BEAUFORT-DELTA OIL PROJECT LIMITED

BOREHOLE DATA BANK DESCRIPTION

AND

GEOTECHNICAL DATA PROFILES

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CONSULTING ENGINEERING & TESTING

BEAUFORT-DELTA OIL PROJECT LIMITED

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Prepared By

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1.0 INTRODUCTION

A previous report ("Beaufort-Delta Borehole Databank") submitted to Beaufort-Delta Oil Project Limited by R. M. Hardy & Associates Ltd. described the borehole databank and presented statistics of borehole data. The present report utilizes the databank to prepare charts of soil stratigraphy and of moisture content versus depth. These charts will be of fundamental importance in thaw settlement calculations, and in estimating pile response to material type.

The results contained in this report will also find extensive application in the following areas:

- route selection and evaluation
- assessment of thermal properties for different terrain units
- spring constants for stress analysis
- assessment of excavation and drilling requirements in different terrain units
- soil strength properties
- soil properties for drainage and erosion control considerations
- borrow assessment

This report comprises two parts: firstly the computer program is described and a user's manual for the program is presented; secondly charts of borehole stratigraphy and moisture content versus depth are given, accompanied by a discussion of these charts and their interpretation.

2.0 COMPUTER PROGRAM AND USER'S MANUAL

The purpose of this section of the report is to summarize the work which has been done so far on the data bank. The status of the data bank is as follows:

a. Information concerning all boreholes has been written on special sheets - one sheet per borehole.

b. These data have been punched on cards - one borehole = one sheet = two data cards (except a small number of boreholes which required a third card).

c. The entire data bank has been printed out, checked against the original sheets and the card copy of the data bank has been corrected.

d. The data bank has been manually sorted out according to physiographic regions which resulted in the Data Bank Version 1. The printout of this data bank is enclosed.

e. Further the data bank has been sorted by computer according to terrain type which resulted in the Data Bank Version 2.

f. Both data banks Version 1 and Version 2 have been stored on magnetic tapes.

g. The soil stratigraphy, as well as water content charts, has been computed and drawn for the data bank Version 2 (BANK2).

h. The thaw-settlement function of the program has been written and results obtained.

The computer program developed to this date is here described together with its user's manual.

2.1 Computer Program BDBANK

The purpose of the program BD BANK (Beaufort-Delta Data Bank) is to perform several handling functions of the data bank. The description of these functions is shown in Figure 1 and can be summarized as follows:

1. Read a part of the data bank (subroutine READWR) from computer cards or from a disk file and print the information in "Borehole data summary sheet" format, six "sheets" per computer printout page.

2. Read a part of the data bank from computer cards or from a disk file, create (program block RETAPE) a catalogued disk file (Record size = 166 bytes, Block size = 13000 bytes = 78 records) in which each record begins with two bytes containing the record number followed by 160 bytes representing an image of two data cards.

3. Function #2 has been used to create six files containing borehole data stored according to physiographic regions separately. For design engineering considerations it is necessary to sort these six files further into subfiles (BANK2) according to different terrain types. This sorting procedure is the purpose of program block SORTER.

4. Read the data bank or its part from computer cards or from a disk file, perform statistical analysis and print results.

5. Read files from data BANK2 (sorted according to physiographic region and different terrain types) and perform computations leading to soil stratigraphy and water content charts. Mean unfrozen and frozen water contents as a result of this computation (for each terrain type) write on the disk file BDP.BANK2.REGXX.MEANWC.

6. Perform thaw-settlement analysis for each borehole as follows: (a) complete the water content profile by linear interpolation and instead of extrapolation use mean water content as obtained in 5, (b) perform thaw-settlement analysis for different depths of pipe burials, (c) perform statistical thaw settlement analysis.

The flow chart of this program is shown in Fig. 1. The program is listed in Appendix A. Its load module is currently available on CSG system on line and therefore can be used anytime. The user's manual as well as JCL cards are described in the next sections.

2.2 User's Manual for BDBANK

The user can choose one or more functions to be performed once or many times in the same run. The preparation for such a run is here described.

The first card in the data deck specified how many title cards follow:

Column	Variable	Format	Description
1-5	NTITLE	I5	Number of title cards

The next set of cards are so-called "title cards" which are used to identify the user, current run, job name, job number, client's name, functions required, etc. There is no limit on the number of title cards.

The next card is to identify the required functions to be run sequentially. The call numbers for function #1 READWR (read and list boreholes) is 1, for function #2 RETAPE (create a file) is 2, for function #3 SORTER (sort according to terrain type) is 3, for function #4 STATIS (perform statistical analysis of data) is 4, for function #5 CHARTS (soil stratigraphy and moisture content charts) is 5 and for function #6 THAWSE (thaw settlement) is 6. Therefore the user is required to punch on one card function numbers 1, 2, 3, 4, 5 or 6 in any required sequence up to 40 in the format 40I2. After each function has been performed the control is transferred to the MASTER routine where a new function number is picked up and required computation continues. Further for each function to be performed one data card is required as follows:

2.2.1 Function #1 READWR

Column	Variable	Format	Description
1-5	IREAD	I5	Unit number

If IREAD = 5 the data bank will be read from data cards (Unit = 5). If the data bank is already stored on a disk file IREAD = FILE number. In this case a correct DD card has to be also specified (see the section for preparation of JCL cards).

2.2.2 Function #2 RETAPE

Column	Variable	Format	Description
1-5	IFILE	I5	File number

IFILE is a file number on which the data bank will be stored. The user is reminded again that a proper DD card for unit IFILE has to be provided.

2.2.3 Function #3 SORTER

Column	Variable	Format	Description
1-5	IFILE	3I5	File number where the data are stored
6-10	IFILE0	3I5	Initial file number for the new files
11-15	IFREST	3I5	File number for the rest of the boreholes

IFILE0 is an initial number for the counter, which calculates the new file numbers. If for example IFILE0 = 20 the first and consecutive files created by the SORTER are 21, 22, etc. The user is required to provide DD cards for all expected new files. The file IFREST is designed to gather all boreholes which do not fit into previously specified files. These are all sets of boreholes of certain terrain types and zones which number less than 5.

Furthermore there are two sets of data cards in this group punched in Format (8(5A2)). The first set specifies selected names of new files which are created by grouping boreholes with similar terrain types and the second set of data cards specifies original terrain types as shown on borehole records. These two sets are shown in Table 2.

2.2.4 Function #4 STATIS

Column	Variable	Format	Description
1-5	IREAD	I5	Unit number

If IREAD = 5 the data will be read from cards (Unit = 5). If IREAD $\neq$ 5, IREAD is a disk file number where the data are stored. Here the DD card has to be provided as well.

2.2.5 Function #5 CHARTS

There is only one card to be specified for each analysis:

Column	Variable	Format	Description
1-5	IREAD	(I5,5X,5A2,I5)	Number of the file to be analyzed
11-20	TERT(I),I=1,5	(I5,5X,5A2,I5)	Terrain type
21-25	IFILMC	(I5,5X,5A2,I5)	Number of the file where mean water contents are to be stored

Care has to be exercised in order to match number of the file to be analyzed = IREAD with the proper terrain type on DD card with DISP = OLD. Here also a proper DD card for the new file IFILMC must be included. The routine CHARTS is called as many times as number of above described data cards. The control is transferred to the MASTER subroutine after reading a blank card.

2.2.6 Function #6 THAWSE

The first card identifies the region under consideration:

Column	Variable	Format	Description
1-2	REG1	A2	Physiographic region to be analyzed
6-10	IFLMC	I5	Number of the file containing mean water contents of all terrain types in REG1

The second and consecutive cards serve to specify the number of the file to be processed as well as its terrain type:

Column	Variable	Format	Description
1-3	IREAD	(I5,5X,5A2)	File number
6-15	TERT1(2),2=1,5	(I5,5X,5A2)	Terrain type

All specified files are processed until a blank card is found after which the control is again transferred to the MASTER routine.

2.3 Data Bank Storage and JCL

2.3.1 Data Bank disk files

The organization of disk files associated with the data bank is designed by use of four identification levels. The first level BDP stands for Beaufort-Delta Project. The second level BANK1 or BANK2 denotes the data bank versions. The third level is used to identify the physiographic region and the fourth level is mainly used in BANK2 version of the data bank for the terrain types. In the description below these names are referred to as BDP.LEVEL2.LEVEL3.LEVEL4.

The first version of the data bank BANK1 which has been sorted according to physiographic regions is stored on six disk files. The names of these files are as follows:

Name	Physiographic Region	Number of records
BDP.BANK1.REG00.MASTERX	0	54
BDP.BANK1.REG01.MASTERX	1	1002
BDP.BANK1.REG02.MASTERX	2	2501
BDP.BANK1.REG03.MASTERX	3	2132
BDP.BANK1.REG6N.MASTERX	6N	2118
BDP.BANK1.REG6S.MASTERX	6S	812

The second version of the data bank BANK2 which has been sorted according to physiographic regions as well as terrain types is stored on some 75 disk files. The first and second level of their names is the same = BDP.BANK2. These files are as follows:

Name	Physiographic Region	Terrain Type	Number of Records	
BDP.BANK2.REG00.APX	00	AP	7	
BDP.BANK2.REG00.GOX	00	GO	10	
BDP.BANK2.REG00.MHX	00	MH	20	
BDP.BANK2.REG00.OU-LPX	00	OU/LP	6	
BDP.BANK2.REG00.RESTX	00	-	11	/ 54
BDP.BANK2.REG01.AFX	01	AF	14	
BDP.BANK2.REG01.APX	01	AP	4	
BDP.BANK2.REG01.GOX	01	GO	59	
BDP.BANK2.REG01.LPX	01	LP	18	
BDP.BANK2.REG01.MEX	01	MD	316	
		ME	27	
BDP.BANK2.REG01.MG-R-MHX	01	MG/R/MH	47	
BDP.BANK2.REG01.MG-RX	01	MG/R	235	
BDP.BANK2.REG01.MGX	01	MG		
BDP.BANK2.REG01.MHX	01	MH	104	

BDP.BANK2.REG01.OU-LPX	01	OU/LP		
BDP.BANK2.REG01.OU-MGX	01	OU/MG	110	
BDP.BANK2.REG01.OUX	01	OU	19	
BDP.BANK2.REG01.RESTX	01	-	49	/1002
BDP.BANK2.REG02.AFX	02	AF	43	
BDP.BANK2.REG02.APX	02	AP	14	
BDP.BANK2.REG02.ATX	02	AT	33	
BDP.BANK2.REG02.CTX	02	CT	191	
BDP.BANK2.REG02.GOX	02	GO	309	
BDP.BANK2.REG02.LPX	02	LP	8	
BDP.BANK2.REG02.MG-R-MHX	02	MG/R/MH	11	
BDP.BANK2.REG02.MG-RX	02	MG/R	241	
BDP.BANK2.REG02.MGX	02	MG	1105	
BDP.BANK2.REG02.MHX	02	MH	340	
BDP.BANK2.REG02.OU-LPX	02	OU/LP	123	
BDP.BANK2.REG02.OU-MGX	02	OU/MG	50	
BDP.BANK2.REG02.OUX	02	OU	28	
BDP.BANK2.REG02.RESTX	02	-	5	/2501
BDP.BANK2.REG03.AFX	03	AF	69	
BDP.BANK2.REG03.APX	03	AP	80	
BDP.BANK2.REG03.ATX	03	AT	26	
BDP.BANK2.REG03.CM-RX	03	CM/R	100	
BDP.BANK2.REG03.CT-RX	03	CT/R	13	
BDP.BANK2.REG03.CTX	03	CT	17	
BDP.BANK2.REG03.EDX	03	ED	5	
BDP.BANK2.REG03.GOX	03	GO	24	
BDP.BANK2.REG03.LBX	03	LB	10	
BDP.BANK2.REG03.LP-ED-X	03	LP(ED)		
BDP.BANK2.REG03.LP-MGX	03	LP/MG	135	
BDP.BANK2.REG03.LPX	03	LP	286	
BDP.BANK2.REG03.MG-RX	03	MG/R	111	
BDP.BANK2.REG03.MGX	03	MG	957	
BDP.BANK2.REG03.OU-LPX	03	OU/LP	214	
BDP.BANK2.REG03.OU-MGX	03	OU/MG	20	
BDP.BANK2.REG03.OUX	03	OU	32	
BDP.BANK2.REG03.RESTX	03	-	33	/2132
BDP.BANK2.REG6N.APX	6N	AP	225	
BDP.BANK2.REG6N.ATX	6N	AT	261	
BDP.BANK2.REG6N.CMX	6N	CM	97	
BDP.BANK2.REG6N.CTX	6N	CT	61	
BDP.BANK2.REG6N.EDX	6N	ED	18	
BDP.BANK2.REG6N.GO-LPX	6N	GO/LP	1	
BDP.BANK2.REG6N.GOX	6N	GO	276	
BDP.BANK2.REG6N.LP-ED-X	6N	LP(ED)	22	
BDP.BANK2.REG6N.LP-MGX	6N	LP/MG	116	
BDP.BANK2.REG6N.LPX	6N	LP	427	
BDP.BANK2.REG6N.MG-RX	6N	MG/R	17	
BDP.BANK2.REG6N.MGX	6N	MG	85	
BDP.BANK2.REG6N.OU-LPX	6N	OU/LP	474	
BDP.BANK2.REG6N.RESTX	6N	-	38	/2118

BDP.BANK2.REG6S.ATX	6S	AT	34	
BDP.BANK2.REG6S.GOX	6S	GO	32	
BDP.BANK2.REG6S.LP-MGX	6S	LP/MG	21	
BDP.BANK2.REG6S.LPX	6S	LP	26	
BDP.BANK2.REG6S.MG-RX	6S	MG/R	17	
BDP.BANK2.REG6S.MGX	6S	MG	489	
BDP.BANK2.REG6S.OU-LPX	6S	OU/LP	11	
BDP.BANK2.REG6S.OU-MGX	6S	OU/MG	128	
BDP.BANK2.REG6S.OUX	6S	OU	4	
BDP.BANK2.REG6S.RESTX	6S	-	50	/ 812

These files were first created by unformated write statement with DCB = (RECFM = VBS, LRECL = 166, BLKSIZE = 13000, BUFNO = 1) which appeared least expensive and most efficient. However, as it is necessary to read them back by using A and I formats it was required to copy them into new files by changing RECFM = VB. This fact is denoted by X on the end of each file name. All files RESTX contain data of those boreholes which did not fit into designed terrain type categories.

There are an additional six files which contain unfrozen and frozen water contents associated with the above 75 data bank files.

3.0 GEOTECHNICAL DATA PROFILES

In the following, the Beaufort-Delta Borehole Databank is employed to prepare charts of soil stratigraphy and moisture content versus depth.

The previous report, "Beaufort-Delta Databank", tabulated the occurrence of terrain groups within the various geographic zones. Where a minimum of 5 holes was available in each terrain group-zone combination, files have been created. Information is drawn from these files to be displayed in chart form, showing the probability of encountering various soil materials within specific depth ranges, and the probable moisture content for both frozen and unfrozen holes. The charts so derived are shown in Appendix B.

The method of preparation of each type of chart is presented below.

3.1 Soil Stratigraphy Charts

A soil stratigraphy chart is prepared via the following steps:

1. The terrain type and zone are specified.

2. Material type is summarized from the Terrain Typing.

3. For each depth range specified in the databank (0-2, 2-4, 4-7, 7-10 ... 30-40 feet) the frequency of occurrence of each soil type is calculated, and plotted as cumulative frequency of material logged in percent of boreholes.

4. The number of holes reaching a given depth is recorded - this number decreases with depth, and few holes penetrate to greater than 40 feet.

For the purpose of simplifying the charts, the original system of symbols for material types was modified by grouping like materials. These are summarized in Table 1.

Table 1

Material	Symbol
Bedrock	B
Silty or clayey till	C
Clayey gravel, silty gravel, gravel	G
Clayey sand, silty sand, sand	S
Organic clay, organic silt, peat	O

This legend should be used in conjunction with the soil stratigraphy charts in Appendix B.

3.2 Moisture Content Charts

A soil moisture content chart is prepared via the following steps:

1. The terrain type and zone are specified.

2. For each depth range specified in the databank, the mean moisture content is calculated in percent dry weight of the soil solids and plotted as a solid line.

3. The number of values on which the mean is based is recorded. This may vary with depth, as the moisture content samples were not taken with respect to the depth ranges used here.

4. Also the 95% confidence limits of the mean moisture content value are displayed as dashed lines.

3.3 Interpretation of Charts

In addition to the stratigraphy and moisture content charts, several columns of information are included on each chart in Appendix B.

3.3.1 Terrain type

The R. M. Hardy terrain typing system forms the basis for the symbol. However there has been some modification of the original system; many types have been grouped, as summarized in the report "Beaufort-Delta Borehole Databank".

3.3.2 Material type

This column gives a broad description of the landform and material type, as inferred from the terrain typing.

3.3.3 Interpretation

A general point is that the number of holes, and thus statistical rigour, varies widely from terrain group to terrain group, and from zone to zone. A minimum of five holes has been employed, but usually charts are based on many more data points.

A major point to be noted in interpreting the charts is that the number of holes on which percentages are based decreases with depth. In the case of soil stratigraphy charts, this is due to holes being terminated on reaching bedrock. Thus in the case of the chart for Terrain Type Mg/R.Mh in Region 1 the percentage of bedrock falls from 47% at 30 feet to 0% at 40 feet, while percentages of soil types G and C increase. This should not be interpreted as bedrock overlying clay, but that holes drilled into bedrock were terminated before those in clay. Also note that the number of holes falls from 45 at depth 30 feet to 3 at 40 feet.

In the case of moisture content charts, it should be noted that the numbers of data points for a given depth range, from which the mean is calculated, do not always correspond to the number of holes at that depth as shown on the soil stratigraphy charts. This is because there are not always values of moisture content at each depth.

In the more northerly regions there are no unfrozen holes, thus no charts of the moisture content in the unfrozen state are given. For the southerly regions, charts of the moisture content in the unfrozen state are given when there are more than 5 values at a given depth.

3.4 Applications of Charts

The charts included here will be of use in several aspects of the route selection and pile studies. The moisture content is of fundamental importance in thaw settlement calculations. Thaw settlement will be calculated for each depth range, based on the moisture content, where bulk density data are not available, and summed for the depth of thaw.

In terms of pile support studies, both soil stratigraphy and moisture content data are required. From the charts a typical stratigraphy will be extracted and employed in calculations of shaft and end-bearing capacity. This will be carried out for each zone and terrain type.

The charts will be consulted on a regular basis during route evaluation studies, to obtain an impression of the soil types, position of bedrock, soil moisture contents, etc.

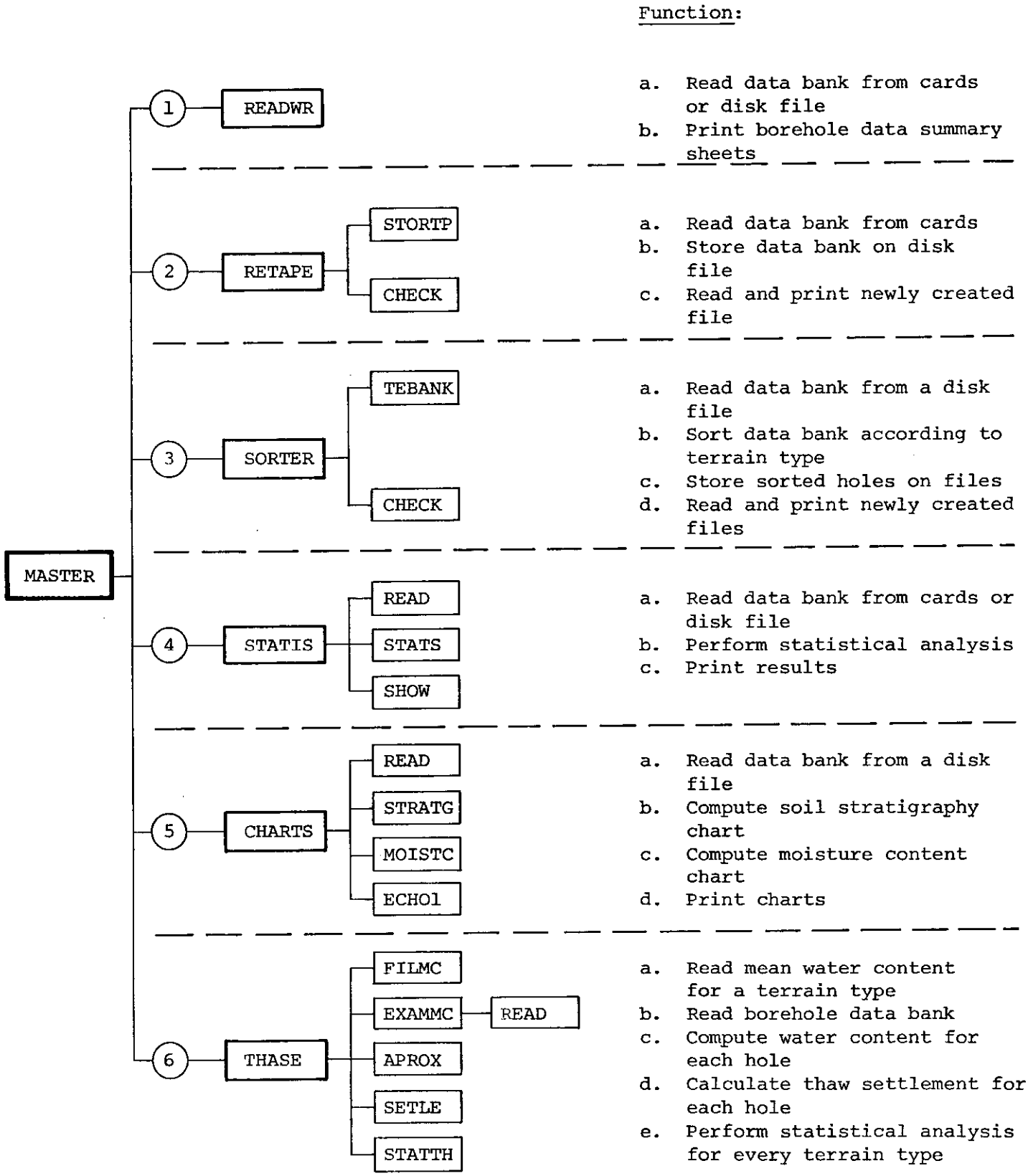
The soil type and moisture content are also important properties when assessing the thermal properties of soil, and the constants required for soil-pipe interation studies.

The presence of gravels, cobbles or stoney tills in any terrain unit are important factors in assessing potential difficulties for ditch excavation, or drilling requirements for above ground pile supports. The frequency of occurrence of these soil types can be determined from the enclosed charts.

The thickness of peat and the near-surface soil types will be important variables in assessing drainage and erosion requirements and buoyancy control. Data on these parameters are also readily available.

The ice contents and quality of granular material can also be reviewed for preliminary borrow source studies.

As the data collection and design processes evolve, other applications will undoubtedly arise for the borehole stratigraphy and moisture content profiles contained in this report.



FLOW CHART

FIGURE 1

APPENDIX A

COMPUTER PROGRAM

```
C
      CALL MASTER
C
      STOP
      END
```

```
      SUBROUTINE MASTER
C
C     THIS ROUTINE COMBINES ALL THE FUNCTIONS OF THE PROGRAM
C
      DIMENSION IPROG(40),LDUMP(40)
      READ(5,2)(IPROG(I),I=1,40)
    2 FORMAT(40I2)
      DO  100  KL=1,16
      II=IPROG(KL)
      IF(II.EQ.0) GO TO 500
      GO TO (10,20,30,40,50,60,70),II
   10 CALL READWR
      GO  TO  100
   20 CALL RETAPE
      GO  TO  100
   30 CALL SORTER(KL)
      GO  TO  100
   40 CALL STATIS
      GO  TO  100
   50 CALL CHARTS
      GO  TO  100
   60 CALL THARSE
      GO  TO  100
   70 IF(KL.EQ.1) READ(5,2)(LDUMP(I),I=1,40)
      II=LDUMP(KL)
      CALL DUMPFL(II)
  100 CONTINUE
  500 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE READWR
      INTEGER DEPTH(3,6),OTHER (3,4),WCONT(3,8),ICE(3,8),III(9),
     *BULKD(3,8)
      INTEGER*2 JJJ(5),TITLE(3,4,5),CLASS(3,8)
      INTEGER*2 IGO
      DATA IGO/'00'/
      DATA III/0,2,4,7,10,15,20,30,40/
      READ(5,1) IREAD
    1 FORMAT(16I5)
      IJK=0
      DO 2  I1=1,10000
      DO 200  I2=1,2
      DO 301  K=1,3
      CLASS(K,8)=UN
      WCONT(K,8)=0
      ICE(K,8)=0
      BULKD(K,8)=0
  301 CONTINUE
      IF(IJK.EQ.1) GO TO 210
      DO 3  K=1,3
      IF(IREAD.NE.5) GO TO 215
      READ(5,30)((TITLE(K,I,J),J=1,5),I=1,4),(DEPTH(K,I),I=1,6),
     *(OTHER(K,I),I=1,4)
   30 FORMAT(20A2,6I5,5I2)
      READ(5,31)(JJJ(I),I=1,5),(CLASS(K,I),I=1,7),(WCONT(K,I),I=1,7),
     *(ICE(K,I),I=1,7),(BULKD(K,I),I=1,7)
   31 FORMAT(5A2,7A2,7I3,7I2,7I3)
      GO  TO  3
  215 CONTINUE
      READ(IREAD,201,END=205)IREC,((TITLE(K,I,J),J=1,5),I=1,4),(DEPTH(
     *K,I),I=1,6),(OTHER(K,I),I=1,4),(CLASS(K,I),I=1,7),(WCONT(K,I),
     *I=1,7),(ICE(K,I),I=1,7),(BULKD(K,I),I=1,7),CLASS(K,8),WCONT(K,8),
     *ICE(K,8),BULKD(K,8)
  201 FORMAT(I2,20A2,6I5,5I2,7A2,7I3,7I2,7I3,1A2,1I3,1I2,1I3)
    3 CONTINUE
  205 IJK=1
      IF(I2.EQ.2)PRINT 35
   35 FORMAT(///////)
      PRINT 21
   21 FORMAT(3( 5X,'BOREHOLE DATA SUMMARY SHEET',12X)/,
     *3( 5X,       '****************************',12X))
      PRINT 22,(((TITLE(K,I,J),J=1,5),I=1,3,2),K=1,3)
      PRINT 23,(((TITLE(K,I,J),J=1,5),I=2,4,2),K=1,3)
   22 FORMAT(3(5X,'BOREH:',5A2,1X,'PHYS.R:',5A2,5X))
   23 FORMAT(3(5X,'MAP S:',5A2,1X,'TER.TY:',5A2,5X))
      PRINT 24
   24 FORMAT(//)
      PRINT 25,((DEPTH(K,I),OTHER(K,I),K=1,3),I=1,3)
```

```
      25   FORMAT(3(5X,'DEPTH HOLE:',I4,5X,'COBBLES:',I3, 7X)/3(5X,'DEPTH PEA
     *T:',I4,5X,'LIMITS :',I3, 7X)/3(5X,'DEPTH BEDR:',I4,5X,'GR.SIZE:',
     *I3,7X))
           PRINT 251,((DEPTH(K,I),K=1,3),I=4,5)
           PRINT 252,(DEPTH(K,6),OTHER(K,4),K=1,3)
      251   FORMAT(3(5X,'DEPTH PERF:',I4,5X,'STRENGTH',10X)/3(5X,'DEPTH THAW:
     *',I4,5X,'OR BLOW ',10X))
      252  FORMAT(3(5X,'DEPTH TILL:',I4,5X,'COUNTS :',I3,7X)//)
           PRINT 26
      26   FORMAT(3(3X,'DEPTH',1X,'UNIFIED',3X,'WATER',3X,'VISIBLE',3X,'BULK'
     *,3X)/3(9X,'CLASSIF',2X,'CONTENT',4X,'OR',5X,'DENSITY',1X)/3(27X,
     *'PURE IC',10X))
           PRINT 28
      28   FORMAT(3(3X,'****************************************',2X))
           PRINT 29,((III(I),III(I+1), CLASS(K,I),WCONT(K,I),ICE(K,I),BULKD(
     *K,I),K=1,3) ,I=1,8)
      29   FORMAT(3(3X,I2,'-',I2,4X,A2,7X,I3,5X,I3,6X,I3,3X))
      200  CONTINUE
      2    CONTINUE
      210  CONTINUE
           RETURN
           END
```

```
      SUBROUTINE SORTER(MM)
C
C     THIS IS A MAIN ROUTINE FOR SORTING PROCEDURE
C     SORTING HERE IS PERFORMED ACCORDING TERRAIN TYPES
C
      COMMON/FIRST/ IFILE,IFILE0,NTYPES,IGO
      INTEGER*2 JCOUNT(23),RECORD(81)
      DO  11  I=1,23
 11   JCOUNT(I)=0
      READ(5,1) IFILE,IFILE0,IFREST
      PRINT 25,IFILE,IFREST
 25    FORMAT(//,T10,'I AM GOING TO SORT FILE =',I3,/'RECORDS WHICH DO N
     *ON FIT ARE STORED ON FILE =',I3//)
 1    FORMAT(16I5)
      CALL SORT2(JCOUNT,IFREST,MM)
      PRINT 21,IFREST,JCOUNT(23)
 21   FORMAT(//,T10,'THIS IS THE FILE CONTAINNING REST OF THE BOREHOLES
     *- FILE NUMBER =',I5/T50,'NUMBER OF RECORDS =',I5/T10,'**********
     **********************************************************'/)
      REWIND IFREST
      PRINT 23
 23   FORMAT(2X,'RECORD',13X,'ORIG.REC.',10X,'RECORD - BOREHOLE DATA'/
     *2X,'**************************************************************
     ***************************'/)
      DO 100  KL=1,10000
      READ(IFREST,END=200)(RECORD(J),J=1,81)
 22   FORMAT(2X,I4,15X,I4,15X,40A2/40X,40A2)
      PRINT 22,KL,(RECORD(J),J=1,81)
100   CONTINUE
200   CONTINUE
      RETURN
      END
```

```
      SUBROUTINE SORT2(JCOUNT,IFREST,MM)
C
C     THIS SUBROUTINE IS A SORTER OF BOREHOLE DATA BANK
C     THE FUNCTION IS TO SORT BOREHOLES ACCORDING TO TERRAIN TYPES AND
C     PLACE THEM IN NEW SEPARATE FILES
C
      COMMON/FIRST/ IFILE,IFILE0,NTYPES,IGO
      INTEGER*2 NEWTYP(22,5),ITEMP(8,5),IT,FILSPC(22)
      INTEGER*2 RECORD(81),TYPE(75,5),NTYP(22),JCOUNT(23)
      DIMENSION NUMFIL(22)
      DATA NTYP/2,6,3,1,1,1,1,1,4,2,1,6,4,4,6,1,5,3,2,5,8,8/
      DATA IT/'  '/
      IF(MM.GT.1) GO TO 7
C
C     THESE ARE NAMES OF THE NEW FILES
C
      READ(5,2)((NEWTYP(I,J),J=1,5),I=1,22)
C
C     THESE ARE TERRAIN TYPES FOUND IN THE DATA BANK
C     THESE TYPES ARE SEQUANTIALY GROUPED
C
      READ(5,2)((TYPE(I,J),J=1,5),I=1,75)
C
C     THIS ARRAY SPECIFIES NUMBER OF TERRAIN TYPES IN EACH GROUP
C
      READ(5,71)(NUMFIL(I),I=1,22)
 71   FORMAT(1615)
      PRINT 51
 51   FORMAT(/,T10,'FILE NAMES AS NEW GROUPED TERRAIN TYPES'/T10,'******
     **********************************************************'/)
      PRINT 52,(I,(NEWTYP(I,J),J=1,5),I=1,22)
 52   FORMAT(6(2X,I3,3X,5A2,2X))
      PRINT 53
 53   FORMAT(/,T10,'OLD TERRAIN TYPES AS RECORDED'/T10,'****************
     **********************************************************'/)
      K1=0
      DO  57  I=1,22
      FILSPC(I)=0
      DO 58  L=1,8
      DO  58  L1=1,5
 58   ITEMP(L,L1)=IT
      JJ=NTYP(I)
      DO  59   L=1,JJ
      DO 59  L1=1,5
 59   ITEMP(L,L1)=TYPE(K1+L,L1)
      PRINT 54, I,((ITEMP(K,L),L=1,5),K=1,8),(NEWTYP(I,L),L=1,5)
 54   FORMAT(2X,I3,5X,8(5A2),5X,'=',5X,5A2)
      K1=K1+JJ
```

```
      57    CONTINUE
            PRINT 61
      61    FORMAT(/,T10,'FILE NUMBERS ASSOCIATED WITH TERRAIN TYPE'/,T10,
           *'*************************************************************'/)
            PRINT 62,(I,(NEWTYP(I,J),J=1,5),NUMFIL(I),I=1,22)
      62    FORMAT(4(2X,'NO=',I3,2X,5A2,'=',I3,6X))
      2     FORMAT(8(5A2))
            READ(5,71)(FILSPC(I),I=1,22)
            PRINT 72
      72    FORMAT(/,T10,'THESE FILES HAVE BEEN SPECIFIED FOR THIS RUN'/T10,'
           *-----------------------------------------------------'/)
            DO  73  I=1,22
            IFL=FILSPC(I)
            IF(IFL.EQ.0) GO TO 74
            REWIND IFL
            IFL1=IFL-IFILE0
            PRINT 75,I,IFL,(NEWTYP (IFL1,L),L=1,5)
      75    FORMAT(T50,I5,5X,'FILE NO.=',I5,5X,'FILE NAME=',5A2)
      73    CONTINUE
      74    CONTINUE
      7     CONTINUE
            DO  11  I=1,23
      11    JCOUNT(I)=0
            REWIND IFILE
            PRINT 300
      300   FORMAT(T10,'RECORD',4X,'REC.NO.',4X,'BOREHOLE I.D.',8X,'TERRAIN TY
           *PE',8X,'FILE NUMBER'/T10,'-------------------------------------
           *-----------------------------------------------'/)
C
C     THIS IS THE MAIN SORTING DO-LOOP
C
            DO  100  KL=1,100000
            READ(IFILE,END=121)(RECORD(I),I=1,81)
            NREC=KL
            JJ=0
            DO  101  II=1,22
            NN=NTYP(II)
            DO  102  LL=1,NN
            JJ=JJ+1
            DO  103  I=1,5
            IF(RECORD(16+I).NE.TYPE(JJ,I)) GO TO 102
      103   CONTINUE
            GO TO 105
      102   CONTINUE
            GO  TO  101
      105   IF=NUMFIL(II)
            DO  106  I=1,22
            IFL=FILSPC(I)
```

```
      IF(IFL.EQ.0) GO TO 110
      IF(IF.NE.IFL) GO TO 106
      GO TO 107
  106 CONTINUE
      GO TO 110
  107 CONTINUE
      WRITE(IF)(RECORD(I),I=1,81)
      JCOUNT(I1)=JCOUNT(I1)+1
      GO  TO  100
  101 CONTINUE
  110 CONTINUE
      IF(IFREST.EQ.0) GO TO 100
      WRITE(IFREST)(RECORD(I),I=1,81)
      JCOUNT(23)=JCOUNT(23)+1
  100 CONTINUE
  121 CONTINUE
C
C     READ AND PRINT JUST CREATED NEW FILES
C
      DO  200  LL=1,22
      NT=JCOUNT(LL)
      IF(NT.EQ.0) GO TO 200
      KL=NUMFIL(LL)
      KL1=LL
      REWIND KL
      PRINT 21,KL,NT,(NEWTYP(KL1,J),J=1,5)
   21 FORMAT(T10,'RECORDS WRITTEN ON FILE =',I4,2X'NUMBER OF RECORDS =',
     *I4,2X,'TERRAIN TYPE =',2X,5A2/T10,'********************************
     **********************************************************'/)
      PRINT 22
   22 FORMAT(2X,'RECORD',12X,'ORIG.REC.',12X,'RECORD - BODEHOLE DATA'/)
      DO  201  J=1,NT
      READ(KL,END=200)(RECORD(I),I=1,81)
      PRINT 205,J,(RECORD(I),I=1,81)
  205 FORMAT(2X,I4,15X,I4,15X,40A2/40X,40A2)
  201 CONTINUE
      PRINT 206
  206 FORMAT(//)
  200 CONTINUE
      ISUM=0
      DO  30  I=1,23
   30 ISUM=ISUM+JCOUNT(I)
      IF(ISUM.NE.NREC) PRINT 31,NREC,ISUM
   31  FORMAT(T10,'*** WARNING *** TOTAL NUMBER OF RECORDS =',I5,2X,'IS
     * NOT EQUAL TO THE SUM OF RECORDS CREATED =',I5/)
      RETURN
      END
```

```
      SUBROUTINE STATIS
C
C     THIS IS THE MAIN ROUTINE FOR STATISTICAL ANALYSIS
C
      COMMON/SECOND/ KCOUNT,NSOURC,IWC,ICEC,IBULKC,NTYPES,IREAD,IGO
      INTEGER*2 IGO,IADD(5),ISOURC(100),TYPE(50,5),JCOUNT(50)
      INTEGER*2 IREFER(100,2),NDEPTH(5)
      INTEGER DEPTH(6),OTHER(4),WCONT(8),BULKD(8)
      INTEGER*2  JJJ(5),TITLE(4,5),CLASS(8),ICE(8),ICE2(8)
      INTEGER*2 IG01
      DATA  IG01/'00'/
      DO  11  I=1,5
      IADD(I)=0
 11   NDEPTH(I)=0
      DO  12  I=1,100
      ISOURC(I)=0
      DO  12  L=1,2
 12   IREFER(I,L)=0
      DO  13  I=1,50
      JCOUNT(I)=0
      DO  13  L=1,5
 13   TYPE(I,L)=IG01
      READ(5,1) IREAD
 1    FORMAT(1615)
      IGO=IG01
      NTYPES=0
      KCOUNT=0
      NSOURC=0
      IWC=0
      ICEC=0
      IBULKC=0
      DO  100  I=1,10000
C
C     READ THE RECORD FROM CARDS OR FROM A DISK FILE
C
      CALL       READ(DEPTH,OTHER,WCONT,ICE,BULKD,JJJ,TITLE,CLASS,ICE2)
      IF(I.EQ.1) PRINT 21,(TITLE(3,J),J=1,5)
 21   FORMAT('1',///,T20,'##################################################
     *##################################################'//,T20,'STATISTICAL RE
     *SULTS FOR PHYSIOGRAPHIC REGION =  ',5A2///,T20,'##################
     *##################################################'///)
      IF(IGO.EQ.21) GO  TO  500
C
C     INCLUDE THIS RECORD IN THE STATISTICAL ARRAY
C
      CALL       STATS(DEPTH,OTHER,WCONT,ICE,BULKD,IREFER,NDEPTH,
     *IADD,ISOURC,TITLE,TYPE,JCOUNT,ICE2)
 100  CONTINUE
```

```
      SUBROUTINE SHOW(IADD,ISOURC,IREFER,NDEPTH,TYPE,JCOUNT)
C
C     THIS ROUTINE PRINT THE RESULTS OF THE STATISTICAL ANALYSIS PERFORMED
C     ON THE DATA BANK OR ITS PART
C
      COMMON/SECOND/ KCOUNT,NSOURC,IWC,ICEC,IBULKC,NTYPES,IREAD,IGO
      INTEGER*2 IGO,TYPE(50,5),JCOUNT(50)
      REAL PERC(100)
      INTEGER*2 IADD(5),ISOURC(100),IREFER(100,2),NDEPTH(5),IZ(6)
      DATA IZ/0,10,20,30,40,999/
      PRINT 50,KCOUNT
   50 FORMAT(//T10,'TOTAL NUMBER OF BORE HOLES =',I5/T10,'**************
     ************************************************************'//)
      PRINT 10
   10 FORMAT(T10,'NUMBER OF HOLES WITH DEPTH IN SPECIFIED LIMITS'/T10,
     *'************************************************************'//)
      ZZ=KCOUNT
      DO  12  I=1,5
   12 PERC(I)=NDEPTH(I)*100/ZZ
      PRINT 11,(IZ(I),IZ(I+1),NDEPTH(I),PERC(I),I=1,5)
   11 FORMAT(T10,I5,1X,'-',I3,5X,I5,5X,'%=',F6.2//)
      DO  22  I=1,5
   22 PERC(I)=IADD(I)*100/ZZ
      PRINT 20
   20 FORMAT(T10,'NUMBER OF HOLES WITH SPECIFIED  " OTHERS "  INFORMATIO
     *N'/T10,'************************************************************'/)
      PRINT 21,(IADD(I),PERC(I),I=1,5)
   21 FORMAT(T10,'COBBLES=',I5,5X,'%=',F6.2/T10,'LIMITS=',I5,5X,'%=',
     *F6.2/T10,'GRAIN SIZE=',I5,5X,'%=',F6.2/T10,'STRENGTH OR BLOW COUNT
     *S=',I5,5X,'%=',F6.2/T10,'NO INFORMATION=',I5,5X,'%=',F6.2//)
      DO  32  I=1,NSOURC
   32 PERC(I)=ISOURC(I)*100/ZZ
      PRINT 30
   30 FORMAT(T10,'SOURCE OF INFORMATION - REFERENCES'/T10,'************
     ************************************************'/)
      PRINT 31,(I,(IREFER(I,L),L=1,2),ISOURC(I),PERC(I),I=1,NSOURC)
   31 FORMAT(T10,I5,5X,'REFERENCE =',2X,2A2,5X,'NUMBER OF HOLES =',I5,
     *5X,'%=',F6.2//)
      P1=IWC*100/ZZ
      P2=ICEC*100/ZZ
      P3=IBULKC*100/ZZ
      PRINT 40
   40 FORMAT(T10,'QUALITY OF DATA BANK'/T10,'**************************
     ***************'/)
      PRINT 41,IWC,P1,ICEC,P2,IBULKC,P3
   41 FORMAT(T10,'NUMBER OF HOLES WITH KNOWN WATER CONTENT IN DEPTH GREA
     *TER THEN 10 FEET =',I5,5X,'%=',F6.2/T10,'NUMBER OF HOLES WITH KNOW
     *N ICE CONTENT IN DEPTH GREATER THEN 10 FEET =',I5,5X,'%=',F6.2/T10
```

```
  500  CONTINUE
C
C      SHOW RESULTS OF STATISTICAL ANALYSIS
C
       CALL        SHOW(IADD,ISOURC,IREFER,NDEPTH,TYPE,JCOUNT)
       RETURN
       END
```

```
     *,'NUMBER OF HOLES WITH KNOWN BULK DENCITIES IN DEPTH GREATER THEN
     * 10 FEET =',I5,5X,'%=',F6.2//)
      DO  53  I=1,NTYPES
53    PERC(I)=JCOUNT(I)*100/ZZ
      PRINT 51
51    FORMAT(T10,'NUMBER OF HOLES WITH THE SAME TERRAIN TYPE'/T10,'*****
     **********************************************************'//)
      PRINT 52,((TYPE(I,L),L=1,5),JCOUNT(I),PERC(I),I=1,NTYPES)
52    FORMAT(5X,'TERRAIN TYPE =',2X,5A2,5X,'NO=',I5,5X,'%=',F6.2//)
      RETURN
      END
```

```
      SUBROUTINE STATS(DEPTH,OTHER,WCONT,ICE,BULKD,IREFER,NDEPTH,
     C
     C      THIS ROUTINE ANALYSES EACH BOREHOLE DATA RECORD AND INCLUDES THE
     C      INFORMATION IN THE OVERALL STATISTICS
     C
     *IADD,ISOURC,TITLE,TYPE,JCOUNT,ICE2)
      COMMON/SECOND/ KCOUNT,NSOURC,IWC,ICEC,IBULKC,NTYPES,IREAD,IGO
      INTEGER*2 IADD(5),ISOURC(100),TYPE(50,5),JCOUNT(50)
      INTEGER*2 IREFER(100,2),NDEPTH(5)
      INTEGER DEPTH(6),OTHER(4),WCONT(8),BULKD(8)
      INTEGER*2  JJJ(5),TITLE(4,5),CLASS(8)
      INTEGER*2 ICE(8),ICE2(8),NEG,IBL,IGO,IC1,IC2
      DATA IBLANK/'    '/,NEG/'- '/,IBL/'  '/
     C
     C    TOTAL COUNT STATISTICS
     C
      KCOUNT=KCOUNT+1
     C
     C    DEPTH STATISTICS
     C
      Z=DEPTH(1)/10
      IZ=Z
      IF(IZ.EQ.0) GO TO 11
      GO  TO (12,13,14,15),IZ
  12  NDEPTH(2)=NDEPTH(2)+1
      GO TO 16
  13  NDEPTH(3)=NDEPTH(3)+1
      GO TO 16
  14  NDEPTH(4)=NDEPTH(4)+1
      GO TO 16
  15  NDEPTH(5)=NDEPTH(5)+1
      GO TO 16
  11  NDEPTH(1)=NDEPTH(1)+1
  16  CONTINUE
     C
     C    COBBLES, LIMITS, GRAIN SIZE, STRENGTH
     C
      JK=0
      DO  201  I=1,4
      IF (OTHER(I).NE.0) GO  TO 202
      GO  TO  201
  202 IADD(I)=IADD(I)+1
      JK=1
  201 CONTINUE
      IF(JK.EQ.0) IADD(5)=IADD(5)+1
     C
     C    INFORMATION SOURCE
     C
```

```
      IF(NSOURC.EQ.0) GO TO 51
      DO  52  KL=1,NSOURC
      DO 50  I=1,2
      IF(TITLE(1,I).NE.IREFER(KL,I)) GO TO 52
 50   CONTINUE
      ISOURC(KL)=ISOURC(KL)+1
      GO TO 60
 52   CONTINUE
 51   NSOURC=NSOURC+1
      IREFER(NSOURC,1)=TITLE(1,1)
      IREFER(NSOURC,2)=TITLE(1,2)
      ISOURC(NSOURC)=ISOURC(NSOURC)+1
C
 60   CONTINUE
C
C    QUALITY OF THE DATA
C
      I1=0
      I2=0
      I3=0
      DO  2  I=1,8
      IF(NCONT(I).NE.IBLANK) I1=I1+1
      IC1=ICE(I)
      IC2=ICE2(I)
      IF(IC2.EQ.IBL) GO TO 71
      IF(IC1.EQ.NEG) GO TO 71
      I2=I2+1
 71   CONTINUE
      IF(BULKD(I).GT.0) I3=I3+1
 2    CONTINUE
      IF(I1.GT.2) IWC=IWC+1
      IF(I2.GT.2) ICEC=ICEC+1
      IF(I3.GT.2) IBULKC=IBULKC+1
C
C    TERRAIN TYPE
C
      IF(NTYPES.EQ.0) GO TO 5
      DO  3  J=1,NTYPES
      DO  4  L=1,5
      IF(TITLE(4,L).NE.TYPE(J,L)) GO TO 3
 4    CONTINUE
      JCOUNT(J)=JCOUNT(J)+1
      GO TO 6
 3    CONTINUE
 5    CONTINUE
      NTYPES=NTYPES+1
      JCOUNT(NTYPES)=JCOUNT(NTYPES)+1
      DO 7  L=1,5
```

```
      7     TYPE(NTYPES,L)=TITLE(4,L)
      6     CONTINUE
            RETURN
            END
```

```
      SUBROUTINE RETAPE
C
C     THIS IS THE MAIN ROUTINE FOR READING THE BOREHOLE DATA BANK FROM
C     CARDS AND STORING THEM ON THE DISK FILES
C     EACH  "SUMMARY BOREHOLE SHEET"  PUNCHED ON TWO OR THREE CARDS IS
C     STORED ON ONE DISK RECORD WHICH SIZE IS 166 BYTES
C
      COMMON/FIRST/ IFILE,IFILE0,NTYPES,IGO
      INTEGER*2 JCOUNT(50),IGO,IGO1
      DATA IGO1/'00'/
      DO  11  I=1,50
   11 JCOUNT(I)=0
      READ(5,1) IFILE
    1 FORMAT(16I5)
      IJK=0
      IGO=IGO1
      NTYPES=1
      IFILE0=IFILE-1
C
C     THIS IS THE MAIN STORAGE PROCEDURE
C
      CALL STORTP(JCOUNT,IJK)
C
C      THIS SUBROUTINE CHECKS THE FILE BY READING AND PRINTING IT  BACK
C
      CALL CHECK(JCOUNT)
      RETURN
      END
```

```
      SUBROUTINE STORTP(JCOUNT,IJK)
C
C     THIS PROCEDURE READS THE DATA BANK OR ITS PART HOLE BY HOLE FROM
C     TWO OR THREE CARDS PER HOLE AND WRITES THESE INFORMATION ON
C     DISK FILE = IFILE
C
      COMMON/FIRST/IFILE,IFILE0,NTYPES,IGO
      INTEGER*2 ICARD1(40),ICARD2(40),IGO,RECORD(81),JCOUNT(50)
      INTEGER*2 BLANK,ICARD3(20),IC3
      DATA IC3/'33'/
      DATA BLANK/'  '/
      II=IFILE-IFILE0
      DO  15 I=1,81
   15 RECORD(I)=BLANK
      DO 100  KL=1,10000
      KLL=KL
   23 CONTINUE
      READ(5,2)(ICARD1(I),I=1,40)
      IF(ICARD1(1).EQ.IC3) GO TO 21
      GO  TO  22
   21 IJK=1
      GO  TO  23
   22 CONTINUE
      IF(ICARD1(1).EQ.IGO) GO TO 200
      READ(5,2)(ICARD2(I),I=1,40)
    2 FORMAT(40A2)
      RECORD(1)=KL
      DO  3  I=1,40
    3 RECORD(1+1)=ICARD1(I)
      DO  4  I=6,40
    4 RECORD(36+I)=ICARD2(I)
      IF(IJK.EQ.0) GO TO 7
    6 FORMAT(20A2)
      READ(5,6)(ICARD3(I),I=1,20)
      DO  5  I=6,10
    5 RECORD(71+1)=ICARD3(I)
    7 CONTINUE
      WRITE(IFILE)(RECORD(I),I=1,81)
      JCOUNT(II)=JCOUNT(II)+1
  100 CONTINUE
  200 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE CHECK(JCOUNT)
C
C     THIS SUBROUTINE CHECKS THE NEWLY CREATED DISK FILES BY READING
C     AND PRINTING THEM BACK - TWO LINES PER RECORD = EXACT IMAGE OF
C     TWO (THREE) DATA CARDS (EXCLUDING THE BOREHOLE ID ON THE SECOND
C     AND THIRD CARD
C
      COMMON/FIRST/ IFILE,IFILE0,NTYPES,IGO
      INTEGER*2 JCOUNT(50),RECORD(81),IGO
      PRINT 100
  100 FORMAT(//,T10,'TOTAL NUMBER OF BOREHOLES OF DIFFRENT TERRAIN TYPE'
     *//)
      PRINT 101,(J,JCOUNT(J),J=1,50)
  101  FORMAT(12(2X,I2,2X,I4))
      PRINT 105
  105 FORMAT(//,T10,'RECORDS AS CARDS IMMAGE'//)
      DO  3  I=1,NTYPES
      IF=IFILE0+I
      KL=JCOUNT(I)
      REWIND IF
      DO 4  L=1,KL
      READ(IF,END=3)(RECORD(J),J=1,81)
      PRINT 11,(RECORD(J),J=1,81)
   11 FORMAT(5X,I5,5X,40A2/15X,40A2/)
    4 CONTINUE
    3 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE CHARTS
C
C     THIS IS THE MAIN ROUTINE FOR SOIL STRATIGRAPHY AND MOISTURE
C     CONTENT CHARTS
C
      COMMON/SECOND/ KCOUNT,NSOURC,IWC,ICEC,IBULKC,NTYPES,IREAD,IGO
      COMMON/THIRD/ NHOLES,IGOO,TERT(5),REG
      COMMON/FOURTH/WCONTA(8)
      INTEGER WCONTA
      REAL MEANU(8),MEANF(8)
      INTEGER*2 IGOO,MAT(17),JJJ(5),III(10),NAME(5),REG
      INTEGER*2 NDEPTH(9),CLASS(8),MATSTR(8,5),TITLE(4,5)
      INTEGER*2 NMOISU(8),NMOISF(8),IGO,ICE(8),ICE2(8)
      INTEGER DEPTH(6),WCONT(8),OTHER(4),BULKD(8)
      REAL MOISCU(8),MOISCF(8),SIGU(8),SIGF(8)
      INTEGER*2 IGO1,TERT,IGO,IGO2
      DATA MAT/'BR','CH','CI','CL','MH','ML','GC','GM','GP','GW','SC',
     *'SM','SP','SW','OH','OL','PT'/
      DATA JJJ/1,5,4,4,3/,IGO1/'00'/,NAME/'B ','C ','G ','S ','O '/
      DATA III/0,2,4,7,10,15,20,30,40,999/
      DATA IGO2/'MC'/
      DO 1000 KL1=1,1000
      IGO=IGO2
      DO 10  I=1,8
      NDEPTH(I)=0
      NMOISU(I)=0
      NMOISF(I)=0
      MOISCU(I)=0.
      MOISCF(I)=0.
      SIGU(I)=0.
   10 SIGF(I)=0.
      KCOUNT=0
      READ(5,1)IREAD,(TERT(I),I=1,5),IFILMC
    1 FORMAT(I5,5X,5A2,I5)
      IF(IREAD.EQ.0) GO TO 2000
      DO  2  I=1,8
      DO  2  J=1,5
    2 MATSTR(I,J)=0
      IGOO=IGO1
      NHOLES=0
C
C     MAIN DO-LOOP OVER ALL RECORDS IN FILE= IREAD
C
      DO  100  KL=1,10000
C
C     READ A RECORD FROM CARDS OR FROM A DISK FILE
C
      CALL READ(DEPTH,OTHER,WCONT,ICE,BULKD,JJJ,TITLE,CLASS,ICE2)
```

```
      IF(IGO.EQ.21) GO TO 500
      IF(KL.GT.1) GO TO 101
      REG=TITLE(3,1)
      PRINT 20
   20 FORMAT('1',///,T10,'$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
     *$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
     *$$'//)
      PRINT 25,IREAD,REG,(TERT(I),I=1,5)
   25 FORMAT(T20,'I AM GOING TO PROCESS FILE # =',I5/T20,'PHYSIOGRAPHIC
     *REGION =',2X,A2/T20,'TERRAIN TYPE =',2X,5A2//)
      PRINT 21
   21 FORMAT(T10,'SOIL TYPES CATEGORIES'/T10,'**************************
     ******************************'/)
      PRINT 22,(I,MAT(I),I=1,17)
   22 FORMAT(10(2X,I2,2X,A2,4X))
      PRINT 23
   23 FORMAT(/////,T10,'$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
     *$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$'/)
  101 CONTINUE
      NHOLES=NHOLES+1
      Z=DEPTH(1)
C
C     INCLUDE THIS RECORD (KL)  INTO THE SOIL STARTIGRAPHY CHART
C
      CALL       STRATG(MAT,JJJ,III,NAME,TITLE,NDEPTH,MATSTR,Z,CLASS)
C
C     INCLUDE THIS RECORD (KL)  INTO THE MOISTURE CONTENT CHART
C
      CALL       MOISTC(WCONT,Z,NMOISU,NMOISF,DEPTH,III,MOISCU,MOISCF,
     *SIGU,SIGF,NDEPTH,TITLE)
  100 CONTINUE
  500 CONTINUE
      CALL       ECHO1(MOISCU,MOISCF,SIGU,SIGF,NMOISU,NMOISF,MATSTR,
     *NDEPTH,III,MEANU,MEANF)
      CALL FILMC(MEANU,MEANF,REG,TERT,IFILMC,1)
 1000 CONTINUE
 2000 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE STRATG(MAT,JJJ,III,NAME,TITLE,NDEPTH,MATSTR,Z,CLASS)
C
C     THIS IS THE SOIL STRATIGRAPHY CHART ROUTINE
C
      COMMON/THIRD/ NHOLES,IGOO,TERT(5),REG
      INTEGER*2 TERT,IGOO,REG
      INTEGER*2 III(10),NDEPTH(9),MAT(17),JJJ(5),CLASS(8),CL1,MATSTR(8,
     *5),TITLE(4,5)
      INTEGER*2 BLANK,CL2
      DATA BLANK/'  '/
      DO  2  I=1,9
      Z1=III(I)
      IF(Z1.GE.Z) GO TO 3
      NDEPTH(I)=NDEPTH(I)+1
    2 CONTINUE
    3 CONTINUE
      DO  20  I=1,8
      IL=I
      CL1=CLASS(I)
      IF(CL1.EQ.BLANK) GO TO 31
      LL=0
      DO  21  J=1,5
      J1=JJJ(J)
      DO  22  JJ=1,J1
      LL=LL+1
      CL2=MAT(LL)
      IF(CL1.EQ.CL2) GO TO 25
   22 CONTINUE
   21  CONTINUE
      PRINT 27,(TITLE(1,L),L=1,5),III(I),III(I+1),CL1
   27 FORMAT(2X,'*** ERROR  *** HOLE =',5A2,5X,'DEPTH=',I2,'-',I2,
     *5X,'MATERIAL =',2X,A2,2X,'COULD NOT BE CATEGORIZED')
      GO TO 20
   25  MATSTR(IL,J)=MATSTR(IL,J)+1
   20 CONTINUE
   31 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE MOISTC(WCONT,Z,NMOISU,NMOISF,DEPTH,III,MOISCU,MOISCF,
     C
     C     THIS IS THE MOISTURE CONTENT CHART ROUTINE
     C
     *SIGU,SIGF,NDEPTH,TITLE)
      COMMON/THIRD/ NHOLES,IGOO,TERT(5),REG
      COMMON/FOURTH/WCONTA(8)
      INTEGER*2 TITLE(4,5)
      INTEGER WCONTA,BLANK
      REAL MOISCU(8),MOISCF(8),SIGU(8),SIGF(8)
      INTEGER*2 NMOISU(8),NMOISF(8),TERT
      INTEGER*2 NDEPTH(9),III(10)
      INTEGER WCONT(8),DEPTH(8)
      INTEGER*2 REG
      DATA BLANK/'    '/
      IZ=DEPTH(4)
      IT=DEPTH(5)
      IF(IT.GT.IZ) GO TO 106
      IF(IZ.EQ.100.AND.IT.EQ.0) GO TO 21
      IF(IZ.EQ.100.AND.IT.EQ.100) GO TO 20
      IF(IZ.EQ.  0.AND.IT.EQ.100) GO TO 20
      GO TO 22
   20 CONTINUE
      DO  2  I=1,8
       W=WCONT(I)
      W1=W/100.
      IF(W.LT.0.) GO TO 2
      IF(WCONTA(I).EQ.BLANK) GO TO 2
      NMOISU(I)=NMOISU(I)+1
      MOISCU(I)=MOISCU(I)+W
      SIGU(I)=SIGU(I)+W1**2
    2 CONTINUE
      GO TO 105
   21 DO  3  I=1,8
      W=WCONT(I)
      W1=W/100.
      IF(W.LT.0.) GO TO 3
      IF(WCONTA(I).EQ.BLANK) GO TO 3
      NMOISF(I)=NMOISF(I)+1
      MOISCF(I)=MOISCF(I)+W
      SIGF(I)=SIGF(I)+W1**2
    3 CONTINUE
       GO TO 105
   22 DO  10  I=1,8
      KL=I
      IF(IZ.GT.III(I).AND.IZ.LE.III(I+1)) GO TO 11
   10 CONTINUE
   11 CONTINUE
```

```
      DO  4  I=1,8
      W=WCONT(I)
      W1=W/100.
      IF(W.LT.0.) GO TO 4
      IF(WCONTA(I).EQ.BLANK) GO TO 4
      IF(I.GT.KL) GO TO 5
      NMOISF(I)=NMOISF(I)+1
      MOISCF(I)=MOISCF(I)+W
      SIGF(I)=SIGF(I)+W1**2
      GO TO 4
5     NMOISU(I)=NMOISU(I)+1
      MOISCU(I)=MOISCU(I)+W
      SIGU(I)=SIGU(I)+W1**2
4     CONTINUE
      GO TO 105
106   PRINT 201,(TITLE(1,I),I=1,5)
201   FORMAT(//,T10,'***  ERROR ***  THAW DEPTH IS GREATER THEN DEPTH OF
     *PERMAFROST - CHECK HOLE = ',5A2)
105    CONTINUE
      RETURN
      END
```

```
      SUBROUTINE ECHO1(MOISCU,MOISCF,SIGU,SIGF,NMOISU,NMOISF,MATSTR,
     *NDEPTH,III,XMU,XMF)
C
C     THIS IS AN OUTPUT ROUTINE FOR THE SOIL STRATIGRAPHY AND THE
C     MOISTURE CONTENT CHARTS
C
      COMMON/THIRD/ NHOLES,IGOO,TERT(5),REG
      INTEGER*2 NMOISU(8),NMOISF(8),TERT
      INTEGER*2 REG,IGOO
      REAL MOISCU(8),MOISCF(8)
      REAL SIGU(8),SIGF(8),XMU(8),XMF(8),PERCN(5)
      INTEGER*2 MATSTR(8,5),NDEPTH(8),III(10)
      REAL TPERC(8)
      ZN=NHOLES
      DO  7  I=1,8
      XMU(I)=0.
 7    XMF(I)=0.
      DO  2  I=1,8
      NMU=NMOISU(I)
      NMF=NMOISF(I)
      IF(NMU.EQ.0) GO TO 51
      SIGU(I)=SQRT(SIGU(I)*10000./NMU)*1.96
      XMU(I)=MOISCU(I)/NMU
 51   IF(NMF.EQ.0) GO TO 2
      SIGF(I)=SQRT(SIGF(I)*10000./NMF)*1.96
      XMF(I)=MOISCF(I)/NMF
 2    CONTINUE
      PRINT 20,REG,(TERT(L),L=1,5),NHOLES
 20   FORMAT('1',//,T20,'INFORMATION FOR SOIL STRATIGRAPHY CHART AND MOI
     *STURE CONTENT CHART'/T20,'REGION=',2X,A2,2X,'TERRAIN TYPE =',5A2,
     *2X,'NUMBER FO HOLES =',I5/T20,'**********************************
     **********************************************************'/)
      PRINT 21
 21   FORMAT(T10,'BOREHOLE STRATIGRAPHY'/T10,'-------------------------
     *-------------------------'/)
      PRINT 41
 41   FORMAT(/,T10,'DEPTH STATISTICS'//)
      PRINT 23
 23   FORMAT(T10,'NO',3X,'LAYER',5X,'NO.HOLES',10X,'PERC'/)
      DO  3  I=1,8
      PERC=NDEPTH(I)*100./ZN
      PRINT 22,I,III(I),III(I+1),NDEPTH(I),PERC
 22   FORMAT(T10,I2,3X,I2,'-',I2,5X,I5,12X,F6.2)
 3    CONTINUE
      PRINT 42
 42   FORMAT(//,T10,'SOIL STATISTICS'//)
      PRINT 24
 24   FORMAT(T10,'NO',2X,'LAYER',3X,2X,'  B',3X,'PERC',3X,'TOTPER',
```

```
     *2X,'  C',3X,'PERC',3X,'TOTPER',2X,'  G',3X,'PERC',3X,'TOTPER',
     *2X,'  S',3X,'PERC',3X,'TOTPER',2X,'  O',3X,'PERC',3X,'TOTPER'//)
      DO  4  I=1,8
      DO 5  J=1,5
      XDP=NDEPTH(I)
      TPERC(J)=0.
      PERCN(J)=0.
      IF(XDP.EQ.0.) GO TO 5
      PERCN(J)=MATSTR(I,J)*100./XDP
      IF(J.EQ.1) GO TO 71
      TPERC(J)=TPERC(J-1)+PERCN(J)
      GO TO 72
71     CONTINUE
      TPERC(J)=PERCN(J)
72    CONTINUE
5     CONTINUE
      PRINT 25,I,III(I),III(I+1),(MATSTR(I,J),PERCN(J),TPERC(J),J=1,5)
4     CONTINUE
25    FORMAT(T10,I2,2X,I2,'-',I2,3X,5(2X,I3,2X,F6.2,2X,F6.2))
      PRINT 31,REG,(TERT(L),L=1,5),NHOLES
31    FORMAT('1',//,T20,'MOISTURE CONTENT CHART'/T20,'REGION =',2X,
     *A2,2X,'TERRAIN TYPE =',5A2,2X,'NUMBER FO BOREHOLES =',I5/T20,
     *'**************************************************************
     ****************'//)
      PRINT 32
32    FORMAT(/,T10,'UNFROZEN MOISTURE CONTENT'/T10,'--------------------
     *------------------------------------------------------------'/)
      PRINT 34
34    FORMAT(T10,'NO',3X,'LAYER',5X,'MEAN MOISTURE C.',5X,'NUMBER OF HOL
     *ES',5X,'95% CONF. LIM.')
      PRINT 33,(I,III(I),III(I+1),XMU(I),NMOISU(I),SIGU(I),I=1,8)
33    FORMAT(T10,I2,3X,I2,'-',I2,7X,G12.5,4X,I10,10X,G12.5)
      PRINT 35
35    FORMAT(T10,'FROZEN MOISTURE CONTENT'/T10,'-----------------------
     *-------------------------------------------------------'/)
      PRINT 36
36    FORMAT(T10,'NO',3X,'LAYER',5X,'MEAN FROZEN M.C.',5X,'NUMBER OF HOL
     *ES',5X,'95% CONF. LIM.'/)
      PRINT 37,(I,III(I),III(I+1),XMF(I),NMOISF(I),SIGF(I),I=1,8)
37     FORMAT(T10,I2,3X,I2,'-',I2,7X,G12.5,4X,I10,10X,G12.5)
      RETURN
      END
```

```
      SUBROUTINE READ(DEPTH,OTHER,WCONT,ICE,BULKD,JJJ,TITLE,CLASS,ICE2)
C
C     THIS ROUTINE READS FROM UNIT = IREAD
C     IF IREAD=5 THE BOREHOLE DATA ARE READ FROM CARDS
C     IF IREAD .GT. 7  THE DATA ARE READ FROM THE DISK FILE = IREAD
C
      COMMON/FOURTH/WCONTA(8)
      COMMON/SECOND/ KCOUNT,NSOURC,IWC,ICEC,IBULKC,NTYPES,IREAD,IGO
      INTEGER DEPTH(6),OTHER(4),WCONT(8),BULKD(8)
      INTEGER*2  JJJ(5),TITLE(4,5),CLASS(8)
      INTEGER*2 IGO,ICE(8),ICE2(8)
      INTEGER WCONTA,BLANK
      INTEGER*2 IREC,IG1
      DATA IG1/'MC'/,BLANK/'    '/
      CALL  RERD99
      DO 21  I=1,8
 21   WCONTA(I)=BLANK
      CLASS(8)=UN
      WCONT(8)=0
      ICE(8)=0
      BULKD(8)=0
      IF(IREAD.EQ.0) GO TO 301
      IF(IREAD.NE.5) GO TO 221
C
C     READ THE FIRST CARD
C
      READ(5,30)((TITLE(I,J),J=1,5),I=1,4),(DEPTH(I),I=1,6),(OTHER(I),
     *I=1,4)
      IF(TITLE(1,1).EQ.IGO) GO TO 100
 30   FORMAT(20A2,6I5,5I2)
C
C     READ THE SECOND CARD
C
      READ(5,31)(JJJ(I),I=1,5),(CLASS(I),I=1,7),(WCONT(I),I=1,7),
     *(ICE(I),ICE2(I),I=1,7),(BULKD(I),I=1,7)
 31   FORMAT(5A2,7A2,7A3,14A1,7I3)
      GO TO 101
 100  IGO=21
      GO TO 101
 221  CONTINUE
C
C     READ FROM DISK FILE = IREAD
C
      READ(IREAD,225,END=227)     ((TITLE(  I,J),J=1,5),I=1,4),(DEPTH(
     *  I),I=1,6),(OTHER(  I),I=1,4),(CLASS(  I),I=1,7),(WCONT(  I),
     *I=1,7),(ICE(I),ICE2(1),I=1,7),(BULKD(I),I=1,7),CLASS(8),WCONT(6),
     *ICE(8),ICE2(8),BULKD(8)
C
```

```
C     READ THE SAME RECORD AGAIN TO PICK UP BLANKS = NO MOISTURE
C     CONTENT DATA
C
      READ(99,226)(WCONTA(I),I=1,8)
 226  FORMAT(96X,7A3,37X,1A3)
 225  FORMAT(2X,20A2,6I5,4I2,2X,7A2,7I3,14A1,7I3,1A2,1I3,2A1,1I3)
      GO TO 101
 227  CONTINUE
      IGO=21
      PRINT 230,KCOUNT
 230  FORMAT(110,'THIS IS THE END OF FILE *** NUMBER OF RECORDS =',I5/)
 101  CONTINUE
      KCOUNT=KCOUNT+1
      GO TO 302
 301  PRINT 303
 303  FORMAT(///,'******  ERROR  ******* INCORRECTLY DEFINED FILE'//)
      STOP
 302  CONTINUE
      RETURN
      END
```

```
      SUBROUTINE THAWSE
C
C     THIS IS THE MAIN ROUTINE FOR THAW SETLEMENTS
C
      COMMON/SECOND/ KCOUNT,NSOURC,IWC,ICEC,IBULKC,NTYPES,IREAD,IGO
      COMMON/THIRD/ NHOLES,IGOO,TERT(5),REG
      COMMON/FOURTH/WCONTA(8)
      COMMON/FIFTH/SETLHO(1200,4),SEMEAN(4),SEMAX(4),NHPIPE(4),NHGT2(4)
      INTEGER*2 REGION(6),PIPED(4),LAYER(8),LZ(8),IPICK(8)
      INTEGER DEPTH(6),WCONT(8),OTHER(4),BULK(8),WCONTA
      REAL TOTSTL(4)
      REAL MEANU(8),MEANF(8)
      INTEGER*2 MAT(17),IGO,IGO1,IGOO,JJJ(5),III(10),NDEPTH(9),CLASS(8),
     *TITLE(4,5),ICE(8),ICE2(8),JUP(8),JDOWN(8),IK(8),INDEX(8),
     *REG,TERT,REG1,TERT1(5)
      INTEGER*2 LAYTH(8),REG2
      INTEGER*2 IPIPDE(4)
      DATA IPIPDE/0,6,9,12/
      DATA LAYTH/2,2,3,3,5,5,10,10/
      DATA MAT/'BR','CH','CI','CL','MH','ML','GC','GM','GP','GW','SC',
     *'SM','SP','SW','OH','OL','PT'/
      DATA LZ/2,4,7,10,15,20,30,40/,JJJ/1,5,4,4,3/,IGO1/'00'/
      DATA REGION/'0 ','1 ','2 ','3 ','6N','6S'/
      READ(5,1) REG1,IFILMC
 1    FORMAT(A2,3X,I5)
      REWIND IFILMC
      PRINT 21,REG1
 21   FORMAT('1',///T20,'THAW SETTLEMENTS FOR PHYSIOGRAPHIC REGION = ',
     *A2/T20,'##################################################################
     *#################################'///)
      PRINT 22,IFILMC
 22   FORMAT(T20,'MEAN WATER CONTENT WILL BE RETRIEVED FROM FILE = ',
     *I5)
      DO 5  I=1,6
      IL=I
      IF(REG1.EQ.REGION(I)) GO TO 7
 5    CONTINUE
      PRINT 4,REG1
 4    FORMAT(//,'***  ERROR   ***   REGION SPECIFIED AS " ',A2,' "  CAN
     * NOT BE FOUND - PROGRAM STOPS'//)
      STOP
C
C------MAXIMAL THAW DEPTH
C
 7    THDP=36.5
      IF(IL.GE.3) THDP=44.5
C
C     MAIN DO-LOOP OVER ENTIRE REGION FILE - READ SINGLE SUB FILES
```

```
C      AS SORTED ACCORDING TO TERRAIN TYPES
C
       REG2=REG1
       DO 200  II=1,100
       READ(5,2) IREAD,(TERT1(I),I=1,5)
 2     FORMAT(I5,5X,5A2)
       IF(IREAD.EQ.0) GO TO 300
       DO 721  I=1,1200
       DO 721  J=1,4
 721   SETLHO(I,J)=0.
       DO 722  I=1,4
       SEMAX(I)=0.
       NHGT2(I)=0
       SEMEAN(I)=0.
 722   NHPIPE(I)=0
       IGO=IGO1
       IGOO=IGO1
       REWIND IREAD
       READ(IREAD,201)((TITLE(I,J),J=1,5),I=1,4)
 201   FORMAT(2X,20A2)
       PRINT 23,IREAD,(TERT1(I),I=1,5),(TITLE(3,I),I=1,5),REG2
 23    FORMAT(5X,I5,5X,5A2,5X,5A2,5X,A2)
       REWIND IREAD
       CALL FILMC(MEANU,MEANF,REG1,TERT1,IFILMC,2)
       PRINT 120
 120   FORMAT('1',T20,'THAW SETTLEMENTS FOR INDIVIDUAL HOLES FOR DIFFEREN
      *T PIPE DEPTHS'/T20,'----------------------------------------
      *------------------------------------------------------------')
       PRINT 121,(IPIPDE(I),I=1,4)
 121   FORMAT(/,2X,'I.D.',8X,'MAP',9X,'REGION',6X,'TE.TYPE',14X,4(5X,
      *I5,5X)/2X,'**********************************************************
      ************************************************************')
C
C      THIS IS A SECONDARY DO-LOOP OVER A SET OF BORE HOLES  BEING
C      READ ONE BY ONE
C
       KCOUNT=0
       DO 100  KL=1,10000
       CALL        EXAMMC(WCONT,JUP,JDOWN,IK,NAPROX,INDEX,TITLE,BULKD,
      *DEPTH,CLASS)
       IF(IGO.EQ.21) GO TO 150
       CALL        APROX(WCONT,WCONTA,JUP,JDOWN,IK,DEPTH,MEANU,MEANF,
      *NAPROX,INDEX,TITLE,LZ,IPICK)
       CALL        SETLE(WCONT,BULKD,THDP,MAT,LAYTH,LZ,IPICK,CLASS,
      *TITLE,DEPTH,KL,TOTSTL,IPIPDE)
 100   CONTINUE
 150   CONTINUE
       DO  750  I=1,4
```

```
  750  SEMEAN(I)=SEMEAN(I)/NHPIPE(I)
       CALL        STATTH
  200  CONTINUE
  300  CONTINUE
       RETURN
       END
```

```
      SUBROUTINE STATTH
      COMMON/FIFTH/SETLHO(1200,4),SEMEAN(4),SEMAX(4),NHPIPE(4),NHGT2(4)
      INTEGER IPIPE(4)
      DATA IPIPE/0,6,9,12/
      PRINT 105
      PRINT 102
  102 FORMAT(T20,'THAW SETTLEMENT STATISTICS'/T20,'%%%%%%%%%%%%%%%%%%%%
     *%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%'//,
     *5X ,'CASE',6X,'PIPE DEPTH',5X,'NUMBER OF HOLES',5X,'MEAN SETTLEMEN
     *T',5X,'STANDART DEVIATION',4X,'N.HOLES>2',7X,'PERS>2',7X,'SE.MAX'
     */5X ,'----------------------------------------------------------------
     *----------------------------------------------------------------')
      DO 2  I=1,4
      M1=NHPIPE(I)
      XMEAN=SEMEAN(I)
      PERC=NHGT2(I)*100./M1
       SUM=0.
      KUNT=0
      DO 3  J=1,M1
    5 KUNT=KUNT+1
      IF(SETLHO(KUNT,I).GT.-0.1) GO TO 4
      GO TO 5
    4 ZZ=XMEAN-SETLHO(KUNT,I)
    3 SUM=SUM+ZZ*ZZ
      STDEV=SQRT(SUM/M1)
      PRINT 101,I,IPIPE(I),M1,XMEAN,STDEV,NHGT2(I),PERC,SEMAX(I)
  101 FORMAT(5X,I3,7X,I6,9X,I10,10X,G12.5,8X,G12.5,8X,I5,8X,F6.2,8X,
     *F6.2)
    2 CONTINUE
      PRINT 105
  105  FORMAT('1')
      RETURN
      END
```

```
      SUBROUTINE FILMC(MEANU,MEANF,REG,TERT,IFILMC,JUMP)
C
C     THIS ROUTINE READS OR CREATES A DISK FILE CONTAINNNIG FROZEN
C     AND UNFROZEN MOISTURE CONTENT PROFILES
C
      REAL MEANU(8),MEANF(8)
      INTEGER*2 REG,TERT(5),REG1,TERT1(5)
      GO TO (11,12),JUMP
 11   PRINT 21,REG,(TERT(I),I=1,5),IFILMC
 21   FORMAT('1',T10,'I AM GOING TO WRITE FROZEN AND UNFROZEN MOISTURE
     *CONTENT ON A DISK FILE'/T10,'PHYSIOGRAPHIC REGION = ', A2/
     *T10,'TERRAIN TYPE = ',5A2/T10,' FILE NUMBER = ',I3/T10,'**********
     **********************************************************'//)
      WRITE(IFILMC,25) REG,(TERT(I),I=1,5),IFILMC,(MEANU(I),I=1,8),
     *(MEANF(I),I=1,8)
 25   FORMAT(A2,5A2,I3,8F10.2,8F10.2)
      GO TO 300
 12   REWIND IFILMC
 200  READ(IFILMC,25,END=100) REG1,(TERT1(I),I=1,5),IFILM1,
     *(MEANU(I),I=1,8),(MEANF(I),I=1,8)
      PRINT 621,REG,REG1,(TERT(I),I=1,5),(TERT1(I),I=1,5),IFILMC,IFILM1,
     *(MEANU(I),I=1,8),(MEANF(I),I=1,8)
 621  FORMAT(5X,2A2,5X,5A2,5X,5A2,2I5,5X,/T20,8F6.2,5X,8F6.2)
      IF(IFILMC.NE.IFILM1 ) GO TO 200
      DO 205  I=1,5
      IF(TERT(I).NE.TERT1(I)) GO TO 200
 205   CONTINUE
      PRINT 210,REG1,(TERT1(I),I=1,5)
      PRINT 211,(I,MEANU(I),MEANF(I),I=1,8)
 211  FORMAT(T60,I4,10X,F6.2,20X,F6.2)
 210  FORMAT(//,T10,'REGION = ',A2,5X,'TERRAIN TYPE = ',5A2,10X,'LAYER',
     *2X,'UNFROZEN WATER CONTENT',5X,'FROZEN WATER CONTENT'/T60,'-------
     *-----------------------------------------------------')
      GO TO 300
 100  PRINT 105,REG,(TERT(I),I=1,5),IFILM1
 105  FORMAT(//,2X,'***  ERROR  *** MEAN MOISTURE CONTENT FILE FOR REGIO
     *N = ',A2,5X,'TERRAIN TYPE = ',5A2,'NOT FOUND ON FILE =',I5/T20,
     *'CHECK YOUR   DD   CARDS FOR MEAN MOISTURE CONTENT FILE  -   PROGR
     *AM STOPS NOW'///)
 300  CONTINUE
      RETURN
      END
```

```
      SUBROUTINE SETLE(WCONT,BULKD,THDP,MAT,LAYER,LZ,IPICK,CLASS,
     *TITLE,DEPTH,IHN,TOTSTL,PIPED)
C
C     THIS ROUTINE CALCULATES ACTUAL SETLEMENTS DUE TO THAWING
C     LAYERS OF PERMAFROST CAUSED BY INSTALATION OF PIPE LINE
C
      COMMON/FIFTH/SETLHO(1200,4),SEMEAN(4),SEMAX(4),NHPIPE(4),NHGT2(4)
      REAL SEMAX1(4)
      REAL SETL(8),TOTSTL(4)
      INTEGER WCONT(8),BULKD(8),DEPTH(6)
      INTEGER*2 LAYER(8),PIPED(4),MAT(17),TITLE(4,5),LZ(8),IPICK(8),
     *CLASS(8),IPIC
      DO 7  I=1,4
 7    TOTSTL(I)=0.
      IP=DEPTH(4)
      IT=DEPTH(5)
      ZZ=DEPTH(1)
      ZZP=IP
C
C-----DO-LOOP OVER DIFFERENT PIPE BURRIALS  =  " 0 ", 6, 9, 12   FEET
C
      DO 100  KL=1,4
      PIPE=PIPED(KL)
      TOTZ=PIPE+THDP
      IF((ZZ-PIPE).LT.6.) GO TO 150
      DO 5  I=1,8
 5    SETL(I)=0.
C
C-----DO-LOOP OVER DIFFERENT LAYER
C
      DO 105  I=1,8
      IPIC=IPICK(I)
      IF(IPIC.EQ.2) GO TO 105
      H=LAYER(I)
      Z=LZ(I)
      IF(Z.LE.PIPE) GO TO 105
      IF(ZZP.LE.PIPE) GO TO 105
      H2=0.
      Z1=0.
      IF(I.NE.1) Z1=LZ(I-1)
      WC=WCONT(I)
      GAM=BULKD(I)
      DO 106   K=15,17
      IF(CLASS(I).EQ.MAT(K))  GO TO 110
 106   CONTINUE
C
C-----THAW SETLEMENT COEFFICIENT A0 FOR ALL SOILS EXCEPT PEAT
C
```

```
      IF(CLASS(I).EQ.MAT(1)) GO TO 105
      IF(GAM.EQ.0.) GO TO 107
      A0=0.736-1.018*ALOG(GAM/62.4)
      GO TO 115
  107 IF(WC.LE.20.) GO TO 108
      IF(WC.LE.42.) GO TO 109
      A0=0.0041*WC+0.128
      GO TO 115
  108  A0=0.0015*WC
      GO TO 115
  109  A0=0.0125*WC-0.25
      GO TO 115
C
C---- THAW SETLEMENT COEFFICIENT  A0 FOR PEAT AND ORGANIC SOILS
C
  110  A0=0.5
  115 CONTINUE
C
C------ CHECK   A0   LIMITS
C
      IF(A0.LT.0.) A0=0.
      IF(A0.GT.1.)   A0=1.
C
C----CALCULATE THE THICKNESS OF THE FROZEN LAYER
C
      IPIC=IPICK(I)
      GO TO (401,105,403,404,405),IPIC
  401 H=LAYER(I)
      GO TO 450
  403 H=IP-Z1
      GO TO 450
  404 H=Z-IT
      GO TO 450
  405 H=IP-IT
  450 CONTINUE
      XZ=Z
      IF(IP.LT.XZ) XZ=IP
      H1=XZ-PIPE
      IF(H1.LT.H) H=H1
      IF(I.EQ.8) GO TO 201
      GO TO 202
  201 H2=TOTZ-Z
      H=H+H2
  202 CONTINUE
C
C---- SETTLEMENT FOR THE LAYER I
C
      SETL(I)=A0*H
```

```
      TOTSTL(KL)=TOTSTL(KL)+SETL(I)
  105  CONTINUE
      SEMEAN(KL)=SEMEAN(KL)+TOTSTL(KL)
      SETLHO(IHN,KL)=TOTSTL(KL)
      NHPIPE(KL)=NHPIPE(KL)+1
      IF(TOTSTL(KL).GT.2.) NHGT2(KL)=NHGT2(KL)+1
      SEMAX1(KL)=TOTSTL(KL)
      GO TO 100
  150 CONTINUE
      SETLHO(IHN,KL)=-0.11
  100 CONTINUE
      DO 121  I=1,4
      IF(SEMAX1(I).GT.SEMAX(I)) SEMAX(I)=SEMAX1(I)
  121 CONTINUE
      PRINT 21,((TITLE(I,J),J=1,5),I=1,4),(TOTSTL(I),I=1,4)
  21  FORMAT(  2X,4(5A2,2X),10X,4G15.4)
      PRINT 621,DEPTH(1),IP,IT,(WCONT(I),I=1,8)
  621 FORMAT(10X,3I4,5X,8I4)
      RETURN
      END
```

```
      SUBROUTINE EXAMMC(WCONT,JUP,JDOWN,IK,NAPROX,INDEX,TITLE,BULKD,
     *DEPTH,CLASS)
      COMMON/SECOND/ KCOUNT,NSOURC,IWC,ICEC,IBULKC,NTYPES,IREAD,IGO
      COMMON/FOURTH/WCONTA(8)
C
C     THIS ROUTINE DETERMINES WHETER INTERPOLATION, OR THE MEAN VALUES
C     FOR MOISTURE CONTENT WILL BE USED
C
      INTEGER*2 JJJ(5),TITLE(4,5),CLASS(8),IGO,ICE(8),ICE2(8),IK(8),
     *INDEX(8),JUP(8),JDOWN(8),MAT(1)
      INTEGER DEPTH(6),OTHER(4),WCONT(8),BULKD(8),WCONTA,BLANK
      DATA BLANK/'    '/
      DATA MAT/'BR'/
      CALL READ(DEPTH,OTHER,WCONT,ICE,BULKD,JJJ,TITLE,CLASS,ICE2)
      IF(IGO.EQ.21) GO TO 20
      IFLAG=0
      DO 30 I=1,8
      IF(CLASS(I).EQ.MAT(1))IFLAG=1
 30   IF(IFLAG.EQ.1)CLASS(I)=MAT(1)
      II=0
      DO  1  I=1,8
      INDEX(I)=0
      JUP(I)=0
 1    JDOWN(I)=0
C
C-----FIND MISSING VALUES  -  -1 'S  OR BLANKS
C
      DO 2  I=1,8
      W=WCONT(I)
      IK(I)=0
      IF(W.LT.0.) GO TO 3
      IF(WCONTA(I).EQ.BLANK) GO TO 3
      GO TO 2
 3    WCONT(I)=999
      IK(I)=1
      II=II+1
      INDEX(II)=I
 2    CONTINUE
      NAPROX=II
      IF(II.EQ.0) GO TO 20
      DO 4  I=1,II
      JJ=INDEX(I)
      IFLASH=0
      IF(JJ.EQ.0) GO TO 4
C
C -----DETERMINE POINTS TO BE USED FOR INTERPOLATION
C
      DO 5   J=1,JJ
```

```
      J1=JJ-J
      IF(J1.EQ.0) GO TO 6
      IF(IK(J1).EQ.0)   GO TO 7
      GO TO 5
7     JUP(JJ)=J1
      IFLASH=1
      GO TO 6
5     CONTINUE
6     CONTINUE
      IF(IFLASH.EQ.0) GO TO 4
      DO 11  J=JJ,8
      IF(IK(J).EQ.0) GO TO 8
      GO TO 11
8     JDOWN(JJ)=J
      GO TO 4
11    CONTINUE
4     CONTINUE
20    CONTINUE
      RETURN
      END
```

```
      SUBROUTINE APROX(WCONT,WCONTA,JUP,JDOWN,IK,DEPTH,MEANU,MEANF,
     *NAPROX,INDEX,TITLE,LZ,IPICK)
C
C     THIS ROUTINE INTERPOLATES WATER CONTENT BETWEEN TWOO KNOWN VALUES
C     AND INSTEAD OF EXTRAPOLATION USES MEAN VALUES
C
      INTEGER*2 LZ(8)
      INTEGER*2 INDEX(8),TITLE(4,5)
      REAL MEANU(8),MEANF(8)
      INTEGER*2 JUP(8),JDOWN(8),IK(8),IPICK(8)
      INTEGER WCONTA(8),BLANK,WCONT(8),DEPTH(6)
      DATA BLANK/'    '/
      DO 1  I=1,8
 1    IPICK(I)=1
      IP=DEPTH(4)
      IT=DEPTH(5)
C
C-----PROFILE DEFINITION
C
      ICASE=3
      IF(IT.EQ.0.AND.IP.EQ.100) GO TO 5
      IF(IP.EQ.0.OR.IP.EQ.100) GO TO 6
      GO TO 10
 5    ICASE=1
      GO TO 10
 6    IF(IT.EQ.100) ICASE=2
 10   CONTINUE
C
C     INDEX DEFINITION FOR INTERPOLATION OR MEAN VALUES LOCATION
C
C
C-------------------------------------------------------------------------
C
C     IPICK(I)=1   LAYER I IS COMPLETELY FROZEN
C     IPICK(I)=2   LAYER I IS COMPLETELY THAWED
C     IPICK(I)=3   UPPER PART OF THE LAYER I IS FROZEN
C     IPICK(I)=4   LOWER PART OF THE LAYER IS FROZEN
C     IPICK(I)=5   MIDLE PART OF THE LAYER I IS FROZEN
C
C-------------------------------------------------------------------------
C
      GO TO (11,12,13),ICASE
 12   DO 15  I=1,8
 15   IPICK(I)=2
      GO TO 11
 13   Z1=0.
      DO 16  I=1,8
      Z2=LZ(I)
```

```
      IF(I.GT.1) Z1=LZ(I-1)
      IF(IT.GE.Z2) GO TO 305
      IF(IP.LE.Z1) GO TO 305
      IF(IP.GE.Z2.AND.IT.LE.Z1) GO TO 303
      IF(IT.LE.Z1.AND.IP.LT.Z2) GO TO 301
      IF(IP.GE.Z2.AND.IT.GT.Z1) GO TO 302
      IPICK(I)=5
      GO TO 16
  302 IPICK(I)=4
      GO TO 16
  301 IPICK(I)=3
      GO TO 16
  303 IPICK(I)=1
      GO TO 16
  305 IPICK(I)=2
   16 CONTINUE
   11 CONTINUE
C
C-----INTERPOLATION
C
      DO 20  II=1,NAPROX
      I=INDEX(II)
      IL=I
      JP1=JUP(I)
      IF(JP1.EQ.0) GO TO 20
      JD1=JDOWN(I)
      IF(JD1.EQ.0) GO TO 20
      Z1=LZ(JP1)
      Z2=LZ(JD1)
      W1=WCONT(JP1)
      W2=WCONT(JD1)
      XK=(W2-W1)/(Z2-Z1)
      IF(WCONT(IL).NE.999) GO TO 100
      WCONT(IL)=XK*(LZ(IL)-Z1)+W1
      GO TO 20
  100 PRINT 121,(TITLE(1,L),L=1,5),IL,JP1,JD1,W1,W2
  121 FORMAT(2X,'*** ERROR IN INTERPOLATION *** HOLE = ',5A2,5X,
     *'LAYER = ',I3,2X,'POINT UP= ',I3,2X,'POINT DOWN = ',I3,'M.C. = ',
     *2G12.5)
   20 CONTINUE
C
C-----OUTSIDE POINT - MEAN WATER CONTENT EMPLOYED
C
      Z1=0.
      DO 25  I=1,8
      IF(WCONT(I).NE.999) GO TO 25
      IJK=IPICK(I)
      Z2=LZ(I)
```

```
      IF(I.GT.1) Z1=LZ(I-1)
      GO TO (21,22,21,21,21),IJK
   21 WCONT(I)=MEANF(I)
      GO TO 25
   22 WCONT(I)=MEANU(I)
   25 CONTINUE
      RETURN
      END
```

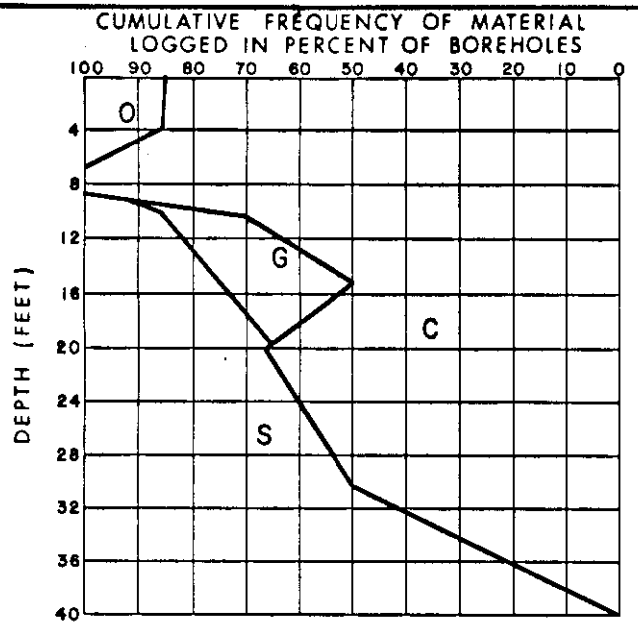
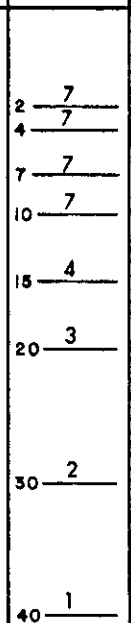
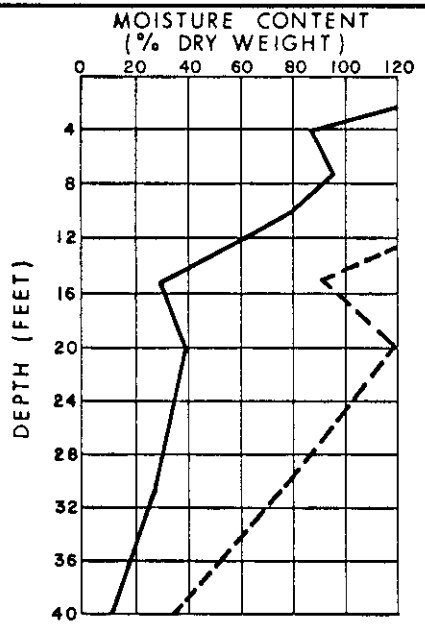
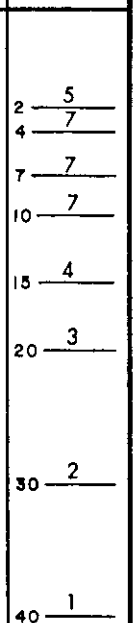
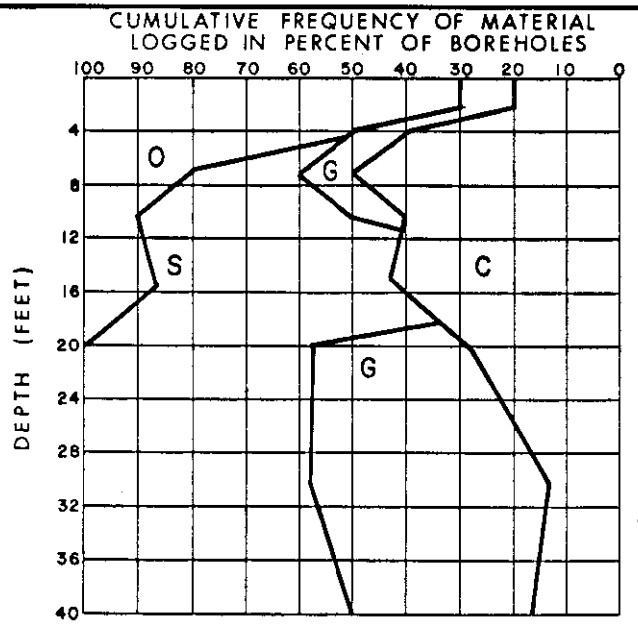
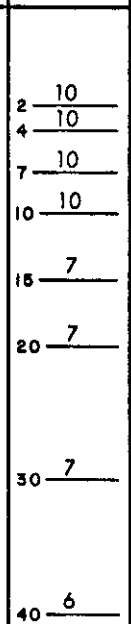
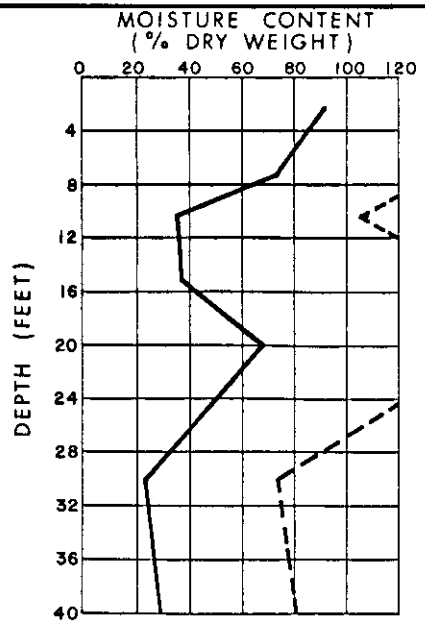
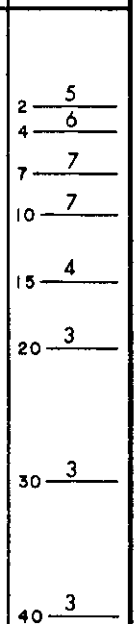
APPENDIX B

BOREHOLE STRATIGRAPHY

AND

MOISTURE CONTENT CHARTS

REGION O

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Ap	ALLUVIAL FLOODPLAIN SILT ON SAND AND GRAVEL				
Go	GLACIAL OUTWASH PLAIN SAND AND GRAVEL SOME OVERLAIN BY LACUSTINE AND ORGANIC				

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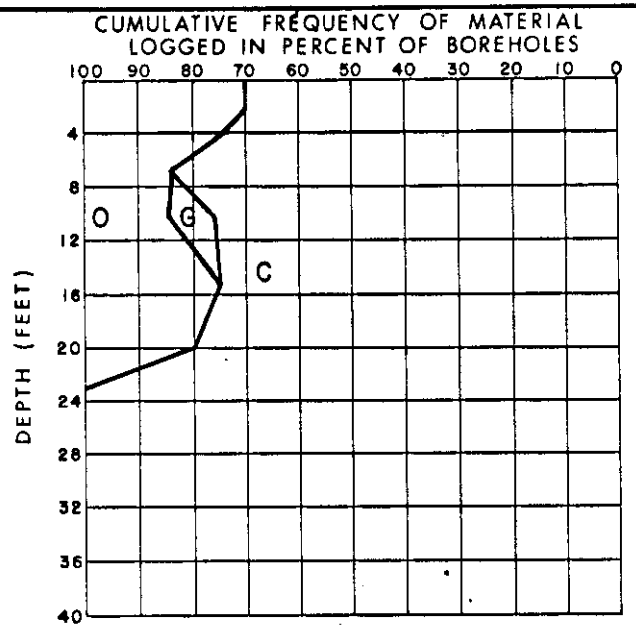
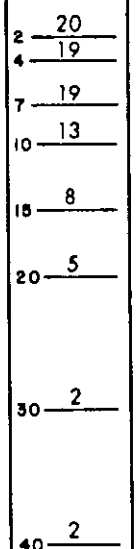
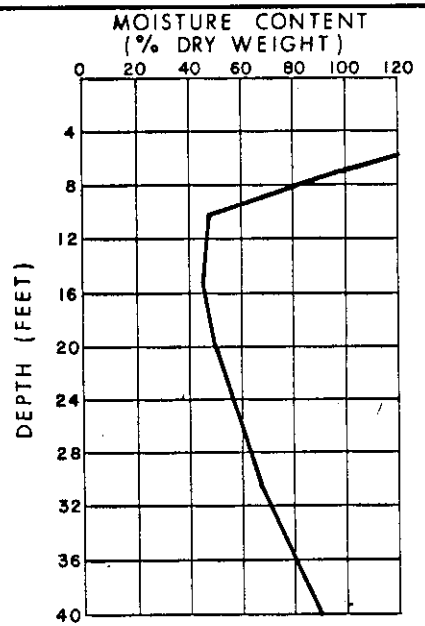
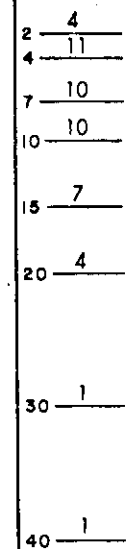
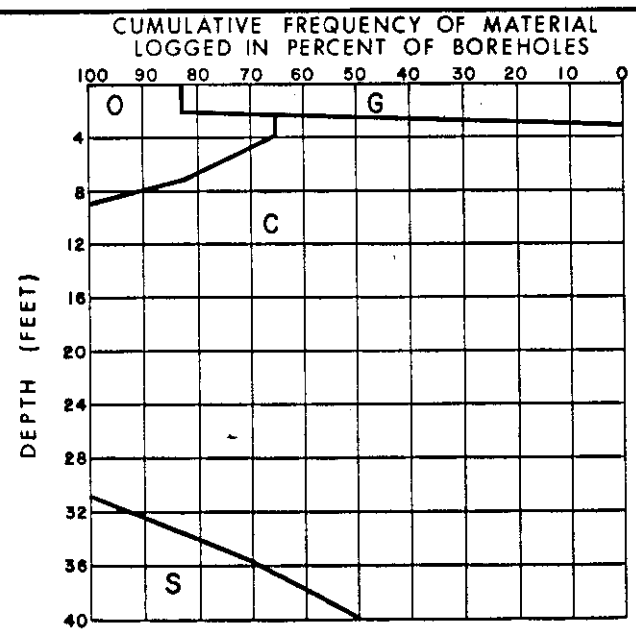
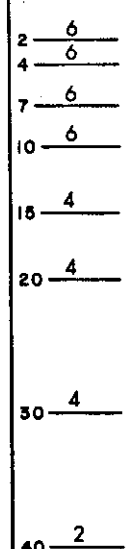
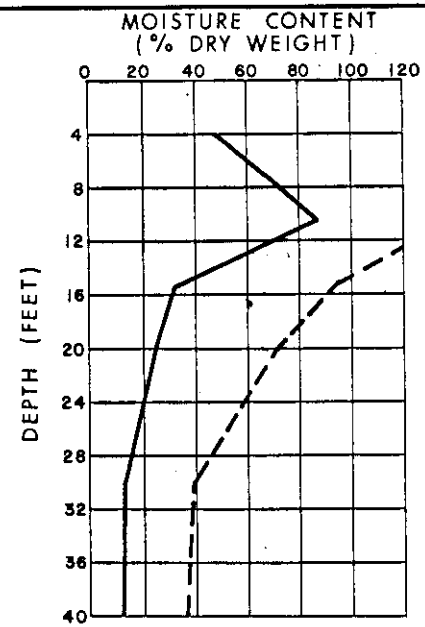
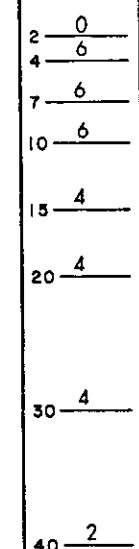
REGION O

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Mh	HUMMOCKY MORAINE SILTY CLAY				
Ou / Lp	ORGANIC OVER LACUSTRINE BASIN ORGANICS OVER SILT				

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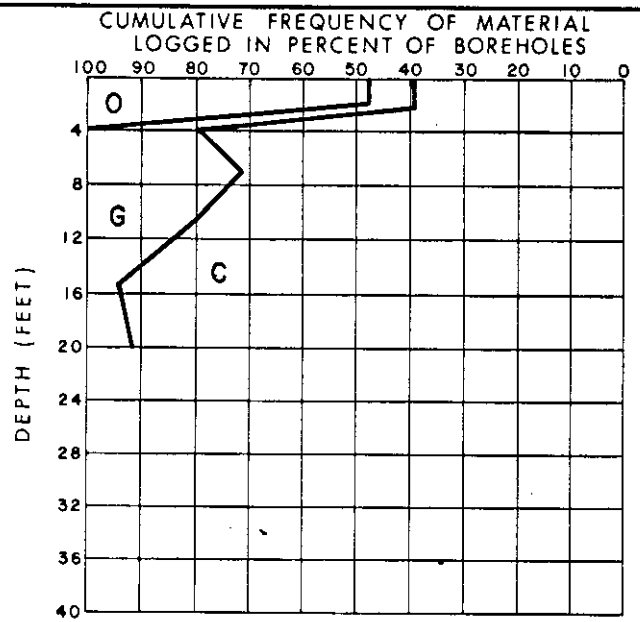
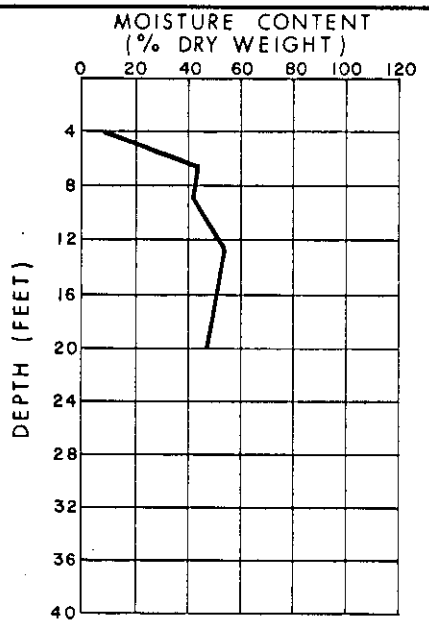
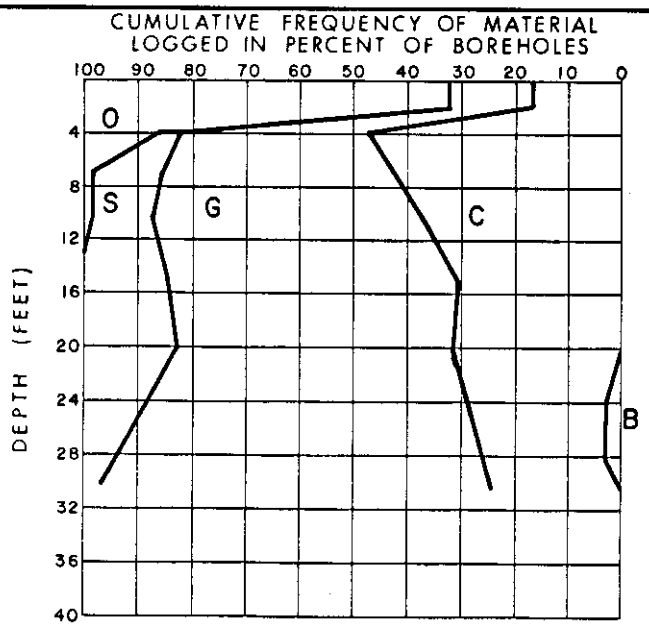
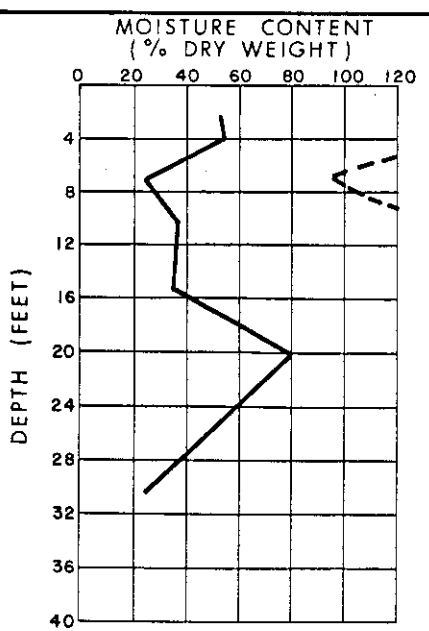
REGION 1

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Af	ALLUVIAL FAN SILT AND CLAY		2 14 4 14 7 14 10 14 15 13 20 12 30 0 40 0		2 0 4 1 7 13 10 13 15 12 20 11 30 0 40 0
Go	GLACIAL OUTWASH GRAVEL WITH SAND LENSES		2 59 4 59 7 59 10 58 15 58 20 43 30 31 40 1		2 5 4 59 7 59 10 58 15 55 20 41 30 30 40 0

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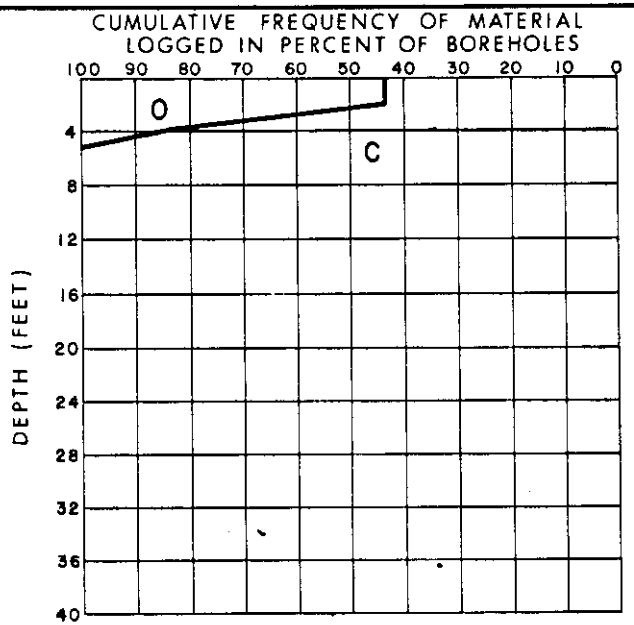
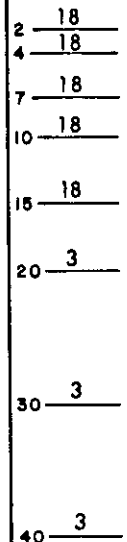
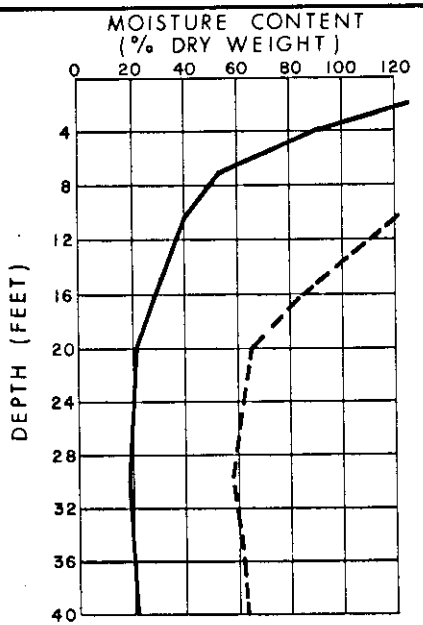
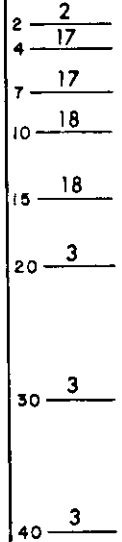
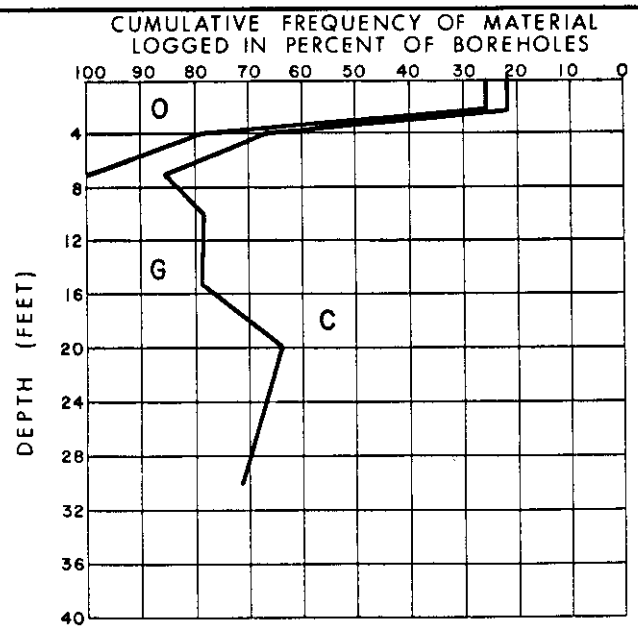
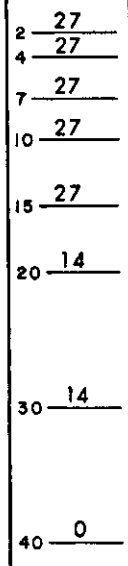
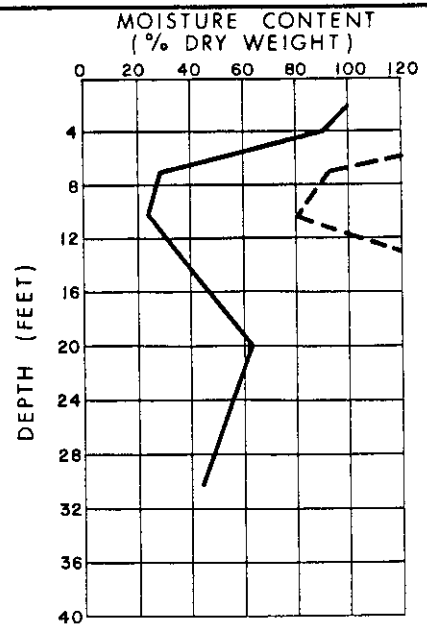
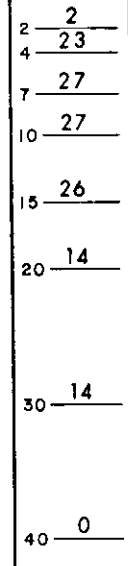
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Lp	LACUSTRINE BASIN SILTY CLAY				
Me	END MORAINE PREDOMINANTLY CLAY WITH INCLUSIONS UP TO BOULDER SIZE				

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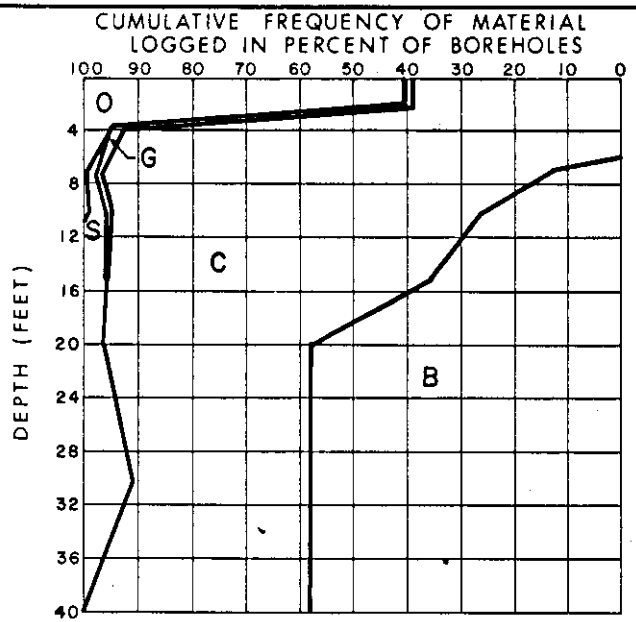
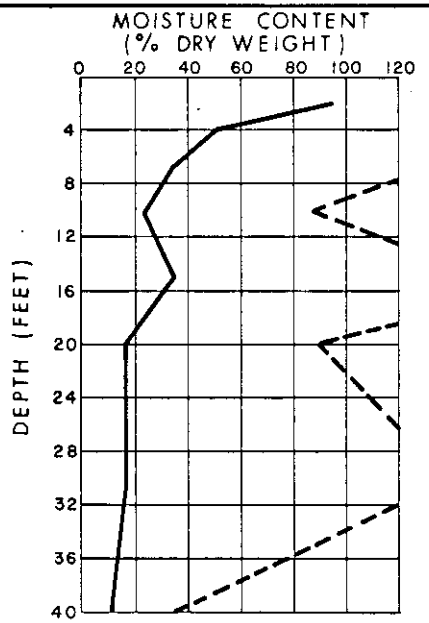
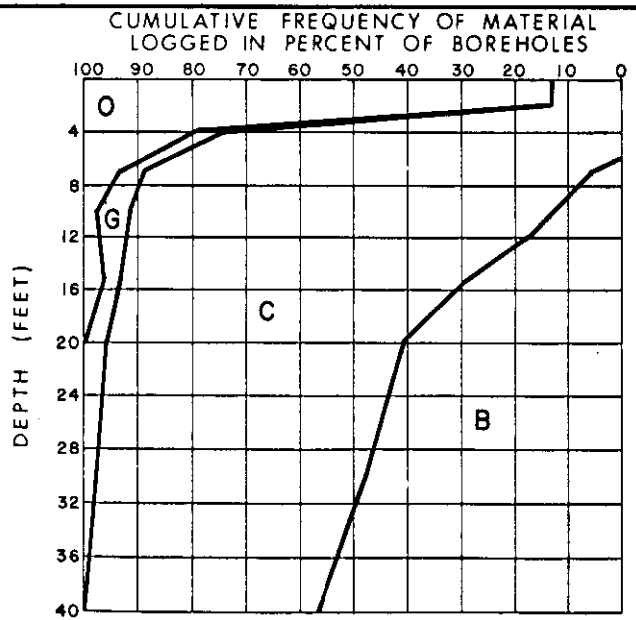
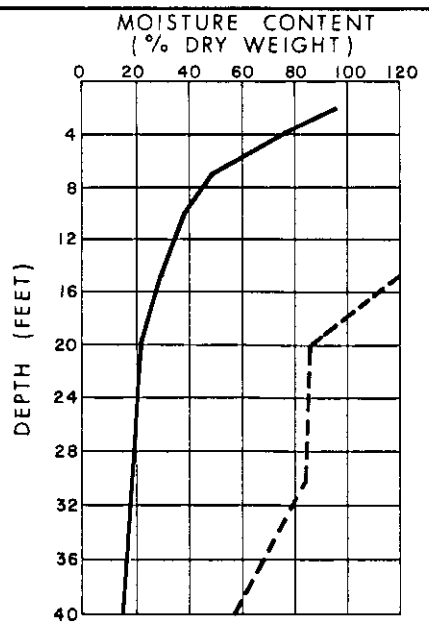
REGION 1

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Mg	GROUND MORAINE SILTY CLAY OVER BEDROCK		2 317 4 316 7 315 10 313 15 307 20 163 30 135 40 22		2 15 4 293 7 310 10 307 15 300 20 154 30 127 40 22
Mg/R	GROUND MORAINE OVER BEDROCK SILTY CLAY OVER BEDROCK		2 258 4 258 7 257 10 256 15 251 20 148 30 135 40 23		2 33 4 250 7 253 10 252 15 246 20 145 30 130 40 18

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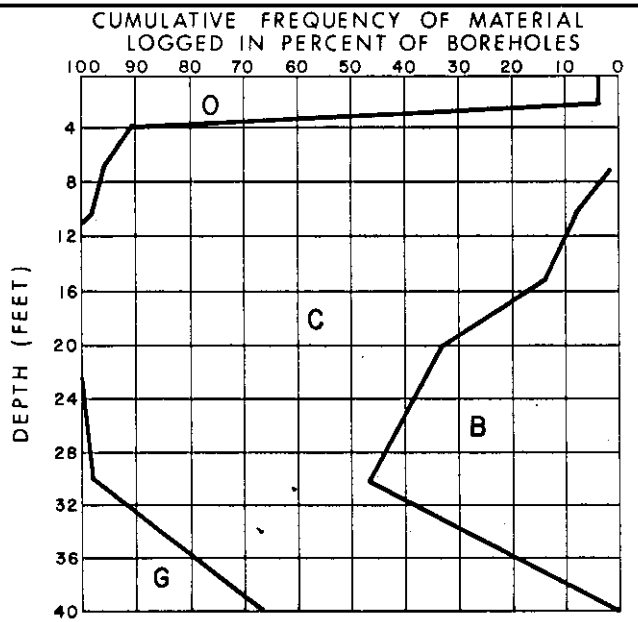
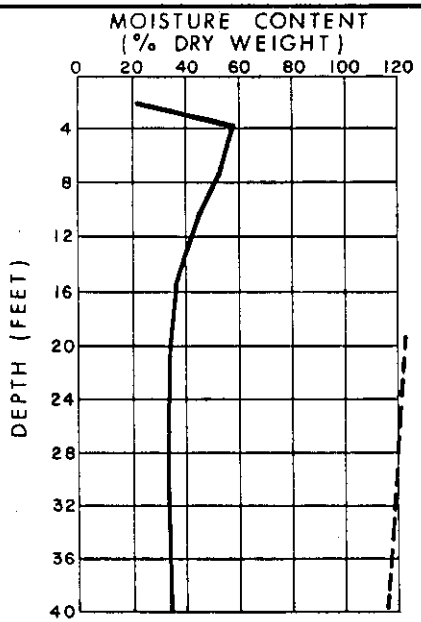
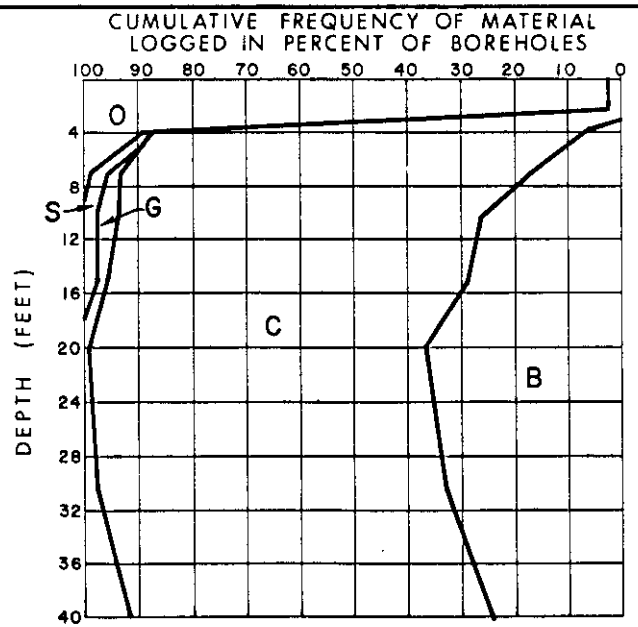
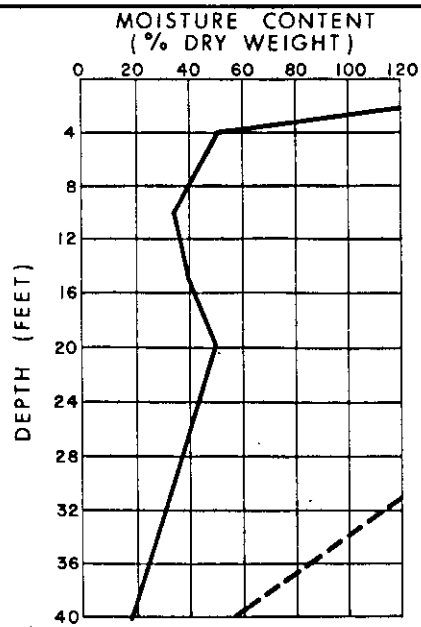
REGION 1

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Mg/R.Mh	GROUND MORAINE OVER BEDROCK WITH HUMMOCKY MORAINE CLAY OVER BEDROCK		2 47 4 47 7 47 10 47 15 47 20 45 30 45 40 3		2 1 4 45 7 47 10 47 15 47 20 45 30 45 40 3
Mh	HUMMOCKY MORAINE CLAY OVER BEDROCK		2 104 4 104 7 104 10 104 15 104 20 100 30 94 40 12		2 15 4 101 7 101 10 102 15 103 20 72 30 74 40 12

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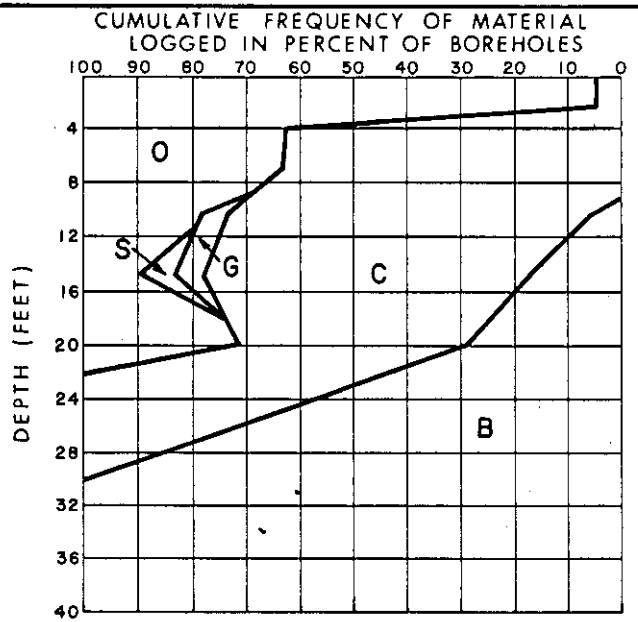
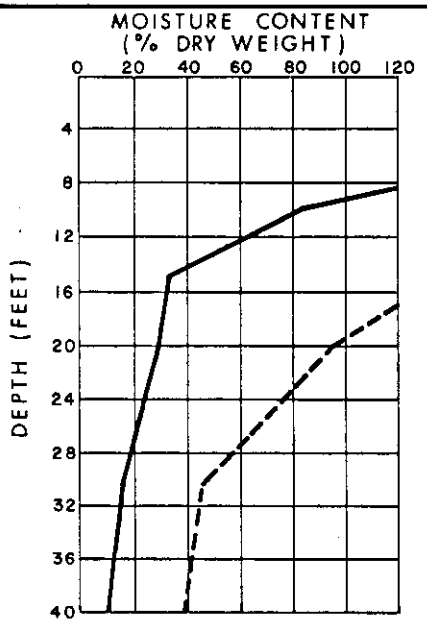
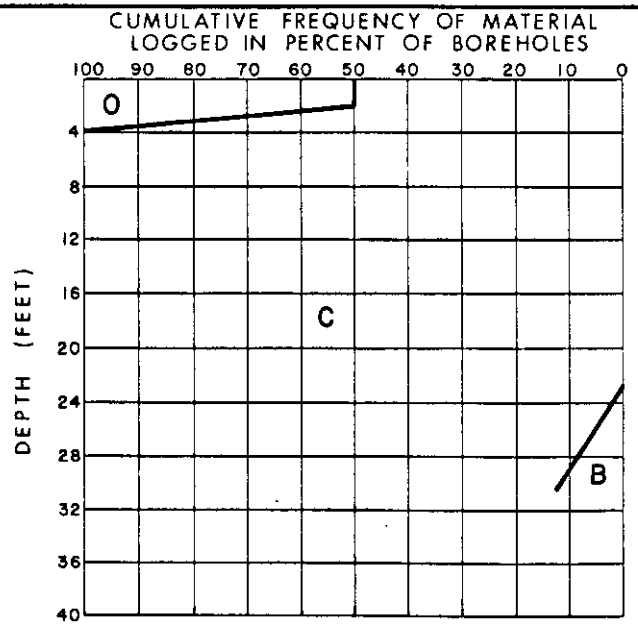
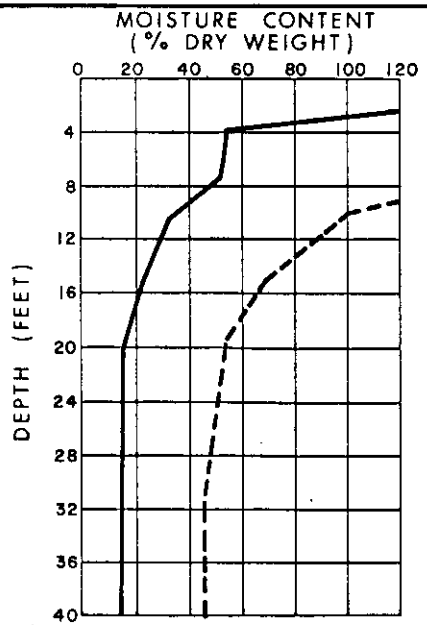
REGION 1

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Ou	ORGANIC ORGANICS OVER CLAY OVER BEDROCK		2 19 4 19 7 19 10 19 15 18 20 7 30 3 40 1		2 7 4 19 7 18 10 18 15 17 20 4 30 1 40 1
Ou / Lp	ORGANIC OVER LACUSTRINE BASIN CLAY AND SILT		2 12 4 12 7 12 10 12 15 11 20 10 30 8 40 7		2 5 4 10 7 12 10 11 15 11 20 10 30 8 40 6

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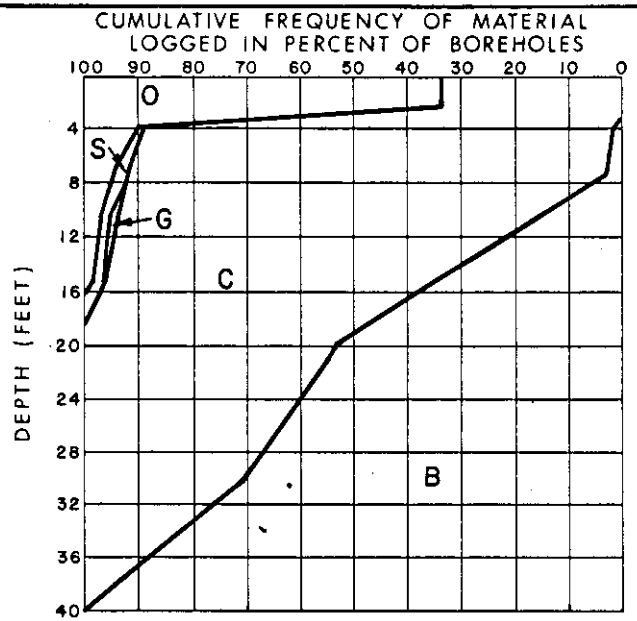
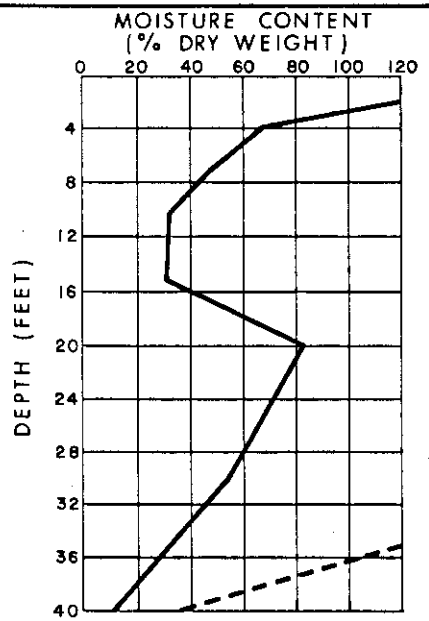
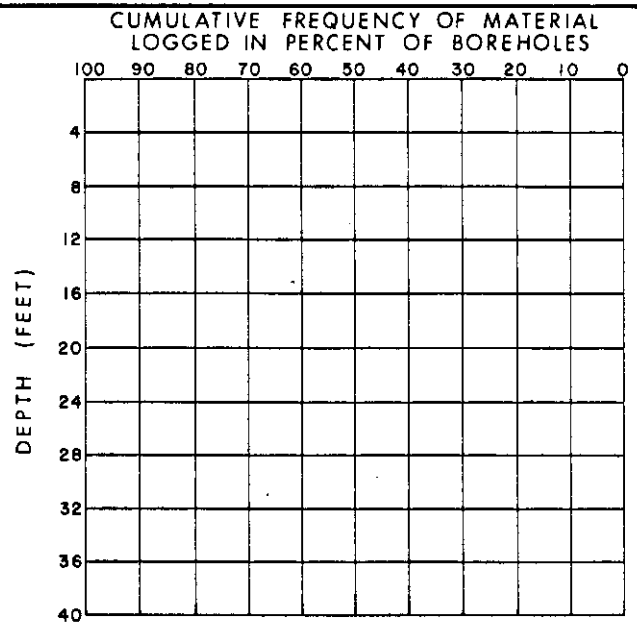
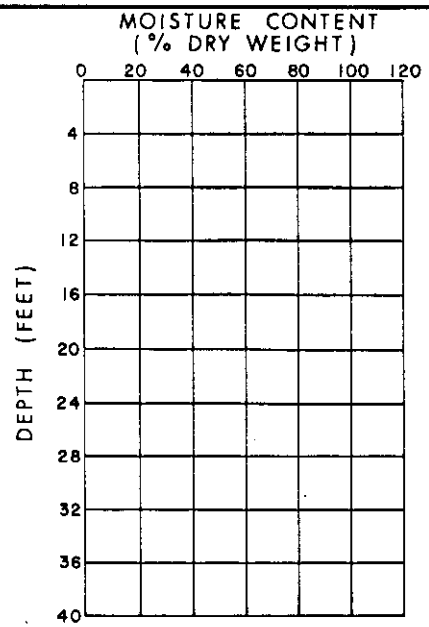
REGION 1

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Ou / Mg	ORGANIC OVER GROUND MORAINE ORGANIC OVER CLAY OVER BEDROCK		2 110 4 110 7 109 10 108 15 108 20 30 30 24 40 3		2 10 4 110 7 109 10 103 15 101 20 29 30 23 40 3
			2 4 7 10 15 20 30 40		2 4 7 10 15 20 30 40

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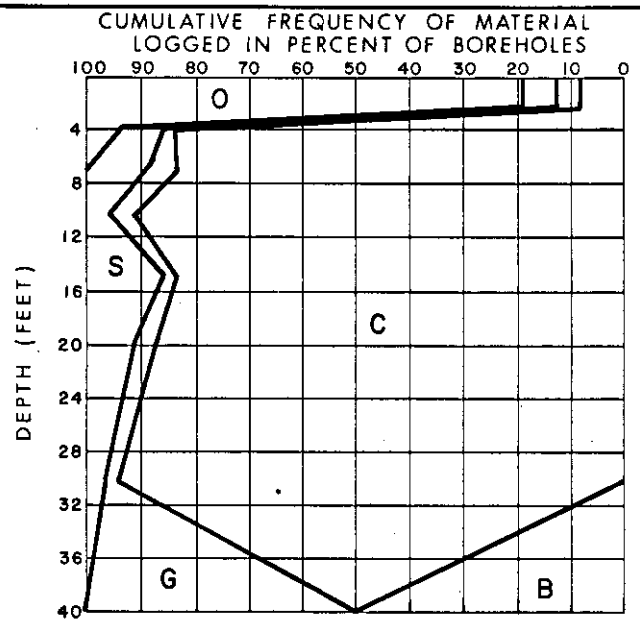
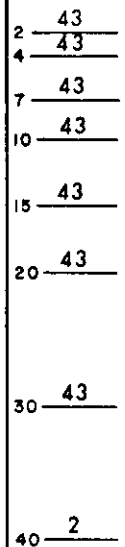
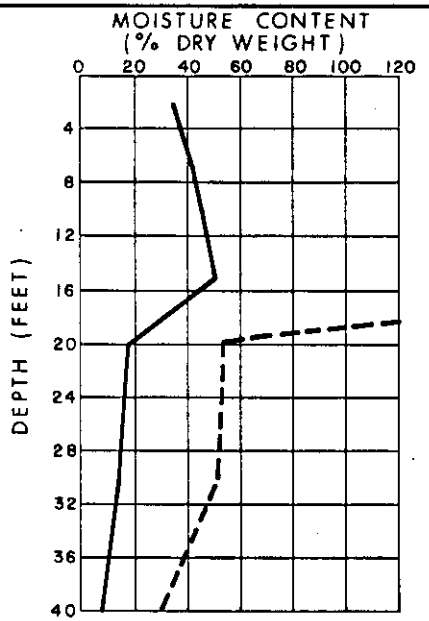
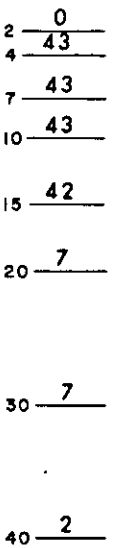
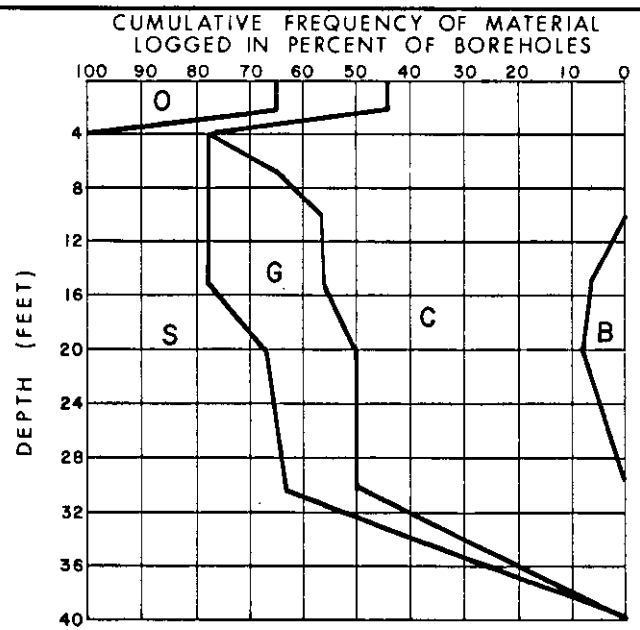
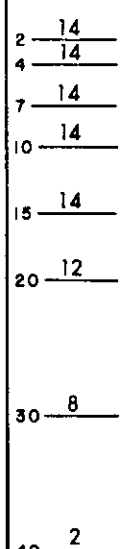
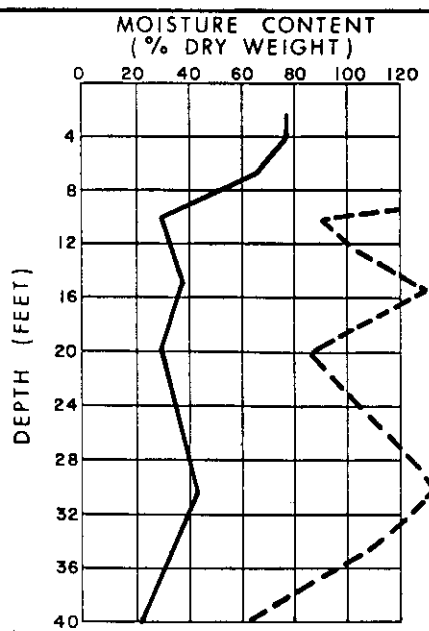
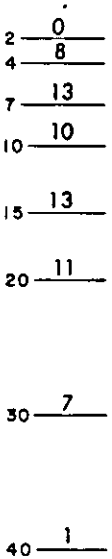
REGION 2

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Af	ALLUVIAL FAN MOSTLY SILT				
Ap	ALLUVIAL FLOODPLAIN SILT OR SAND AND GRAVEL				

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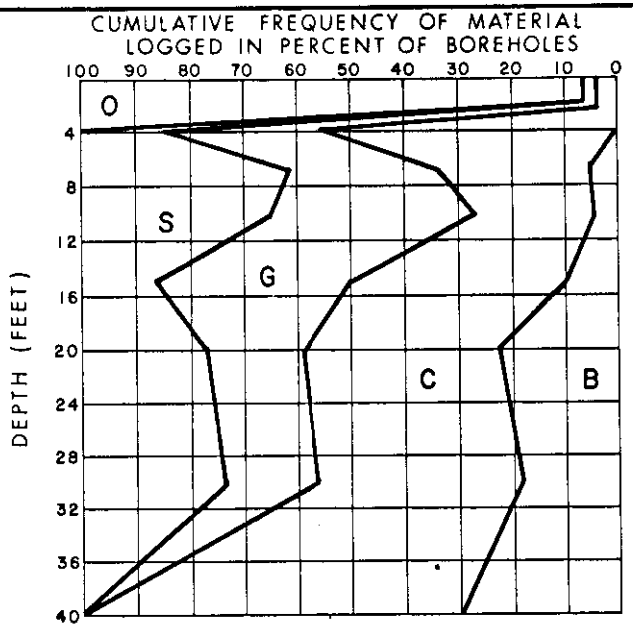
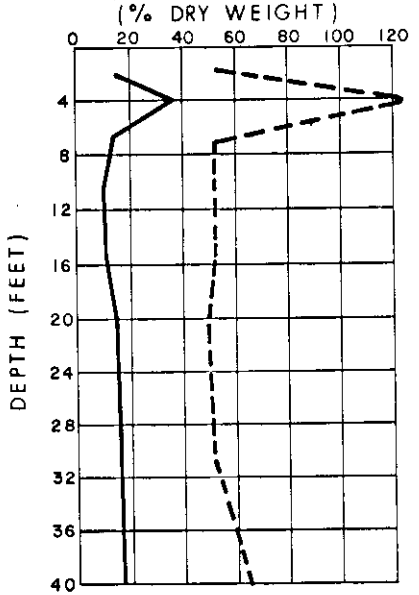
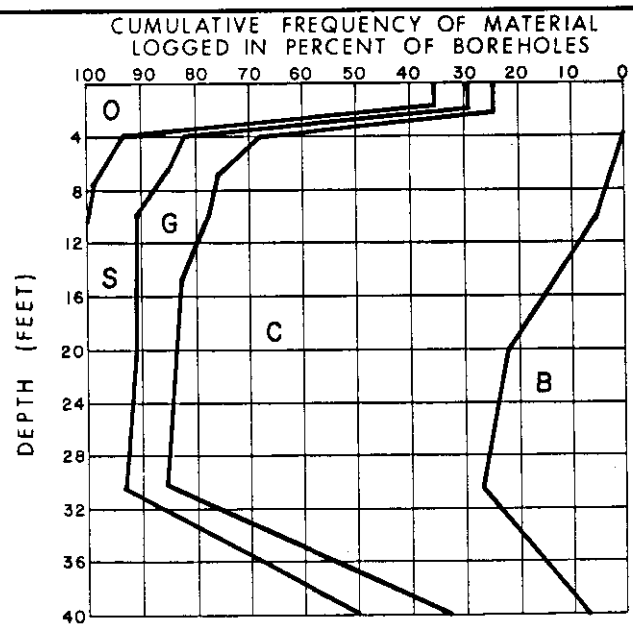
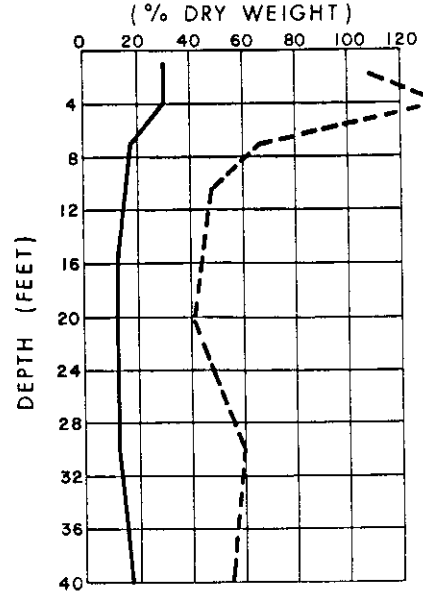
REGION 2

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
At	ALLUVIAL TERRACE EROSIONAL AND DEPOSITIONAL TERRACES – SAND, GRAVEL, CLAY AND BEDROCK		2 33 4 33 7 33 10 31 15 30 20 27 30 26 40 10		2 2 4 23 7 26 10 25 15 27 20 19 30 19 40 10
Ct	COLLUVIAL – TALUS SLOPE SILT WITH BOULDERS		2 191 4 191 7 191 10 189 15 186 20 181 30 176 40 12		2 10 4 190 7 190 10 187 15 185 20 157 30 153 40 12

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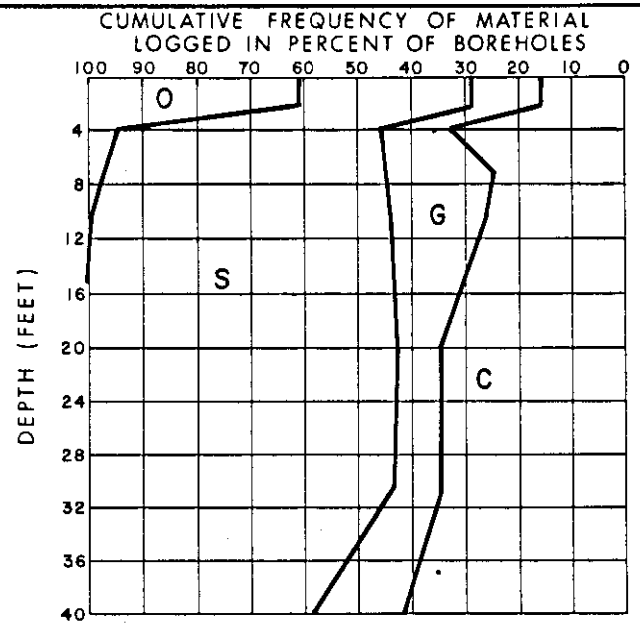
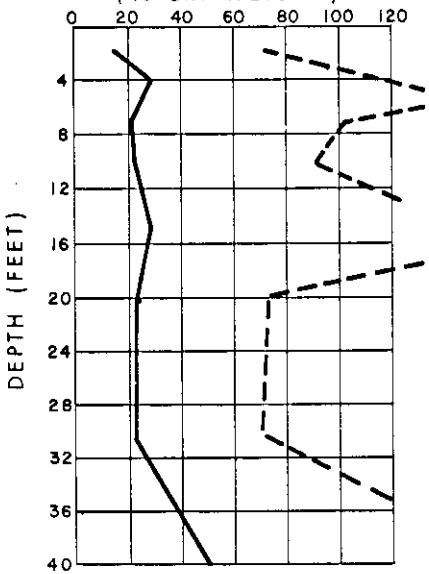
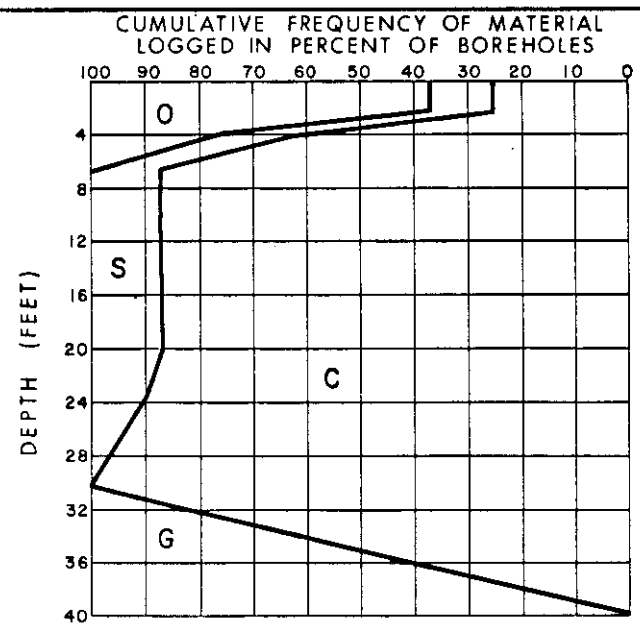
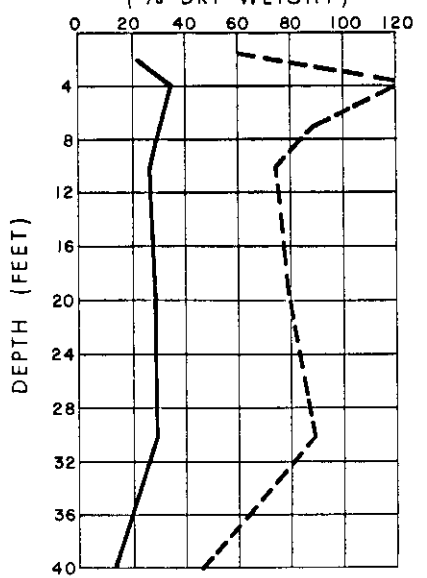
REGION 2

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Go	GLACIAL OUTWASH MAINLY SAND WITH GRAVEL AND CLAY		2 309 4 309 7 308 10 305 15 298 20 246 30 215 40 17		2 17 4 299 7 304 10 297 15 291 20 222 30 189 40 15
Lp	LACUSTRINE BASIN CLAY		2 8 4 8 7 8 10 8 15 8 20 8 30 4 40 1		2 1 4 8 7 8 10 8 15 8 20 5 30 1 40 1

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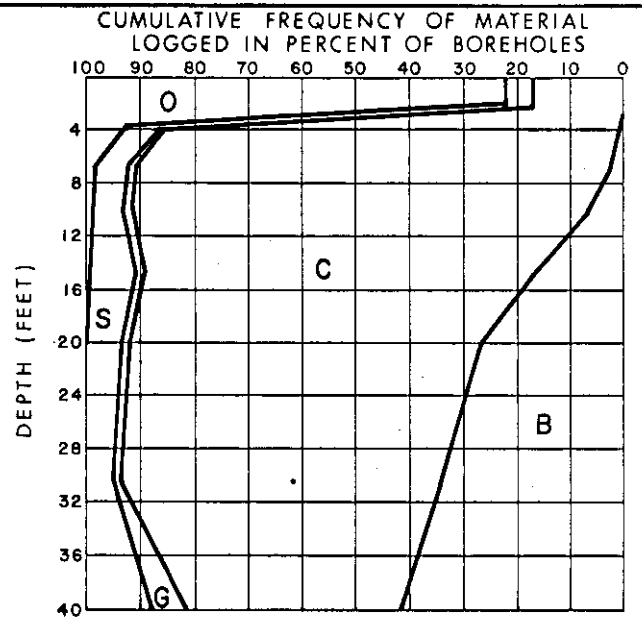
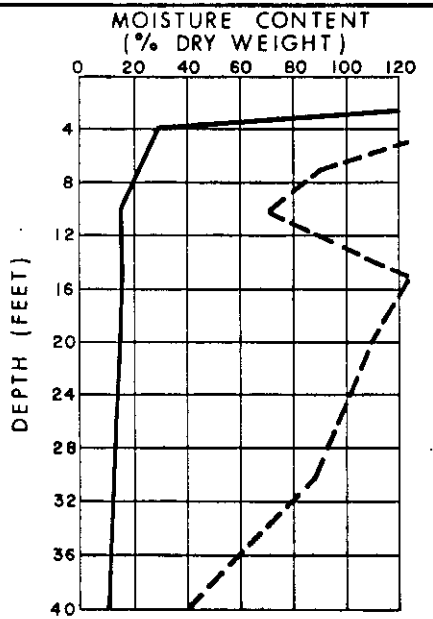
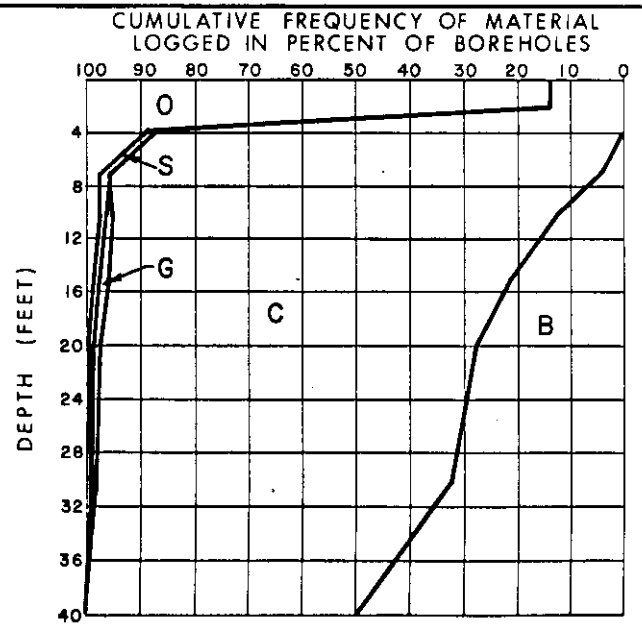
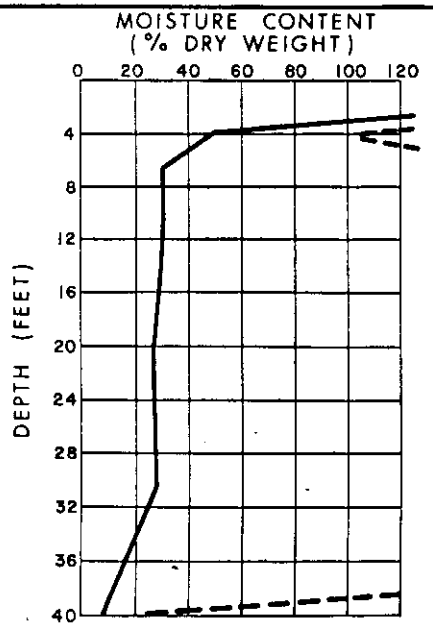
REGION 2

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Mg	GROUND MORAINE CLAY OVER BEDROCK		2 1105 4 1105 7 1105 10 1102 15 1097 20 1078 30 1057 40 27		2 33 4 1070 7 1093 10 1093 15 1085 20 824 30 798 40 25
Mg / R	GROUND MORAINE OVER BEDROCK CLAY OVER BEDROCK		2 241 4 241 7 241 10 240 15 239 20 230 30 226 40 4		2 10 4 238 7 239 10 236 15 233 20 144 30 142 40 2

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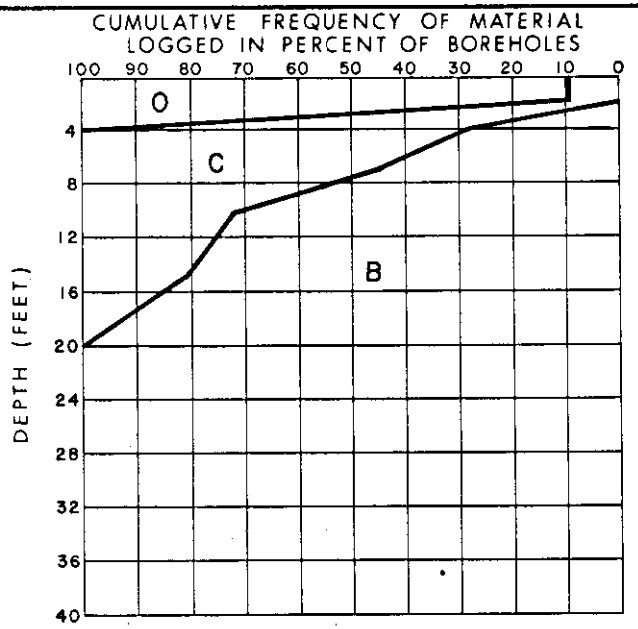
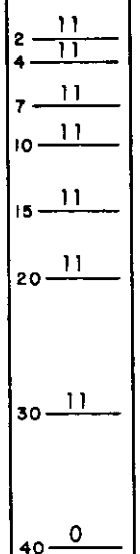
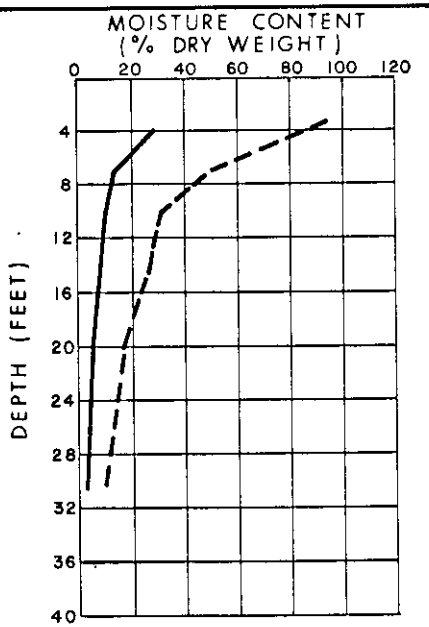
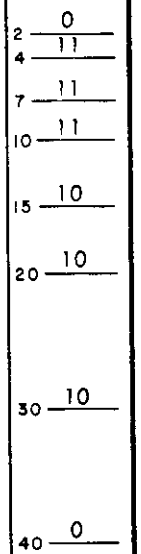
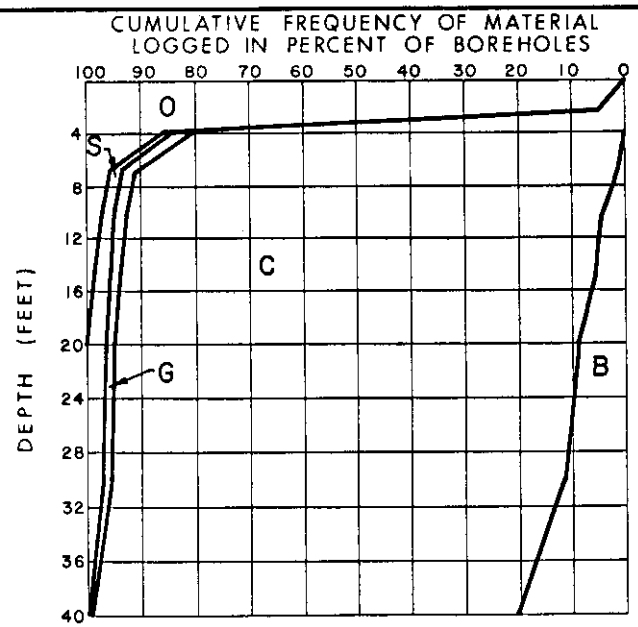
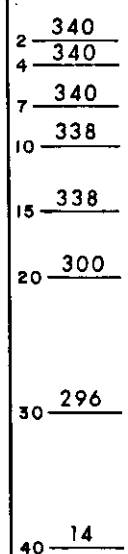
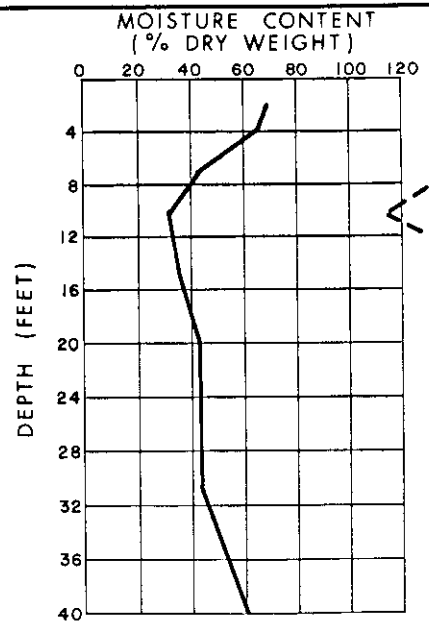
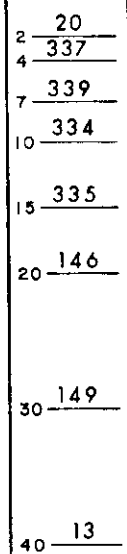
REGION 2

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Mg/R. Mh	GROUND MORAINE OVER BEDROCK WITH HUMMOCKY MORAINE MAINLY CLAY OVER BEDROCK				
Mh	HUMMOCKY MORAINE CLAY				

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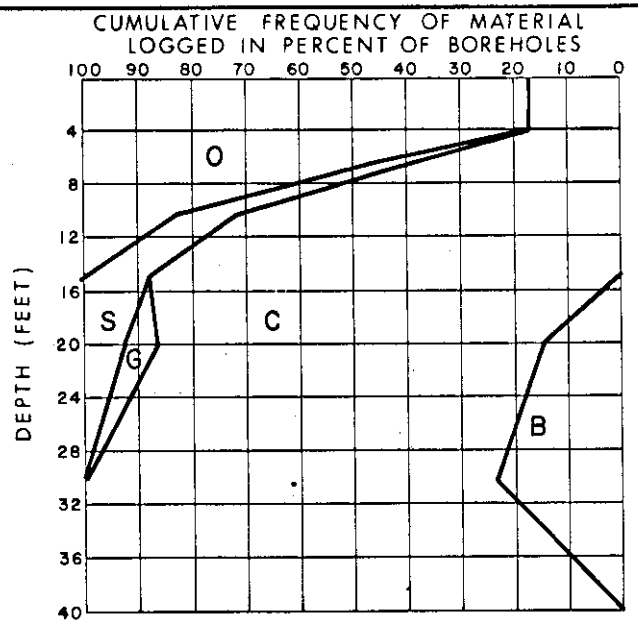
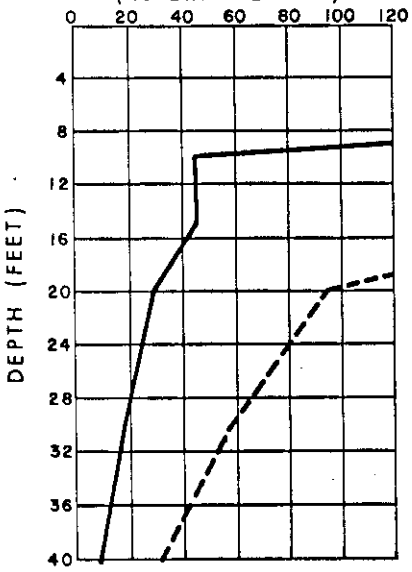
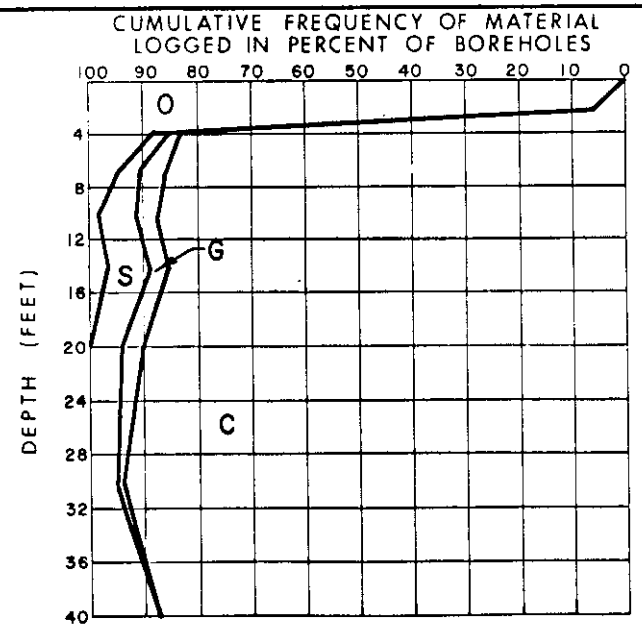
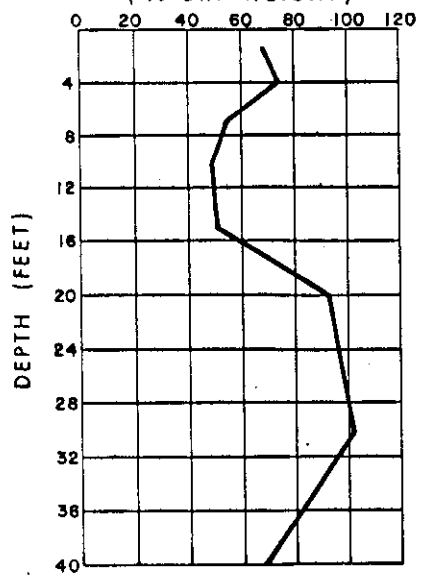
REGION 2

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Ou	ORGANIC ORGANIC OVER CLAY		2 28 4 28 7 28 10 28 15 27 20 25 30 13 40 2		2 2 4 15 7 22 10 17 15 26 20 22 30 11 40 1
Ou/Lp	ORGANIC OVER LACUSTRINE BASIN ORGANIC OVER CLAY		2 123 4 123 7 123 10 123 15 122 20 117 30 112 40 8		2 9 4 122 7 123 10 122 15 122 20 36 30 31 40 6

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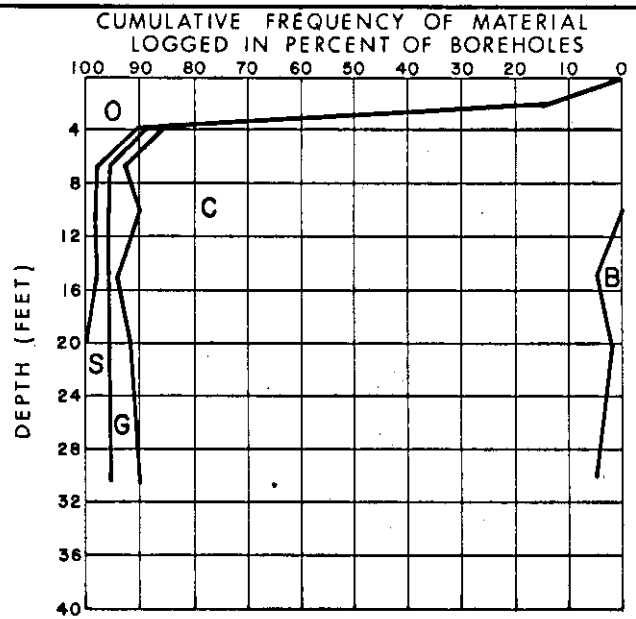
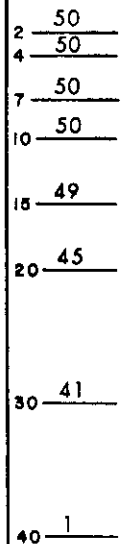
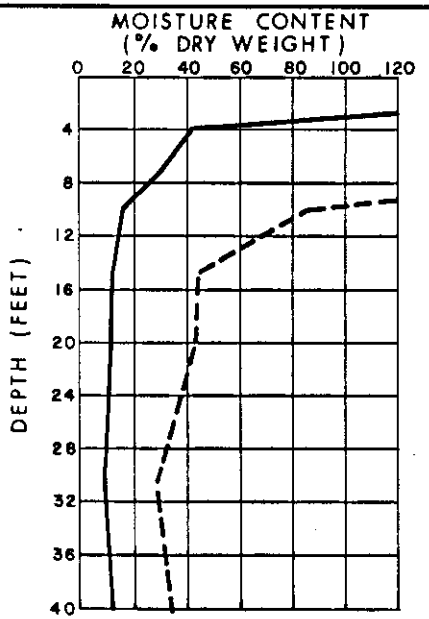
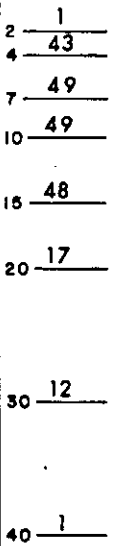
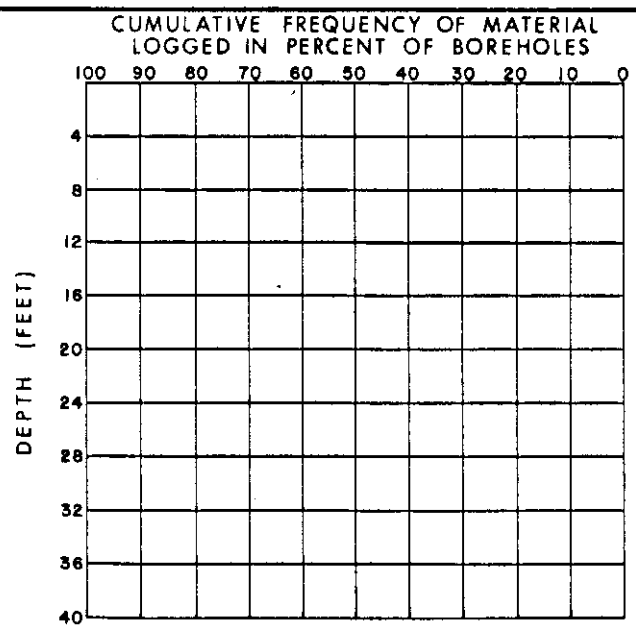
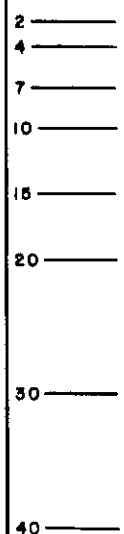
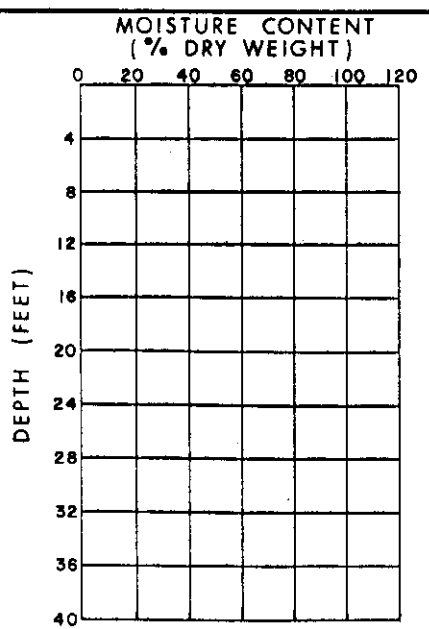
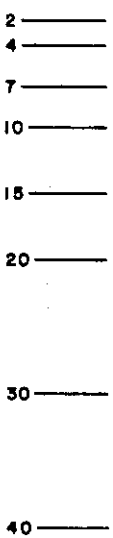
REGION 2

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Ou / Mg	ORGANIC OVER GROUND MORAINE ORGANIC OVER CLAY				
					

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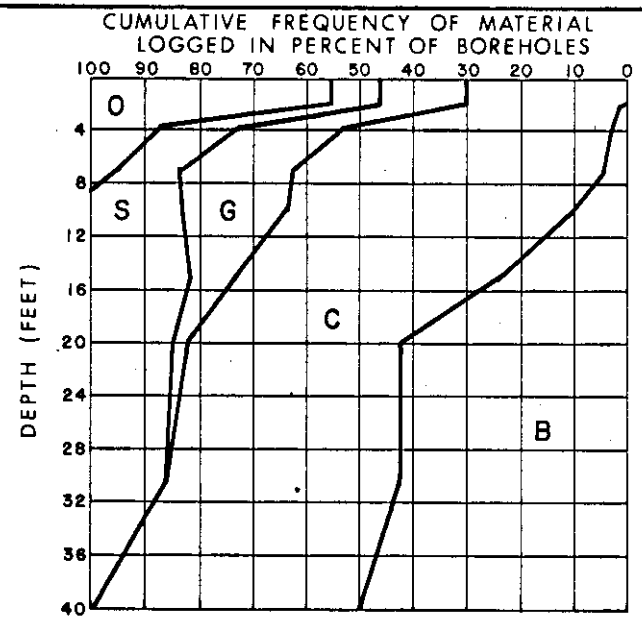
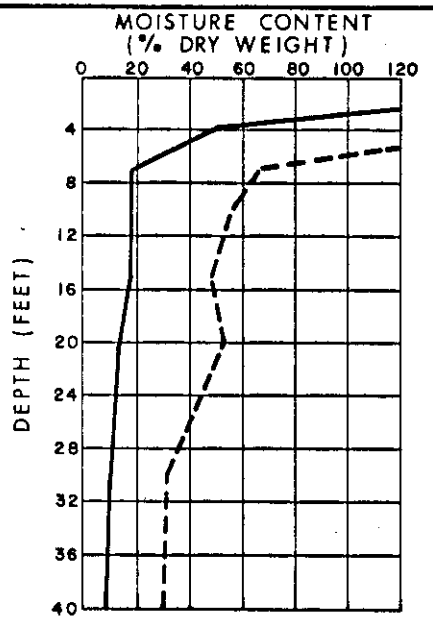
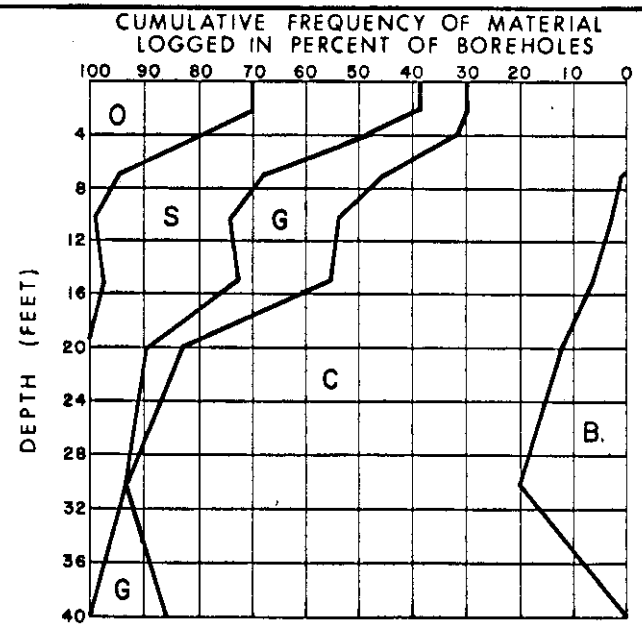
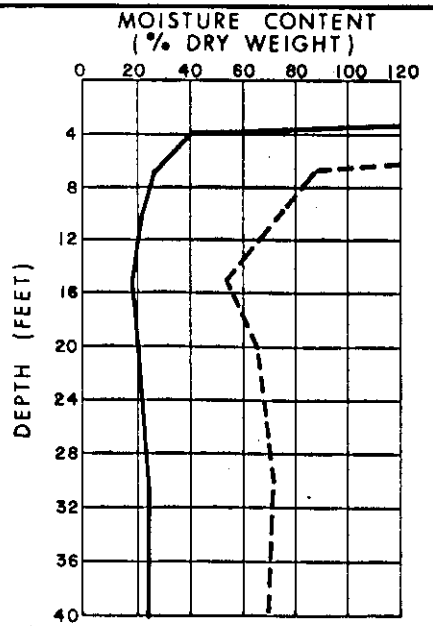
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Af	ALLUVIAL FAN MAINLY SILTY CLAY AND SAND OVER BEDROCK		2 69 4 69 7 69 10 67 15 53 20 40 30 7 40 6		2 11 4 66 7 67 10 62 15 50 20 35 30 7 40 5
Ap	ALLUVIAL FLOODPLAIN MAINLY SILTY CLAY AND SAND		2 80 4 80 7 79 10 78 15 73 20 38 30 15 40 8		2 2 4 74 7 76 10 75 15 66 20 34 30 14 40 8

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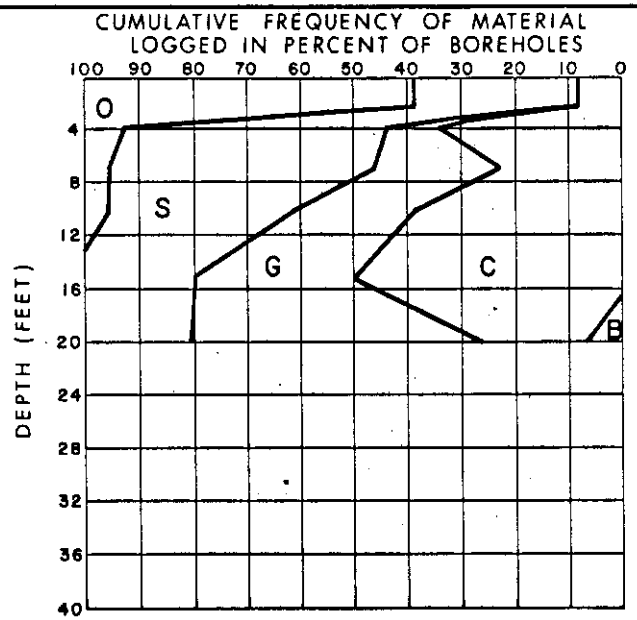
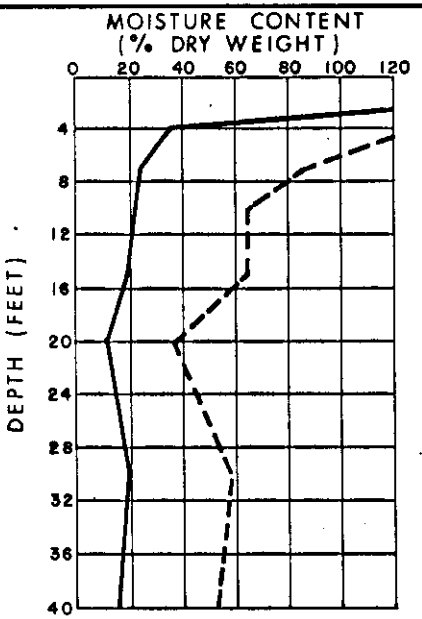
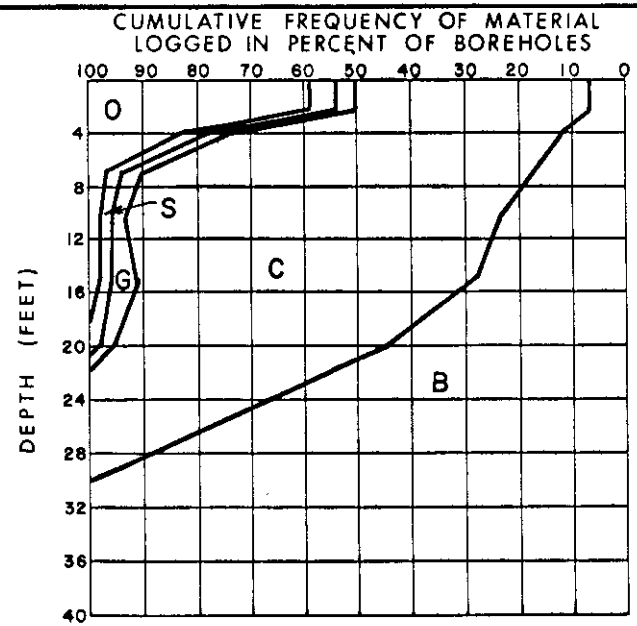
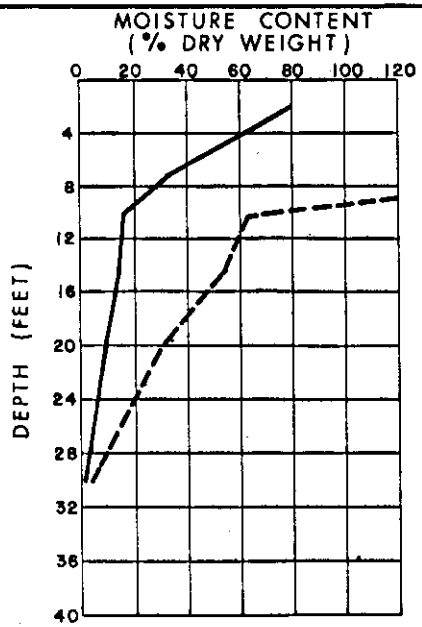
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
At	**ALLUVIAL TERRACE** CLAY, SILT, SAND AND GRAVEL		2 26 4 26 7 26 10 26 15 20 20 15 30 2 40 2		2 7 4 22 7 23 10 23 15 18 20 12 30 3 40 3
Cm/R	**SLOPEWASH OVER BEDROCK** MAINLY SILTY CLAY OVER BEDROCK		2 100 4 99 7 97 10 89 15 71 20 45 30 3 40 1		2 2 4 95 7 91 10 81 15 55 20 33 30 3 40 1

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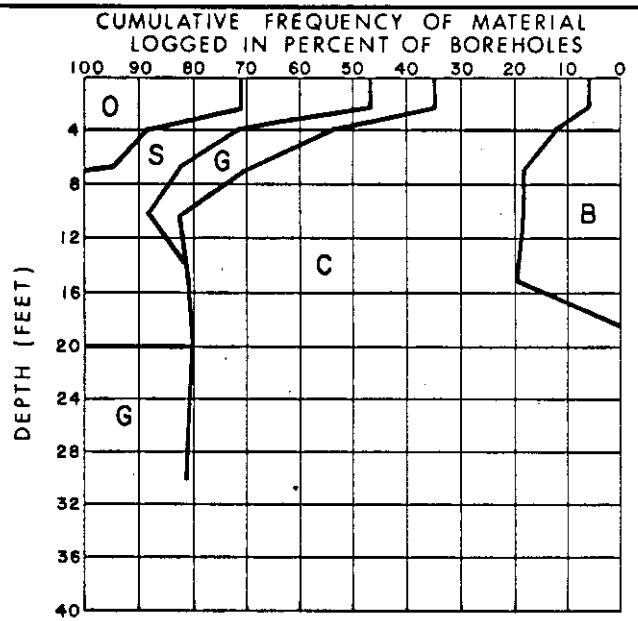
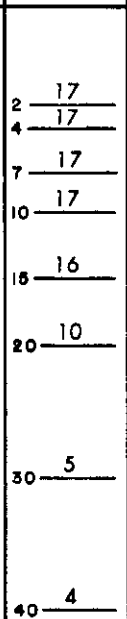
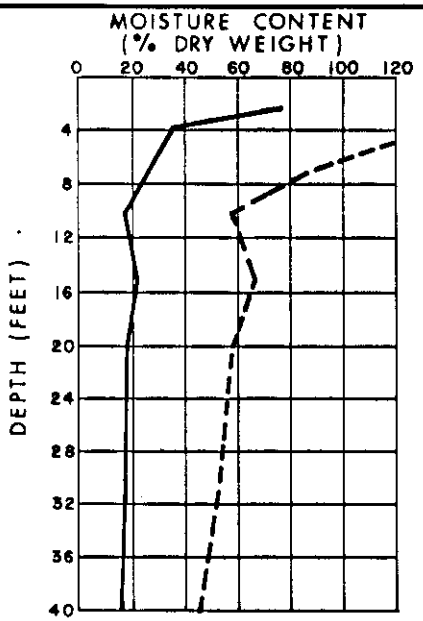
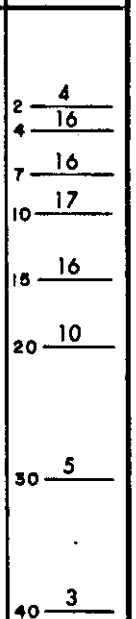
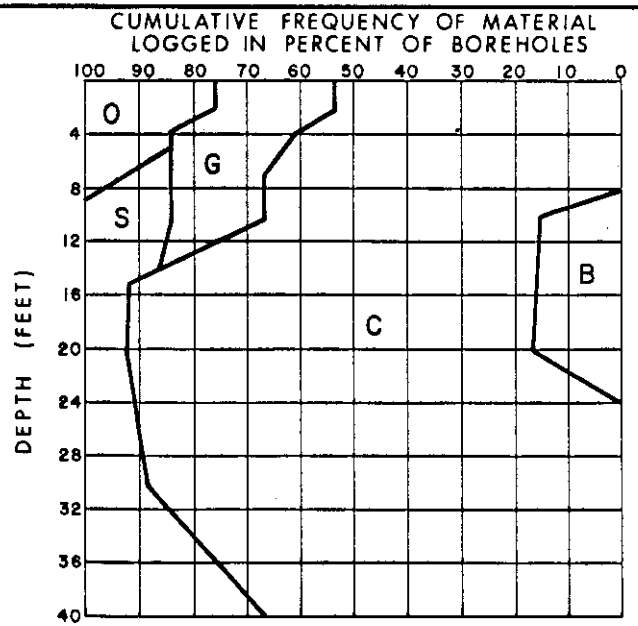
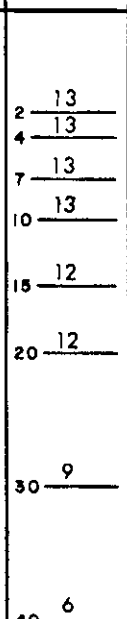
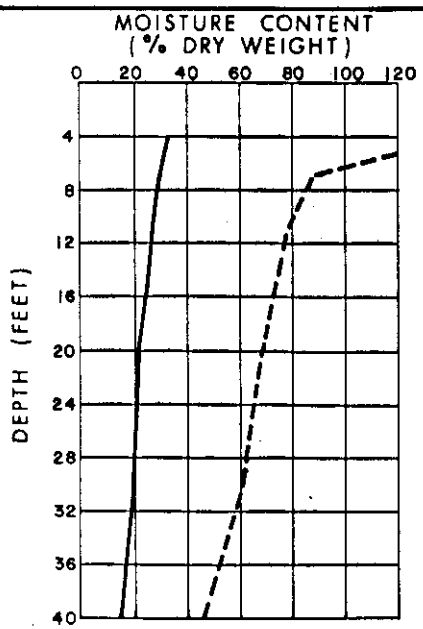
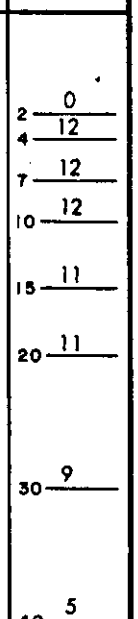
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Ct	COLLUVIAL - TALUS SLOPE MAINLY SILTY CLAY				
Ct/R	COLLUVIAL - TALUS SLOPE OVER BEDROCK MAINLY SILTY CLAY OVER BEDROCK				

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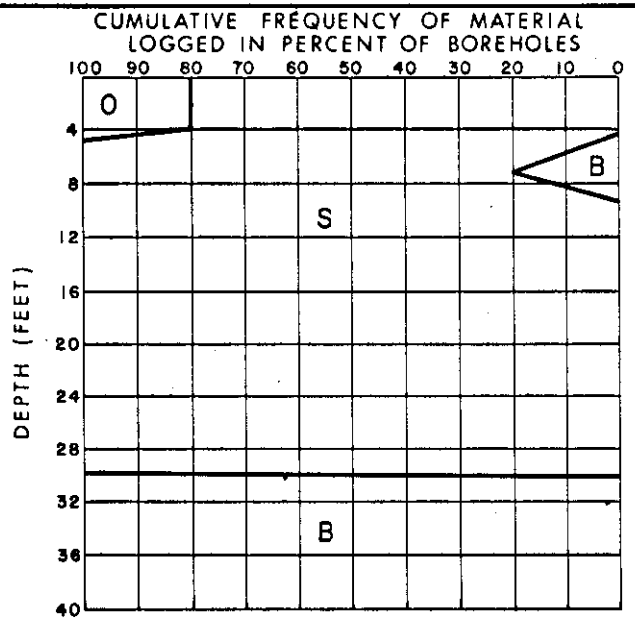
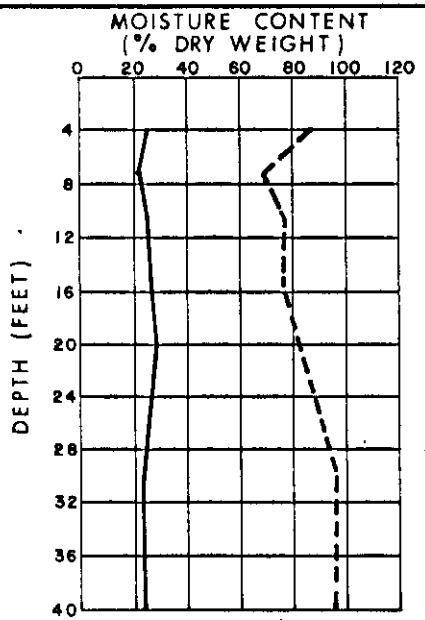
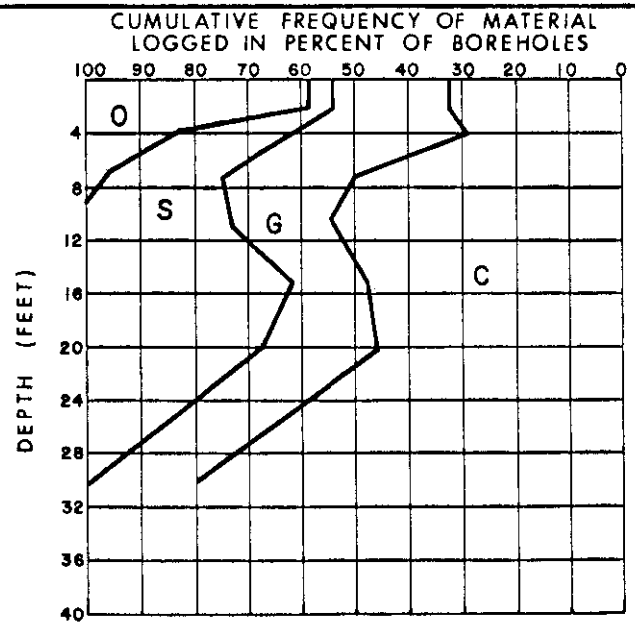
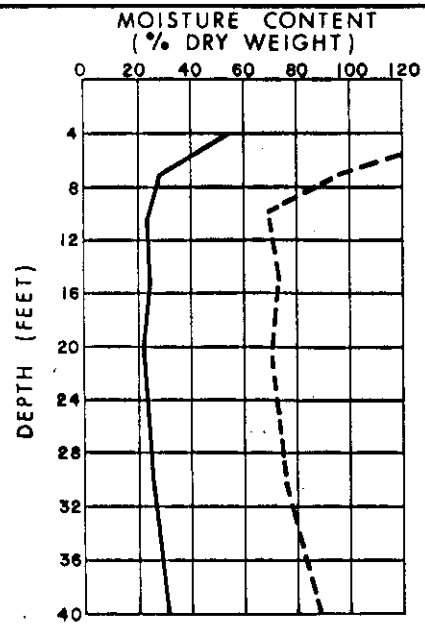
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Ed	EOLIAN DUNES SAND		2 — 5 4 — 5 7 — 5 10 — 5 15 — 4 20 — 4 30 — 1 40 — 1		2 — 0 4 — 5 7 — 5 10 — 5 15 — 4 20 — 4 30 — 1 40 — 1
Go	GLACIAL OUTWASH MAINLY SILTY CLAY AND SAND		2 — 24 4 — 24 7 — 24 10 — 22 15 — 21 20 — 15 30 — 5 40 — 0		2 — 6 4 — 21 7 — 23 10 — 19 15 — 19 20 — 13 30 — 5 40 — 1

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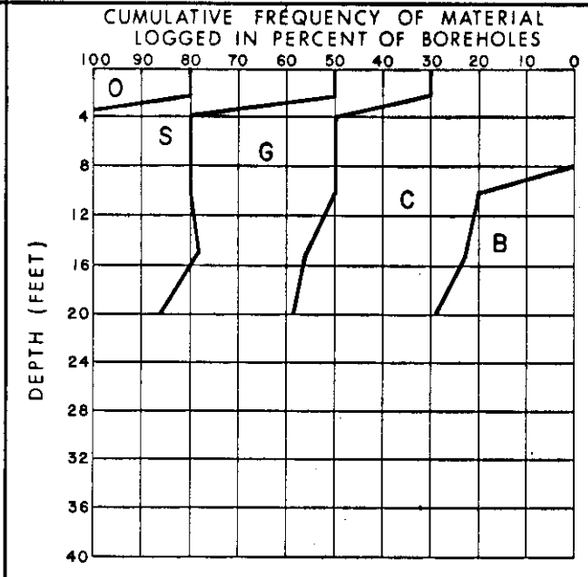
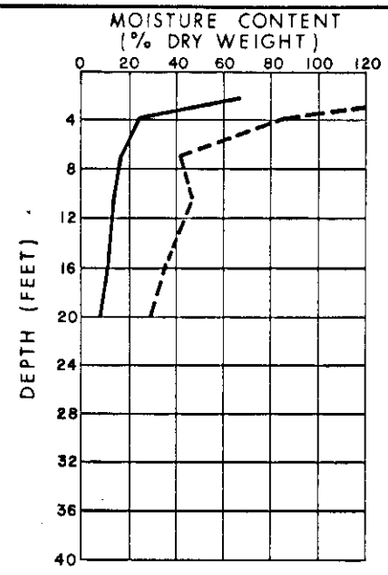
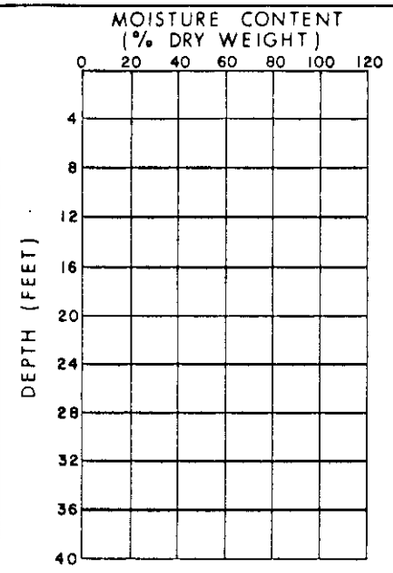
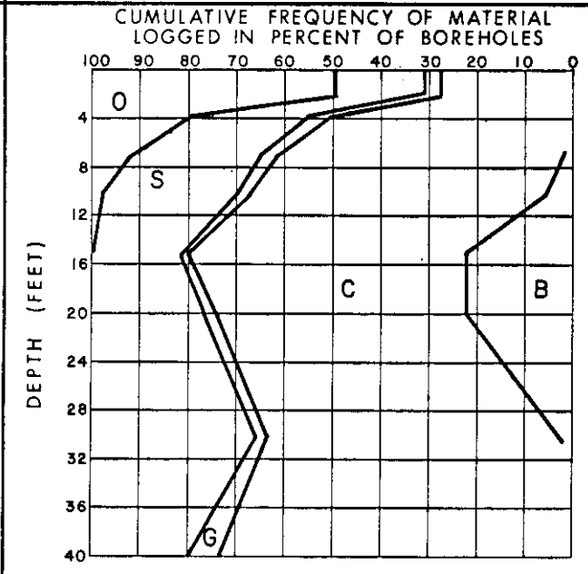
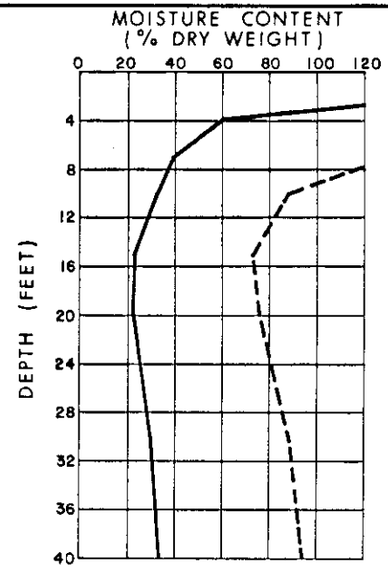
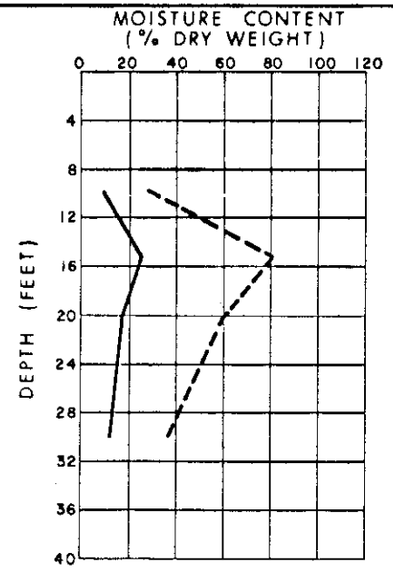
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES	MOISTURE CONTENT OF UNFROZEN MATERIAL	NO. OF VALUES
Lb	**RAISED BEACH RIDGES** VARIOUS MATERIALS		2 10 4 10 7 10 10 10 15 9 20 7 30 0 40 0		2 3 4 10 7 10 10 10 15 9 20 6 30 0 40 0		2 4 7 10 15 20 30 40
Lp	**LACUSTRINE BASIN** MAINLY CLAY AND SAND		2 286 4 286 7 286 10 283 15 235 20 184 30 41 40 15		2 38 4 271 7 278 10 273 15 221 20 159 30 37 40 12		2 0 4 0 7 0 10 1 15 8 20 20 30 2 40 0

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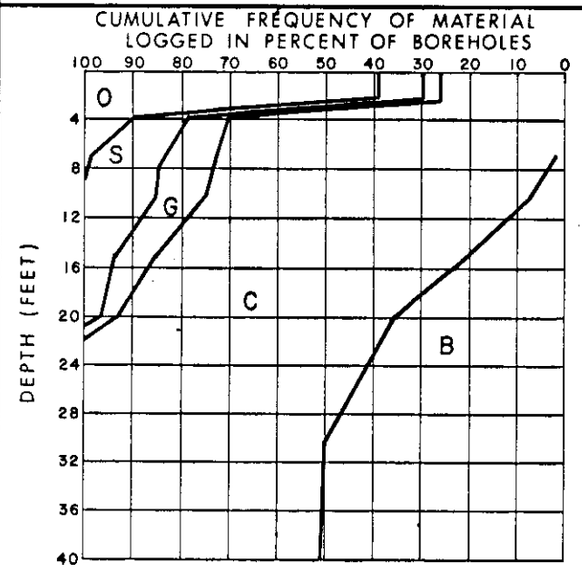
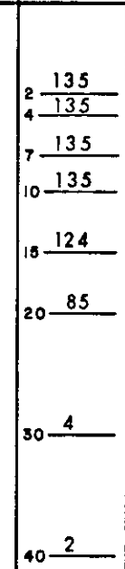
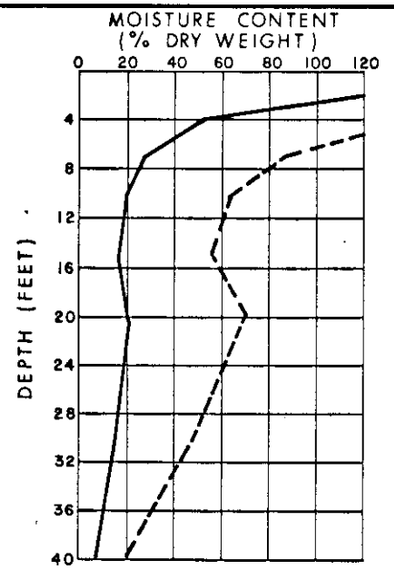
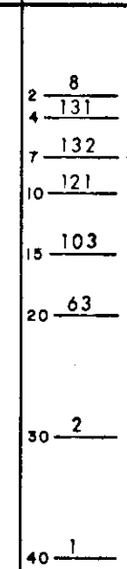
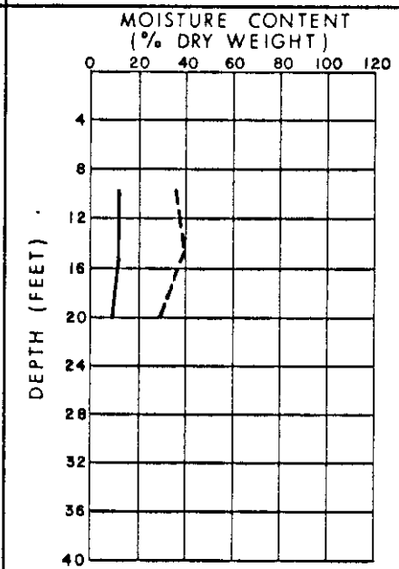
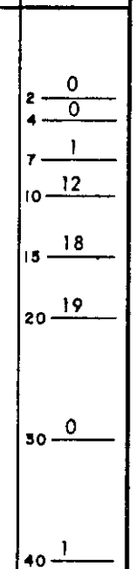
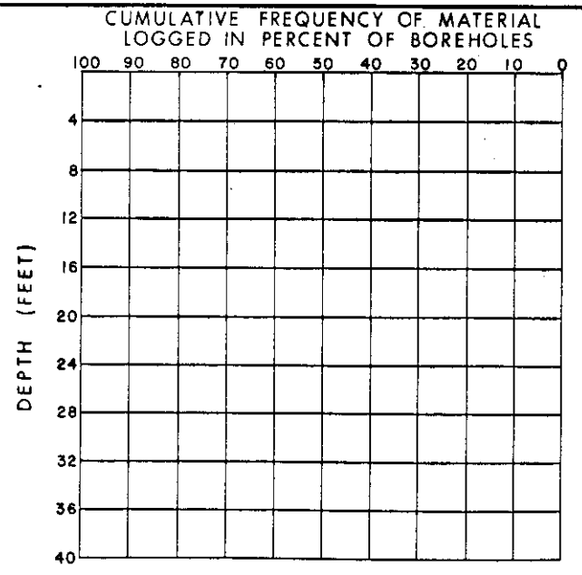
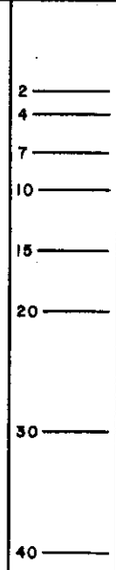
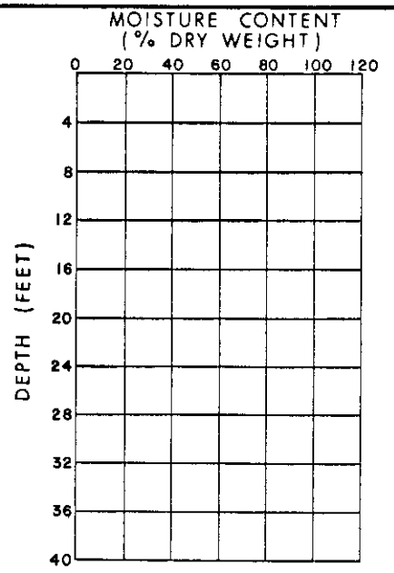
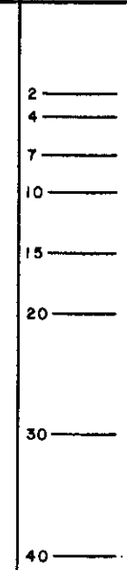
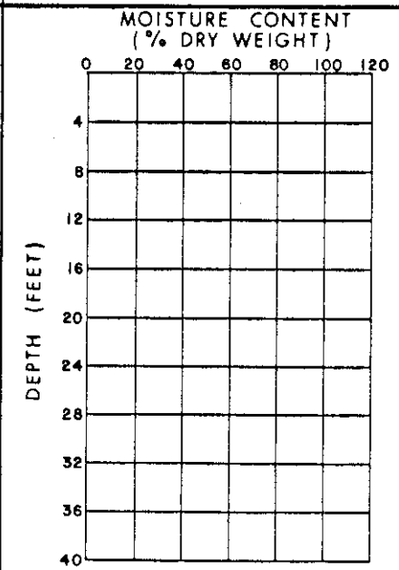
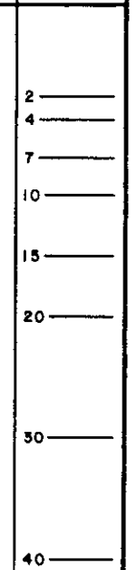
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES	MOISTURE CONTENT OF UNFROZEN MATERIAL	NO. OF VALUES
Lp/Mg	LACUSTRINE BASIN OVER GROUND MORAINE MAINLY CLAY						
							

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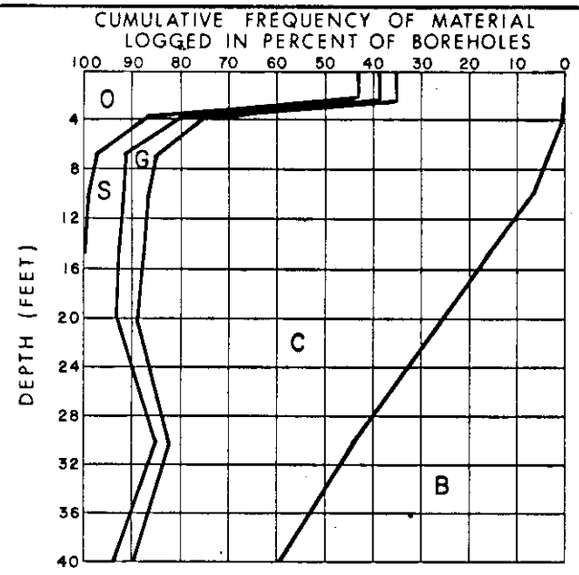
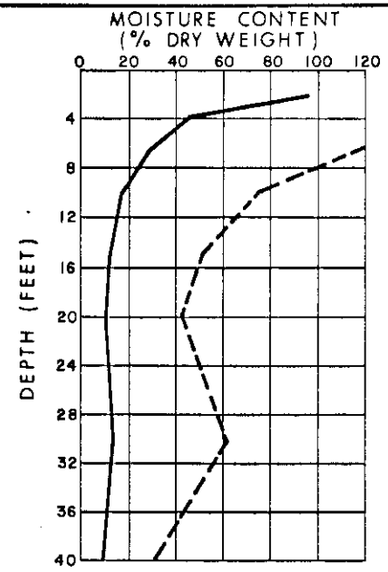
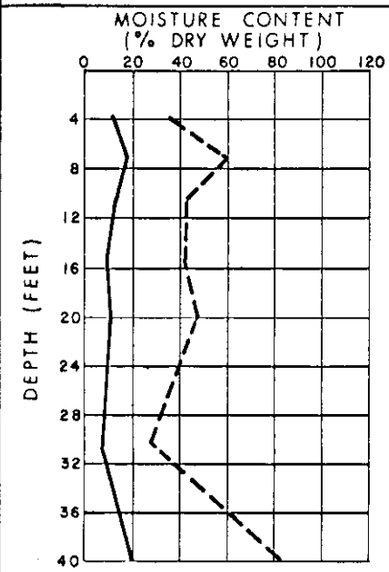
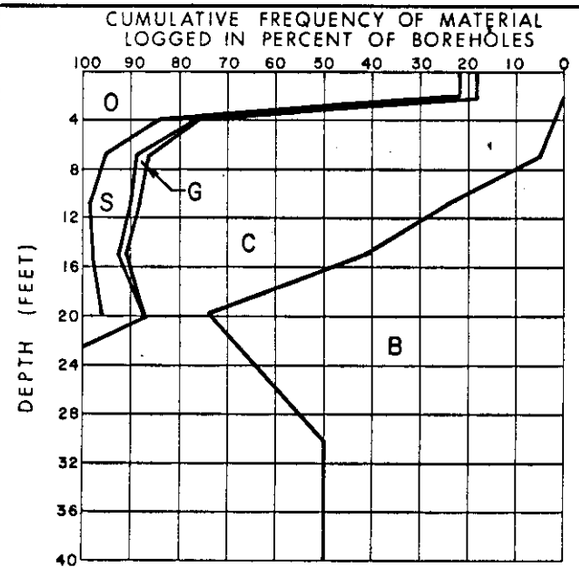
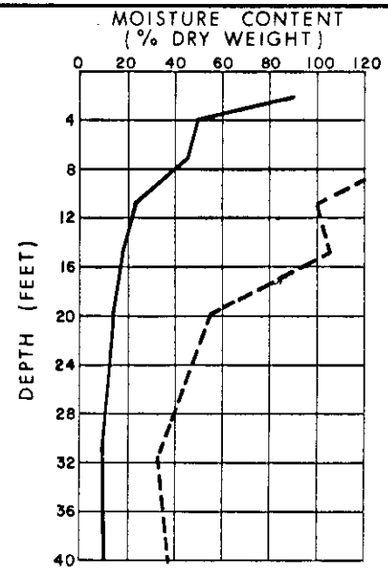
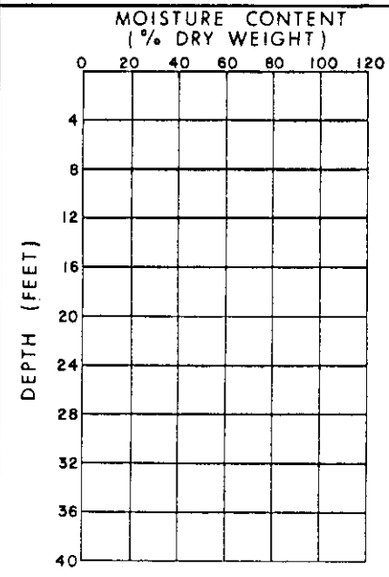
Mg	GROUND MORAINE MAINLY CLAY OVER BEDROCK		2 957 4 956 7 955 10 947 15 843 20 644 30 69 40 32		2 88 4 940 7 947 10 900 15 769 20 545 30 52 40 24		2 0 4 1 7 2 10 36 15 62 20 81 30 8 40 5
Mg / R	GROUND MORAINE OVER BEDROCK MAINLY CLAY OVER BEDROCK		2 111 4 111 7 111 10 111 15 101 20 85 30 8 40 2		2 16 4 110 7 111 10 107 15 89 20 70 30 5 40 2		2 4 7 10 15 20 30 40

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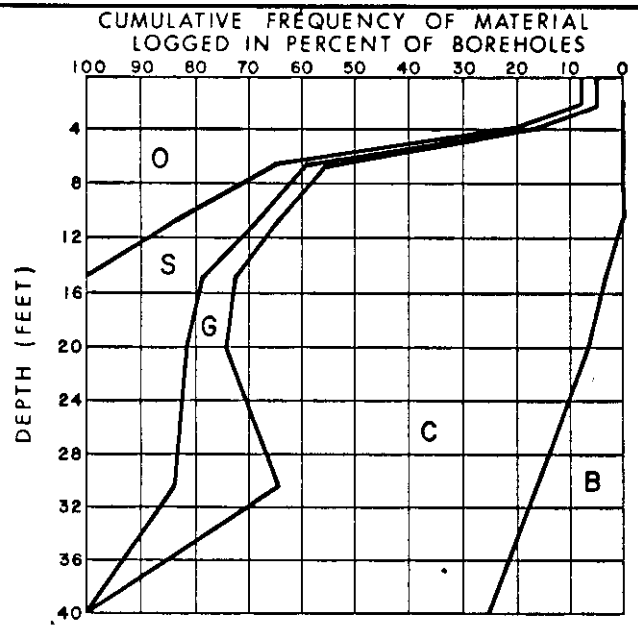
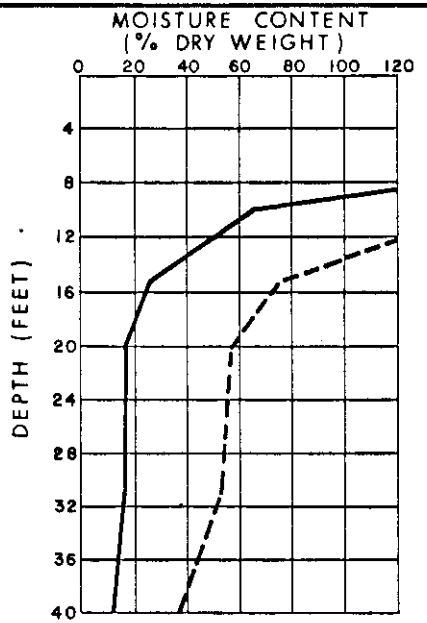
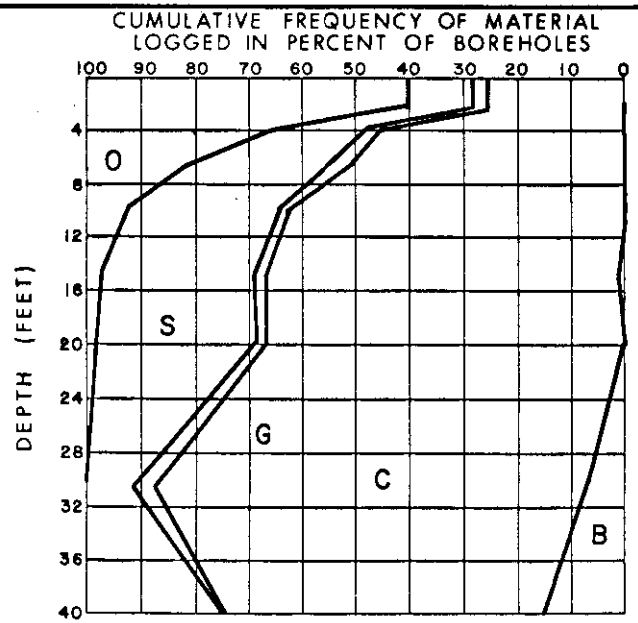
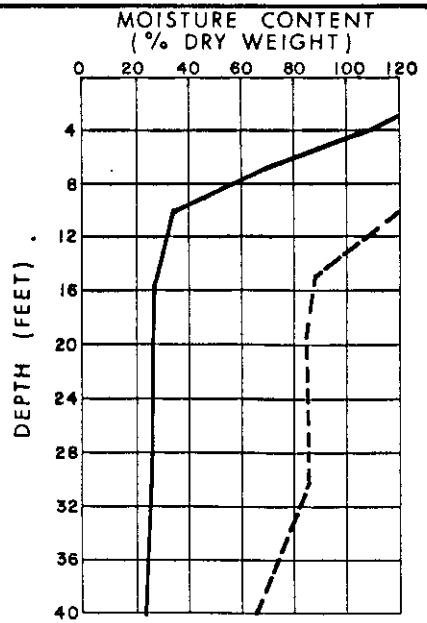
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Ou	ORGANIC ORGANIC OVER CLAY, SOME BEDROCK		2 32 4 32 7 32 10 32 15 29 20 27 30 12 40 4		2 9 4 28 7 30 10 30 15 28 20 21 30 9 40 3
Ou/Lp	ORGANIC OVER LACUSTRINE BASIN ORGANIC OVER CLAY, SOME BEDROCK		2 214 4 214 7 214 10 209 15 161 20 121 30 57 40 20		2 21 4 188 7 194 10 192 15 147 20 111 30 50 40 19

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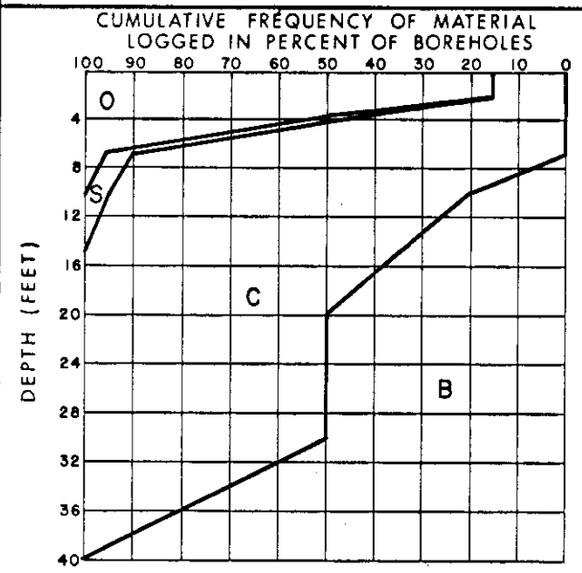
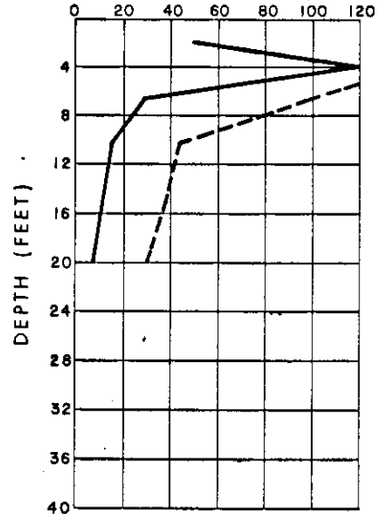
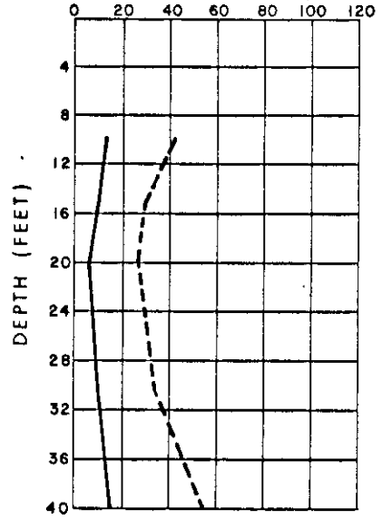
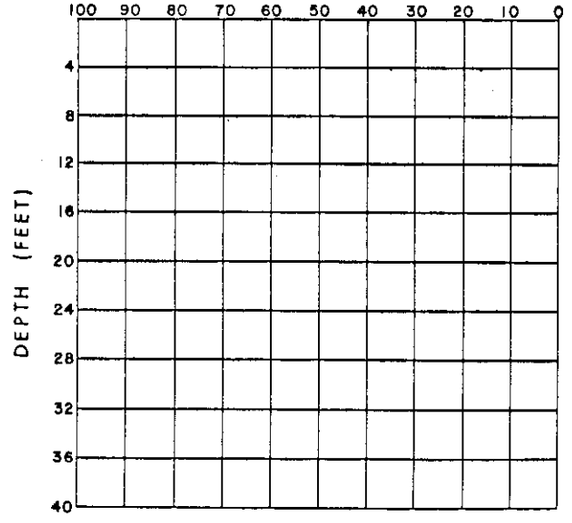
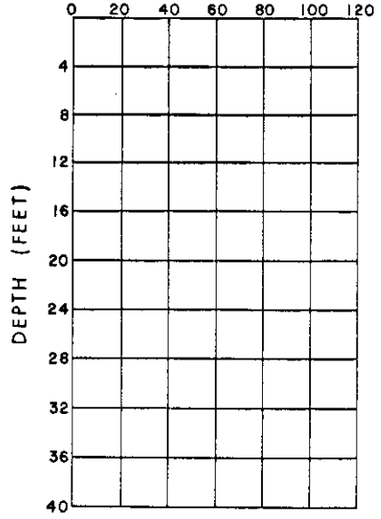
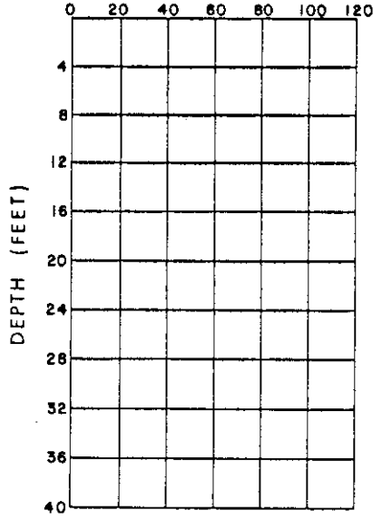
REGION 3

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES	MOISTURE CONTENT OF UNFROZEN MATERIAL	NO. OF VALUES
Ou/Mg	ORGANIC OVER GROUND MORAINE ORGANIC OVER CLAY OVER BEDROCK		2 20 4 20 7 20 10 20 15 19 20 14 30 2 40 2		2 2 4 18 7 19 10 16 15 12 20 9 30 0 40 0		2 0 4 0 7 0 10 4 15 6 20 5 30 2 40 2
			2 4 7 10 15 20 30 40		2 4 7 10 15 20 30 40		2 4 7 10 15 20 30 40

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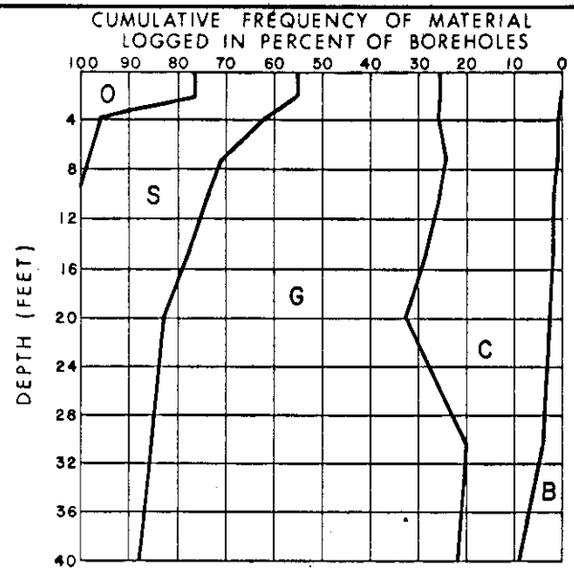
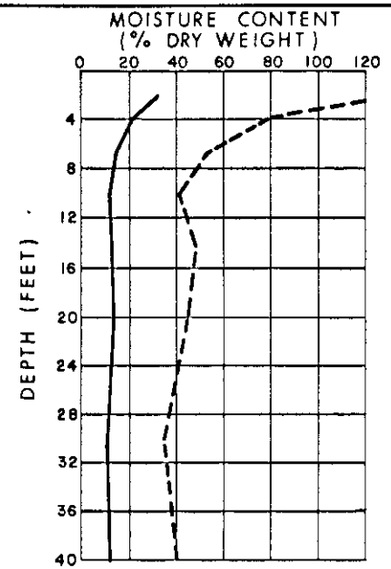
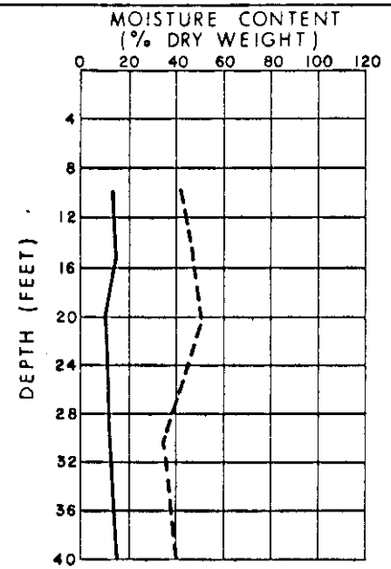
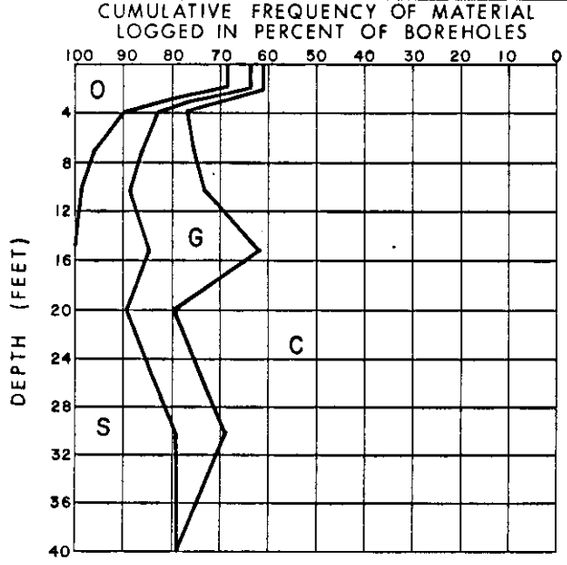
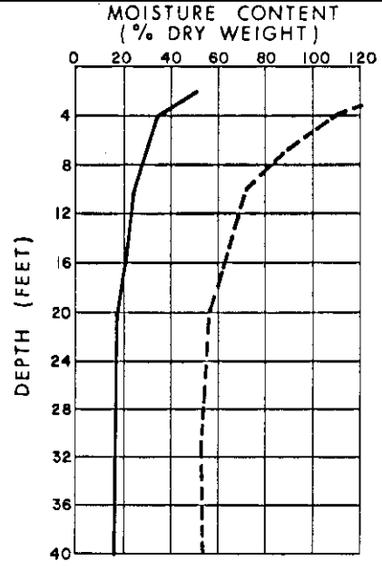
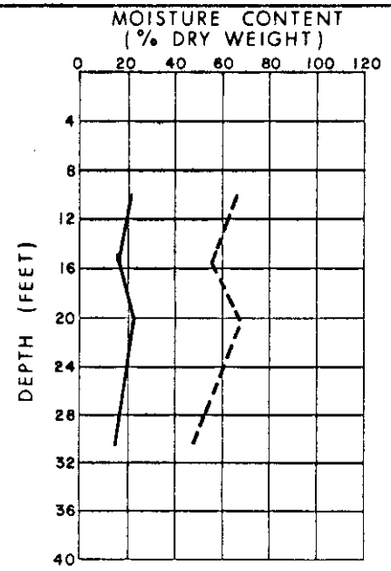
REGION 6N

TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES	MOISTURE CONTENT OF UNFROZEN MATERIAL	NO. OF VALUES
Ap	ALLUVIAL FLOODPLAIN SILT, SAND AND GRAVEL		2 225 4 225 7 224 10 216 15 195 20 74 30 47 40 32		2 114 4 193 7 193 10 181 15 141 20 47 30 28 40 14		2 0 4 0 7 0 10 7 15 14 20 2 30 3 40 3
At	ALLUVIAL TERRACE MAINLY SILT AND CLAY		2 261 4 261 7 261 10 261 15 254 20 47 30 19 40 5		2 194 4 255 7 254 10 253 15 233 20 33 30 16 40 6		2 0 4 0 7 0 10 3 15 7 20 2 30 2 40 0

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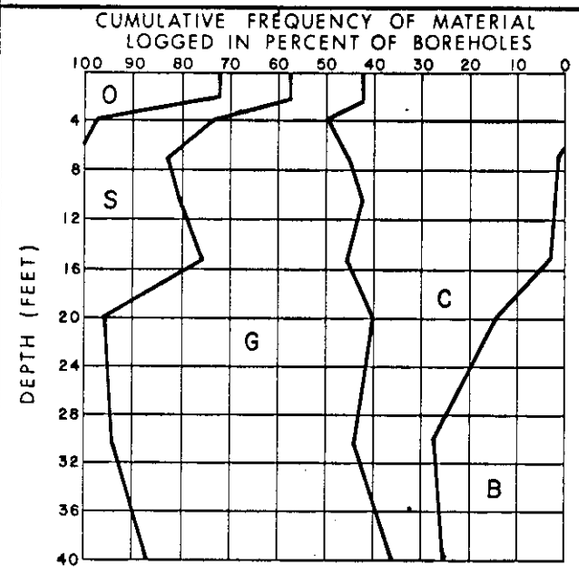
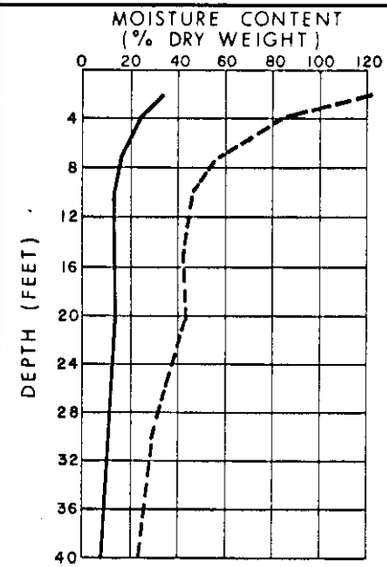
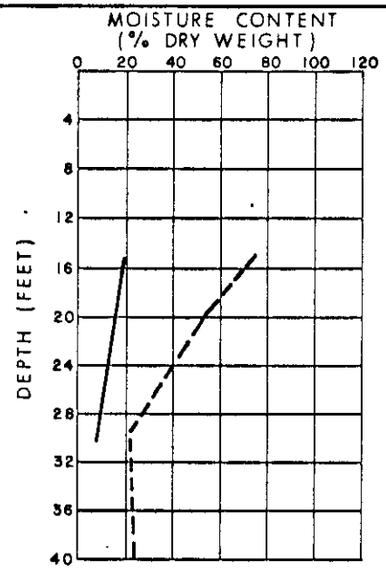
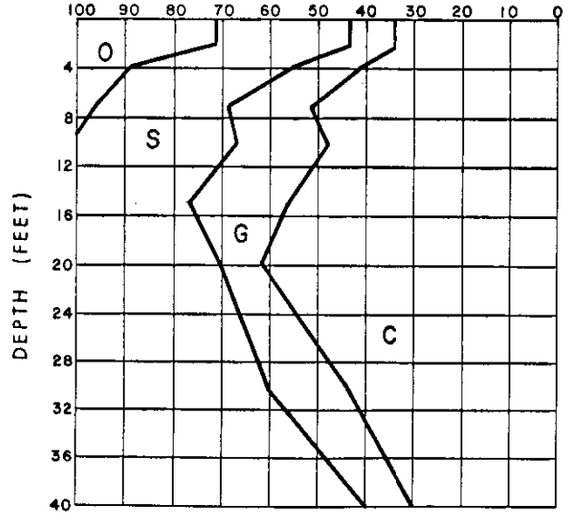
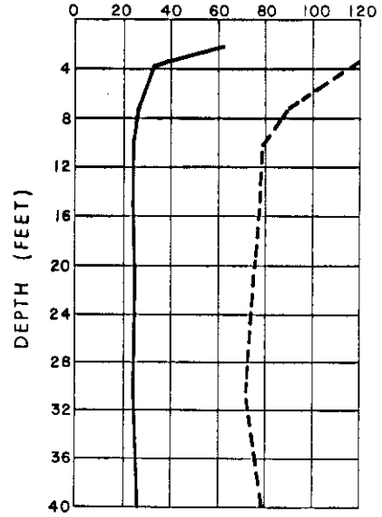
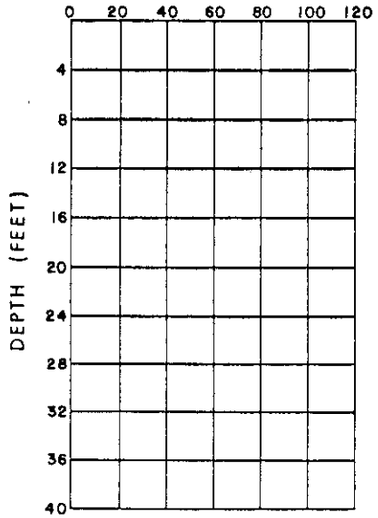
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES	MOISTURE CONTENT OF UNFROZEN MATERIAL	NO. OF VALUES
Cm	COLLUVIAL - SLOPEWASH CLAY AND GRAVEL OVER BEDROCK		2 97 4 97 7 97 10 97 15 91 20 27 30 18 40 8		2 56 4 88 7 88 10 87 15 69 20 18 30 7 40 2		2 0 4 0 7 0 10 0 15 9 20 3 30 1 40 2
Ct	COLLUVIAL - TALUS SLOPE MAINLY CLAY, MORE SAND AT DEPTH		2 61 4 61 7 61 10 58 15 56 20 31 30 18 40 10		2 25 4 58 7 58 10 52 15 52 20 27 30 16 40 8		2 4 7 10 15 20 30 40

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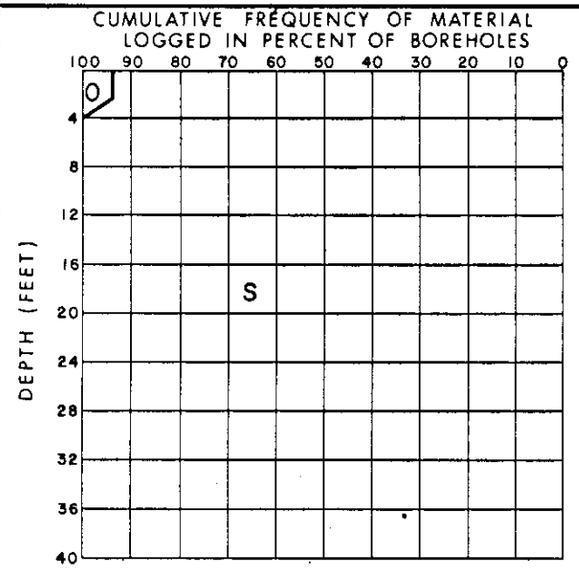
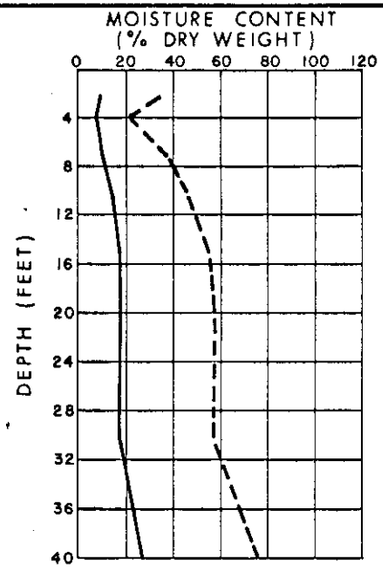
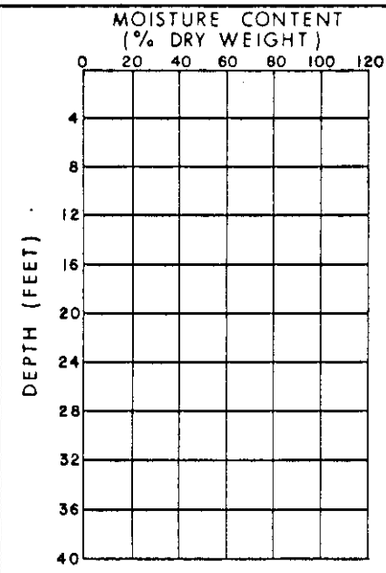
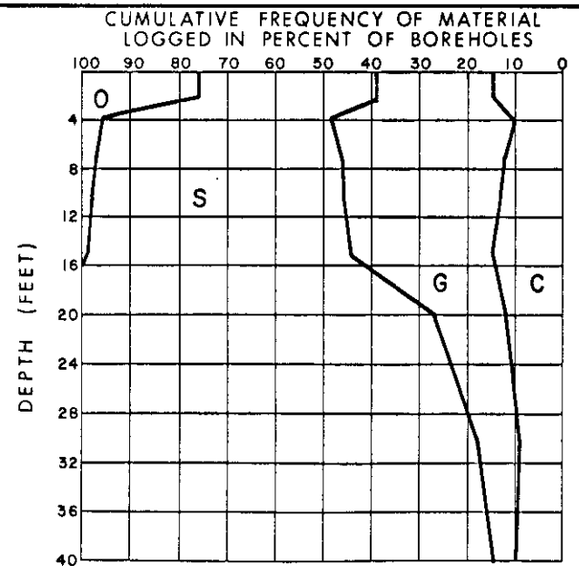
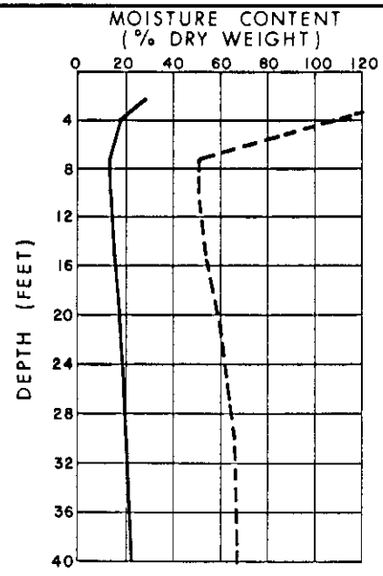
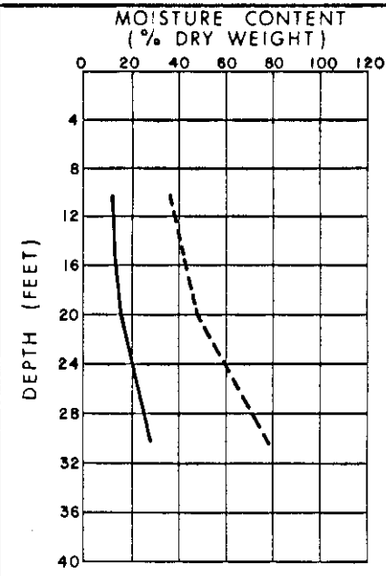
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES	MOISTURE CONTENT OF UNFROZEN MATERIAL	NO. OF VALUES
Ed	EOLIAN DUNES SAND		2 18 4 18 7 18 10 18 15 18 20 18 30 17 40 6		2 16 4 18 7 18 10 18 15 18 20 18 30 17 40 6		2 4 7 10 15 20 30 40
Go	GLACIAL OUTWASH MAINLY SAND, SOME GRAVEL AND MINOR CLAY		2 276 4 276 7 276 10 243 15 207 20 81 30 44 40 20		2 148 4 250 7 230 10 209 15 168 20 65 30 37 40 17		2 0 4 0 7 0 10 4 15 7 20 6 30 2 40 0

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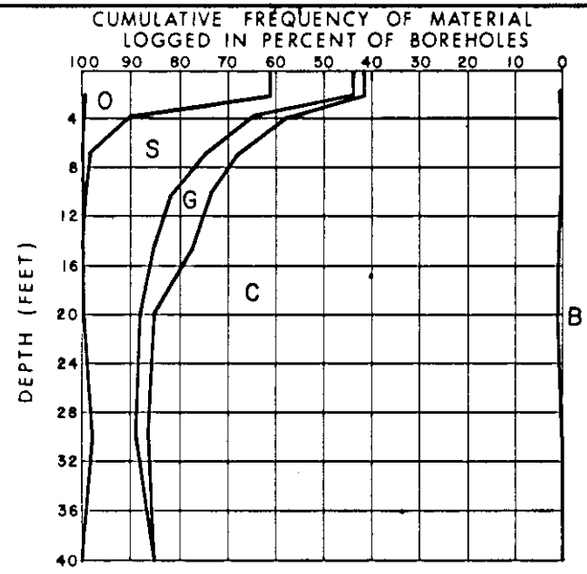
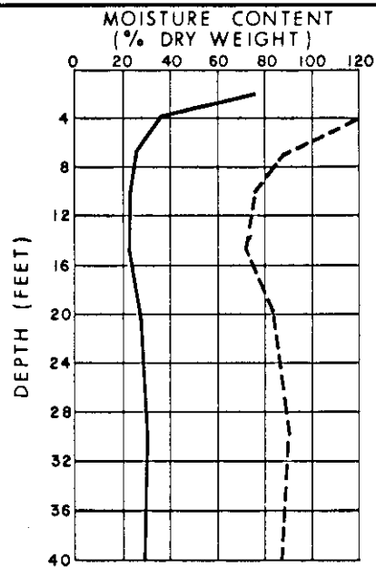
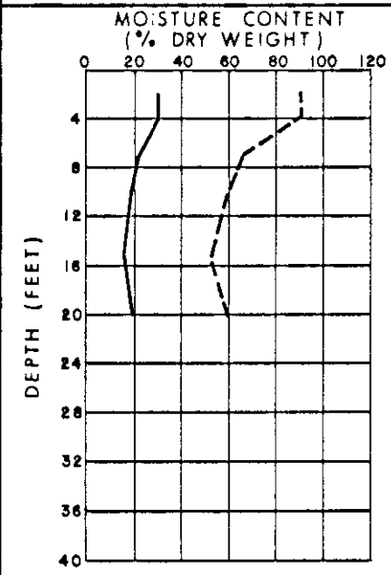
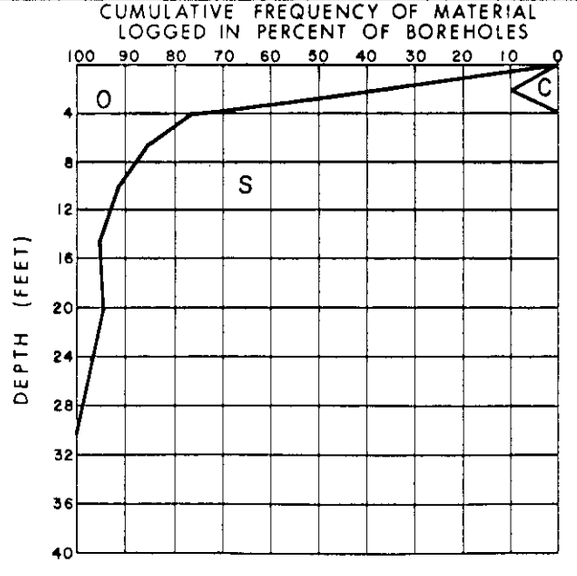
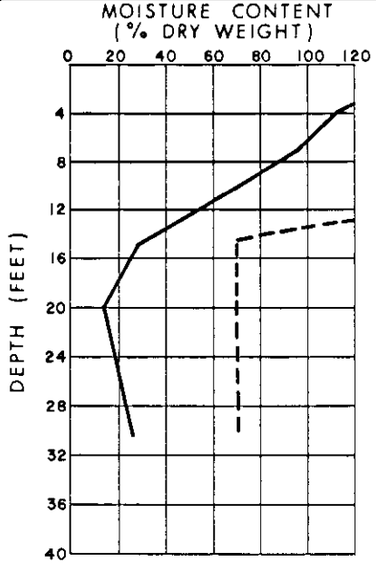
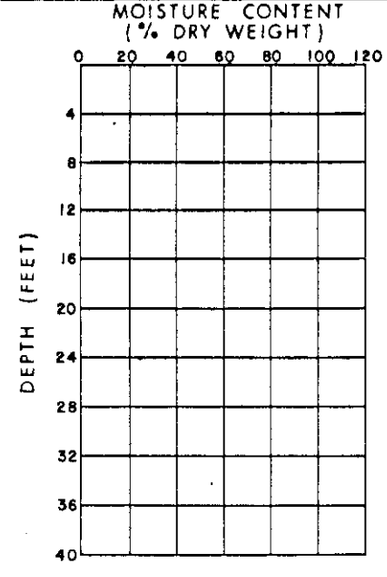
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES	MOISTURE CONTENT OF UNFROZEN MATERIAL	NO. OF VALUES
Lp	LACUSTRINE BASIN MAINLY CLAY		2 427 4 427 7 426 10 423 15 416 20 187 30 58 40 7		2 243 4 395 7 405 10 393 15 378 20 162 30 49 40 4		2 1 4 1 7 3 10 11 15 20 20 7 30 0 40 0
Lp.Ed	LACUSTRINE WITH EOLIAN DUNES ORGANIC OVER SAND		2 22 4 22 7 22 10 22 15 22 20 16 30 1 40 0		2 18 4 20 7 22 10 22 15 22 20 16 30 1 40 0		2 4 7 10 15 20 30 40

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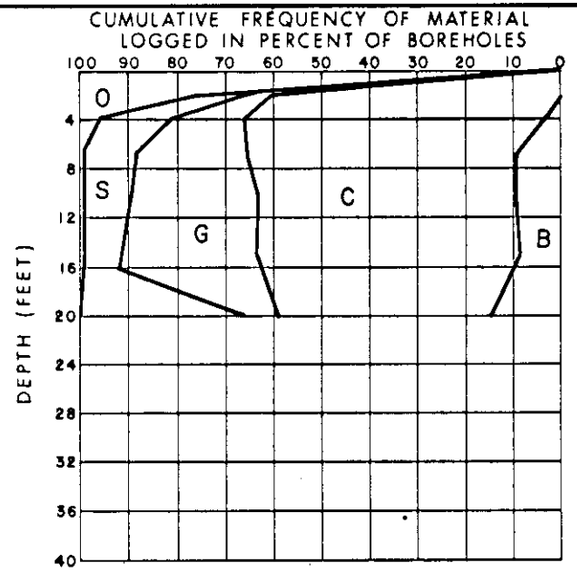
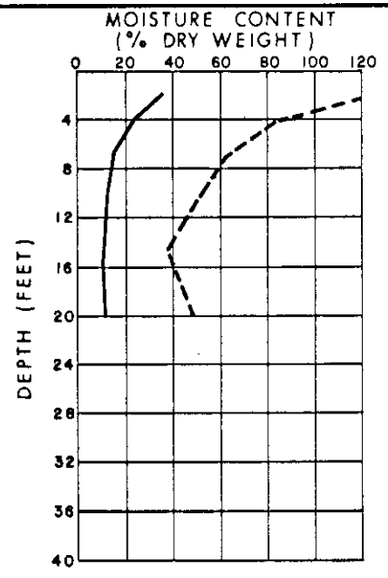
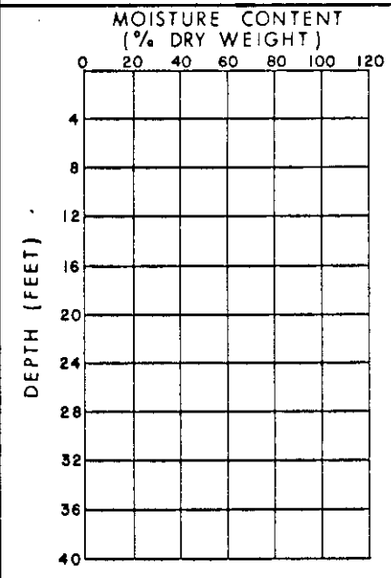
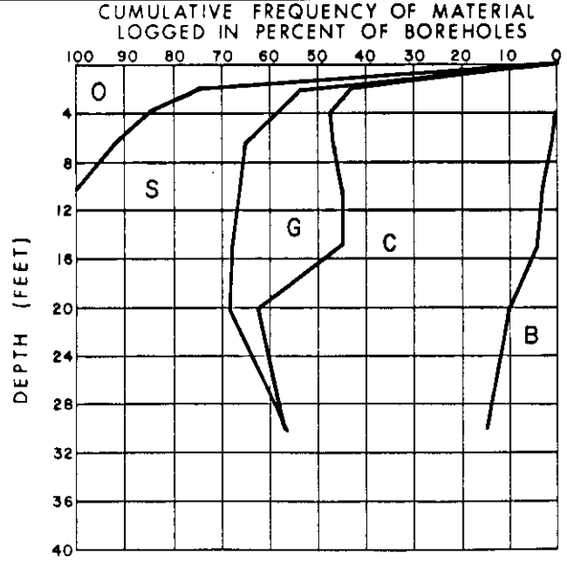
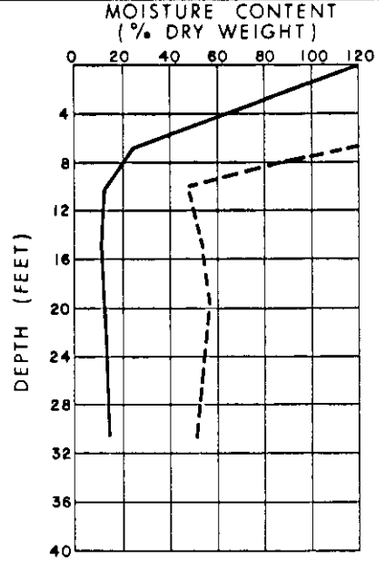
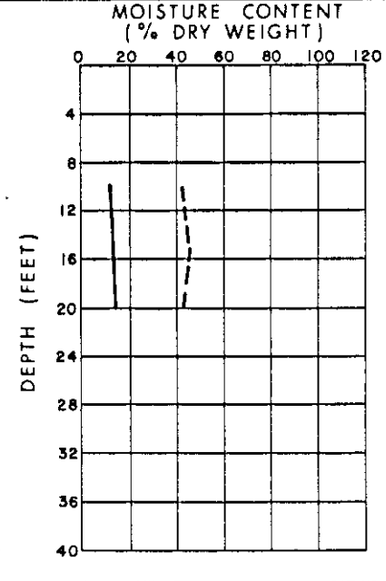
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES	MOISTURE CONTENT OF UNFROZEN MATERIAL	NO. OF VALUES
Lp/Mg	LACUSTRINE BASIN OVER GROUND MORAINE MAINLY CLAY, MINOR GRAVEL		2 116 4 116 7 116 10 113 15 110 20 13 30 0 40 0		2 93 4 107 7 112 10 109 15 97 20 10 30 0 40 0		2 4 7 10 15 20 30 40
Mg	GROUND MORAINE MAINLY CLAY AND SAND		2 85 4 85 7 85 10 84 15 82 20 29 30 7 40 0		2 44 4 76 7 81 10 78 15 71 20 26 30 6 40 0		2 0 4 0 7 3 10 6 15 1 20 0 30 0 40 0

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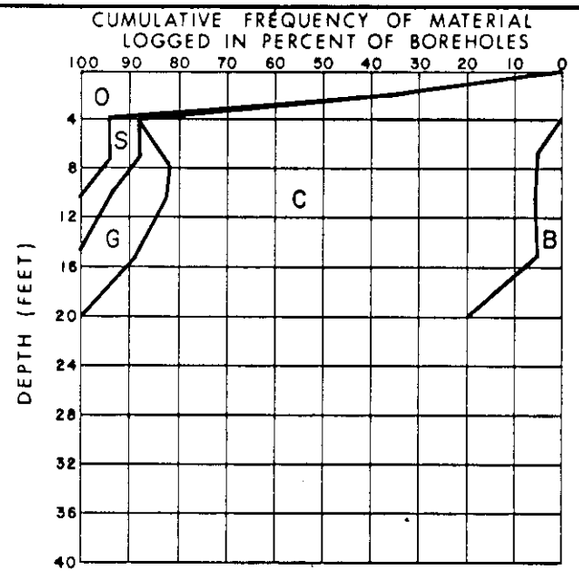
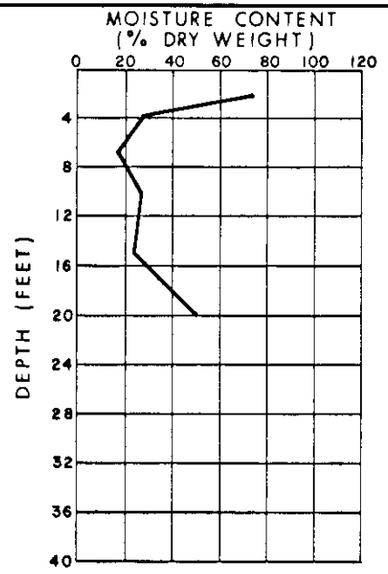
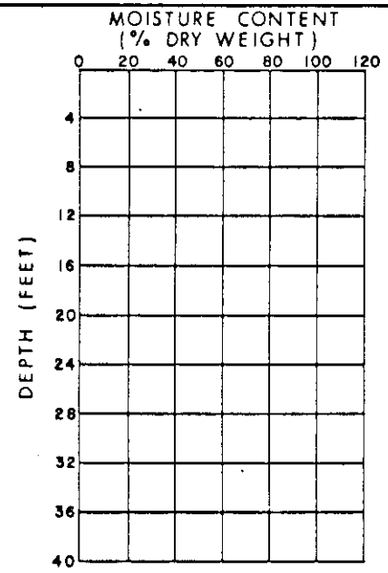
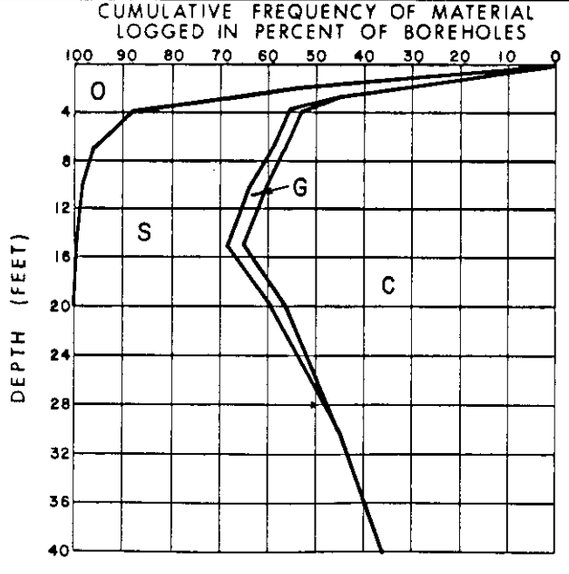
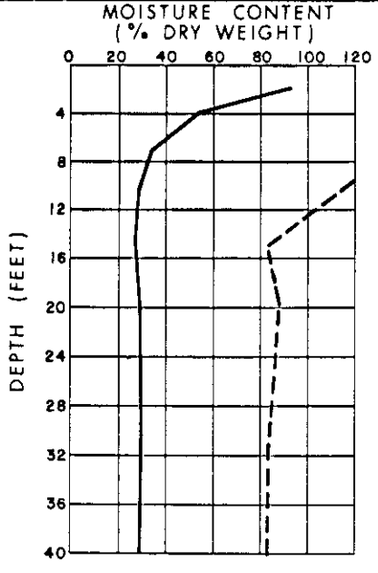
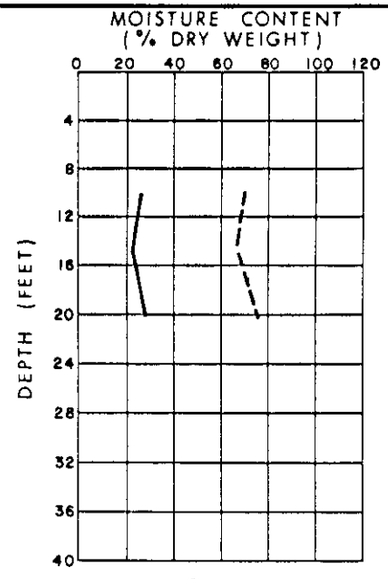
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES	MOISTURE CONTENT OF UNFROZEN MATERIAL	NO. OF VALUES
Mg / R	GROUND MORAINE OVER BEDROCK MAINLY CLAY OVER BEDROCK		2 17 4 17 7 17 10 17 15 17 20 5 30 0 40 0		2 15 4 16 7 16 10 16 15 14 20 4 30 0 40 0		2 4 7 10 15 20 30 40
Ou / Lp	ORGANIC OVER LACUSTRINE BASIN ORGANIC OVER MAINLY CLAY AND SAND		2 474 4 474 7 473 10 468 15 461 20 211 30 90 40 19		2 260 4 426 7 438 10 434 15 434 20 180 30 85 40 18		2 0 4 0 7 1 10 6 15 15 20 3 30 0 40 1

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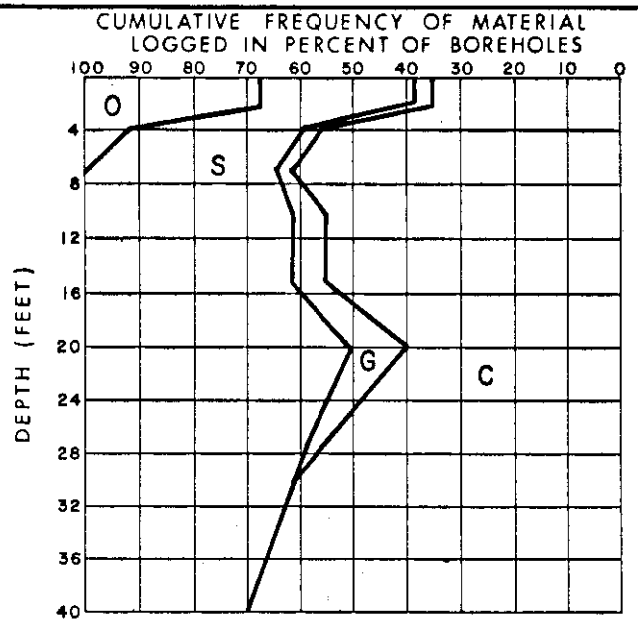
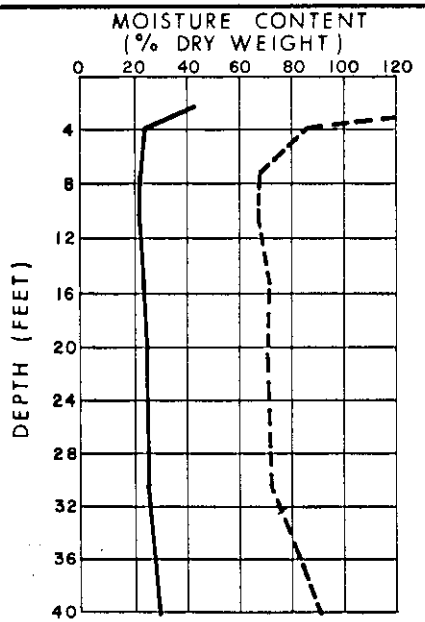
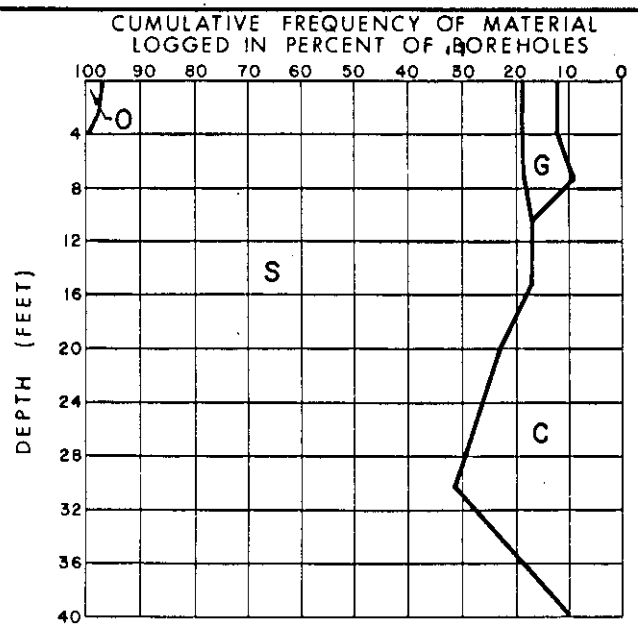
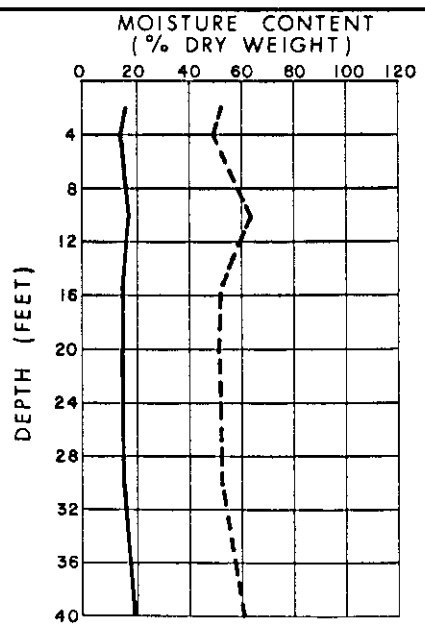
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
At	**ALLUVIAL TERRACE** MAINLY SAND AND CLAY		2 34 4 34 7 34 10 33 15 33 20 18 30 13 40 10		2 6 4 14 7 25 10 22 15 22 20 11 30 6 40 5
Go	**GLACIAL OUTWASH** MAINLY SAND		2 32 4 32 7 32 10 30 15 30 20 17 30 16 40 10		2 11 4 24 7 25 10 25 15 23 20 12 30 10 40 6

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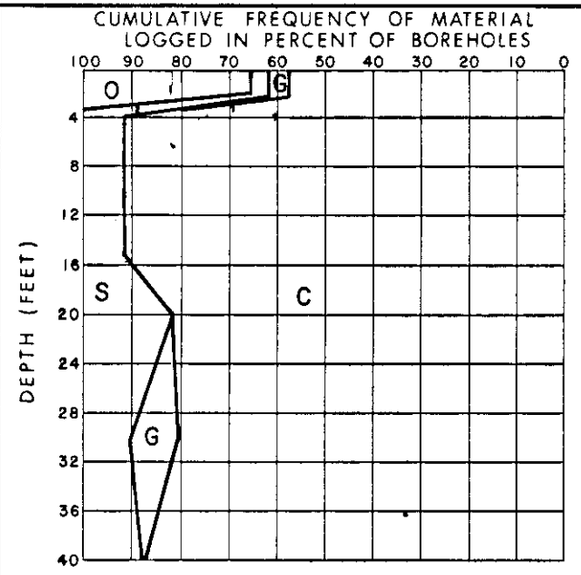
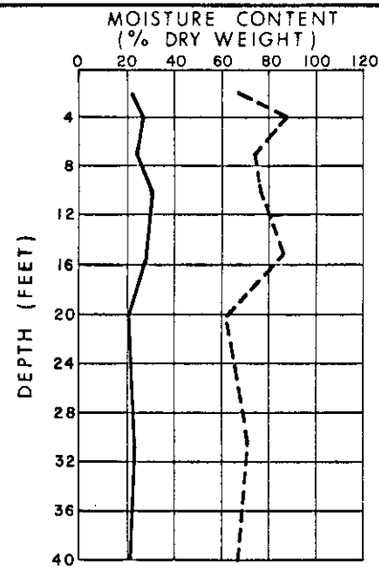
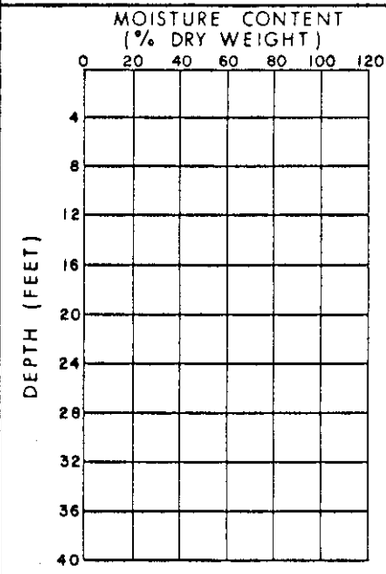
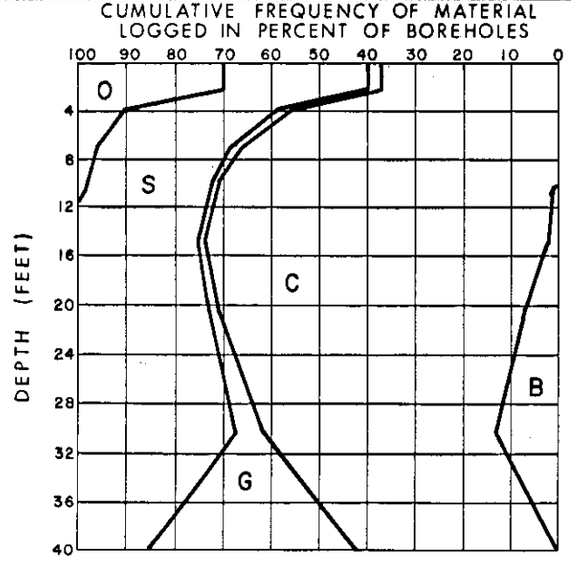
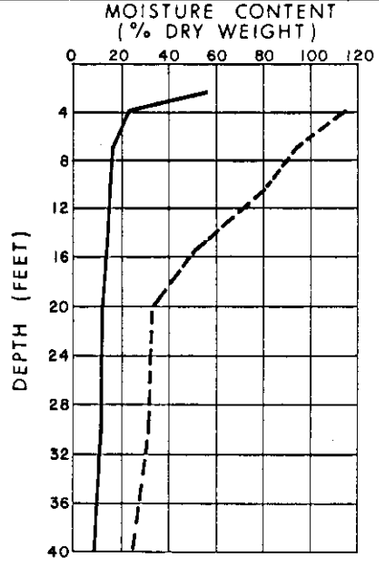
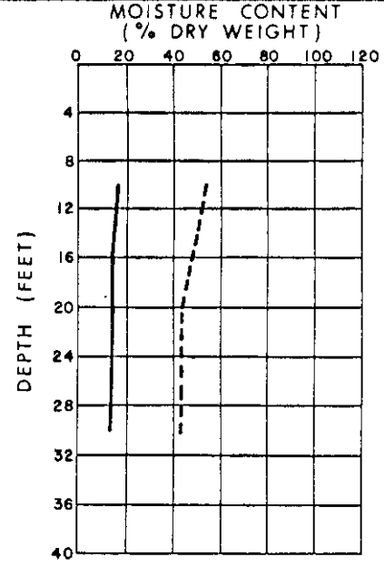
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES	MOISTURE CONTENT OF UNFROZEN MATERIAL	NO. OF VALUES
Lp	LACUSTRINE BASIN MAINLY CLAY		2 26 4 26 7 25 10 25 15 23 20 16 30 10 40 8		2 13 4 16 7 16 10 16 15 12 20 8 30 5 40 2		2 4 7 10 15 20 30 40
Mg	GROUND MORAINE MAINLY CLAY AND SAND OVER BEDROCK		2 489 4 486 7 477 10 467 15 460 20 161 30 96 40 7		2 98 4 366 7 385 10 394 15 368 20 112 30 62 40 3		2 0 4 0 7 0 10 7 15 11 20 8 30 5 40 1

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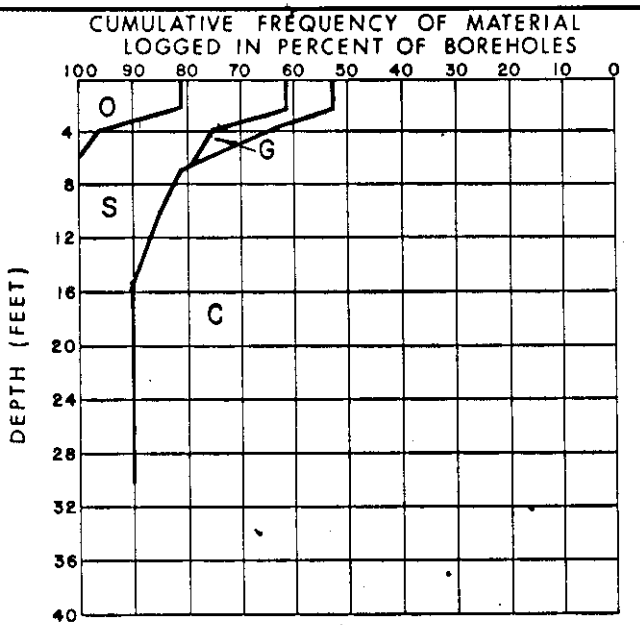
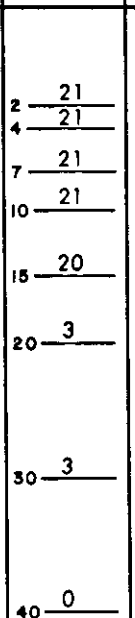
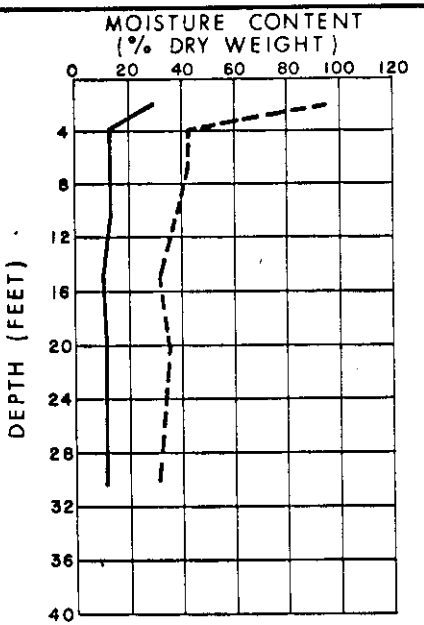
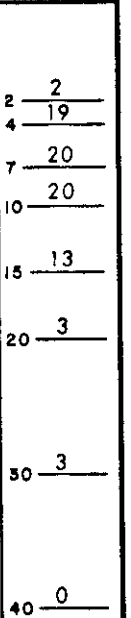
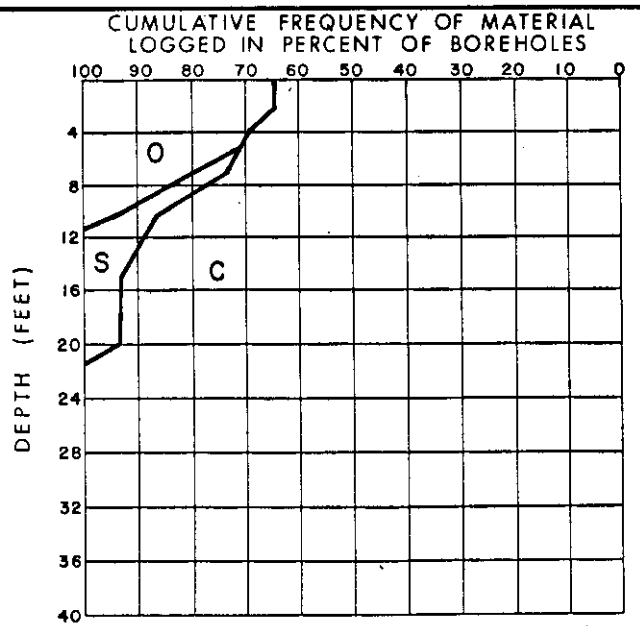
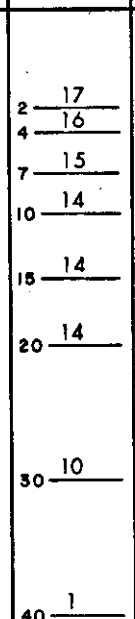
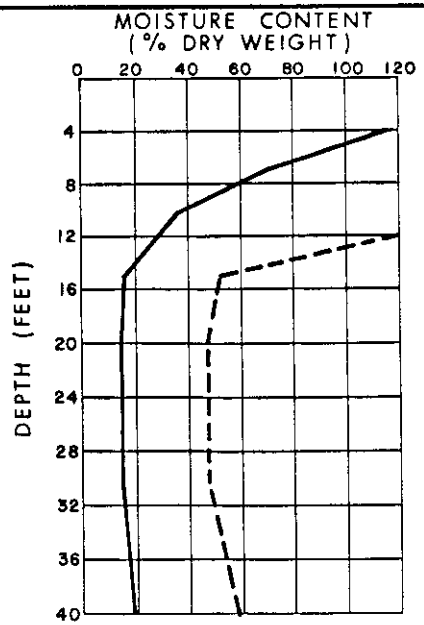
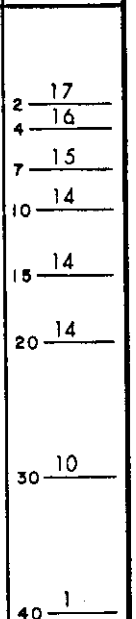
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Mg.Lp / Mg	GROUND MORAINE WITH LAKE BASIN OVER GROUND MORAINE MAINLY CLAY				
Mg / R	GROUND MORAINE OVER BEDROCK MAINLY CLAY				

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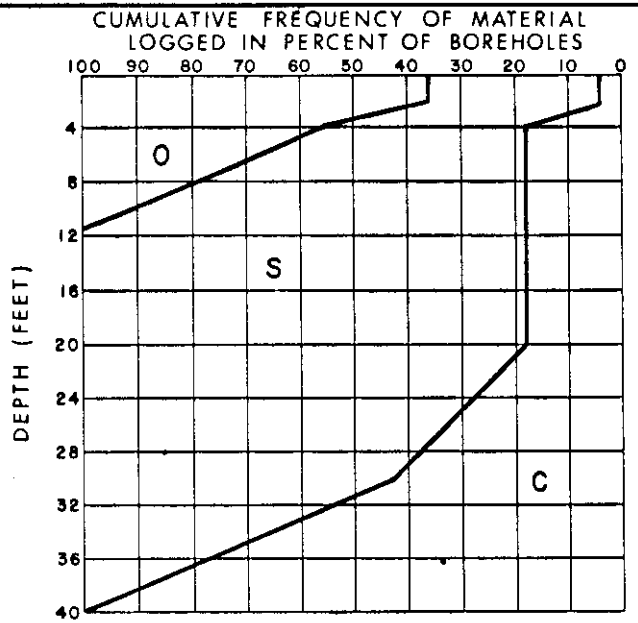
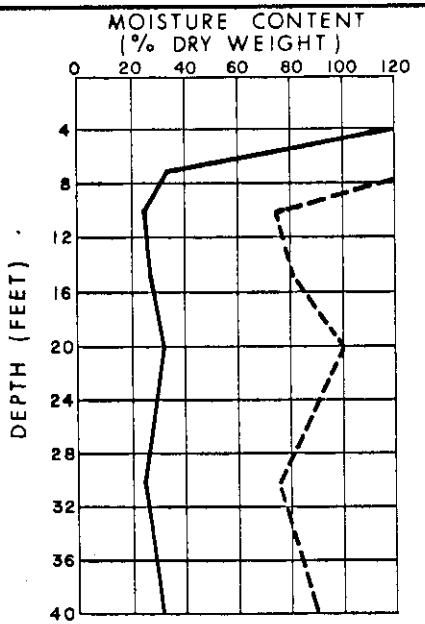
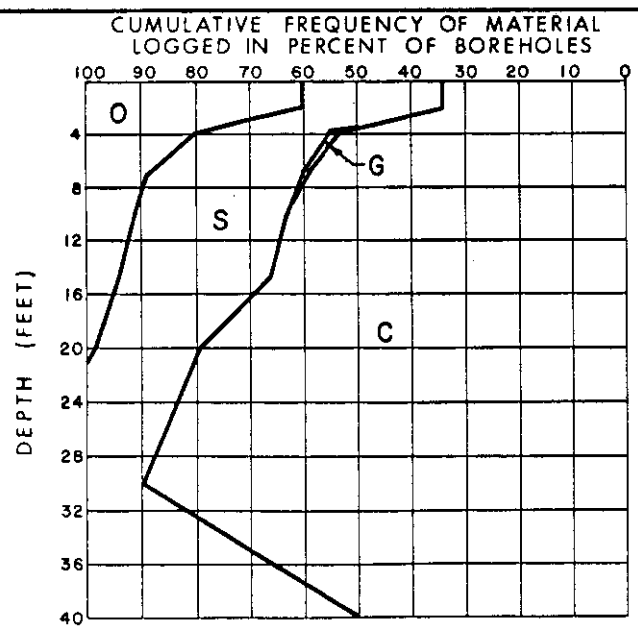
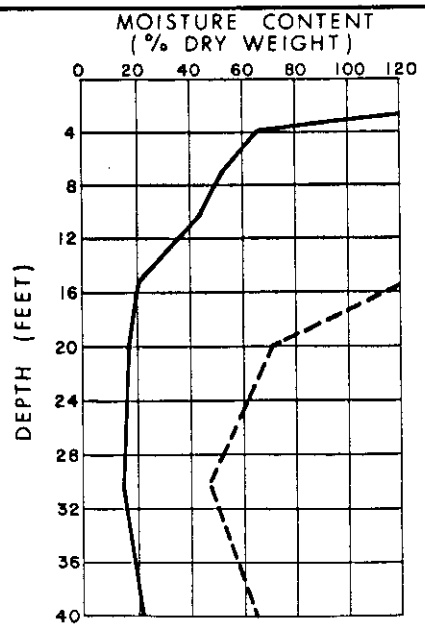
TERRAIN TYPE	MATERIAL TYPE	BOREHOLE STRATIGRAPHY	NO. OF BORE-HOLES	MOISTURE CONTENT	NO. OF VALUES
Ou/Lp	ORGANIC OVER LACUSTRINE BASIN ORGANIC OVER SAND OVER CLAY		2 11 4 11 7 11 10 11 15 11 20 11 30 7 40 2		2 8 4 11 7 11 10 9 15 10 20 6 30 6 40 2
Ou/Mg	ORGANIC OVER GROUND MORAINE MAINLY CLAY		2 128 4 128 7 126 10 124 15 119 20 55 30 28 40 2		2 34 4 105 7 105 10 110 15 102 20 39 30 23 40 1

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