PB99-107633

REPORT NO. 1
FINAL REPORT
CONTRACT NO 3Z6248
(REPORT NO. 250, MRCE SERIES)
BRANCH AVENUE STORAGE YARD
SECTION F011, BRANCH ROUTE
SUBSURFACE INVESTIGATION

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August 20, 1997

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Results are summarized herein of 37 supplementary borings to investigate subsurface conditions in the Branch Avenue storage yard. The report contains geological sections which summarize information from the borings, logs of borings, results of laboratory tests on samples recovered and a text describing design and contraction problems.

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Re: Branch Avenue Storage Yard
Section F-011, Branch Route
Final Report
MRCE File No. 8737

Dear Mr. Szczur:

In accordance with our contract, we submit herewith 13 copies of this final report for the subsurface investigation for the Branch Avenue Yard in Section F011 of Branch Route. Single copies of the report are being sent at the same time to the Section Designer and WMATA F-Route management. Following the established schedules, a draft of preliminary report was submitted on July 16, 1997. Comments received from WMATA and Section Designer on the preliminary report have been incorporated in this final report. We believe that this completes the planned investigation in Section F011.

Very truly yours,

MUESER RUTLEDGE CONSULTING ENGINEERS

By: Hugh S. Lacy

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TABLE OF CONTENTS

1.0 INTRODUCTION **Page**

1.1 Authorization....1

1.2 Scope of Work....2

1.3 General Features of the Project....3

2.0 TEST BORINGS AND LABORATORY PROGRAM....

2.1 Presentation of Boring Data....3

2.2 Laboratory Testing Program....4

2.3 Field Permeability Tests....4

2.4 Ground Water Condition....5

2.5 Potential Corrosion Characteristics....5

3.0 SUBSURFACE CONDITIONS....

3.1 General Geology....5

3.2 Strata Descriptions....5

3.2.1. Stratum F....5

3.2.2. Stratum Q2....6

3.2.3. Stratum Cc....6

3.2.4. Stratum Cs....6

3.2.5. Stratum Ec....6

3.2.6. Stratum Es....7

3.2.7. Stratum Mc....7

3.2.8. Stratum Ms....8

4.0 SUMMARY OF DESIGN AND CONSTRUCTION PROBLEMS....

4.1 Yard Earthwork Operations....8

4.2 Structure Foundations....9

4.2.1. Retaining Wall No. 1....9

4.2.2. Retaining Wall No. 2....9

4.3 Maintenance Building, Equipment Chemical Storage Building & Fueling Facility....10

4.4 Operations Building....11

4.5 CMT Shop Facility & Traction Power Substation....11

4.6 Car-Wash Building....12

EXHIBITS

EXHIBIT NO.	DESCRIPTION
Table No. 1	Survey Data for Borings
Table No. 2	Summary of Laboratory Data
Table No. 3	Summary of Permeability Tests
Table No. 4	Representative Permeability Values
Table No. 5	Results of Grain Size Tests Based on USDA System
Table No. 6	Soil Properties for Design

Plate No. 1	Plasticity Chart
Plate No. 2 through Plate No. 7	Gradation Curves
Plate No. 8 through Plate No. 18	Summary of Strength Tests
Drawing No. SK-1	General Location Plan
Drawing No. SK-2	Topographic Survey of Site - 1951
Drawing No. SK-3	Topographic Survey of Site - 1956
Drawing No. SK-4	Topographic Survey of Site - 1979
Drawing No. F-1	Subsurface Investigation General Information Drawing
Drawing No. F-F-457	Boring Location Plan
Drawing No. F-F-458	Geologic Section A-A
Drawing No. F-F-459	Geologic Sections B-B & C-C
Drawing No. F-F-460	Geologic Sections D-D & E-E
Drawing No. F-F-461	Geologic Sections F-F & G-G
Drawing No. F-F-462	Geologic Section H-H
Drawing No. F-F-463	Geologic Section J-J
Drawing No. F-F-464	Geologic Sections K-K, L-L & M-M
Appendix A	Laboratory Test Results from Earlier WMATA Investigations on Soils of Calvert, Aquia and Monmouth Formations
Appendix B	Corrosion and Chemical Tests for this Investigation

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SUBSURFACE INVESTIGATION

1. 0 INTRODUCTION

1.1 Authorization

Contract No. 3Z6248 between De Leuw, Cather and Company (DCCO) and Mueser Rutledge Consulting Engineers (MRCE) provides for subsurface investigations, laboratory testing and summary reports relating to certain sections of the Rapid Transit System. One portion of that contract covers the making of 37 borings at various locations within the planned Branch Avenue Storage Yard in Section F011 of Branch Route.

At WMATA's request, we prepared a Specification on September 1995, for the making of 31 borings for the storage yard. On February 14, 1997 the Section Designer, Rummel, Klepper & Kahl (RK&K) reviewed the boring program and increased the scope to 37 borings, comprising Borings, Nos. YB-1 through YB-37. Borings Nos. YB-13, YB-33, YB-35 and YB-36 were deleted from the program following WMATA's review of the scope of work. Boring No. YB-2A was added for the installation of an observation well. Boring No. YB-16A was added after Boring No. YB-16 was abandoned due to an obstruction. Washed Borings Nos. YB-23A and YB-31A were added to perform falling-head permeability tests at the locations of the planned ponds. Exploratory work started on April 4, 1997 after WMATA authorization to proceed. The field work was completed on June 10, 1997.

The following MRCE reports contain exploratory data obtained previously in Section F004 to F010, or information relevant to this section:

1. Final Report, Subsurface Investigation, Branch Route, Stations 106+60 (F003) to 454+00 (F008), dated February 1973. (MRWJ Series Report No. 78).

2. Final Report, Subsurface Investigation, Branch Route, "B" Corridor Alignment, Sections 178+28 to 484+00 (F004 to F008), dated November 15, 1975 (MRWJ Series Report No. 142).

3. Subsurface Investigation, Branch Route, Sections F006 to F008, dated June 22, 1981 (MRJD Series Report No. 166).

4. Supplementary Subsurface Investigation, Section F006 through F010, Branch Route, dated March 7, 1994 (MRCE Series Report No. 241).

5. Supplementary Subsurface Investigation, Final Report, Section F008, Branch Route, dated November 11, 1994 (MRCE Series Report No. 243).

6. Supplementary Subsurface Investigation, Final Report, Section F006, Branch Route, dated February 2, 1995 (MRCE Series Report No. 242).

7. Supplementary Subsurface Investigation, Final Report, Section F009, Branch Route, dated February 9, 1995, (MRCE Series Report No. 244).

8. Supplementary Subsurface Investigation, Final Report Section F007, Branch Route, dated February 1995 (MRCE Series Report No 245).

9. Supplementary Subsurface Investigation, Final Report, Section F010, Branch Route, dated March 31, 1995 (MRCE Series Report No. 246).

10. Supplementary Subsurface Investigation, Final Report, Section F010, Branch Route, dated April 26, 1996 (MRCE Series Report No. 247).

1.2 Scope of Work

The completed work comprised a group of 37 borings designated as YB-1, YB-2U, YB-2A, YB-3 through YB-12, YB-14 through YB-16, YB-16A through YB-23U, YB-23A, YB-24U through YB-31U, YB-31A, YB-32U, YB-34 and YB-37. All borings were made by National Foundation Engineering, Inc., (NFE) under subcontract to Earth Engineering and Sciences, Inc., (EESI). The borings were inspected by NFE. An MRCE representative was present on a part-time basis at the site during the course of the boring operations to insure that the work was performed in accordance with Metro standards. The boreholes were made by conventional soil boring methods utilizing a tri-cone roller but with the aid of drilling mud or water to advance the hole. Observation wells were installed in 16 of the borings for continuing measurement of groundwater levels. All boreholes except those containing piezometers were grouted at completion.

All soil samples were transported to our New York City laboratory for examination, checked of field classifications and performance of identification testing and engineering properties tests. Soil samples remaining after the laboratory testing was completed were returned to Washington, DC to be stored at the designated storage facility.

Chemical analysis tests on soil and water samples recovered from selected borings were performed by Gascoyne Laboratories, Inc., (GLI) under subcontract to NFE. The results of these

tests are included in the Appendix to this report.

1.3 General Features of the Project

As shown on the Boring Location Plan, Drawing No. F-F-457, the storage yard is located in the parcel of land directly north of the limit of Section F010, bordered on the east by a tributary of Henson Creek and on the west by the Capital Gateway Drive, in Prince George's County, Maryland. General location plan on Drawing No. SK-1 shows in synoptic form the location of the Yard. Facilities starting from the junction with F010 subway line consist of a car wash building, salt dome, CMNT shop facility, traction power substation, operations building, fueling facility building, chemical equipment storage building and maintenance building. A retaining wall borders the Yard trackage along the north and east of the yard. Three storm water management ponds will be located within the yard complex. The two lead tracks feed a gang of tracks located in the north half of the yard starting from approximate Elev. 243 at the south sloping downwards to about Elev. 236 at the north end of the yard. The northeastern section of the yard will be in a substantial new controlled fill of up to about 40 feet in thickness.

2.0 TEST BORINGS AND LABORATORY PROGRAM

2.1 Presentation of Boring Data

Locations of all 37 borings are shown on Drawing No. F-F-457. Locations of the geological sections as well as the principal yard features are also shown on this drawing. Information from the 37 borings of YB series are plotted in a series of Geological Sections, A-A through M-M, presented on Drawings Nos. F-F-458 through F-F-464. All sections are drawn at a scale distortion of one to four with the exception of Geological Section A-A which is plotted at a scale of one to 10 distortion.

Soil data plotted on the geological sections include sample number designation and position, standard sample penetration resistance, Unified Soil Classifications, (USCS), water contents of fine grained soils, Atterberg limits and shear strengths in ksf. Also shown on the sections are the results of grain size tests on representative soil samples from the borings, giving the percent by dry weight of particles passing the Nos. 200 and 40 sieves and of the gravel retained upon the No. 4 sieve. The legend explaining these test symbols is shown on the bottom of Drawing No. F-F-458.

Final logs of the completed 37 borings are presented on Drawings Nos. F-F 465 through F-F-471. These logs are based on laboratory examination of soil samples and identification testing, and they may differ in detailed interpretation from the drillers logs, copies of which were placed on file with WMATA. Coordinate locations and ground surface elevations of the boring are listed in Table No. 1. General Information Drawing No. F-1 presents notes and legend applicable to both the geological sections and boring log drawings. This drawing also summarizes the sequence of the principal soil strata with their general description.

2.2 Laboratory Testing Program

Three-inch undisturbed samples were recovered by pushing or tapping thin Shelby tubes. Accepted samples were transported to our New York laboratory for tests of engineering properties. These tests comprised determination of shear strength by unconsolidated-undrained triaxial shear tests, and unconfined shear tests. In addition, Atterberg limit tests, and grain size determinations were performed. The results of these tests are listed in Table No. 2, Summary of Laboratory Test Data.

All split-spoon samples were examined in the laboratory, field classifications were checked and water contents determined for fine grained soils. Atterberg limit values were determined for typical clays of Strata Cc, Ec and Mc. Results of the plasticity tests are plotted on Plate No. 1. A total of twenty-five grain-size determinations were made on fill material and Tertiary soils of Brandywine sands of Stratum Q2, Culvert formation of Stratum Cs, Aquia formation of Stratum Es and Ec, and Monmouth formation of Stratum Ms. Results are plotted on Plates Nos. 2 through 7.

The results of grain size tests from soil samples from Borings Nos. YB-23U, YB-31U, YB-34 and YB-37 located in the Ponds areas, are presented in Table No. 5. The soil samples were classified based on the U.S. Department of Agriculture System (USDA), in accordance with the requirements of the Maryland Department of the Environment (MDE). The results of the grain size tests are intended to be used in the design of storm water management system. Thirty four unconsolidated-undrained triaxial tests were performed on Tertiary soils of Strata Es, Ec, and Ms. Two unconfined compression tests were performed on materials of Stratum Es. Results of the tests are presented on Plates Nos. 8 through 18.

Table No. 6 summarizes properties of soils of the Tertiary strata. This table is intended for use in design of permanent structures. In any situation, specific boring and laboratory tests in the formation at the location of interest should be consulted in selecting parameters for design since the values tabulated are generalized over a wide area. The allowable soil bearing capacity for spread foundations of the structures in Section F011 are given in section 4 of this report.

2.3 Field Permeability Tests

Sixteen falling-head permeability tests were performed in the 16 observation wells installed in the YB series borings. Results of permeability tests are plotted in Table No. 3, which gives basic information on circumstances of the test, stratum tested and average computed coefficients of permeability. The highest computed permeability value is equal to 8.2×10^{-4} feet per minute in materials of Strata Cs and Ec. This value reflect the permeability of Stratum Cs, which is substantially higher than the fine grained Stratum Ec.

Because of muddy conditions in the borehole and in filter material of observation wells and the impracticability of keeping the hole open in the cleanest and most pervious materials, the resulting permeability values tend to be low. They are not comparable in reliability to the pumping test results. Table No. 4 lists generalized coefficients of permeabilities of the Tertiary strata based

on full scale, deep-well pumping tests in earlier WMATA studies made primarily in the Pleistocene and Cretaceous strata. That information has been extrapolated to the Tertiary soils on the basis of a comparison of identification properties. These values chiefly reflect the horizontal coefficients because of the flow conditions to the test wells.

In order to evaluate the permeability of subsoils in the general area of the planned stormwater management ponds, a group of 18 falling-head permeability tests were performed in Borings Nos. YB-23A, YB-31A and YB-37. The test at three feet depth in Boring YB-31A was discarded due to incomplete data. The tests were generally performed in a two foot interval of open hole at depths of 3, 8, 13, 18, 23 and 28 feet below ground surface. Results are also listed in Table No. 3. The majority of the test were in clays of Stratum Ec. The computed permeability values were in general less than $1x10^{-7}$ feet per minute.

2.4 Groundwater Conditions

Water levels measured in observation wells installed in earlier borings and the borings made for this investigation are indicated on the geological sections by a triangular symbol. An average water table position estimated from this group of readings is indicated by a dashed line on the geological sections. In general, the groundwater level is a subdued reflection of the ground surface and it rises from a low at Elev. 190 at the north end of the yard to a high about Elev. 250 near the limit with Section F010. There is some evidence from the borings and observation wells of perched water in the fill overlying clayey Tertiary strata.

2.5 Potential Corrosion Characteristics

A group of twelve soil samples and seven water samples from the YB-series borings was obtained at the request of the Section Designer for tests relating to potential corrosion characteristics including pH, resistivity, chlorides, sulfates and total sulfur. Results of that testing are presented in Appendix B of this report. The soil and water samples exhibited pH values, ranging from 4.4 to 7.8 in 12 soil samples and 5.8 to 9.2 in seven water samples.

3.0 SUBSURFACE CONDITIONS

3.1 General Geology

The principal materials encountered in the site of the planned yard comprise Tertiary marine deposits of Brandywine of Stratum Q2, Culvert sands and clays of Strata Cs and Cc, Aquia sands and clays of Strata Es and Ec and Monmouth sands and clays of Strata Ms and Mc, under fill ranging in thickness between five and 40 feet.

3.2 Strata Descriptions

3.2.1 Stratum F A substantial amount of fill has been placed in the yard area, in particular on the east side, following gravel quarry operations, as depicted on Drawings Nos. SK-2 through

SK-4. The contours of elevations depict the old ground surface between 1951 and 1979. In general, the fill increases in thickness from west to east. Fill descriptions are relevant only at the locations of the borings. Unlike natural soil deposits, the nature and density of the fill may vary widely between boring locations. The fill has been placed in an uncontrolled condition and consists of loose to very compact silty to clayey fine sand, trace to some gravel to gravely fine to coarse sand, trace to some clay, clay pockets mixed with silty to sandy clay, sandy to clayey silt and plastic clay with varying amounts of cemented sand pieces, brick, concrete fragments, asphalt, wood, vegetation, lignite, glass, roots, leaves and rubble obstructions. Rubble material was observed at the ground surface in the southwest area of the yard in the general vicinity of Borings Nos. YB-28 through YB-31U. In the adjacent section F010, the fill has been found to contain building rubble including a massive concrete slab within the excavation for the Branch Avenue Station. The existing fill from excavated areas will generally not be suitable for use as embankment fill or utility backfill. It may be possible to obtain satisfactory backfill meeting WMATA Specifications from some of the site fill through careful sorting and/or processing or screening the soil.

3.2.2 Stratum Q2 Stratum Q2, consists of medium compact to very compact brown, tan or yellow orange fine to coarse sand, some gravel and boulders, to fine to coarse sandy gravel, trace to some silt and clay with occasional silty fine sand layers. It was encountered only in Boring No. YB-2U. It appears that the Brandywine has been stripped from the rest of the site, in the quarrying operations.

3.2.3 Stratum Cc Stratum Cc consists of plastic clay, silty clay and sandy clay or clayey silt. Theses clays are substantially overconsolidated to stresses of 7 to 12 tsf. Shear strength increases with depth from about 1.5 to 2.5 ksf, as shown on Plate No. 12 from MRCE Series Report No. 78, bound in Appendix A of this report. This stratum was encountered in some of the borings interlayered with sands of Stratum Cs.

3.2.4 Stratum Cs Stratum Cs of the Culvert formation is a loose to medium compact fine sand, trace to some silt, clay and silty or clayey fine sand. These sands were encountered in some of the borings interlayered at certain locations with clays of Stratum Cc. Standard Penetration Test resistance is generally in the range of 5 to 10 blows per foot, occasionally up to 20 blows per foot. The wide variation in standard penetration resistance is apparently due to sampling techniques and does not represent an actual variation in densities of the stratum. The sands are markedly single-sized and it appears likely that positive pore pressures are built up by driving the sampler which accounts for the exceptionally low blow counts. Although Stratum Cs is rated as loose to medium compact based on the Standard Penetration Test resistance recorded in the borings, the actual consistency can be classified as medium compact as demonstrated by the strength tests.

3.2.5 Stratum Ec Stratum Ec consists of medium to stiff gray, green, olive gray slickensided and fissured plastic clay to silty and sandy clay or clayey silt, trace lignite with occasional slightly organic fine sandy and silty clay layers, trace shells. This is the oldest of the Tertiary marine sediments found in most of the borings and it is interlayered at certain locations with Aquia sands of Stratum Es. Results of Atterberg limits determinations are plotted in Plate No. 1 of this report and in Plate No. 14 of the MRCE Series Report No. 78, bound in Appendix A of this

report. Median values are: liquid limit, 55; plastic limit, 30; plasticity index, 25. Strength and consolidation properties, summarized in profile on Plate No. 14, indicate that typical preconsolidation stresses range from about 7.5 to 8.5 tsf, and shear strengths increase with depth from about 2 to 3.5 ksf. Natural water contents are generally positioned midway between the liquid and plastic limits, with typical values of about 40 to 45 percent The median shear strength value from 16 triaxial shear strength tests on undisturbed samples from the YB-Series borings is 1.8 ksf. Median shear strengths from earlier testing in Sections F009 and F010 are summarized in the table below. The low strength in the current testing may be due to numerous slickensides and fissures in the clays at this site.

SECTION	REPORT NUMBER	MEDIAN SHEAR STRENGTH (KSF)
F009	244	3.6
F010	246	3.1
F011	250	1.8

3.2.6 Stratum Es Aquia Stratum Es consists of loose to medium compact gray, green, olive gray silty and clayey fine sand, trace shells with occasional slightly organic silty and clayey fine sand layers. This stratum is interlayered at certain locations with Aquia clays of Stratum Ec. Standard penetration resistance is generally between 5 and 10 blows per foot, with occasional blow counts as high as 50 blows per foot. As in the case of the Culvert sands, the wide variation in standard penetration resistance is apparently due to sampling techniques, and does not represent a true variation in consistency. Although the stratum is rated as loose to medium compact based on the Standard Penetration Test resistance recorded in the borings, the actual consistency can be classified as a medium compact based on the results of strength tests on undisturbed samples of Es sands conducted for this as well as for earlier WMATA investigations. The results of triaxial tests on undisturbed samples of Es sands, from YB-Series in Section F011, the DM-Series borings in Section F010, and RKK Series borings in Section F009 are shown on Table No. 2 of the corresponding reports. Copies of Table No. 2 from reports for Sections F009 and F010 are bound in Appendix A of this report. The shear strength ranges between 0.9 and 3.8 ksf. Direct shear tests were carried out on undisturbed samples from Borings Nos. F204-U and F207-U in the 1975 subsurface investigation summarized in MRCE Series Report No. 142. These tests disclosed angles of internal friction in the range of 32° to 40.5°, as shown on Plates Nos. A56 and A57 of Report No. 142. Results of all the above tests are included in Appendix A of this report.

3.2.7 Stratum Mc Stratum Mc of the upper Cretaceous Monmouth formation comprises medium compact to very compact dark green, slightly organic, micaceous fine sandy silt, and very stiff to hard clayey silt, some shells and irregular lenses and layers of calcium cemented sand and shell hash. This stratum was encountered only in a few of the borings interlayered with Monmouth

Sands of Stratum Ms. This material is heavily preconsolidated, in excess of 10 tsf.

3.2.8 Stratum Ms Monmouth sands of Stratum Ms consists of medium compact to very compact dark green slightly organic micaceous silty fine sand, trace clay and clayey fine sand, some shells, plus irregular lenses of cemented sand and shell hash. The Ms sands are occasionally interlayered with Mc clays. Standard penetration resistance is generally high and in many instances exceeds 100 blows per foot, reflecting the presence of lenses or layers of cemented sands and shells. Various amounts of cemented sand layers were encountered in Borings Nos. YB-1, YB-3, YB-4U, YB-5, YB-18 and YB-25. Hard drilling was experienced in these borings due to probable presence of cemented materials. A tri-cone roller bit was necessary to penetrate this formation. Pile driving in this material in Section F010 was impossible. Blasting was required to penetrate this stratum with H-piles, sheetpiles and precast concrete piles fitted with a "stinger".

The Median shear strength from five triaxial shear tests in the YB-Series Borings is 3.5 ksf. The Median triaxial shear tests from earlier investigations in Sections F008 and F010 are summarized in the table below. These medians are shown on Plate No. 12 of MRCE Series Report No. 78.

DESIGN SECTION	REPORT NUMBER	MEDIAN SHEAR STRENGTH VALUE (KSF)
F008	243	3.6
F010	246	3.6
F011	250	3.5

4.0 SUMMARY OF DESIGN AND CONSTRUCTION PROBLEMS

4.1 Yard Earthwork

As shown on F-F-457, the existing ground elevation within the yard complex ranges from a low at Elev. 197 in the vicinity of Boring No. YB-4U to a high at Elev. 253 in the general area of Boring No. YB-27U. According to the General Plans, subgrade ranges between Elev. 236 and Elev. 243 at the north and south side of the yard, respectively. The general area north of a line joining Borings No. YB-7 and YB-16A will be primarily on a new controlled embankment up to about 40 feet high, retained by perimeter retaining wall bordering the site roughly between Borings No. YB-1 through YB-9. The fill is intended to meet WMATA Specification requirements for "materials for embankment", Section 204, Article 2.1.A, compacted in accordance with requirements of Article 3.5. The backfill shall be placed up to the base of the trackage suballast. The existing ground should be heavily proof rolled prior to placing the controlled fill. Undercutting will be necessary in areas where soft yielding materials are detected by the proofrolling.

4.2 Retaining Walls Foundations

4.2.1 Retaining Wall No. 1 The retaining wall is located near the south end of the yard, roughly between Borings Nos. YB-24U and YB-25, as shown on Drawing No. F-F-457. The retaining wall is borders the west limit of the SWM pond. Conditions are presented in Geological Section B-B on Drawing No. F-F-459. Subsoils in order of depth consist of fill, Culvert sands and clays of Strata Cs and Cc, Aquia sands and clays of Strata Es and Ec and Monmouth sands and clays of strata Ms and Mc. The retaining wall is up to 14 feet high. Because of potential undermining of the wall foundation, by the effect of wave action of the water in the pond, it is recommended that the retaining wall be supported on piles. The piles could consist of precast concrete or closed-end pipe piles of up to 40 tons capacity with penetration of about 30 to 40 feet into the Aquia formation. Control of existing water in the pond will be necessary prior to the construction of the wall foundation. The use of permanent sheeting below the retaining wall would permit positioning of the base of the retaining walls above the pond surface level and the groundwater level enhancing contructability.

An alternative to the reinforced concrete wall could consist of placing a three foot thick rip-rap on the face of the slope embankment slope not steeper than 1 3/4 horizontal to one vertical. The design would have to provide adequate slope stability. A filter system should be placed over the face of the slope prior to placing the rip-rap designed to prevent the migration of fines through the rip-rap.

4.2.2 Retaining Wall No. 2 As shown on Drawing No. F-F-457, Retaining Wall No. 2 is located along the north and east perimeter of the yard, roughly between Borings Nos YB-1 and YB-9. The purpose of the wall is to retain the new fill that will be placed to support the yard trackage. Subsurface conditions are depicted in Geological Section A-A on Drawing No. F-F-458. The retaining wall ranges in height roughly between 10 and 40 feet. Subsoils consist of a thick layer of fill ranging in thickness between 5 and 30 feet. The greatest thickness of fill was encountered, roughly between Borings Nos. YB-2U and YB-4U. Underlying the fill are clays and sands of the Brandywine, Culvert, Aquia and Monmouth formations. The top of the Monmouth formation is relatively level and ranges between about Elev. 165 and Elev. 180. A spread bearing foundation is not suitable for the retaining wall due to the presence of fill and the high toe pressures resulting from a substantial height of the retained fill. Therefore, pile support for the retaining wall will be necessary. Piles of up to 100 ton capacity could consist of precast concrete or closed-end pipe piles.

The design should include evaluation of mass stability of the slope modified by new embankment above the pile supported retaining wall. To develop 100 ton capacity, we estimate pile tip penetration below the top Stratum Ms of about 40 to 50 feet, roughly in the general area between Boring Nos. YB-3 and YB-8U and somewhat less penetration into the Ms sands outside of this limit. The choice of pile type will be influenced by market conditions. One or two pile load tests will be necessary to evaluate the typical penetration necessary for the selected design load. Because of the presence of cemented sand layers in the Monmouth formation, pile installation could prove to be difficult. Prospective Contractors should get information from WMATA on pile installations problems in Section F010, before submitting their bids.

Alternatives to conventional cast-in-place concrete retaining walls might be considered for Retaining Wall No. 2. This could consist of driven soldier piles with pre-cast concrete lagging, faced with architectural concrete panels or shotcrete. Driven piles in an A-frame at the soldier piles might be considered to take the horizontal force. Because of loss of metal due to potential stray current corrosion, the choice of working stress should be conservative.

4.3. Maintenance Building, Equipment/Chemical Storage Building and Fueling Facility

Locations of these three facilities are on the northwest area of the yard as shown on Drawing No. F-F-457. Subsoil conditions for the maintenance building are depicted on the left hand side of Geological Section A-A and on Section M-M. Conditions for equipment storage and fueling facility are depicted on Sections C-C and D-D, respectively. Subsoils consist of fill overlying Culvert sands and clays over the Monmouth formation.

The subgrade level for the maintenance building will be on a new controlled embankment fill, with finished floor at Elev. 234. Because of the presence of the uncontrolled fill at this site, the building foundation should be pile-supported. Alternatively, if the deeper fill to the north does not extend below the limits of the building, it may be possible to replace this random fill with a controlled fill suitable for the support of spread footings.

The extent of obstructions within the fill is uncertain and undefined. The foundation pile layout should be flexible enough to permit field changes without redesign because of obstructions. The buildings could be supported on piles of up to 40 ton working capacity. We estimate penetration of a closed-end or pre-cast concrete pile into Culvert and Aquia formation of about 30 to 40 feet to develop the 40 ton working capacity. The area within the building should be filled to a level of six inches below the bottom of the slab-on-grade with "materials for embankment" fill meeting WMATA Specifications, Section 204, Article 2.1.A, and then six inches "drainage material" meeting WMATA Specification, Section 204, Article 2.1.D, should be placed on top of the fill prior to casting the floor slab.

Subsurface conditions at the location at the chemical storage building are depicted on Section C-C on Drawing No. F-F-459. Conditions consist of a relatively thin layer of fill over Tertiary formation of Strata Cs, Ec and Es. The existing groundwater level is at about Elev. 215 and the building finished floor level is at Elev. 234. We recommend that the existing fill within the building area be removed, and the area be backfilled with controlled "select fill" material meeting WMATA Specifications Section 204 Article 2.1.B to a level of six inches below the bottom of the floor slab on grade and then six-inch "drainage material" meeting WMATA Specifications, Section 204, Article 2.1.D, should be placed on top of the fill prior to casing the floor slab. The building can be founded on spread bearing on the surface of the select controlled fill, at a maximum bearing pressure of 1 1/2 tons per square foot.

Foundation subgrade for the fueling facility will be at or near the top of Culvert sands of Stratum Cs. The existing fill should be removed and the building founded on spread bearing foundation on the Culvert formation at maximum allowable bearing capacity of 2.0 tons per square

foot. The area within the building should be backfilled to a level of six inches below the bottom of the slab on grade with "materials for embankment" fill meeting WMATA Specifications, Section 204, Article 2.1.A and then six-inch "drainage material" meeting WMATA Specifications Section 204, Article 2.1.D, should be placed on top of the fill prior to casting the floor slab.

4.4 Operations Building

The planned operations building is located on the east side of yard between Borings Nos. YB-7 and YB-8U, as shown on Drawing No. F-F 457. Subsurface conditions are presented in Geological Section A-A on Drawing No. F-F-458. A fill layer approximately 10 feet thick overlies soils of Strata Es, Mc and Ms at this location. The finished floor of the building is at Elev. 239 bearing on over 30 feet of new embankment controlled fill. Settlement of the existing granular deposits due to the weight of the superposed new fill will occur rapidly. Therefore, the operations building can be founded on spread bearing on the surface of the controlled select fill, at maximum bearing pressure of 1 ½ tons per square foot. The area within the building should be backfilled with controlled embankment fill to a level of four feet below the base of the slab on grade with "materials for embankment" fill meeting WMATA Specification, Section 204, Article 2.1.A and then backfilled to a level of six inches below the bottom of the slab on grade with controlled "select material" fill meeting WMATA Specification, Section 204, Article 2.1.B. A six inch "drainage material" meeting WMATA Specification, Section 204, Article 2.1.D should be placed on top of the fill prior to casting the floor slab.

4.5 CMNT Shop Facility and Traction Power Substation

These two buildings are located near the middle section of the yard, as shown on Drawing No. F-F-457. Subsurface conditions of the area covered by CMNT Shop Facility and Traction Power substation are presented in Geological Sections F-F, G-G and H-H on Drawings Nos. F-F-461 and F-F-462. The ground floor for the CMNT Shop Facility and Traction Power Substation are at Elev. 242 and Elev. 234, respectively. Subsurface conditions consist of a layer of fill up to 40 thick overlying Aquia deposits of Strata Ec and Ec. Groundwater levels vary between approximate Elev. 220 and Elev. 240. Because of the presence of a thick layer of uncontrolled fill below the base of the building foundations, spread bearing foundation is not a feasible alternative and the buildings must be supported on piles. The piles could consist of pre-cast concrete or of closed end pipe piles of up to 40 ton capacity driven between 30 to 40 feet into the Aquia formation. One pile load test will be necessary to evaluate the typical pile penetration necessary for the selected design load.

The existing fill within the building area should be removed to a depth of two feet below the base of the floor slab and then the surface be heavily proofrolled, and any soft yielding material removed prior to placing controlled "select fill" to a level of 6-inches below the base of the floor slab, meeting WMATA Specifications, Section 204, Article 2.1.B. A six-inch drainage material meeting WMATA Specifications, Section 204, Article 2.1.D should be placed prior to casting the slab on grade.

4.6 Car-Wash Building

The planned car wash building is located near the south end of the yard between Borings Nos. YB-26 and YB-27U, as shown in boring location plan on Drawing No. F-F-457. Subsurface conditions are presented on Geological Section J-J on Drawing No. F-F-463. The finished floor of the building is at Elev. 242. Subsoils consists of a relatively thin layer of fill overlying interlayered sands and clays of Strata Cs, Es and Ec. The existing groundwater level ranges between Elev 225 and Elev. 230. The central part of the building extends through the edge of an existing SWM pond. It will be necessary to construct a cofferdam in the pond east of the building and the planned retaining wall to permit dewatering, subgrade preparation and placement of controlled fill for support of this structure. We recommend that the existing fill be removed, and the area backfilled with controlled "select fill" to six inches below the bottom of the ground floor slab, meeting WMATA Specifications, Section 204, Article 2.1.B, and then a six inch "drainage material" meeting WMATA Specifications, Section 204, Article 2.1.D, be placed on top of the select fill prior to casting the ground floor slab. The car wash building can then be founded on spread bearing on the surface of the controlled select fill at a maximum bearing intensity of 1½ tons per square foot. Control of water level in the pond will be necessary prior to the construction of the building foundation. Special attention should be given to protection of the clay subgrade in the dewatered pond and during removal of existing fill and the placement of embankment soils.

TABLE NO. 1, SURVEY DATA FOR BORINGS (SECTION F011, BRANCH AVE YARD)

BORING NUMBER	HORIZONTAL CONTROL COORDINATES:		VERTICAL CONTROL: GROUND SURFACE ELEVATION (FT)	STATUS OF OBSERVATION WELLS		
	NORTH	EAST		INSTALLED	TYPE	PRESENT CONDITION
YB-1	363,680	826,140	224.2			
YB-2U	363,853	826,270	226.5			
YB-2A	363,848	826,265	226.5	05-09-97	1-1/2"	F
YB-3	363,880	826,462	211.5			
YB-4U	363,583	826,585	196.6	04-21-97	1-1/2"	F
YB-5	363,320	826,678	203.8			
YB-6U	362,975	826,799	204.1	05-05-97	1-1/2"	F
YB-7	362,619	826,848	211.9			
YB-8U	362,489	826,936	210.5	05-16-97	1-1/2"	F
YB-9	362,217	826,944	226.3			
YB-10	363,695	826,260	225.1			
YB-11	363,286	826,481	230.0			
YB-12	362,905	826,630	220.0			
YB-13	DELETED					
YB-14	363,178	826,365	242.1			
YB-15	362,945	826,475	243.1	04-16-97	1-1/2"	F
YB-16	362,650	826,575	231.0			
YB-16A	362,650	826,582	231.0			
YB-17	362,459	826,682	248.2	05-02-97	1-1/2"	F

TABLE NO. 1, SURVEY DATA FOR BORINGS (SECTION F011, BRANCH AVE YARD - CONT'D)

BORING NUMBER	HORIZONTAL CONTROL COORDINATES:		VERTICAL CONTROL: GROUND SURFACE ELEVATION (FT)	STATUS OF OBSERVATION WELLS		
	NORTH	EAST		INSTALLED	TYPE	PRESENT CONDITION
YB-18	362,276	826,837	253.9	05-08-97	1-1/2"	F
YB-19	361,933	826,900	247.2			
YB-20U	362,118	826,809	246.1	05-12-97	1-1/2"	F
YB-21U	362,240	826,642	245.9	05-12-97	1-1/2"	F
YB-22	362,000	826,740	248.1			
YB-23U	361,905	827,086	240.2	05-22-97	1-1/2"	F
YB-23A	361,910	827,075	240.2			
YB-24U	361,590	827,054	250.5	04-30-97	1-1/2"	F
YB-25	361,161	826,996	241.5			
YB-26	361,600	826,980	238.9			
YB-27U	361,238	826,916	252.7	04-29-97	1-1/2"	F
YB-28	361,928	826,386	267.1	04-23-97	1-1/2"	F
YB-29U	361,682	826,475	264.7	04-25-97	1-1/2"	F
YB-30	361,538	826,658	265.9	05-01-97	1-1/2"	F
YB-31U	361,297	826,770	253.1	04-28-97	1-1/2"	F
YB-31A	361,295	826,778	253.1			
YB-32U	363,442	826,275	229.3			
YB-33	DELETED					
YB-34	361,417	826,931	238.3			

TABLE NO. 1, SURVEY DATA FOR BORINGS (SECTION F011, BRANCH AVE YARD - CONT'D)

BORING NUMBER	HORIZONTAL CONTROL COORDINATES:		VERTICAL CONTROL: GROUND SURFACE ELEVATION (FT)	STATUS OF OBSERVATION WELLS		
	NORTH	EAST		INSTALLED	TYPE	PRESENT CONDITION
YB-35	DELETED					
YB-36	DELETED					
YB-37	363,888	826,325	227.3			

LEGEND
F - Indicates observation well functioning in 1997.

TABLE NO. 2

SUMMARY OF LABORATORY TEST DATA

SAMPLE IDENTIFICATION				CLASSIFICATION PROPERTIES									PHYSICAL PROPERTIES												
										UNIFIED SOIL CLASSIFICATION SYSTEM			STRENGTH								CONSOLIDATION					
													UNCONFINED COMPRESSION			TRIAXIAL COMPRESSION										
BORING NUMBER	SAMPLE NUMBER	DEPTH FT.	STRATUM DESIGNATION	NATURAL WATER CONTENT % (W) AVERAGE OF ENTIRE SAMPLE	LIQUID LIMIT (W_L)	PLASTICITY INDEX (I_P)	NATURAL WATER CONTENT OF LIMIT SAMPLE, Wn,%	SPECIFIC GRAVITY OF SOLIDS (G_s)	DRY DENSITY, PCF	SOIL TYPE	% SAND (<# 4 >#200 SIEVE)	% FINES (<#200 SIEVE)	COMPRESSIVE STRENGTH TSF	WATER CONTENT AT END OF TEST, %	STRAIN AT FAILURE, %	TYPE OF TEST	DEVIATOR STRESS (σ_1-σ_3), TSF	CONFINING PRESSURE (σ_3), TSF	NATURAL WATER CONTENT, Wn, %	WATER CONTENT AT END OF TEST, Wf, %	NATURAL WATER CONTENT, Wn, %	EXISTING OVERBURDEN STRESS P_o, TSF	ESTIMATED PRECONSOLIDATION STRESS, P_c, TSF	COMPRESSION INDEX, C_c	SWELLING INDEX, C_c	VOID RATIO AT START OF SWELL, e_r
YB-2U	12U	49	Es	34				2.65		SM-SC			2.04	35	10.4											
										SM-SC	64	35				Q	3.64	1.0	36	35						
										SM-SC						Q	3.74	2.0	31	31						
	15U	59	Ms	30						SM-SC						Q	3.5	0.5	30	30						
								2.74		SM-SC	54	46				Q	3.5	1.0	29	30						
YB-4U	6U	11	F	43						SM-SC																
	8U	19	F	48						SM-SC																
	10U	24	Mc	42	82	37	44			MH						Q	**4.7	1.0	41	41						
YB-6U	9U	29	Es	31						SM-SC	67	33				Q	2.50	0.5	31	31						
										SM-SC						Q	3.44	1.0	29	29						
										SM-SC						Q	4.02	2.0	32	32						
	12U	39	Ms	32						SM-SC	56	44				Q	**1.97	0.5	31	31						
										SM-SC						Q	3.83	1.0	29	29						
	15U	49	Ms	31						SM-SC**																
YB-8U	6U	14	Es	38						SM-SC	84	16														
	9U	24	Es	48						SM-SC																
			Ec	94						ML																
	11U	29	Ec	93	126	56	84			MH						Q	2.74	0.5	89	90						
										MH						Q	3.17	1.0	86	87						
										MH						Q	3.71	2.0	94	95						
YB-20U	6U	14	F	55						CH																
	9U	24	Ec	40	80	47	39			CH																
YB-21U	11U	39	Ec	46	58	25	47			MH						Q	1.77	1.0	46	46						
	13U	44	Es	37						SM-SC						Q	2.47	0.5	38	38						
										SM-SC						Q	1.87	1.0	35	35						
	15U	49	Es	37						SM			1.17	38	17.7											
										SM	79	21				Q	2.54	2.0	39	38						

1. ALL TESTS SUMMARIZED ABOVE WERE PERFORMED IN THE SOILS LABORATORY OF MUESER RUTLEDGE CONSULTING ENGINEERS.
2. THE SAMPLE DEPTH LISTED ABOVE IS THE AVERAGE DEPTH OF THE SAMPLE RECOVERED.
3. FOR GROUND SURFACE ELEVATIONS AT THE BORINGS SEE TABLE NO. 1. FOR GENERALIZED STRATA DESCRIPTIONS SEE DRAWING NO. F-1.
4. "NATURAL WATER CONTENT OF THE ENTIRE SAMPLE" IS A WEIGHTED AVERAGE OF ALL MATERIAL TYPES RECOVERED.
5. THE TRIAXIAL COMPRESSION TESTS PERFORMED WERE:
   - Q - QUICK TESTS (UU - UNCONSOLIDATED UNDRAINED TESTS)
   - Qc - CONSOLIDATED QUICK TESTS (CU - CONSOLIDATED UNDRAINED TESTS)
6. STRENGTH TESTS WERE PERFORMED ON PISTON TYPE SAMPLES (U) APPROXIMATELY 2.9 INCHES IN DIAMETER AND ON SHELBY TYPE SAMPLES (S) APPROXIMATELY 1.8 INCHES IN DIAMETER. THE RATIO OF HEIGHT TO DIAMETER OF ALL STRENGTH TEST SPECIMENS WAS APPROXIMATELY 2.0.
7. THE TRIAXIAL COMPRESSION TESTS WERE PERFORMED AT A RATE OF STRAIN OF APPROXIMATELY 1 PER CENT PER MINUTE.
8. THE DIRECT SHEAR TESTS WERE PERFORMED AT A CONSTANT RATE OF STRAIN EQUAL TO A HORIZONTAL DISPLACEMENT OF 0.02 INCHES PER HOUR. THE SPECIMENS WERE OF APPROXIMATELY 1/2 INCH THICKNESS.
9. COMPRESSION INDEX Cc - STRAIGHT LINE PORTION OF THE VIRGIN CURVE OF CONSOLIDATLION TEST: e = eo - Cc LOG P/Po
10. SWELLING INDEX Cs - STRAIGHT LINE PORTION OF THE REBOUND CURVE OF CONSOLIDATION TEST: e = eo - Cs LOG P/Po

* SAMPLE FAILED ON SLICKENSIDED PLANES

**TRACE TO SOME CEMENTED SAND AND CEMENTED SILT

TABLE NO. 2 SUMMARY OF LABORATORY TEST DATA (CONT'D)

SAMPLE IDENTIFICATION				CLASSIFICATION PROPERTIES									PHYSICAL PROPERTIES													
										UNIFIED SOIL CLASSIFICATION SYSTEM			STRENGTH								CONSOLIDATION					
													UNCONFINED COMPRESSION			TRIAXIAL COMPRESSION										
BORING NUMBER	SAMPLE NUMBER	DEPTH FT.	STRATUM DESIGNATION	NATURAL WATER CONTENT % (W) AVERAGE OF ENTIRE SAMPLE	LIQUID LIMIT (W_L)	PLASTICITY INDEX (I_P)	NATURAL WATER CONTENT OF LIMIT SAMPLE, W_n,%	SPECIFIC GRAVITY OF SOLIDS (G_s)	DRY DENSITY, PCF	SOIL TYPE	% SAND (<# 4 >#200 SIEVE)	% FINES (<#200 SIEVE)	COMPRESSIVE STRENGTH TSF	WATER CONTENT AT END OF TEST, %	STRAIN AT FAILURE, %	TYPE OF TEST	DEVIATOR STRESS (σ_1-σ_3), TSF	CONFINING PRESSURE (σ_3), TSF	NATURAL WATER CONTENT, W_n, %	WATER CONTENT AT END OF TEST, W_f, %	NATURAL WATER CONTENT, W_n, %	EXISTING OVERBURDEN STRESS P_o, TSF	ESTIMATED PRECONSOLIDATION STRESS, P_c, TSF	COMPRESSION INDEX, C_c	SWELLING INDEX, C_c	VOID RATIO AT START OF SWELL, e_r
YB-23U	7U	19	Ec	47						CH						Q	3.28	0.5	47	47						
										CH						Q	2.32	1.0	45	45						
	9U	24	Ec	45						ML	47	53														
	11U	29	Ec	47						ML	40	60														
YB-24U	7U	19	Ec	42	82	52	40			CH						Q	1.93	0.5	40	40						
																Q	*1.22	1.0	43	43						
																Q	*1.57	2.0	44	44						
	9U	29	Ec	44						MH																
	11U	39	Ec	46						CH																
YB-27U	6U	19	Ec	41	74	46	49			CH						Q	1.82	0.5	42	42						
										CH						Q	*1.63	1.0	41	40						
										CH						Q	1.44	2.0	44	44						
	8U	29	Ec	49						CH																
	10U	39	Es	39						SM-SC	52	48				Q	1.86	0.5	41	41						
										SM-SC						Q	2.24	1.0	42	42						
										SM-SC						Q	2.30	2.0	33	33						
YB-29U	6U	14	F	45						CH																
	11U	34	Ec	50						CH&CL																
YB-31U	7U	19	Ec	48	71	45	47			CH						Q	*1.52	0.5	46	46						
										CH						Q	*1.45	1.0	44	44						
										CH						Q	*1.49	2.0	48	48						
	8U	24	Ec	53						CH																
	10U	29	Ec	50						CH																
YB-32U	7U	16	Ec	46	96	61	47			CH						Q	*1.32	2.0	48	47						
	10U	26	Es	38						SC																
	13U	36	Es	33						SM-SC	80	20				Q	2.12	0.5	32	33						
										SM-SC						Q	1.63	1.0	35	35						
										SM-SC						Q	2.58	2.0	33	33						

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GENERAL ENGINEERING CONSULTANTS

TABLE NO. 3, SUMMARY OF RISING AND FALLING HEAD PERMEABILITY TESTS IN BOREHOLES AND OBSERVATION WELLS (SECT. F011, BRANCH AVENUE YARD)

BORING NO.	YB-2A OBSERVATION WELL	YB-4U OBSERVATION WELL	YB-6U OBSERVATION WELL	YB-8U OBSERVATION WELL	YB-15 OBSERVATION WELL	YB-17 OBSERVATION WELL
TYPE OF TEST	FALLING HEAD	FALLING HEAD	FALLING HEAD	FALLING HEAD	FALLING HEAD	FALLING HEAD
ELEVATION OF TOP AND BOTTOM OF OPENING TESTED	+ 206.5 + 191.5	+ 163.6 + 128.6	+ 169.1 + 126.1	+ 175.5 + 127.5	+ 228.1 + 215.1	+ 233.3 + 208.2
LENGTH OF OPENING IN FEET	15	35	43	48	13	25
AVERAGE COMPUTED PERMEABILITY, FEET/MINUTE	WELL DRY	4.8×10^{-5}	4.8×10^{-6}	5.1×10^{-6}	6.6×10^{-4}	WELL DRY
STRATUM TESTED	F & Q2	Ms	Ms	Mc & Ms	Cs & Ec	F & Es

BORING NO.	YB-18 OBSERVATION WELL	YB-20U OBSERVATION WELL	YB-21U OBSERVATION WELL	YB-23U OBSERVATION WELL	YB-23A	YB-23A
TYPE OF TEST	FALLING HEAD	FALLING HEAD	FALLING HEAD	FALLING HEAD	FALLING HEAD	FALLING HEAD
ELEVATION OF TOP AND BOTTOM OF OPENING TESTED	+ 223.9 + 175.9	+ 211.1 + 198.1	+ 210.9 + 195.9	+ 205.2 + 192.2	+ 235.7 + 235.0	+ 232.2 + 230.2
LENGTH OF OPENING IN FEET	48	13	15	13	0.7	2
AVERAGE COMPUTED PERMEABILITY, FEET/MINUTE	2.3×10^{-5}	4.4×10^{-5}	5.6×10^{-6}	9.2×10^{-6}	$<1.0 \times 10^{-7}$	5.4×10^{-5}
STRATUM TESTED	F, Ec & Es	Ec & Es	Ec & Es	Ec & Es	Fill	Cs

TABLE NO. 3, SUMMARY OF RISING AND FALLING HEAD PERMEABILITY TESTS IN BOREHOLES AND OBSERVATION WELLS (SECT. F011, BRANCH AVENUE YARD) - CONT'D

BORING NO.	YB-23A	YB-23A	YB-23A	YB-23A	YB-24U OBSERVATION WELL	YB-27U OBSERVATION WELL
TYPE OF TEST	FALLING HEAD	FALLING HEAD	FALLING HEAD	FALLING HEAD	FALLING HEAD	FALLING HEAD
ELEVATION OF TOP AND BOTTOM OF OPENING TESTED	+ 227.2 + 225.2	+ 222.2 + 220.2	+ 217.2 + 215.2	+ 212.2 + 210.2	+ 220.5 + 147.5	+ 217.7 + 204.7
LENGTH OF OPENING IN FEET	2	2	2	2	73	13
AVERAGE COMPUTED PERMEABILITY, FEET/MINUTE	$<1.0 \times 10^{-7}$	$<1.0 \times 10^{-7}$	$<1.0 \times 10^{-7}$	$<1.0 \times 10^{-7}$	4.7×10^{-6}	$<1.0 \times 10^{-7}$
STRATUM TESTED	Ec	Ec	Ec	Ec	Ec, Es, Mc & Ms	Es & Ec

BORING NO.	YB-28 OBSERVATION WELL	YB-29U OBSERVATION WELL	YB-30 OBSERVATION WELL	YB-31U OBSERVATION WELL	YB-31A	
TYPE OF TEST	FALLING HEAD	FALLING HEAD	FALLING HEAD	FALLING HEAD	FALLING HEAD	
ELEVATION OF TOP AND BOTTOM OF OPENING TESTED	+ 252.1 + 239.1	+ 239.7 + 226.7	+ 245.9 + 227.9	+ 218.1 + 205.1	+ 245.1 + 243.1	
LENGTH OF OPENING IN FEET	13	13	18	13	2	
AVERAGE COMPUTED PERMEABILITY, FEET/MINUTE	1.1×10^{-3}	8.2×10^{-4}	6.5×10^{-4}	3.5×10^{-6}	4.8×10^{-5}	
STRATUM TESTED	F	Cs & Ec	Cs & Ec	Es & Ec	Cs	

TABLE NO. 3, SUMMARY OF RISING AND FALLING HEAD PERMEABILITY TESTS IN BOREHOLES AND OBSERVATION WELLS (SECT. F011, BRANCH AVENUE YARD) - CONT'D

BORING NO.	YB-31A	YB-31A	YB-31A	YB-31A	YB-37	YB-37
TYPE OF TEST	FALLING HEAD	FALLING HEAD	FALLING HEAD	FALLING HEAD	FALLING HEAD	FALLING HEAD
ELEVATION OF TOP AND BOTTOM OF OPENING TESTED	+ 240.1 + 238.1	+ 235.1 + 233.1	+ 230.1 + 228.1	+ 225.1 + 223.1	+ 224.3 + 222.3	+ 219.3 + 217.3
LENGTH OF OPENING IN FEET	2	2	2	2	2	2
AVERAGE COMPUTED PERMEABILITY, FEET/MINUTE	$<1.0 \times 10^{-7}$	$<1.0 \times 10^{-7}$	$<1.0 \times 10^{-7}$	$<1.0 \times 10^{-7}$	$<1.0 \times 10^{-7}$	$<1.0 \times 10^{-7}$
STRATUM TESTED	Ec	Ec	Ec	Ec	F	F

BORING NO.	YB-37	YB-37	YB-37	YB-37		
TYPE OF TEST	FALLING HEAD	FALLING HEAD	FALLING HEAD	FALLING HEAD		
ELEVATION OF TOP AND BOTTOM OF OPENING TESTED	+ 214.3 + 212.3	+ 209.3 + 207.3	+ 204.3 + 202.3	+ 199.3 + 197.3		
LENGTH OF OPENING IN FEET	2	2	2	2		
AVERAGE COMPUTED PERMEABILITY, FEET/MINUTE	$<1.0 \times 10^{-7}$	$<1.0 \times 10^{-7}$	1.4×10^{-4}	2.7×10^{-5}		
STRATUM TESTED	F	F	F	F		

TABLE NO. 4
REPRESENTATIVE PERMEABILITY VALUES

STRATUM	SOIL TYPE	COEFFICIENT OF PERMEABILITY K, (FT/MIN)
Q2	Fine to coarse sand, some medium to coarse gravel	5×10^{-2} to 10^{-3}
Cc	Plastic clay, silty and sandy clay or clayey silt	10^{-6} to 10^{-7}
Cs	Fine sand, trace to some silt, clay and clayey fine sand	10^{-3} to 10^{-5}
Ec	Plastic clay to silty and sandy clay or clayey silt	10^{-6} to 10^{-7}
Es	Silty and clayey fine sand	10^{-3} to 10^{-5}
Mc	Slightly organic fine sandy silt and clayey silt	10^{-5} to 10^{-6}
Ms	Slightly organic micaceous silty or clayey fine sand	10^{-3} to 10^{-5}

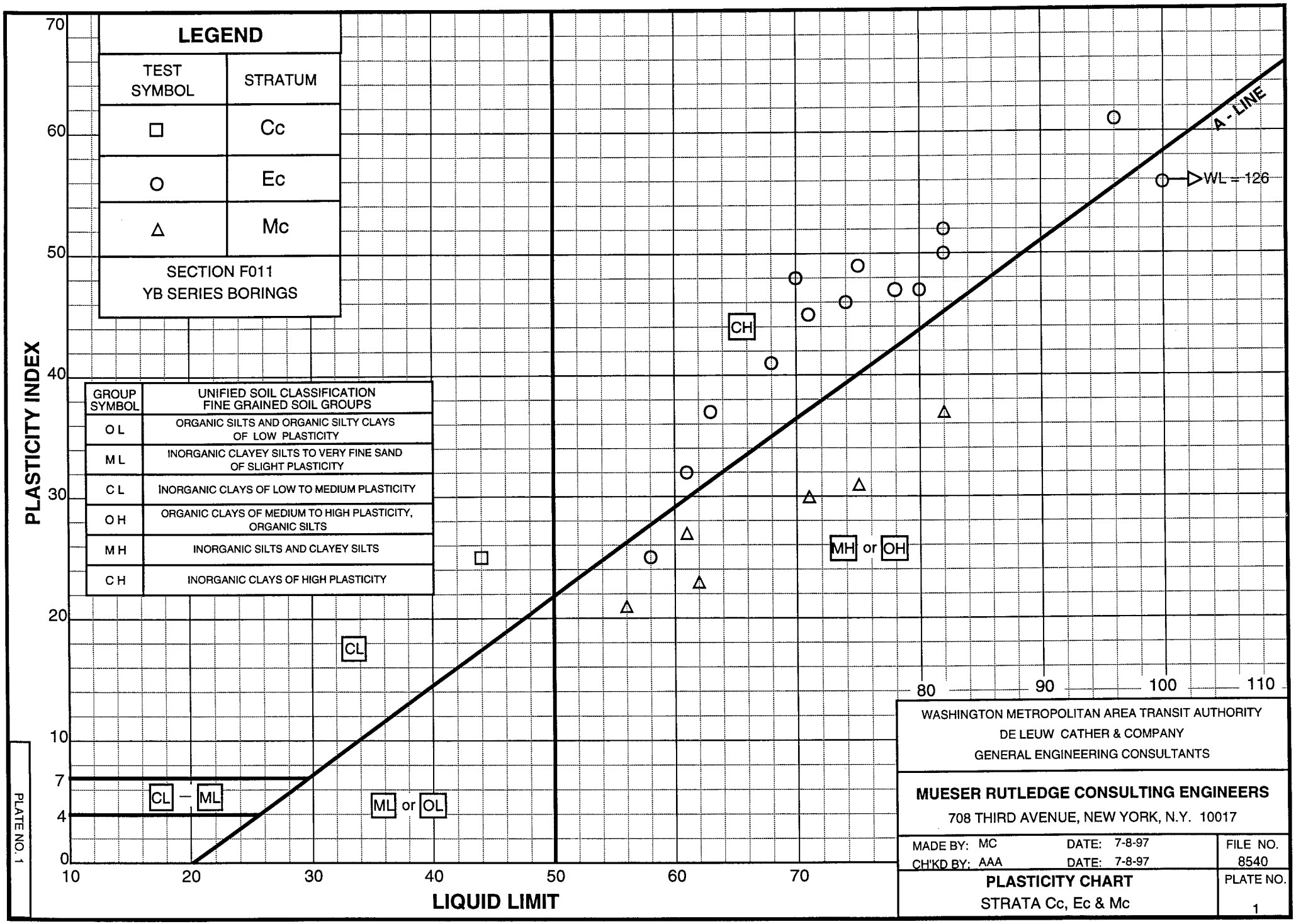
RESULTS OF GRAIN SIZE TESTS
BASED ON U.S. DEPARTMENT OF AGRICULTURE (USDA) SYSTEM

TABLE NO. 5

BORING NO.	SAMPLE NO.	DEPTH IN FT.	% >2mm (GRAVEL)	% BETWEEN 2mm & 0.05mm (SAND)	% BETWEEN 0.05 & 0.002mm (SILT)	% LESS THAN 0.002mm (CLAY)	USDA CLASSIFICATION	USCS CLASSIFICATION	STRATUM
YB-23U	5D	8'-10'	6	60	15	19	SANDY LOAM	SM	Cs
	9U	23'-25'	0	56	23	21	SANDY CLAY LOAM	ML	Ec
	11U	28'-30'	0	50	24	26	SANDY CLAY LOAM	ML	Ec
YB-31U	1D BOT	1.0'-2.0'	37	51	6	6	GRAVELLY LOAMY SAND	SM	Q2
	3D	4'-6'	0	92	2	6	SAND	SP-SM	CS
YB-34	8D	23'-25'	0	63	29	8	SANDY LOAM	CL	Ec
YB-37	2D	2'-4'	9	61	18	12	SANDY LOAM	SC&SM	FILL
	5D	8'-10'	4	79	7	10	LOAMY SAND	SM	FILL
	7D	18'-20'	9	57	22	12	SANDY LOAM	SC&CL	FILL
	13D	48'-50'	1	75	13	11	SANDY LOAM	SM-SC	Es

TABLE NO. 6
SOIL PROPERTIES FOR DESIGN

STRATUM	TOTAL UNIT WEIGHT (PCF)	EFFECTIVE FRICTION ANGLE Φ	UNDRAINED SHEAR STRENGTH (KSF)	POISSON'S RATIO μ	COEFFICIENT OF SUBGRADE REACTION (KCF)	RECOMPRESSION CONSOLIDATION INDEX (CR)	COEFFICIENT OF AT-REST PRESSURE	YOUNG MODULUS OF ELASTICITY (KSI)
F Existing Fill	120-130	30°	-	-	-	-	-	-
Q2 Fine to coarse sand, some medium to coarse gravel	130	38°	-	0.35-0.4	180	.01-.02	.4	12-15
Cc Plastic clay, silty and sandy clay or clayey silt	130	25°	1.5-2.5	0.3-0.35	100	.015-.03	.55	6-8
Cs Fine sand, trace to some silt, clay and clayey fine sand	130	30°-32°	-	0.3-0.35	140	.01-.02	.5	8-10
Ec Plastic clay to silty and sandy clay or clayey silt	130	25°	2.0-3.5	0.35-0.4	100	.015-.03	.55	6-8
Es Silty and clayey fine sand	130	30°-32°	-	0.35-0.4	140	.01-.02	.5	8-10
Mc Slightly organic fine sandy silt and clayey silt	130	25°	3.0-3.5	0.35-0.4	120	.015-.03	.6	8-10
Ms Slightly organic micaceous silty or clayey fine sand	130	32°-34°	-	0.35-0.4	160	.01-.02	.45	10-12


LEGEND
TEST SYMBOL
STRATUM
Cc
Ec
Mc
SECTION F011
YB SERIES BORINGS
GROUP SYMBOL
UNIFIED SOIL CLASSIFICATION FINE GRAINED SOIL GROUPS
OL ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
ML INORGANIC CLAYEY SILTS TO VERY FINE SAND OF SLIGHT PLASTICITY
CL INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY
OH ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
MH INORGANIC SILTS AND CLAYEY SILTS
CH INORGANIC CLAYS OF HIGH PLASTICITY
PLASTICITY INDEX
LIQUID LIMIT
A - LINE
WL = 126
CH
MH or OH
CL
CL — ML
ML or OL
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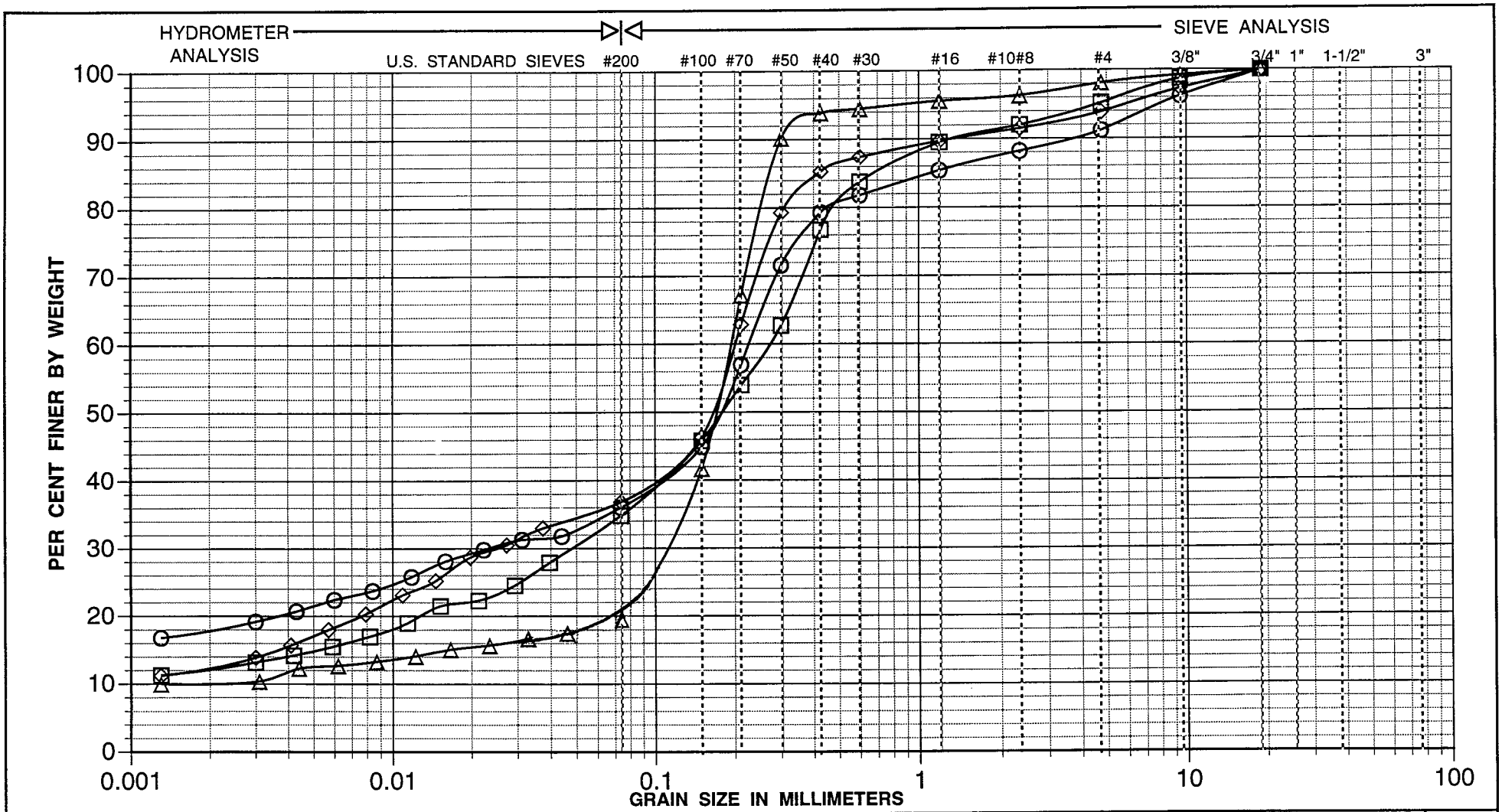
FILE NO. 8540
PLASTICITY CHART
STRATA Cc, Ec & Mc
PLATE NO. 1
PLATE NO. 1



UNIFIED SOILS CLASSIFICATION	CLAY OR SILT	SAND			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	

SYMBOL	BORING	SAMPLE	DESCRIPTION OF SAMPLE
○	YB-28	5D	STRATUM F
□	YB-37	2D	
△	YB-37	5D	
◇	YB-37	7D	

PLATE NO. 2

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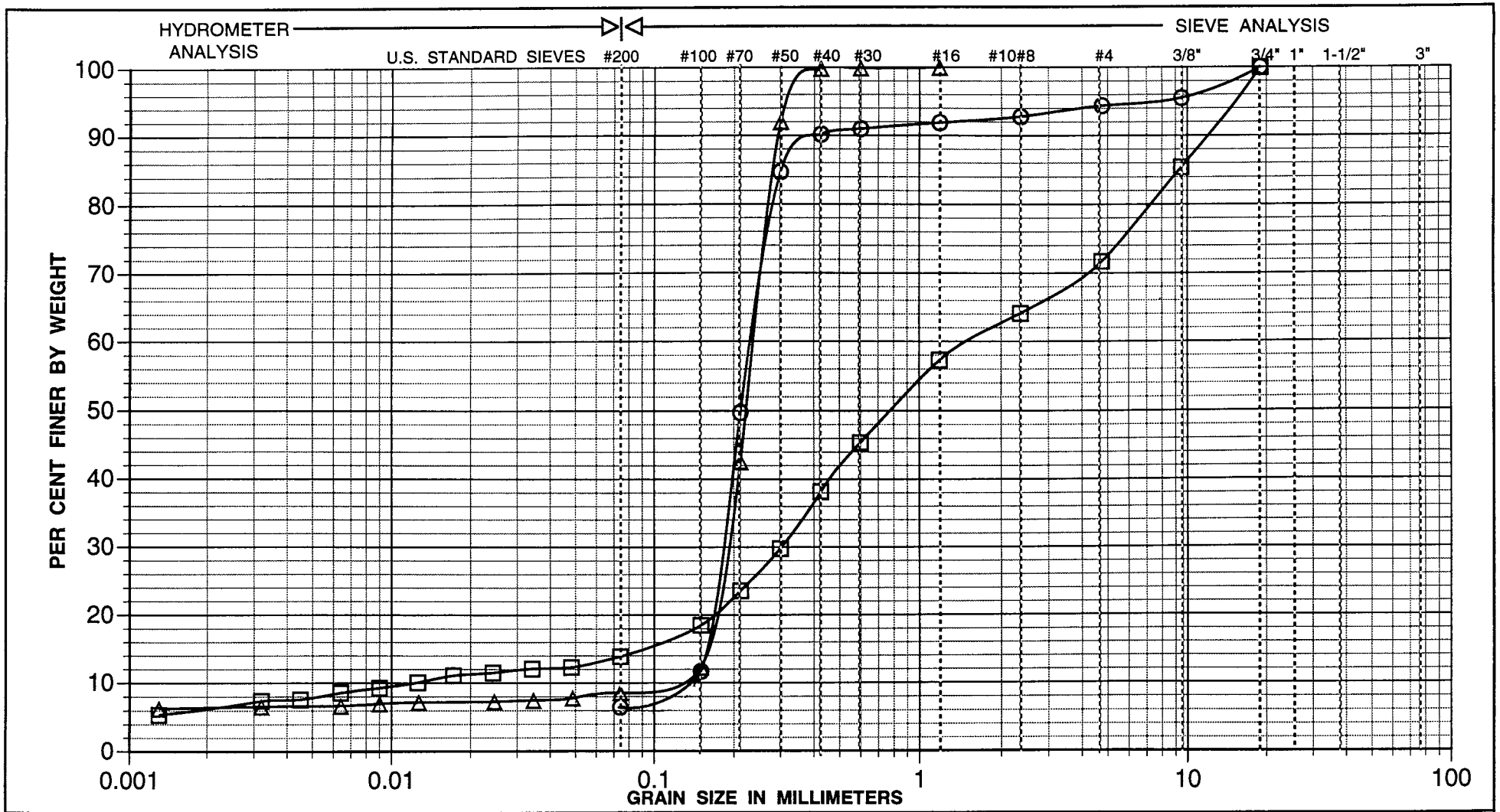
GRADATION CURVES
STRATUM F

PLATE NO. 2



UNIFIED SOILS CLASSIFICATION	CLAY OR SILT	SAND			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	

PLATE NO. 3

SYMBOL	BORING	SAMPLE	STRATA	DESCRIPTION OF SAMPLE
○	YB-30	7D	Cs	STRATA Cs & Q2
□	YB-31U	1D BOT	Q2	
△	YB-31U	3D	Cs	

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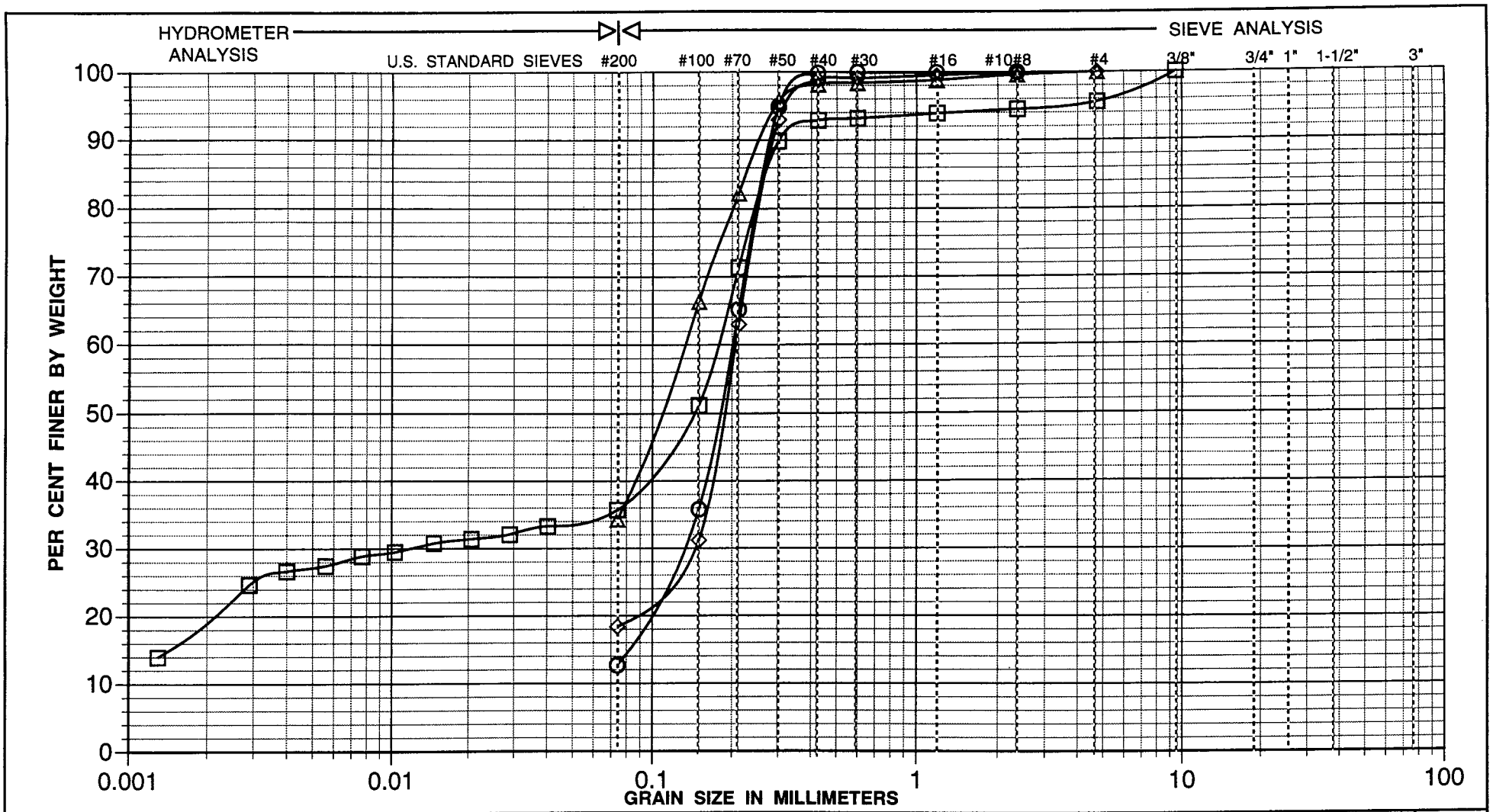
FILE NO. 8540

GRADATION CURVES
STRATA Cs & Q2

PLATE NO. 3



UNIFIED SOILS CLASSIFICATION	CLAY OR SILT	SAND			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	

SYMBOL	BORING	SAMPLE	DESCRIPTION OF SAMPLE
○	YB-11	4D	STRATUM Cs
□	YB-23U	5D	
△	YB-26	3D	
◇	YB-29U	9D	

PLATE NO. 4

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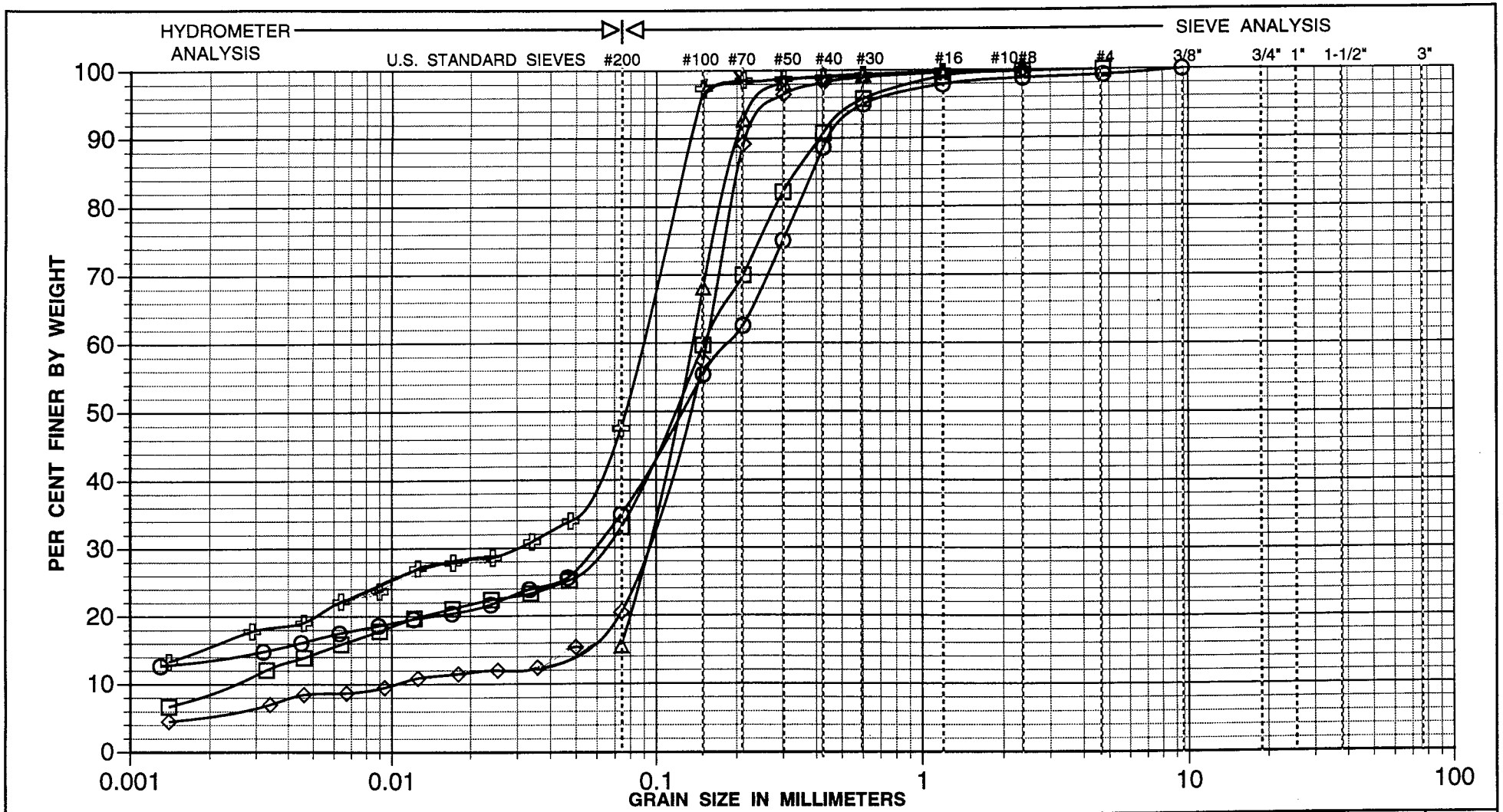
GRADATION CURVES
STRATUM Cs

PLATE NO. 4



UNIFIED SOILS CLASSIFICATION	CLAY OR SILT	SAND			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	

SYMBOL	BORING	SAMPLE	DESCRIPTION OF SAMPLE
○	YB-2U	12U	STRATUM Es
□	YB-6U	9U	
△	YB-8U	6U	
◇	YB-21U	15U	
✚	YB-27U	10U	

PLATE NO. 5

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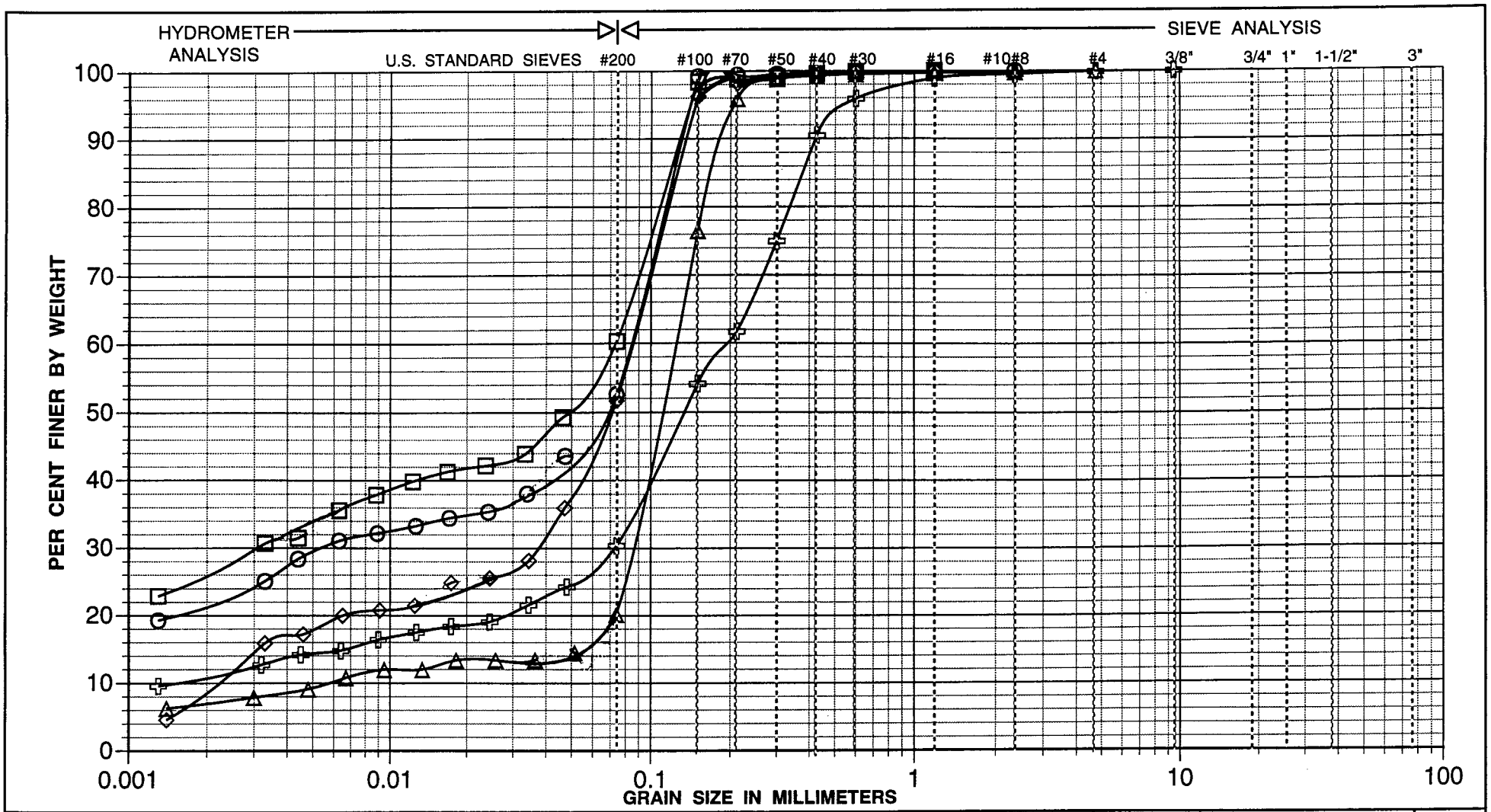
GRADATION CURVES
STRATUM Es

PLATE NO. 5



UNIFIED SOILS CLASSIFICATION	CLAY OR SILT	SAND			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	

SYMBOL	BORING	SAMPLE	STRATA	DESCRIPTION OF SAMPLE
○	YB-23U	9U	Ec	STRATA Es & Ec
□	YB-23U	11U	Ec	
△	YB-32U	13U	Es	
◇	YB-34	8D	Ec	
✢	YB-37	13D	Es	

PLATE NO. 6

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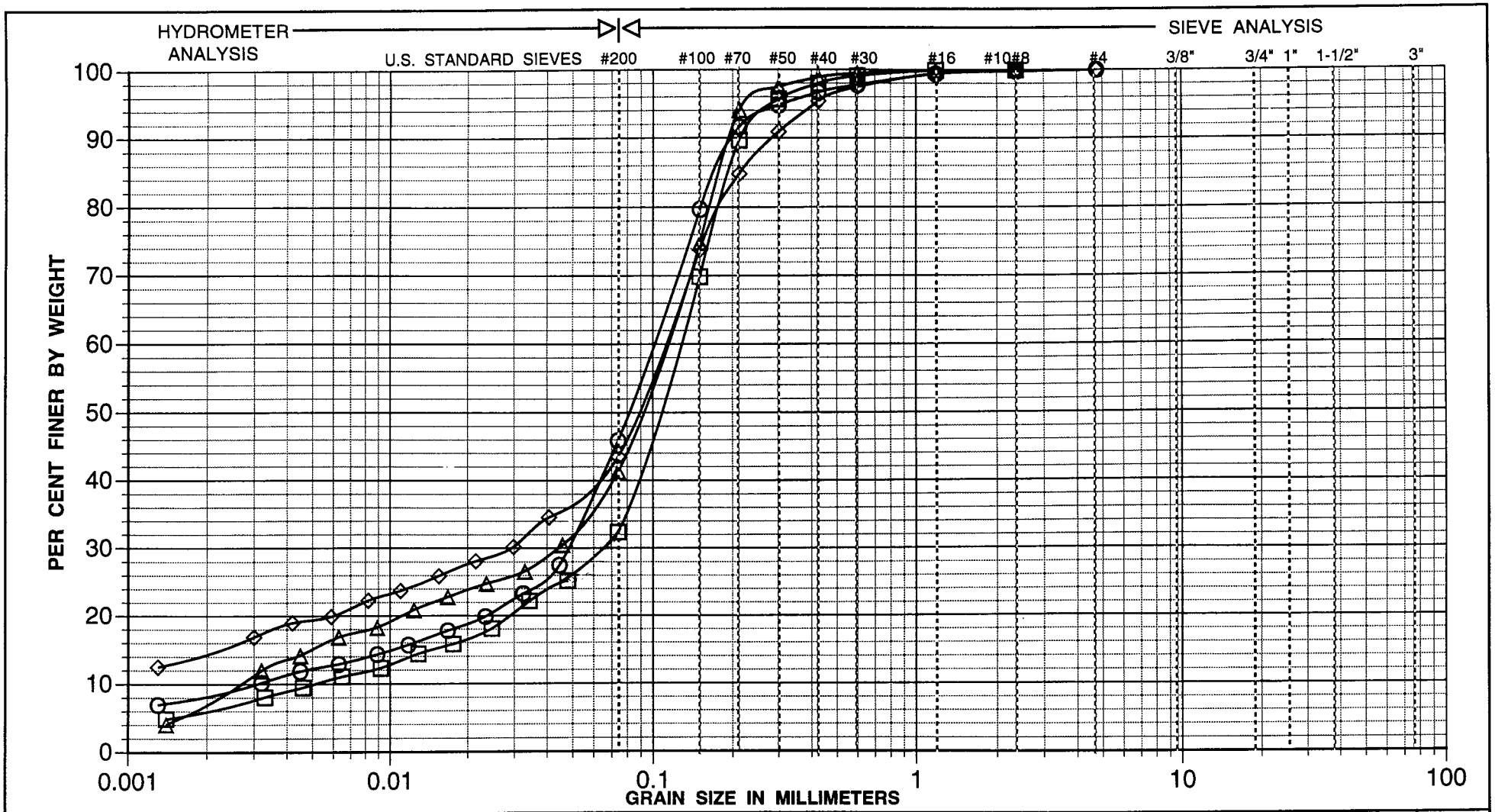
GRADATION CURVES
STRATA Es & Ec

PLATE NO. 6



UNIFIED SOILS CLASSIFICATION	CLAY OR SILT	SAND			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	

SYMBOL	BORING	SAMPLE	DESCRIPTION OF SAMPLE
○	YB-2U	15U	STRATUM Ms
□	YB-4U	12D	
△	YB-5	10D	
◇	YB-6U	12U	

PLATE NO. 7

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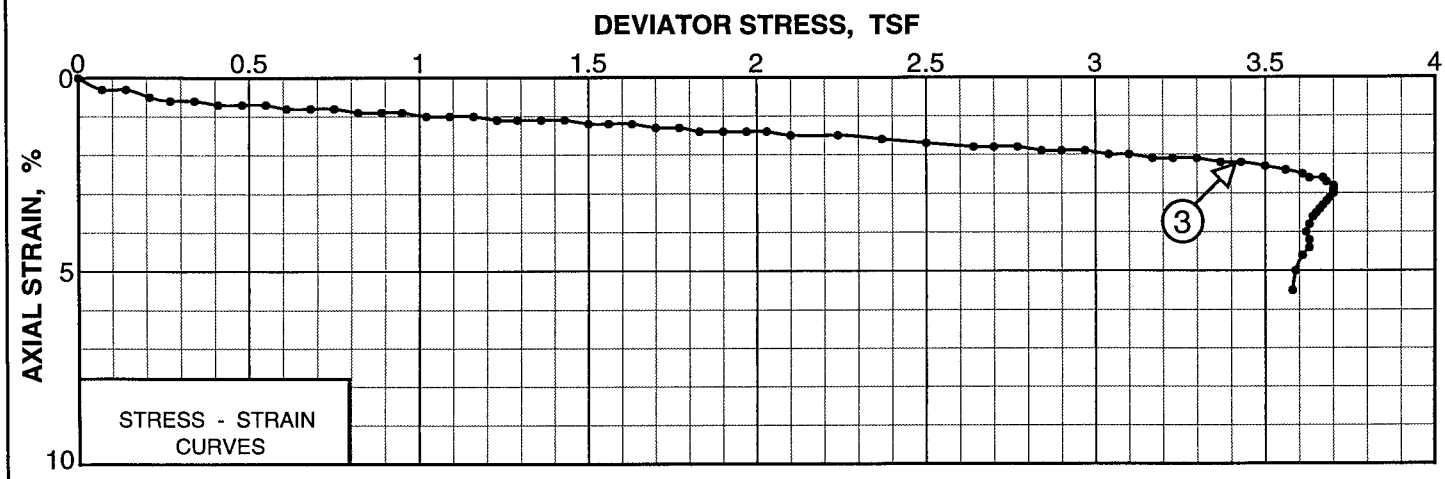
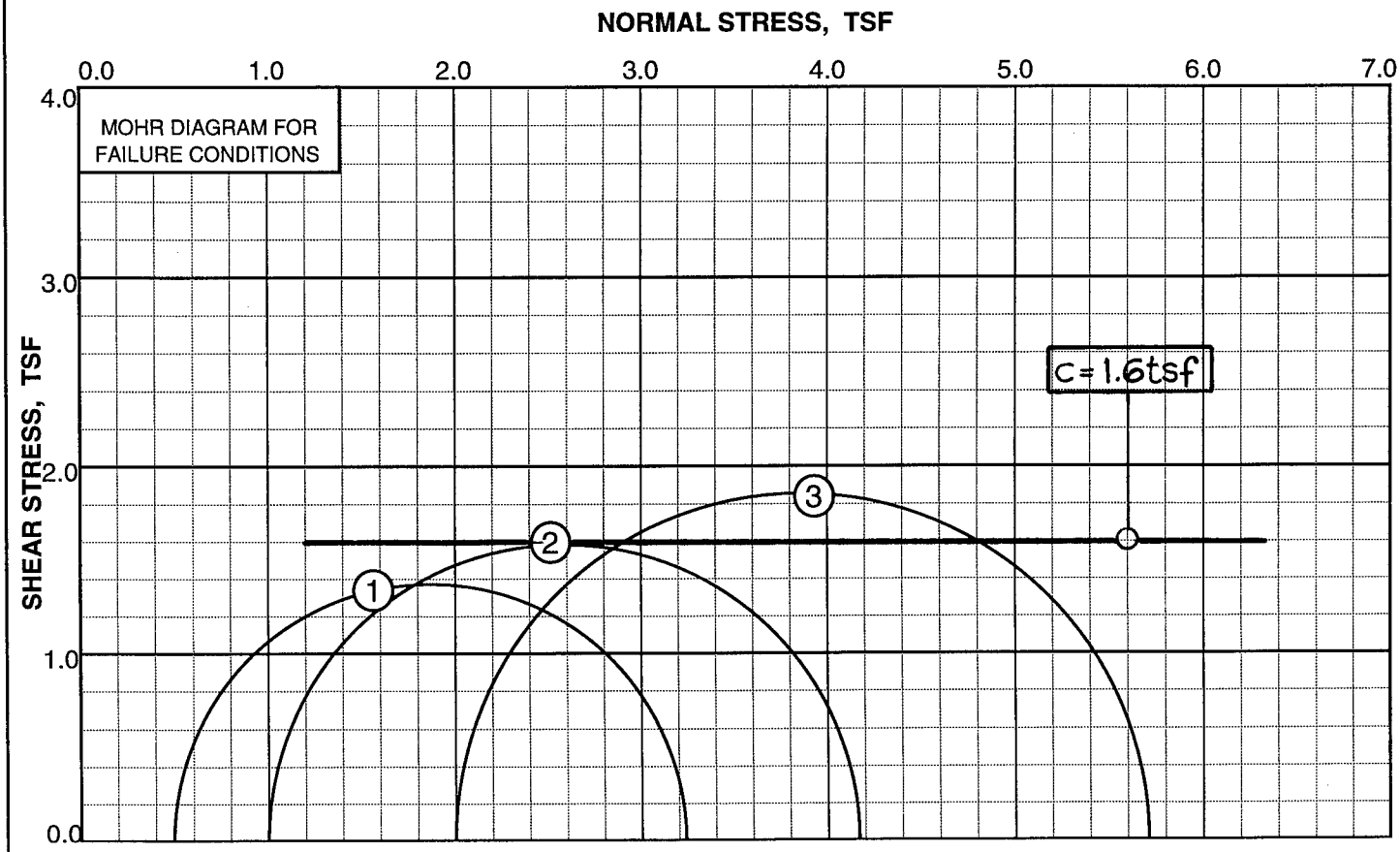
GRADATION CURVES
STRATUM Ms

PLATE NO. 7





DESCRIPTION OF MATERIAL TESTED	SYMBOLS FOR TEST TYPES
VERY STIFF GRAY GREEN CLAYEY SILT, SOME FINE SAND, TRACE FINE SAND LAYERS AND POCKETS STRATUM (Ec)	Q- UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE TSF	WATER CONTENT-%		DEGREE OF SATURATION-%		DEVIATOR STRESS TSF	AXIAL STRAIN %
						INITIAL	FINAL	INITIAL	FINAL		
1	YB-8U	11U	MH	Q	0.5	89	90			2.74	2.9
2	YB-8U	11U	MH	Q	1.0	86	87			3.17	1.8
3	YB-8U	11U	MH	Q	2.0	94	95			3.71	2.8

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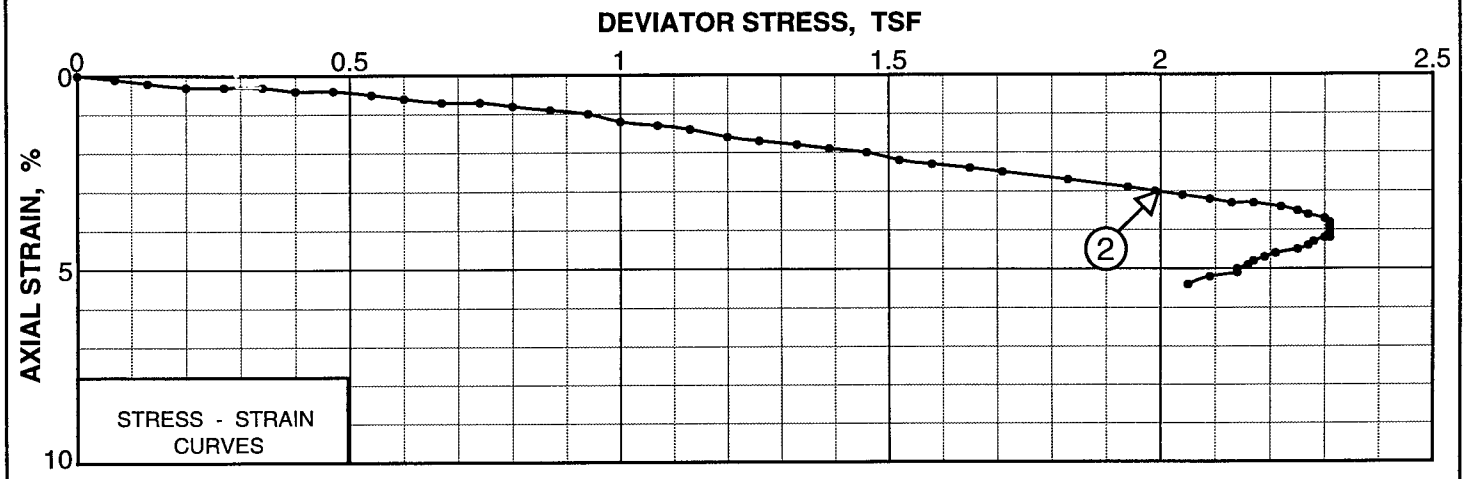
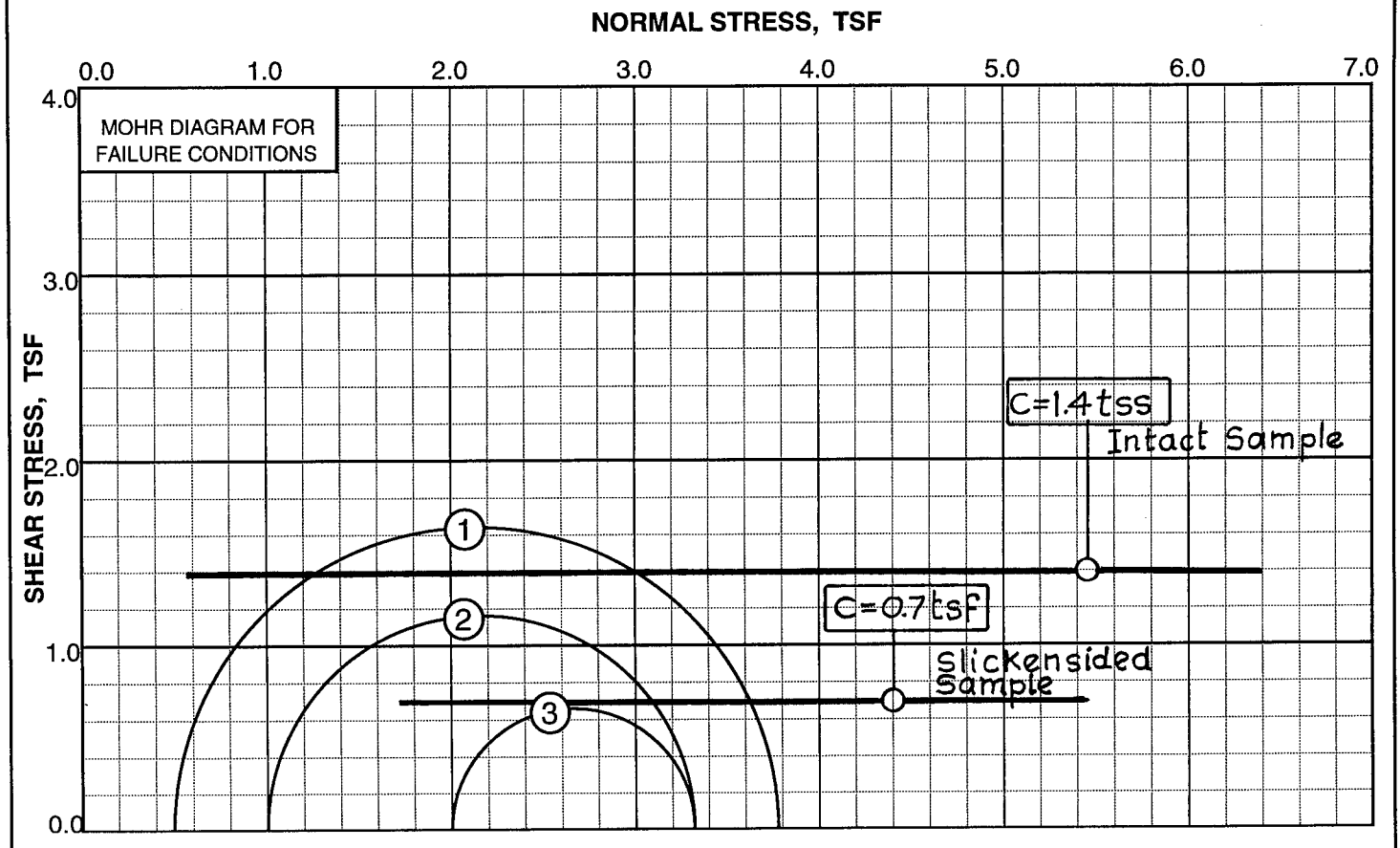
SUMMARY OF STRENGTH TESTS BORING NO. YB-8U		PLATE NO. 8





DESCRIPTION OF MATERIAL TESTED	SYMBOLS FOR TEST TYPES
VERY STIFF TO STIFF GRAY CLAY , TRACE FINE SAND, FINE SAND SEAMS AND POCKETS, SILT POCKETS, MICA, SHELLS STRATUM Ec	Q- UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE TSF	WATER CONTENT-%		DEGREE OF SATURATION-%		DEVIATOR STRESS TSF	AXIAL STRAIN %
						INITIAL	FINAL	INITIAL	FINAL		
1	YB-23U	7U	CH	Q	0.5	47	47			3.28	1.5
2	YB-23U	7U	CH	Q	1.0	45	45			2.32	3.8
3	YB-32U	7U	CH	Q	2.0	48	47			1.32 *	1.6

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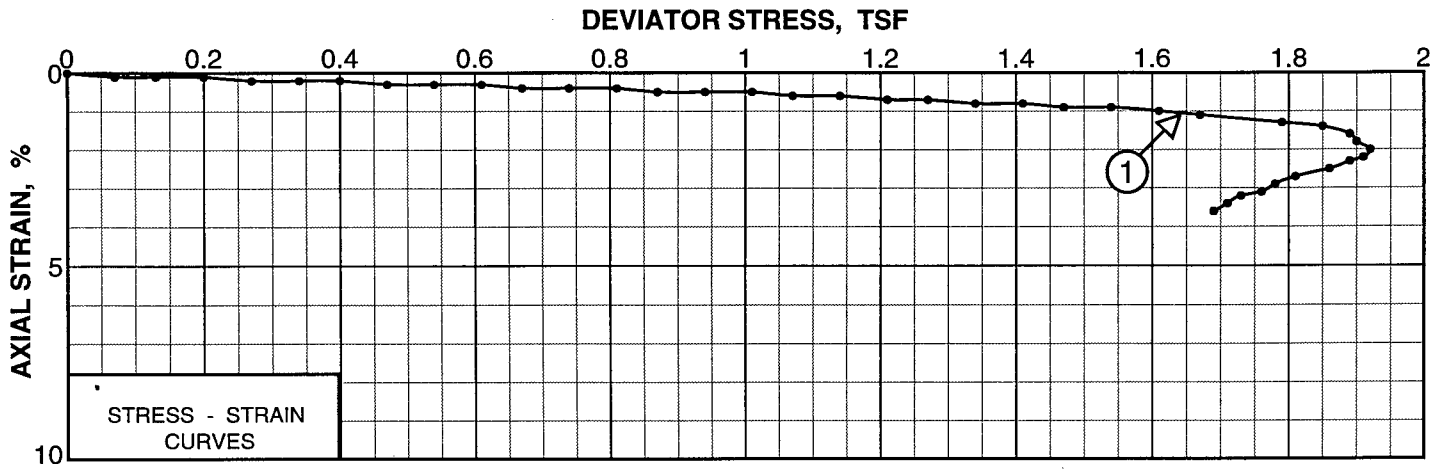
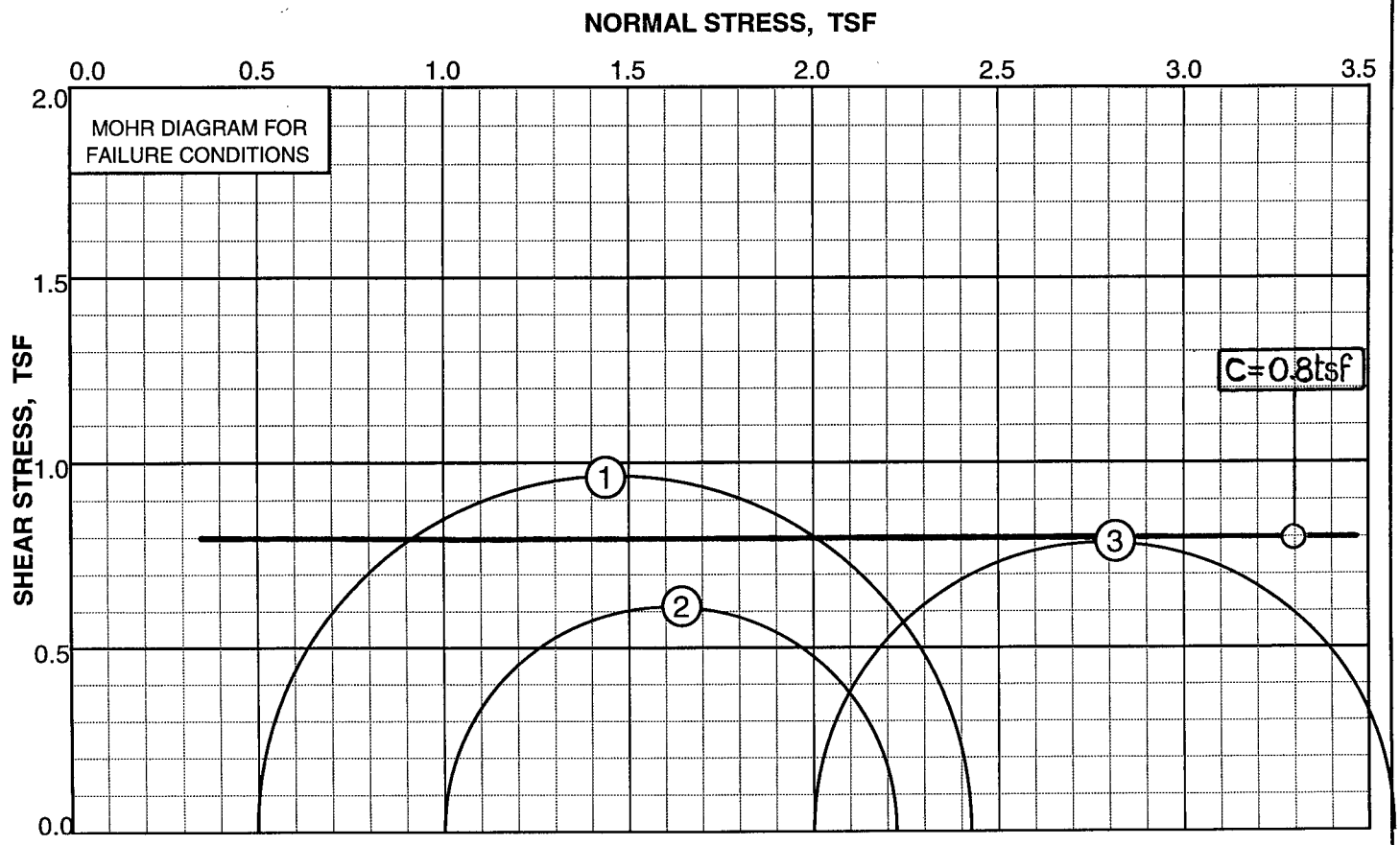
SUMMARY OF STRENGTH TESTS	PLATE NO.
BORING NO. YB-23U & YB-32U	9

* SAMPLE FAILED ON SLICKENSIDED PLANE





DESCRIPTION OF MATERIAL TESTED	SYMBOLS FOR TEST TYPES
STIFF GRAY CLAY, TRACE FINE SAND, MICA STRATUM (Ec)	Q- UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE TSF	WATER CONTENT-% INITIAL	WATER CONTENT-% FINAL	DEGREE OF SATURATION-% INITIAL	DEGREE OF SATURATION-% FINAL	DEVIATOR STRESS TSF	AXIAL STRAIN %
1	YB-24U	7U	CH	Q	0.5	40	40			1.93	2.0
2	YB-24U	7U	CH	Q	1.0	43	43			1.22 *	3.6
3	YB-24U	7U	CH	Q	2.0	44	44			1.57 *	2.4

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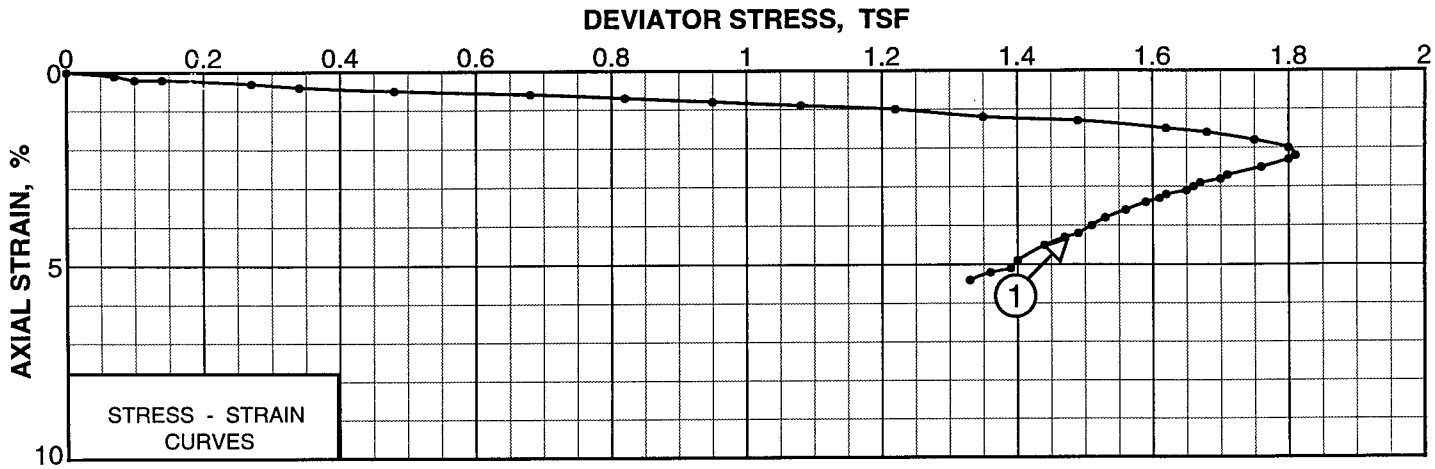
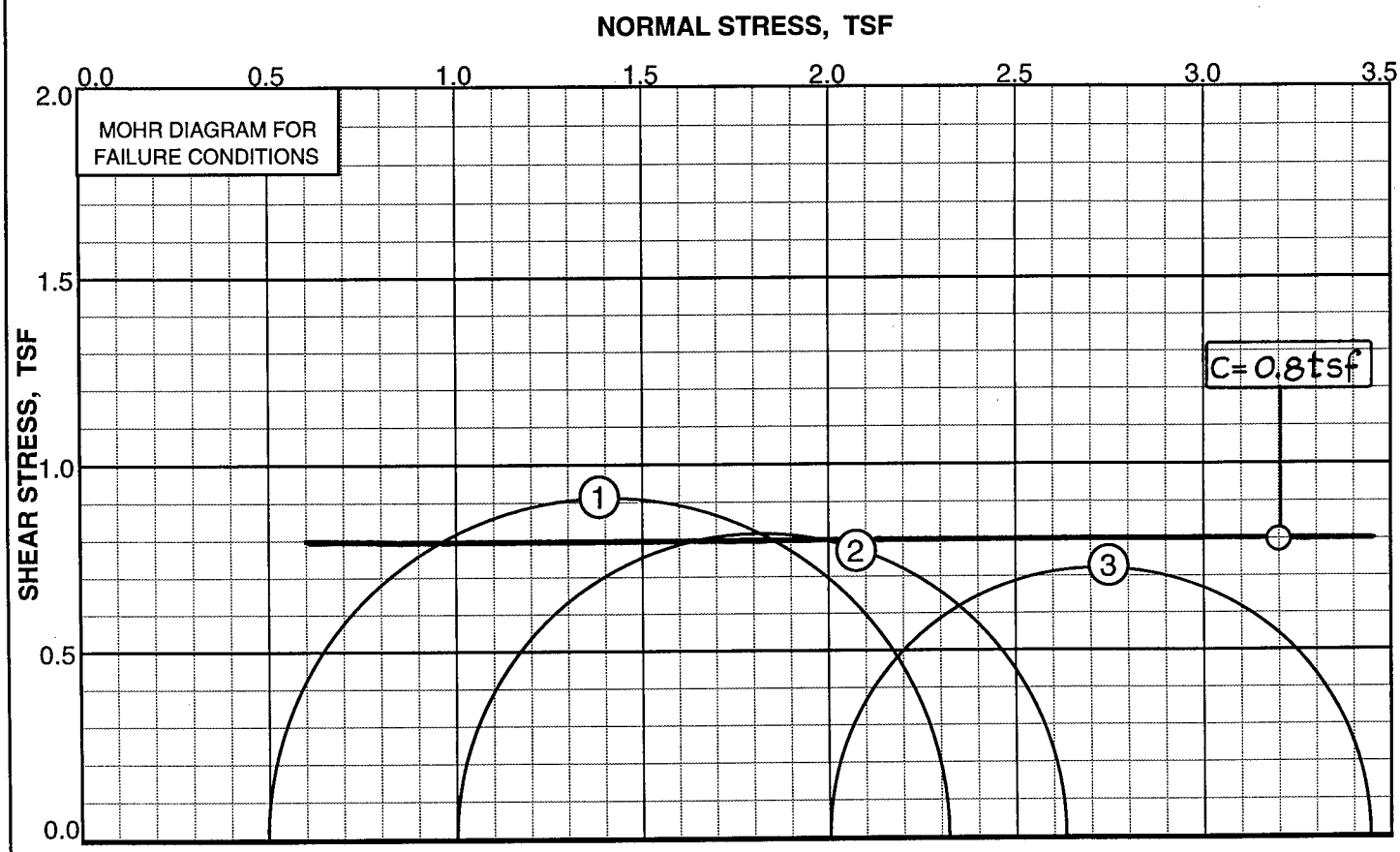
SUMMARY OF STRENGTH TESTS	PLATE NO.
BORING NO. YB-24U	10

* SAMPLE FAILED ON SLICKENSIDED PLANE





DESCRIPTION OF MATERIAL TESTED	SYMBOLS FOR TEST TYPES
STIFF GRAY CLAY, TRACE FINE SAND STRATUM (Ec)	Q- UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE TSF	WATER CONTENT-%		DEGREE OF SATURATION-%		DEVIATOR STRESS TSF	AXIAL STRAIN %
						INITIAL	FINAL	INITIAL	FINAL		
1	YB-27U	6U	CH	Q	0.5	42	42			1.82	2.2
2	YB-27U	6U	CH	Q	1.0	41	40			1.63 *	4.0
3	YB-27U	6U	CH	Q	2.0	44	44			1.44	4.0

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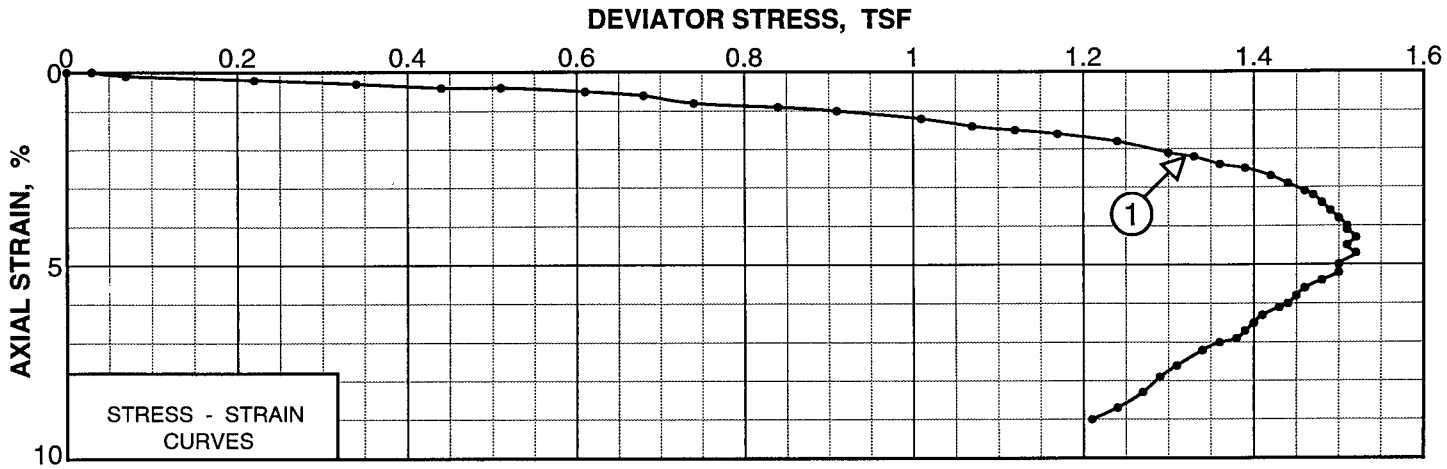
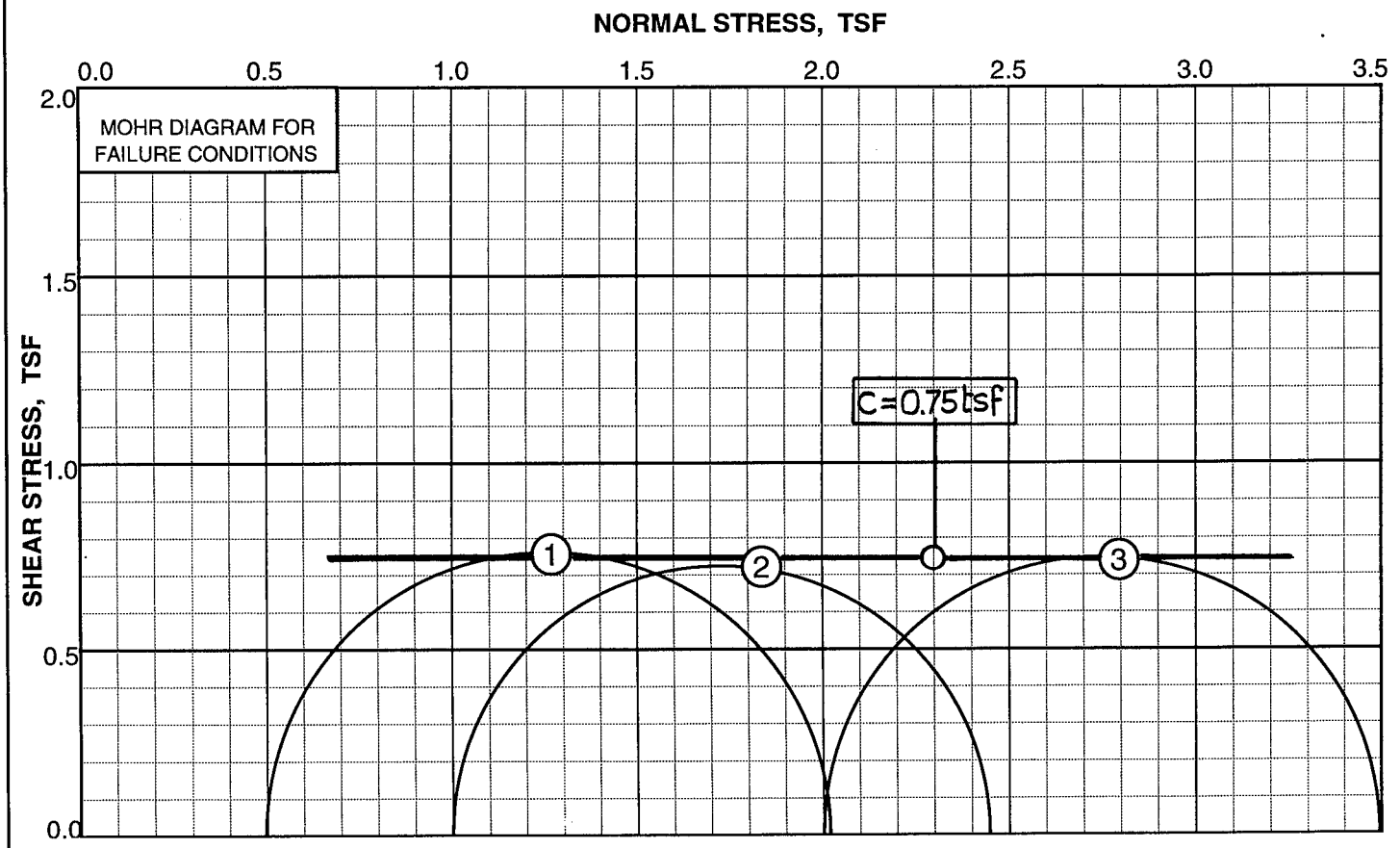
SUMMARY OF STRENGTH TESTS
BORING NO. YB-27U

PLATE NO. 11

* SAMPLE FAILED ON SLICKENSIDED PLANE





DESCRIPTION OF MATERIAL TESTED	SYMBOLS FOR TEST TYPES
STIFF GRAY CLAY, TRACE MICA, SILT POCKETS STRATUM (Ec)	Q- UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE TSF	WATER CONTENT-%		DEGREE OF SATURATION-%		DEVIATOR STRESS TSF	AXIAL STRAIN %
						INITIAL	FINAL	INITIAL	FINAL		
1	YB-31U	7U	CH	Q	0.5	46	46			1.52 *	4.3
2	YB-31U	7U	CH	Q	1.0	44	44			1.45 *	2.7
3	YB-31U	7U	CH	Q	2.0	48	48			1.49 *	2.0

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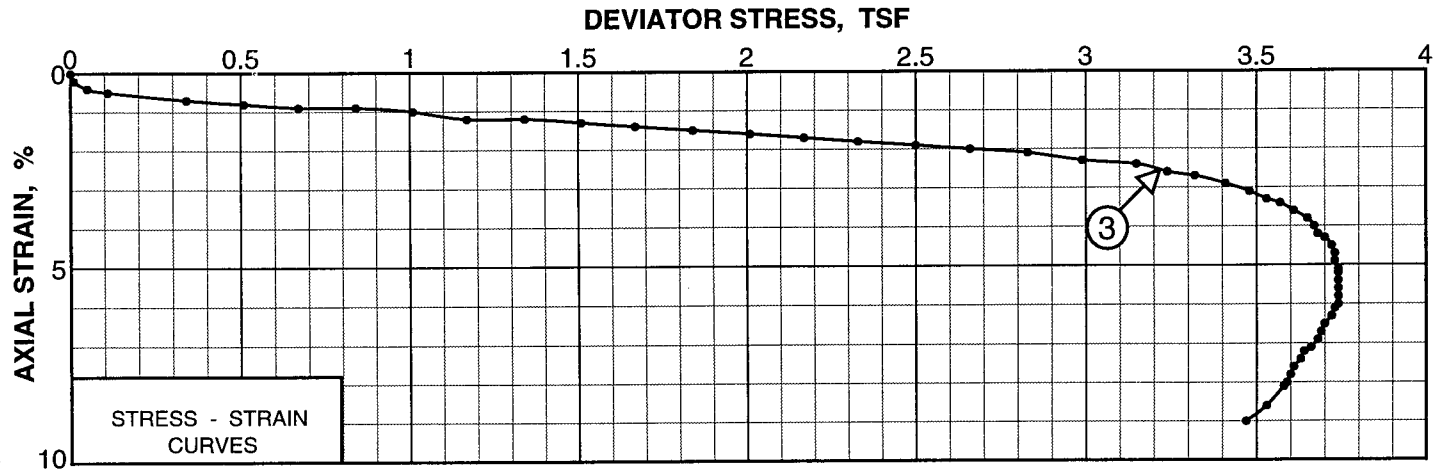
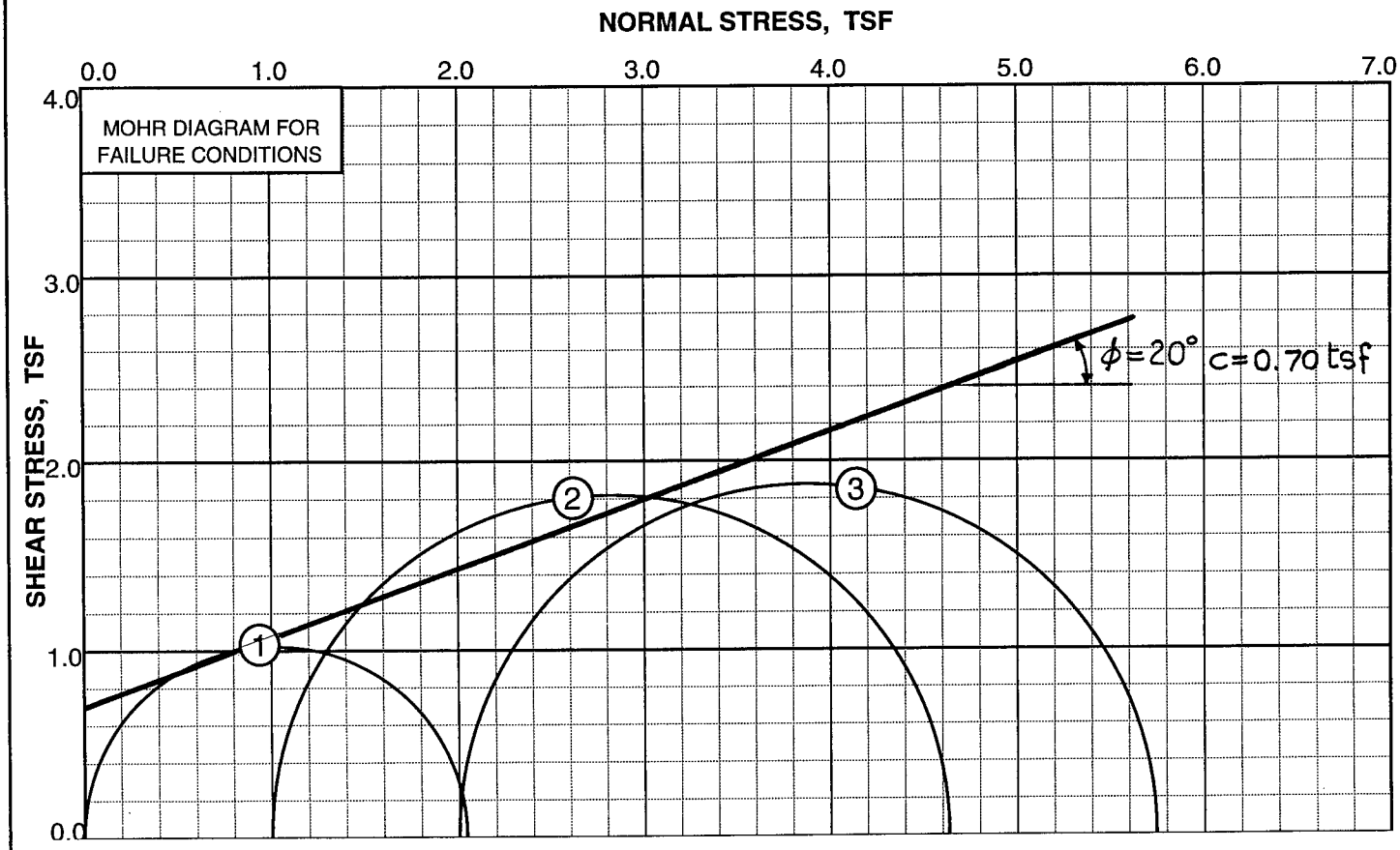
MADE BY: MC	DATE: 7-7-97	FILE NO. 8540
CH'KD BY: AAA	DATE: 7-14-97	

SUMMARY OF STRENGTH TESTS — PLATE NO. 12

BORING NO. YB-31U

* SAMPLES FAILED ON SLICKENSIDED PLANES





DESCRIPTION OF MATERIAL TESTED											
GRAY GREEN SILTY FINE SAND, TRACE CLAY STRATUM (Es)											
KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE TSF	WATER CONTENT-%		DEGREE OF SATURATION-%		DEVIATOR STRESS TSF	AXIAL STRAIN %
						INITIAL	FINAL	INITIAL	FINAL		
1	YB-2U	12U	SM-SC	U	0	35	35			2.04	10.4
2	YB-2U	12U	SM-SC	Q	1.0	36	35			3.64	5.4
3	YB-2U	12U	SM-SC	Q	2.0	31	31			3.74	5.1

SYMBOLS FOR TEST TYPES

U- UNCONFINED COMPRESSION TEST

Q- UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

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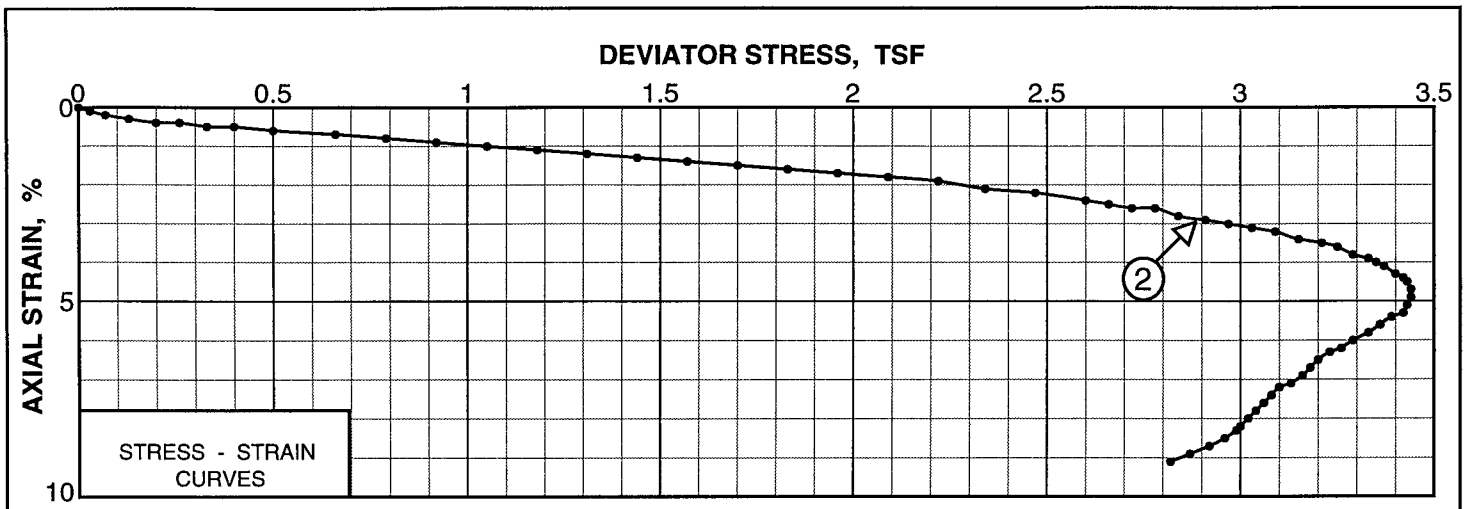
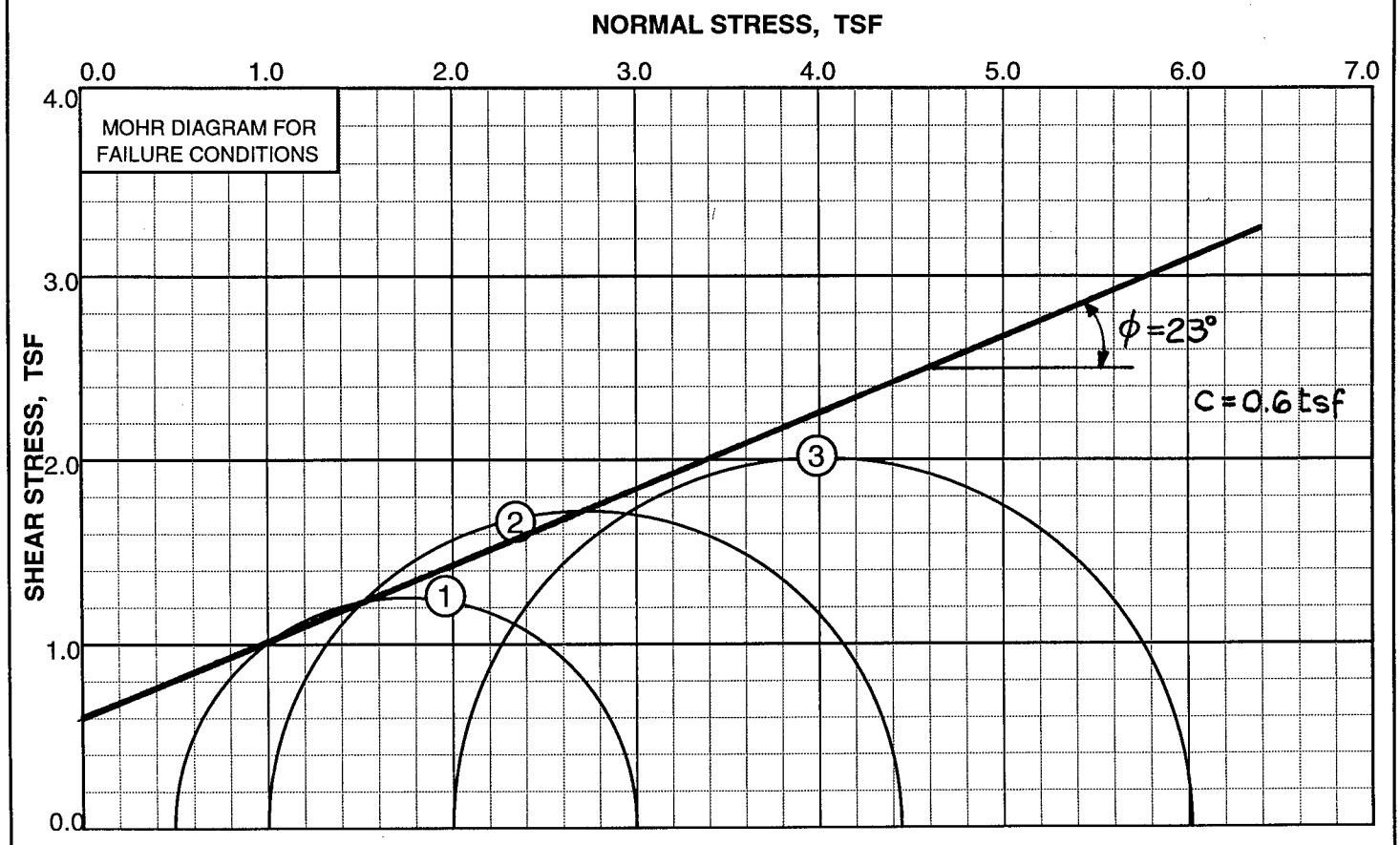
708 THIRD AVENUE, NEW YORK, N.Y. 10017

MADE BY: MC	DATE: 7-7-97	FILE NO. 8540
CH'KD BY: AAA	DATE: 7-14-97	

SUMMARY OF STRENGTH TESTS
BORING NO. YB-2U

PLATE NO. 13





DESCRIPTION OF MATERIAL TESTED	SYMBOLS FOR TEST TYPES
GRAY GREEN SILTY FINE SAND, TRACE CLAY, MEDIUM SAND, CLAY POCKETS STRATUM Es	Q- UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE TSF	WATER CONTENT-%		DEGREE OF SATURATION-%		DEVIATOR STRESS TSF	AXIAL STRAIN %
						INITIAL	FINAL	INITIAL	FINAL		
1	YB-6U	9U	SM-SC	Q	0.5	31	31			2.50	6.2
2	YB-6U	9U	SM-SC	Q	1.0	29	29			3.44	4.7
3	YB-6U	9U	SM-SC	Q	2.0	32	32			4.02	4.7

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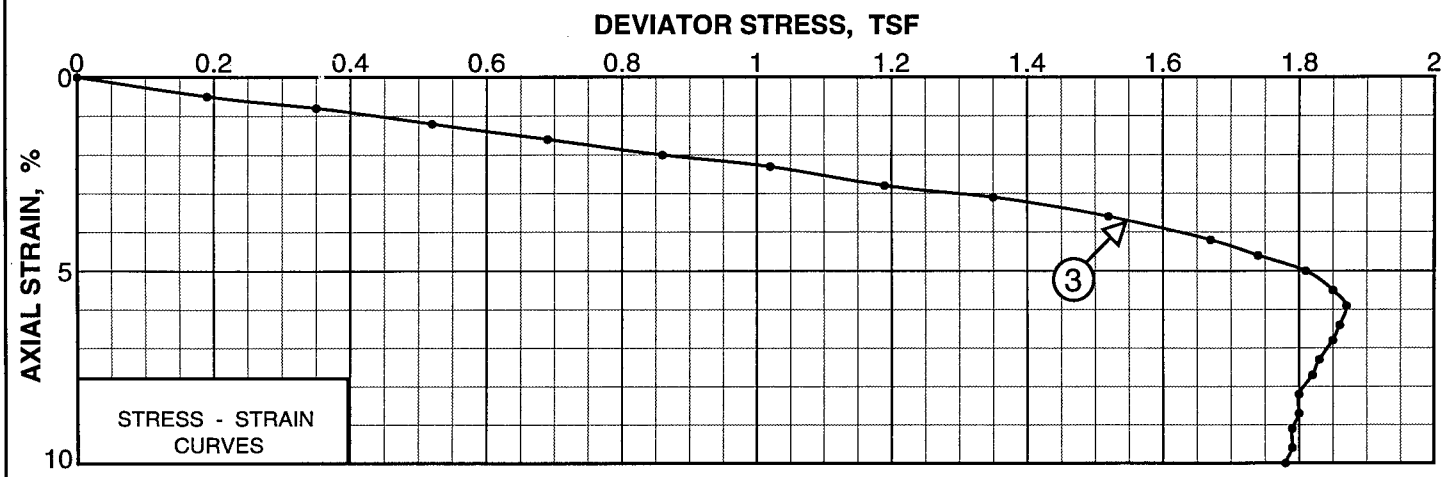
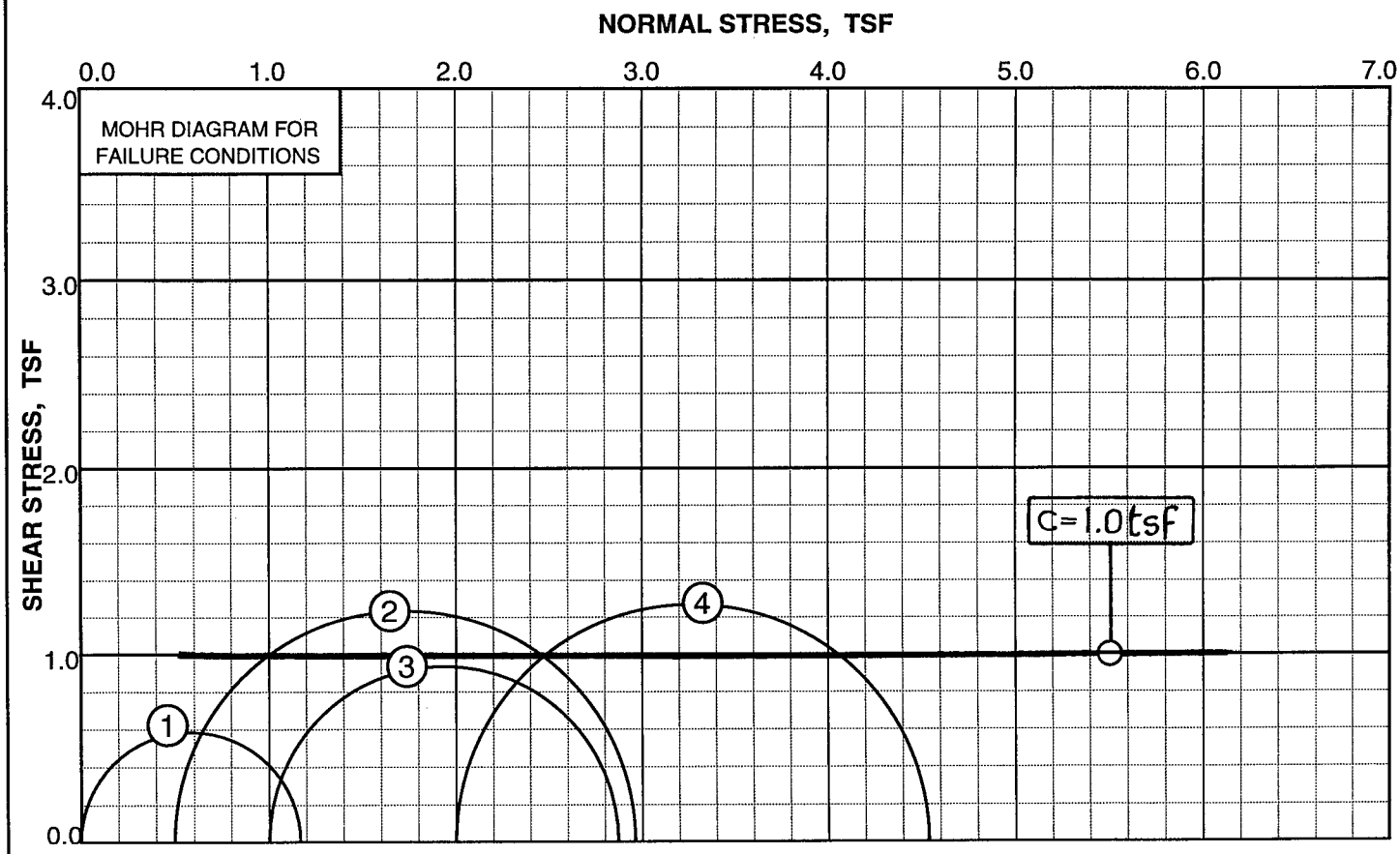
SUMMARY OF STRENGTH TESTS
BORING NO. YB-6U

PLATE NO. 14





DESCRIPTION OF MATERIAL TESTED	SYMBOLS FOR TEST TYPES
GRAY GREEN SAND, SOME SILT AND SILTY FINE SAND, TRACE CLAY, CLAY POCKETS STRATUM Es	U- UNCONFINED COMPRESSION TEST Q- UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE TSF	WATER CONTENT-%		DEGREE OF SATURATION-%		DEVIATOR STRESS TSF	AXIAL STRAIN %
						INITIAL	FINAL	INITIAL	FINAL		
1	YB-21U	15U	SM	U	0	38	38			1.17	17.7
2	YB-21U	13U	SM-SC	Q	0.5	38	38			2.47	3.6
3	YB-21U	13U	SM-SC	Q	1.0	35	35			1.87	5.9
4	YB-21U	15U	SM	Q	2.0	39	38			2.54	6.4

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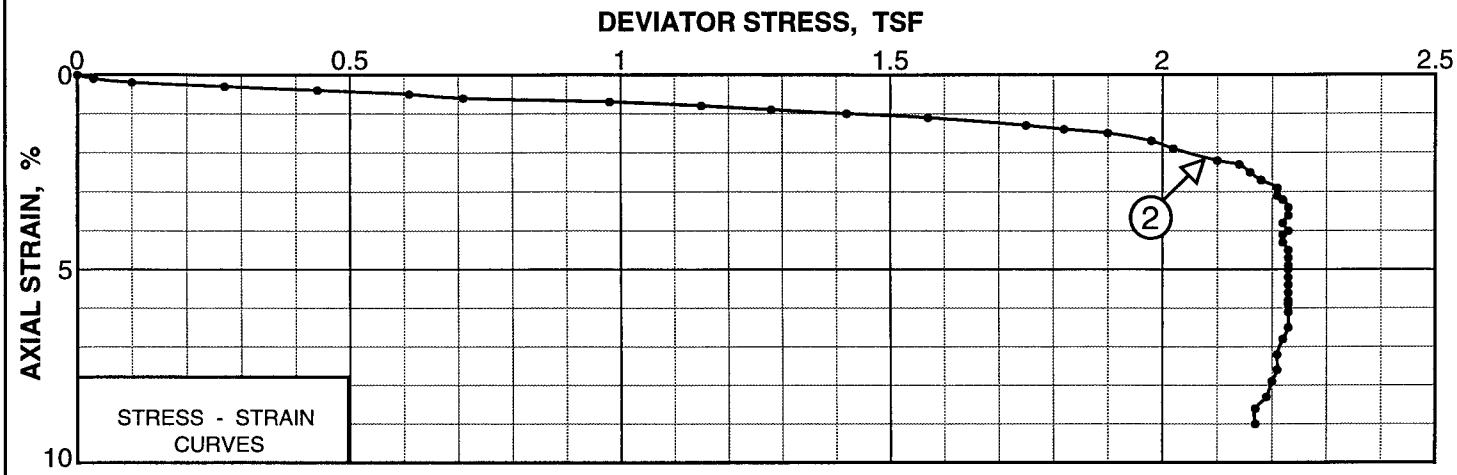
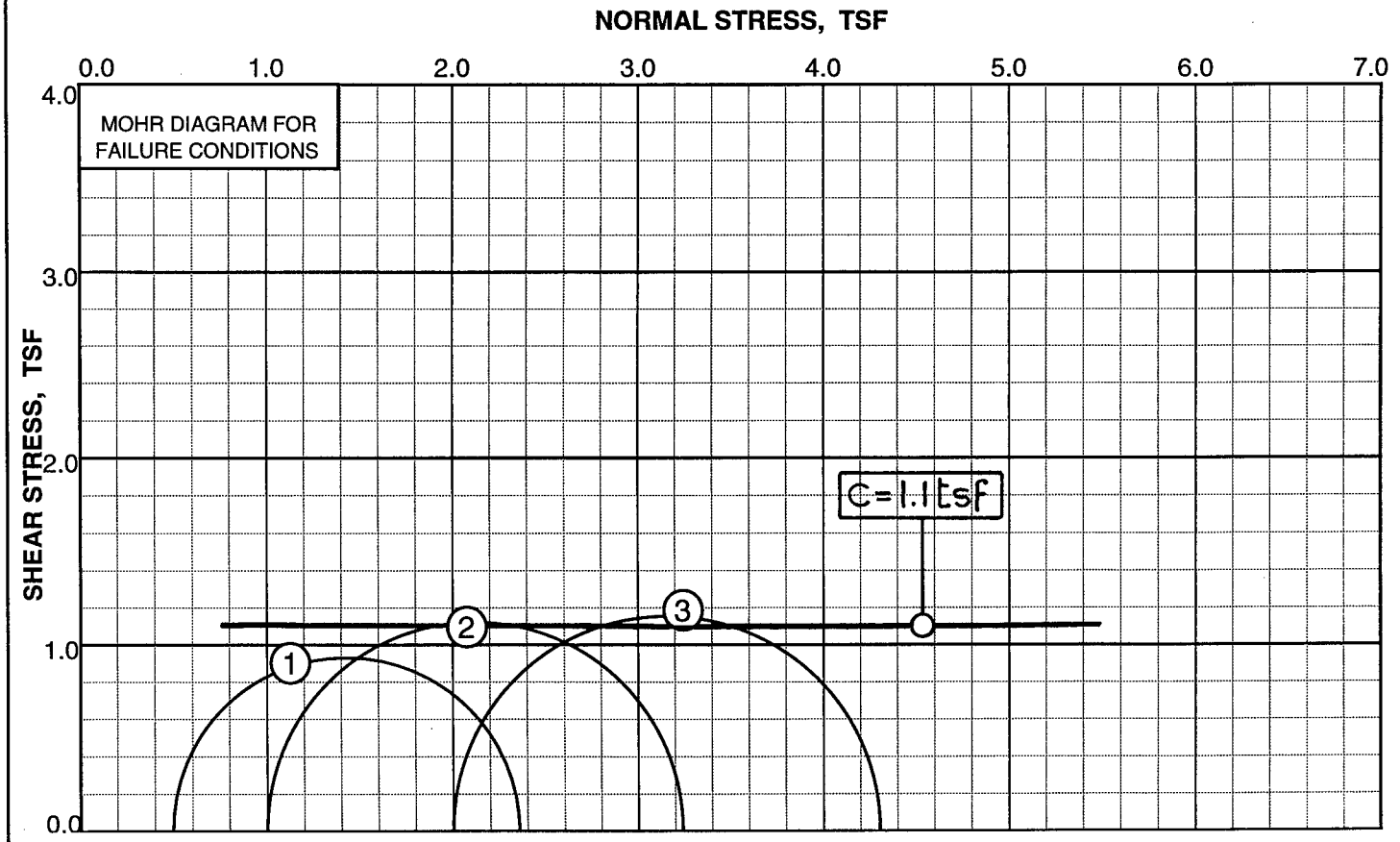
SUMMARY OF STRENGTH TESTS BORING NO. YB-21U		PLATE NO. 15





DESCRIPTION OF MATERIAL TESTED											
GRAY GREEN SILTY FINE SAND, SOME CLAY, TRACE FINE SAND SEAMS STRATUM Es											
KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE TSF	WATER CONTENT-%		DEGREE OF SATURATION-%		DEVIATOR STRESS TSF	AXIAL STRAIN %
						INITIAL	FINAL	INITIAL	FINAL		
1	YB-27U	10U	SM-SC	Q	0.5	41	41			1.86	6.7
2	YB-27U	10U	SM-SC	Q	1.0	42	42			2.24	3.4
3	YB-27U	10U	SM-SC	Q	2.0	33	33			2.30	10.4

SYMBOLS FOR TEST TYPES

Q- UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

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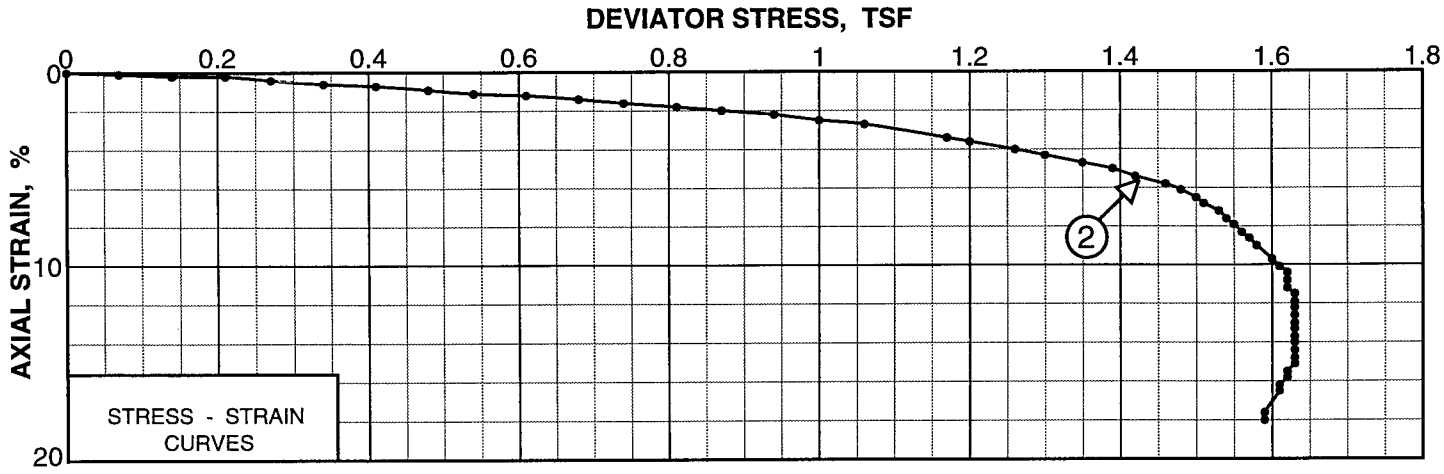
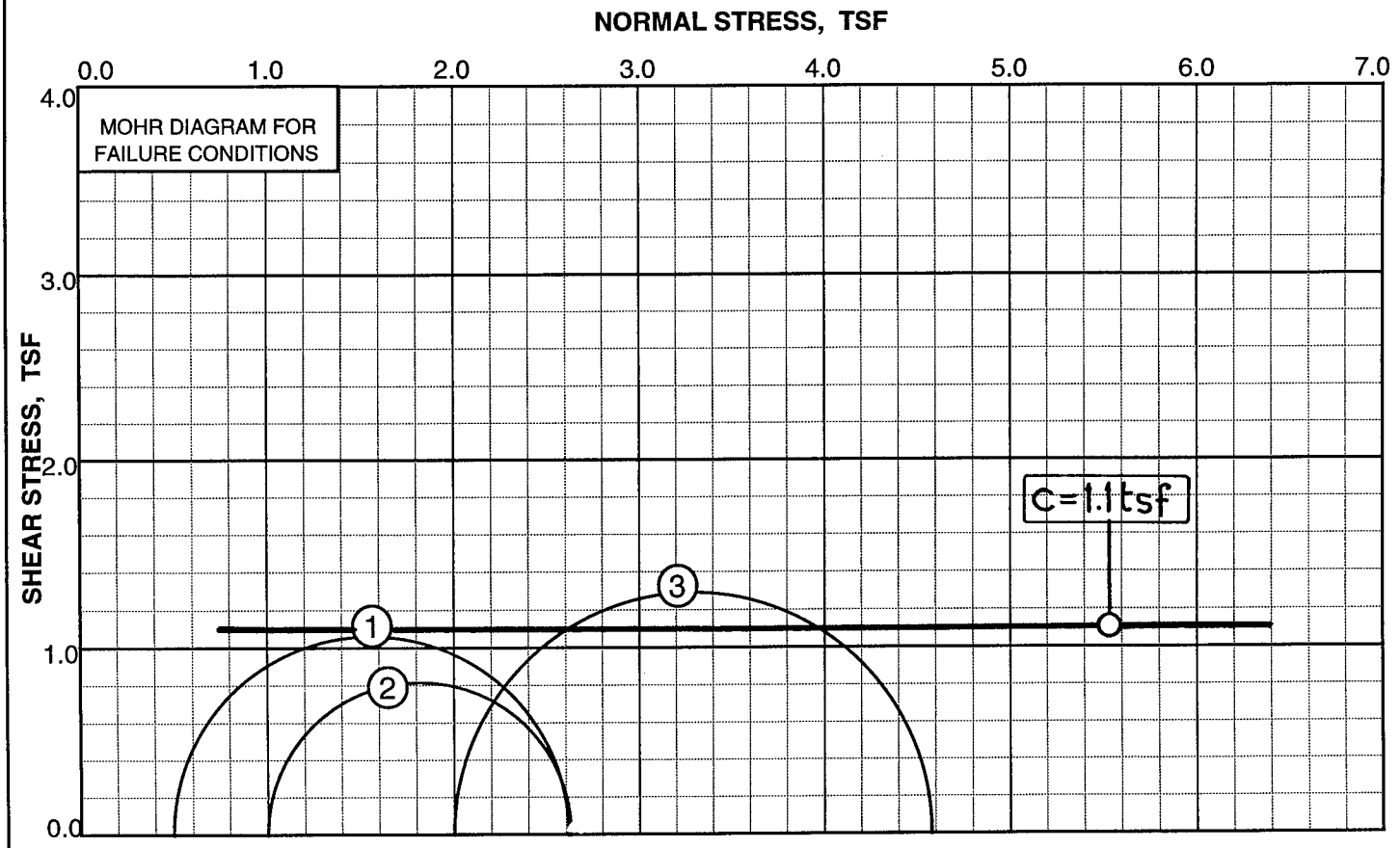
MADE BY: MC	DATE: 7-7-97	FILE NO.
CH'KD BY: AAA	DATE: 7-14-97	8540
SUMMARY OF STRENGTH TESTS		PLATE NO.
BORING NO. YB-27U		16





DESCRIPTION OF MATERIAL TESTED	SYMBOLS FOR TEST TYPES
GRAY FINE SAND, SOME SILT, TRACE CLAY, FINE SAND POCKETS STRATUM (Es)	Q- UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE TSF	WATER CONTENT-%		DEGREE OF SATURATION-%		DEVIATOR STRESS TSF	AXIAL STRAIN %
						INITIAL	FINAL	INITIAL	FINAL		
1	YB-32U	13U	SM-SC	Q	0.5	32	32			2.12	17.5
2	YB-32U	13U	SM-SC	Q	1.0	35	35			1.63	11.5
3	YB-32U	13U	SM-SC	Q	2.0	33	33			2.58	17.9

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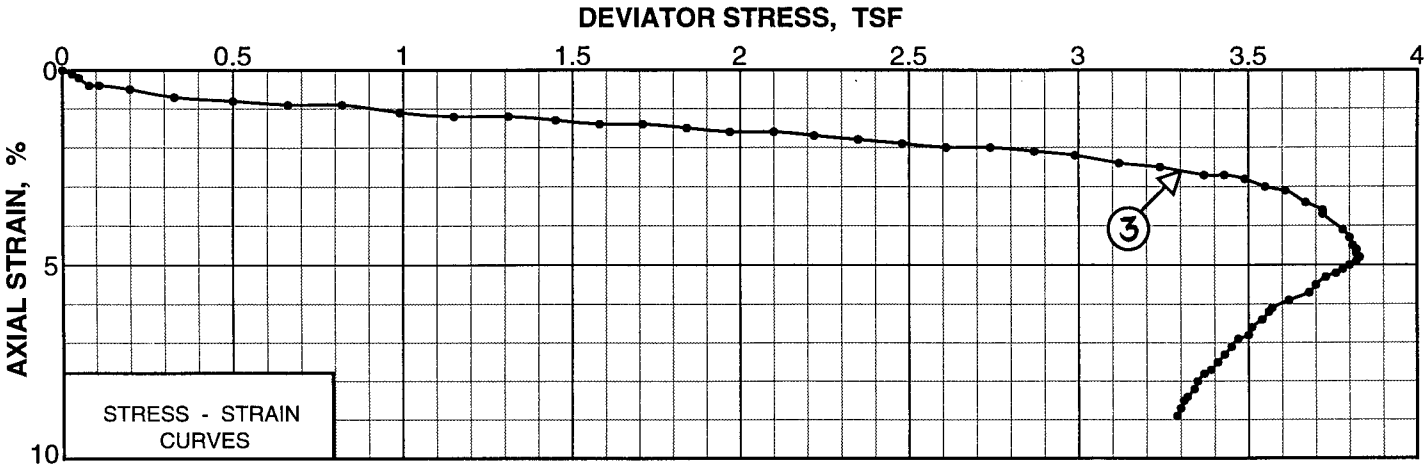
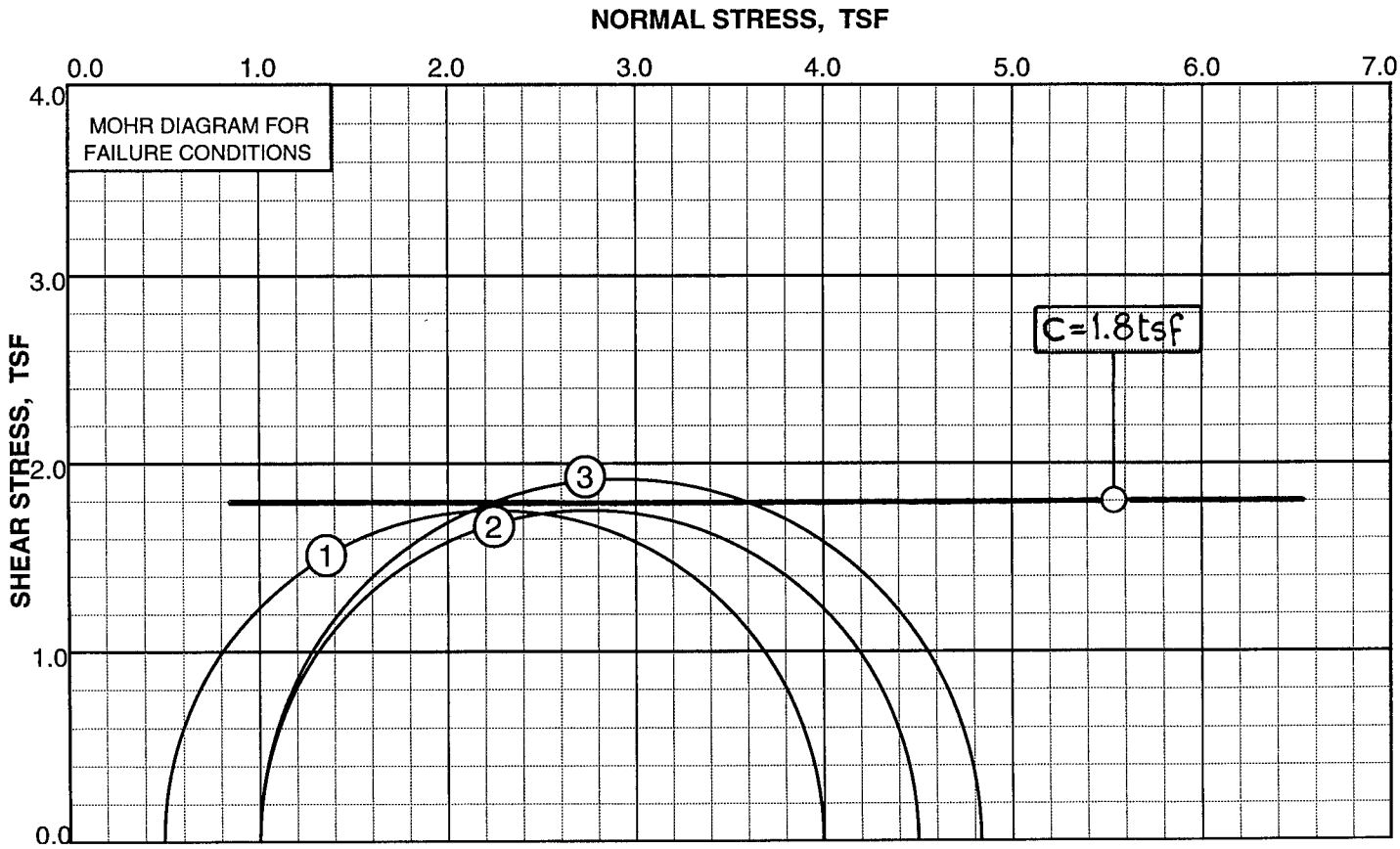
MADE BY: MC	DATE: 7-7-97	FILE NO. 8540
CH'KD BY: AAA	DATE: 7-14-97	

SUMMARY OF STRENGTH TESTS — PLATE NO. 17

BORING NO. YB-32U





DESCRIPTION OF MATERIAL TESTED											
GRAY SLIGHTLY ORGANIC MICACEOUS SILTY FINE SAND, TRACE CLAY, CEMENTED SAND STRATUM (Ms)											
KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE TSF	WATER CONTENT-%		DEGREE OF SATURATION-%		DEVIATOR STRESS TSF	AXIAL STRAIN %
						INITIAL	FINAL	INITIAL	FINAL		
1	YB-2U	15U	SM-SC	Q	0.5	30	30			3.50	2.1
2	YB-2U	15U	SM-SC	Q	1.0	29	30			3.50	6.3
3	YB-6U	12U	SM-SC	Q	1.0	29	29			3.83	4.8

SYMBOLS FOR TEST TYPES

Q- UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

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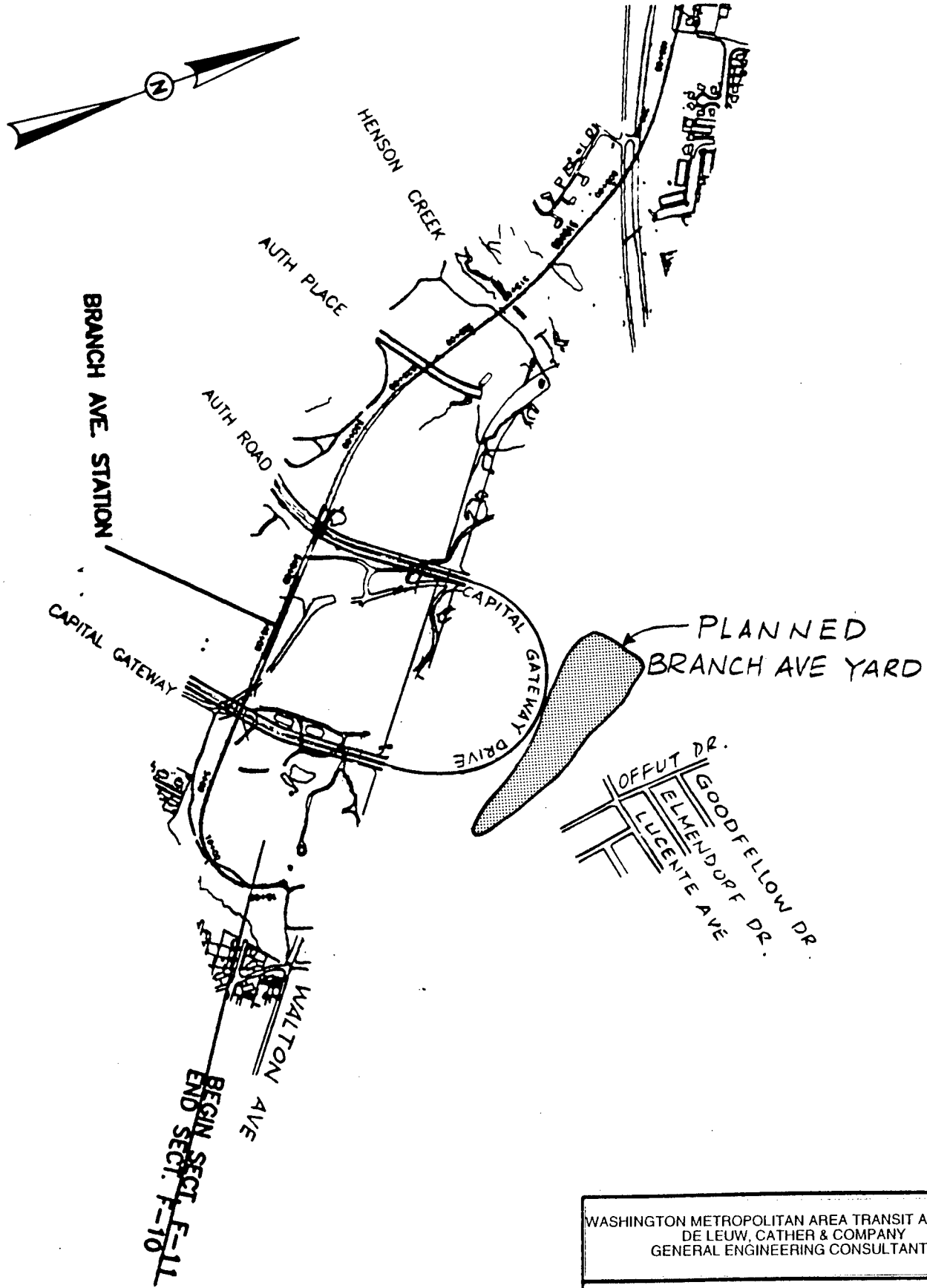
MADE BY: MC	DATE: 7-15-97	FILE NO. 8540
CH'KD BY: AAA	DATE: 7-15-97	
SUMMARY OF STRENGTH TESTS BORING NO. YB-2U & YB-6U		PLATE NO. 18



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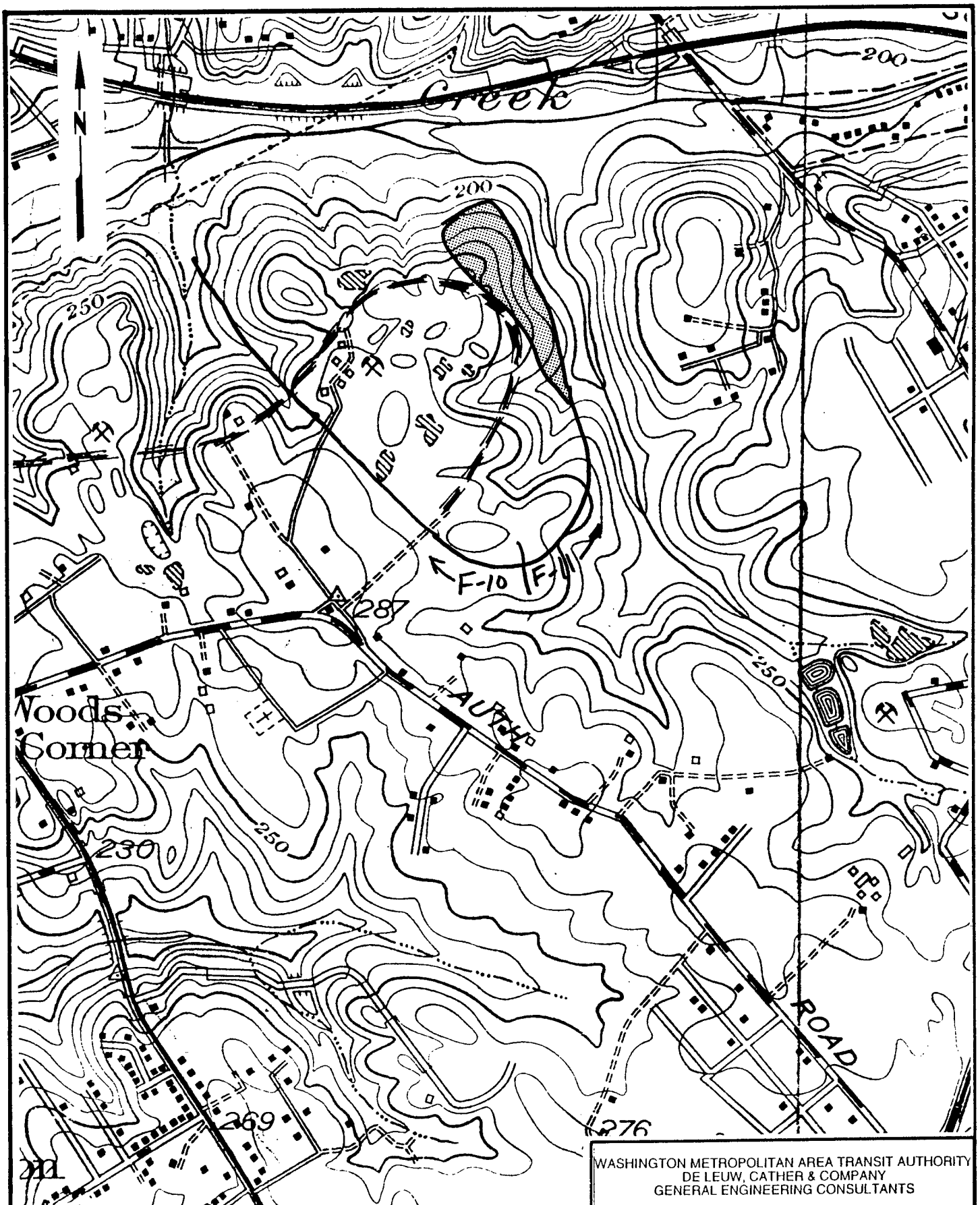
SCALE	MADE BY A.O.	DATE 7-97	FILE NO
NTS	CHKD BY	DATE	8737
GENERAL LOCATION PLAN			DRAWING NO SK-1



PORTION OF MAP TITLED:
USGS ANACOSTIA QUADRANGLE
CONTOUR INTERVAL 10FT-
MEAN SEA LEVEL DATUM

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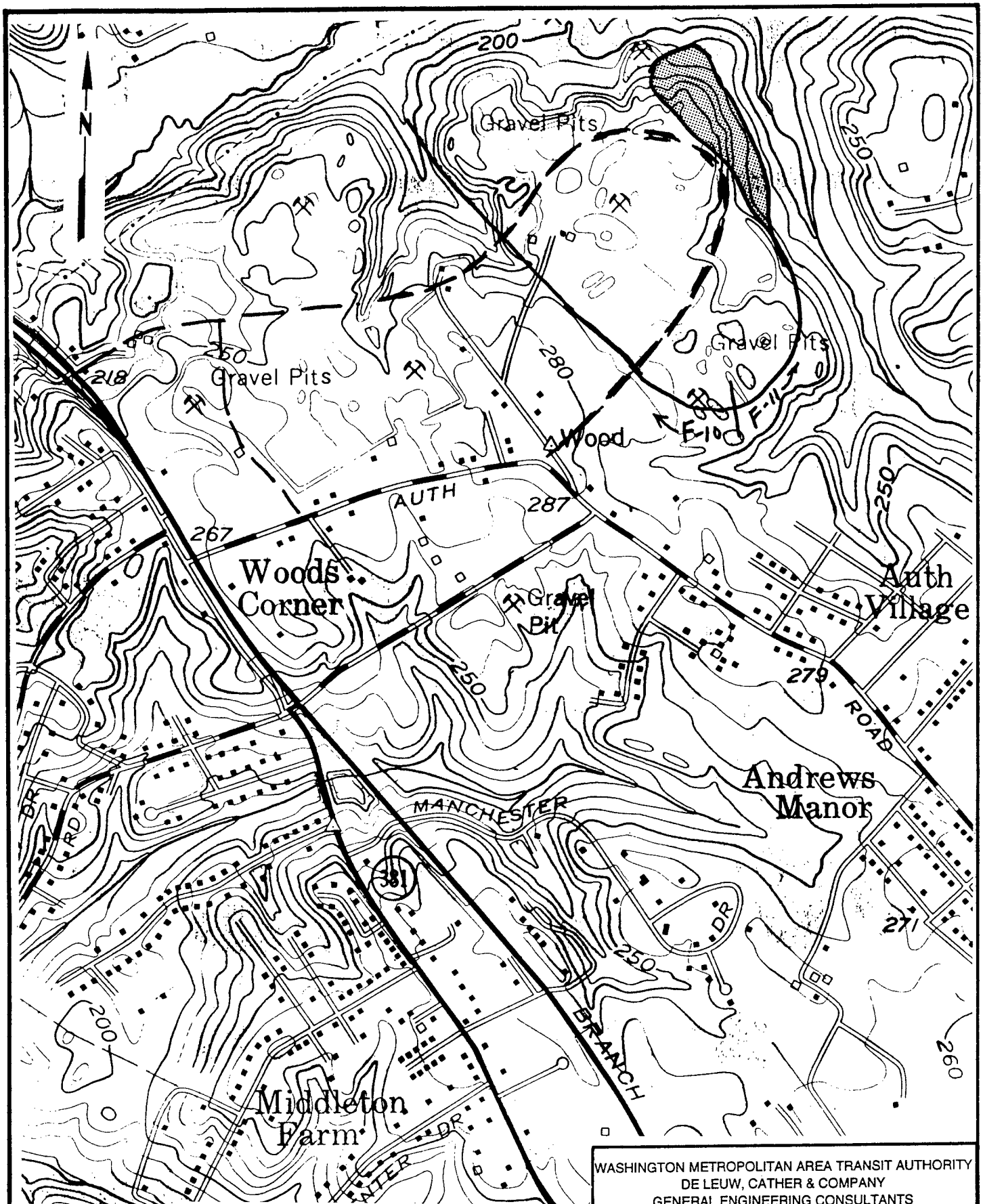
SCALE	MADE BY	DATE	FILE NO
1"=1000'	A.O.	7-97	8737
	CH'KD BY	DATE	DRAWING NO
TOPOGRAPHIC SURVEY OF SITE - 1951			SK-2



PORTION OF MAP TITLED:
USGS ANACOSTIA QUADRANGLE
CONTOUR INTERVAL 10FT-
MEAN SEA LEVEL DATUM

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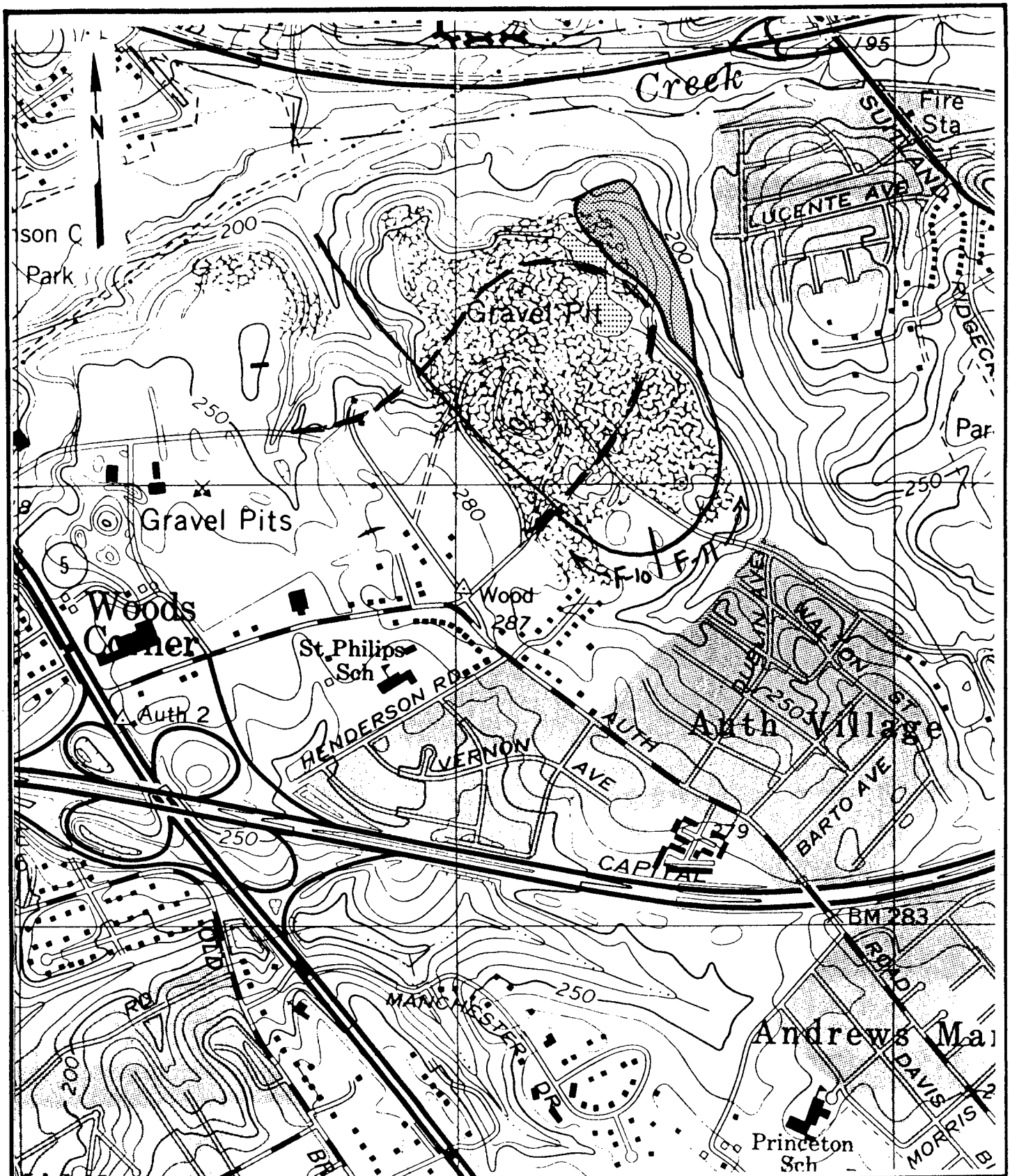
SCALE	MADE BY	DATE	FILE NO
1"=1000'	A.O.	7-97	8737
	CH'KD BY	DATE	DRAWING NO
TOPOGRAPHIC SURVEY OF SITE - 1956			SK-3



PORTION OF MAP TITLED:
USGS ANACOSTIA QUADRANGLE
CONTOUR INTERVAL 10FT., NGV 1929

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SCALE	MADE BY	DATE	FILE NO
1" = 1000'	A O	7-97	8737
	CH'KD BY	DATE	DRAWING NO
TOPOGRAPHIC SURVEY OF SITE - 1979			SK-4

GENERAL NOTES

THIS DRAWING CONTAINS REFERENCE INFORMATION FOR ANY SUBSURFACE INVESTIGATION PERFORMED FOR THE WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY (WMATA). SPECIFIC DETAILS WHICH PERTAIN TO INDIVIDUAL INVESTIGATIONS ARE CONTAINED ON BORING LOG DRAWINGS OR GEOLOGICAL SECTIONS IN A SERIES OF TECHNICAL REPORTS.

THE BORINGS WHOSE DETAILED LOGS ARE CONTAINED IN THESE REPORTS WERE MADE BY A BORING CONTRACTOR UNDER THE CONTINUOUS INSPECTION OF RESIDENT ENGINEERS OF MUESER, RUTLEDGE, WENTWORTH & JOHNSTON (MRWJ). THESE DETAILED LOGS WERE DERIVED FROM MRWJ FIELD BORING LOGS AFTER EXAMINATION AND CHECK OF SOIL CLASSIFICATION IN THE LABORATORY. SOIL DESCRIPTIONS MAY NOT AGREE WITH THE ORIGINAL MRWJ FIELD LOGS OR WITH THE BORING CONTRACTOR'S LOGS, COPIES OF WHICH ARE ON FILE AT WMATA. THESE SOURCES SHOULD BE CONSULTED FOR ADDITIONAL DETAILS REGARDING BORING OPERATIONS AND THE NATURE OF MATERIALS ENCOUNTERED.

SOIL SAMPLES AND ROCK CORES RECOVERED IN BORINGS MADE FOR WMATA WHICH REMAINED AFTER LABORATORY TESTING HAVE BEEN STORED IN WASHINGTON D.C. AT THE WMATA WAREHOUSE AND ARE AVAILABLE FOR INSPECTION.

ELEVATIONS SHOWN ON THE DRAWINGS OR NOTED ON THE BORING LOGS REFER TO USC&GS MEAN SEA LEVEL DATUM OF 1929, WHICH IS DESIGNATED AS PROJECT DATUM. COORDINATES LISTED FOR BORING LOCATIONS REFER TO THE COORDINATE SYSTEMS EMPLOYED ON THIS PROJECT WHICH GENERALLY COMPRISE THE MARYLAND STATE PLANE COORDINATE SYSTEM OR THE VIRGINIA STATE PLANE COORDINATE SYSTEM, ADJUSTED FOR SCALE AND ELEVATION TO THE PROJECT GRID.

THE PLAN AND PROFILE ON GEOLOGICAL SECTION DRAWINGS GENERALLY SHOW THE CENTERLINE OF THE SUBWAY OUTBOUND TRACK, STATIONING ON THAT CENTERLINE, THE POSITION OF TOP OF RAIL IN PROFILE, AND, IN SOME INSTANCES, THE TOP AND BOTTOM OF THE EXTERIOR OF THE SUBWAY STRUCTURE IN PROFILE. THESE DATA WERE OBTAINED FROM THE DE LEUW, CATHER AND COMPANY GENERAL PLANS WHICH WERE AVAILABLE AT THE DATE OF THE REPORT. THE SUBWAY PLAN AND PROFILE WHICH ARE SHOWN IN REPORTS MADE PRIOR TO CONSTRUCTION ARE SUBJECT TO CHANGE IN FINAL PLANS.

GEOLOGICAL SECTION DRAWINGS DEPICT THE OVERALL SUBSURFACE STRATIFICATION, DIVIDING MATERIALS INTO THE BROAD CATEGORIES LISTED UNDER "GENERALIZED STRATA DESCRIPTIONS". THE LINES SEPARATING STRATA ARE NECESSARILY INTERPOLATED BETWEEN BORINGS AND MAY OR MAY NOT REPRESENT ACTUAL SUBSURFACE CONDITIONS.

IN CERTAIN INSTANCES THE SUBSURFACE INVESTIGATIONS FOR WMATA HAVE UTILIZED BORING DATA AND REPORTS PREPARED BY OTHER ORGANIZATIONS FOR OTHER PROJECTS. COPIES OF THESE ORIGINAL DATA AND REPORTS ARE ON FILE AT WMATA AND SHOULD BE CONSULTED FOR FURTHER DETAILS.

THE GROUND WATER LEVELS NOTED ON THE DETAILED BORING LOGS AND PLOTTED ON THE GEOLOGICAL SECTIONS REPRESENT AVERAGE OR TYPICAL VALUES OBSERVED DURING THE PERIOD OF THE BORING OPERATION OR SHORTLY AFTER COMPLETION OF A BORE HOLE. THESE OBSERVATIONS MAY NOT REFLECT SEASONAL CHANGES IN THE WATER TABLE OR THE EFFECTS OF INTENSE RAINFALL OR RUNOFF. IN ANY EXCAVATION TRICKLING FLOW OR SEEPAGE MAY BE ENCOUNTERED FROM PERCHED WATER WHICH IS AT LEVELS ABOVE THE WATER TABLE OBSERVED IN THE BORINGS.

OBSERVATION WELLS OR PIEZOMETERS CONSISTING OF A STEEL OR PVC STANDPIPE WITH A PERFORATED INTAKE POINT MAY HAVE BEEN INSTALLED IN CERTAIN OF THE TEST BORINGS, AS NOTED ON THE BORING LOGS. MEASUREMENTS OF WATER LEVELS MAY HAVE BEEN MADE IN CERTAIN OF THESE STANDPIPES AT VARIOUS TIMES. THESE DATA ARE ON FILE AT WMATA AND SHOULD BE CONSULTED FOR AN INDICATION OF SEASONAL FLUCTUATIONS OF GROUND WATER LEVELS.

UNIFIED CLASSIFICATION SYSTEM

(MORE THAN HALF LARGER THAN NO.200 SIEVE)	GRAVELS AND GRAVELLY SOILS (MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO.4)	CLEAN (LESS THAN 5% SMALLER THAN NO.200)	GW	WELL GRADED GRAVEL, LITTLE OR NO FINES.
			GP	SINGLE-SIZE, NARROWLY GRADED GRAVEL, FEW FINES
			GP-GM	GRAVEL WITH MODERATE FINES, 5% TO 12% PASSING NO.200.
		DIRTY (MORE THAN 12% SMALLER THAN NO.200)	GM	SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURES.
			GC	CLAYEY GRAVEL, GRAVEL-SAND-CLAY MIXTURES.
			GM-GC	GRAVEL-SAND MIX WITH SILTY CLAY OR CLAYEY SILT FINES.
	SANDS AND SANDY SOILS (MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO.4)	CLEAN (LESS THAN 5% SMALLER THAN NO.200)	SW	WELL GRADED SAND, LITTLE OR NO FINES.
			SP	SINGLE-SIZE NARROWLY GRADED LEVEL, FEW FINES.
			SP-SM	SAND WITH MODERATE FINES, 5% TO 12% PASSING NO.200.
		DIRTY (MORE THAN 12% SMALLER THAN NO.200)	SM	SILTY SAND, SAND-SILT MIXTURES.
			SC	CLAYEY SAND, SAND-CLAY MIXTURES
			SM-SC	SAND WITH SILTY CLAY OR CLAYEY SILT FINES.
(MORE THAN HALF SMALLER THAN NO.200 SIEVE)	SILTS AND CLAYS LL<50	ML	INORGANIC SILT, ROCK FLOUR, CLAYEY SILT (LIMITS PLOT BELOW A-LINE)	
		CL	INORGANIC CLAY OF LOW TO MEDIUM PLASTICITY (LIMITS PLOT ABOVE A-LINE)	
		OL	ORGANIC SILT AND SILTY CLAY OF LOW PLASTICITY LIMITS PLOT BELOW A-LINE)	
	SILTS AND CLAYS LL>50	MH	INORGANIC SILT, SPONGY, TALCY, MICACEOUS SILT (LIMITS PLOT BELOW A-LINE)	
		CH	INORGANIC PLASTIC CLAY, TOUGH AND FAT CLAY (LIMITS PLOT ABOVE A-LINE)	
		OH	ORGANIC CLAY OF MEDIUM TO HIGH PLASTICITY (LIMITS PLOT BELOW A-LINE	
	PEAT AND HIGHLY ORGANIC	PT	PEAT, HIGHLY ORGANIC SOIL, SPONGY, COMPRESSIBLE, DARK COLOR, FIBROUS, DISTINCT ORGANIC ODOR (LIMITS PLOT BELOW A-LINE)	

NOTES AND LEGEND FOR PLANS AND GEOLOGICAL SECTIONS

SYMBOLS UTILIZED ON LOCATION PLANS AND STRIP MAPS

1. BORINGS MADE IN THIS INVESTIGATION FOR WMATA UNDER THE CONTINUOUS INSPECTION OF MRWJ RESIDENT ENGINEERS ARE SHOWN THUS:

   ON LOCATION PLANS AND STRIP MAPS:
   BORINGS WITHOUT UNDISTURBED SAMPLES:
   BORINGS WITH UNDISTURBED SAMPLES:

   ON GEOLOGICAL SECTIONS:
   BORINGS WITHOUT UNDISTURBED SAMPLES:
   BORINGS WITH UNDISTURBED SAMPLES:

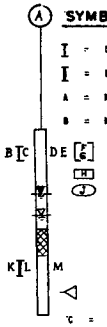
2. BORINGS WHICH HAVE BEEN MADE BY OTHER ORGANIZATIONS FOR OTHER PROJECTS AND ARE UTILIZED IN THIS INVESTIGATION ARE SHOWN THUS:

   ON LOCATION PLANS AND STRIP MAPS:
   ON GEOLOGICAL SECTIONS:

   THE GENERAL LOCATION OF THESE PROJECTS IN PLAN ARE SHOWN WITH A NUMBER DESIGNATION WITHIN A DIAMOND SYMBOL: (5)

3. LOCATION AND ORIENTATION OF GEOLOGICAL SECTIONS GENERALLY ARE SHOWN ON THE PLAN ON WHICH BORING LOCATIONS ARE PLOTTED.

SYMBOLS UTILIZED ON GEOLOGICAL SECTIONS



I = LOCATION AND LENGTH OF SOIL SAMPLE

I = LOCATION AND LENGTH OF ROCK CORE RUN

A = NUMBER AND LOCATION OF BORING.

B = NUMBER AND TYPE OF SOIL SAMPLE:
- SUFFIX "D" = DRY SAMPLE TAKEN WITH 2" OD SPLIT SPOON;
- SUFFIX "S" = SHELBY SAMPLE TAKEN WITH 2" OD THIN TUBE;
- SUFFIX "U" = UNDISTURBED SAMPLE TAKEN WITH 3" OD THIN TUBE USING PISTON SAMPLER;
- SUFFIX "R" = SAMPLE TAKEN WITH OPEN-END DRILL ROD;
- SUFFIX "UD" OR "SD" = THIN TUBE SAMPLE DISTURBED IN SAMPLING;
- "NR" = SAMPLE ATTEMPTED BUT NOT RECOVERED;
- SUFFIX "C" = ROCK CORE RUN USING NX SIZE DOUBLE TUBE DIAMOND CORE BARREL, PRODUCING CORE APPROXIMATELY 2-1/8" Ø;
- "CORE" = CORING IN OVERBURDEN OR CORING IN BEDROCK WITH SAWTOOTH BIT OR ROTARY DRILLING BIT.

C = SAMPLER PENETRATION RESISTANCE IN BLOWS PER FOOT EXCEPT WHERE SPECIFIC DISTANCE IS NOTED.
SAMPLER DRIVEN WITH 140 LB. HAMMER FALLING 30".
P = THIN TUBE SAMPLE ADVANCED BY PUSHING
T = THIN TUBE SAMPLE ADVANCED BY TAPPING.
WR = SAMPLER ADVANCED UNDER WEIGHT OF RODS
WH = SAMPLER ADVANCED UNDER WEIGHT OF RODS AND HAMMER
(R SAMPLES DRIVEN WITH 300 LB. HAMMER FALLING 18")

D = SAMPLE CLASSIFICATION ACCORDING TO UNIFIED SOIL CLASSIFICATION SYSTEM

E = SAMPLE NATURAL WATER CONTENT IN PERCENT OF DRY WEIGHT

F = ATTERBERG LIQUID LIMIT VALUE.

G = ATTERBERG PLASTIC LIMIT VALUE.

H = SHEAR STRENGTH IN KSF DETERMINED FROM UNCONFINED COMPRESSION TEST FOR SOIL SAMPLES OR COMPRESSIVE STRENGTH IN KSI FOR ROCK CORES.

J = SHEAR STRENGTH IN KSF DETERMINED FROM UNCONSOLIDATED-UNDRAINED TRIAXIAL SHEAR TEST.

K = NUMBER DESIGNATION OF NX SIZE ROCK CORE RUN.

L = LENGTH OF ROCK CORE RECOVERY EXPRESSED AS A PERCENT OF LENGTH OF CORE RUN

M = ROCK QUALITY DESIGNATION (RQD) IN PERCENT.

= GROUND WATER LEVELS OBSERVED DURING THE PERIOD OF THIS FIELD INVESTIGATION PROGRAM.

= GROUND WATER LEVELS OBSERVED AT AN EARLIER TIME IN BORINGS NOT MADE FOR THIS INVESTIGATION.

= POSITION OF POROUS BACKFILL SURROUNDING OBSERVATION WELL IN BORINGS MADE FOR WMATA.

M.L. = POSITION OF MATCH LINE BETWEEN GEOLOGICAL SECTIONS.

= CORROSION TEST OF SOIL SAMPLE.

= CORROSION TEST OF WATER SAMPLE.

NOTES AND LEGEND FOR BORING LOG DRAWINGS

A | B | C | D | E | F

A = DEPTH BELOW GROUND SURFACE IN FEET

B = NUMBER OF BLOWS OF 300 LB. HAMMER FALLING 18" REQUIRED TO DRIVE CASING OF THE SIZE NOTED ONE FOOT.

C = NUMBER AND TYPE OF SAMPLE
- SUFFIX "D" = DRY SAMPLE TAKEN WITH 2" OD SPLIT SPOON;
- SUFFIX "S" = SHELBY SAMPLE TAKEN WITH 2" OD THIN TUBE;
- SUFFIX "U" = UNDISTURBED SAMPLE TAKEN WITH 3" OD THIN TUBE USING PISTON SAMPLER;
- SUFFIX "R" = SAMPLE TAKEN WITH OPEN-END DRILL ROD;
- SUFFIX "UD" OR "SD" = THIN TUBE SAMPLE DISTURBED IN SAMPLING;
- "NR" = SAMPLE ATTEMPTED BUT NOT RECOVERED;
- SUFFIX "C" = ROCK CORE RUN USING NX SIZE DOUBLE TUBE DIAMOND CORE BARREL, PRODUCING CORE APPROXIMATELY 2-1/8" Ø;
- "CORE" = CORING IN OVERBURDEN OR CORING IN BEDROCK WITH SAWTOOTH BIT OR ROTARY DRILLING BIT.

D = SAMPLER PENETRATION RESISTANCE IN BLOWS PER 6" OF DRIVING EXCEPT WHERE SPECIFIC DISTANCE IS NOTED.
SAMPLER DRIVEN WITH 140 LB. HAMMER FALLING 30"
P = THIN TUBE SAMPLE ADVANCED BY PUSHING
T = THIN TUBE SAMPLE ADVANCED BY TAPPING
WR = SAMPLER ADVANCED UNDER WEIGHT OF RODS
WH = SAMPLER ADVANCED UNDER WEIGHT OF RODS AND HAMMER
(R SAMPLES DRIVEN WITH 300 LB. HAMMER FALLING 18")

78/25 — 78 = LENGTH OF ROCK CORE RECOVERY EXPRESSED AS A PERCENT OF LENGTH OF CORE RUN; 25 = ROCK QUALITY DESIGNATION (RQD) IN PERCENT

E = DESCRIPTION OF INDIVIDUAL SOIL SAMPLE, INCLUDING UNIFIED SOIL CLASSIFICATION SYMBOL, OR DESCRIPTION OF INDIVIDUAL ROCK CORE RUN.

F = DESCRIPTION OF PRINCIPAL SOIL STRATA OR PRINCIPAL DIVISIONS OF BEDROCK. STRATA DIVISION LINES ARE NOTED WITH DEPTH BELOW GROUND SURFACE.

CONSISTENCY OR COMPACTNESS FROM SAMPLER PENETRATION RESISTANCE

THE DEGREE OF CONSISTENCY OR COMPACTNESS OF SAMPLES IS NOT GIVEN IN THE BORING LOG DESCRIPTIONS BUT IS INDICATED BY THE FOLLOWING VALUES OF STANDARD SAMPLER PENETRATION RESISTANCE IN BLOWS PER FOOT:

FINE GRAINED SOILS, SILTS AND CLAYS:		COARSE GRAINED SOILS, SANDS AND GRAVELS:	
LESS THAN 2 BPF	= VERY SOFT	LESS THAN 4 BPF	= VERY LOOSE
2 TO 4 BPF	= SOFT	4 TO 10 BPF	= LOOSE
4 TO 8 BPF	= MEDIUM STIFF	10 TO 30 BPF	= MEDIUM COMPACT
8 TO 15 BPF	= STIFF	30 TO 50 BPF	= COMPACT
15 TO 30 BPF	= VERY STIFF	GREATER THAN 50	= VERY COMPACT
GREATER THAN 30	= HARD		

ABBREVIATIONS

MISCELLANEOUS		GRAIN SIZE AND SHAPE		COLOR	
BOTTOM	= BOT.	ANGULAR	= ANG.	BLACK	= BLK.
CARBONACEOUS	= CARB.	COARSE	= C	BLUE	= BL.
CAVITIES	= CVTS.	COARSE TO FINE	= C-F	BROWN	= BRN.
CEMENTED	= CEM.	COARSE TO MEDIUM	= C-M	DARK	= DK.
CONCRETIONS	= CONC.	FINE	= F	GRAY	= GRY.
DITTO	= Do.	FINE TO COARSE	= F-C	GREEN	= GRN.
FRAGMENTS	= FGMTS.	FINE TO MEDIUM	= F-M	LIGHT	= LT.
INTERBEDDED	= INTRBD.	MEDIUM	= M	MOTTLED	= MTLD.
INTERLAYERED	= INLAD.	MEDIUM TO COARSE	= M-C	PURPLE	= PRP.
LAYERS	= LYRS.	MEDIUM TO FINE	= M-F	ORANGE	= OR.
LENSES	= LNS.	SMALL	= SML.	WHITE	= WHT.
MATERIAL	= MTL.			YELLOW	= YEL.
MATTER	= MTR.	CONSISTENCY		SOIL OR ROCK TYPE	
MEADOW MAT	= MDW.MT.	COMPACT	= CPT.	BOULDER	= BLDR.
MICACEOUS	= MIC.	MEDIUM COMPACT	= MED.CPT.	BRICK	= BRK.
MISCELLANEOUS	= MISC.	DECAYED	= DCYD.	CINDERS	= CNDR.
MONGANOS	= MGN.	DECOMPOSED	= DEC.	CLAY	= CL.
OCCASIONAL	= OCC.	DISINTEGRATED	= DSNTG.	CLAYEY SAND	= CL.SA.
ORGANIC	= ORG.	FRACTURED	= FRCT.	CLAYEY SILT	= CL.SI.
PARTICLES	= PCLS.	HARD	= HD.	COBBLE	= CBL.
PEAT	= PT.	MEDIUM	= MED.	GNEISS	= GNS.
PIECES	= PCS.	RELATIVELY SOUND	= REL.SND.	GRANITE	= GRT.
POCKET	= PKT.	SOFT	= SFT.	GRAVEL	= GVL.
PROBABLY	= PROB.	SOUND	= SND.	LIGNITE	= LIGN.
ROOTS	= RTS.	STIFF	= STF.	SAND	= SA.
SEAMS	= SMS.	WEATHERED	= WTHRD.	SANDY CLAY	= SA.CL.
SLICKENSIDED	= SLKS.			SANDY SILT	= SA.SI.
SLIGHTLY	= SL.			SCHIST	= SCH.
SOME	= SM.			SHALE	= SH.
TRACE	= TR.			SHELLS	= SLS.
VEGETATION	= VEG.			SILT	= SI.
VERY	= V			SILTY CLAY	= SI.CL.
WITH	= W/			SILTY SAND	= SI.SA.

GENERALIZED STRATA DESCRIPTIONS

SYMBOL	DESCRIPTION	UNIFIED SOIL CLASSIFICATION PRIMARY	UNIFIED SOIL CLASSIFICATION SECONDARY	SOURCE AND AGE
F	FILL, GENERALLY COMPOSED OF INORGANIC SOIL OBTAINED FROM NEARBY NATURAL MATERIALS. MAY BE DERIVED FROM TERRACE, CRETACEOUS SOILS OR DECOMPOSED ROCK.	ML SM	SC CL	MAN-MADE IN HISTORIC TIMES
A1	VERY SOFT TO MEDIUM STIFF DARK GRAY AND BROWN ORGANIC CLAY WITH LENSES OF HIGHLY ORGANIC MATERIAL (WHERE LOCATED UNDER WATER). SOFT TO STIFF MOTTLED GRAY-BROWN SLIGHTLY ORGANIC SILTY OR SANDY CLAY (WHERE LOCATED ON LAND).	CL CH OH	OL PT	RIVER ALLUVIUM OF POST-GLACIAL TIMES
A2	LOOSE TO MEDIUM COMPACT GRAY OR DARK BROWN SILTY FINE TO MEDIUM SAND WITH OCCASIONAL POCKETS OR LENSES OF SMALL GRAVEL. MAY BE SLIGHTLY TO MODERATELY ORGANIC.	SM	SP	
T1	STIFF TO MEDIUM STIFF LIGHT BROWN OR GRAY OR MOTTLED BROWN-GRAY SILTY CLAY OR CLAYEY SILT WITH LENSES OF BROWN SILTY FINE SAND. IN SOME AREAS, SEVERAL SEPARATE LAYERS OF PLEISTOCENE CLAYS HAVE BEEN ENCOUNTERED, WHICH ARE DISTINGUISHED BY A LETTER SUFFIX: T1A, T1C, ETC.	CL ML CH	LENSES OF SM OR SC	PORTIONS OF THE "25-FOOT" "50-FOOT" AND "30-FOOT" TERRACES, DEPOSITED BY RIVERS IN PLEISTOCENE TIMES
T0	MEDIUM STIFF TO STIFF DARK GRAY ORGANIC CLAY WITH NUMEROUS WOOD FRAGMENTS. USUALLY FOUND INTERLENSED WITH STRATUM T4.	CL OL	CH OH	
T2	MEDIUM COMPACT TO COMPACT BROWN AND RED-BROWN SILTY OR CLAYEY FINE TO MEDIUM SAND WITH TRACE OF GRAVEL AND OCCASIONAL BOULDERS.	SM SC	SP SW	
T3	COMPACT TO VERY COMPACT BROWN AND RED-BROWN FINE TO COARSE SAND WITH SOME SILT AND GRAVEL AND VARIABLE AMOUNTS OF COBBLES AND BOULDERS.	SW SM	SP GM	
T4	MEDIUM COMPACT TO COMPACT GRAY AND GRAY-BROWN FINE TO MEDIUM SAND WITH SOME SILT AND SMALL GRAVEL, CONTAINING LENSES OF DARK GRAY CLAY, OCCASIONALLY SLIGHTLY ORGANIC.	SM SP	SW	
T5	COMPACT TO VERY COMPACT GRAY AND GRAY-BROWN FINE TO COARSE SAND WITH SOME GRAVEL, SOME TO TRACE OF SILT AND VARIABLE AMOUNTS OF COBBLES AND BOULDERS, OFTEN CONCENTRATED AT BASE OF LAYER.	SW SM	SP GM	
Q1	LOOSE TO MEDIUM COMPACT LIGHT BROWN SILTY OR CLAYEY FINE TO MEDIUM SAND WITH TRACE OF SMALL GRAVEL.	SM SC		BRANDYWINE FORMATION OF EARLY PLEISTOCENE OR PLIOCENE TIMES
Q2	LOOSE TO MEDIUM COMPACT LIGHT BROWN OR TAN SILTY OR CLAYEY MEDIUM TO FINE SAND WITH SOME SMALL GRAVEL.	SM SC	SP	
C	MEDIUM COMPACT GRAY AND TAN SILTY FINE SAND OR MEDIUM STIFF TO STIFF DARK GRAY TO OLIVE-GREEN CLAY. CALVERT FORMATION OF MIOCENE AGE.	SM CH	SP CL	MARINE DEPOSITS OF TERTIARY OR UPPER CRETACEOUS PERIODS
E	MEDIUM STIFF DARK GREEN OR BROWN CLAY AND SILTY CLAY. AQUIA FORMATION OF EOCENE AGE.	MH CH	ML CL	
M	MEDIUM STIFF TO STIFF GREEN OR BROWN SILT AND CLAY. MONMOUTH FORMATION OF UPPER CRETACEOUS AGE.	MH CL	ML CH	
P1	HARD MOTTLED RED-BROWN AND GRAY OR LIGHT GRAY AND TAN PLASTIC CLAY WITH OCCASIONAL POCKETS OF FINE SAND. GENERALLY CONSISTS OF PATAPSCO FORMATION BUT MAY INCLUDE RARITAN FORMATION AT UPPER LEVELS.	CH	CL	POTOMAC GROUP OF CRETACEOUS PERIOD
P2	COMPACT TO VERY COMPACT LIGHT GRAY OR TAN SILTY OR CLAYEY FINE TO MEDIUM SAND WITH POCKETS OF SILTY CLAY AND TRACE OF SMALL GRAVEL. OCCASIONAL LIGNITE FRAGMENTS. ALSO INCLUDES MAGOTHY FORMATION OF UPPER CRETACEOUS AGE.	SM SC SP	SP	
P3	HARD GRAY-GREEN OR GRAY-BLUE-GREEN SILTY OR SANDY CLAY AND VERY COMPACT SILTY OR CLAYEY FINE TO MEDIUM SAND WITH OCCASIONAL SMALL GRAVEL AND SCATTERED BOULDERS.	CL SC	ML SM	
P4	VERY COMPACT MOTTLED LIGHT GRAY, TAN, BUFF OR WHITE SILTY OR CLAYEY FINE TO MEDIUM SAND WITH SOME GRAVEL AND SCATTERED LIGNITE FRAGMENTS, FREQUENTLY WITH DENSE NESTS AND POCKETS OF ANGULAR ROCK FRAGMENTS, COBBLES AND BOULDERS.	SM SW SC	SP GM	

NOTE

THE GENERALIZED STRATA DESCRIPTIONS NOTED IN THIS COLUMN AND GIVEN IN THE TEXT OF THE MRJD REPORTS ON SUBSURFACE INVESTIGATIONS ARE INTENDED TO COVER THE TYPICAL RANGE OF MATERIALS GROUPED WITHIN A PARTICULAR STRATUM.

FOR A DETAILED BREAKDOWN OF THE ACTUAL CONSTITUENT MATERIALS WITHIN THAT STRATUM, REFERENCE SHOULD BE MADE TO BORING AND LABORATORY TEST INFORMATION RELEVANT TO ANY SPECIFIC LOCATION.

DEFINITION OF MODIFYING ADJECTIVES USED TO DESCRIBE SOIL CONSTITUENTS IN SAMPLE AND STRATA DESCRIPTIONS

CONSTITUENT	PROPORTIONS OF SOIL CONSTITUENTS	PERCENTAGE BY DRY WEIGHT
MAJOR	NOUN FORM: GRAVEL, SAND, SILT, ETC.	50 OR MORE
MINOR	ADJECTIVE FORM: GRAVELLY, SANDY, ETC.	31 TO 49
	SOME: SOME SAND SOME SILT, ETC.	13 TO 30
	TRACE: TRACE GRAVEL, TRACE CLAY	1 TO 12
	AND: SAND AND GRAVEL	USE FOR EQUAL AMOUNTS
	WITH: WITH ROCK FRAGMENTS WITH ORGANIC MATTER	INDICATES PRESENCE ONLY

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
3-86	JPG	Revised Abbreviations.	3-76	JPG	Revised Generalized Strata Descriptions
5-93	JPG	Revised Percentage limits of Soil adjectives "trace" and "Some".	5-80	JPG	Revised General Notes and Sampler Penetration Resistance.
			3-81	JPG	Added Note on Generalized Strata Descriptions and Definition of Soil Adjectives.

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415 MADISON AVE., NEW YORK 17, N. Y.

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT

HARRY WEESE & ASSOCIATES
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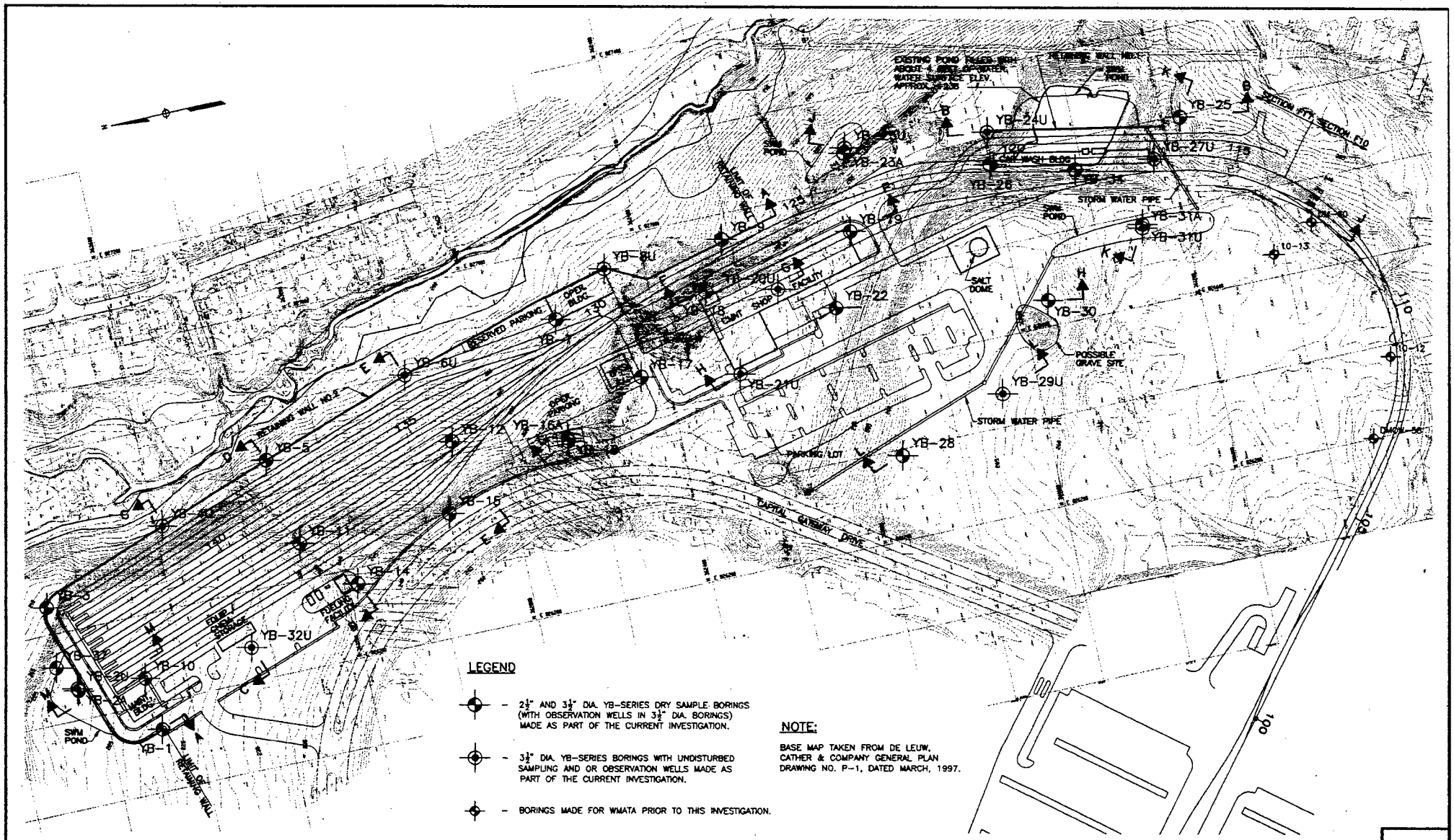
SUBSURFACE INVESTIGATION
GENERAL INFORMATION DRAWING

SCALE _____ DRAWING NO. F-1



LEGEND

- $2\frac{1}{2}$" AND $3\frac{1}{2}$" DIA. YB-SERIES DRY SAMPLE BORINGS (WITH OBSERVATION WELLS IN $3\frac{1}{2}$" DIA. BORINGS) MADE AS PART OF THE CURRENT INVESTIGATION.
- $3\frac{1}{2}$" DIA. YB-SERIES BORINGS WITH UNDISTURBED SAMPLING AND OR OBSERVATION WELLS MADE AS PART OF THE CURRENT INVESTIGATION.
- BORINGS MADE FOR WMATA PRIOR TO THIS INVESTIGATION.

NOTE:

BASE MAP TAKEN FROM DE LEUW, CATHER & COMPANY GENERAL PLAN DRAWING NO. P-1, DATED MARCH, 1997.

DESIGNED		DATE
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REFERENCE DRAWING

NUMBER	DESCRIPTION
F-1	GENERAL NOTES AND LEGEND
F-F-458	GEOLOGICAL SECTIONS
TO	
F-F-464	

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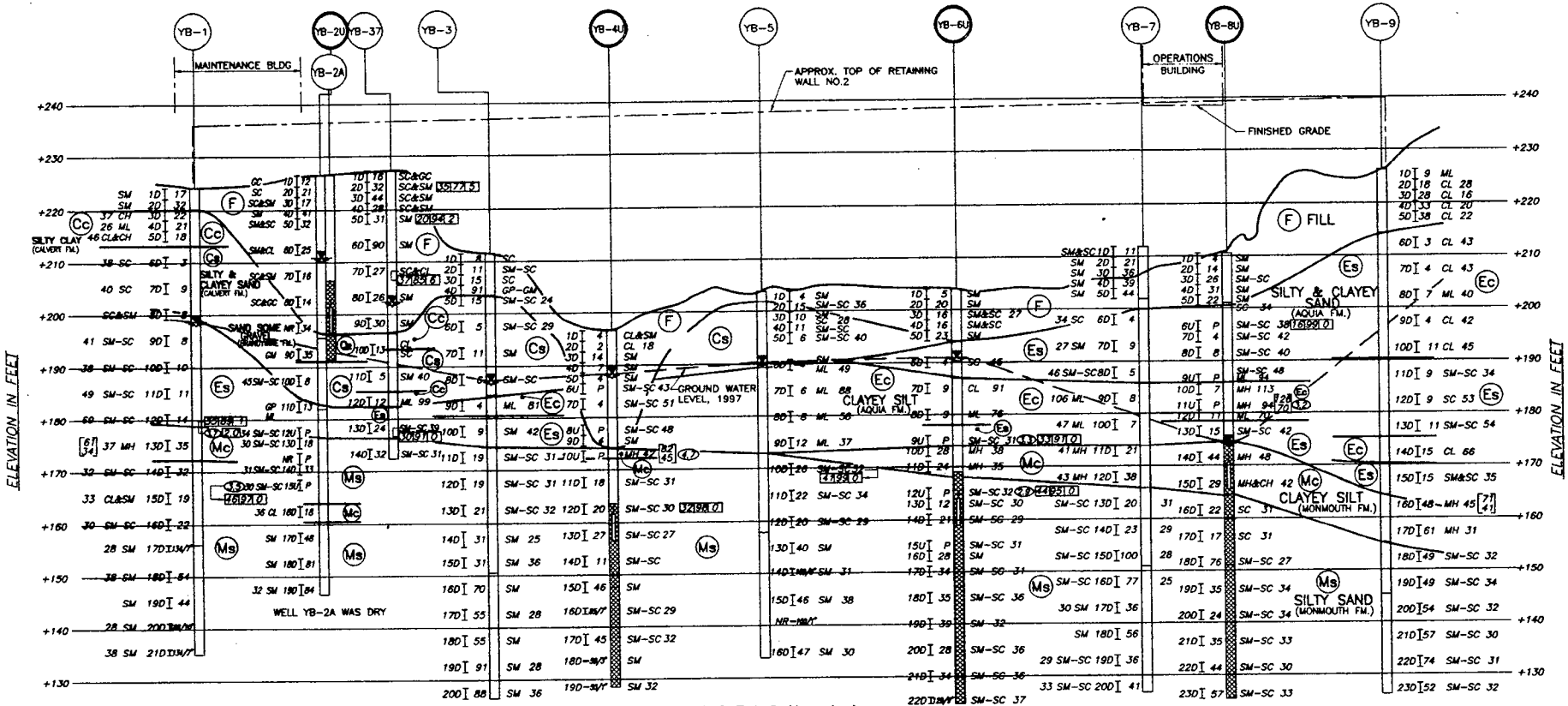
APPROVED

BRANCH ROUTE (F011)
BRANCH AVENUE YARD
BORING LOCATION PLAN

SCALE 0 100' 200'

DRAWING NO. F-F-457



SECTION A-A

GENERAL STRATA DESCRIPTIONS

STRATUM Qb (BRANDYWINE), FINE TO COARSE SAND, SOME GRAVEL AND BOULDERS: MEDIUM COMPACT TO VERY COMPACT BROWN, TAN OR YELLOW ORANGE FINE TO COARSE SAND, SOME GRAVEL AND BOULDERS, TO FINE TO COARSE SANDY GRAVEL, TRACE TO SOME SILT, CLAY WITH OCCASIONAL SILTY FINE SAND LAYERS.

STRATUM Cc (CALVERT), PLASTIC CLAY, SILTY AND SANDY CLAY OR CLAYEY SILT: MEDIUM TO STIFF DARK GRAY, GREEN, BROWN AND YELLOW ORANGE PLASTIC CLAY, SILTY AND SANDY CLAY OR CLAYEY SILT, TRACE FINE SAND, GRAVEL.

STRATUM Cs (CALVERT), FINE SAND, TRACE TO SOME SILT, CLAY AND SILTY OR CLAYEY FINE SAND: LOOSE TO MEDIUM COMPACT DARK GRAY, OLIVE GRAY, GREEN BROWN AND YELLOW ORANGE FINE SAND, TRACE TO SOME SILT, CLAY AND SILTY OR CLAYEY FINE SAND, TRACE GRAVEL.

STRATUM Ec (AQUIA), PLASTIC TO SILTY AND SANDY CLAY OR CLAYEY SILT: MEDIUM TO STIFF GRAY, GREEN, OLIVE GRAY SLICKENSIDED AND FISSURED PLASTIC CLAY TO SILTY AND SANDY CLAY OR CLAYEY SILT, TRACE LIGNITE WITH OCCASIONAL SLIGHTLY ORGANIC FINE SANDY AND SILTY CLAY LAYERS, TRACE SHELLS.

STRATUM Es (AQUIA), SILTY AND CLAYEY FINE SAND: LOOSE TO MEDIUM COMPACT GRAY GREEN, OLIVE GRAY SILTY AND CLAYEY FINE SAND, TRACE SHELLS WITH OCCASIONAL SLIGHTLY ORGANIC SILTY AND CLAYEY FINE SAND LAYERS.

STRATUM Mc (MONMOUTH), SLIGHTLY ORGANIC FINE SANDY SILT AND CLAYEY SILT: MEDIUM COMPACT TO VERY COMPACT DARK GREEN SLIGHTLY ORGANIC MICACEOUS FINE SANDY SILT AND VERY STIFF TO HARD CLAYEY SILT, TRACE SHELLS, OCCASIONALLY CEMENTED.

STRATUM Ms (MONMOUTH), SLIGHTLY ORGANIC MICACEOUS SILTY FINE SAND AND CLAYEY FINE SAND: MEDIUM COMPACT TO VERY COMPACT DARK GREEN TO DARK GRAY SLIGHTLY ORGANIC MICACEOUS SILTY FINE SAND, TRACE CLAY AND CLAYEY FINE SAND, TRACE TO SOME SHELLS, OCCASIONALLY CEMENTED, CEMENTED SAND LAYERS AND BEDS.

LEGEND

4199 0

- PERCENT OF MATERIAL RETAINED ON NO.4 SIEVE SIZE.
- PERCENT OF MATERIAL PASSING THE NO.40 SIEVE SIZE.
- PERCENT OF MATERIAL PASSING THE NO.200 SIEVE SIZE.

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F-1	GENERAL NOTES AND LEGEND			
F-F-457	BORING LOCATION PLAN			

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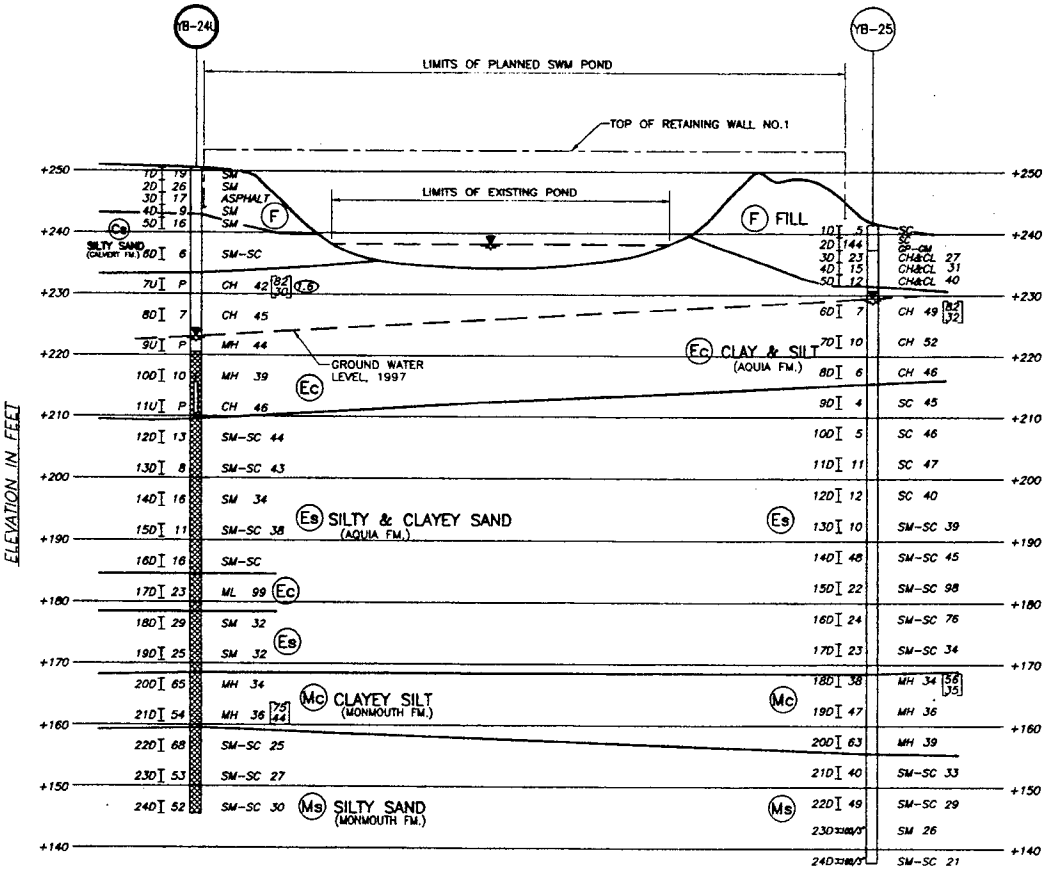
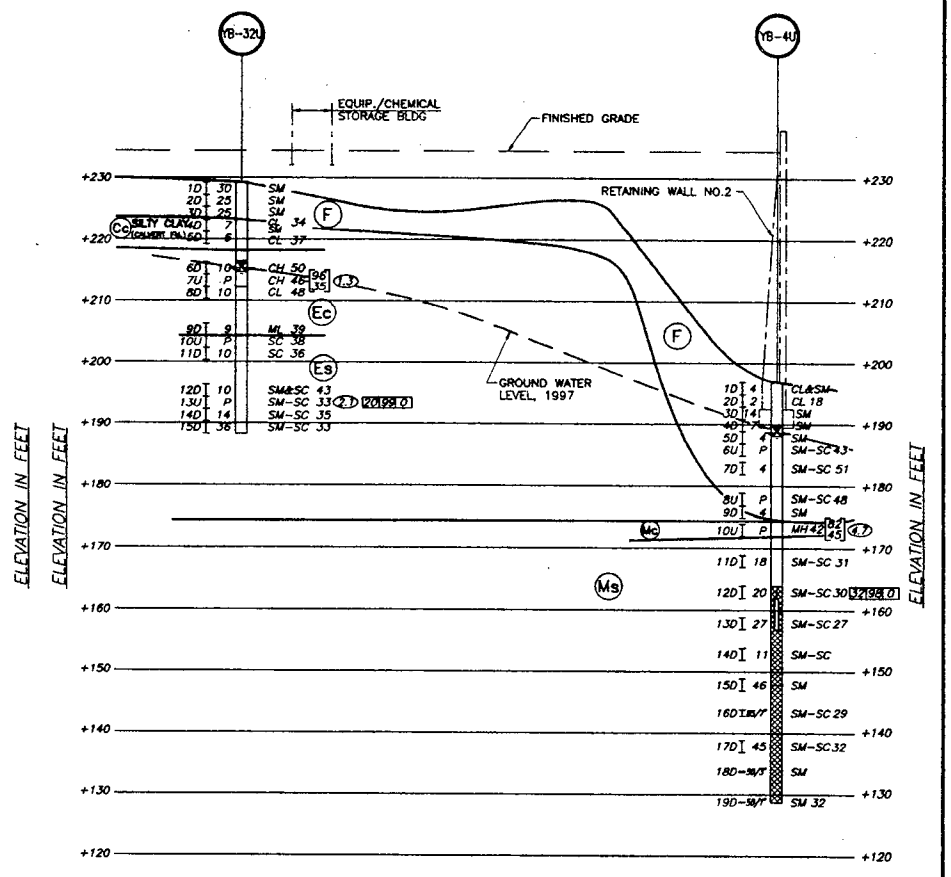
BRANCH ROUTE (F011)
BRANCH AVENUE YARD
GEOLOGIC SECTION A-A

SCALE HORIZ. 0 100' 200' VERT. 0 10' 20'

DRAWING NO. F-F-458



SECTION B-B



SECTION C-C

REFERENCE DRAWING	
NUMBER	DESCRIPTION
F-1 &	GENERAL NOTES, LEGEND AND
F-F-458	GENERAL STRATA DESCRIPTIONS
F-F-457	BORING LOCATION PLAN

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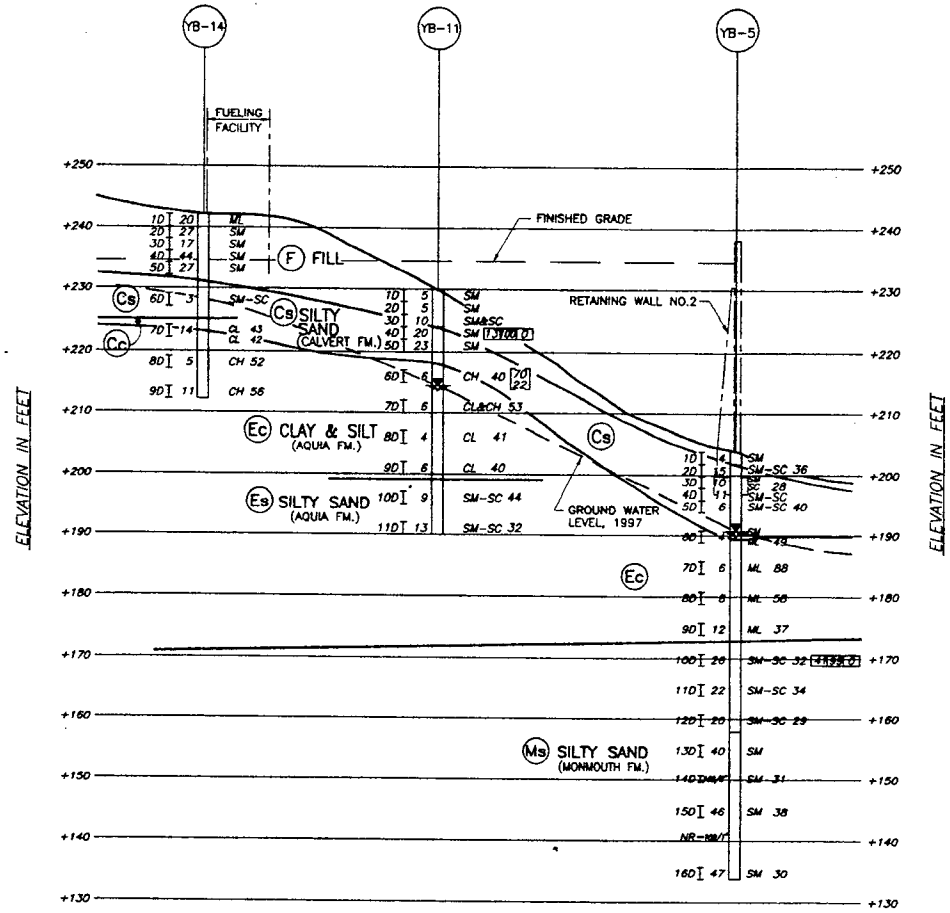
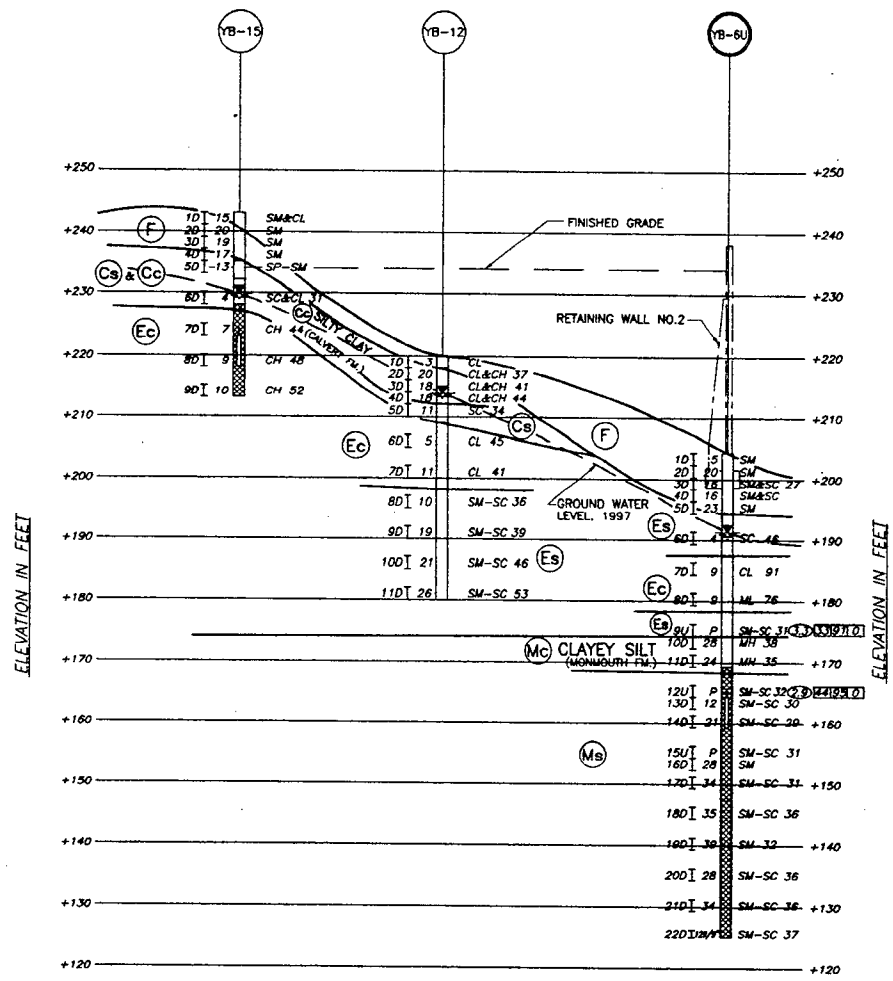
BRANCH ROUTE (F011)
BRANCH AVENUE YARD
GEOLOGIC SECTIONS B-B & C-C

SCALE HORZ. 0 40' 80' VERT. 0 10' 20'

DRAWING NO. F-F-459



SECTION D-D



SECTION E-E

REFERENCE DRAWING	
NUMBER	DESCRIPTION
F-1 & F-F-458	GENERAL NOTES, LEGEND AND GENERAL STRATA DESCRIPTIONS
F-F-457	BORING LOCATION PLAN

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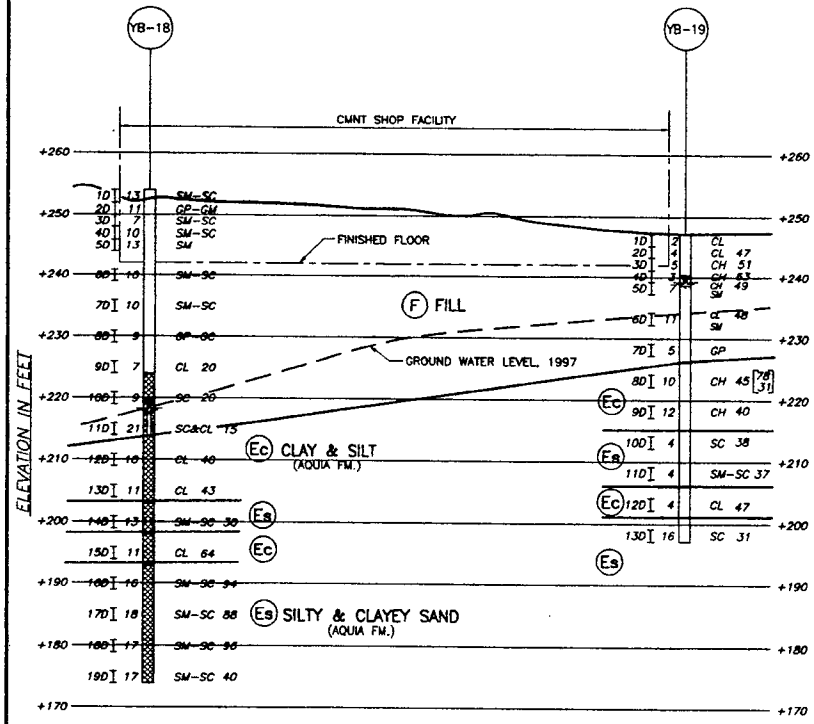
APPROVED ____

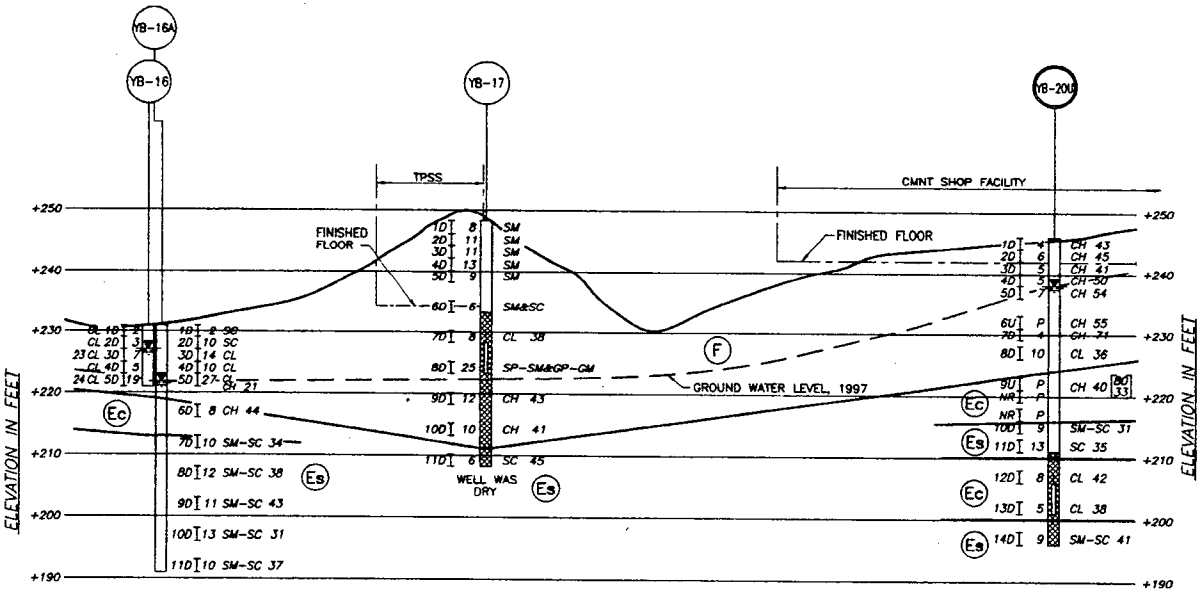
BRANCH ROUTE (F011)
BRANCH AVENUE YARD
GEOLOGIC SECTIONS D-D & E-E

SCALE HORIZ. 0 40' 80' VERT. 0 10' 20'

DRAWING NO. F-F-460



SECTION F-F



SECTION G-G

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APPROVED			DATE

REFERENCE DRAWING

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F-1 & F-458	GENERAL NOTES, LEGEND AND GENERAL STRATA DESCRIPTIONS
F-F-457	BORING LOCATION PLAN

REVISIONS

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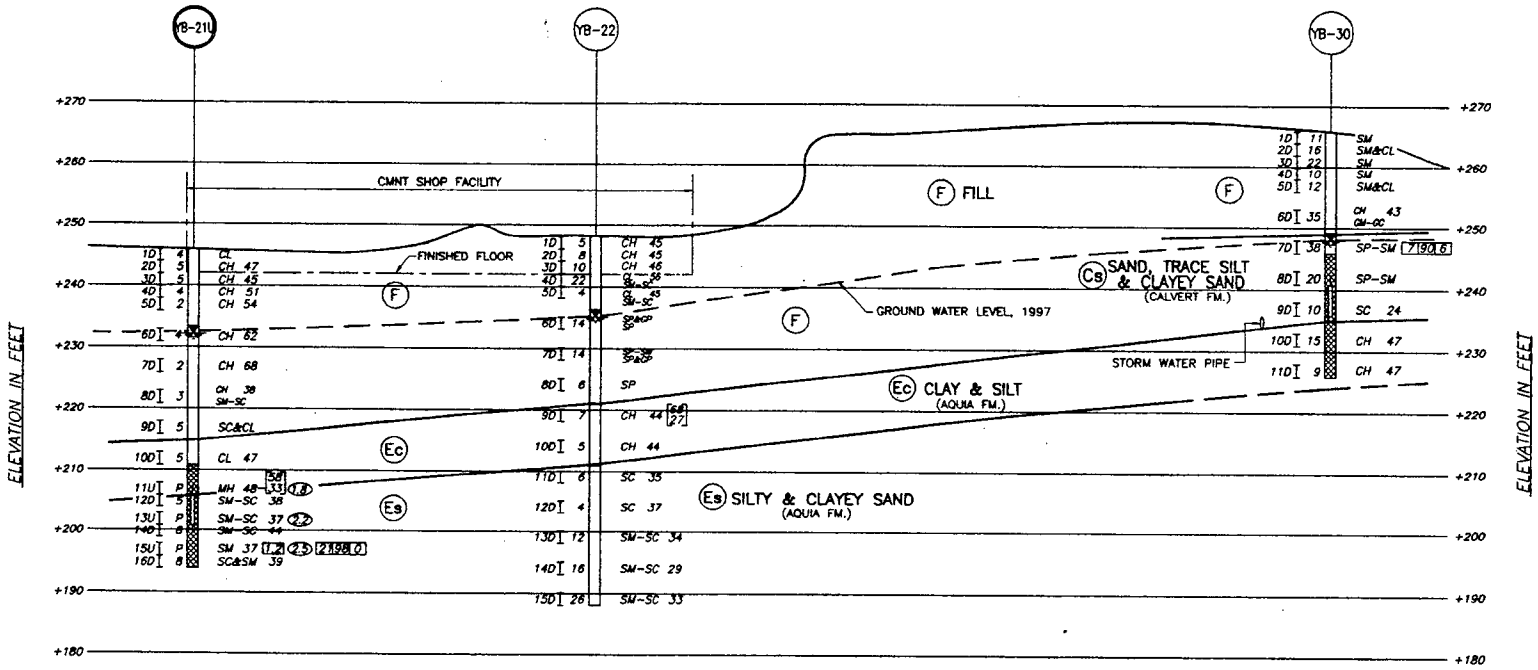
APPROVED

BRANCH ROUTE (F011)
BRANCH AVENUE YARD
GEOLOGIC SECTIONS F-F & G-G

SCALE HORZ. 0 40' 80' VERT. 0 10' 20'

DRAWING NO. F-F-461



SECTION H-H

REFERENCE DRAWING		REVISIONS		
NUMBER	DESCRIPTION	DATE	BY	DESCRIPTION
F-1 &	GENERAL NOTES, LEGEND AND			
F-F-458	GENERAL STRATA DESCRIPTIONS			
F-F-457	BORING LOCATION PLAN			

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DISTRICT OF COLUMBIA HUGH S. LACY No. 8759 REGISTERED PROFESSIONAL ENGINEER

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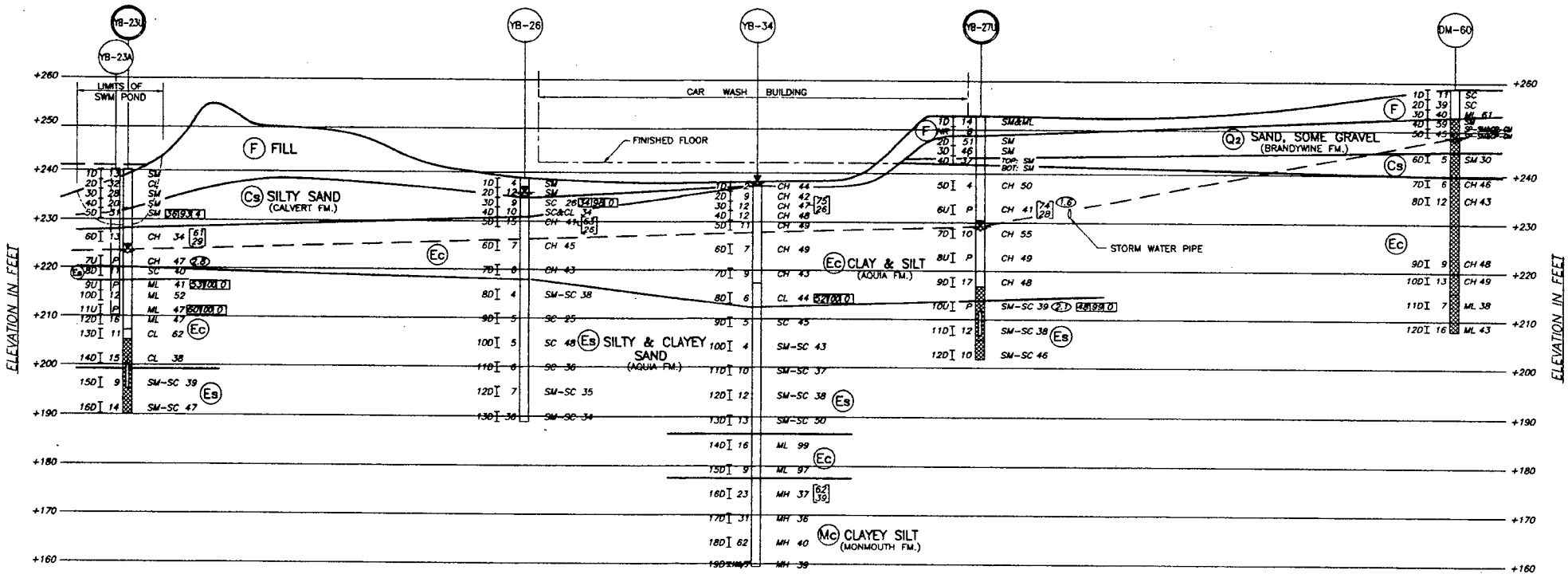
GENERAL ENGINEERING CONSULTANT
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT
APPROVED

BRANCH ROUTE (F011)
BRANCH AVENUE YARD
GEOLOGIC SECTION H-H

SCALE HORIZ. 0 40' 80' VERT. 0 10' 20'

DRAWING NO. F-F-462



SECTION J-J

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F-1 &	GENERAL NOTES, LEGEND AND
F-F-458	GENERAL STRATA DESCRIPTIONS
F-F-457	BORING LOCATION PLAN

REVISIONS		
DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — HUGH S. LEE — No. 9786 — PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER RUTLEDGE CONSULTING ENGINEERS
708 THIRD AVENUE, NEW YORK, N.Y. 10017

SUBMITTED

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT

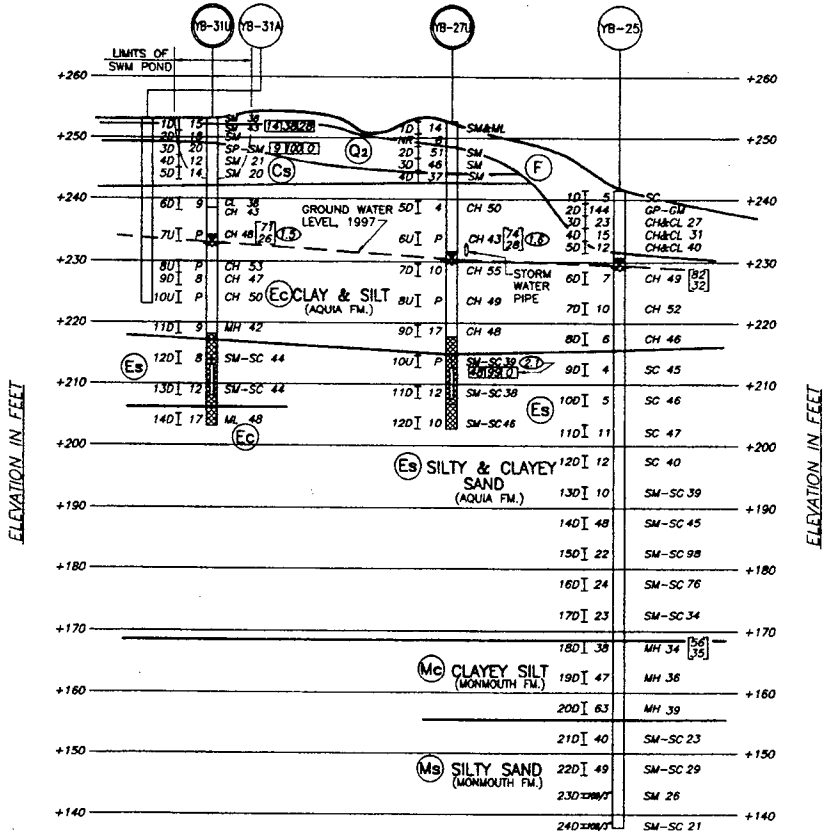
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT

APPROVED

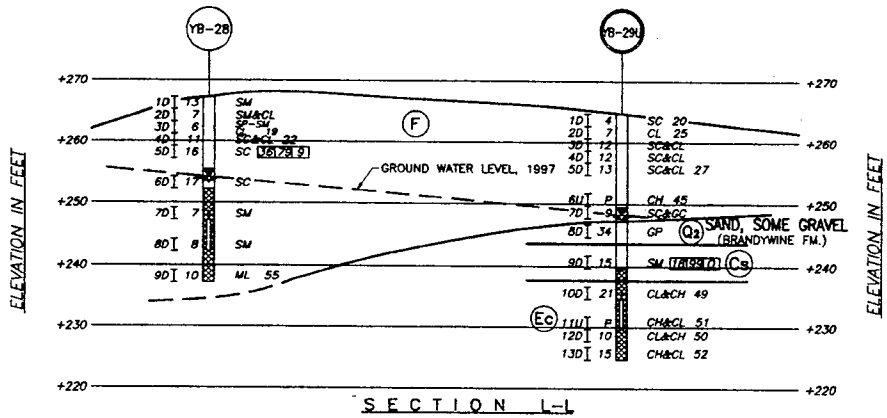
BRANCH ROUTE (F011)
BRANCH AVENUE YARD
GEOLOGIC SECTION J-J

SCALE HORIZ. 0 40' 80' VERT. 0 10' 20'

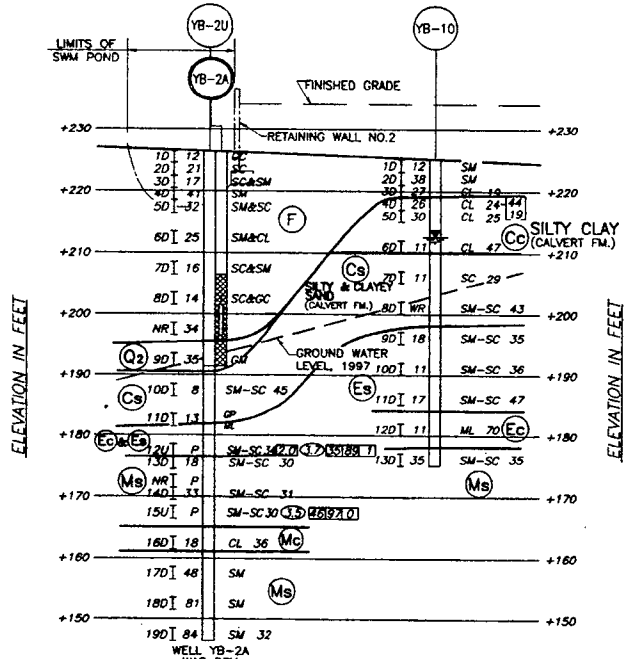
DRAWING NO. F-F-463



SECTION K-K



SECTION L-L



SECTION M-M

DESIGNED		DATE
DRAWN	I.Y.	8-97 DATE
CHECKED	HSL, SLT, AAA	8-97 DATE
APPROVED		DATE

REFERENCE DRAWING

NUMBER	DESCRIPTION
F-1 &	GENERAL NOTES, LEGEND AND
F-F-458	GENERAL STRATA DESCRIPTIONS
F-F-457	BORING LOCATION PLAN

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA HIGH & LACY No. 9788 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER RUTLEDGE CONSULTING ENGINEERS
708 THIRD AVENUE, NEW YORK, N.Y. 10017
SUBMITTED

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT

HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT

APPROVED

BRANCH ROUTE (F011)
BRANCH AVENUE YARD
GEOLOGIC SECTIONS K-K, L-L & M-M

SCALE HORIZ. 0 40' 80' VERT. 0 10' 20'

DRAWING NO. F-F-464

BORING NUMBER YB-1

Ground surface elevation +224.2

1D	5,7,10,12	Brown black silty fine sand, trace gravel, coarse sand, roots, leaves (Fill) (SM)	FILL 4.0'
2D	20,20,12,10	Brown silty fine sand, trace gravel (Fill) (SM)	
3D	11,11,11,11	Very stiff mottled brown gray clay, trace fine sand (CH)	STIFF TO VERY STIFF CLAY AND CLAYEY SILT, TR F SAND, F SAND SEAMS 11.0'
4D	11,11,10,10	Stiff brown gray clayey silt, trace fine sand, fine sand seams (ML)	
5D	9,9,9,9	Very stiff brown gray silty clay & clay, trace fine sand (CL&CH)	
6D	1,1,2,2	Brown clayey fine sand, trace fine sandy clay layers (SC)	VERY LOOSE TO LOOSE BROWN CLAYEY FINE SAND, SOME SILTY FINE SAND LAYERS, TRACE FINE SAND, CLAY LAYERS 25.0'
7D	3,4,5,6	Do 6D (SC)	
8D	3,4,4,4	Brown gray clayey and silty fine sand (SC&SM)	
9D	3,4,4,5	Gray silty fine sand, trace clay, clay layers & pockets (SM-SC)	LOOSE TO MEDIUM COMPACT GRAY SILTY FINE SAND, TRACE CLAY, CLAY LAYERS AND POCKETS 45.5'
10D	5,5,5,6	Do 9D (SM-SC)	
11D	5,5,6,7	Do 9D (SM-SC)	
12D	6,7,7,8	Do 9D (SM-SC)	
13D	15,16,19,25	Very stiff dark gray slightly organic fine sandy silt, trace clay, fine sand seams, gravel, mica (MH)	52.0'
14D	14,15,17,23	Dark gray slightly organic micaceous silty fine sand, trace clay (SM-SC)	MEDIUM COMPACT TO COMPACT DARK GRAY SLIGHTLY ORGANIC MICACEOUS SILTY FINE SAND, TRACE CLAY, CLAY LAYERS 58.0'
15D	9,9,10,12	Interlayered medium stiff gray slightly organic micaceous fine sandy clay & micaceous silty fine sand, trace clay (CL&SM)	
16D	8,10,12,19	Dark gray slightly organic micaceous silty fine sand, trace clay (SM-SC)	
17D	29,34,100/1"	Gray slightly organic silty fine sand, some cemented sand, trace clay, gravel (SM)	VERY COMPACT GRAY SLIGHTLY ORGANIC SILTY FINE SAND, SOME SHELLS, TRACE CLAY, CEMENTED SAND, GRAVEL, CEMENTED SAND LAYERS
18D	21,25,29,40	Dark gray slightly organic silty fine sand, some shells, trace clay (SM)	
19D	15,19,25,32	Gray silty fine sand, some shells, trace clay (SM)	
20D	54,89,100/4"	Do 19D (SM)	
21D	15,34,100/1"	Do 19D (SM)	89.1'

BORING NUMBER YB-2U

Ground surface elevation +226.5

1D	5,5,7,7	Brown fine to coarse sandy gravel, some clay, trace clay pockets (Fill) (GC)	FILL
2D	10,9,12,12	Brown clayey fine to coarse sand, trace silty fine sand pockets, gravel (Fill) (SC)	
3D	12,10,7,8	Brown clayey & silty f-c sand, some gravel, trace decomposed wood (Fill) (SC&SM)	
4D	12,20,21,20	Tan fine to medium sand, some silt, trace clay, gravel (Fill) (SM)	
5D	18,20,12,7	Do 4D & red brown clayey fine sand, trace gravel, coarse sand (Fill) (SM&SC)	
6D	9,13,12,9	Brown silty fine to coarse sand, some clay layers, gravel (Fill) (SM&CL)	
7D	9,4,12,9	Brown clayey fine sand, some silty fine sand layers, trace gravel, coarse sand, lignite, lignite layers, clay layers (Fill) (SC&SM)	
8D	4,5,9,12	Brown fine to coarse sand & gravel, some clay (Fill) (SC&GC)	
NR	20,19,15,12	Possibly, Do 8D	31.0'
9D	9,15,20,10	Brown fine to coarse sandy gravel, some silt (GM)	COMPACT FINE TO COARSE SANDY GRAVEL, SOME SILT 36.0'
10D	3,4,4,5	Tan gray silty fine sand, trace clay, gravel, coarse sand (SM-SC)	LOOSE TO MEDIUM COMPACT TAN GRAY SILTY FINE SAND, SOME CEMENTED SILT, TR CLAY, GRAVEL 44.5'
11D	5,6,7,12	Top: Brown cemented silt (GP) Bot: Gray fine sandy silt, trace clay (ML)	
12U	P	Gray green silty fine sand, trace clay, medium to coarse sand, gravel (SM-SC)	MED CPT SILTY FINE SAND, TR CLAY, GRAVEL, FINE SANDY SILT LAYERS 50.0'
13D	7,8,10,14	Dark gray slightly organic micaceous silty fine sand, trace clay, clay pockets (SM-SC)	MED CPT TO CPT DARK GRAY SLIGHTLY ORGANIC MICACEOUS SILTY FINE SAND, TRACE CLAY, CEMENTED SAND, CLAY POCKETS, CEMENTED SAND LAYERS 62.0'
NR	P	Possibly, Do 12D	
14D	10,14,19,21	Gray slightly organic micaceous silty fine sand, some clay (SM-SC)	
15U	P	Gray slightly organic micaceous silty fine sand, trace clay, cemented sand, medium sand (SM-SC)	
16D	7,8,10,10	Stiff dark gray slightly organic micaceous fine sandy clay (CL)	66.0'
17D	18,21,27,31	Gray fine to medium sand, some shells, silt, trace cemented shells, cemented sand, clay pockets (SM)	VERY COMPACT GRAY FINE TO MEDIUM SAND, SOME SILT AND DARK GRAY SLIGHTLY ORGANIC SILTY FINE SAND, SOME SHELLS, TRACE CEMENTED SHELLS, CEMENTED SAND, CLAY POCKETS 80.0'
18D	38,40,41,44	Top: Do 17D (SM) Bot: Dark gray slightly organic silty fine sand, some shells, trace cemented shells, clay (SM)	
19D	37,40,44,50	Do 18D, bot, trace clay pockets (SM)	

BORING NUMBER YB-2A

Ground surface elevation +226.5

Drilled without sampling to 35' depth

35.0'

BORING NUMBER YB-3

Ground surface elevation +211.5

1D	2,4,4,4	Brown clayey fine sand, some dec veg, trace crushed stone (Fill) (SC)	FILL 6.0'
2D	4,5,6,7	Brn black f-c sand, sm clay, gravel, tr brick, asphalt, conc fgmts, veg (Fill) (SM-SC)	
3D	5,10,5,43	Brown black clayey fine to coarse sand, some gravel, trace brick, asphalt (Fill) (SC)	
4D	14,77,14,8	Brown fine to coarse sandy gravel, trace silt, clay (Fill) (GP-GM)	
5D	4,7,8,10	Brown silty fine sand, trace clay, clay seams, vegetation (SM-SC)	LOOSE TO MEDIUM COMPACT SILTY FINE SAND, TRACE CLAY AND FINE SAND, SOME SILT, CLAY, TRACE CLAY SEAMS, VEGETATION 27.0'
6D	2,2,3,3	Do 5D (SM-SC)	
7D	4,5,6,7	Light brown fine sand, some silt, trace clay seams (SM)	
8D	2,3,3,4	Brown fine sand, some clay (SM-SC)	
9D	2,2,2,3	Medium stiff gray clayey silt, some fine sand, trace organics (Fissured) (ML)	31.0'
10D	3,4,5,5	Gray silty fine sand, trace clay (SM)	LOOSE GRAY SILTY FINE SAND, TRACE CLAY 37.0'
11D	6,9,10,13	Dark gray slightly organic micaceous silty fine sand, trace clay, clay seams (SM-SC)	MEDIUM COMPACT TO COMPACT DARK GRAY SLIGHTLY ORGANIC MICACEOUS SILTY FINE SAND, TRACE CLAY, CLAY SEAMS, CEMENTED SAND
12D	9,9,10,12	Do 11D (SM-SC)	
13D	10,10,11,12	Do 11D (SM-SC)	
14D	12,14,17,25	Gray micaceous silty fine sand, trace clay (SM)	
15D	12,14,17,26	Gray slightly organic micaceous silty fine sand, some cemented sand, trace clay (SM)	61.0'
16D	20,30,40,50	Gray silty fine sand, some shells, trace clay, mica (SM)	VERY COMPACT GRAY SILTY FINE SAND, SOME SHELLS, CEMENTED SAND LAYERS, TRACE CLAY, MICA
17D	19,24,31,34	Do 16D (SM)	
18D	24,24,31,40	Do 16D (SM)	
19D	31,37,54,60	Do 16D (SM)	
20D	77,40,48,69	Do 16D, trace clay pockets (SM)	85.0'

NOTES FOR BORING NO. YB - 1

Boring started 4-22-97 completed 4-24-97
Final depths:
Boring = 89.1' Casing = 10.0'
Casing diameter = 3"
Average depth of ground water observed in the boring = 25.0' =El. +199.2

REMARKS:

Casing blows not recorded.

Used water below 10' depth to maintain hole open.

High spoon blows at 59' depth are probably due to the presence of cemented sand layers.

Hard drilling between 82' and 88' depth and high spoon blows at sample depths 83' and 89' due to cemented sand layers and/or cemented shell layers.

Borehole was grouted upon completion.

NOTES FOR BORING NO. YB - 2A

Boring started 5-9-97 completed 5-9-97
Final depths:
Boring = 35.0' Casing = 0
Casing diameter = —
Average depth of ground water observed in the boring = DRY at 30' depth =El. —

REMARKS:

Washed hole with water to 35' depth without casing.

Observation well consisting of 1-1/2" PVC pipe installed with tip at 30' depth.

Borehole was grouted between 0' and 18' depth.

NOTES FOR BORING NO. YB - 2U

Boring started 4-17-97 completed 4-17-97
Final depths:
Boring = 80.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 15.1' =El. +211.4

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Recovered soil sample at 3' depth for corrosion test.

Used drilling mud below 10' depth to maintain hole open.

Sample not recovered in two attempts between 28' and 30' depth due to possible presence of gravel or cobbles.

Attempted 3" diameter steel tube sample between 53' and 55' depth, the bottom of tube bent due to probable presence of cemented sand layers. No recovery of sample.

The depth of groundwater observed in the hole may not be representative due to the presence of mud in the hole.

Borehole was grouted upon completion.

NOTES FOR BORING NO. YB - 3

Boring started 4-24-97 completed 4-28-97
Final depths:
Boring = 85.0' Casing = 10.0'
Casing diameter = 3"
Average depth of ground water observed in the boring = 24.2' =El. +187.3

REMARKS:

Casing blows not recorded.

Used water below 10' depth to maintain hole open.

Fill contained large gravel, brick and cobblestones which caused problems setting casing straight.

Spoon stuck at 65' and 85' depth and pulled out with difficulty due to presence of cemented sand.

Encountered cemented sand layers at 53', 58', 65', 71', 73', 80.5', 82' and 85' depths.

Borehole was grouted upon completion.

NOTES:

1. BORING NOS. YB-1, YB-2U, YB-2A, YB-3 THROUGH YB-12, YB-14 THROUGH YB-18, YB-18A THROUGH YB-23U, YB-23A, YB-24U THROUGH YB-31U, YB-31A, YB-32U, YB-34 AND YB-37 WERE MADE AND INSPECTED BY NATIONAL FOUNDATION ENGINEERING, INC., (NFE) UNDER SUBCONTRACT TO EARTH ENGINEERING AND SCIENCES, INC., (EESI) BETWEEN APRIL, 1997 AND JUNE, 1997.
2. BORING NOS. YB-13, YB-33, YB-35 AND YB-36 WERE DELETED.
3. ALL BORINGS WITH OBSERVATION WELLS WERE DRILLED WITH THE USE OF REVERT. THE REMAINING BORINGS WERE DRILLED WITH THE USE OF WATER AND/OR DRILLING MUD. THE OBSERVED GROUND WATER LEVELS IN THIS LATTER GROUP OF BORINGS MAY OR MAY NOT BE REPRESENTATIVE OF THE ACTUAL GROUNDWATER TABLE.
4. COORDINATES LOCATIONS OF THE BORINGS ARE LISTED IN TABLE NO. 1 OF MRCE SERIES REPORT NO. 250.

SIGNED		DATE
DRAWN	A.P.	DATE 8-97
CHECKED	H.S.L., S.L.T. & A.A.A.	DATE 8-97
APPROVED		DATE
		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes and Legend
F-F-457	Boring Location Plan and
F-F-458	Geological Sections
F-F-464	

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA HUGH S. LACY No. 9769 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER RUTLEDGE CONSULTING ENGINEERS
708 THIRD AVENUE, NEW YORK, N.Y. 10017

SUBMITTED Hugh S. Lacy

DE LEUW, CATHER & COMPANY. GENERAL ENGINEERING CONSULTANT ☐
HARRY WEESE & ASSOCIATES GENERAL ARCHITECTURAL CONSULTANT ☐
APPROVED

BRANCH ROUTE (F011)
LOGS OF YB – SERIES BORINGS
YB–1, YB–2U, YB–2A, AND YB–3

SCALE 0 3' 6' 12'

DRAWING NO. F-F-465

BORING NUMBER YB-4U

Ground surface elevation +196.6

1D	2,2,2,2	Brown silty clay, some silty fine sand layers, trace roots (Fill) (CL&SM)	FILL
2D	1,1,1,2	Brown silty clay, some fine sand, trace roots (Fill) (CL)	
3D	6,7,7,6	Tan brown fine sand, some silt (Fill) (SM)	
4D	6,4,3,3	Do 3D, trace clay seams (Fill) (SM)	
5D	2,2,2,2	Do 3D, trace clay, clay seams (Fill) (SM)	
6D	P	Gray silty fine sand, trace clay (Fill) (SM-SC)	
7D	2,2,2,2	Gray silty fine sand, trace clay, clay seams (Fill) (SM-SC)	
8U	P	Tan brown fine sand, some silt, clay, trace cemented sand layers (Fill) (SM-SC)	
9D	2,2,2,2	Brown tan fine sand, some silt, trace coarse sand (Fill) (SM)	22.5'
10U	P	Hard gray clayey silt, some cemented silt layers, trace fine sand seams (Fissured) (MH)	24.5'
11D	7,9,9,12	Dark gray slightly organic micaceous silty fine sand, trace clay, shells (SM-SC)	MEDIUM COMPACT DARK GRAY SLIGHTLY ORGANIC MICACEOUS SILTY FINE SAND, TRACE CLAY, SHELLS, GRAVEL
12D	7,10,10,10	Dark gray slighty organic micaceous silty fine sand, trace clay (SM-SC)	
13D	7,10,17,17	Do 12D (SM-SC)	
14D	5,5,6,6	Dark gray slightly organic fine to coarse sand, some clay, gravel, trace shells (SM-SC)	
15D	7,14,32,35	Gray fine to medium sand, some silt, shells, trace cemented sand, cemented shells, clay (SM)	49.0'
16D	19,35,50/1"	Dark gray silty fine sand, some shells, trace clay (SM-SC)	VERY COMPACT DARK GRAY SILTY FINE SAND, SOME SHELLS, TRACE CLAY, CEMENTED SAND, CEMENTED SHELLS, CEMENTED SAND LAYERS
17D	16,16,29,31	Gray silty fine sand, some shells, trace clay (SM-SC)	
18D	50/3"	Dark gray silty fine sand, some shells, trace cemented sand, cemented shells, clay (SM)	68.1'
19D	50/1"	Do 18D (SM)	

Boring started 4-21-97 completed 4-23-97
Final depths:
Boring = 68.1' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 8.2' =El. +188.4

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Recovered soil sample at 3' depth for corrosion test.

Used Revert drilling fluid below 10' depth to maintain hole open.

High spoon blows at 54', 63' and 68' depth are probably due to the presence of cemented sand layers.

Observation well consisting of 1-1/2" PVC pipe installed with tip at 40' depth.

Borehole was grouted between 0' and 31' depth.

BORING NUMBER YB-5

Ground surface elevation +203.8

1D	2,2,2,2	Brown silty fine sand, trace clay, roots, gravel, decomposed veg (Fill) (SM)	FILL 2.0'
2D	5,7,8,9	Brown silty fine sand, trace clay, clay seams, roots (SM-SC)	LOOSE TO MEDIUM COMPACT BRN SILTY FINE SAND, TRACE CLAY, CLAY SEAMS, CLAYEY FINE SAND LAYERS, ROOTS, DECOMPOSED VEGETATION
3D	4,5,5,6	Top: Brn silty fine sand, tr clay (SM) Bot: Brn clayey fine sand, tr dec veg (SC)	
4D	6,6,5,6	Brown silty fine sand, trace clay, clay seams (SM-SC)	
5D	5,3,3,2	Do 4D (SM-SC)	14.5'
6D	1,2,2,4	Top: Brown silty fine sand, trace clay (SM) Bot: Gray fine sandy silt, trace clay (ML)	LOOSE GRAY FINE SANDY SILT, TRACE CLAY AND STIFF GRAY CLAYEY SILT, SOME FINE SAND (OCCASIONALLY FISSURED)
7D	3,3,3,3	Gray fine sandy silt, trace clay (ML)	
8D	3,3,5,7	Do 7D (ML)	
9D	5,5,6,6	Stiff gray clayey silt, some fine sand, (Fissured) (ML)	31.0'
10D	10,12,14,15	Dark gray slightly organic micaceous silty fine sand, trace clay (SM-SC)	MEDIUM COMPACT DARK GRAY SLIGHTLY ORGANIC MICACEOUS SILTY FINE SAND, TRACE CLAY
11D	10,10,12,12	Do 10D (SM-SC)	
12D	6,9,11,14	Do 10D (SM-SC)	46.0'
13D	15,19,21,24	Gray silty fine sand, some shells, trace cemented shells, mica (SM)	COMPACT TO VERY COMPACT GRAY SILTY FINE SAND, SOME SHELLS, CEMENTED SAND LAYERS, TRACE CEMENTED SHELLS, CLAY, MICA
14D	39,69,100/3"	Do 13D, trace clay (SM)	
15D	15,19,27,36	Gray silty fine sand, some shells, trace clay (SM)	
NR	100/1"	Possible cemented sand layer	
16D	15,21,26,50	Gray silty fine sand, some shells, trace clay, mica (SM)	70.0'

Boring started 4-28-97 completed 4-29-97
Final depths:
Boring = 70.0' Casing = 10.0'
Casing diameter = 3"
Average depth of ground water observed in the boring = 13.1' =El. +190.7

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Used water below 10' depth to maintain hole open.

High spoon blows between 53' and 54.2' depth are probably due to the presence of cemented sand layers.

Encountered cemented sand layers between 62' and 67' depth.

Borehole was grouted upon completion.

BORING NUMBER YB-6U

Ground surface elevation +204.1

1D	2,2,3,4	Brown black silty fine sand, some gravel, trace clay, roots (Fill) (SM)	FILL 10.0'
2D	3,8,12,10	Brown tan silty fine sand, sm gravel, tr clay pockets & layers, coarse sand (Fill) (SM)	
3D	7,9,8,10	Brn gray silty fine sand, some clayey fine sand seams, tr gvl, clay sms (Fill) (SM&SC)	
4D	6,7,9,9	Do 3D, trace decomposed vegetation (Fill) (SM&SC)	
5D	7,11,12,12	Brown gray red gravelly fine to coarse sand, some silt, trace cemented sand layers (Fill) (SM)	
6D	2,2,2,3	Gray clayey fine sand, trace gravel, mica (SC)	LOOSE GRAY CLAYEY FINE SAND, TRACE GRAVEL 17.0'
7D	3,4,5,4	Stiff gray fine sandy clay (CL)	STIFF GRAY FINE SANDY CLAY AND LOOSE FINE SANDY SILT, TRACE CLAY 26.0'
8D	3,4,5,5	Gray fine sandy silt, trace clay, coarse sand (ML)	
9U	P	Gray green silty fine sand, tr clay, medium sand, cemented sand, clay pkts (SM-SC)	30.0'
10D	10,14,14,15	Very stiff gray clayey silt, trace fine sand seams (Fissured) (MH)	VERY STIFF GRAY CLAYEY SILT, TRACE FINE SAND SEAMS (FISSURED) 36.0'
11D	11,12,12,15	Do 10D (Fissured) (MH)	
12U	P	Dark gray slightly org micaceous si f sand, tr clay, medium sand, cem sand (SM-SC)	MEDIUM COMPACT TO COMPACT DARK GRAY SLIGHTLY ORGANIC MICACEOUS SILTY FINE SAND, TRACE TO SOME CEMENTED SAND, TRACE CLAY, CEMENTED SAND LAYERS
13D	4,5,7,6	Dark gray green slightly organic micaceous silty fine sand, trace clay (SM-SC)	
14D	8,9,12,10	Do 13D (SM-SC)	
15U	P	Dark gray slighty org micaceous si f sand, sm cem sand, cem sand lyrs, tr cl(SM-SC)	
16D	12,11,17,20	Dark gray slightly organic micaceous silty fine sand, trace clay, cemented sand (SM)	
17D	11,11,23,20	Dark gray slightly organic micaceous silty fine sand, trace clay (SM-SC)	57.0'
18D	11,14,21,23	Gray silty fine to medium sand, some shells, trace clay (SM-SC)	COMPACT TO VERY COMPACT GRAY SILTY FINE SAND, SOME SHELLS, TRACE CLAY, CEMENTED SAND LAYERS
19D	10,15,24,27	Gray silty fine sand, some shells, trace clay (SM)	
20D	12,13,15,23	Gray silty fine sand, some shells, trace clay (SM-SC)	
21D	13,14,20,25	Do 20D (SM-SC)	
22D	21,29,100/3"	Do 20D (SM-SC)	79.2'

Boring started 5-5-97 completed 5-6-97
Final depths:
Boring = 79.2' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 13.1' =EL +191.0

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Recovered soil sample at 3' depth for corrosion test.

Used Revert drilling fluid below 10' depth to maintain hole open.

The bottom 2" of 3" diameter steel tube of Sample No. 15U bent due to presence of cemented sand layers.

Encountered sandstone-like cemented sand layers during drilling between 66' and 68' depth.

Observation well consisting of 1-1/2" PVC pipe installed with tip at 45' depth.

Borehole was grouted between 0' and 33' depth.

BORING NUMBER YB-7

Ground surface elevation +211.9

1D	5,4,7,12	Brown silty and clayey fine sand, trace gravel, coarse sand (Fill) (SM&SC)	FILL
2D	4,5,16,29	Brown silty fine sand, trace gravel (Fill)(SM)	
3D	12,16,20,18	Brown fine to medium sand, some silt, trace gravel, clay pockets (Fill) (SM)	
4D	16,19,20,24	Brown fine to medium sand, some silt, trace gravel (Fill) (SM)	
5D	19,23,21,25	Do 4D (Fill) (SM)	10.0'
6D	2,2,2,2	Gray clayey fine sand, trace gravel (SC)	LOOSE GRAY CLAYEY FINE SAND AND SILTY FINE SAND, TRACE CLAY, MICA, GRAVEL
7D	5,4,5,5	Gray fine sand, some silt, trace clay, mica (SM)	
8D	2,3,2,2	Gray silty fine sand, trace clay, mica (SM-SC)	26.0'
9D	3,4,4,5	Gray fine sandy silt, trace clay (ML)	LOOSE GRAY FINE SANDY SILT, TRACE CLAY
10D	3,4,3,3	Do 9D (ML)	38.0'
11D	8,9,12,12	Hard light gray clayey silt, some fine sand, trace cemented silt (Fissured) (MH)	HARD LIGHT GRAY CLAYEY SILT, SOME FINE SAND, TRACE CEMENTED SILT (FISSURED AND SLICKENSIDED)
12D	19,19,19,21	Do 11D (Fissured & Slickensided) (MH)	46.0'
13D	7,10,10,12	Dark gray slightly organic micaceous silty fine sand, trace clay (SM-SC)	MEDIUM COMPACT TO VERY COMPACT DARK GRAY SLIGHTLY ORGANIC MICACEOUS SILTY FINE SAND, TRACE CLAY
14D	9,10,,13,22	Dark gray slightly organic micaceous silty fine sand, trace clay (SM-SC)	
15D	32,42,58,61	Do 14D (SM-SC)	61.0'
16D	41,43,34,40	Gray micaceous silty fine sand, trace to some shells, trace clay (SM-SC)	COMPACT TO VERY COMPACT GRAY SILTY FINE SAND, SOME SHELLS, TRACE CLAY, MICA, CEMENTED SAND LAYERS
17D	12,15,21,25	Gray silty fine sand, some shells, trace clay, mica (SM)	
18D	13,21,35,22	Gray silty fine sand, trace to some shells, trace mica (SM)	
19D	11,17,19,22	Gray silty fine sand, some shells, trace clay, mica (SM-SC)	
20D	12,16,25,40	Do 19D (SM-SC)	85.0'

Boring started 5-13-97 completed 5-14-97
Final depths:
Boring = 85.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = — =EL —

REMARKS:
Washed ahead of casing to 10' depth and then pushed casing to 10' depth.
Used drilling mud below 10' depth to maintain hole open.
Encountered sandstone-like cemented sand layers during drilling between 76' and 77' depth.
No measurement of groundwater level was made in this borehole.
Borehole was grouted upon completion.

BORING NUMBER YB-8U

Ground surface elevation +210.5

1D	2,2,2,2	Brown black silty fine to coarse sand, sm gravel, tr clay pockets, roots (Fill) (SM)	FILL
2D	4,11,3,3	Brown silty fine sand, trace coarse sand, gravel, clay (Fill) (SM)	
3D	5,11,15,19	Brown silty fine sand, some gravel, trace clay, roots, coarse sand (Fill) (SM-SC)	
4D	10,11,20,24	Brown gravelly fine to coarse sand, some silt, trace clay (Fill) (SM)	
5D	17,12,10,6	Top: Brown silty fine sand, some gravel, trace clay pockets (Fill) (SM) Bot: Gray green clayey fine sand (Fill) (SC)	10.0'
6U	P	Gray green fine sand, some clay (SM-SC)	LOOSE GRAY GREEN SILTY FINE SAND, TRACE CLAY, MICA AND GRAY GREEN FINE SAND, SOME CLAY
7D	2,2,2,3	Gray green silty fine sand, trace clay, mica (SM-SC)	
8D	2,4,4,5	Do 7D (SM-SC)	
9U	P	Top: Dark green silty fine sand, trace clay (SM-SC)	24.5'
10D	3,4,3,3	Bot: Dark green f sandy silt, tr clay (ML) Medium stiff gray clayey silt, some fine sand (MH)	MED TO V STIFF GRY GRN CLAYEY SILT, SM SAND AND LOOSE TO MED CPT FINE SANDY SILT, TR F SAND LYRS 32.0'
11U	P	Very stiff gray grn clayey silt, sm fine sand, trace fine sand layers & pkts, mica (MH)	
12D	4,5,6,6	Gray fine sandy silt, trace clay (ML)	
13D	5,8,7,8	Gray silty fine sand, trace clay (SM-SC)	MED CPT SILTY FINE SAND, TRACE CLAY 36.0'
14D	15,21,23,26	Hard gray clayey silt, trace fine sand, fine sand seams (Fissured) (MH)	HARD GRAY CLAYEY SILT AND CLAY, TRACE TO SOME FINE SAND, TRACE FINE SAND POCKETS (FISSURED)
15D	9,12,17,21	Hard gray clayey silt & clay, some fine sand layers, trace fine sand pockets (Fissured) (MH&CH)	46.0'
16D	6,8,14,15	Dark gray slightly organic micaceous clayey fine sand (SC)	MED CPT TO VERY CPT DARK GRAY SLIGHTLY ORGANIC MICACEOUS CLAYEY AND SILTY FINE SAND
17D	7,8,9,9	Do 16D (SC)	
18D	17,31,45, 50/3"	Dark gray slightly organic micaceous silty fine sand, trace clay (SM-SC)	59.5'
19D	9,17,18,21	Gray silty fine sand, some shells, trace clay (SM-SC)	COMPACT TO VERY COMPACT GRAY SILTY FINE SAND, SOME SHELLS, TRACE CLAY
20D	9,12,12,15	Do 19D (SM-SC)	
21D	10,16,19,27	Do 19D (SM-SC)	
22D	13,20,24,35	Do 19D (SM-SC)	
23D	17,23,34,40	Do 19D (SM-SC)	85.0'

Boring started 5-16-97 completed 5-16-97
Final depths:
Boring = 85.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 36.0' =El. +174.5

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.
Recovered soil sample at 10' depth for corrosion test.
Used Revert drilling fluid below 10' depth to maintain hole open.
High spoon blows between 59' and 59.8' depth are probably due to the presence of cemented sand layer.
Observation well consisting of 1-1/2" PVC pipe installed with tip at 45' depth.
Borehole was grouted between 0' and 33' depth.

NED		DATE
N	A.P.	8-97 DATE
CED	H.S.L., S.L.T. & A.A.	8-97 DATE
OVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-F-455	General Notes and Legend
F-F-457	Boring Location Plan and
F-F-458	Geological Sections
F-F-459	
F-F-460	

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — HUGH B. LACY — No. 8759 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER RUTLEDGE CONSULTING ENGINEERS
708 THIRD AVENUE, NEW YORK, N.Y. 10017

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT

HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT

SUBMITTED

APPROVED

BRANCH ROUTE (F011)
LOGS OF YB – SERIES BORINGS
YB–4U THROUGH YB–8U

SCALE 0 3' 6' 12'

DRAWING NO. F-F-466

BORING NUMBER YB-9

Ground surface elevation +226.3

Sample	Blows	Description
1D	4,4,5,5	Black brown fine sandy silt, trace roots, gravel, clay (Fill) (ML)
2D	6,7,11,12	Very stiff brown fine sandy clay, trace gravel, coarse sand, wood (Fill) (CL)
3D	12,13,15,17	Very stiff brown fine sandy clay, trace gravel, coarse sand, root (Fill) (CL)
4D	10,16,17,20	Hard brown fine sandy clay, trace gravel, coarse sand (Fill) (CL)
5D	14,17,21,25	Hard brown silty clay, some fine sand, trace gravel (Fill) (CL)
6D	2,1,2,3	Soft gray silty clay, trace fine sand (CL)
7D	2,2,2,3	Stiff gray fine sandy clay (CL)
8D	3,4,3,4	Gray fine sandy silt, trace clay, mica (ML)
9D	3,2,2,3	Soft gray fine sandy clay, trace mica (CL)
10D	4,5,6,6	Medium stiff gray fine sandy clay, trace mica (CL)
11D	7,5,4,4	Gray silty fine sand, trace clay, clay pockets, mica (SM-SC)
12D	4,4,5,6	Gray clayey fine sand, trace mica (SC)
13D	3,4,7,8	Gray silty fine sand, trace clay, clay pockets, mica (SM-SC)
14D	5,7,8,8	Soft gray silty clay, some fine sand (CL)
15D	6,7,8,4	Gray silty and clayey fine sand (SM&SC)
16D	17,21,27,42	Stiff gray clayey silt, trace fine sand (Slickensided) (MH)
17D	25,27,34,40	Dark gray slightly organic fine sandy silt, trace clay, mica (MH)
18D	18,21,28,35	Dark gray slightly organic micaceous silty fine sand, trace clay (SM-SC)
19D	15,20,29,36	Gray slightly organic micaceous silty fine sand, trace clay, shells (SM-SC)
20D	17,23,31,35	Gray silty fine sand, some shells, trace clay (SM-SC)
21D	19,24,33,47	Do 20D (SM-SC)
22D	20,35,39,49	Do 20D (SM-SC)
23D	21,22,30,41	Do 20D (SM-SC)

Stratum	Bottom
FILL	12.0'
SOFT TO STIFF GRAY SANDY CLAY TO SILTY CLAY AND LOOSE FINE SANDY SILT, TRACE CLAY, MICA	36.0'
LOOSE TO MEDIUM COMPACT GRAY SILTY FINE SAND, TRACE CLAY, CLAY POCKETS AND CLAYEY FINE SAND, TRACE MICA	51.0'
(CL)	56.0'
MEDIUM CPT GRAY SILTY AND CLAYEY FINE SAND	62.0'
STIFF GRAY TO DARK GRAY CLAYEY SILT AND VERY COMPACT SLIGHTLY ORG FINE SANDY SILT, TR CLAY (SLICKENSIDED)	71.0'
COMPACT GRAY SLIGHTLY ORGANIC MICACEOUS SILTY FINE SAND, TRACE CLAY, SHELLS	81.0'
VERY COMPACT GRAY SILTY FINE SAND, SOME SHELLS, TRACE CLAY	100.0'

NOTES FOR BORING NO. YB - 9

Boring started 5-21-97 completed 5-21-97
Final depths:
Boring = 100.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = — =El. —

REMARKS:

Washed ahead of casing to 10' depth then pushed casing to 10' depth.

Used mud below 10' depth to maintain hole open.

No measurement of groundwater level was made in this borehole.

Borehole was grouted upon completion.

BORING NUMBER YB-10

Ground surface elevation +225.1

Casing blows: 15, 57, 107, 60, 33, 38, 50, 65, 65, 65

Sample	Blows	Description
1D	4,4,8,10	Top: Brn f-c sa, sm si, gvl, tr cl pkts (Fill) (SM); Bot: Brn si fine sand, tr gravel, cl (Fill) (SM)
2D	14,19,19,14	Do 1D, bot, trace clay lenses (Fill) (SM)
3D	11,11,16,17	Very stiff brown silty clay, some fine sand, trace gravel pockets, dec veg (Fill) (CL)
4D	12,12,14,15	Very stiff brown silty clay, some fine sand, tr fine to medium sand pockets (CL)
5D	14,14,16,16	Very stiff brown silty clay, trace fine sand, fine sand pockets (CL)
6D	4,5,6,9	Stiff mottled brown gray silty clay, trace fine sand, cemented sand, roots (CL)
7D	5,5,6,6	Brown clayey fine sand, trace clay seams (SC)
8D	WR/24"	Brown silty fine sand, trace clay (SM-SC)
9D	14,8,10,8	Gray silty fine sand, trace clay, lignite (SM-SC)
10D	5,5,6,5	Do 9D, trace mica (SM-SC)
11D	8,8,9,9	Gray silty fine sand, trace clay, mica (SM-SC)
12D	5,5,6,6	Stiff gray clayey silt, some fine sand (ML)
13D	21,18,17,17	Gray slightly organic silty fine sand, trace clay, mica (SM-SC)

Stratum	Bottom
FILL	6.0'
STIFF TO VERY STIFF BROWN GRAY SILTY CLAY TRACE TO SM FINE SAND, CEMENTED SAND	15.0'
LOOSE TO MEDIUM COMPACT BROWN CLAYEY AND SILTY FINE SAND	27.0'
MEDIUM COMPACT GRAY SILTY FINE SAND, TRACE CLAY, LIGNITE, MICA	41.0'
STIFF GRAY CLAYEY SILT, SOME FINE SAND	47.0'
(SM-SC)	50.0'

Boring started 4-17-97 completed 4-17-97
Final depths:
Boring = 50.0' Casing = 10.0'
Casing diameter = 3"
Average depth of ground water observed in the boring = 12.5' =El. +212.6

REMARKS:

Used mud below 10' depth to maintain hole open.

Recovered soil sample at 10' depth for corrosion test.

Sample penetration resistance of Sample No. 8D does not appear to be representative. The blow count recorded may be due to disturbance during drilling and sampling sand under unbalanced head condition created in the borehole while withdrawing the drill rods before sampling.

The depth of groundwater observed in the hole may not be representative due to the presence of mud in the hole.

Borehole was grouted upon completion.

BORING NUMBER YB-11

Ground surface elevation +230.0

Sample	Blows	Description
1D	2,2,3,3	Brown gray silty fine sand, trace gravel, roots (Fill) (SM)
2D	4,2,3,3	Do 1D (Fill) (SM)
3D	4,4,6,10	Interlayered brn gray si fine sand, tr gvl & f sand, sm clay, gvl, tr roots (Fill) (SM&SC)
4D	8,10,10,11	Brown fine sand, some silt (SM)
5D	10,12,11,11	Do 4D (SM)
6D	3,3,3,4	Medium stiff gray clay, trace fine sand (Fissured) (CH)
7D	2,3,3,4	Medium stiff gray silty clay and clay, some fine sand, trace fine sand pockets (Fissured) (CL&CH)
8D	2,2,2,2	Medium stiff gray silty clay, some fine sand (CL)
9D	3,3,3,4	Do 8D, trace fine sand seams (CL)
10D	4,4,5,5	Gray silty fine sand, trace clay, clay pockets (SM-SC)
11D	5,6,7,7	Do 10D (SM-SC)

Stratum	Bottom
FILL	6.0'
MEDIUM COMPACT BROWN FINE SAND, SOME SILT	12.0'
MEDIUM STIFF GRAY CLAY AND SILTY CLAY, TRACE TO SOME FINE SAND, TRACE FINE SAND SEAMS & POCKETS (FISSURED)	31.0'
LOOSE TO MEDIUM COMPACT GRAY SILTY FINE SAND, TRACE CLAY, CLAY POCKETS	40.0'

Boring started 4-16-97 completed 4-16-97
Final depths:
Boring = 40.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 15.6' =El. +214.4

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Used mud below 10' depth to maintain hole open.

The depth of groundwater observed in the hole may not be representative due to the presence of mud in the hole.

Borehole was grouted upon completion.

BORING NUMBER YB-12

Ground surface elevation +220.0

Sample	Blows	Description
1D	1,1,2,3	Medium stiff brown silty clay, some fine sand, trace roots (Fill) (CL)
2D	9,10,10,10	Very stiff mottled brown gray silty clay & clay, trace fine sand (CL&CH)
3D	10,9,9,12	Do 2D, trace cemented sand (CL&CH)
4D	15,10,8,7	Stiff brown gray silty clay and clay, trace fine sand, cemented sand (CL&CH)
5D	10,7,4,3	Brown gray clayey fine sand (SC)
6D	2,2,3,4	Stiff gray fine sandy clay (Fissured) (CL)
7D	5,5,6,6	Do 6D (Fissured) (CL)
8D	5,5,5,7	Gray silty fine sand, trace clay (SM-SC)
9D	8,9,10,10	Do 8D, trace mica (SM-SC)
10D	9,10,11,12	Do 8D, trace mica (SM-SC)
11D	10,12,14,15	Do 8D, trace mica (SM-SC)

Stratum	Bottom
FILL	2.0'
STIFF TO VERY STIFF BROWN GRAY SILTY CLAY AND CLAY, TR CEMENTED SAND	8.0'
(SC)	11.0'
STIFF GRAY FINE SANDY CLAY (FISSURED)	22.0'
MEDIUM COMPACT GRAY SILTY FINE SAND, TRACE CLAY, MICA	40.0'

Boring started 4-29-97 completed 4-29-97
Final depths:
Boring = 40.0' Casing = 10.0'
Casing diameter = 3"
Average depth of ground water observed in the boring = 6.2' =El. +213.8

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Used water below 10' depth to maintain hole open.

Borehole was grouted upon completion.

BORING NUMBER YB-14

Ground surface elevation +242.1

Casing blows: 50, 75, 54, 47, 49, 115, 143, 121, 167, 112

Sample	Blows	Description
1D	2,6,14,12	Brown black fine sandy silt, some gravel, trace clay, organics (Fill) (ML)
2D	14,16,11,11	Brown red silty fine sand, trace gravel, clay seams (Fill) (SM)
3D	6,8,9,12	Do 2D (Fill) (SM)
4D	14,22,22,18	Brown red silty fine sand, some gravel, trace clay (Fill) (SM)
5D	12,12,15,15	Do 4D (Fill) (SM)
6D	4,2,1,1	Red brown fine sand, some silt, trace clay, clay seams (SM-SC)
7D	7,7,7,8	Top: Stiff red silty clay, trace fine sand, fine sand seams (CL); Bot: Medium stiff gray silty clay, trace fine sand (CL)
8D	2,2,3,4	Medium stiff gray clay, trace fine sand, silt pockets (Slickensided) (CH)
9D	5,5,6,7	Do 8D (Slickensided) (CH)

Stratum	Bottom
FILL	11.0'
LOOSE RED BROWN FINE SAND, SOME SILT, TRACE CLAY	17.0'
(CL)	19.0'
MEDIUM STIFF GRAY CLAY AND SILTY CLAY, TRACE FINE SAND, SILT POCKETS (SLICKENSIDED)	30.0'

Boring started 4-15-97 completed 4-15-97
Final depths:
Boring = 30.0' Casing = 10.0'
Casing diameter = 3"
Average depth of ground water observed in the boring = — =El. —

REMARKS:

Washed ahead of casing to 10' depth and then drove casing to 10' depth.

Used mud below 10' to maintain hole open.

Recovered soil sample at 3' depth for corrosion test.

No measurement of groundwater level was made in this borehole.

Borehole was grouted upon completion.

SIGNED		DATE
DRAWN	A.P.	DATE 8-97
CHECKED	H.S.L., S.L.T. & A.A.A.	DATE 8-97
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-F-465	General Notes and Legend
F-F-457	Boring Location Plan and
F-F-458	Geological Sections
F-F-460	
F-F-464	

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — HUGH S. LACY — No. 8769 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER RUTLEDGE CONSULTING ENGINEERS
708 THIRD AVENUE, NEW YORK, N.Y. 10017
SUBMITTED [signature]

DE LEUW, CATHER & COMPANY — GENERAL ENGINEERING CONSULTANT
HARRY WEESE & ASSOCIATES — GENERAL ARCHITECTURAL CONSULTANT
APPROVED

BRANCH ROUTE (F011)
LOGS OF YB – SERIES BORINGS
YB-9 THROUGH YB-12 AND YB-14

SCALE 0 3' 6' 12'

DRAWING NO. F-F-467

BORING NUMBER YB-15

Ground surface elevation +243.1

1D	4,5,10,10	Gray brn silty fine sand, some clay layers, gravel, trace organics, glass (Fill) (SM&CL)	FILL	
2D	10,9,11,11	Gry brn silty fine sand, some gravel, trace coarse sand, clay layers, org (Fill) (SM)		
3D	11,10,9,6	Brown fine sand, some silt, trace gravel, roots (Fill) (SM)		
4D	6,6,11,7	Brown fine to coarse sand, some silt, gravel, trace clay, roots (Fill) (SM)		8.0'
5D	5,6,7,7	Tan brown fine sand, trace silt (SP-SM)	MED CPT FINE SAND, TR SILT	11.0'
6D	1,2,2,2	Interlayered tan brown clayey fine sand and fine sandy clay (SC&CL)	INTERLAYERED LOOSE CLAYEY FINE SAND AND SOFT FINE SANDY CLAY	16.0'
7D	3,3,4,6	Medium stiff gray clay, trace fine sand (Slickensided) (CH)	MEDIUM STIFF TO STIFF GRAY CLAY, TRACE FINE SAND, SILT POCKETS (SLICKENSIDED)	
8D	3,4,5,5	Stiff gray clay, trace fine sand, silt pockets (Slickensided) (CH)		
9D	3,4,6,7	Do 8D (Slickensided) (CH)		30.0'

Boring started 4-15-97 completed 4-15-97
Final depths:
Boring = 30.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water
observed in the boring = 13.3' =El. +229.8

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Used Revert drilling fluid below 10' depth to maintain hole open.

Observation well consisting of 1-1/2" PVC pipe installed with tip at 25' depth.

Borehole was grouted between 0' and 13' depth.

BORING NUMBER YB-16

Ground surface elevation +231.0

1D	1,1,1,1	Brown fine to medium sandy clay, trace gravel, roots (Fill) (CL)	FILL	
2D	1,2,1,1	Brown fine to medium sandy clay, trace gravel, coarse sand (Fill) (CL)		
3D	3,3,4,5	Brown fine sandy clay, trace coarse sand, gravel (Fill) (CL)		
4D	3,2,3,5	Brown fine sandy clay, trace gravel (Fill) (CL)		
5D	11,10,9,9	Brown red silty clay, trace gravel (Fill) (CL)		11.0'

112
94

Boring started 4-16-97 completed 4-16-97
Final depths:
Boring = 11.0' Casing = 10.0'
Casing diameter = 3"
Average depth of ground water
observed in the boring = 4.0' =El. +227.0

REMARKS:

Washed ahead of casing to 8' and then pushed casing to 8' depth.

Hole abandoned at 11' depth after hitting an obstruction which was probably a quartz boulder. Roller bit worn out from attempts to advance boring through obstruction.

The depth of groundwater observed in the hole may not be representative. Water level observed appears to be wash water.

Borehole was grouted upon completion.

Drilled a replacement boring at the location of YB-16A.

BORING NUMBER YB-16A

Ground surface elevation +231.0

1D	1,1,1,1	Brown clayey fine to medium sand, trace clay pockets, gravel, roots (Fill) (SC)	FILL	
2D	1,5,5,6	Do 1D (Fill) (SC)		
3D	5,6,8,5	Brown fine to coarse sandy clay, some gravel (Fill) (CL)		
4D	3,4,6,6	Do 3D (Fill) (CL)		12.0'
5D	10,10,17,24	Top: Do 3D (Fill) (CL) Bot: Hard mottled red gray clay, trace fine sand (Fill) (CH)		
6D	3,3,5,5	Medium stiff gray silty clay, trace fine sand, lignite (Fissured & Slickensided) (CH)		18.0'
7D	5,5,5,5	Gray silty fine sand, trace clay, clay layers (SM-SC)	LOOSE TO MEDIUM COMPACT GRAY SILTY FINE SAND, TRACE CLAY, CLAY LAYERS AND SEAMS	
8D	6,6,6,7	Do 7D (SM-SC)		
9D	5,5,6,6	Gray silty fine sand, trace clay, clay seams (SM-SC)		
10D	9,7,6,6	Do 9D (SM-SC)		
11D	4,5,5,5	Gray silty fine sand, trace clay (SM-SC)		40.0'

15
15
15
48
108
115

Boring started 4-16-97 completed 4-16-97
Final depths:
Boring = 40.0' Casing = 10.0'
Casing diameter = 3"
Average depth of ground water
observed in the boring = 9.2' =El. +221.8

REMARKS:

Washed ahead of casing with roller bit and then drove the casing to 10' depth. The casing blows are not indicative of consistency.

Recovered soil sample at 3' depth for corrosion test.

Used mud below 10' depth to maintain hole open.

The depth of groundwater observed in the hole may not be representative due to the presence of mud in the hole.

Borehole was grouted upon completion.

BORING NUMBER YB-17

Ground surface elevation +248.2

1D	3,4,4,5	Brown fine to coarse sand, some gravel, silt, trace roots (Fill) (SM)	FILL	
2D	4,5,6,3	Brown fine to coarse sand, some gravel, silt (Fill) (SM)		
3D	4,5,6,6	Brown silty fine sand, trace gravel, clay pockets, roots (Fill) (SM)		
4D	4,5,8,8	Brn silty fine sand, sm gravel, cemented sand lyrs, tr clay pockets, veg (Fill) (SM)		
5D	3,4,5,5	Brown silty fine to medium sand, some gravel, trace clay, roots (Fill) (SM)		
6D	2,3,3,4	Brown silty & clayey fine to coarse sand, some gravel (Fill) (SM&SC)		
7D	3,4,4,5	Medium stiff mottled brown gray silty clay, trace fine sand (Fill) (CL)		
8D	16,13,12,12	Brown gray fine to coarse sand & gravel, trace silt (Fill) (SP-SM&GP-GM)		
9D	6,5,7,7	Stiff mottled brown gray clay, trace fine sand, cemented silt seams (Fill) (CH)		
10D	6,5,5,6	Do 9D (Fill) (CH)		37.0'
11D	3,3,3,4	Gray clayey fine sand (SC)	LOOSE CLAYEY FINE SAND	40.0'

Boring started 5-2-97 completed 5-2-97
Final depths:
Boring = 40.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water
observed in the boring = DRY at 25' depth =El. —

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Used Revert drilling fluid below 10' depth to maintain hole open.

Observation well consisting of 1-1/2" PVC pipe installed with tip at 25' depth.

Borehole was grouted between 0' and 13' depth.

BORING NUMBER YB-18

Ground surface elevation +253.9

1D	3,4,9,5	Brown gray silty fine sand, some gravel, trace clay, concrete, wood (Fill) (SM-SC)	FILL	
2D	6,6,5,4	Gray fine to coarse sandy gravel, trace silt, concrete (Fill) (GP-GM)		
3D	3,4,3,3	Brown gray fine to coarse sand, some gravel, clay (Fill) (SM-SC)		
4D	6,5,5,5	Brown gravelly fine to coarse sand, some clay (Fill) (SM-SC)		
5D	5,6,7,6	Brown gravelly fine to coarse sand, some silt, trace clay pockets (Fill) (SM)		
6D	4,5,5,6	Brown gravelly fine to coarse sand, some clay (SM-SC)		
7D	4,5,5,4	Do 6D , some clay pockets (Fill) (SM-SC)		
8D	4,4,5,6	Brown fine to coarse sandy gravel, trace clay (Fill) (GP-GC)		
9D	3,3,4,6	Brown fine to coarse sandy clay, trace to some gravel, trace organics, roots (Fill) (CL)		
10D	3,4,5,5	Brown clayey fine sand, some gravel, organics, trace clay pockets, roots (Fill) (SC)		
11D	6,10,11,12	Brown clayey fine to medium sand & fine sandy clay, some gravel (Fill) (SC&CL)		40.0'
12D	2,4,6,5	Medium stiff gray fine sandy clay (CL)	MEDIUM STIFF GRAY FINE SANDY CLAY AND SILTY CLAY, SOME FINE SAND	
13D	5,5,6,7	Medium stiff gray silty clay, some fine sand (CL)		51.0'
14D	4,6,7,7	Gray silty fine sand, trace clay, clay pockets, cemented sand (SM-SC)	MED CPT SILTY FINE SAND, TR CLAY, CEMENTED SAND	56.0'
15D	5,6,5,4	Medium stiff gray silty clay, some fine sand (CL)		61.0'
16D	7,8,8,8	Gray silty fine sand, trace clay, mica (SM-SC)	MEDIUM COMPACT GRAY SILTY FINE SAND, TRACE CLAY, MICA, GRAVEL	
17D	6,8,10,10	Do 16D (SM-SC)		
18D	7,7,10,12	Gray silty fine sand, trace clay, gravel, mica (SM-SC)		
19D	7,8,9,9	Gray silty fine sand, trace clay, mica (SM-SC)		80.0'

Boring started 5-8-97 completed 5-8-97
Final depths:
Boring = 80.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water
observed in the boring = 35.7' =El. +218.2

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Used Revert drilling fluid below 10' depth to maintain hole open.

Samples Nos. 6D, 8D and 15D appeared to be washed.

Observation well consisting of 1-1/2" PVC pipe installed with tip at 40' depth.

Borehole was grouted between 0' and 28' depth.

BORING NUMBER YB-19

Ground surface elevation +247.2

1D	1,1,1,1	Soft brown silty clay, trace fine sand (Fill) (CL)	FILL	
2D	1,2,2,3	Medium stiff red brown silty clay, trace fine sand (Fill) (CL)		
3D	3,3,2,2	Soft red brown clay, trace fine sand, roots (Fill) (CH)		
4D	1,1,2,2	Soft red brown clay, trace fine sand (Fill) (CH)		
5D	2,2,5,6	Top: Do 4D (Fill) (CH) Bot: Brown fine sand, some silt, trace clay (Fill) (SM)		
6D	7,6,5,5	Top: Soft brown silty clay, some fine sand (Fill) (CL) Bot: Brown fine sand, some silt, trace clay pockets (Fill) (SM)		
7D	2,2,3,3	Brown white gravel, trace medium to coarse sand, silt (Fill) (GP)		21.0'
8D	4,5,5,5	Medium stiff gray clay, trace fine sand, mica (Slickensided) (CH)	MEDIUM STIFF GRAY CLAY, TRACE FINE SAND, MICA (SLICKENDSIDED)	
9D	5,6,6,6	Do 8D (CH)		32.0'
10D	1,2,2,2	Gray clayey fine sand (SC)	LOOSE GRAY CLAYEY AND SILTY FINE SAND	
11D	2,2,2,3	Gray silty fine sand, trace clay (SM-SC)		41.0'
12D	2,2,2,2	Medium stiff gray fine sandy clay (CL)		46.0'
13D	14,8,8,8	Gray clayey fine sand (SC)	MEDIUM CPT CLAYEY FINE SAND	50.0'

Boring started 5-2-97 completed 5-2-97
Final depths:
Boring = 50.0' Casing = 10.0'
Casing diameter = 3"
Average depth of ground water
observed in the boring = 8.0' =El. +239.2

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Used mud below 10' depth to maintain hole open.

Recovered soil sample at 10' depth for corrosion test.

Sample No. 7D appeared to be washed.

The depth of groundwater observed in the hole may not be representative due to the presence of mud in the hole

Borehole was grouted upon completion.

		DATE
GNED		
WN	A.P.	8-97
CKED	H.S.L., S.L.T. & A.A.A.	8-97
ROVED		

REFERENCE DRAWINGS		REVISIONS		
NUMBER	DESCRIPTION	DATE	BY	DESCRIPTION
F-F-456	General Notes and Legend			
F-F-457	Boring Location Plan and			
F-F-460	Geological Sections			
F-F-461				

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER RUTLEDGE CONSULTING ENGINEERS
708 THIRD AVENUE, NEW YORK, N.Y. 10017

DE LEUW, CATHER & COMPANY, GENERAL ENGINEERING CONSULTANT

HARRY WEESE & ASSOCIATES GENERAL ARCHITECTURAL CONSULTANT

SUBMITTED

APPROVED

BRANCH ROUTE (F011)
LOGS OF YB – SERIES BORINGS
YB–15, YB–16, YB–16A, YB–17 THRU YB–19

SCALE 0 3' 6' 12'

DRAWING NO. F–F–468

DEPTH BELOW GROUND SURFACE, FEET

BORING NUMBER YB-20U

Ground surface elevation +246.1

1D	2,2,2,2	Stiff brown clay, trace fine sand, fine sand pockets (Fill) (CH)	FILL
2D	2,3,3,2	Do 1D (Fill) (CH)	
3D	2,3,2,2	Do 1D (Fill) (CH)	
4D	3,3,2,4	Medium stiff brown clay, trace fine sand (Fill) (CH)	
5D	3,3,4,4	Soft brown clay, trace fine sand (Fill) (CH)	
6U	P	Stiff tan clay, trace fine sand (Fill) (CH)	
7D	2,2,2,3	Soft brown clay, trace lignite, gravel (Fill) (CH)	
8D	4,5,5,5	Soft brown silty clay, trace gravel, coarse sand (Fill) (CL)	22.0'
9U	P	Stiff gray clay, trace fine sand, gravel (CH)	STIFF GRAY CLAY, TRACE FINE SAND, GRAVEL
NR	P	Probably, Do 9U	
NR	P	Probably, Do 9U	30.0'
10D	3,4,5,6	Gray silty fine sand, trace clay, gravel (SM-SC)	LOOSE TO MED CPT GRAY SILTY AND CLAYEY FINE SAND, TRACE GRAVEL
11D	4,6,7,7	Gray clayey fine sand (SC)	36.0'
12D	3,4,4,5	Medium stiff gray fine sandy clay, trace fine sand seams (CL)	MEDIUM STIFF GRAY FINE SANDY CLAY, TRACE FINE SAND SEAMS
13D	2,2,3,3	Do 11D (CL)	46.0'
14D	3,4,5,5	Gray silty fine sand, trace clay (SM-SC)	LOOSE SILTY FINE SAND, TRACE CLAY 50.0'

Boring started 5-9-97 completed 5-9-97
Final depths:
Boring = 50.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 8.0' =El. +238.1

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Used Revert drilling fluid below 10' depth to maintain hole open.

Observation well consisting of 1-1/2" PVC pipe installed with tip at 45' depth.

Borehole was grouted between 0' and 33' depth.

BORING NUMBER YB-21U

Ground surface elevation +245.9

1D	2,2,2,2	Brown silty clay, some fine sand, trace roots, organics (Fill) (CL)	FILL
2D	2,3,2,3	Stiff mottled brown gray clay, trace fine sand (Fill) (CH)	
3D	2,2,3,2	Do 2D (Fill) (CH)	
4D	2,2,2,2	Soft mottled brown gray clay, trace fine sand, fine sand seams (Fill) (CH)	
5D	1,1,1,1	Very soft mottled brown gray clay, trace fine sand, fine sand seams (Fill) (CH)	
6D	3,2,2,2	Do 5D (Fill) (CH)	
7D	1,1,1,2	Do 5D (Fill) (CH)	
8D	2,2,1,1	Top: Do 5D (Fill) (CH) Bot: Brown fine sand, some clay (Fill) (SM-SC)	
9D	4,3,2,2	Brown clayey fine sand, some clay pockets, gravel (Fill) (SC&CL)	31.0'
10D	2,2,3,3	Medium gray fine sandy clay, trace mica (CL)	MEDIUM GRAY FINE SANDY CLAY & LOOSE FINE SANDY SILT, TRACE GRAVEL, MICA
11U	P	Gray fine sandy silt, trace clay, clayey silt pockets, gravel (MH)	40.0'
12D	3,2,2,3	Gray silty fine sand, trace clay, clay pockets (SM-SC)	LOOSE GRAY SILTY FINE SAND, TRACE CLAY, CLAY POCKETS, CLAYEY FINE SAND LAYERS, CEMENTED SILT
13U	P	Gray silty fine sand, trace clay, clay pockets (SM-SC)	
14D	3,4,4,3	Do 13U (SM-SC)	
15U	P	Gray fine sand, some silt, trace clay, cemented silt (SM)	52.0'
16D	3,4,4,4	Gray clayey fine sand, sm silty fine sand layers & pockets, tr clay pockets (SC&SM)	

Boring started 5-12-97 completed 5-12-97
Final depths:
Boring = 52.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 13.8' =El. +232.1

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Recovered soil sample at 10' depth for corrosion test.

Used Revert drilling fluid below 10' depth to maintain hole open.

Observation well consisting of 1-1/2" PVC pipe installed with tip at 45' depth.

Borehole was grouted between 0' and 33' depth.

BORING NUMBER YB-22

Ground surface elevation +248.1

1D	2,2,3,4	Medium stiff brown clay, trace fine sand, roots (Fill) (CH)	FILL
2D	4,4,4,4	Stiff brown clay, trace fine sand, roots (Fill) (CH)	
3D	4,5,5,4	Medium stiff brown clay, trace fine sand (Fill) (CH)	
4D	7,10,12,5	Top: Soft bm silty clay, tr f sand (Fill) (CL) Bot: Brn f-c sa, sm gvl, cl, tr brk (Fill) (SM-SC)	
5D	2,2,2,2	Top: Soft brown silty clay, trace fine sand, gravel (Fill) (CL) Bot: Brown gravelly fine to coarse sand, some clay (Fill) (SM-SC)	
6D	5,7,7,10	Top: Brown fine to coarse sand & gravel (Fill) (SP&GP) Bot: Brown fine sand, trace silt (Fill) (SP)	
7D	7,7,7,7	Top: Brown fine sand, trace silt (Fill) (SP-SM) Bot: Brown fine to coarse sand & gravel (Fill) (SP&GP)	
8D	3,3,3,3	Brown fine sand, trace gravel, silt (Possible Fill) (SP)	27.0'
9D	3,3,4,5	Medium stiff gray clay, trace fine sand (CH)	MEDIUM STIFF GRAY CLAY, TRACE FINE SAND (SLICKENSIDED)
10D	1,2,3,2	Do 9D (Slickensided) (CH)	37.0'
11D	2,3,3,3	Gray clayey fine sand (SC)	LOOSE GRAY CLAYEY FINE SAND & MEDIUM COMPACT GRAY SILTY FINE SAND, TRACE CLAY, MICA
12D	2,2,2,2	Do 11D (SC)	
13D	5,6,6,7	Gray silty fine sand, trace clay, mica (SM-SC)	
14D	5,7,9,10	Do 13D (SM-SC)	
15D	12,12,14,14	Do 13D (SM-SC)	60.0'

Boring started 4-30-97 completed 4-30-97
Final depths:
Boring = 60.0' Casing = 25.0'
Casing diameter = 3"
Average depth of ground water observed in the boring = 13.0' =El. +235.1

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Used drilling mud below 10' depth to maintain hole open.

Hole caved in at 25' depth. Hole could not be kept open with mud due to presence of large amount of gravel. Tapped casing with 140 lb. hammer from 10' depth to 25' depth to stop caving.

Borehole was grouted upon completion.

BORING NUMBER YB-23U

Ground surface elevation +240.2

1D	6,6,7,10	Brown silty fine sand, trace gravel, clay pockets, roots (Fill) (SM)	FILL
2D	7,14,18,21	Brown silty clay, some fine sand, trace gravel (Fill) (CL)	
3D	20,14,14,10	Brown silty fine to medium sand, trace gravel, clay seams (Fill) (SM)	
4D	14,10,10,11	Brn tan sl f sand, tr clay pockets, clay seams, f-c sand, gravel (Possible Fill) (SM)	8.0'
5D	11,15,15,14	Brown silty fine sand, trace gravel, clay pockets, medium to coarse sand (SM)	COMPACT SILTY FINE SAND, TRACE GRAVEL 12.0'
6D	5,7,6,6	Stiff mottled gray brown clay, trace fine sand, fine sand seams (CH)	STIFF TO VERY STIFF GRAY CLAY, TRACE FINE SAND (SLICKENSIDED)
7U	P	Very stiff gray clay, tr fine sand, fine sand pkts & seams, mica (Slickensided) (CH)	20.0'
8D	4,5,6,6	Gray clayey fine sand (SC)	23.0'
9U	P	Gray green fine sandy silt, trace clay (ML)	MEDIUM COMPACT GRAY GREEN FINE SANDY SILT, TRACE CLAY
10D	4,6,6,7	Do 9U (ML)	
11U	P	Do 9U (ML)	
12D	7,8,8,8	Do 9U (ML)	33.0'
13D	5,5,6,5	Medium stiff gray fine sandy clay, trace mica (CL)	MEDIUM STIFF GRAY FINE SANDY CLAY, TRACE MICA
14D	6,6,7,7	Do 13D (CL)	41.0'
15D	7,4,5,4	Gray silty fine sand, trace clay, mica (SM-SC)	LOOSE TO MEDIUM COMPACT GRAY SILTY FINE SAND, TRACE CLAY, MICA
16D	7,8,6,7	Do 15D (SM-SC)	50.0'

Boring started 5-20-97 completed 5-22-97
Final depths:
Boring = 50.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 16.5' =El. +223.6

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Used Revert drilling fluid below 10' depth to maintain hole open.

Observation well consisting of 1-1/2" PVC pipe installed with tip at 45' depth.

Borehole was grouted between 0' and 33' depth.

BORING NUMBER YB-23A

Ground surface elevation +240.2

Boring was drilled without sampling to 30.0' depth to perform Falling Head Permeability Tests.

30.0'

Boring started 6-10-97 completed 6-10-97
Final depths:
Boring = 30.0' Casing = 28.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = --- =El. ---

REMARKS:

Washed the hole with water between 0' and 30' depth; casing blows not recorded.

No soil samples recovered.

Groundwater level was observed at Elev. +224.2 in nearby observation well in Boring No. YB-23U.

Performed six falling head permeability tests with the aid of casing. Drove casing to 4.5' depth, washed ahead of casing with a 3-3/4" diameter roller bit to 6.5' depth. Hole caved-in at 5.2' depth. Performed first falling head permeability test between 4.5' and 5.2' depth with tip of casing at 4.5' depth. Likewise, five other falling head permeability tests were performed in two-foot depths of open hole at depths of 8, 13, 18, 23 feet below ground surface.

Borehole was grouted upon completion.

SIGNED		DATE
DRAWN	A.P.	DATE 8-97
CHECKED	H.S.L., S.L.T. & A.A.	DATE 8-97
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-F-455	General Notes and Legend
F-F-457	Boring Location Plan and
F-F-461	Geologic Sections
F-F-463	

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA HUGH S. LACY No. 9768 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER RUTLEDGE CONSULTING ENGINEERS
708 THIRD AVENUE, NEW YORK, N.Y. 10017
SUBMITTED

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT

HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT

APPROVED

BRANCH ROUTE (F011)
LOGS OF YB – SERIES BORINGS
YB–20U THROUGH YB–23U AND YB–23A

SCALE 0 3' 6' 12'

DRAWING NO. F–F–469

APPENDIX A

LABORATORY TEST RESULTS FROM EARLIER WMATA INVESTIGATIONS ON SOILS OF CALVERT, AQUIA AND MONMOUTH FORMATIONS

TABLE NO. 2

SUMMARY OF LABORATORY TEST DATA

REPORT NO. 244
SECTION FOO9, BRANCH ROUTE

SAMPLE IDENTIFICATION				CLASSIFICATION PROPERTIES									PHYSICAL PROPERTIES												
										UNIFIED SOIL CLASSIFICATION SYSTEM			STRENGTH								CONSOLIDATION				
													UNCONFINED COMPRESSION			TRIAXIAL COMPRESSION									
BORING NUMBER	SAMPLE NUMBER	DEPTH FT.	STRATUM DESIGNATION	NATURAL WATER CONTENT % (W) AVERAGE OF ENTIRE SAMPLE	LIQUID LIMIT (W_L)	PLASTICITY INDEX (I_P)	NATURAL WATER CONTENT OF LIMIT SAMPLE, Wn,%	SPECIFIC GRAVITY OF SOLIDS (G_s)	DRY DENSITY, PCF	SOIL TYPE	% SAND (<# 4 >#200 SIEVE)	% FINES (<#200 SIEVE)	COMPRESSIVE STRENGTH TSF	WATER CONTENT AT END OF TEST, %	STRAIN AT FAILURE, %	TYPE OF TEST	DEVIATOR STRESS ($\sigma_1 - \sigma_3$) TSF	CONFINING PRESSURE (σ_3) TSF	NATURAL WATER CONTENT, Wn, %	WATER CONTENT AT END OF TEST, W_f, %	NATURAL WATER CONTENT, Wn, %	EXISTING OVERBURDEN STRESS, P_o, TSF	ESTIMATED PRECONSOLIDATION STRESS, P_c, TSF	COMPRESSION INDEX, C_c	SWELLING INDEX, C_s
RKK-2U	7U	16	Cc&Ec	58						MH&CH						Q	1.48	0.5	58	58					
			Ec	49						MH						Q	2.50	1.0	49	49					
			Cc	60						CH						Q	0.98	2.0	60	60					
RKK-6U	12U	36	Ec	49	79	49	49	2.77		CH						Q	3.05	1.0	49	49	49.5	2.3	10.0	1.120	0.140
										MH						Q	4.56	0.5	58	58					
										MH						Q	4.17	1.0	60	60					
	16U	51	Ec	63	110	59	77			MH						Q	5.89	2.0	69	69					
RKK-6AU	1U	11	Cs&Cc	33				2.74		SM-SC						Q	0.62	0.5	28	27					
										SM-SC						Q	0.71	1.0	38	37					
										&CL	20	80													
	2U BOT	16	Es	39						SC						Q	0.88	1.0	36	35					
RKK-12U	7U	13	Cc	55	90	57	59			CH						Q	1.04	2.0	66	66					
RKK-14U	7U	16	Cs&Cc	16						SM-SC	52	48													
										&CL															
	11U	31	Es	38	33	2	37			SM-SC						Q	1.46	0.5	38	37					
										SM-SC						Q	1.51	1.0	38	38					
										SM-SC						Q	1.95	2.0	40	39					
RKK-18U	9U	19	Cc	35						CL						Q	0.87	1.0	30	30					
										CL						Q	0.77	1.0	41	41					
	12U	31	Ec	41	49	17	26			ML						Q	1.25	1.0	43	44					
RKK-21U	8U	21	Cc	45						MH						Q	0.91	0.5	45	46	42.6	1.2	2.7	0.450	0.035
					59	27	45	2.73		MH						Q	1.04	1.0	47	47					
										MH						Q	0.86	2.0	47	48					
	11U	36	Es	39						SM-SC						Q	2.19	1.5	39	39					

NOTES

1. ALL TESTS SUMMARIZED ABOVE WERE PERFORMED IN THE SOILS LABORATORY OF MUESER RUTLEDGE CONSULTING ENGINEERS.
2. THE SAMPLE DEPTH LISTED ABOVE IS THE AVERAGE DEPTH OF THE SAMPLE RECOVERED.
3. FOR GROUND SURFACE ELEVATIONS AT THE BORINGS SEE TABLE NO. 1. FOR GENERALIZED STRATA DESCRIPTIONS SEE DRAWING NO. F-1.
4. "NATURAL WATER CONTENT OF THE ENTIRE SAMPLE" IS A WEIGHTED AVERAGE OF ALL MATERIAL TYPES RECOVERED.
5. THE TRIAXIAL COMPRESSION TESTS PERFORMED WERE:

   Q - QUICK TESTS (UU - UNCONSOLIDATED UNDRAINED TESTS)

   Qc- CONSOLIDATED QUICK TESTS (CU - CONSOLIDATED UNDRAINED TESTS)
6. STRENGTH TESTS WERE PERFORMED ON PISTON TYPE SAMPLES (U) APPROXIMATELY 2.9 INCHES IN DIAMETER AND ON SHELBY TYPE SAMPLES (S) APPROXIMATELY 1.8 INCHES IN DIAMETER. THE RATIO OF HEIGHT TO DIAMETER OF ALL STRENGTH TEST SPECIMENS WAS APPROXIMATELY 2.0.
7. THE TRIAXIAL COMPRESSION TESTS WERE PERFORMED AT A RATE OF STRAIN OF APPROXIMATELY 1 PER CENT PER MINUTE.
8. THE DIRECT SHEAR TESTS WERE PERFORMED AT A CONSTANT RATE OF STRAIN EQUAL TO A HORIZONTAL DISPLACEMENT OF 0.02 INCHES PER HOUR. THE SPECIMENS WERE OF APPROXIMATELY 1/2 INCH THICKNESS.
9. COMPRESSION INDEX Cc - STRAIGHT LINE PORTION OF THE VIRGIN CURVE OF CONSOLIDATLION TEST: $e = e_o - C_c \log P/P_o$
10. SWELLING INDEX Cs - STRAIGHT LINE PORTION OF THE REBOUND CURVE OF CONSOLIDATION TEST: $e = e_o - C_s \log P/P_o$

MUESER RUTLEDGE CONSULTING ENGINEERS

708 THIRD AVENUE, NEW YORK, N.Y., 10017

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

PARSONS DE LEUW, INC.

GENERAL ENGINEERING CONSULTANTS

TABLE NO. 2

REPORT NO. 244

SUMMARY OF LABORATORY TEST DATA (CONT'D) SECTION FOO9, BRANCH ROUTE

SAMPLE IDENTIFICATION				CLASSIFICATION PROPERTIES									PHYSICAL PROPERTIES													
										UNIFIED SOIL CLASSIFICATION SYSTEM			STRENGTH								CONSOLIDATION				
													UNCONFINED COMPRESSION			TRIAXIAL COMPRESSION									
BORING NUMBER	SAMPLE NUMBER	DEPTH FT.	STRATUM DESIGNATION	NATURAL WATER CONTENT % (W) AVERAGE OF ENTIRE SAMPLE	LIQUID LIMIT, W_L, %	PLASTICITY INDEX, I_P, %	NATURAL WATER CONTENT OF LIMIT SAMPLE, Wn,%	SPECIFIC GRAVITY OF SOLIDS, G_S	DRY DENSITY, PCF	SOIL TYPE	% SAND (<# 4 >#200 SIEVE)	% FINES (<#200 SIEVE)	COMPRESSIVE STRENGTH TSF	WATER CONTENT AT END OF TEST, %	STRAIN AT FAILURE, %	TYPE OF TEST	COMPRESSIVE STRENGTH $(\sigma_1 - \sigma_3)$, TSF	CONFINING PRESSURE σ_3, TSF	NATURAL WATER CONTENT, Wn, %	WATER CONTENT AT END OF TEST, W_f, %	NATURAL WATER CONTENT, Wn, %	EXISTING OVERBURDEN STRESS, P_o, TSF	ESTIMATED PRECONSOLIDATION STRESS, P_c, TSF	COMPRESSION INDEX, C_c	SWELLING INDEX, C_s
RKK-26U	12U	31	Cs	43						SC						Q	0.73	0.5	42	43					
			Cs							SC						Q	0.85	1.0	44	44					
			Cs&Cc							SC&CL						Q	0.98	2.0	42	39					
	14U	41	Ec	38						CL						Q	1.28	1.5	38	38					
RKK-35U	9U	26	Es	37	41	15	44			SM						Q	0.79	0.5	39	37					
										SM						Q	0.93	1.0	38	35					
										SM						Q	1.05	2.0	33	33					
	11U	36	Es							SM						Q	1.51	1.0	32	32					
																Q	1.48	1.5	34	34					
	14U	51	Es	39						SM-SC															
																Q	2.48	2.0	40	40					
	18U	69.7	Ec	47	85	50	54			CH						Q	2.76	2.0	45	45					
RKK-37AU	6U	34	Cs	30						SM	85	15				Q	1.12	0.5	29	29					
										SM	34	22				Q	1.50	1.0	31	30					
										SM						Q	4.11	2.0	30	29					
	8U	41	Cs	39						SM-SC						Q	0.49	2.0	39	38					
	11U	51	Es	40						SM															
																Q	1.57	2.5	40	39					
	16U	66	Ec	59	72	41	59			CH															
RKK-38U	11U	36	Cs	21						SM-SC						Q	1.36	0.5	22	22					
										SM-SC						Q	0.33	1.0	20	20					
										SM-SC						Q	6.49	2.0	21	21					
RKK-59U	15U	55.7	Cs	25						SP-SM	94	6				Q	3.04	1.0	25	25					
	17U	64	Cc&Cs	36						CL&SC						Q	1.08	1.0	36	36					
																Q	0.99	2.0	36	36					
RKKSW-4U										CH						Q	3.55	0.5	50	50					
	16U	58	Ec	48	83	49	50			CH						Q	3.71	1.0	49	49					
										CH						Q	2.60	2.0	46	45					
RKKSS-2U	13U									SM-SC						Q	1.36	0.5	36	36					
		46	Es	35						SM-SC	82	18				Q	1.66	1.0	36	36					
										SM-SC						Q	2.57	2.0	35	35					
	19U	70.9	Ec	51	74	42	51			CH															

MUESER RUTLEDGE CONSULTING ENGINEERS

708 THIRD AVENUE, NEW YORK, N.Y., 10017

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

PARSONS DE LEUW, INC.

TABLE NO. 2

SUMMARY OF LABORATORY TEST DATA

REPORT NO. 246
SECTION FO1O, BRANCH ROUTE

SAMPLE IDENTIFICATION				CLASSIFICATION PROPERTIES									PHYSICAL PROPERTIES												
										UNIFIED SOIL CLASSIFICATION SYSTEM			STRENGTH								CONSOLIDATION				
													UNCONFINED COMPRESSION			TRIAXIAL COMPRESSION									
BORING NUMBER	SAMPLE NUMBER	DEPTH FT.	STRATUM DESIGNATION	NATURAL WATER CONTENT % (W) AVERAGE OF ENTIRE SAMPLE	LIQUID LIMIT (W_L)	PLASTICITY INDEX (I_P)	NATURAL WATER CONTENT OF LIMIT SAMPLE, Wn,%	SPECIFIC GRAVITY OF SOLIDS (G_s)	DRY DENSITY, PCF	SOIL TYPE	% SAND (<# 4 >#200 SIEVE)	% FINES (<#200 SIEVE)	COMPRESSIVE STRENGTH TSF	WATER CONTENT AT END OF TEST, %	STRAIN AT FAILURE, %	TYPE OF TEST	DEVIATOR STRESS ($q_1 - q_3$) TSF	CONFINING PRESSURE (q_3) TSF	NATURAL WATER CONTENT, Wn, %	WATER CONTENT AT END OF TEST, W_f, %	NATURAL WATER CONTENT, Wn, %	EXISTING OVERBURDEN STRESS, P_o, TSF	ESTIMATED PRECONSOLIDATION STRESS, P_c, TSF	COMPRESSION INDEX, C_c	SWELLING INDEX, C_s
DM-7U	14U	41	Cs	29						SC						Q	3.21	1.0	29	28					
	23U	71	Es	26						SM						Q	2.77	1.0	26	27					
DM-19U	11U	33.5	Es	31					91	SM						Q	3.80	1.0	32	32					
	15U	46 5	Ms	28					94	SM	69	26				Q	3.59	0.5	31	31					
									94	SM						Q	2.88	1.0	31	31					
									103	SM						Q	5.48	2.0	24	24					
	21U	71 5	Ms	30					102	SM						Q	5.91	2.0	30	30					
DM-40U	15U	56	Es	31						SM						Q	2.07	1.5	32	33					
										SM						Q	2.37	2.0	31	31					
	21U	76	Es	33						SM						Q	4 30	2.5	33	33					
DM-43AU	25U	115	Ms	24						SP-SM	91	9				Q	2.98	0.5	24	24					
	26U	119 5	Ms	27						SM						Q	3.28	1.0	27	27					
	28U	126.5	Ms	24						SM						Q	5.50	2.0	24	24					
DM-45U	14U	51	Ec	42	73	47	42	2.75		CH						Q	1.53	0.5	43	43	41 5	2.4	6.2	0.768	0.120
										CH						Q	3.22	1 0	42	42					
										CH						Q	3.13	2.0	42	42					
	20U	71	Ec	40						ML						Q	4 41	2.0	41	41					
										ML						Q	4.66	2.5	39	39					
DM-58U	16U	61	Ec	43						CL	40	60				Q	2.30	0.5	43	43					
										CL						Q	2.03	1.0	44	44					
	22U	81	Es	37						SM						Q	2.28	1.5	37	37					
										SM						Q	3.40	2.0	38	37					

NOTES

1. ALL TESTS SUMMARIZED ABOVE WERE PERFORMED IN THE SOILS LABORATORY OF MUESER RUTLEDGE CONSULTING ENGINEERS.
2. THE SAMPLE DEPTH LISTED ABOVE IS THE AVERAGE DEPTH OF THE SAMPLE RECOVERED.
3. FOR GROUND SURFACE ELEVATIONS AT THE BORINGS SEE TABLE NO 1. FOR GENERALIZED STRATA DESCRIPTIONS SEE DRAWING NO. F-1
4. "NATURAL WATER CONTENT OF THE ENTIRE SAMPLE" IS A WEIGHTED AVERAGE OF ALL MATERIAL TYPES RECOVERED
5. THE TRIAXIAL COMPRESSION TESTS PERFORMED WERE
   - Q - QUICK TESTS (UU - UNCONSOLIDATED UNDRAINED TESTS)
   - Qc- CONSOLIDATED QUICK TESTS (CU - CONSOLIDATED UNDRAINED TESTS)
6. STRENGTH TESTS WERE PERFORMED ON PISTON TYPE SAMPLES (U) APPROXIMATELY 2 9 INCHES IN DIAMETER AND ON SHELBY TYPE SAMPLES (S) APPROXIMATELY 1 8 INCHES IN DIAMETER THE RATIO OF HEIGHT TO DIAMETER OF ALL STRENGTH TEST SPECIMENS WAS APPROXIMATELY 2 0
7. THE TRIAXIAL COMPRESSION TESTS WERE PERFORMED AT A RATE OF STRAIN OF APPROXIMATELY 1 PER CENT PER MINUTE.
8. THE DIRECT SHEAR TESTS WERE PERFORMED AT A CONSTANT RATE OF STRAIN EQUAL TO A HORIZONTAL DISPLACEMENT OF 0 02 INCHES PER HOUR THE SPECIMENS WERE OF APPROXIMATELY 1/2 INCH THICKNESS
9. COMPRESSION INDEX Cc - STRAIGHT LINE PORTION OF THE VIRGIN CURVE OF CONSOLIDATLION TEST $e = e_o - C_c \log P/P_o$
10. SWELLING INDEX Cs - STRAIGHT LINE PORTION OF THE REBOUND CURVE OF CONSOLIDATION TEST. $e = e_o - C_s \log P/P_o$

MUESER RUTLEDGE CONSULTING ENGINEERS

708 THIRD AVENUE, NEW YORK, N.Y., 10017

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

PARSONS DE LEUW, INC.

GENERAL ENGINEERING CONSULTANTS

BORING NUMBER YB-24U

Ground surface elevation +250.5

Sample	Blows	Description	Stratum
1D	4,10,9,8	Brown silty f-c sand, sm gravel, tr asphalt, organics, clay pkts, roots (Fill) (SM)	FILL
2D	10,17,9,8	Gray brown fine to coarse sand, some silt, gravel, trace roots (Fill) (SM)	
3D	10,12,5,6	Black asphalt, some clayey fine to coarse sand (Fill)	
4D	3,4,5,5	Top: Do 3D (Fill) Bot: Brown silty fine sand, tr gravel (SM)	7.5'
5D	6,8,8,10	Brown silty fine sand, trace clay (SM)	LOOSE TO MEDIUM COMPACT BROWN SILTY FINE SAND, TRACE CLAY, CLAY SEAMS
6D	2,3,3,4	Brown silty fine sand, trace clay, clay seams (SM-SC)	17.0'
7U	P	Stiff gray clay, trace fine sand, mica (Slickensided) (CH)	STIFF GRAY GREEN CLAY, TRACE FINE SAND AND STIFF GRAY CLAYEY SILT TO FINE SANDY SILT (SLICKENSIDED & FISSURED)
8D	3,3,4,5	Stiff gray clay, trace fine sand, fine sand pockets (Fissured) (CH)	
9U	P	Gray green fine sandy silt, trace clay (MH)	
10D	6,5,5,6	Stiff gray clayey silt, trace fine sand, fine sand pockets (Slickensided & Fissured) (MH)	
11U	P	Stiff gray clay, trace fine sand (CH)	41.0'
12D	5,6,7,10	Gray silty fine sand, trace clay, mica (SM-SC)	LOOSE TO MEDIUM COMPACT GRAY SILTY FINE SAND, TRACE CLAY, MICA
13D	3,4,4,5	Do 12D (SM-SC)	
14D	6,7,9,13	Gray silty fine sand, trace clay, mica (SM)	
15D	3,4,7,11	Gray silty fine sand, trace clay, mica (SM-SC)	
16D	6,7,9,11	Do 15D (SM-SC)	66.0'
17D	9,10,13,17	Gray silt, some fine sand, trace mica (ML)	MEDIUM COMPACT GRAY SILT, SOME FINE SAND 72.0'
18D	7,13,16,32	Gray silty fine sand, trace clay, mica (SM)	MEDIUM COMPACT GRAY SILTY FINE SAND, TRACE CLAY, MICA
19D	10,11,14,14	Gray silty fine sand, trace mica, clay, silt pockets (SM)	82.0'
20D	20,32,33,36	Hard gray clayey silt, trace fine sand (MH)	HARD GRAY CLAYEY SILT, TRACE FINE SAND
21D	17,21,33,42	Do 20D (MH)	91.0'
22D	20,32,36,45	Gray slightly organic micaceous silty fine sand, trace clay, shells (SM-SC)	VERY COMPACT GRAY SLIGHTLY ORGANIC MICACEOUS SILTY FINE SAND, TRACE CLAY, SHELLS
23D	22,23,30,37	Do 22D (SM-SC)	
24D	20,26,26,31	Do 22D (SM-SC)	105.0'

BORING NUMBER YB-25

Ground surface elevation +241.5

Sample	Blows	Description	Stratum
1D	2,2,3,4	Brown clayey fine sand, trace gravel, coarse sand, roots (Fill) (SC)	FILL
2D	40,81,63,33	Top: Do 1D (Fill) (SC) Bot: Brn tan f-c sandy gravel, trace silt, clay (Fill)(GP-GM)	
3D	17,12,11,10	Very stiff mottled brown gray clay, & silty clay, trace fine sand (Fill)(CH&CL)	
4D	10,8,7,7	Stiff mottled brown gray clay & silty clay, trace f-m sand, roots (Fill)(CH&CL)	
5D	7,7,5,5	Stiff mottled brown gray clay & silty clay, trace fine to medium sand (Fill)(CH&CL)	10.0'
6D	2,3,4,5	Stiff gray clay, trace fine sand (Slickensided) (CH)	MEDIUM STIFF TO STIFF GRAY CLAY, TRACE FINE SAND, FINE SAND LAYERS (SLICKENSIDED)
7D	4,5,5,5	Medium stiff gray clay, trace fine sand (Slickensided) (CH)	
8D	3,3,3,4	Medium stiff gray silty clay, trace fine sand layers (CH)	26.0'
9D	2,2,2,2	Gray clayey fine sand, trace mica (SC)	LOOSE TO COMPACT GRAY CLAYEY FINE SAND, TRACE MICA AND SILTY FINE SAND, TRACE CLAY, MICA
10D	2,2,3,3	Do 9D (SC)	
11D	5,5,6,6	Do 9D (SC)	
12D	6,6,6,6	Do 9D (SC)	
13D	6,4,6,11	Gray silty fine sand, trace clay, mica (SM-SC)	
14D	17,21,27,31	Do 13D (SM-SC)	
15D	9,10,12,15	Do 13D (SM-SC)	
16D	10,12,12,14	Do 13D (SM-SC)	
17D	9,11,12,14	Do 13D (SM-SC)	73.0'
18D	15,17,21,27	Very stiff light gray clayey silt, trace mica (Fissured) (MH)	VERY STIFF TO HARD GRAY CLAYEY SILT, TRACE FINE SAND, FINE SAND SEAMS, MICA, ORGANICS (OCCASIONALLY FISSURED)
19D	15,20,27,32	Hard gray clayey silt, trace fine sand, fine sand seams, organics (MH)	
20D	19,27,36,41	Do 19D (MH)	86.0'
21D	14,19,21,30	Dark gray slightly organic micaceous silty fine sand, trace to some shells, trace clay (SM-SC)	COMPACT TO VERY COMPACT DARK GRAY SLIGHTLY ORGANIC MICACEOUS SILTY FINE SAND, TRACE TO SOME SHELLS, TRACE CLAY, SHELL LAYERS
22D	15,22,27,38	Do 21D (SM-SC)	
23D	57,100/3"	Dark gray slightly organic micaceous silty fine sand, some shells, trace clay (SM)	
24D	102,100/3"	Dark gray slightly organic micaceous silty fine sand, trace to some shells, trace clay (SM-SC)	103.7'

BORING NUMBER YB-26

Ground surface elevation +238.9

Sample	Blows	Description	Stratum
1D	2,2,2,2	Brown fine to medium sand, some silt, trace clay, organics (Fill) (SM)	FILL
2D	3,5,7,7	Do 1D (Fill) (SM)	4.0'
3D	4,4,5,5	Brown clayey fine sand (SC)	LOOSE BROWN CLAYEY FINE SAND
4D	5,5,5,6	Brown clayey fine sand, some clay pockets & seams (SC&CL)	8.0'
5D	7,7,8,8	Medium stiff gray clay, trace fine sand (Slickensided) (CH)	MEDIUM STIFF GRAY CLAY, TRACE FINE SAND (SLICKENSIDED)
6D	2,3,4,5	Do 5D (Slickensided) (CH)	
7D	2,3,3,4	Do 5D, trace mica (CH)	21.0'
8D	2,2,2,2	Gray silty fine sand, trace clay, mica (SM-SC)	LOOSE TO COMPACT GRAY CLAYEY FINE SAND, TRACE MICA AND SILTY FINE SAND, TRACE CLAY, MICA, LIGNITE
9D	2,2,3,3	Gray clayey fine sand, trace mica (SC)	
10D	2,2,3,3	Do 9D (SC)	
11D	3,3,3,4	Do 9D (SC)	
12D	3,3,4,5	Gray silty fine sand, trace clay, lignite, mica (SM-SC)	
13D	16,17,19,21	Do 12D (SM-SC)	50.0'

BORING NUMBER 27U

Ground surface elevation +252.7

Sample	Blows	Description	Stratum
1D	6,7,7,7	Brown black silty f-c sand, some gravel, fine sandy silt layers, tr rts (Fill) (SM&ML)	FILL
NR	6,3,3,5	Possible Fill	4.0'
2D	16,18,33,35	Brown fine to coarse sand, some gravel, silt, trace clay pockets (SM)	COMPACT TO V CPT F-C SAND, SM GVL, SILT
3D	21,20,26,26	Brown gravelly fine to coarse sand, some silt (SM)	8.5'
4D	23,19,18,21	Top: Do 3D (SM) Bot: Brown silty fine sand, trace gravel (SM)	10.0'
5D	2,2,2,2	Medium stiff gray clay, trace fine sand, fine sand pockets, silt pockets (Fissured) (CH)	MEDIUM STIFF TO STIFF GRAY CLAY, TRACE FINE SAND POCKETS, SILT POCKETS (SLICKENSIDED AND FISSURED)
6U	P	Stiff gray clay, trace fine sand (Slickensided) (CH)	
7D	6,4,6,6	Stiff gray clay, trace fine sand, fine sand pockets (Slickensided & Fissured) (CH)	
8U	P	Very stiff gray clay, trace fine sand (CH)	
9D	7,8,9,9	Stiff gray clay, trace fine sand, fine sand pockets, silt pockets (Fissured) (CH)	38.0'
10U	P	Gray silty fine sand, some clay, trace fine sand seams (SM-SC)	MEDIUM COMPACT GRAY SILTY FINE SAND, TRACE TO SOME CLAY, TRACE FINE SAND SEAMS, MICA
11D	3,5,7,7	Do 10U (SM-SC)	
12D	5,3,7,8	Gray silty fine sand, trace clay, mica (SM-SC)	50.0'

BORING NUMBER YB-28

Ground surface elevation +267.1

Sample	Blows	Description	Stratum
1D	6,6,7,7	Brown silty fine to medium sand, trace gravel, coarse sand, roots, clay (Fill) (SM)	FILL
2D	5,5,2,3	Interlayered brn silty f-m sand, tr clay, gravel, rts & f-m sandy clay (Fill)(SM&CL)	
3D	4,3,3,3	Top: Brn & tan gravelly f-c sand, tr silt, clay pockets (Fill) (SP-SM) Bot: Brn f sa clay, sm lig, tr gvl (Fill)(CL)	
4D	4,5,6,6	Interlayered clayey fine sand & fine sandy clay, trace gravel, lignite (Fill) (SC&CL)	
5D	9,7,9,7	Brown clayey fine sand, trace medium to coarse sand, gravel, clay layers, lignite (Fill) (SC)	
6D	6,8,9,7	Brown clayey fine sand, some gravel, trace lignite, glass (Fill) (SC)	
7D	3,3,4,5	Brown black gravelly fine to coarse sand, some silt, trace roots, rubber, brick, wire (Fill) (SM)	
8D	3,4,4,5	Brown tan fine sand, trace to some silt, trace clay, gravel (Fill) (SM)	
9D	8,5,5,4	Brown to dark gray clayey silt, trace fine sand, organics, roots (Fill) (ML)	30.0'

Boring started 4-23-97 completed 4-23-97
Final depths:
Boring = 30.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 13.1' =EL +254.0

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Used Revert drilling fluid below 10' depth to maintain hole open.

Observation well consisting of 1-1/2" PVC pipe installed with tip at 25' depth.

Borehole was grouted between 0' and 13' depth.

Notes for Boring YB-26

Boring started 5-5-97 completed 5-5-97
Final depths:
Boring = 50.0' Casing = 10.0'
Casing diameter = 3"
Average depth of ground water observed in the boring = 3.0' =EL +235.9

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Recovered soil sample at 3' depth for corrosion test.

Used water below 10' depth to wash the hole.

Depth of groundwater observed in the boring is parched water table.

Borehole was grouted upon completion.

Notes for Boring 27U

Boring started 4-28-97 completed 4-29-97
Final depths:
Boring = 50.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 22.3' =EL +230.4

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Used Revert drilling fluid to maintain hole open below 10' depth.

Observation well consisting of 1-1/2" PVC pipe installed with tip at 45' depth.

Borehole was grouted between 0' and 33' depth.

NOTES FOR BORING NO. YB - 24U

Boring started 4-29-97 completed 4-30-97
Final depths:
Boring = 105.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 27.4' =EL +223.1

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Used Revert drilling fluid below 10' depth to maintain hole open.

Observation well consisting of 1-1/2" PVC pipe installed with tip at 40' depth.

Borehole was grouted between 0' and 28' depth.

NOTES FOR BORING NO. YB - 25

Boring started 5-6-97 completed 5-7-97
Final depths:
Boring = 103.7' Casing = 10.0'
Casing diameter = 3"
Average depth of ground water observed in the boring = 12.0' =EL +229.5

REMARKS:

Washed ahead of casing to 10' depth and then drove casing to 10' depth. Took over one hour to drive casing with 140 lb. hammer between 0' and 10' depth due to probable presence of rubble or boulder obstructions. High spoon blows between 2' and 4' depth are probably due to the presence of rubble or boulder obstructions.

Recovered soil sample at 3' depth for corrosion test.

Used drilling mud below 10' depth to maintain hole open.

Hard drilling between 70' and 103' depth.

Encountered shell layer at 88' depth.

High spoon blows at 98' and 103' depths are probably due to the presence of cemented sand layers.

Borehole was grouted upon completion.

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION
F-F-465	General Notes & Legend
F-F-457	Boring Location Plan and
F-F-459	Geological Sections
F-F-463	
F-F-464	

REVISIONS		
DATE	BY	DESCRIPTION

[...]NED ______ DATE
[...]N A.P. DATE 8-97
[...]KED H.S.L., S.L.T. & A.A.A. DATE 8-97
[...]OVED ______ DATE

DISTRICT OF COLUMBIA — HUGH S. LACY — No. 8756 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER RUTLEDGE CONSULTING ENGINEERS
708 THIRD AVENUE, NEW YORK, N.Y. 10017

SUBMITTED ______

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT

HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT

APPROVED ______

BRANCH ROUTE (F011)
LOGS OF YB - SERIES BORINGS
YB-24 THROUGH YB-28

SCALE 0 3' 6' 12'

DRAWING NO. F-F-470

DEEPTH BELOW GROUND SURFACE, FEET

BORING NUMBER YB-29U

Ground surface elevation +264.7

Sample	Blows	Description	Stratum
1D	2,2,2,2	Brown clayey fine to medium sand, trace roots, gravel (Fill) (SC)	FILL
2D	3,3,4,5	Brown fine sandy clay, trace gravel, roots (Fill) (CL)	
3D	5,5,7,7	Interlayered brn clayey f-m sand & f sandy clay, tr gvl, rts, wood (Fill)(SC&CL)	
4D	5,6,6,5	Do 3D, trace coarse sand, gravel layers (Fill) (SC&CL)	
5D	7,6,7,7	Brown clayey fine to medium sand, some fine sandy clay layers, trace gravel, coarse sand, roots (Fill) (SC&CL)	
6U	P	Stiff tan clay, trace fine sand (Fill) (CH)	
7D	4,4,5,4	Brown fine to coarse sand & gravel, some clay, trace roots, clay layers (Fill) (SC&GC)	17.5'
8D	15,17,17,18	Brown fine to coarse sandy gravel (GP)	CPT F-C SANDY GRAVEL 21.0'
9D	6,8,7,6	Brown red fine sand, some silt, trace clay, medium to coarse sand (SM)	MED CPT BROWN RED FINE SAND, SOME SILT, TRACE CLAY 27.0'
10D	7,9,12,18	Medium stiff gray silty clay & clay, trace fine sand (Slickensided) (CL&CH)	MEDIUM STIFF TO STIFF GRAY CLAY AND SILTY CLAY, TRACE FINE SAND (OCCASIONALLY FISSURED AND SLICKENSIDED)
11U	P	Stiff gray clay & silty clay, trace fine sand (CH&CL)	
12D	4,4,6,7	Stiff gray silty clay & clay, trace fine sand (Slickensided) (CL&CH)	
13D	4,7,8,12	Stiff gray clay & silty clay, trace fine sand (Fissured) (CH&CL)	40.0'

Boring started 4-24-97 completed 4-25-97
Final depths:
Boring = 40.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 16.4' =EL +248.3

REMARKS:

Washed ahead of casing and then drove casing to 10' depth. Casing blows not recorded.

Used Revert drilling fluid below 10' to maintain hole open.

Observation well consisting of 1-1/2" PVC pipe installed with tip at 35' depth.

Borehole was grouted between 0' and 23' depth.

BORING NUMBER YB-30

Ground surface elevation +265.9

Sample	Blows	Description	Stratum
1D	5,5,6,6	Brown silty fine sand, trace gravel, roots, clay pockets (Fill) (SM)	FILL
2D	6,7,9,10	Brown silty fine sand & silty clay, trace gravel, roots (Fill) (SM&CL)	
3D	10,11,11,12	Brown silty fine sand, trace gravel, clay, roots (Fill) (SM)	
4D	6,5,5,4	Brown fine to medium sand, some silt, trace clay pockets, roots (Fill) (SM)	
5D	5,6,6,8	Brown silty fine to medium sand & silty clay, trace gravel, asphalt (Fill) (SM&CL)	
6D	4,5,30,25	Top: Stiff brown clay, trace fine sand (Fill) (CH) Bot: Brown fine to coarse sandy gravel, some clay (Fill) (GM-GC)	17.0'
7D	16,20,18,21	Brown fine to medium sand, trace silt, gravel (SP-SM)	MEDIUM CPT TO COMPACT BROWN FINE TO MEDIUM SAND, TRACE SILT, GRAVEL AND CLAYEY FINE TO MEDIUM SAND
8D	7,9,11,12	Brown fine to medium sand, trace silt, clay, gravel (SP-SM)	
9D	5,4,6,6	Brown gray clayey fine to medium sand, trace clay pockets (SC)	31.0'
10D	6,7,8,8	Medium stiff gray clay, trace fine sand (Slickensided) (CH)	MEDIUM STIFF GRAY CLAY, TRACE FINE SAND (SLICKENSIDED)
11D	3,4,5,5	Do 10D (Slickensided) (CH)	40.0'

BORING NUMBER YB-31U

Ground surface elevation +253.1

Sample	Blows	Description	Stratum
1D	4,7,8,9	Top: Brn sl f-c sa, sm gvl, tr cl, rts(Fill)(SM) Bot: Brn f-c sand, some gravel, silt (SM)	1.0' FILL MED CPT F-C SAND, SM GVL, SILT 4.0'
2D	9,9,9,11	Brown fine to coarse sand, some silt, gravel, trace clay seams & pockets (SM)	
3D	13,11,9,8	Brown fine sand, trace silt, clay (SP-SM)	MEDIUM COMPACT BRN FINE SAND, TRACE TO SOME SILT, TRACE CLAY 11.0'
4D	5,6,6,8	Brown fine sand, some silt (SM)	
5D	5,6,8,8	Do 4D, trace clay pockets (SM)	
6D	2,4,5,5	Top: Medium stiff brown silty clay, trace fine sand, fine sand seams (CL) Bot: Medium stiff gray silty clay, trace fine sand, mica, lignite (CH)	14.5'
7U	P	Stiff gray clay, trace mica, silt pockets (Slickensided) (CH)	MEDIUM STIFF TO STIFF GRAY CLAY AND CLAYEY SILT, TRACE FINE SAND, SILT POCKETS, MICA, LIGNITE, FINE SAND POCKETS
8U	P	Stiff gray clay, trace fine sand, silt pockets (CH)	
9D	3,4,4,5	Stiff gray clay, some fine sand, trace mica (Slickensided & fissured) (CH)	
10U	P	Stiff gray clay, trace fine sand, silt pockets (CH)	
11D	3,4,5,10	Stiff gray clayey silt, trace fine sand, fine sand pockets (Fissured) (MH)	36.0'
12D	3,4,4,6	Gray silty fine sand, trace clay, mica (SM-SC)	LOOSE TO MEDIUM COMPACT GRAY SILTY FINE SAND, TRACE CLAY, MICA
13D	4,5,7,7	Do 12D (SM-SC)	47.0'
14D	6,8,9,7	Gray fine sandy silt, trace clay (ML)	50.0'

Boring started 4-25-97 completed 4-28-97
Final depths:
Boring = 50.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 20.1' =EL +233.0

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Used Revert drilling fluid below 10' depth to maintain hole open.

Observation well consisting of 1-1/2" PVC pipe installed with tip at 45' depth.

Borehole was grouted between 0' and 33' depth.

NOTES FOR BORING NO. YB - 30

Boring started 5-1-97 completed 5-1-97
Final depths:
Boring = 40.0' Casing = 10.0'.
Casing diameter = 4"
Average depth of ground water observed in the boring = 18.0' =EL +247.9

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Recovered soil sample at 3' depth for corrosion test.

Used Revert drilling fluid below 10' depth to maintain hole open.

Observation well consisting of 1-1/2" PVC pipe installed with tip at 30' depth.

Borehole was grouted between 0' and 18' depth.

BORING NUMBER YB-32U

Ground surface elevation +229.3

Sample	Blows	Description	Stratum
1D	6,10,20,15	Brown silty fine sand, trace clay (Fill) (SM)	FILL
2D	12,10,15,19	Brown silty fine sand, trace clay, clay layers (Fill) (SM)	
3D	20,12,13,9	Brn f sand, sm silt, tr clay (Poss. Fill) (SM)	6.0'
4D	5,4,3,3	Top: Med stiff red brn sl clay, sm fine sand, tr fine sand seams (CL) Bot: Red brown fine sand, some silt, trace clay, clay seams (SM)	MED STIFF SILTY CLAY AND FINE SANDY CLAY, SM FINE SAND LYRS 11.0'
5D	2,3,3,3	Medium stiff red brown fine sandy clay, trace roots (CL)	
6D	4,4,5,7	Stiff gray clay, trace fine sand, silt pockets (Slickensided) (CH)	STIFF GRAY CLAY TR FINE SAND, SHELL, SILT PKTS (SLICKENSIDED) 17.0'
7U	P	Stiff gray clay, trace fine sand, silt pockets, shells, mica (Slickensided) (CH)	
8D	4,6,4,4	Stiff gray silty and fine sandy clay (CL)	STIFF GRAY SILTY TO FINE SANDY CLAY AND LOOSE FINE SANDY SILT, TRACE CLAY
9D	3,4,5,5	Gray fine sandy silt, trace clay (ML)	25.0'
10U	P	Gray clayey fine sand, trace clay layers (SC)	MEDIUM COMPACT GRAY CLAYEY AND SILTY FINE SAND, TRACE CLAY, CLAY POCKETS
11D	3,4,6,5	Gray clayey fine sand, trace fine sandy clay layers (SC)	
12D	4,5,5,6	Gray silty fine sand, some clayey fine sand layers & pockets (SM&SC)	
13U	P	Gray fine sand, some silt, trace clay, fine sand pockets (SM-SC)	
14D	5,6,8,8	Gray silty fine sand, trace clay, clay pockets (SM-SC)	
15D	13,16,20,21	Do 14D (SM-SC)	41.0'

Boring started 4-15-97 completed 4-15-97
Final depths:
Boring = 41.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 14.0' =El. +215.3

REMARKS:

Washed ahead of casing to 10' depth and then pushed casing to 10' depth.

Used drilling mud below 10' depth to maintain hole open.

The depth of groundwater observed in the hole may not be representative due to the presence of mud in the hole.

Borehole was grouted upon completion.

BORING NUMBER YB-31A

Ground surface elevation +253.1

Sample	Blows	Description	Stratum
		Boring was drilled without sampling to 30.0' depth to perform Falling Head Permeability Tests.	30.0'

Boring started 6-9-97 completed 6-9-97
Final depths:
Boring = 30.0' Casing = 28.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = — =EL —

REMARKS:

Washed the hole with water between 0' and 30' depth; casing blows not recorded.

No soil samples recovered.

Groundwater level was observed at Elev. 233.1 in nearby observation well in Boring No. YB-31U.

Performed six falling head permeability tests with the aid of casing. Drove casing to 3' depth, washed ahead of casing with 3-3/4" diameter roller bit to 5' depth and performed first falling head test between 3' and 5' depth with tip of casing at 3' depth. Likewise, five other falling head permeability tests were performed in two-foot depths of open hole at depths of 8, 13, 18, 23 and 28 feet below ground surface.

Data from the permeability test performed between 3' and 5' depth were unreliable and are not reported in Table No. 3.

Borehole was grouted upon completion.

BORING NUMBER YB-34

Ground surface elevation +238.3

Sample	Blows	Description	Stratum
1D	1,1,1,1	Top: Mtld brn gry sl clay, tr f sand(Fill) (CH) Bot: Medium stiff gray clay, tr f sand (CH)	FILL 1.0'
2D	3,4,5,6	Do 1D, bottom (Slickensided) (CH)	MEDIUM STIFF TO STIFF GRAY CLAY, TRACE FINE SAND, FINE SAND SEAMS AND POCKETS (SLICKENSIDED)
3D	6,6,6,6	Medium stiff gray clay, trace fine sand, fine sand seams (Slickensided) (CH)	
4D	7,6,6,6	Do 3D (CH)	
5D	6,5,6,6	Do 3D (Slickensided) (CH)	
6D	2,3,4,5	Do 3D (Slickensided) (CH)	
7D	4,4,5,9	Stiff gray clay, trace fine sand, fine sand pockets (CH)	21.0'
8D	2,3,3,4	Medium stiff gray fine sandy clay (CL)	26.0'
9D	2,2,3,3	Gray clayey fine sand (SC)	LOOSE TO MEDIUM COMPACT CLAYEY FINE SAND AND SILTY FINE SAND, TRACE CLAY, MICA
10D	2,2,2,2	Gray silty fine sand, trace clay (SM-SC)	
11D	4,5,5,6	Do 10D (SM-SC)	
12D	4,5,7,9	Do 10D (SM-SC)	
13D	7,6,7,8	Do 10D, trace mica (SM-SC)	52.0'
14D	5,7,9,12	Gray fine sandy silt, trace clay, mica (ML)	LOOSE TO MEDIUM COMPACT GRAY FINE SANDY SILT, TRACE CLAY, MICA
15D	3,4,5,5	Gray fine sandy silt, trace clay (ML)	61.0'
16D	10,11,12,14	Very stiff gray clayey silt, some fine sand (Fissured) (MH)	VERY STIFF TO HARD GRAY CLAYEY SILT, TRACE FINE SAND (OCCASIONALLY FISSURED)
17D	12,12,19,49	Hard gray clayey silt, trace fine sand (Fissured) (MH)	
18D	25,27,35,41	Do 17D (MH)	
19D	107,100/3"	Do 17D (MH)	78.8'

Boring started 5-8-97 completed 5-8-97
Final depths:
Boring = 78.8' Casing = 10.0'
Casing diameter = 3"
Average depth of ground water observed in the boring = 0.0' =EL +238.3

REMARKS:

Washed ahead of casing to 10' depth and then drove casing to 10' depth.

Used water below 10' to wash the hole.

Encountered spoon refusal at 78.8' depth due to possible presence of cemented sand layers.

Boring was drilled at the edge of existing pond filled with about 4 feet of water. The groundwater level recorded is a perched water table.

Borehole was grouted upon completion.

BORING NUMBER YB-37

Ground surface elevation +227.3

Sample	Blows	Description	Stratum
1D	9,8,8,7	Brown f-c sand & gravel, some clay, trace clay pockets, roots (Fill) (SC&GC)	FILL
2D	11,16,16,15	Brn clayey f-m sand, sm silty fine sand layers, tr gravel, c sand (Fill)(SC&SM)	
3D	16,25,19,16	Do 2D (Fill) (SC&SM)	
4D	16,14,14,14	Do 2D (Fill) (SC&SM)	
5D	17,16,15,12	Brown tan fine sand, some silt, trace medium to coarse sand, gravel, clay, clay layers (Fill) (SM)	
6D	25,39,51,57	Brown fine sand, some silt, trace gravel, coarse sand, clay (Fill) (SM)	
7D	7,12,15,19	Interlayered brown clayey fine sand and silty clay, trace gravel, medium to coarse sand (Fill) (SC&CL)	
8D	14,14,12,12	Brown fine sand, some silt, gravel, trace clay layers (Fill) (SM)	
9D	12,14,16,19	Brown gravelly fine to coarse sand, some silt, trace clay pockets (Fill) (SM)	31.0'
10D	6,6,7,8	Top: Medium stiff fine to medium sandy clay (CL) Bot: Brown clayey fine sand, trace gravel, coarse sand (SC)	34.0' LOOSE TO MEDIUM COMPACT BRN SILTY & CLAYEY FINE SAND, TR TO SOME GRAVEL, TRACE CLAY
11D	WR,2,3,3	Brown silty fine sand, trace gravel, clay (SM)	42.0'
12D	3,5,7,9	Stiff tan clayey silt, trace fine sand, fine sand pockets, dark green clay pockets (ML)	45.0'
13D	10,10,14,15	Dark gray slightly organic fine sand, some silt, trace medium to coarse sand, clay, clay layers, mica (SM-SC)	M CPT SLIGHTLY ORGANIC FINE SAND, SOME SILT, TR CLAY, CLAY LAYERS 51.0'
14D	12,14,18,25	Dark gray slightly organic micaceous silty fine sand, trace clay (SM-SC)	CPT SLIGHTLY ORG MIC SI F SAND, TR CLAY 55.0'

Boring started 4-18-97 completed 4-22-97
Final depths:
Boring = 55.0' Casing = 30.0'
Casing diameter = 3"
Average depth of ground water observed in the boring = 25.0' =EL +202.3

REMARKS:

Washed the hole with water between 0' and 53' depth; casing blows not recorded.

Performed six falling head permeability tests with the aid of casing. Drove casing to 3' depth, washed ahead of casing with 2-7/8" diameter roller bit to 5' depth and performed first falling head permeability test between 3' and 5' depth with tip of casing at 3' depth. Likewise, five other falling head permeability tests were performed in two-foot depths of open hole at depths of 8, 13, 18, 23 and 28 feet below ground surface.

The depth of groundwater observed in the hole may not be representative.

Borehole was grouted upon completion.

		DATE
DESIGNED		
DRAWN	A.P.	8-97
CHECKED	H.S.L., S.L.T.&A.A.A.	8-97
APPROVED		

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-F-465	General Notes & Legend
F-F-457	Boring Location Plan and
F-F-459	Geological Sections
F-F-462	
To F-F-464	

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA HUGH S. LACY No. 8788 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER RUTLEDGE CONSULTING ENGINEERS
708 THIRD AVENUE, NEW YORK, N.Y. 10017
SUBMITTED

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT

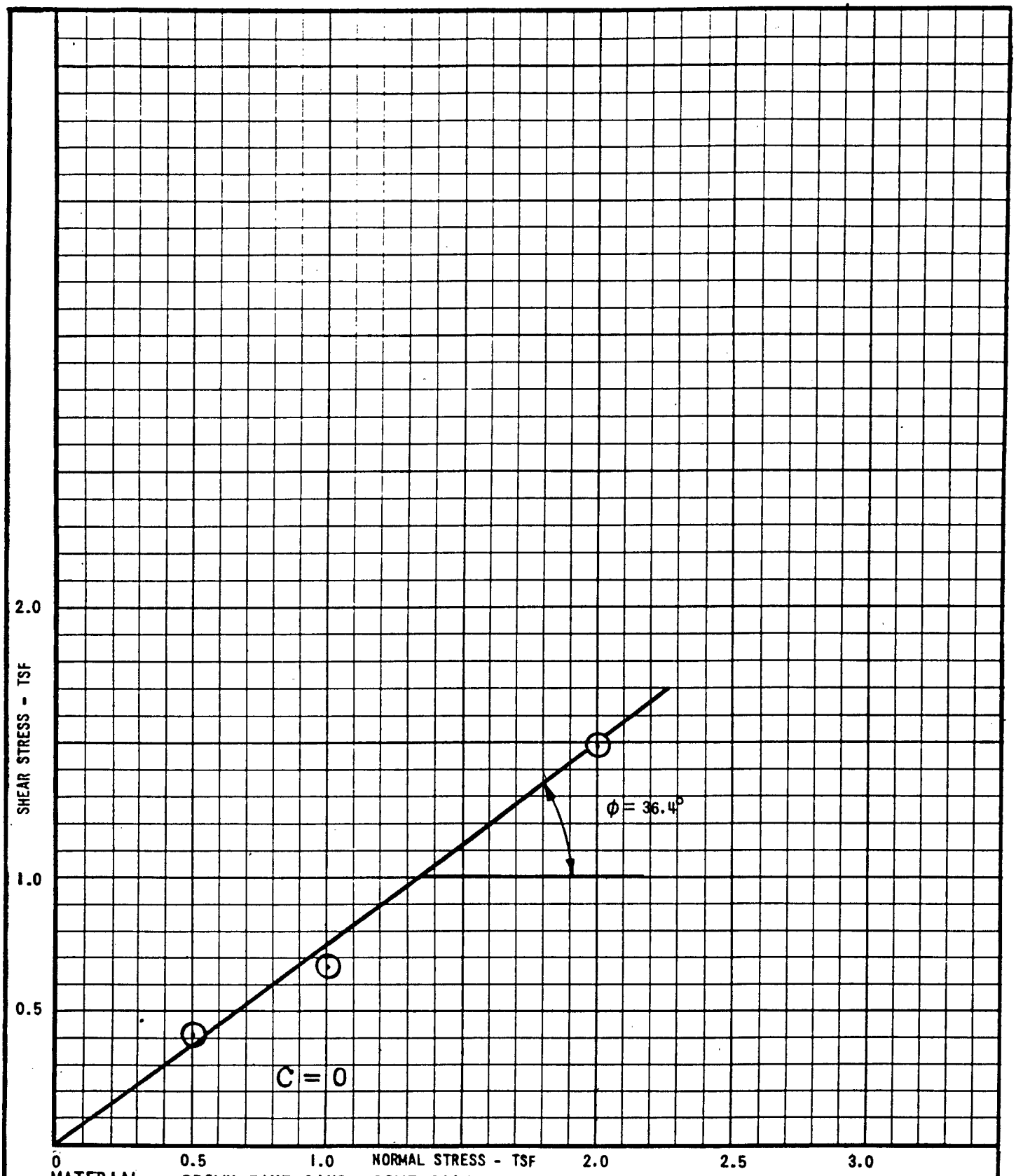
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT

APPROVED

BRANCH ROUTE (F011)
LOGS OF YB – SERIES BORINGS
YB-29U THRU YB-31U, YB-31A, YB-32U, YB-34 & YB-37

SCALE 0 3' 6' 12'

DRAWING NO. F-F-471



MATERIAL: BROWN FINE SAND, SOME SILT

STRATUM (C)

BORING NUMBER	SAMPLE NUMBER	FINAL CONDITION			
		WATER CONTENT	PER CENT SATURATION	NORMAL STRESS TSF	SHEAR STRESS TSF
F-197U	13U	25	100+	0.5	0.40
		26		1.0	0.66
		26		2.0	1.48

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

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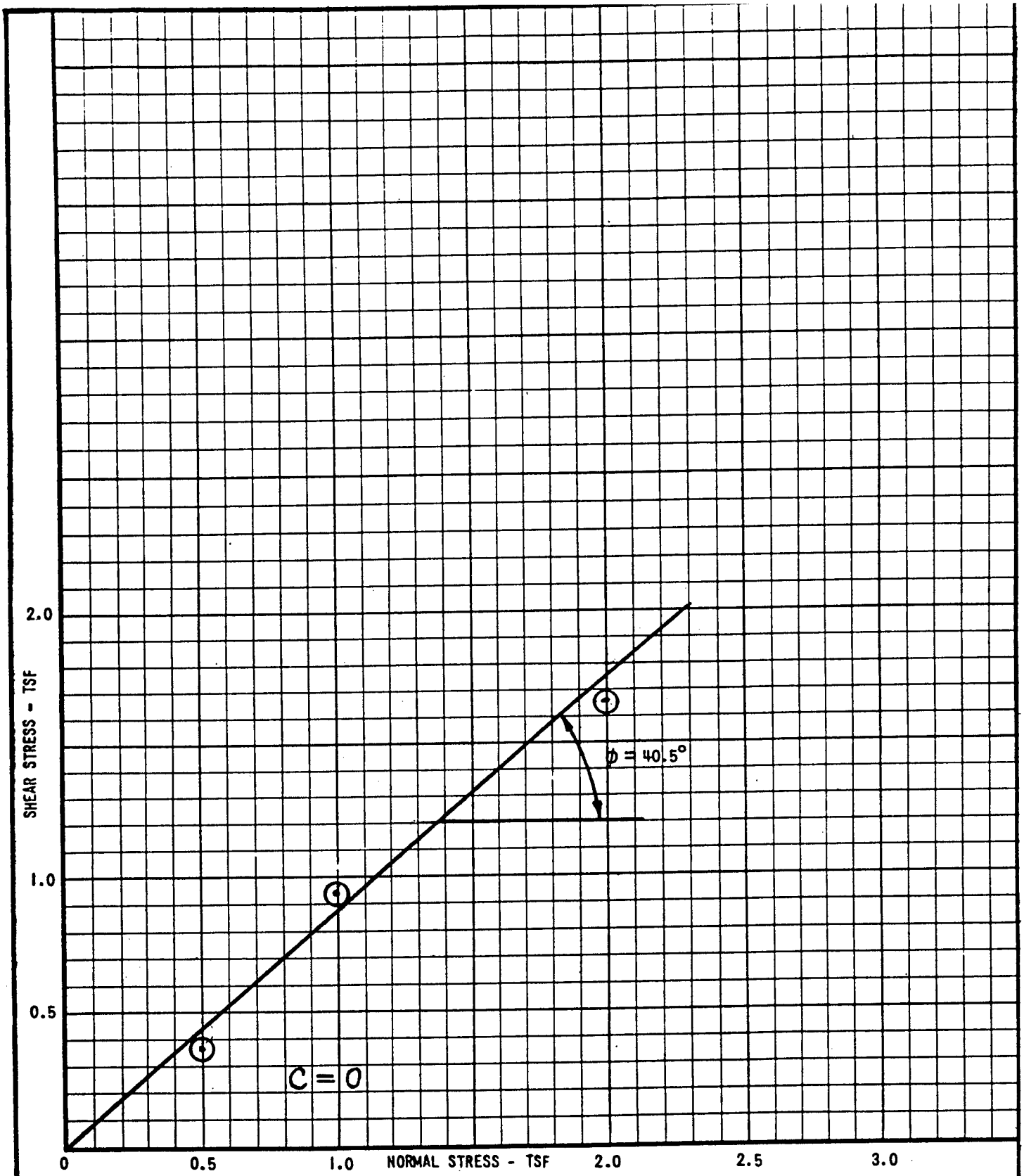
CONSULTING ENGINEERS
415 MADISON AVE. NEW YORK 17, N.Y.

MADE BY: AAK DATE: 9-17-75
CH'KED BY: VLT DATE: 9-19-75
FILE NO. 3291L

DIRECT SHEAR TEST
BORING F-197U SAMPLE 13U

PLATE NO. A55



MATERIAL: DARK GRAY SILTY FINE SAND, SOME CLAY, TRACE SHELLS STRATUM (E)

BORING NUMBER	SAMPLE NUMBER	FINAL CONDITION			
		WATER CONTENT	PER CENT SATURATION	NORMAL STRESS TSF	SHEAR STRESS TSF
F-204U	6U	32	100+	0.5	0.43
		32		1.0	1.04
		32		2.0	1.83

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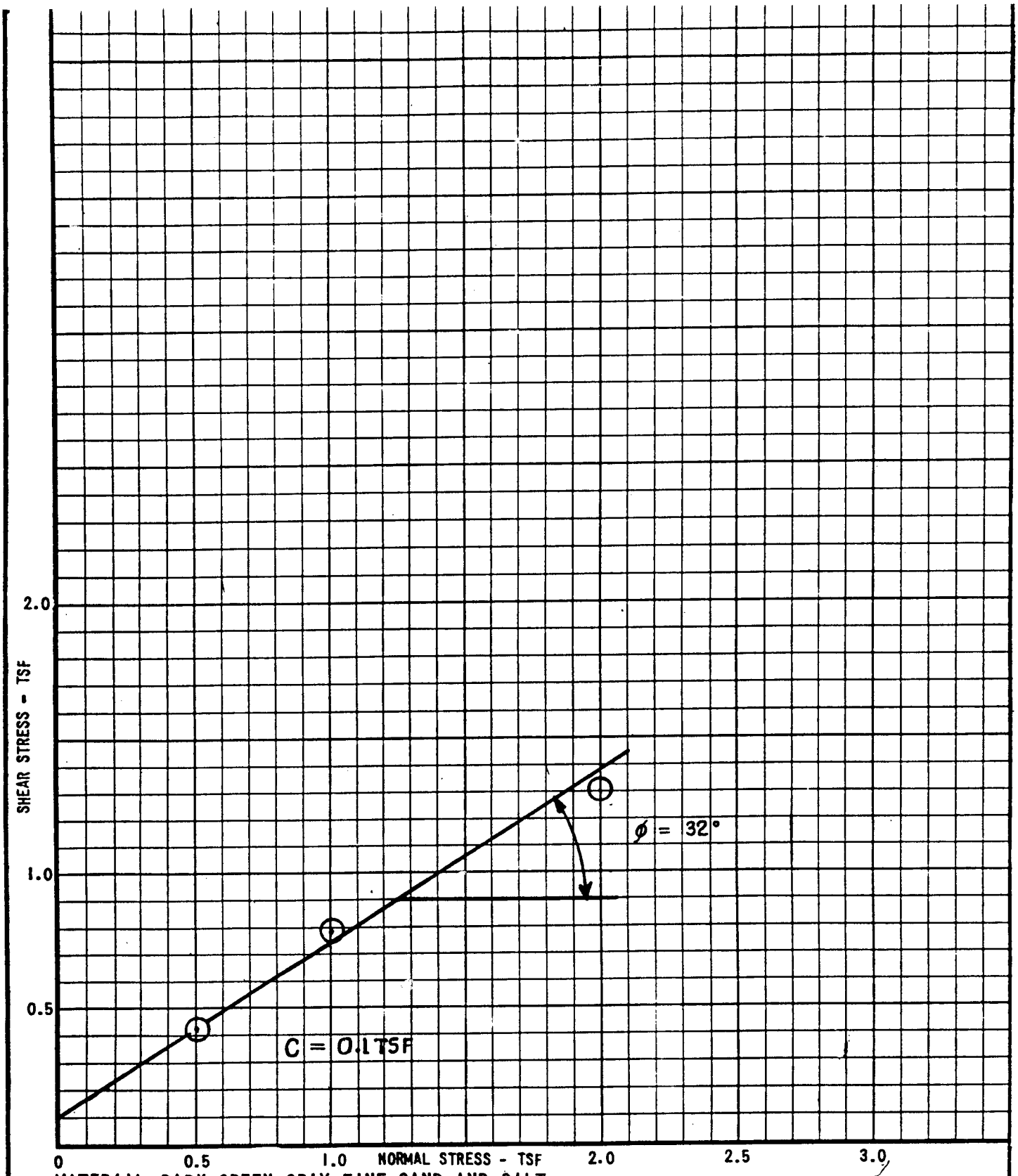
MADE BY: AAK DATE: 9-19-75
CH'KED BY: VLT DATE: 9-19-75

FILE NO. 32911

DIRECT SHEAR TEST
BORING F-204U SAMPLE 6U

PLATE NO. A56



MATERIAL: DARK GREEN-GRAY FINE SAND AND SILT

STRATUM (E)

BORING NUMBER	SAMPLE NUMBER	FINAL CONDITION			
		WATER CONTENT	PER CENT SATURATION	NORMAL STRESS TSF	SHEAR STRESS TSF
F-207U	8U	30	100+	0.5	0.42
		28		1.0	0.78
		29		2.0	1.30

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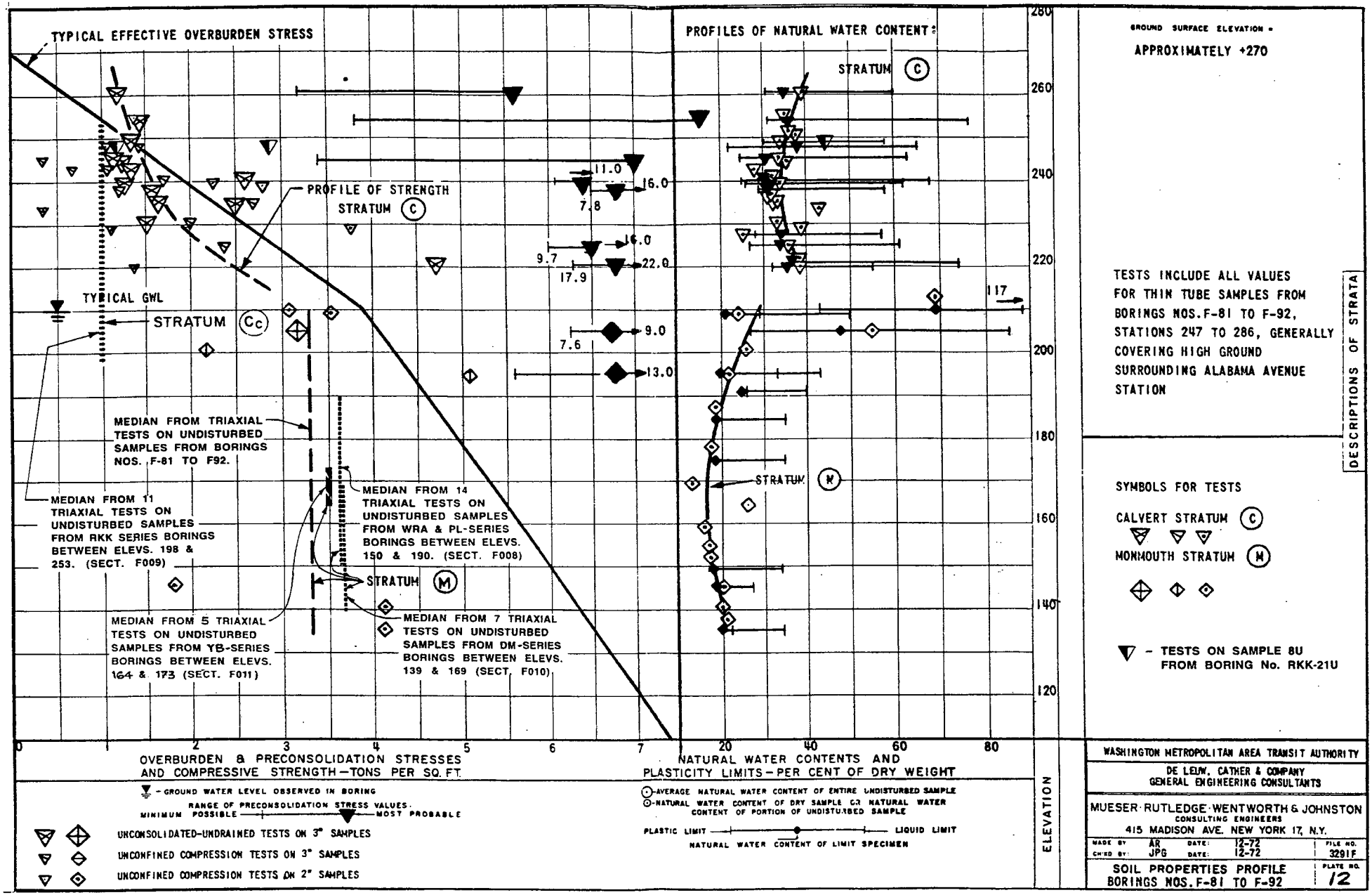
MADE BY: AAK DATE: 9-25-75
CH'KED BY: DATE:

FILE NO. 3291L

DIRECT SHEAR TEST
BORING F-207U SAMPLE 8U

PLATE NO. A57



GROUND SURFACE ELEVATION = APPROXIMATELY +270

TESTS INCLUDE ALL VALUES FOR THIN TUBE SAMPLES FROM BORINGS NOS. F-81 TO F-92, STATIONS 247 TO 286, GENERALLY COVERING HIGH GROUND SURROUNDING ALABAMA AVENUE STATION

DESCRIPTIONS OF STRATA

SYMBOLS FOR TESTS

CALVERT STRATUM (C)

MONMOUTH STRATUM (M)

- TESTS ON SAMPLE 8U FROM BORING No. RKK-21U

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

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GENERAL ENGINEERING CONSULTANTS

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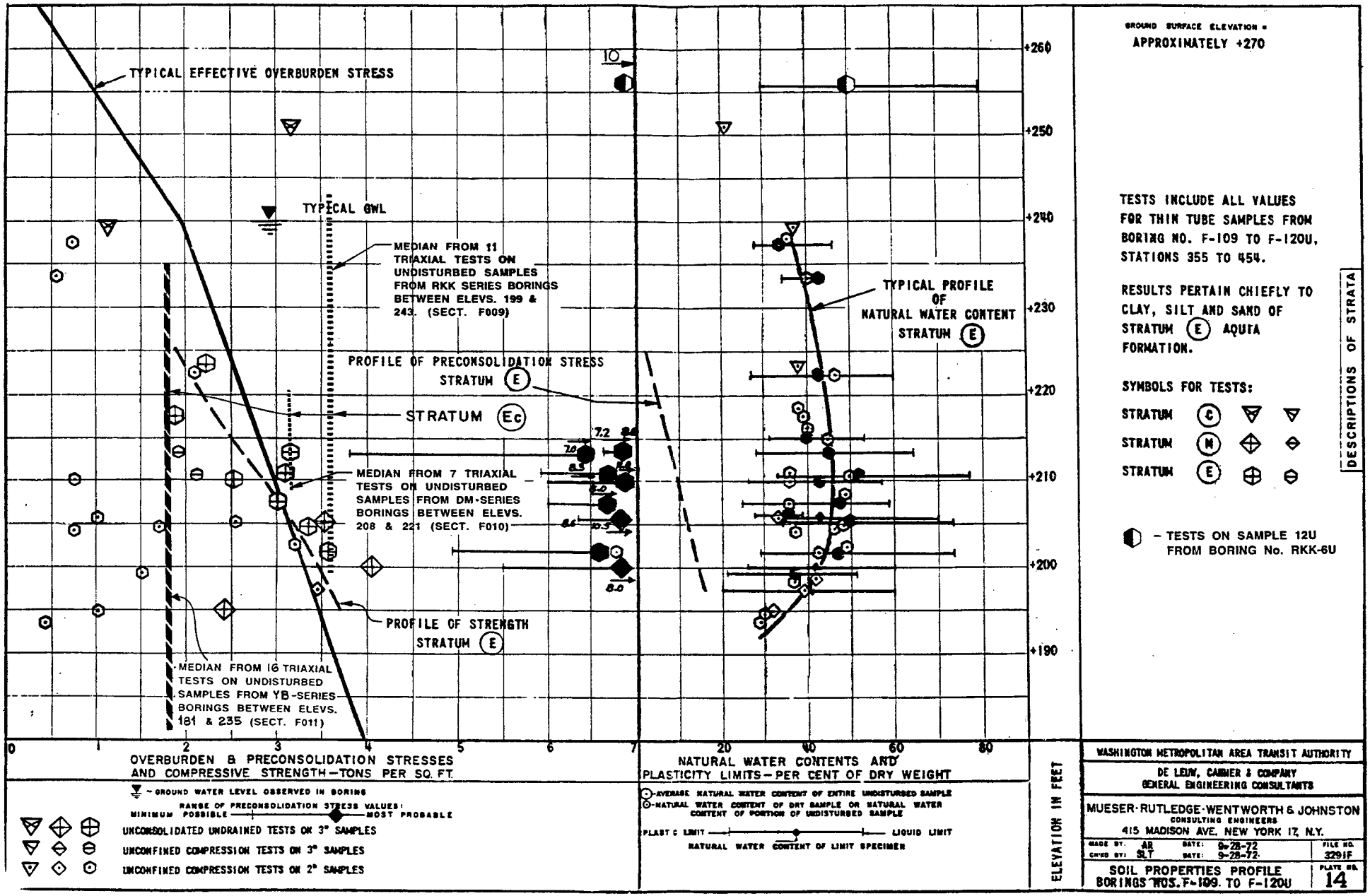
CONSULTING ENGINEERS
415 MADISON AVE. NEW YORK 17, N.Y.

MADE BY	AR	DATE:	12-72	FILE NO. 3291F
CH'KD BY:	JPG	DATE:	12-72	

SOIL PROPERTIES PROFILE
BORINGS NOS. F-81 TO F-92

PLATE NO. 12



GROUND SURFACE ELEVATION = APPROXIMATELY +270

TESTS INCLUDE ALL VALUES FOR THIN TUBE SAMPLES FROM BORING NO. F-109 TO F-120U, STATIONS 355 TO 454.

RESULTS PERTAIN CHIEFLY TO CLAY, SILT AND SAND OF STRATUM (E) AQUIA FORMATION.

SYMBOLS FOR TESTS:

STRATUM (C)
STRATUM (M)
STRATUM (E)

- TESTS ON SAMPLE 12U FROM BORING No. RKK-6U

DESCRIPTIONS OF STRATA

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

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GENERAL ENGINEERING CONSULTANTS

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CONSULTING ENGINEERS
415 MADISON AVE. NEW YORK 17, N.Y.

MADE BY: AR	DATE: 9-28-72	FILE NO. 3291F	
CHKD BY: SLT	DATE: 9-28-72		

SOIL PROPERTIES PROFILE
BORINGS NOS. F-109 TO F-120U

PLATE NO. 14

APPENDIX B

CORROSION AND CHEMICAL TESTS FOR THIS INVESTIGATION

Gascoyne Laboratories, Inc.

YOUR ON-TIME QUALITY LAB...

Baltimore, MD 21224

(410) 633-1800
(800) GAS-COYN
FAX NO.
(410) 633-5443

REPORT OF ANALYSIS

Report No. 9700656 Report Date: May 20, 1997

Report To: NFE, Inc. Page: 1 of 12

Sample I.D. Submitted Soil: 8540, YB-2, dated 04/28/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	5.3	NA	EPA 9045C	PRG	05/07/97
Sulfur(S), wt (%)	<0.05	0.05	ASTMD 129	PRG	05/09/97
Sulfate(S04), mg/kg	10	5	CA 417	PRG	05/13/97
Chloride (Cl), mg/kg	7	5	CA 422	PRG	05/13/97
Resistivity, ohms-cm(2)	39,500	NA	ASTMG 57	PRG	05/13/97

Branch Ave Yard F-11 P.G. County, MD

Boring No. YB-2U

Sample No. 2D

Sample Depth 3.0

Sample Matrix Soil

MRCE 8540 F-11

Notes: (1) Results expressed on an as received basis.
(2) Analysis performed on a saturated basis.

William L. Lock
Laboratory Director

Gascoyne Laboratories, Inc.

YOUR ON-TIME QUALITY LAB...

Baltimore, MD 21224

(410) 633-1800
(800) GAS-COYN
FAX NO.
(410) 633-5443

REPORT OF ANALYSIS

Report No. 9700656 Report Date: May 15, 1997

Report To: NFE, Inc. Page: 2 of 12

Sample I.D. Submitted Soil: 8540, YB-4, dated 04/28/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	7.8	NA	EPA 9045C	PRG	05/07/97
Sulfur(S), wt (%)	<0.05	0.05	ASTMD 129	PRG	05/09/97
Sulfate(S04), mg/kg	73	5	CA 417	PRG	05/13/97
Chloride (Cl), mg/kg	<5	5	CA 422	PRG	05/13/97
Resistivity, ohms-cm	(3)	NA	ASTMG 57	PRG	05/13/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-4U

Sample No. 2-D

Sample Depth 3.0

Sample Matrix Soil

MRCE 8540 F-11

Notes: (1) Results expressed on an as received basis.
(2) Insufficient amount of sample to perform analysis.

William L. Lock
Laboratory Director

Please see reverse side for explanation of terms and other information

Gascoyne Laboratories, Inc.

YOUR ON-TIME QUALITY LAB...

Baltimore, MD 21224

(410) 633-1800
(800) GAS-COYN
FAX NO.
(410) 633-5443

REPORT OF ANALYSIS

Report No. 9700921 Report Date: May 30, 1997

Report To: NFE, Inc. Page: 3 of 12

Sample I.D. Submitted Soil: 8540, YB-6U, dated 05/09/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	4.6	NA	EPA 9045C	PRG	05/28/97
Sulfur(S), wt (%)	<0.05	0.05	ASTM D 129	PRG	05/28/97
Sulfate(S04), mg/kg	48	5	CA 417	PRG	05/29/97
Chloride (Cl), mg/kg	7	5	CA 422	PRG	05/29/97
Resistivity, ohms-cm(2)	19,000	NA	ASTM G 57	PRG	05/29/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-6U

Sample No. 2-D

Sample Depth 3.0

Sample Matrix Soil

MRCE 8540 F-11

Notes: (1) Results expressed on an as received basis.
(2) Analysis performed on a saturated basis.

William L. Lock
Laboratory Director

Gascoyne Laboratories, Inc.

YOUR ON-TIME QUALITY LAB...

Baltimore, MD 21224

(410) 633-1800
(800) GAS-COYN
FAX NO.
(410) 633-5443

REPORT OF ANALYSIS

Report No. 9701104 Report Date: June 11, 1997

Report To: NFE, Inc. Page: 4 of 12

Sample I.D. Submitted Soil: 8540, YB-8U, dated 05/20/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	5.6	NA	EPA 9045C	PRG	05/28/97
Sulfur(S)	<500	500	ASTMD 129	PRG	05/28/97
Sulfate(S04)	14	5	CA 417	PRG	05/29/97
Chloride (Cl)	<5	5	CA 422	PRG	05/29/97
Resistivity, ohms-cm(2)	33000	NA	CA-DOT 643	PRG	05/29/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-8U

Sample No. 5-D

Sample Depth 10.0

Sample Matrix Soil

MRCE 8540 F-11

Notes: (1) Results expressed as mg/kg on an as received basis.
(2) Analysis performed on a saturated basis.

William L. Lock
Laboratory Director

Gascoyne Laboratories, Inc.

YOUR ON-TIME QUALITY LAB...

Baltimore, MD 21224

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FAX NO.
(410) 633-5443

REPORT OF ANALYSIS

Report No. 9700575 Report Date: May 15, 1997

Report To: NFE, Inc. Page: 5 of 12

Sample I.D. Submitted Soil: MRCF-8540, YB-10, dated 04/24/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	4.5	NA	EPA 9045C	PRG	05/07/97
Sulfur(S), wt (%)	<0.05	0.05	ASTMD 129	PRG	05/09/97
Sulfate(S04), wt (%)	<5	5	CA 417	PRG	05/13/97
Chloride (Cl), mg/kg	51	5	CA 422	PRG	05/13/97
Resistivity, ohms-cm(2)	7,500	NA	ASTMG 57	PRG	05/13/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-10

Sample No. 5-D

Sample Depth 10.0

Sample Matrix Soil

MRCE 8540 F-11

Notes: (1) Results expressed on an as received basis.
(2) Analysis performed on a saturated basis.

Thomas A. McVicker
QA/QC Officer

Gascoyne Laboratories, Inc.

YOUR ON-TIME QUALITY LAB...

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(410) 633-5443

Report No. 9700575 Report Date: May 15, 1997

REPORT OF ANALYSIS

Report To: NFE, Inc. Page: 6 of 12

Sample I.D. Submitted Soil: MRCF-8540, YB-14, dated 04/24/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	4.4	NA	EPA 9045C	PRG	05/07/97
Sulfur(S), wt (%)	<0.05	0.05	ASTMD 129	PRG	05/09/97
Sulfate(S04), wt (%)	210	5	CA 417	PRG	05/13/97
Chloride (Cl), mg/kg	11	5	CA 422	PRG	05/13/97
Resistivity, ohms-cm(2)	2,900	NA	ASTMG 57	PRG	05/13/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-14

Sample No. 2-D

Sample Depth 3.0

Sample Matrix Soil

MRCE 8540 F-11

Notes: (1) Results expressed on an as received basis.
(2) Analysis performed on a saturated basis.

Thomas A. McVicker
QA/QC Officer

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REPORT OF ANALYSIS

Report No. 9700575 Report Date: May 15, 1997

Report To: NFE, Inc. Page: 7 of 12

Sample I.D. Submitted Soil: MRCF-8540, YB-16A, dated 04/24/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	7.4	NA	EPA 9045C	PRG	05/07/97
Sulfur(S), wt (%)	<0.05	0.05	ASTMD 129	PRG	05/09/97
Sulfate(S04), wt (%)	56	5	CA 417	PRG	05/13/97
Chloride (Cl), mg/kg	6	5	CA 422	PRG	05/13/97
Resistivity, ohms-cm(2)	4,300	NA	ASTMG 57	PRG	05/13/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-16A

Sample No. 2-D

Sample Depth 3.0

Sample Matrix Soil

MRCE 8540 F-11

Notes: (1) Results expressed on an as received basis.
(2) Analysis performed on a saturated basis.

Thomas A. McVicker
QA/QC Officer

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REPORT OF ANALYSIS

Report No. 9700921 Report Date: May 30, 1997

Report To: NFE, Inc. Page: 8 of 12

Sample I.D. Submitted Soil: 8540, YB-19, dated 05/09/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	5.4	NA	EPA 9045C	PRG	05/28/97
Sulfur(S), wt (%)	<0.05	0.05	ASTM D 129	PRG	05/28/97
Sulfate(S04), mg/kg	38	5	CA 417	PRG	05/29/97
Chloride (Cl), mg/kg	<5	5	CA 422	PRG	05/29/97
Resistivity, ohms-cm(2)	34,000	NA	ASTM G 57	PRG	05/29/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-19

Sample No. 5-D

Sample Depth 10.0

Sample Matrix Soil

MRCE 8540 F-11

Notes: (1) Results expressed on an as received basis.
(2) Analysis performed on a saturated basis.

William L. Lock
Laboratory Director

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REPORT OF ANALYSIS

Report No. 9701104 Report Date: June 11, 1997

Report To: NFE, Inc. Page: 9 of 12

Sample I.D. Submitted Soil: 8540, YB-21U, dated 05/20/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	5.4	NA	EPA 9045C	PRG	05/28/97
Sulfur(S)	<500	500	ASTMD 129	PRG	05/28/97
Sulfate(S04)	26	5	CA 417	PRG	05/29/97
Chloride (Cl)	7	5	CA 422	PRG	05/29/97
Resistivity, ohms-cm(2)	32000	NA	CA-DOT 643	PRG	05/29/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-21U

Sample No. 5-D

Sample Depth 10.0

Sample Matrix Soil

MRCE 8540 F-11

Notes: (1) Results expressed as mg/kg on an as received basis.
(2) Analysis performed on a saturated basis.

William L. Lock
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REPORT OF ANALYSIS

Report No. 9700921 Report Date: May 30, 1997

Report To: NFE, Inc. Page: 10 of 12

Sample I.D. Submitted Soil: 8540, YB-25, dated 05/09/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	5.1	NA	EPA 9045C	PRG	05/28/97
Sulfur(S), wt (%)	<0.05	0.05	ASTM D 129	PRG	05/28/97
Sulfate(S04), mg/kg	27	5	CA 417	PRG	05/29/97
Chloride (Cl), mg/kg	<5	5	CA 422	PRG	05/29/97
Resistivity, ohms-cm(2)	47,000	NA	ASTM G 57	PRG	05/29/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-25

Sample No. 2-D

Sample Depth 3.0

Sample Matrix Soil

MRCE 8540 F-11

Notes: (1) Results expressed on an as received basis.
(2) Analysis performed on a saturated basis.

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REPORT OF ANALYSIS

Report No. 9700921 Report Date: May 30, 1997

Report To: NFE, Inc. Page: 11 of 12

Sample I.D. Submitted Soil: 8540, YB-26, dated 05/09/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	5.9	NA	EPA 9045C	PRG	05/28/97
Sulfur(S), wt (%)	<0.05	0.05	ASTM D 129	PRG	05/28/97
Sulfate(S04), mg/kg	9	5	CA 417	PRG	05/29/97
Chloride (Cl), mg/kg	<5	5	CA 422	PRG	05/29/97
Resistivity, ohms-cm(2)	4,000	NA	ASTM G 57	PRG	05/29/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-26

Sample No. 2-D

Sample Depth 3.0

Sample Matrix Soil

MRCE 8540 F-11

Notes: (1) Results expressed on an as received basis.
(2) Analysis performed on a saturated basis.

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REPORT OF ANALYSIS

Report No. 9700921 Report Date: May 30, 1997

Report To: NFE, Inc. Page: 12 of 12

Sample I.D. Submitted Soil: 8540, YB-30, dated 05/09/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	5.5	NA	EPA 9045C	PRG	05/28/97
Sulfur(S), wt (%)	<0.05	0.05	ASTM D 129	PRG	05/28/97
Sulfate(S04), mg/kg	44	5	CA 417	PRG	05/29/97
Chloride (Cl), mg/kg	<5	5	CA 422	PRG	05/29/97
Resistivity, ohms-cm(2)	31,000	NA	ASTM G 57	PRG	05/29/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-30

Sample No. 2-D

Sample Depth 3.0

Sample Matrix Soil

MRCE 8540 F-11

Notes: (1) Results expressed on an as received basis.
(2) Analysis performed on a saturated basis.

William L. Lock
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REPORT OF ANALYSIS

Report No. 9700656 Report Date: May 15, 1997

Report To: NFE, Inc. Page: 1 of 7

Sample I.D. Submitted Water: 8540, YB-4, dated 04/28/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	6.9	NA	EPA 9045B	TMV	04/30/97
Sulfate(S04)	37	2	EPA 375.4	RED	05/09/97
Chloride (Cl)	8	1	EPA 9252A	DMW	05/02/97
Resistivity, umhos/cm	0.0013	0.0001	EPA 9050	PBK	05/01/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-4U

Sample No. 1

Sample Depth N/A

Sample Matrix Water

MRCE 8540 F-11

Notes: (1) Results expressed as mg/liter (ppm).

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REPORT OF ANALYSIS

Report No. 9701258 Report Date: June 18, 1997

Report To: NFE, Inc.

Sample I.D. Submitted Water: 8540, YB-6U, dated 05/27/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	7.6	NA	EPA 9040B	TMV	05/27/97
Sulfate(S04)	22	2	EPA 375.4	TMV	06/05/97
Chloride (Cl)	15	4	EPA-9252A	DMW	05/30/97
Resistivity, uohms-cm	0.0023	0.0001	EPA 9050	TMV	05/29/97

Branch Avenue Yard F-11 P.G. County, MD

Boring NO. YB-6U

Sample No. 1

Sample Depth N/A

Sample Matrix Water

MRCE 8540 F-11

Notes: (1) Results expressed as mg/liter (ppm).

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REPORT OF ANALYSIS

Report No. 9701258 Report Date: June 18, 1997

Report To: NFE, Inc.

Sample I.D. Submitted Water: 8540, YB-8U, dated 05/27/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	7.6	NA	EPA 9040B	TMV	05/27/97
Sulfate(S04)	22	2	EPA 375.4	TMV	06/05/97
Chloride (Cl)	17	4	EPA 9252A	DMW	05/30/97
Resistivity, uohms-cm	0.0023	0.0001	EPA 9050	TMV	05/29/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-8U

Sample No. 1

Sample Depth N/A

Sample Matrix Water

MRCE 8540 F-11

Notes: (1) Results expressed as mg/liter (ppm).

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REPORT OF ANALYSIS

Report No. 9701258 Report Date: June 18, 1997

Report To: NFE, Inc. Page: 4 of 7

Sample I.D. Submitted Water: 8540, YB-20U, dated 05/27/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	6.6	NA	EPA 9040B	TMV	05/27/97
Sulfate(S04)	24	2	EPA 375.4	TMV	06/05/97
Chloride (Cl)	30	4	EPA 9252A	DMW	05/30/97
Resistivity, uohms-cm	0.0035	0.001	EPA 9050	TMV	05/29/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-20U

Sample No. 1

Sample Depth N/A

Sample Matrix Water

MRCE 8540 F-11

Notes: (1) Results expressed as mg/liter (ppm).

William L. Lock
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REPORT OF ANALYSIS

Report No. 9701258 Report Date: June 18, 1997

Report To: NFE, Inc. Page: 5 of 7

Sample I.D. Submitted Water: 8540, YB-21U, dated 05/27/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	9.2	NA	EPA 9040B	TMV	05/27/97
Sulfate(S04)	46	2	EPA 375.4	TMV	06/05/97
Chloride (Cl)	26	4	EPA 9252A	DMW	05/30/97
Resistivity, uohms-cm	0.0034	0.0001	EPA 9050	TMV	05/29/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-21U

Sample No. 1

Sample Depth N/A

Sample Matrix Water

MRCE 8540 F-11

Notes: (1) Results expressed as mg/kg on an as received basis.

William L. Lock
Laboratory Director

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REPORT OF ANALYSIS

Report No. 9700921 Report Date: May 30, 1997

Report To: NFE, Inc. Page: 6 of 7

Sample I.D. Submitted Water: 8540, YB-27U, dated 05/09/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	7.8	NA	EPA 9040B	TMV	05/09/97
Sulfate(S04)	50	2	EPA 375.4	TMV	05/22/97
Chloride (Cl)	24	1	EPA 9252A	DMW	05/15/97
Resistivity, uohms-cm	0.0034	0.0001	EPA 9050	TMV	05/29/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-27U

Sample No. 1

Sample Depth N/A

Sample Matrix Water

MRCE 8540 F-11

Notes: (1) Results expressed as mg/liter (ppm).

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REPORT OF ANALYSIS

Report No. 9700656 Report Date: May 15, 1997

Report To: NFE, Inc. Page: 7 of 7

Sample I.D. Submitted Water: 8540, YB-37, dated 04/28/97

	Test Results	Detection Limits	Method	Analyst	Date Test Completed
pH	5.8	NA	EPA 9045B	TMV	04/30/97
Sulfate(S04)	16	1	EPA 375.4	RED	05/09/97
Chloride (Cl)	26	1	EPA 9252A	DMW	05/02/97
Resistivity, umhos/cm	0.0056	0.0001	EPA 9050	PBK	05/01/97

Branch Avenue Yard F-11 P.G. County, MD

Boring No. YB-37

Sample No. 1

Sample Depth N/A

Sample Matrix Water

MRCE 8540 F-11

Notes: (1) Results expressed as mg/liter (ppm).

William L. Lock
Laboratory Director