of water has been added to or removed from the well casing. During the slug tests, a 6 foot stainless steel rod was quickly introduced into the well casing. During the bail tests, the same 6 foot stainless steel rod was rapidly removed from below the static water level. In both tests, a pressure transducer set 2 to 10 feet below the static water level was used to record water level recovery on a strip-chart recorder (Enviro-Labs Model DL-240 Data Logger). Thus, a chart of pressure (at a specific measuring point) versus time was obtained for use in calculating the horizontal hydraulic conductivity (Figure __).

Calculations of horizontal hydraulic conductivity (K_h) were based on the following equation (Dept. of the Navy, 1982):

$$K_h = \frac{R^2}{2L} \ln\left(\frac{L}{R}\right) \frac{\ln(H_1/H_2)}{(T_2 - T_1)}$$

where: K = horizontal hydraulic conductivity (L/t)

R = inside radius of casing/screen (L)

L = length of uncased/screened portion of well (L)

H = pressure/distance of water level from equilibrium value (chart units)

T = time expired from test start (t)

This method assumes that the aquifer tested is unconfined, homogeneous, and isotropic. The method is applicable to wells cased below the water table with uncased or screened extensions where L/R is greater than 8. It is, therefore, applicable to intermediate and deep wells assuming a homogeneous and isotropic aquifer. It is not strictly applicable to shallow wells with uncased or screened portions above the water table, but it does serve as an approximation.

The Hvorslev (1951) method was also used to analyze the slug and bail test data for each of the wells. The following equation was used to calculate K_h:

$$K_h = r^2 \frac{\ln (L/R)}{2 LT_o}$$

where: K_h = horizontal hydraulic conductivity

r = radius of riser in which water level fluctuations occur

R = radius of well screen

L = well screen length

T_o = basic time lag

Individual well results and an overall summary of the horizontal hydraulic conductivity tests using both methods are shown in Appendix _____.

Overall hydraulic conductivities were determined using results from the grain size analyses. The Hazen relation

$$K = Ad_{10}^2$$

relies on the effective grain size, d_{10}, and predicts a power-law relation with K. The d_{10} value can be taken directly from the grain size graduation curves as determined by the sieve analyses. The coefficient A is equal to 1.0. Hazen's approximation provides rough but useful estimates for most soils in the fine sand to gravel range (Freeze & Cherry, 1979).

A second estimate of hydraulic conductivity based on the results of the grain size analyses was obtained using a method outlined by Summers and Weber (Groundwater, Vol. 22, No. 4, p. 474). The method involves comparing the grain size distribution of the soil sample to an existing data base of 500 analyzed samples for which hydraulic conductivity values had been previously determined. The data base is presented as a trilinear diagram with three variables representing the percentages of silt and clay, sand, and gravel. Superimposed over the trilinear diagram are isohydraulic conductivity lines representing the maximum hydraulic conductivity values associated with the grain size distributions.

Each grain size analysis from the site was reduced to percentages of silt and clay, sand, and gravel (as classified by Summers and Weber) and plotted as a point on the trilinear diagram. The corresponding maximum hydraulic conductivity values were used as a means of comparison with respect to the values obtained by the slug/bail tests and Hazen's approximation. The results of the Hazen's approximation and the Summers and Weber method are included in Appendix ____.

SUMMARY OF THE HYDRAULIC CONDUCTIVITY TESTING

Table ______

Stratigraphic Unit	Median K* (cm/sec)	Median K_v** (cm/sec)	Median K_h*** (cm/sec)
Alluvium	6.4×10^{-5}	--	4.2×10^{-4}
Glaciofluvial Outwash	--	6.4×10^{-3}	--
Ice Contact Deposits	--	--	1.2×10^{-3}
Glaciolacustrine	3.6×10^{-3}	2.8×10^{-2}	1.8×10^{-2}
Glaciofluvial Deltaic	1.5×10^{-2}	2.7×10^{-2}	2.5×10^{-2}
Till	4.0×10^{-4}	6.2×10^{-3}	7.8×10^{-5}
Gneiss	--	--	1.4×10^{-4}
Marble	--	--	1.9×10^{-3}

* as determined by the Hazen's Approximation (grain size analyses)

** as determined from insitu tests

*** as determined by slug and bail tests according to the Hvorslev and DM7 methods

HORIZONTAL HYDRAULIC CONDUCTIVITY RESULTS

Slug and Bail Tests

Table ______

Well #	Depth	Stratigraphic Unit	Hvorslev Method (cm/sec) Bail	Slug	DM? Method (cm/sec) Bail	Slug	Mean
1S	2.5 - 9.0'	AL	2.0×10^{-3}	4.3×10^{-3}	2.1×10^{-3}	4.3×10^{-3}	3.2×10^{-3}
1I	34.7 - 42.0'	GL	5.4×10^{-3}	1.0×10^{-3}	5.5×10^{-3}	1.0×10^{-2}	2.3×10^{-2}
1D	90.0 - 103.0'	Gn	--	1.0×10^{-9}	--	1.0×10^{-9}	1.0×10^{-9}
2S	3.5 - 9.0'	AL	--	3.7×10^{-4}	--	4.6×10^{-4}	4.2×10^{-4}
2I	14.0 - 20.0'	GL	1.0×10^{-2}	1.3×10^{-2}	9.7×10^{-3}	1.4×10^{-2}	1.3×10^{-2}
2D	29.1 - 39.1'	Gn	8.8×10^{-4}	6.6×10^{-4}	8.7×10^{-4}	6.8×10^{-4}	7.7×10^{-4}
3S	4.3 - 12.8'	AL/GL	1.2×10^{-4}	1.4×10^{-4}	1.4×10^{-4}	1.4×10^{-4}	1.4×10^{-4}
3I	19.0 - 24.0'	GF	1.0×10^{-1}	3.8×10^{-2}	1.0×10^{-1}	3.7×10^{-2}	6.9×10^{-2}
5S	6.3 - 22.0'	IC	1.8×10^{-3}	5.4×10^{-4}	1.6×10^{-3}	7.8×10^{-4}	1.2×10^{-3}
5I	65.5 - 73.6'	I.C./Till	--	3.1×10^{-4}	--	$.3 \times 10^{-4}$	3.1×10^{-4}
6S	3.5 - 10.0'	Fill/AL	8.4×10^{-5}	4.0×10^{-4}	1.1×10^{-4}	6.6×10^{-4}	3.1×10^{-4}
6I	28.0 - 33.0'	GF	3.2×10^{-2}	1.4×10^{-2}	3.4×10^{-2}	1.3×10^{-2}	2.3×10^{-2}
7S	2.5 - 9.0'	AL/OW	3.4×10^{-3}	4.7×10^{-3}	3.3×10^{-3}	4.6×10^{-3}	4.0×10^{-3}
7I	34.9 - 40.0'	GL	--	1.4×10^{-4}	--	1.4×10^{-4}	1.4×10^{-4}
7D	104.0 - 112.0'	M	--	3.3×10^{-4}	--	3.2×10^{-4}	3.3×10^{-4}
8S	3.0 - 9.5'	AL/OW	1.3×10^{-3}	3.9×10^{-3}	1.4×10^{-3}	4.2×10^{-3}	2.7×10^{-3}
8I	61.7 - 74.0'	GF	1.6×10^{-3}	3.0×10^{-3}	1.5×10^{-3}	3.2×10^{-3}	2.3×10^{-3}
9S	3.0 - 9.5'	AL/OW/GL	2.1×10^{-4}	5.6×10^{-4}	2.1×10^{-4}	5.6×10^{-4}	3.9×10^{-4}
9I	32.0 - 44.5'	GL	2.3×10^{-2}	--	3.2×10^{-2}	--	2.8×10^{-2}
10S	3.3 - 10.3	AL/OW	6.4×10^{-4}	1.3×10^{-3}	6.8×10^{-4}	1.3×10^{-3}	9.6×10^{-4}
10I	37.8 - 42.5'	I.C./Till	--	1.2×10^{-4}	--	1.2×10^{-4}	1.2×10^{-4}
10D	58.0 - 66.0'	Gn	--	2.6×10^{-4}	--	2.6×10^{-4}	2.6×10^{-4}
11S	2.5 - 9.0'	AL/GL	2.2×10^{-3}	1.1×10^{-3}	2.3×10^{-3}	1.2×10^{-3}	1.7×10^{-3}
11I	18.6 - 24.3'	Till	--	1.3×10^{-4}	--	1.3×10^{-4}	1.3×10^{-4}
12S	3.5 - 10.0'	AL/OW	3.5×10^{-3}	2.1×10^{-3}	3.5×10^{-3}	2.0×10^{-3}	2.8×10^{-3}
12IA	34.0 - 41.7'	OW/Till	--	--	--	--	--
13S	2.5 - 9.0'	AL	6.6×10^{-4}	2.5×10^{-3}	7.1×10^{-4}	2.9×10^{-3}	1.7×10^{-3}
13I	56.9 - 64.4'	GL/Till	2.9×10^{-2}	--	3.2×10^{-2}	--	3.1×10^{-2}
14S	4.5 - 11.5'	Fill/AL/GF	3.6×10^{-4}	4.9×10^{-4}	4.1×10^{-4}	6.4×10^{-4}	4.8×10^{-4}
14I	24.0 - 30.0'	GF	8.6×10^{-3}	7.6×10^{-3}	9.0×10^{-3}	7.6×10^{-3}	8.6×10^{-3}
				8.5×10^{-3}		1.0×10^{-2}	
14D	71.2 - 80.2'	Gn	--	1.3×10^{-5}	--	1.3×10^{-5}	1.3×10^{-5}
15S	3.7 - 13.0'	AL/Till	7.0×10^{-4}	1.8×10^{-3}	6.7×10^{-4}	1.7×10^{-3}	1.2×10^{-3}
15S	43.9 - 49.8'	Till	--	2.6×10^{-5}	--	2.6×10^{-5}	2.6×10^{-5}
15D	96.2 - 106.2'	M	1.6×10^{-3}	5.1×10^{-3}	1.5×10^{-3}	5.2×10^{-3}	3.4×10^{-3}
16S	2.8 - 10.0'	AL/GL	--	1.0×10^{-2}	--	1.1×10^{-2}	1.1×10^{-2}
16I	30.0 - 37.0'	GF	--	9.3×10^{-3}	--	8.9×10^{-3}	9.1×10^{-3}
17S	3.0 - 10.0'	AL/GL	--	4.3×10^{-4}	--	4.3×10^{-4}	4.3×10^{-4}
17I	27.2 - 34.5'	GF	1.1×10^{-2}	4.2×10^{-2}	1.2×10^{-2}	3.5×10^{-2}	2.5×10^{-2}
18S	3.0 - 10.0'	Fill/AL	--	7.7×10^{-5}	--	9.2×10^{-5}	8.5×10^{-5}
18I	16.5 - 29.0'	GL/GF	--	4.9×10^{-3}	--	4.5×10^{-3}	4.7×10^{-3}
19S	5.0 - 12.0'	AL/GF	2.1×10^{-3}	2.7×10^{-3}	2.1×10^{-3}	2.7×10^{-3}	2.4×10^{-3}
19I	17.0 - 24.0'	GF	8.5×10^{-2}	7.0×10^{-2}	8.7×10^{-2}	6.5×10^{-2}	7.7×10^{-2}
20I	1.7 - 12.5'	Fill	--	2.8×10^{-3}	--	3.2×10^{-3}	4.6×10^{-3}
				6.4×10^{-3}		6.1×10^{-3}	

AL - Alluvium
GF - Glaciofluvial/Deltaic
M - Marble
OW - Outwash
GL - Glaciolacustrine
IC - Ice Contact Deposits
G - Gneiss

SUMMARY OF HORIZONTAL HYDRAULIC
CONDUCTIVITY RESULTS

Stratigraphic Unit	Mean K_h (cm/sec)	Number of Samples	Variance (cm/sec)	Standard Deviation (cm/sec)	Median K_h (cm/sec)	Range (cm/sec)
Alluvium	1.1×10^{-3}	5	1.4×10^{-6}	1.2×10^{-3}	4.2×10^{-4}	2.2×10^{-3} to 8.8×10^{-5}
Glaciofluvial Outwash	--	-	--	--	--	--
Glaciolacustrine	1.6×10^{-2}	4	1.2×10^{-4}	1.1×10^{-3}	1.8×10^{-2}	2.5×10^{-2} to 1.4×10^{-4}
Ice Contact Deposits	1.2×10^{-3}	1	--	--	1.2×10^{-3}	--
Glaciofluvial Deltaic	3.9×10^{-2}	7	1.1×10^{-3}	3.3×10^{-2}	2.5×10^{-2}	8.3×10^{-2} to 3.3×10^{-3}
Glacial Till	7.8×10^{-5}	2	2.7×10^{-9}	5.2×10^{-5}	7.8×10^{-5}	1.3×10^{-4} to 2.6×10^{-5}
Gneiss	2.6×10^{-4}	4	9.7×10^{-8}	3.1×10^{-4}	1.4×10^{-4}	8.8×10^{-4} to 1.0×10^{-9}
Marble	1.9×10^{-3}	2	2.4×10^{-6}	2.5×10^{-3}	1.9×10^{-3}	5.2×10^{-3} to 3.2×10^{-4}

VERTICAL HYDRAULIC CONDUCTIVITY RESULTS

Falling Head Tests Performed During Drilling

Location	Date	Depth	Stratigraphic Unit	K_V cm/s
DGC-16I	10/07/85	45'	Till	5.1×10^{-4}
DGC-16I	10/07/85	45'	Till	6.0×10^{-4}
DGC- 1I	10/08/85	66'	Till	2.2×10^{-2}
DGC- 1I	10/08/85	66'	Till	1.2×10^{-2}
DGC- 1I	10/08/85	66'	Till	1.0×10^{-2}
DGC- 1I	09/26/85	60'	Till	8.4×10^{-3}
DGC- 1I	09/26/85	60'	Till	3.9×10^{-3}
DGC- 1I	09/23/85	22'	Glaciofluvial-Outwash	7.3×10^{-3}
DGC- 1I	09/23/85	22'	Glaciofluvial-Outwash	5.5×10^{-3}
DGC- 7I	09/12/85	44'	Glaciofluvial-Deltaic	3.5×10^{-2}
DGC- 7I	09/12/85	44'	Glaciofluvial-Deltaic	1.9×10^{-2}
DGC-13I	09/05/85	40'	Glaciolacustrine	2.8×10^{-2}
DGC-13I	09/05/85	40'	Glaciolacustrine	2.7×10^{-2}

Range for Till

2.2×10^{-2} to 5.1×10^{-4} cm/sec

Mean for Till

7.2×10^{-3} cm/sec

Range for Glaciofluvial & Glaciolacustrine

3.5×10^{-2} to 5.5×10^{-3} cm/sec

Mean for Glaciofluvial & Glaciolacustrine

2.0×10^{-2} cm/sec

HYDRAULIC CONDUCTIVITY ESTIMATES

Based on Hazen's approximation and Summers and Weber Method

Well #	Depth (ft.)	Stratigraphic Unit	Hazen's Approx. (cm/sec)	*Summers & Weber Method (cm/sec)
1	58-60	Till	1.6×10^{-3}	1.7×10^{-2}
6	10-12	AL	6.4×10^{-5}	7.0×10^{-4}
6	20-22	GF	6.4×10^{-3}	5.2×10^{-2}
8	30-32	GL	7.2×10^{-3}	2.5×10^{-2}
9	15-17	GL	9.0×10^{-4}	2.8×10^{-3}
9	40-42	GL	3.6×10^{-3}	3.1×10^{-3}
11	25-27	Till	2.0×10^{-4}	3.5×10^{-4}
15	50-52	Till	4.0×10^{-4}	4.2×10^{-4}
19	20-22	GF	2.3×10^{-2}	7.0×10^{-2}

Alluvium (AL): 6.4×10^{-5} cm/sec

Glaciolacustrine (GL): range 7.2×10^{-3} to 9.4×10^{-4} cm/sec, mean 3.9×10^{-3} cm/sec

Glaciofluvial Deltaic (GF): range 2.3×10^{-2} to 6.4×10^{-3} cm/sec, mean 1.5×10^{-2} cm/sec

Glacial Till (Till): range 1.6×10^{-3} to 2.0×10^{-4} cm/sec, mean 7.3×10^{-4} cm/sec

* Represents the highest anticipated hydraulic conductivity based on the grain size distribution.

4.11 Regional Bedrock Geology

Three distinct bedrock types underlie the general site area: gneiss, limestone/marble, and schist. The gneiss, found generally north of the East Branch Croton River, is part of the Hudson Highlands, while the limestone/marble and schist are stratigraphic units within the Manhattan Prong. The limestone/marble unit is locally referred to as either the Inwood Marble or Stockbridge Limestone, and the schist is known as the Manhattan Schist.

The gneiss is described by Prucha (1968) as a hornblende - biotite-plagioclase gneiss with intercalated marble. The gneiss is further characterized as gray, well-foliated and demonstrating well developed but discontinuous felsic and mafic bands. Thin sheets of hornblende-biotite granite have been injected into the gneiss in several places. Layers of dark amphibolite are commonplace, extending several hundreds of feet laterally. Thin localized layers of silicated graphitic marble and calc-silicate rock are found intercalated with the gneiss. General agreement exists concerning the Precambrian Age of the gneiss. Several cycles of deformation have taken place within the gneiss, creating a structurally complex situation.

The Inwood Marble and Stockbridge Limestone are correlative formations with the Inwood Marble representing the Stockbridge Limestone after metamorphism. The Inwood Marble is found in the vicinity of the site, although several drillers' logs identify this formation as the Stockbridge Limestone. The marble is white to gray and ranges in composition from calcite to nearly pure dolomite. Weathered surfaces tend to be rusty-brown due to abundant pyrite. Small amounts of silicate minerals are found throughout the marble and contribute to distinct color banding and mineralogic layering.

The Manhattan Schist is predominantly gray to dark gray. Primary constituents include sillimanite, garnet, muscovite, and biotite. The schist is interbedded with calcite marble at the base. Weathered surfaces are typically rusty or brown. Locally, thin lenses of dark amphibolite are intercalated concordantly with schist.

Disagreement exists among geologists concerning both the stratigraphy and structure of the Manhattan Prong. Prucha (1968) argues a conformable sequence from the Inwood Marble to the Manhattan Schist. He feels that the strongest argument in favor of a conformable sequence is the alternation of lithologic types at formation boundaries. In contrast, Hall (1968) feels that an angular unconformity exists between the Manhattan Schist and the Inwood Marble. Hall states that the interlayered beds of marble found in the base of the Manhattan Schist are not beds of the Inwood Marble, and, in fact, the Manhattan Schist truncates all members of the Inwood Marble at various locations.

Several episodes of folding have led to a regionally complex bedrock structure. Prucha (1968) states that at least three episodes of folding have taken place subsequent to the deposition of the Manhattan Schist. Metamorphism reached sillimanite grade. The Precambrian Gneiss of the Hudson Highlands, although structurally and petrologically distinct from the Manhattan Prong to the south, has similarly undergone repeated deformational events. Isotope dating of the Hudson Highlands (Long and Kulp, 1962) indicates major metamorphic events about 1150 and 840 m.y.a. An additional event about 360 m.y.a. is interpreted as the result of a reheating of the gneiss during a metamorphic event in the adjacent Manhattan Prong.

A major fault exists in the immediate vicinity of the site. The location of the fault coincides with the contact between the Precambrian Gneiss of the Hudson Highlands and the Inwood Marble of the Manhattan Prong. Prucha (1968) indicates the fault as a steep reverse fault dipping 70 degrees or more under the Precambrian block of the Hudson Highlands. Direct evidence of the fault exists as severe crushing and mylonitization of the rock, up to several hundred feet in width, on both sides of the fault. An excellent exposure of the fault exists along the west side of the Croton River north of Croton Falls. A topographic break along the length of the fault and truncation of the stratigraphic units and folds serve as indirect evidence of the fault's location. The location of the fault has been delineated in Prucha's study (1968), in a Putnam County bedrock formation map (Grossman, 1957), and on the Lower Hudson Sheet of the New York State Museum and Science Service (Map and Chart Series 15) bedrock map of 1970.

A fault trace and lineament map based on an aerial photo analysis was produced by Geraghty & Miller, Inc., in 1979 as part of a study to locate an additional water supply for the village of Brewster. The map indicates a northeast trending fault extending up the East Branch Croton River valley to within approximately 3,000 feet of the well field. This location agrees with the aforementioned fault. A second, apparently unconnected, fault trace is shown beginning about 1,000 feet east of the well field and extending south-southeast. Several lineaments are also shown throughout the area with a predominantly north-northeast trend. Three or more of these lineaments extend into the well field valley. In some cases linaments have been found to correspond with faults or fracture zones.

4.21 Site Bedrock Geology

Due to the limited amount of bedrock data available of the Brewster Well Field Site, a structural analysis would be impossible. The existing bedrock structure appears to be exceedingly complex as the result of several episodes of folding. Outcrops of gneiss were found throughout the area with isolated outcrops of the less resistant Cambrian - Ordivician Inwood Marble (also known as the Stockbridge Limestone by local drillers) observed primarily along the southern edge of the East Branch Reservoir. Records of wells previously drilled near the site (Grossman, 1957) indicate two wells approximately 1600 and 3000 feet southeast of Brady Stannard that penetrate the Stockbridge Limestone.

Bedrock was penetrated at six locations during the test boring/monitoring well installation program. A minimum of 8 feet of NX size core was obtained from each test boring. Before coring, an 8 inch tricone roller bit was advanced between five to fifteen feet into the bedrock, creating a rock socket into which the well casing was then grouted. All core samples were boxed, labeled, and transferred to Dunn Geoscience Corporation for logging. The rock core logs are included in Appendix _____.

Gneiss was encountered in test borings DGC - 1D, 2D, 10D, and 14D, and dolomitic marble was observed in test borings DGC - 7D and 15D. The gneiss was generally unweathered, varying widely in both texture and composition. The color ranged from light to dark gray in test borings DGC - 1D, 2D, and 14D, to pink in test boring DGC-10D. Grain size varied from 0.1 to 4 mm. Compositionally, the percentage of mafic minerals ranged from 20% to 50%, quartz from 25% to 60%, and feldspar from 25% to 40%. Potassium feldspar constituted approximately 40% of the core obtained at DGC-10D. Common accessory minerals included pyrite and garnet. Jointing and fractures were common in all borings although no preferred orientation was observed. Most fractures were partially to totally healed with a soft black mineral (chlorite?). Iron staining was evident at joints and fractures. A weathered fracture zone exists in a biotite gneiss section of DGC-14D from 77.4 feet to 79.1 feet. A similar fracture zone was observed in boring DGC-1D from 91.5 to 92 feet. A soft friable zone of serpentine was penetrated from 101.5 to 102.8 feet in DGC-1D. This zone likely represents the transformation of an ultramafic dike.

The Inwood Marble was encountered in test borings DGC-7D and 15D. The marble was found to consist mainly of dolomite and is, therefore, referred to as dolomitic marble. The color varied from white to light gray with 15% to 35% of the core exhibiting a distinct yellow-brown staining. Grain size varied from 0.5 to 3 mm. Secondary minerals included chlorite, muscovite and an unidentified vitreous dark mineral. The chlorite was often observed as forming bands or zones approximately one inch in thickness and constituting up to 15% of the sample. Solution induced joints, generally perpendicular to the axis of the core, were found to occur as frequently as every half inch throughout the cores from both borings. A single partially healed fracture parallel to the axis of the core was identified in DGC-15D from 105.5 to 107.2 feet.

The secondary porosity of the two rock types is very different. The gneiss, a dense crystalline rock that contains partially or totally healed joints and fractures, has a lower porosity than the marble with its solution induced jointing. Based on the studied core samples, we estimate the secondary porosity of the gneiss varies from 0 to 10% while the secondary porosity of the marble ranges from 10 to 20%.

4.22 Site Surficial Geology

Unconsolidated deposits range in thickness from a minimum of 25 feet at DGC-2 to a maxium of 95 feet at DGC-7. Alluvial, floodplain and swamp deposits constitute the top 5 to 10 feet of these deposits throughout most of the site. Underlying these deposits are sediments of glacial origin deposited in a frequently changing environment. By studying the soil samples collected during the test boring/monitoring well installation phase and the boring logs from previously installed wells, as well as incorporating information obtained from the geophysical survey and surficial mapping program, a depositional sequence can be constructed for the observed unconsolidated deposits.

Four geologic profiles have been prepared based predominantely on the DGC test boring logs and to a lesser degree on selected "TH" series wells installed in 1979 under the supervision of the NYSDEC. The profiles are located in ___________ and are referred to below.

Depositional Sequence of the Unconsolidated Deposits

As the continental glacier advanced southward, it scoured older unconsolidated deposits and weathered rock down to a fresh bedrock surface. The eroded material was subsequently deposited under pressure of the overlying ice as a nearly ubiquitous layer of gray to green-gray densely packed sand, gravel and boulders in a clayey silt matrix over a relatively unweathered bedrock surface. This material known as lodgement glacial till was found to be absent only at DGC-2 where a thin layer of till may have been eroded by fluvial processes shortly after the glacier retreated. Although several test borings were terminated in the sediments overlying the till, the mode of deposition of lodgement till strongly suggests that glacial till is also present at these locations. Other than DGC-2, the thinest observed deposit of glacial till was 10 feet at DGC-10. The hill northeast of the well field is a drumlin, having a thick deposit of till overlying a rock core. The till thickness within the valley appears to increase in a southerly direction reaching a thickness in excess of 34 feet at DGC-7, 14, and 15 suggesting a thick blanket of till extending to the east of Alben Cleaners and Brady Stannard. A maximum thickness of 71 feet was observed at DGC-15. A contour map of the glacial till surface is provided in ______________.

As the glacier retreated from the valley to the north, a limited secondary deposit of till was laid down over the existing lodgement till. This till deposit, known as ablation till, occurs where debris is concentrated at or near the surface and is gradually deposited during slow melting of the glacial ice. Ablation till is much less dense than lodgement till. Ablation till was observed in borings DGC-1 and DGC-5 with thicknesses of 4 feet and 10 feet, respectively.

Sediments deposited in a void within the portion of the glacier still occupying the northern portion of the valley, or between the glacier and the drumlin to the east of the valley, collapsed into the valley creating a topographic high. This feature is evident at and north of DGC-5 in which 43 feet of collapsed ice contact deposits was encountered. It is believed that the depositional collapse of this kamic ice contact deposit extends several hundred feet south and west of the center of the deposit. The western extent of the deposit is shown on profile C-C' at DGC-10 where 12 feet of the material was penetrated. Also during the glacial retreat from the valley, ice blocks stranded by the retreating glacier prevented the drainage of the melt water from the valley; subsequently, creating a lake in the southern portion of the valley.

A major southern inlet to the lake was active at this time, forming a delta as its sediment - ladden melt waters encountered the relatively calm waters of the lake. A likely pathway for the incoming glaciofluvial sediments is evident today as the north-northwest trending valley south of route 22 and west of I-84. A natural grading of the incoming sediment occurred with the coarse deltaic glaciofluvial material settling out nearest to the mouth and the finer glaciolacustrine material extending progressively further out into the lake. As the supply of sediment continued, the forset beds of the delta progressed out into the lake in a semi-radial fashion while glaciolacustrine sands and silts were being deposited in the lower energy sections of the lake. These glaciolacustrine deposits may also be considered bottom set beds of the forming delta. The deltaic glaciofluvial deposits were observed in test borings DGC - 3, 6 7, 8, 9, 14, 16, 17, 18 and 19 with a maximum thickness of 40 feet at DCG-18 and a minimum thickness of 17 feet at DGC-7. The two major factors controlling the thickness of the deltaic glaciofluvial deposits in the valley were the proximity to the sediment source and the elevation of the top of the till surface. In the area penetrated by the test borings, the top of the glacial till elevation was the dominant control. The delta's surface slopes to the north and east indicating a source to the southwest. The top of the glacial till also slopes to the north, but at a more rapid rate, producing thick localized deltaic glaciofluvial deposits as seen at DGC-8. All four profiles intersect this deposit, illustrating the sloping surface of the deltaic deposit within the site area.

The sediment source responsible for the deltaic deposit eventually decreased or stopped. A new source of material began to arrive from an inlet east of the lake, probably along a pathway similar to the current channel of the East Branch Croton River. The newly arriving sediment, although of a generally finer nature than the underlying deltaic deposits, was similarily deposited, leaving the coarsest materials in the eastern end of the lake near the source, with gradual fining to the west and north. This period of deposition produced a massive deposit of glaciolacustrine sands and silts to an elevation of about 330 feet. Throughout this period, water was also exiting the lake through an outlet most likely aligned with the existing western section of the East Branch Croton River. Due to the currents created by this dynamic situation, the very fine silt and clay particles were not able to settle out in significant quantities. The absence of this fine material has consequently produced an atypical glaciolacustrine deposit, lacking the silt and clay content that exists within classical glaciolacustrine environments. Glaciolacustrine deposits were observed in all test borings except DGC - 6, 12, 14, 15, 19, and 20. Borings DGC - 14 and 19 exhibit deltaic glaciofluvial deposits above the limits of lacustrine deposition, and borings DGC - 15 and 20 similarily show till above the lacustrine depositional limit. Glaciolacustrine deposits probably once present at DGC-12 were subsequently eroded away during an erosional/depositional episode. DGC-6 exhibits a dark gray upwardly fining sequence of sand and silt from about 18 to 10 feet. Organic matter is also evident in these deposits. The character of these sediments suggests an abandoned river channel in-fill deposit. A narrow deposit of glaciolacustrine sand may remain below the in-fill deposit and above the deltaic glaciofluvial deposit. Profile B-B' illustrates this erosional feature at DGC-3, abruptly deviating from the fairly constant top of the glaciolacustrine sediments found at an elevation of 330 feet. The glaciolacustrine sands and silts range in thickness from a minimum of 3 feet at DGC-11 to a maximum of 36 feet at DGC-9. Silt content varies widely throughout the deposit. In general, the higher silt content deposits were found in areas protected from the strong currents of the lake, such as the northern portion of the site (DGC 10) and the eastern side of the delta (DGC-7).

Near the end of this glaciolacustrine depositional period, a major influx of material occurred along a similar route from the east, eroding large amounts of glaciolacustrine sands along its path. This short episode was probably the result of the rapid release of waters previously contained by a stranded ice block upstream of the lake. Replacing the eroded glaciolacustrine deposits was a generally coarse, although poorly sorted, glaciofluvial outwash deposit. This deposit extended along the river valley east of and well into the lake. Test borings DGC-1, 7, 8, 9, 12, 13, and 17 penetrate this outwash deposit and have thickness ranging from a minimum of 2 feet in DGC-17 to a maximum of 32 feet in DGC-12. Profile B-B' intersects about 1000 lateral feet of this outwash deposit. Profiles A-A' and C-C' intersect this deposit across the axis of deposition marking the thalwag of the channel near DGC-13.

A roughly contemporaneous influx of sediment arrived from the northern portion of the valley in the form of a glaciofluvial outwash deposit. The source of this sediment was most likely a result of a release of waters previously trapped by the ice. The lower extent of these deposits are visible in DGC-10 above the 325 foot elevation mark as a relatively silt-free deposit of fine to coarse sand and fine gravel. At DGC-10I pockets of silt were observed at a depth of about 10 to 11 feet (elevation 325 to 326) indicating a reworking of the lower glaciolacustrine fine sands and silts by fluvial processes.

The lake was eventually emptied by the melting of the ice block damming the valley. The resulting river, similar in many respects to the current section of the East Branch Croton River, although much larger, seasonally overflowed its banks flooding widespread topographically low lying areas north and south of the river. This continuing sequence of flooding coupled with a high groundwater table has created a swampy-peaty-alluvial deposit several feet in thickness. These swamp and floodplain deposits were encountered in all test borings except DGC-4, 5, and 20 where existing deposits were above the flood level of the river.

GENERALIZED STRATIGRAPHY AND GEOHYDROLOGY

Table _____

Thickness	Stratigraphic Unit	Description	Geohydrologic
0-12'	Alluvium	Brown to Black Silt & fine Sand to Clay, trace fine Gravel, freq-ueqnt organic odor	Leaky Aquitard
0-32'	Glaciofluvial Outwash	Brown to Gray coarse to fine Sand and medium to fine Gravel	Unconsolidated Aquifer
0-36'	Glaciolacustrine	Brown to Gray medium to fine Sand little Silt, occassional Silt seams	
0-43'	Ice Contact Deposits	Brown medium to fine Sand, little Silt, trace fine Gravel	
0-40'	Glaciofluvial Deltaic	Brown to Gray coarse to fine Sand and Gravel, trace Silt	
0-10'	Ablation Till	Gray Silt, trace medium to fine Sand Sand, little medium to fine Gravel	Leaky Aquitard
0-71'	Lodgement Till	Gray Clayey Silt and medium to fine Sand little coarse to fine Gravel	
?	Bedrock	<u>Gneiss</u> - light Pink to dark Gray hornblende-biotite-plagioclase Plagio-clase gneiss, un-weathered, well-foliated, fractured, <u>Marble</u> - White to light Gray dolomitic marble, unweathered, solution-induced joints	Semi-Confined Bedrock Aquifer

P)	WELL DIAMETER (IN)	WELL DEPTH (FT)	BORING DEPTH (FT)	FORMATION SCREENED	SCREEN DEPTH (FT) TOP	SCREEN DEPTH (FT) BOTTOM	SCREEN ELEVATION (FT) TOP	SCREEN ELEVATION (FT) BOTTOM	NX CORE DEPTH (FT) TOP	NX CORE DEPTH (FT) BOTTOM	NX CORE ELEVATION (FT) TOP	NX CORE ELEVATION (FT) BOTTOM
	2	8.2	9.0	CMF SAND/SILT	3.2	8.2	332.52	327.52	N/A	N/A	N/A	N/A
	2	40.7	67.5	F SAND	35.7	40.7	300.04	295.04	N/A	N/A	N/A	N/A
	4	103.0	103.0	GNEISS	N/A	N/A	N/A	N/A	90.0	103.0	245.87	232.87
	2	8.6	9.0	SILTY CLAY	3.6	8.6	334.16	329.16	N/A	N/A	N/A	N/A
	2	17.8	27.6	CMF SAND	15.3	17.8	321.98	319.48	N/A	N/A	N/A	N/A
	4	39.1	39.1	GNEISS	N/A	N/A	N/A	N/A	29.1	39.1	308.63	298.63
	2	10.3	12.8	CLAYEY SILT	5.3	10.3	331.92	326.92	N/A	N/A	N/A	N/A
	2	23.2	52.5	CMF SAND	20.7	23.2	316.43	313.93	N/A	N/A	N/A	N/A
	N/A	N/A	42.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2	18.7	22.0	CMF SAND	8.7	18.7	331.89	321.89	N/A	N/A	N/A	N/A
	2	72.3	80.8	MF SAND/SILT-TILL	67.3	72.3	272.86	267.86	N/A	N/A	N/A	N/A
	2	8.6	10.0	M SAND/F SAND	3.6	8.6	334.14	329.14	N/A	N/A	N/A	N/A
	2	32.2	42.0	CMF GRAVEL & SAND	29.7	32.2	307.84	305.34	N/A	N/A	N/A	N/A
	2	8.4	9.0	SILT/CM SAND	3.4	8.4	329.99	324.99	N/A	N/A	N/A	N/A
	2	38.5	77.0	SILT	36.0	38.5	297.15	294.65	N/A	N/A	N/A	N/A
	4	112.0	112.0	MARBLE	N/A	N/A	N/A	N/A	104.0	112.0	229.84	221.84
	2	8.3	9.5	CLAY/CMF SAND	3.3	8.3	330.61	325.61	N/A	N/A	N/A	N/A
	2	73.0	82.0	F SAND	63.0	73.0	271.14	261.14	N/A	N/A	N/A	N/A
	2	8.5	9.5	CLAY & SILT/CMF SAND	3.5	8.5	329.26	324.26	N/A	N/A	N/A	N/A
	2	43.4	52.0	MF SAND	33.4	43.4	299.20	289.20	N/A	N/A	N/A	N/A
	2	9.1	10.3	SILTY CLAY/CMF SAND	4.1	9.1	332.03	327.03	N/A	N/A	N/A	N/A
	2	42.1	50.5	F SAND/C SAND	39.6	42.1	296.81	294.31	N/A	N/A	N/A	N/A
	4	66.0	66.0	GNEISS	N/A	N/A	N/A	N/A	58.0	66.0	278.22	270.22
	2	7.8	9.0	MF SAND	2.8	7.8	332.91	324.91	N/A	N/A	N/A	N/A
	2	23.1	30.1	MF SAND--TILL	20.6	23.1	315.11	312.61	N/A	N/A	N/A	N/A
	2	8.7	10.0	CMF SAND	3.7	8.7	332.91	327.91	N/A	N/A	N/A	N/A
	N/A	N/A	46.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2	40.4	52.0	CMF GRAVEL	35.2	40.5	301.24	295.94	N/A	N/A	N/A	N/A
	2	7.7	9.0	CM SAND	2.7	7.7	331.72	326.72	N/A	N/A	N/A	N/A
	2	64.0	67.0	C SAND/SILT-TILL	59.0	64.0	275.37	270.37	N/A	N/A	N/A	N/A
	2	10.6	11.5	F SAND	5.6	10.6	334.72	329.72	N/A	N/A	N/A	N/A
	2	29.2	50.4	CMF SAND	26.7	29.2	313.95	311.45	N/A	N/A	N/A	N/A
	4	80.2	80.2	GNEISS	N/A	N/A	N/A	N/A	71.2	80.2	268.72	259.72
	2	12.0	13.0	MF SAND	4.5	12.0	336.96	329.46	N/A	N/A	N/A	N/A
	2	48.6	54.5	MF GRAVEL--TILL	46.1	48.6	295.35	292.85	N/A	N/A	N/A	N/A
	4	106.2	106.2	MARBLE	N/A	N/A	N/A	N/A	96.2	106.2	245.30	235.30
	2	8.0	10.0	CLAYEY SILT/CLAY	3.0	8.0	335.57	330.57	N/A	N/A	N/A	N/A
	2	36.1	43.0	CM GRAVEL	31.1	36.1	307.56	302.56	N/A	N/A	N/A	N/A
	2	8.4	10.0	CLAY/CLAYEY SILT	3.4	8.4	331.29	326.29	N/A	N/A	N/A	N/A
	2	33.2	50.0	CM GRAVEL	28.2	33.2	306.19	301.19	N/A	N/A	N/A	N/A
	2	8.2	10.0	CLAYEY SILT/SILTYCLAY	3.2	8.2	334.05	329.05	N/A	N/A	N/A	N/A
	2	27.7	62.0	F SAND	17.7	27.7	319.39	309.39	N/A	N/A	N/A	N/A
	2	11.0	12.0	CLAY & SILT	5.3	10.6	332.89	327.19	N/A	N/A	N/A	N/A
	2	22.8	42.0	CMF GRAVEL & SAND	17.8	23.1	320.36	315.06	N/A	N/A	N/A	N/A
	2	11.7	13.5	VF SAND, SOME SILT	1.7	11.7	347.14	337.14	N/A	N/A	N/A	N/A
		1355.5	1787.0		658.1	849.0			448.5	506.5		

AMT SCREEN = 191.1   AMT RISER (2") = 714.1   AMT RISER (4") = 456.6

GROUND ELEVATION (FT)	STICKUP (FT)	CONSTRUCTION MATERIALS/ DIAMETER	BEDROCK DEPTH (FT)	BORING DEPTH (FT)	FORMATION SCREENED	SCREEN DEPTH (FT)		SCREEN ELEVATION (FT)	
						TOP	BOTTOM	TOP	BOTTOM
335.88	7.4	STEEL/6"	49.5	49.5	MF GRAVEL/M SAND	20.0	35.0	315.88	300.88
335.14	4.2	STEEL/6"	51.0	51.0	F SAND/SILT	20.0	50.0	315.14	285.14
333.94	8.6	STEEL/6"							
334.54	9.3	STEEL/6"							
339.29	1.3	STEEL/8-6"							
338.91	2.8	STEEL/8-6"		2.4					
337.66	2.1	STEEL/8-6"	48.0	440.0					
334.49									
334.89	1.3			27.4					
334.99									
335.29	1.9			23.7					
335.44				28.1					
335.33	1.9			20.4					
335.49	1.2			31.0					
335.34	-0.3			20.1					
335.53	1.4			29.2					
		STEEL/4"	49.0	49.0	F SND/MC SND & FM GRVL	45.0	49.0		
335.22	1.3	STEEL/6"	63.7	63.7	C SAND	53.0	63.0	283.52	273.52
335.83	2.1	STEEL/6"	50.0	50.0		N/A	N/A		
	1.5	STEEL/6"	49.5	49.5	C SAND & F GRAVEL	44.5	49.5		
374.50	1.2	STEEL/6"	74.0	74.0	CM SAND & F GRAVEL	51.0	71.0	325.20	305.20
371.07	2.0	STEEL/8-6"	120.0	400.0					
		STEEL/8-6"	43.0	355.0					
		STEEL/8-6"	17.0	440.0					
332.55	1.4	PVC/2"		20.7					
332.06	1.4	PVC/2"		14.0					
332.48	0.2	PVC/2"		23.7	F SAND-SAND	20.0	25.0	312.68	307.68
334.89	1.7	PVC/2"		22.9	C SAND-C SAND/GRAVEL	11.0	21.0	323.89	313.89
336.66	1.6	PVC/2"		28.5	C SAND-F GRAVEL	23.0	30.0	313.66	306.66
333.78	0.7	PVC/2"		28.2	SAND-F GRAVEL-ORG	5.0	8.0	328.78	325.78
333.39	0.2	PVC/2"		25.4	SAND-GRAVEL	27.0	30.0	306.39	303.39
333.42	2.1	PVC/2"		9.4	SAND-GRAVEL	5.0	8.0	328.39	325.39
337.05	0.5	PVC/2"		34.5	SAND-GRAVEL	20.0	35.0	317.05	302.62
337.94	0.5	PVC/2"		34.8	SAND-GRAVEL				
338.25	1.1	PVC/2"		23.2	SAND-GRAVEL				
340.90		PVC/2"		40.0					
		STEEL/4"	56.0	56.0	SILT/CMF GRVL/CMF SAND	16.0	51.0		
336.34	0.9	STEEL/6"	51.0	51.0	SILT & MF SAND/MF GRVL	5.0	50.0	331.34	286.34
334.74	1.8	STEEL/2"		24.0		20.0	24.0	314.74	310.74
335.48	1.5	STEEL/2"		24.0		20.0	24.0	315.48	311.48
335.24	2.0	STEEL/1.25"		25.5		23.0	25.5	312.24	309.74
334.74	1.2	STEEL/1.25"		21.5		19.0	21.5	315.74	313.24
334.84	1.3	STEEL/1.25"		21.5		19.0	21.5	315.84	313.34
335.64	1.1	STEEL/1.25"		21.5		19.0	21.5	316.64	314.14
334.58	2.8	STEEL/2.5"	40.0	43.7		44.9	49.9	289.68	284.68
333.94	1.6	STEEL/2.5"		36.9					
334.53	4.0	STEEL/2.5"		18.8					
334.04	0.6	STEEL/2.5"		41.3					
334.58	1.7	STEEL/2.5"		32.2					
333.88	3.0	STEEL/2.5"		37.2					
334.08	0.6	STEEL/2.5"		35.7					
			62.0	327.0					
			100.0	195.0					
			25.0	117.0					
				350.0					
				350.0					
				13.1					

							330.79
					330.30	332.23	330.68
			330.13		330.36	330.29	330.67
DGC-14S		331.46	331.83	331.74	331.71		332.61
DGC-14I		330.65	330.91	331.16	331.12		331.63
DGC-14D				336.25	336.43		337.15
DGC-15S		335.40	335.21	335.44	335.20		336.46
DGC-15I		336.07	336.52	336.15	336.00		336.98
DGC-15D				341.42	341.46		342.12
DGC-16S				331.15	331.07		331.86
DGC-16I				330.61	330.62		330.86
DGC-17S				330.66	330.52		331.03
DGC-17I				330.57	330.54		330.86
DGC-18S				331.45	331.22		332.35
DGC-18I				331.00	330.85		331.27
DGC-19S				330.86	330.79		331.16
DGC-19I				330.92	330.78		331.12
DGC-20I							
DW-1	332.81		221.57		344.60		332.43
DW-2	330.71						
DW-3	330.74		322.69		-		334.20
B-2	333.27		333.37		334.92		335.48
B-3	-		336.51		-		
B-4	334.08		-		335.58		335.71
B-7	348.65				350.67		351.02
TH-2	327.53		328.19		329.37		330.17
TH-3	328.24		329.02		330.28		331.19
TH-5	328.93						
TH-6	327.65		328.65		329.20		329.79
TH-7	328.76		329.99		330.25		330.55
TH-9	329.18				329.99		330.35
TH-11A	329.19				329.45		329.93
TH-11B	327.67				329.82		330.28
TH-12	329.96		330.36		330.58		330.88
TH-13	330.33		DRY		331.07		331.59
TH-14	330.28		DRY		DRY		331.93
TW-1	324.00				327.10		327.82
TW-2	318.82						321.49
TW-3	324.11				328.15		328.76
TW-4	328.09						329.17
TW-5	326.23				328.01		328.62
TW-6	317.63				321.18		321.87
TW-7	325.78						326.88
OW-2	327.98						329.69
OW-3	326.77				328.84		329.24
OW-4	328.49				329.79		330.27
OW-5	327.89				329.98		330.47
OW-6	329.03						330.56
OW-7	329.38				329.79		330.53
OW-8	329.05						330.62
SW-1	333.35						
SW-2	333.29						
SW-3	330.67						
SW-4	330.55					330.40	330.47
SW-5	330.50					330.32	330.37
WELL-2	324.46						330.35
WELL-4	323.57						325.70
WELL-5	327.36						
WELL-6	323.97						
WELL-7	324.30						327.30
WELL-8	325.56						324.53
WELL-9	325.21						
TPW-2							332.47
TPW-6							332.38
TPW-9							DRY
TPW-12							333.01

BREWSTER WELL FIELD
2006-1-4172
WELL INFORMATION

WELL NO.	DATE COMPLETED MN-DY-YR	INSPECTOR	DRILLING COMPANY	DRILLER	GROUND ELEVATION (FT)	STICKUP (FT)	WELL DIAMETER (IN)	WELL DEPTH (FT)	BORING DEPTH (FT)	FORMATION SCREENED	SCREEN DEPTH (FT) TOP	SCREEN DEPTH (FT) BOTTOM	SCREEN ELEVATION (FT) TOP	SCREEN ELEVATION (FT) BOTTOM	NX CORE DEPTH (FT) TOP	NX CORE DEPTH (FT) BOTTOM	NX CORE ELEVATION (FT) TOP	NX CORE ELEVATION (FT) BOTTOM
DGC-1S	9-20-85	KFB	KENDRICK	KENDRICK	335.72	1.8	2	8.2	9.0	CMF SAND/SILT	3.2	8.2	332.52	327.52	N/A	N/A	N/A	N/A
DGC-1I	8-29-85	KFB/DAW	GDT	STONE/RAP	335.74	1.8	2	40.7	67.5	F SAND	35.7	40.7	300.04	295.04	N/A	N/A	N/A	N/A
DGC-1D	9-18-85/10-10-85	DAW	BOYD/GDT	HEAD/RAP	335.87	1.7	4	103.0	103.0	GNEISS	N/A	N/A	N/A	N/A	90.0	103.0	245.87	232.87
DGC-2S	8-1-85	BTG	GDT	STONE	337.76	1.4	2	8.6	9.0	SILTY CLAY	3.6	8.6	334.16	329.16	N/A	N/A	N/A	N/A
DGC-2I	8-1-85	BTG	GDT	STONE	337.28	2.2	2	17.8	27.6	CMF SAND	15.3	17.8	321.98	319.48	N/A	N/A	N/A	N/A
DGC-2D	9-17-85/9-24-85	DAW/SANDS	BOYD/D-E	HEAD/RICE	337.73	1.5	4	39.1	39.1	GNEISS	N/A	N/A	N/A	N/A	29.1	39.1	308.63	298.63
DGC-3S	8-27-85	RS	BOYD	BENNETT	337.22	-0.3	2	10.3	12.8	CLAYEY SILT	5.3	10.3	331.92	326.92	N/A	N/A	N/A	N/A
DGC-3I	8-12-85	BTG	GDT	STONE	337.13	-0.7	2	23.2	52.5	CMF SAND	20.7	23.2	316.43	313.93	N/A	N/A	N/A	N/A
DGC-4	9-17-85	DAW	GDT	RAPPOLD	358.90	N/A	N/A	N/A	42.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DGC-5S	8-27-85	RS	BOYD	BENNETT	340.59	1.3	2	18.7	22.0	CMF SAND	8.7	18.7	331.89	321.89	N/A	N/A	N/A	N/A
DGC-5I	8-26-85	KFB	GDT	STONE	340.16	2.7	2	72.3	80.8	MF SAND/SILT-TILL	67.3	72.3	272.86	267.86	N/A	N/A	N/A	N/A
DGC-6S	9-19-85	SANDS	KENDRICK	KENDRICK	337.74	1.4	2	8.6	10.0	M SAND/F SAND	3.6	8.6	334.14	329.14	N/A	N/A	N/A	N/A
DGC-6I	8-21-85	KFB	GDT	STONE	337.54	2.8	2	32.2	42.0	CMF GRAVEL & SAND	29.7	32.2	307.84	305.34	N/A	N/A	N/A	N/A
DGC-7S	9-19-85	KFB	KENDRICK	KENDRICK	333.39	1.6	2	8.4	9.0	SILT/CM SAND	3.4	8.4	329.99	324.99	N/A	N/A	N/A	N/A
DGC-7I	9-17-85	KFB	GDT	STONE	333.15	1.5	2	38.5	77.0	SILT	36.0	38.5	297.15	294.65	N/A	N/A	N/A	N/A
DGC-7D	10-3-85/10-14-85	MARTIN/DAW	BOYD/GDT	WILLIAMS/RAP	333.84	1.0	4	112.0	112.0	MARBLE	N/A	N/A	N/A	N/A	104.0	112.0	229.84	221.84
DGC-8S	9-25-85	SANDS	D-E	RICE	333.91	1.7	2	8.3	9.5	CLAY/CMF SAND	3.3	8.3	330.61	325.61	N/A	N/A	N/A	N/A
DGC-8I	9-23-85	DAW	GDT	RAPPOLD	334.14	2.0	2	73.0	82.0	F SAND	63.0	73.0	271.14	261.14	N/A	N/A	N/A	N/A
DGC-9S	9-25-85	SANDS	D-E	RICE	332.76	1.5	2	8.5	9.5	CLAY & SILT/CMF SAND	3.5	8.5	329.26	324.26	N/A	N/A	N/A	N/A
DGC-9I	9-26-85	DAW	GDT	RAPPOLD	332.60	1.6	2	43.4	52.0	MF SAND	33.4	43.4	299.20	289.20	N/A	N/A	N/A	N/A
DGC-10S	9-25-85	SANDS	D-E	RICE	336.13	0.9	2	9.1	10.3	SILTY CLAY/CMF SAND	4.1	9.1	332.03	327.03	N/A	N/A	N/A	N/A
DGC-10I	8-29-85	KFB	GDT	STONE	336.41	2.9	2	42.1	50.5	F SAND/C SAND	39.6	42.1	296.81	294.31	N/A	N/A	N/A	N/A
DGC-10D	10-1-85/10-15-85	DAW	BOYD/GDT	WILLIAMS/RAP	336.22	1.5	4	66.0	66.0	GNEISS	N/A	N/A	N/A	N/A	58.0	66.0	278.22	270.22
DGC-11S	9-16-85	SANDS	GDT	RAPPOLD	335.71	2.2	2	7.8	9.0	MF SAND	2.8	7.8	332.91	324.91	N/A	N/A	N/A	N/A
DGC-11I	9-4-85	KFB	GDT	STONE	335.71	1.9	2	23.1	30.1	MF SAND--TILL	20.6	23.1	315.11	312.61	N/A	N/A	N/A	N/A
DGC-12S	9-20-85	KFB	KENDRICK	KENDRICK	336.61	1.3	2	8.7	10.0	CMF SAND	3.7	8.7	332.91	327.91	N/A	N/A	N/A	N/A
DGC-12I	10-11-85	DAW	GDT	RAPPOLD	N/A	N/A	N/A	N/A	46.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DGC-12IA	10-21-85	DAW	GDT	RAPPOLD	336.44	2.3	2	40.4	52.0	CMF GRAVEL	35.2	40.5	301.24	295.94	N/A	N/A	N/A	N/A
DGC-13S	9-19-85	KFB	KENDRICK	KENDRICK	334.42	2.3	2	7.7	9.0	CM SAND	2.7	7.7	331.72	326.72	N/A	N/A	N/A	N/A
DGC-13I	9-10-85	KFB	GDT	STONE	334.37	1.0	2	64.0	67.0	C SAND/SILT-TILL	59.0	64.0	275.37	270.37	N/A	N/A	N/A	N/A
DGC-14S	8-6-85	BTG	GDT	STONE	340.32	1.9	2	10.6	11.5	F SAND	5.6	10.6	334.72	329.72	N/A	N/A	N/A	N/A
DGC-14I	8-6-85	BTG	GDT	STONE	340.65	0.8	2	29.2	50.4	CMF SAND	26.7	29.2	313.95	311.45	N/A	N/A	N/A	N/A
DGC-14D	9-11-85/9-24-85	DAW	BOYD/GDT	HEAD/RAP	339.92	1.3	4	80.2	80.2	GNEISS	N/A	N/A	N/A	N/A	71.2	80.2	268.72	259.72
DGC-15S	8-27-85	RS	BOYD	BENNETT	341.46	3.0	2	12.0	13.0	MF SAND	4.5	12.0	336.96	329.46	N/A	N/A	N/A	N/A
DGC-15I	8-19-85	KP	GDT	STONE	341.45	1.4	2	48.6	54.5	MF GRAVEL--TILL	46.1	48.6	295.35	292.85	N/A	N/A	N/A	N/A
DGC-15D	9-13-85/9-24-85	DAW/SANDS	BOYD/D-E	HEAD/RICE	341.50	1.3	4	106.2	106.2	MARBLE	N/A	N/A	N/A	N/A	96.2	106.2	245.30	235.30
DGC-16S	9-25-85	SANDS	D-E	RICE	338.57	2.0	2	8.0	10.0	CLAYEY SILT/CLAY	3.0	8.0	335.57	330.57	N/A	N/A	N/A	N/A
DGC-16I	10-7-85	DAW	GDT	RAPPOLD	338.66	1.4	2	36.1	43.0	CM GRAVEL	31.1	36.1	307.56	302.56	N/A	N/A	N/A	N/A
DGC-17S	9-26-85	SANDS	D-E	RICE	334.69	1.6	2	8.4	10.0	CLAY/CLAYEY SILT	3.4	8.4	331.29	326.29	N/A	N/A	N/A	N/A
DGC-17I	10-3-85	DAW	GDT	RAPPOLD	334.39	1.8	2	33.2	50.0	CM GRAVEL	28.2	33.2	306.19	301.19	N/A	N/A	N/A	N/A
DGC-18S	9-26-85	SANDS	D-E	RICE	337.25	1.8	2	8.2	10.0	CLAYEY SILT/SILTYCLAY	3.2	8.2	334.05	329.05	N/A	N/A	N/A	N/A
DGC-18I	10-1-85	DAW	GDT	RAPPOLD	337.09	2.3	2	27.7	62.0	F SAND	17.7	27.7	319.39	309.39	N/A	N/A	N/A	N/A
DGC-19S	10-17-85	DAW	GDT	RAPPOLD	338.19	-0.3	2	11.0	12.0	CLAY & SILT	5.3	10.6	332.89	327.19	N/A	N/A	N/A	N/A
DGC-19I	10-17-85	DAW	GDT	RAPPOLD	338.16	-0.3	2	22.8	42.0	CMF GRAVEL & SAND	17.8	23.1	320.36	315.06	N/A	N/A	N/A	N/A
DGC-20I	10-22-85	DAW	GDT	RAPPOLD	348.84	-0.3	2	11.7	13.5	VF SAND, SOME SILT	1.7	11.7	347.14	337.14	N/A	N/A	N/A	N/A
						64.5		1355.5	1787.0		658.1	849.0			448.5	506.5		

AMT SCREEN = 191.1 AMT RISER (2") = 714.1 AMT RISER (4") = 456.6

Note: Accessory minerals will be identified, and the text changed accordingly.

BREWSTER WELL FIELD
2006-1-4172
OLD WELL INFORMATION

WELL NO./ DESIGNATION	INSTALLER (YEAR)	GROUND ELEVATION (FT)	STICKUP (FT)	CONSTRUCTION MATERIALS/ DIAMETER	BEDROCK DEPTH (FT)	BORING DEPTH (FT)	FORMATION SCREENED	SCREEN DEPTH (FT)		SCREEN ELEVATION (FT)	
								TOP	BOTTOM	TOP	BOTTOM
SG-1	G&M (1980)	335.88	7.4	STEEL/6"	49.5	49.5	MF GRAVEL/M SAND	20.0	35.0	315.88	300.89
SG-2	G&M (1980)	335.14	4.2	STEEL/6"	51.0	51.0	F SAND/SILT	20.0	50.0	315.14	285.14
SG-3	G&M (1980)	333.94	8.6	STEEL/6"							
SG-4	G&M (1980)	334.54	9.3	STEEL/6"							
DW-1	G&M (1980)	339.29	1.3	STEEL/8-6"							
DW-2	G&M (1980)	328.51	2.8	STEEL/8-6"		7.4					
DW-3	G&M (1980)	337.66	2.1	STEEL/8-6"	48.0	440.0					
WELL-1	(1954)	334.49									
WELL-2		334.89	1.3			27.4					
WELL-3		334.99									
WELL-4		335.29	1.9			33.7					
WELL-5		335.44				28.1					
WELL-6		335.33	1.9			20.4					
WELL-7		335.49	1.2			31.0					
WELL-8		335.34	-0.3			20.1					
WELL-9		335.53	1.4			29.2					
WELL-10	(1967)										
WELL-11											
WELL-12											
WELL-13											
WELL-14											
WELL-15											
WELL-16											
WELL-17											
WELL-18											
B-1	G&M (1980)			STEEL/4"	49.0	49.0	F SND/MC SND & FM GRVL	45.0	49.0		
B-2	G&M (1980)	335.22	1.3	STEEL/6"	63.7	63.7	C SAND	53.0	63.0	283.52	273.52
B-3	G&M (1980)	335.83	2.1	STEEL/6"	50.0	50.0		N/A	N/A		
B-4	G&M (1980)		1.5	STEEL/6"	49.5	49.5	C SAND & F GRAVEL	44.5	49.5		
B-7	G&M (1980)	374.50	1.2	STEEL/6"	74.0	74.0	CM SAND & F GRAVEL	51.0	71.0	325.20	305.20
BW-1	G&M (1980)	371.07	2.0	STEEL/8-6"	120.0	400.0					
BW-2	G&M (1980)			STEEL/8-6"	43.0	355.0					
BW-3	G&M (1980)			STEEL/8-6"	17.0	440.0					
TH-2	NYS/DOT(1979)	332.55	1.4	PVC/2"		20.7					
TH-3	NYS/DOT(1979)	332.06	1.4	PVC/2"		14.0					
TH-5	NYS/DOT(1979)	332.48	0.2	PVC/2"		25.7	F SAND-SAND	20.0	25.0	312.68	307.68
TH-6	NYS/DOT(1979)	334.89	1.7	PVC/2"		22.9	C SAND-C SAND/GRAVEL	11.0	21.0	323.89	313.89
TH-7	NYS/DOT(1979)	336.66	1.6	PVC/2"		28.5	C SAND-F GRAVEL	33.0	30.0	313.66	306.66
TH-9	NYS/DOT(1979)	333.78	0.7	PVC/2"		28.2	SAND-F GRAVEL-ORG	5.0	8.0	328.78	325.78
TH-11A	NYS/DOT(1979)	333.39	0.2	PVC/2"		25.4	SAND-GRAVEL	27.0	30.0	306.39	303.39
TH-11B	NYS/DOT(1979)	333.42	2.1	PVC/2"		9.4	SAND-GRAVEL	5.0	8.0	328.39	325.39
TH-12	NYS/DOT(1979)	337.05	0.5	PVC/2"		34.5	SAND-GRAVEL	20.0	35.0	317.05	302.62
TH-13	NYS/DOT(1979)	337.94	0.5	PVC/2"		34.4	SAND-GRAVEL				
TH-14	NYS/DOT(1979)	338.25	1.1	PVC/2"		23.2	SAND-GRAVEL				
TH-15	NYS/DOT(1979)	340.90		PVC/2"		40.0					
OW-1	G&M (1980)			STEEL/4"	56.0	56.0	SILT/CMF GRVL/CMF SAND	16.0	51.0		
OW-2	G&M (1980)	336.34	0.9	STEEL/6"	51.0	51.0	SILT & MF SAND/MF GRVL	5.0	50.0	331.34	286.34
OW-3	G&M (1980)	334.74	1.8	STEEL/2"		24.0		20.0	24.0	314.74	310.74
OW-4	G&M (1980)	335.48	1.5	STEEL/2"		24.0		20.0	24.0	315.48	311.48
OW-5	G&M (1980)	335.24	2.0	STEEL/1.25"		25.5		23.0	25.5	312.24	309.74
OW-6	G&M (1980)	334.74	1.2	STEEL/1.25"		21.5		19.0	21.5	315.74	313.24
OW-7	G&M (1980)	334.84	1.1	STEEL/1.25"		21.5		19.0	21.5	315.84	313.34
OW-8	G&M (1980)	335.64	1.1	STEEL/1.25"		21.5		19.0	21.5	316.64	314.14
TW-1	(1983)	334.58	2.8	STEEL/2.5"	40.0	43.7		44.9	49.9	289.68	284.68
TW-2	(1983)	333.94	1.6	STEEL/2.5"		36.9					
TW-3	(1983)	334.53	4.0	STEEL/2.5"		18.8					
TW-4	(1983)	334.04	0.6	STEEL/2.5"		41.1					
TW-5	(1983)	334.58	1.7	STEEL/2.5"		32.3					
TW-6	(1983)	333.88	3.0	STEEL/2.5"		37.2					
TW-7	(1983)	334.08	0.6	STEEL/2.5"		35.7					
SW-1											
SW-2											
SW-3											
SW-4											
SW-5											
BRADY STANNARD					62.0	327.0					
SMALLEY					100.0	195.0					
L.KING					25.0	117.0					
V. OF BREWSTER						350.0					
V. OF BREWSTER						350.0					
DUG WELL						13.1					

BREWSTER WELL FIELD
2006-1-4172
WATER TABLE ELEVATIONS

WELL NUMBER	WATER TABLE ELEVATIONS 5-16-85	9-3-85	9-24-85	10-18-85	10-21-85	11-1-85	11-19-85
DGC-1S			329.95		330.04		330.94
DGC-1I					330.00		330.47
DGC-1D					330.15		330.86
DGC-2S		330.27	330.14		330.44		330.87
DGC-2I		333.07	329.68		330.11		330.54
DGC-2D			330.67		331.84		332.60
DGC-3S		331.77	332.58	331.02	330.96		331.41
DGC-3I		330.23		331.05	330.83		331.20
DGC-5S		329.24	329.32		330.30		330.60
DGC-5I		327.99	328.86		328.70		329.40
DGC-6S			331.67	332.01	331.76		334.07
DGC-6I		330.64	330.34	330.64	330.62		330.92
DGC-7S			329.63	330.40	330.41		330.86
DGC-7I			330.24	330.36	330.43		330.79
DGC-7D				335.14	335.04		334.62
DGC-8S				330.49	330.45	330.40	330.68
DGC-8I				330.43	330.45	332.16	330.75
DGC-9S				330.31	330.32	330.27	330.62
DGC-9I				330.08	330.11	330.03	330.43
DGC-10S					332.21		332.92
DGC-10I		330.92	329.58		331.69		332.59
DGC-10D					331.99		333.29
DGC-11S			328.71		329.81		331.69
DGC-11I			326.81		330.40		332.12
DGC-12S			330.79		330.97		331.66
DGC-12IA					-		330.79
DGC-13S			327.23		330.30	332.23	330.68
DGC-13I			330.13		330.36	330.29	330.67
DGC-14S		331.46	331.83	331.74	331.71		332.61
DGC-14I		330.65	330.91	331.16	331.12		331.63
DGC-14D				336.25	336.43		337.15
DGC-15S		335.40	335.21	335.44	335.20		336.46
DGC-15I		336.07	336.52	336.15	336.00		336.98
DGC-15D				341.42	341.46		342.12
DGC-16S				331.15	331.07		331.86
DGC-16I				330.61	330.62		330.86
DGC-17S				330.66	330.52		331.03
DGC-17I				330.57	330.54		330.86
DGC-18S				331.45	331.22		332.35
DGC-18I				331.00	330.85		331.27
DGC-19S				330.86	330.79		331.16
DGC-19I				330.92	330.78		331.12
DGC-20I							
DW-1	332.81		221.57		344.60		332.43
DW-2	330.71						
DW-3	330.74		322.69		-		334.20
B-2	333.27		333.37		334.92		335.48
B-3	-		336.51		-		
B-4	334.08		-		335.58		335.71
B-7	348.65				350.67		351.02
TH-2	327.53		328.19		329.37		330.17
TH-3	328.24		329.02		330.28		331.19
TH-5	328.93						
TH-6	327.65		328.65		329.20		329.79
TH-7	328.76		329.99		330.25		330.55
TH-9	329.18				329.99		330.35
TH-11A	329.19				329.45		329.93
TH-11B	327.67				329.82		330.28
TH-12	329.96		330.36		330.58		330.88
TH-13	330.33		DRY		331.07		331.59
TH-14	330.28		DRY		DRY		331.93
TW-1	324.00				327.10		327.82
TW-2	318.82						321.49
TW-3	324.11				328.15		328.76
TW-4	328.09						329.17
TW-5	326.23				328.01		328.62
TW-6	317.63				321.18		321.87
TW-7	325.78						326.88
OW-2	327.98						329.69
OW-3	326.77				328.84		329.24
OW-4	328.49				329.79		330.27
OW-5	327.89				329.98		330.47
OW-6	329.03						330.56
OW-7	329.38				329.79		330.53
OW-8	329.05						330.62
SW-1	333.35						
SW-2	333.29						
SW-3	330.67					330.40	330.47
SW-4	330.55					330.32	330.37
SW-5	330.50						330.35
WELL-2	324.46						325.70
WELL-4	323.57						
WELL-5	327.36						
WELL-6	323.97						327.30
WELL-7	324.30						324.53
WELL-8	325.56						
WELL-9	325.21						
TPW-2							332.47
TPW-6							332.38
TPW-9							DRY
TPW-12							333.01

GHR ENGINEERING ASSOCIATES, INC.
75 Tarkiln Hill Road
NEW BEDFORD, MASSACHUSETTS 02745

(617) 995-5136

LETTER OF TRANSMITTAL

DATE: 2-5-86
JOB NO.: 7019-112
ATTENTION: BILL HALL
RE: BREWSTER RI REPORT

TO: DUNN GEOSCIENCE CORP.
5 NORTHWAY LANE N.
LATHAM, NY 12110

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via ______ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☒ ROUGH DRAFT

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1			BREWSTER RI REPORT

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REMARKS: THIS A COPY OF THE RI REPORT IN ITS CURRENT STATE. WE ARE PROCEEDING WITH WORK ON MISSING SECTIONS AS NOTED AND EXCEPT TO HAVE THEM IN DRAFT BY 2-14-86.

IF YOU HAVE ANY MORE SECTIONS COMPLETED, AS NOTED IN YOUR LETTER OF 1/15/86, I WOULD APPRECIATE YOUR SENDING THEM ON TO ME SO THEY CAN BE ENTERED INTO OUR SYSTEM.

COPY TO ______

SIGNED: Virginia Trewarg