

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 31B-57

DIST. 8 REGION EASTERN

W.P. No. _____

CONT. No. _____

W. O. No. _____

STR. SITE No. _____

HWY. No. _____

LOCATION SOUTH MOUNTAIN BRIDGE
OVER NATION RIVER

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. _____

REMARKS: _____

rec'd on 31 B map

McROSTIE & ASSOCIATES LTD.

CONSULTING ENGINEERS

OTTAWA 1

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1. TERMS OF REFERENCE

We were requested by Mr. Cramm of G. C. Parker & Associates Ltd., to make a subsurface investigation and a study of the possible types of bridge foundations at the proposed crossing of the Nation River at South Mountain. The type of super structure would be chosen to be compatible with the subsurface conditions; details of the live and dead loads involved were supplied by Mr. Cramm.

2. CONCLUSIONS AND RECOMMENDATIONS

2.1 Type of Foundations

We recommend that the feasibility be studied of a foundation scheme involving support of the two centre piers by piles driven to rock since the soils at their locations contain a low density layers. Support of the two abutments in this scheme would be on the medium to dense glacial till soils at convenient depths. This arrangement would appear to us to be the most economical one and we have analyzed the amounts of differential settlement that could be expected between piers and abutments. The expected settlements are quite small, a range of 0.05 feet to 0.02 feet has been calculated, and an economical rigid structure may therefore be possible.

2.2 Soil and Rock Strengths

For abutment footings on the till soils a soil bearing pressure of 6,000 POUNDS PER SQUARE FOOT can be recommended for use at about elevation 248. Detailed rock bearing capacities have not been assigned since no footings would reach them but it can be stated that the rock at the site is adequate for the support of any type of end bearing pile. The higher penetration types of pile might go one foot into the rock surface but no significant penetration would be possible.

2.3 Assumptions in Settlement Calculations

The estimated range of differential settlements of 0.05 to 0.02 feet is based on calculations of the expected total settlement of the bridge abutments since the expected settlement of the bridge piers on piles to rock would be only the elastic shortening of the piles under applied live loads.

Figures for live load and dead load of the bridge and dead load of the abutment were supplied to us in a letter from C. C. Parker Limited, dated August 4, 1964. We do not feel that the abutment dead load needs to be considered as contributing to differential settlements which would produce stresses in the bridge structure since the soil deformations due to the abutment dead load will have taken place, in this type of soil, during the construction of the abutment and before the bridge structure is in place.

Some judgement is required in choosing the assumed soil coefficient of subgrade reaction to be used in the settlement calculations. We have assumed a possible range of values from 100 tons per cubic foot to 200 tons per cubic foot since this is the range that we have observed in actual load tests or settlement observations on similar materials.

Finally, we have made calculations of the differential settlements between bridge abutment and piers during which we have deliberately neglected the stiffness of the superstructure. For any rigid structure, a considerable amount of load redistribution would actually take place.

2.4 Construction Precautions

If the bridge is built during the wet seasons of the year, groundwater levels would rise above footing bottoms at the abutment locations. If this occurs two approaches can be used. First, lowering of groundwater levels can be attempted by ditching around

2.4 Construction Precautions

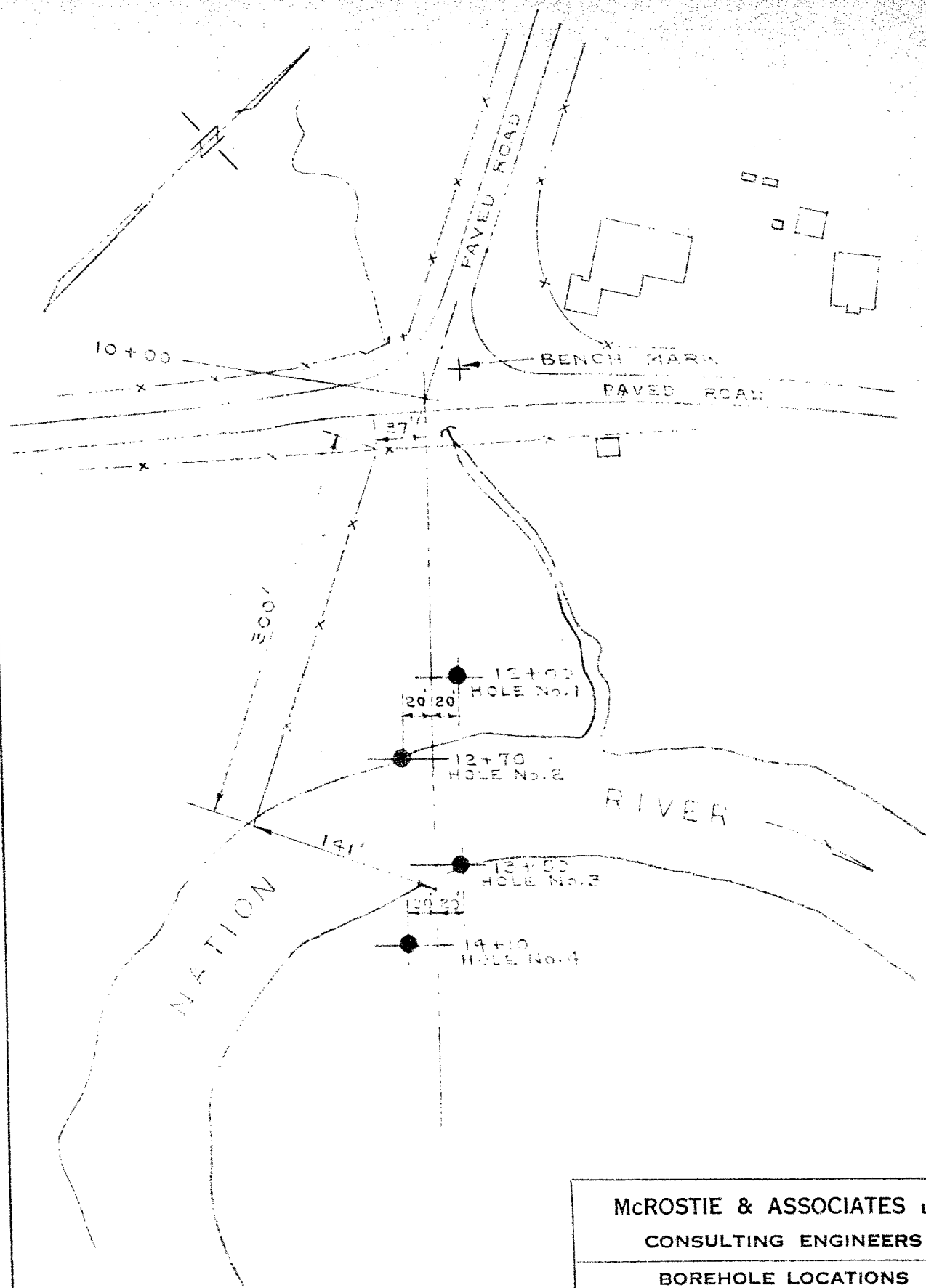
the footing locations with the ditch outlet running to adjacent lower ground. Second, the last one foot of soil excavation can be made within a short a time as possible and preferably less than a few hours before the placing of footing concrete for abutment footings.

Construction of the Bridge Centre Piers during periods of High River Level would of course require the use of cofferdams or continuous piling. Even during low water periods, some special measures are likely to be required as pervious areas are often encountered in the generally impervious till. The evidence of Artesian groundwater pressures at one of the pier locations also indicates an expected flow of groundwater into the pier excavations.

3. SITE INVESTIGATION

Four test holes were made at the site with our drilling equipment in the location shown on plate 1 attached to this report. Two inch split barrel samples were taken in the soil layers and the standard penetration test was performed during the sampling operation. Groundwater levels were recorded during the field work, and when rock was reached it was diamond drilled and cores were recovered for inspection and logging by a foundation Engineer. All samples were returned to our laboratory where they were visually reclassified and a group of water content tests were made to aid in estimating the construction behaviour of the soils.

Details of the soils and rock encountered are shown on plates 2 to 5 but they can be generalized as consisting of about 35 feet of glacial till (a mixture of boulders, gravel sands, silt and clay), with densities ranging from loose to very dense. Beneath the till is sound dolomitic rock of the Oxford Formation. Groundwater was observed at about the 10 foot depth at the abutment locations and a slight Artesian Flow was observed at one of the pier locations. The borehole in which the Artesian Flow was observed was sealed with a concrete plug. During wet seasons the groundwater levels and Artesian pressures will likely be a few feet higher.



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BOREHOLE LOCATIONS
SOUTH MOUNTAIN

SCALE 1" = 100'

PLATE 1

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SOIL PROFILE AND SUMMARY
OF FIELD AND LABORATORY TESTS

SOUTH MOUNTAIN

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 257.1' DATE JULY 15, 1964
REMARKS B.M. (EL. 270.00) GEODETIC - E. OF PAVED ROAD AT CHAINAGE
9+80 TAKEN FROM C.C. PARKER DRAWING No. 1

HOLE NO.
1

UNCONFINED COMPRESSION STRENGTH KIPS/FT. ²							SMALL SCALE PENETROMETER KIPS/FT. ²		STANDARD PENETRATION BLOWS/FT.		SAMPLE NUMBER		DESCRIPTION OF SOIL		DEPTH IN FEET		ELEVATION		PRESSURE OR VANE TEST					
													GROUND SURFACE						LB. HAMMER INCH DROP		NO CASING INCH DIA. ROD			
																			BLOWS PER FOOT OR SHEAR STRENGTH IN KIPS PER FT. ²					
														TOPSOIL FINE SAND AND SILT		0'	257.1'	ARTESIAN PRESSURE - 257.1'						
														MEDIUM DENSE CLAYEY SILT WITH A LITTLE FINE SAND AND A TRACE OF GRAVEL AND TOPSOIL		12'	255.9'							
														15		1-1			5'	252.1'	WATER CONTENT			
														18		1-2	MEDIUM DENSE SILTY TILL							
														50					7.5'	249.6'				
														15 for 6"		1-3	DENSE							
														22 for 6"			TO VERY DENSE							
														60 for 6"		1-4	SILTY TILL							
														8					12.5'	244.6'				
														7 for 6"		1-5	LOOSE TO MEDIUM DENSE SILTY TILL							
														35		1-6	DENSE SILTY TILL BOULDERS		15'	242.1'				
														110		1-7			17.5'	239.6'				
																	VERY DENSE							
														60 for 5"		1-8	SILTY TILL BOULDERS							
														65					24'	233.1'				
														60 for 4"		1-9	VERY DENSE SANDY							
														68			TILL							
														50 for 6"		1-10	BOULDERS							
														36		1-11	DENSE SANDY TILL		30'	227.1'				
														83		1-12	VERY DENSE SILT WITH A LITTLE GRAVEL		32.5'	224.6'				
														97		1-13	VERY DENSE SILTY TILL		35'	222.1'				
																	BOTTOM OF HOLE		36.5'	220.6'				

0 20 40 60 80 100
% WATER CONTENT
NATURAL ○
LIQUID LIMIT □
PLASTIC LIMIT △
PLATE 2

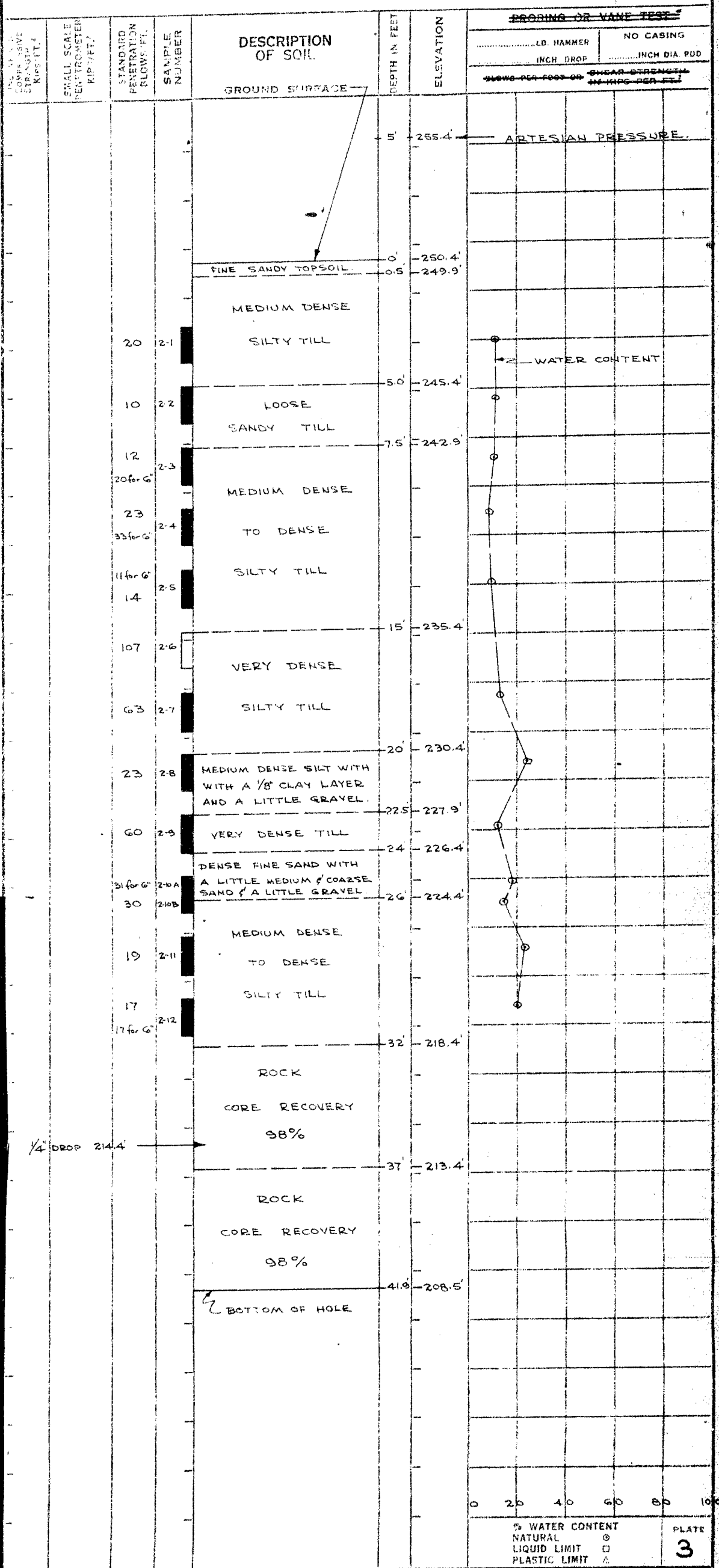
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SOIL PROFILE AND SUMMARY
OF FIELD AND LABORATORY TESTS

SOUTH MOUNTAIN

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 250.4' DATE JULY 16, 1964
REMARKS SEE PLATE No. 2

HOLE NO.
2



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SOIL PROFILE AND SUMMARY OF FIELD AND LABORATORY TESTS

SOUTH MOUNTAIN

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 249.8' DATE JULY 16, 1964
REMARKS SEE PLATE No. 2.

HOLE No.

3

UNCONSOLIDATED COMPRESSIVE STRENGTH KIPS/FT. ²	SMALL SCALE PENETROMETER KIPS/FT. ²	STANDARD PENETRATION BLOWS/FT.	SAMPLE NUMBER	DESCRIPTION OF SOIL	DEPTH IN FEET	ELEVATION	PROBING OR VANE TEST	
							LB. HAMMER INCH DROP	NO CASING INCH DIA. ROD
							BLOWS PER FOOT OR	SHEAR STRENGTH IN KIPS PER FT.
				GROUND SURFACE				
					25'	252.3'		ARTESIAN PRESSURE
				FINE SANDY TOP SOIL	0.3'	249.8'		
				MEDIUM DENSE TILL				WATER CONTENT
13	3-1				5'	244.8'		
18	3-2			MEDIUM DENSE SILTY TILL	7.5'	242.3'		
15 for 6"								
14	3-3			MEDIUM DENSE SANDY TILL				
10 for 6"								
8 for 6"	3-4				15'	234.8'		
10	3-5							
10				MEDIUM DENSE SILTY TILL				
8	3-6				22.5'	227.8'		
11 for 6"					23.5'	226.3'		
12	3-7			VERY LOOSE SILTY TILL				
12	3-8							
1	3-9			MEDIUM DENSE SILTY TILL				
10					32.0'	217.8'		
15	3-10			ROCK				
				CORE RECOVERY 98 %	36.9'	212.9'		
				ROCK				
				CORE RECOVERY 98 %	41.8'	208.0'		
				BOTTOM OF HOLE				
							0 20 40 60 80 100	
							% WATER CONTENT	
							NATURAL	
							LIQUID LIMIT	
							PLASTIC LIMIT	
							PLATE	
							4	

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SOIL PROFILE AND SUMMARY OF FIELD AND LABORATORY TESTS

SOUTH MOUNTAIN

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 256.5

DATE JULY 17, 1964

HCLF No.

4

CORRECTED COMPRESSIVE STRENGTH KIPS/FT ²	SMALL SCALE PENETROMETER KIPS/FT ²	STANDARD PENETRATION BLOWS/FT.	SAMPLE NUMBER	DESCRIPTION OF SOIL	DEPTH IN FEET	ELEVATION	PROVING OR VANE TEST	
							LB. HAMMER	NO. CASING
							INCH DROP	INCH DIA. ROD
				GROUND SURFACE	0	256.5'		
				FINE SANDY TOPSOIL	1	255.5'		
				MEDIUM DENSE SILTY TILL	3	253.5'		
6 for 6"			31 4-1	DENSE				
44			4-2	TO MEDIUM DENSE				
23 for 6"				SILTY				
26			4-3	TILL				
12				MEDIUM DENSE	10	246.5'		
21 for 6"			4-4	TO DENSE SILTY TILL	12.5	244.0'		
48				DENSE				
31 for 6"			4-5	TO VERY DENSE				
23			4-6	SANDY				
43				TILL				
30 for 6"			4-7		20	236.5'		
36			4-8	DENSE SILTY TILL	22.5	234.0'		
68			4-9	VERY DENSE SILTY				
50			4-10	TILL	26.5	230.0'		
27			4-11	DENSE SANDY TILL	29	227.5'		
				BOTTOM OF HOLE				

WATER CONTENT

WATER LEVEL AFTER 1 HOUR 248.6

0 20 40 60 80 100

% WATER CONTENT

NATURAL 0

LIQUID LIMIT 0

PLASTIC LIMIT 0

PLATE

5