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PAPERS AND DISCUSSIONS

Page

Boring Data From Greater Boston. Section 1: Boston Peninsula. *Committee on Subsoils of Boston* 391

The Limestone Air Force Base.

Design and Construction of Runways, Taxiways and Parking Apron. *John E. Allen* 458

Drainage, Water Supply and Sewerage. *Elliot F. Childs* 466

Buildings. *John Wm. Leslie* 476

Colonel Charles Rice Cow 483

OF GENERAL INTEREST

Proceedings of the Society 486

Annual Reports 492

CONTENTS AND INDEX—VOLUME 36, 1949

Contents

Index

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BORING DATA FROM GREATER BOSTON

Section 1: Boston Peninsula

PREPARED BY COMMITTEE ON SUBSOILS OF BOSTON

THE Committee on Subsoils of Boston has existed for many years. Under the chairmanship of Harry E. Sawtell from 1920 to 1939, this committee was active in collecting boring data and a report which many members of the Society still are using was published in the JOURNAL of September, 1931. This report also contains comments on groundwater conditions. An earlier treatise on "Boston Foundations", which was published by J. R. Worcester in the JOURNAL in 1914, also contained boring data.

In the years immediately subsequent to 1931, much boring data was accumulated by the Committee in cooperation with the Emergency Planning and Research Bureau, Inc., and smaller amounts have been collected in more recent years. Also a series of maps was prepared to show locations of borings in the following general areas: Boston Peninsula, Brighton, Brookline, Cambridge, Charlestown, Chelsea, Dorchester, East Boston, Everett, Hyde Park, Roxbury, Somerville, South Boston and West Roxbury. These data and maps have been available for reference in the Society rooms but they have not been published. The aim of the series of articles, of which this is the first, is to make available to the profession in better and more convenient form this information on subsurface conditions in the Boston region.

It is proposed that other sections will be published at fairly frequent intervals in the JOURNAL. Also consideration is being given to the inclusion of other subsurface data. In a later section, it is

proposed to give a summary of the geological features which have bearing on subsoil conditions.

Since the borings represented are from many sources, it is inevitable that the terminology used will not be entirely consistent. It is believed, however, that the various terms used for describing soil types are in reasonable agreement with those most commonly used and with those given in the Building Code of the City of Boston, 1944 edition, page 234.

The tabulation which follows covers the Boston Peninsula and includes 1556 borings and 6 open-cut excavations to bedrock. Accompanying this report is Map No. 1, showing locations of all borings and excavations covered by the tabulation. A key to boring notations is given on the map. Column 1 of the tabulation contains two items, the boring number and the coordinates defining the location on the map. Columns 2 and 3 give elevations or depths; elevations always are given with plus or minus signs and refer to Boston City Base (5.65 feet below mean sea level), whereas depths are used when elevations are not known and it is to be noted that figures without sign always represent depths. In the final column soil types are given.

MILES N. CLAIR
IRVING B. CROSBY
STANLEY M. DORE
LAWRENCE G. ROPES
DONALD W. TAYLOR, *Chairman*
Committee on Subsoils of Boston

May 26, 1949

No. and location	Elevations or depths From	To	Formation
1	+18.0	+ 8.5	Gravel fill
F6	+ 8.5	+ 3.5	Shells, gravel, silt
	+ 3.5	+ 2.0	Hard blue clay
2	+16.0	— 1.5	Fill; sand, gravel, clay
F6	— 1.5	—10.5	Soft silt
	—10.5	—12.0	Soft peat
	—12.0	—15.0	Blue clay, gravel
3	+16.5	+ 2.5	Fill; sand, gravel, clay, ash, brick
C6	+ 2.5	— 0.5	Stiff yellow clay
4	+15.5	— 6.5	Fill; sand, gravel, clay, ash, brick
D6	— 6.5	— 9.5	Stiff yellow clay
5	+20.0	+15.0	Yellow sand, gravel
K9	+15.0	+ 9.0	Little sand and gravel, rubbish fill
	+ 9.0	+ 3.5	Blue clay, very little gravel fill and sand
	+ 3.5	— 1.5	Silt, shells, rubbish
	— 1.5	— 5.0	Black silt, very little sand and gravel
	— 5.0	—35.0	Fairly stiff blue clay
	—35.0	—49.0	Clay, little sand and gravel
	—49.0	—58.5	Hard sand, clay, very little gravel
	—58.5	—59.5	Soft rock
	—59.5	unknown	Rock
6	+16.0	+ 7.0	Dirt fill
G8	+ 7.0	+ 1.0	Fine sand and silt
	+ 1.0	— 2.0	Hard clay
7	+16.5	+ 8.5	Dirt fill
G8	+ 8.5	+ 1.5	Silty sand
	+ 1.5	— 1.5	Hard clay
8	+16.0	+13.0	Dirt fill
G8	+13.0	+ 0.0	Peat, silty sand
	+ 0.0	— 7.0	Hard clay
9	+15.5	+ 1.5	Dirt fill
H8	obstruction encountered		
10	+15.2	+ 3.0	Dirt fill
I8	+ 3.0	— 5.0	Silt, sand
	— 5.0	—10.0	Hard yellow clay
11	+18.0	+ 8.0	Fill; sand, gravel, brick
M5	+ 8.0	+ 1.0	Black silt
	+ 1.0	— 1.5	Sand, gravel
	— 1.5	— 3.5	Silt, peat
	— 3.5	—12.5	Hard brown clay
12	+18.0	+15.0	Dirt fill
C5	+15.0	+ 9.0	Coarse red sand
	+ 9.0	— 3.0	Fine sand and gravel
	— 3.0	— 5.0	Coarse sand and gravel
13	Surface	12	Sand fill
D2	12	17	Fine silty sand, mud
	17	30	Hard packed coarse sand
	30	41	Fine sand, little clay

No. and location	Elevations or depths From	To	Formation
14	+14.0	— 9.0	Fill
E2	— 9.0	—14.0	Mud
	—14.0	—24.0	Coarse sand, gravel
15	Surface	14	Sand and gravel fill
E2	14	19	Fine silty sand
	19	25	Coarse sand, gravel
16	Surface	19	Fill
D2	19	22	Mud
	22	36	Sand and gravel, hard
	36	—	Hard pan (not till)
17	Surface	17	Gravel fill
E2	17	18	Mud
	18	32	Sand, gravel
18	+17	+10	Ash and brick fill
F5	+10	+ 9	Concrete floor
	+ 9	—10	Ash and brick fill
	—10	—33	Dock mud
	—33	—38	Blue clay
19	Surface	8.9	Fill
C9	8.9	29.0	Mud
	29.0	38.0	Hard clay
	38.0	50.0	Hard clay
20	+18	— 1	Fine soft sand fill
E3	— 1	— 7	Silt, peat, little sand
	— 7	—18	Fine silty sand, gravel
	—18	—23	Silty sand, harder
	—23	—28	Fine sand, little gravel and clay
	—28	—31	Same, harder
	—31	—36	Stiff blue clay
21	+23	+21	Cinder fill
E3	+21	+17	Gravel fill
	+17	+ 5	Fine sand fill
	+ 5	— 2	Silt, little sand and peat
	— 2	—10	Hard sand and gravel
	—10	—20	Fine sand
	—20	—24	Stiff blue clay
22	+14	+ 3	Fill
D3	+ 3	— 3	Mud
	— 3	—17	Sand
	—17	—26	Hard clay
	—26	—42	Soft clay
23	+18 (sidewalk)	— 0	Space
D3	— 0	— 9	Sand and gravel fill
	— 9	—21	Silt
	—21	—26	Very hard sand and gravel
24	Surface	6	Sand
E4	6	11	Sand, gravel
	11	15	Mud, sand
	15	39	Sand
	39	50	Clay
25	+18	— 2	Fill
F3	— 2	— 9	Mud
	— 9	—22	Hard packed sand and gravel

No. and location	Elevations or depths From	To	Formation
26	+15	−14	Sand fill
G3	−14	−23	Mud
	−23	−29	Sand, gravel
27	Surface	16	Sand and gravel fill
G3	16	40	Fine sand
28	+33	+15	Sand and gravel fill
F4	+15	+ 1	Silt
	+ 1	− 5	Hard blue clay
29	+14	+ 9	Fill
D4	+ 9	+ 2	Soft mud
	+ 2	−16	Rocks and gravel, hard
30	Surface	4	Fill
B8	4	22	Medium hard clay, sand
	22	35	Soft blue clay
31	+ 7	− 3	Sand
C4	− 3	−11	Sand, gravel, rocks
32	+18	−10	Fill
C5	−10	−14	Compressed mud
	−14	−20	Fine compact sand
33	+18	− 1	Sand and gravel fill
E5	− 1	−18	Mud
	−18	−29	Blue clay
34	+18	− 1	Gravel fill
F5	− 1	−23	Mud
	−23	−28	Blue clay
35	+28	+ 2	Sand and gravel fill
F5	+ 2	−22	Silt
	−22	−27	Hard blue clay
36	+18	− 3	Sand and gravel fill
F4	− 3	−24	Soft mud
	−24	−26	Clay
	−26	−42	Tough blue clay
37	+15	+ 7	Loamy sand fill
H4	+ 7	−10	Fine sand and gravel fill
	−10	−28	Silt, fine sand, shells
	−28	−34	Hard sand and gravel
38	Surface	18	Fill
H4	18	32	Fine silty sand, mud
	32	50	Hard blue clay, sandy silt
39	+18	+16	Loam fill
G5	+16	+ 9	Sand and gravel fill
	+ 9	+ 3	Sand fill
	+ 3	− 1	Silt, very fine sand
	− 1	− 7	Fine sand and silt
	− 7	−12	Peaty silt, shells
	−12	−16	Stiff blue clay
	−16	−22	Stiff yellow clay
40	+18	− 1	Fill; sand, gravel,
H4			wood
	− 1	− 5	Fill; sand, gravel
	− 5	−19	Mud
	−19	−33	Blue clay
41	Surface	20	Fill
H4	20	28	Fine silty sand, mud
	28	40	Clay, sand, stones
42	Surface	15	Fill
H5	15	17	Mud
	17	23	Clay, sand
	23	32	Clay
43	− 2	−22	Silt
G5	−22	−37	Medium clay
	−37	−52	Fine sand
	−52	−82	Medium clay
	−82	−102	Stiff clay, gravel (probably till)
44	+10.7	− 3.3	Fill
G5	− 3.3	−12.3	Silt, sand, shells
	−12.3	−14.3	Peat
	−14.3	−17.3	Hard blue clay, fine sand
	−17.3	−23.3	Hard yellow clay, fine sand
45	+18	+ 6	Fill
H5	+ 6	+ 4	Mud
	+ 4	+ 2	Fine sand
	+ 2	−11	Mud
	−11	−16	Clay
	−16	−48	Fine sand
46	+15.0	+ 5.5	Yellow clay
G9	+ 5.5	− 3.0	Mud
	− 3.0	− 5.0	Blue clay
47	+12.4	− 7.5	Loose sand and gravel fill
G5			
	− 7.5	−23.0	Soft sand, silt, shells
	−23.0	−31.0	Stiff blue clay
	−31.0	−38.0	Rather soft blue clay
	−38.0	−42.0	Blue clay, sand, gravel
	−42.0	−88.0	Medium blue clay
48	Surface	20	Fill
F5	20	41	Dock mud
	41	50	Hard blue clay
49	+15	+ 1	Fill
H5	+ 1	− 7	Mud, sand
	− 7	−14	Fine sand
	−14	−32	Hard clay
50	Surface	16	Fill
H5	16	24	Clay, fine sand
	24	48	Medium blue clay
51	+ 9.5	+ 0.5	Fill
	(Basement floor)		
H5	+ 0.5	− 4.5	Hard yellow clay
	− 4.5	−30.5	Very fine sand, trace of clay
	−30.5	−51.5	Soft blue clay
52	Street	13	Fill
H5	13	30	Mud
	30	35	Gray sand, clay
	35	52	Yellow sand, clay
53	+12	−10	Fill
I4	−10	−14	Black mud
	−14	−23	Mud, sand
	−23	−30	Sand, gravel
	−30	−43	Blue clay
54	+12	−11	Fill
I4	−11	−25	Soft mud, little sand
	−25	−33	Rocks and gravel, very hard (till)

No. and location	Elevations or depths From	To	Formation
55	Bottom of pit		Fill
I4	5	21	Soft peat mud
	21	33	Soft dock mud
	33	40	Coarse sand, gravel
56	+12	− 3	Fill
I4	− 3	− 6	Soft black silt, sand
	− 6	−11	Black silt, little very fine sand
	−11	−15	Silt, fine sand
	−15	−23	Soft silt, very little fine sand
	−23	−27	Silty peat, little fine sand
	−27	−28	Rather loose sand, gravel, little peat
	−28	−31	Firm sand, gravel, little clay
	−31	−34	Stiff blue clay, very little fine sand
57	Surface	16	Fill
I4	16	23	Peat mud
	23	67	Sand, mud
	67	72.5	Clay, gravel
58	+12	− 7	Fill
I4	− 7	−13	Mud
	−13	−15	Sand, gravel
	−15	−21	Clay
59	+18 (Sidewalk) (+18)	+10	Space
I4	+10	+ 8	Fill
	+ 8	+ 5	Silt
	+ 5	+ 4	Sand, little gravel
	+ 4	− 2	Stiff blue clay, little gravel
60	+18 (Sidewalk) (+18)	+ 8	Basement
I4	+ 8	+ 0	Sand and gravel fill
	+ 0	− 9	Silt
	− 9	−10	Stiff clay, gravel
	−10	−18	Stiff yellow clay, little fine sand
61	+18	+11.5	Mud
I4	+11.5	+10	Fill
	+10	+ 7	Mud, fill
	+ 7	−22	Silt
	−22	−32	Hard clay
62	Surface	18	Fill
I4	18	25	Mud
	25	31	Compact sand and gravel, little clay; struck rock
63	Basement	16	Fill
J3	16	25	Hard pan
64	+19	+10	Fill
K3	+10	− 1	Fill; clay, sand, gravel
	− 1	−10	Silt, fine sand, shells
	−10	−11	Soft blue clay
	−11	−16	Medium blue clay
65	+18	+ 3	Cinder fill
K3	+ 3	+ 0	Sand and gravel fill
	+ 0	−13	Soft silt, very little fine sand
	−13	−14	Silty peat
	−14	−16	Hard silty sand
	−16	−20	Hard blue clay
66	Surface	25	Fill
K3	25	33	Mud
	33	35	Soft clay
	35	52	Soft clay
67	Surface	24	Fill
K2	24	39	Mud
	39	60	Hard clay
68	Surface	18	Fill
K3	18	25	Fill
	25	30	Wood fill
	30	34	Clay, rocks
	34	44	Hard rocks, clay
69	+18	+ 3	Fill
K3	+ 3	−16	Dock mud
	−16	−19	Hard clay
70	Surface	9	Sand, rocks, mud
L3	9	21	Hard clay
	21	24	Sand, gravel, clay
71	+24	+19	Fill
K3	+19	+16	Silt
	+16	+13	Peat
	+13	+ 7	Stiff blue clay
72	Sidewalk	10	Fill
K5	10	36	Clay, sand
	36	52	Rocks, sand, clay (till)
73	+73.9	+65.4	Hard yellow sand, little clay
K5	+65.4	+64.4	Hard yellow clay, little sand
	+64.4	+62.4	Hard yellow sand, little clay
	+62.4	+60.6	Hard sand, gravel, clay
	+60.6	+49.4	Hard clay, little fine sand
	+49.4	+47.4	Hard sand, gravel
74	Grade	20	Fine sand
K5	20	38	Sand
	38	41	Hard clay
75	Surface	11	Hard compact gravel, rocks
K5	11	31	Coarse sand, gravel, little clay; hard pan at 31
76	Surface	5	Fill
L2	5	6	Mud, sand
	6	14	Mud
	14	15	Clay, sand
	15	30	Soft blue slate rock
77	+19.0	+11.5	Fill
L3	+11.5	+ 3.5	Mud
	+ 3.5	−14.0	Sand, gravel

No. and location	Elevations or depths From	To	Formation
78	+38	+37	Fill
L5	+37	+15	Firm yellow sand, very little clay
	+15	+ 8	Firm blue sand
79	+10	− 1	Fill
L3	− 1	− 4	Clay
	− 4	− 6	Fine sand
	− 6	−17	Blue clay
80	+15	+ 7	Fill
M3	+ 7	− 4	Loose sand
	− 4	− 8	Sand, gravel
	− 8	−29	Dark mud
	−29	−42	Hard blue clay
81	Surface	20	Fill
M4	20	40	Dock mud
	40	55	Hard blue clay
82	+ 8	+ 0	Fill
L4	+ 0	−15	Mud
	−15	−32	Hard clay
83	+18	+ 5	Fill
L4	+ 5	− 8	Mud
	− 8	−22	Hard clay
84	+18	+ 6	Fill
L4	+ 6	− 1	Mud
	− 1	−11	Clay, rocks
85	+18	+ 8	Old wood fill
M4	+ 8	− 5	Soft clay
	− 5	−17	Hard clay
86	+18	+14	Fill
M5	+14	+ 4	Silt
	+ 4	− 2	Hard blue clay
87	+12	+ 6	Fill
M4	+ 6	−12	Silt
	−12	−13	Peat
	−13	−17	Stiff blue clay, little sand
88	+18	+ 8	Fill
M4	+ 8	− 7	Old wood-mud fill
	− 7	−20	Fine silty sand, mud
	−20	−32	Hard blue clay
89	+18	+ 8	Fill; sand, gravel, clay
N4	+ 8	−28	Fine sand, silt, shells
	−28	−30	Silty sand, gravel
	−30	−35	Medium blue clay, fine sand
90	+18	+13	Sand and gravel fill
N4	+13	−28	Silt, little fine sand, shells
	−28	−31	Sand, little fine gravel, little silt
	−31	−37	Soft blue clay
91	+18	+ 4	Fill
M4	+ 4	−11	Dock mud, little sand
	−11	−24	Hard blue clay
92	+18	+ 8	Fill
M5	+ 8	−20	Soft mud
	−20	−24	Blue clay
93	+18	+11	Mud fill
N5	+11	− 3	Hard clay
94	+18	+ 6	Mud
M5	+ 6	−23	Blue clay
	−23	−32	Clay, rocks
	−32	−39	Soft slate rock
95	+12	+ 8	Stiff clay
M5	+ 8	−13	Clay, rocks, hard pan
96	+20	+12	Fill
O4	+12	+ 5	Fine silty sand
	+ 5	+ 0	Coarse sand
	+ 0	−10	Hard blue clay
97	−14	−21	Silty sand
O4	−21	−32	Hard yellow clay
	−32	−47	Medium blue clay
98	+25	+23	Fill
O5	+23	+ 5	Hard clay, rocks
99	Start	16	Sand, ashes, rocks, fill
O4	16	30	Hard blue sand
	30	37	Sand, clay
100	−16	−20	Soft mud
P4	−20	−42	Coarse sand, gravel
	−42	−56	Hard coarse sand, gravel
101	−24	−27	Silty sand
P4	−27	−30	Fine blue sand
	−30	−32	Medium yellow clay
	−32	−35	Medium blue clay
	−35	−54	Medium yellow clay
	−54	−74	Soft blue clay
102			Fill; clay, stones
P5			
103	Surface	13	Sand and gravel fill
P5	13	20	Silt
	20	25	Silty sand
	25	30	Hard yellow clay
104	Surface	9	Fill
O5	9	40	Hard clay, rocks
105	+20	+ 2	Fill
O6	+ 2	−15	Blue clay
106	Surface	23	Fill
O6	23	33	Clay
	33	50	Clay, sand, rocks
107	+18	+12	Fill
O6	+12	+ 7	Mud, old wood
	+ 7	− 8	Clay, gravel
108	Surface	22	Old wood, mud fill
N6	22	24	Clay, sand, rocks
	24	32	Hard clay
109	Surface	11	Clay and rock fill
O4	11	25	Ash and wood fill
	25	38	Coarse gravel, struck rock
110	+18	+ 1	Fill
N6	+ 1	−22	Clay, small stones

No. and location	Elevations or depths From	To	Formation
111 N6	+18	− 2	Fill
	− 2	− 7	Blue clay
112 M6	+15	+ 8	Fill; concrete, sand, wood
	+ 8	+ 7	Silt, gravel
	+ 7	+ 0	Medium yelow clay, little fine sand
	+ 0	− 3	Medium blue clay
	− 3	− 8	Compact sharp sand, little clay
	− 8	−10	Medium blue clay
113 L6	+30	+24	Fill
	+24	+20	Peat
	+20	+14	Soft blue clay, fine sand
	+14	+10	Fine sand, little gravel
	+10	+ 6	Loose fine sand, clay
	+ 6	− 5	Medium blue clay, sand
	− 5	−10	Hard sand, gravel, very little clay
114 G5	12±	−10	Fill
	−10	−18	Soft mud
	−18	−40	Hard clay
115 L6	+30	+28	Fill
	+28	+23	Sand, gravel
	+23	+19	Coarse sand
	+19	+ 5	Hard fine dry sand, coarse gravel
	+ 5	− 6	Dry cemented sand, clay, little gravel (hardpan)
	− 6	−14	Hard coarse sand, coarse gravel, little clay
	−14	−19	Cemented sand, gravel, clay
116	Bottom of cellar	9	Fill
L7	9	22	Stiff clay
	22	58	Soft clay
	58	68	Gray sand, little clay
117 L7	+16	+10	Fill
	+10	+ 1	Hard clay
	+ 1	−16	Medium blue clay
118 M6	+ 7	− 4	Sand, mud
	− 4	− 6	Clay
119 M7	+ 5	−12	Fill, mud
	−12	−20	Hard clay
	−20	−55	Medium hard clay
120 L7	+15	+ 3	Fill
	+ 3	+ 0	Silt, very fine sand
	+ 0	− 6	Hard yellow clay
	− 6	−11	Stiff yellow clay
121 M7	−18	−27	Mud
	−27	−68	Clay
	−68	−86	Clay, sand
	−86	−110	Clay
	−110		Bedrock

No. and location	Elevations or depths From	To	Formation
122 N6	+ 7	− 9	Mud
	− 9	−28	Hard clay, little fine sand
	−28	−43	Medium blue clay
123 N7	+15	− 5	Fill; sand, gravel, ash
	− 5	−20	Dock mud
	−20	−35	Hard blue clay
124 M6	Surface	16	Fill
	16	30	Mud, sand
	30	37	Hard yellow clay
125 L7	Basement area	6	Fill
	6	27	Hard clay, rocks
	27	34	Hard yellow clay
	34	50	Medium blue clay
126 M7	+ 8	− 5	Fill
	− 5	−13	Dock mud
	−13	−20	Hard yellow clay
	−20	−48	Medium hard blue clay
127 M7	+15	− 4	Fill
	− 4	−22	Dock mud
	−22	−35	Hard blue clay
128 M7	+14	− 8	Clay and stone fill
	− 8	−15	Dock mud
	−15	−34	Hard blue clay
129 N7	+15	+ 2	Water
	+ 2	− 2	Soft silt
	− 2	− 9	Silt, little fine sand
	− 9	−19	Soft silt
	−19	−20	Peat
	−20	−28	Stiff blue clay
	−28	−42	Stiff blue clay
130 N7	Surface	32	Soft fill, dock mud, sand
131 N7	+14	+ 2	Fill
	+ 2	−17	Silt, fine sand, shells
	−17	−18	Soft blue clay
	−18	−29	Medium clay, blue and yellow
132 L7	Surface	5.0	Fill
	5.0	10.3	Peat
	10.3	15.2	Hard yellow clay
	15.2	16.5	Fine yelow sand, little clay
	16.5	28.0	Medium blue clay
	28.0	32.3	Medium blue clay, fine sand
	32.3	52.3	Medium blue clay
	52.3	58.5	Medium blue clay, fine sand
	58.5	65.0	Hard sand, gravel, clay
133 L7	+ 2	− 5	Fill
	− 5	− 7	Mud
	− 7	−16	Clay, rocks
	−16	−43	Medium hard blue clay
134 L7	+12	+11	Fill
	+11	+ 2	Hard blue clay
	2	− 6	Medium blue clay
	− 6	−13	Hard sand, gravel, very little clay

No. and location	Elevations or depths From	To	Formation
135	+ 2	+ 0	Concrete
L7	+ 0	− 4	Hard yellow clay
	− 4	− 6	Medium blue clay
	− 6	−10	Medium blue clay, little fine sand
	−10	−16	Medium blue clay
	−16	−18	Fine clay, gravel
136	Surface	10	Fill, hard
M8	10	18	Mostly old wood
	18	33	Clay and rocks, hard
137	−11.5	−19.5	Silt, miscellaneous fill
L8	−19.5	−21.5	Medium blue clay, little fine sand
	−21.5	−31.5	Hard yellow clay, little fine sand
138	− 9	−15	Mud
K9	−15	−23	Hard yellow clay
	−23	−78	Soft blue clay
	−78		Rock
139	−28	−36	Sand and gravel fill
K9	−36	−39	Fine silty sand
	−39	−50	Very stiff blue clay
140	−28.0	−35.6	Sand and gravel fill
B5	−35.6	−39.0	Fine silty sand
	−39.0	−49.0	Very stiff blue clay
141	+14	+ 0	Fill
C6	+ 0	−11	Sand and gravel fill
	−11	−26	Hard blue clay
142	+20	+ 8	Fill
F7	+ 8	− 4	Fine silty sand, mud, old timbers
	− 4	−20	Hard yellow clay
143	Cellar	15	Fill
G6	15	29	Mud
	29	45	Hard clay
144	+18	+11	Fill
H6	+11	+ 6	Mud
	+ 6	− 7	Hard clay
145	Surface	1	Fill
H6	1	8	Hard clay, fine yellow sand
	8	26	Fine, medium coarse sand
	26	29	Medium blue clay
	29	40	Fine blue sand, little clay
	40	45	Medium blue clay
146	Surface	4	Clay
I6	4	7	Coarse sand
	7	31	Clay
	31	45	Fine sand
147	Surface (Basement floor)	2	Sand, gravel
I6	2	8	Stiff clay, little gravel
	8	40	Fine sand, very little clay
148	+34	+33	Fill
K6	+33	+27	Clay, sand, gravel
	+27	+23	Sand, gravel (hardpan)
149	Basement floor	2	Fill
K7	2	9	Hard yellow clay
	9	20	Medium soft blue clay
	20	30	Soft blue clay, streaks of sand
150	Cellar floor	3	Clay, sand
K7	3	15	Clay
	15	19	Blue clay
	19	25	Rocks, gravel, clay
151	Surface	5	Clay, sand
K7	5	15	Blue clay
	15	20	Clay, rocks
152	Cellar floor	7	Clay
K7	7	15	Sand, clay
	15	28	Sand, clay
	28	36	Blue clay
	36	47	Clay, rocks (till)
153	+18	+16	Fill
J7	+16	+ 2	Hard blue clay
	+ 2	+ 0	Medium blue clay, little fine sand
	+ 0	− 2	Medium blue clay
	− 2	−11	Fine blue sand
	−11	−23	Medium blue clay
	−23	−25	Blue clay, little sand and gravel
154	+18	+ 1	Fill
J7	+ 1	− 3	Flowing sand
	− 3	−22	Medium blue clay
155	+26.5	+18.5	Fill
I7	+18.5	+ 7.5	Hard yellow clay, little fine sand
	+ 7.5	+ 1.5	Medium yellow clay, fine sand
	+ 1.5	− 5.5	Fine sand, little clay
	− 5.5	−10.5	Medium blue clay
	−10.5	−18.5	Fine sand, very little clay
	−18.5	−22.5	Soft blue clay, fine sand
	−22.5	−31.5	Fine sharp sand
	−31.5	−61.5	Soft blue clay
	−61.5	−67.5	Hard sand, gravel, little clay, rock or boulder
156	+30.6	+23.6	Fill
H7	+23.6	+ 7.6	Hard yellow clay, little fine sand
	+ 7.6	+ 3.6	Medium blue clay
	+ 3.6	+ 0.6	Fine sand
	+ 0.6	− 6.4	Medium blue clay
	− 6.4	−11.4	Fine sand, very little clay
	−11.4	−24.4	Medium blue clay
157	+26	+22	Sand, gravel
H7	+22	+16	Hard clay, gravel, sand
	+16	+ 5	Hard yellow clay
	+ 5	+ 1	Blue clay, little fine sand
	+ 1	− 3	Hard yellow sand
	− 3	− 8	Fine yellow sand
	− 8	−16	Fine gray sand
	−16	−24	Soft blue clay

No. and location	Elevations or depths From	To	Formation
158 H6	+27.5	+18.5	Sand, little gravel and clay
	+18.5	+14.5	Hard sand, clay, gravel
	+14.5	+ 7.5	Hard yellow clay
	+ 7.5	− 3.5	Medium blue clay
	− 3.5	−11.5	Compact fine sand
159 G6	Surface	20	Sand and gravel fill
	20	40	Mud, sand
	40	50	Clay
160 F7	+14	+ 4	Fill
	+ 4	+ 0.5	Silt, fine sand
	+ 0.5	−11.5	Hard blue clay
161 F8	Bottom of cellar	5	Mud and sand fill
	5	7	Hard clay
162 F7	+18	+ 7	Fill
	+ 7	+ 1	Hard yellow clay, rocks
	+ 1	−12	Hard blue clay
163 G7	+18	+ 0	Fill
	+ 0	−20	Clay
164 G7	+21	+15	Concrete
	+15	+ 4	Sand and fill
	+ 4	+ 2	Mud and fill
	+ 2	− 1	Medium clay, little sand
	− 1	− 2	Sand, gravel, clay
	− 2	− 9	Medium clay
165 G8	+15	+ 1	Fill
	+ 1	− 2	Peat mud
	− 2	−15	Hard clay
166 H8	5±	− 2	Loose fill
	− 2	−15	Mud and fill, mixed
	−15	−45	Soft blue clay
167 H8	Surface	7	Fill
	7	14	Mud
	14	25	Clay
168 I7	Bottom cellar	14	Hard yellow clay
	14	22	Blue clay, little sand
	22	51	Blue clay, little sand
169 I7	Surface	12	Fill
	12	18	Hard clay
	18	40	Stiff blue clay
170 J7	+14	+13	Fill
	+13	+ 9	Hard yellow clay, little fine sand
	+ 9	− 6	Medium blue clay
	− 6	−17	Fine compact sand, little clay
	−17	−26	Medium blue clay
171 K7	+22	+12	Fill
	+12	−40	Hard blue clay
	−40	−49	Coarse sand, gravel, wet
172 K7	+12	+ 4	Fill
	+ 4	−35	Medium blue clay
	−35	−37	Fine sand, little clay
	−37	−42	Medium blue clay
	−42	−46	Compact sharp sand

No. and location	Elevations or depths From	To	Formation
173 J8	Cellar	7	Fill
	7	15	Clay
174 I7	Surface	7	Clay, little sand
	7	17	Clay
	17	25	Sand, clay
175 I8	+17	+ 9	Fill
	+ 9	+ 0	Mud
	+ 0	−21	Hard blue clay
176 I8	Surface	18	Fill, mud, old wood
	18	40	Hard blue clay
177 I8	+15.7	+ 8	Fill
	+ 8	−23	Mud
	−23	−29	Hard clay
178 I8	Surface	9	Fill
	9	16	Mud
	16	26	Hard clay
179 H8	+15	+10	Fill
	+10	− 4	Mud
	− 4	− 5	Medium blue clay
	− 5	−12	Hard yellow clay
180 H8	+11	− 3	Gravel
	− 3	−20	Blue clay
181 J8	Surface	9	Fill
	9	29	Mud
	29	42	Clay
182 J8	+ 6	− 9	Silt, shells
	− 9	−10	Silty peat
	−10	−14	Very stiff blue clay
183 J8	+11	− 1.5	Fill
	− 1.5	−19.5	Silt
	−19.5	−29.0	Hard blue clay
184 J8	Surface	11	Fill
	11	26	Mud
	26	37	Clay
185 J8	+10	+22	Clay, sand, rocks, gravel; probably fill
186 K8	Top of well	17	Water
	17	28	Soft mud
	28	32	Hard clay
187 G8	+18	+15	Clay, rocks, fill
	+15	+ 0	Hard clay
	+ 0	−16	Medium clay
188 G8	Cellar	15	Mud
	15	22	Hard sand, clay
	22	29	Hard clay
189 G9	Surface	7	Fill
	7	15	Mud
	15	30	Stiff clay
190 G9	Surface	12	Fill
	12	25	Fine sand, mud
	25	40	Blue clay
191 G9	Surface	14	Fill
	14	26	Fine sand, mud
	26	38	Hard clay

No. and location	Elevations or depths From	To	Formation
192 F9	River bed 28	28 35	Dock mud Hard blue clay
193 F9	+14 + 0 −14 −26	+ 0 −14 −26 −36	Fill Soft clay, sand Soft clay, sand Stiff clay
194 E9	+14 − 6 −26	− 6 −26 −36	Fill Mud Clay
195 F9	+14 − 5 −26	− 5 −26 −34	Loose fill Mud Hard clay
196 E8	Start 22	22 27	Medium blue clay Hard clay, little fine sand
197 E8	+18 +17 +15 +11 +10	+17 +15 +11 +10 − 2	Paving Sand and gravel fill Hard yellow clay Sand, gravel, clay Hard clay
198 C8	Surface 8 26	8 26 65	Fill Peat mud Medium hard clay
199 C8	Start 21 34	21 34 40	Rocks, fill Mud Clay
200 C9	Surface 10 16	10 16 40	Fill Peat mud Hard clay
201 B9	Surface 11 22	11 22 30	Fill Peat mud Blue clay
202 C9	Surface 9 17 20 24	9 17 20 24 58	Fill Soft mud Loose sand Soft mud Hard clay
203 L7	0 1 10 18	1 10 18 25	Fill Hard blue clay Medium blue clay Hard sand and gravel, very little clay
204 D9	Surface 10 25	10 25 40	Fill; gravel and mixed Dock mud Hard yellow clay
205 J7	Surface 8 8 16 21	8 16 16 21 26	Stiff clay, rocks Soft clay Fine sand, clay Stiff clay
206 L7	Cellar bottom 6 6 18	6 18 18 45	Fill Hard yellow clay Blue clay
207 K7	Cellar bottom 4.5 4.5 15.0	4.5 15.0 15.0 42.0	Fill Clay, sand Clay
208 L7	+10 + 5 − 3 −10 −25	+ 5 − 3 −10 −25 −44	Fill Hard yellow clay Soft clay, streaks of sand Soft clay Soft clay
209 F5	+18 −12 −27	−12 −27 −36	Fill Dock mud Blue clay
210 M6	+20 + 1 − 2	+ 1 − 2 −22	Fill, mud Fine sand, clay Hard clay
211 F5	Surface 13 13 32 39	13 32 32 39 45	Fill Silt, mud Hard blue clay Medium blue clay
212 E9	Surface 6.0 6.0 23.75	6.0 23.75 23.75 35.0	Sand and gravel fill Fine silty sand, mud Hard blue clay
213 L6	+25 +22 +17 + 7 − 2	+22 +17 + 7 − 2 −31	Sand Clay Sand, gravel, rocks Sand, clay Sand, clay; hardened at bottom
214 C9	+14 + 6 + 2 −10	+ 6 + 2 −10 −36	Fill Dock mud Hard packed gravel Hard clay
215 F9	Surface 12 12 16 18	12 16 16 18 30	Fill Peat Medium blue clay Hard yeilow clay
216 M6	Cellar floor 3 3 22	3 22 22 28	Old wood Hard clay Clay
217 E5	+21 +20 + 8 + 0 − 9 −25 −28	+20 + 8 + 0 − 9 −25 −28 −33	Road bed, cracked stone Fill; sand, gravel, ash Fine sand, little gravel Coarse sand, gravel Silt and shells, soft Peat Stiff blue clay
218 J7	+31 +19 +13 + 3 − 2 −16	+19 +13 + 3 − 2 −16 −25	Fill Medium yellow clay, fine sand Fine yellow sand, wet Medium blue clay, little fine sand Fine blue sand Medium blue clay, very little fine sand
	−25	−29	Clay, gravel
219 B5	Bottom of pit 3 3 20	3 20 20 26	Fill Peat, mud Hard clay

No. and location	Elevations or depths From	To	Formation
220	Surface	13	Sand fill
F4	13	27	Silt, mud
	27	30	Coarse sand
	30	40	Hard clay
221	Surface	9	Fill
H9	9	25	Mud
	25	40	Hard blue clay
222	Surface	15	Fill
H5	15	19	Hard blue clay, little gravel
	19	25	Hard blue clay
	25	33	Wet compact yellow sand, clay
	33	37	Compact yellow sand, little clay
	37	51	Medium blue clay, little fine sand
	51	74	Compact gray sand, dry
	74	76	Soft blue clay, sand
	76	92	Fine gray sand
	92	95	Fine gray sand, little clay
223	+17	+ 8	Rubbish fill
G9	+ 8	— 8	Soft silt
	— 8	—16	Hard blue clay
224	+16	0	
	Harbor bottom		
N7	+ 0	—11	Silt
	—11	—26	Hard blue clay
	—26	—39	Hard blue clay, coarse gravel
225	Cellar	8	Soft fill
L7	8	20	Yellow clay
	20	35	Blue clay
	35	58	Soft blue clay
226	+17.0	+ 4.0	Fill; sand, gravel, clay
E6	+ 4.0	— 1.0	Little sand, gravel, soft mud
	— 1.0	— 2.5	Soft silt
	— 2.5	— 6.0	Stiff yellow clay
227	Surface	15	Fill
C4	15	23	Loose packed sand, gravel
	23	32	Silt
	32	38	Compact coarse sand
228	Surface	7	Fill
H7	7	31	Clay
229	Surface	15	Clay
J7	15	25	Clay, sand
	25	30	Sand, streaks of clay
230	Surface	24	Fill
F8	24	34	Medium blue clay
231	Basement	11	Loose sand, gravel,
G7			rocks and fill
	11	26	Mud
	26	38	Clay, little fine sand
232	Cellar bottom	9	Fill and wood
M7	9	15	Hard clay
	15	17	Sand, clay
	17	25	Clay, gravel
233	Cellar	11	Clay, rocks
L8	11	16	Hard clay, rocks
	16	20	Hard clay, rocks. Struck boulder
234	Bottom cellar	12	Fill
M8	12	26	Hard clay, rocks
235	Cellar floor	13	Fill
C5	13	17	Mud
	17	30	Hard blue clay
236	Cellar	2	Fill
K7	2	29	Stiff blue clay
	29	46	Sand, clay
	46	48	Rocks, clay, hard
237	Surface	7	Clay, rocks
L8	7	15	Clay
	15	25	Clay, rocks
238	Cellar	5	Fill
M5	5	19	Dock mud
	19	50	Hard clay
239	Surface	10	Filling
H8	10	15	Soft clay
	15	38	Soft clay
240	Surface	8	Fill
D8	8	16	Mud
	16	30	Hard yellow clay
241	Surface	13	Yellow sand, gravel
G5	13	19	Blue sand, gravel, very little clay
	19	36	Silt, little sand
	36	48	Stiff blue clay
	48	60	Stiff blue clay, little sand
242	— 6.5	— 7.5	Silt, few shells
F4	— 7.5	— 8.5	Peat
	— 8.5	— 9.5	Silt, few shells
	— 9.5	—17.5	Fine blue sand
	—17.5	—32.5	Stiff blue clay
243	Surface	5	Space
F9	5	2	Loose rubbish fill
	2	— 3	Soft black silt, fine sand
	— 3	—19	Soft silt, fine sand
	—19	—22	Soft silty peat, fine sand
	—22	—29	Medium blue clay, fine sand
	—29	—56	Soft blue clay
	—56	—60	Hard clay, sand, gravel, rock or boulder (till)
244	Surface	20	Soft silt, shells
D2	20	24	Firm sand, gravel
	24	28	Coarse sand
	28	35	Sand, gravel
	35	45	Hard medium sand
245	Surface	19	Fill
E6	19	24	Mud
	24	38	Hard clay

No. and location	Elevations or depths From	To	Formation
246 J8	+27	+ 8	Hard yellow sand, gravel, little clay
	+ 8	−11	Blue clay, sand, gravel
	−11	−21	Hard blue clay, sand, gravel; rock
247 L7	Surface	34	Clay
248 F6	Surface	21	Fill
	21	33	Mud
	33	42	Hard clay
249 J3	Surface	21	Fill
	21	30	Sand, gravel, clay, rocks (hard pan)
250 J4	Surface	19	Hard packed gravel fill
	19	31	Dock mud
	31	39	Loose sand, gravel
	39	44	Hard clay, rocks
251 N4	Surface	19	Fill
	19	61	Fine sand; rock at 61
252 H7	Surface	8	Fill
	8	25	Clay, rocks
253 D3	Surface	52.5	Soft sand fill Hard gravel Tough clay
254 F4	Surface	14	Sand and gravel fill
	14	26	Dock mud
	26	31	Coarse sand
	31	80	Blue clay
255	Bottom of cellar	40	Stiff clay
L7	40	50	Fine hard sand
256 F6	Surface	10	Fill
	10	20	Soft clay
	20	40	Stiff clay
257 G9	Surface	19	Fill
	19	36	Soft blue clay, mud
	36	55	Hard blue clay
258 H4	Surface	26	Fill
	26	31	Fine silty sand, mud
	31	40	Clay, sand, rocks (hardpan)
259 H5	Surface	18	Fill
	18	29	Sand
	29	36	Clay
	36	50.5	Clay, rocks
260 H5	Start	12	Fill
	12	23	Mud, sand
	23	36	Hard yellow clay
	36	65	Medium clay, very little fine sand
261 J3	Surface	18	Fill
	18	28	Clay, sand, gravel; hard
262 F5	Surface	18	Fill
	18	44	Silt, mud
	44	63	Medium blue clay
263 G9	Surface	12	Fill
	12	19	Black mud
	19	41	Dock mud
	41	54	Blue clay
264 H8	Surface	8	Fill
	8	22	Mud
	22	36	Hard clay
265 F5	Surface	11	Fill
	11	32	Mud
	32	41	Hard clay
	41	56	Medium clay
266 L4	+35	+33	Fill
	+33	+28	Hard yellow clay
	+28	+24	Medium yellow clay
	+24	+23	Fine yellow sand
	+23	+15	Medium blue clay
	+15	+12	Medium blue sand
267 D9	Cellar bottom	19	Fill
	19	25	Mud
	25	35	Hard yellow clay
268 C6	Surface	13	Fill
	13	22	Hard clay
	22	28	Medium clay
269 E2	Surface	23	Sand and gravel fill
	23	33	Fine sand, rocks
270 G4	Surface	5	Fill
	5	15	Fill sand
	15	30	Dock mud
	30	33	Medium sand
	33	45	Hard blue clay
271 D2	Surface	14	Fill; sand, gravel
	14	15	Sand, gravel, mud
	15	20	Medium sand
	20	26	Sand, rocks
272 J3	Surface	15	Gravel, fill
	15	20	Fill and silt
	20	30	Clay, sand, rocks; struck boulder
273 K3	Cellar bottom	9	Fill
	9	12	Mud
	12	22	Hard yellow clay
274 H4	Surface	14	Fill
	14	47	Silt mud
	47	49	Hard packed sand and gravel
	49	55	Medium blue clay
275 I7	− 3.5	− 9.0	Fine sand, very little clay
	− 9.0	−10.5	Medium blue clay
	−10.5	−17.5	Fine sand, little clay
	−17.5	−36.5	Fine sand
	−36.5	−39.8	Soft blue clay, sand
	−39.8	−44.5	Soft yellow clay
	−44.5	−48.5	Medium sand, little gravel
	−48 5	−50.0	Clay, sand, gravel

No. and location	Elevations or depths From	To	Formation
276 D4	Surface	5	Ashes, fill
	5	12	Sand and gravel fill
	12	17	Mud
	17	26	Loose sand
	26	32	Loose sand, gravel
277 F7	Cellar bottom	4.6	Ash and sand fill
	4.6	15.0	Silt and mud
	15.0	22.0	Hard clay
278 B8	+15	+ 8	Fill
	+ 8	+ 2	Peat
	+ 2	+ 1	Medium blue clay
	+ 1	− 5	Hard yellow clay, fine sand
	− 5	−10	Medium yellow clay
	−10	−15	Medium blue clay
279 K8	+27	+24	Coarse sand, gravel
	+24	+11	Fairly hard yellow clay, sand, little gravel
	+11	+ 5	Hard blue clay, sand, gravel
	+ 5	−17	Hard dry blue clay, sand, gravel; rock
280 I7	Surface	12	Fill
	12	22	Medium yellow clay, little fine sand
	22	33	Soft blue clay, little fine sand
	33	35	Fine blue sand, little clay
281 I7	8′ below sidewalk	1	Silt, shells
	1	3	Medium blue clay, gravel
	3	5	Hard yellow clay
282 J6	Surface	12	Sand and gravel fill
	12	16	Sharp fine sand
	16	19	Blue clay, fine sand
	19	39	Sharp fine sand
	39	47	Medium blue clay
283 I6	+ 6	+ 3	Pit
	+ 3	− 7	Fine yellow sand
	− 7	−18	Soft blue clay
284 G7	+22	− 4	Fill; hard sand, gravel, clay
	− 4	−12	Soft silt
	−12	−13	Silty sand
	−13	−21	Silty peat
	−21	−31	Hard blue clay
	−31	−39	Hard fine sand
	−39	−80	Medium blue clay
285 H6	+19	− 3	Fill
	− 3	−12	Silt, shells
	−12	−14	Sand, gravel, clay
	−14	−23	Medium yellow clay
	−23	−58	Soft blue clay
	−58	−61	Medium sand, little clay
	−61	−83	Medium blue clay
	−83	−87	Hard clay, sand, gravel
286 G6	−10.5	−13	Fill
	−13	−17	Hard yellow clay
	−17	−23	Soft blue clay, fine sand
287 H6	Surface	3	Fill
	3	19	Hard yellow clay, gravel
	19	34	Hard yellow clay, fine sand
	34	49	Medium blue clay
	49	58	Fine yellow sand, little clay
288 D9	+13	+ 6	Coarse sand
	+ 6	+ 5	Fine sand and water
	+ 5	− 1	Very fine silty sand
	− 1	− 6	Peat, little silt
	− 6	−10	Gray sand
	−10	−16	Coarse gray sand, gravel; lots of water
	−16	−21	Gravel, much water
	−21	−22	Stiff blue clay
289 B9	Surface	17	Fill
	17	30	Mud
	30	43	Hard blue clay
290 L6	Surface	8	Fill
	8	18	Hard clay
	18	35	Medium clay
291 M6	Surface	4	Fill
	4	28	Hard yellow clay
292 K3	Surface	2	Loam
	2	10	Fill
	10	31	Fine silty sand, mud
	31	50	Hard blue clay
293 I8	Surface	9	Fill
	9	16	Mud
	16	26	Hard clay
294 C3	Surface	5	Fill
	5	10	Mud
	10	17	Medium sand, stones
	17	27	Coarse sand, stones
295 M6	Cellar bottom	6	Medium yellow clay, fine sand
	6	20	Fine sand, little clay
	20	33	Medium blue clay
296 C4	Surface	13	Miscellaneous fill
	13	20	Mud
	20	25	Sand
	25	33	Sand, stones
297 M5	Surface	7	Fill
	7	23	Gravel, clay
	23	25	Clay, sand, gravel
298 J6	Surface	5	Fill
	5	15	Coarse sand
	15	20	Sand, gravel, stones
	20	30	Hard packed sand
	30	40	Sand, stones, little clay

No. and location	Elevations or depths From	To	Formation
299	Surface	9	Fill
E8	9	24	Mud
	24	39	Hard clay, little fine sand
300	Bottom of harbor	27	Mud
L9	27	28	Medium blue clay
	28	38	Hard blue clay
301	Surface	9	Gravel fill
M8	9	20	Gravel fill
	20	30	Clay, gravel, stones
302	Cellar bottom	5	Fill; clay, stones
L6	5	9	Hard blue clay
	9	16	Soft blue clay
	16	24	Medium blue clay
	24	30	Clay, gravel, stones
303	Surface	15	Miscellaneous fill
K3	15	18	Mud, sand
	18	38	Hardpan, sand, gravel
304	Surface	30	Fill; miscellaneous
F4	30	43	Mud
	43	56	Hard clay
305	Cellar floor	3	Fill
I6	3	10	Hard clay, sand
	10	16	Hard packed coarse sand
	16	28	Hard clay, sand, stones
	28	40	Medium blue clay, layers of sand
306	Surface	15	Fill
I4	15	31	Mud
	31	38	Hard packed sand, gravel
307	Surface	18	Fill
D4	18	21	Sand and gravel fill
	21	24	Sand, little mud
	24	33	Hard clay
308	Surface	11	Fill
C6	11	30	Hard clay
309	Surface	20	Sand and gravel fill
J3	20	28	Clay, sand, stones
310	Surface	18	Fill
F3	18	32	Fine silty sand, mud
	32	40	Hard packed sand, gravel
	40	50	Medium blue clay
311	Surface	24	Fill
C4	24	30	Mud
	30	42	Medium clay
312	Surface	14	Fill
H7	14	18	Fill and mud
	18	23	Clay and stone fill
	23	35	Medium clay
313	Basement	3	Fill
J6	3	43	Clay, sand, stones (hardpan)

No. and location	Elevations or depths From	To	Formation
314	− 8	−12	Clay, black mud
O6	−12	−17	Soft blue clay
	−17	−21	Blue clay
	−21	−38	Hard blue clay
	−38	−42	Clay, sand, stones
315	+14	− 6	Fill
O6	− 6	−15	Fine yellow sand, silt
	−15	−37	Hard yellow clay
	−37	−59	Clay, sand, stones; hard
316	+15	+ 9	Fill
O6	+ 9	+ 4	Mud, shells
	+ 4	− 5	Fine yellow sand, silt
	− 5	− 9	Mud
	− 9	−17	Fine sand, silt
	−17	−49	Hard yellow clay
	−49	−58	Clay, sand, stones
317	+17	+ 5	Fill
O6	+ 5	− 2	Gravel
	− 2 and below		Clay
318	+17	+ 6	Fill
O6	+ 6	− 2	Gravel
	− 2 and below		Clay
319	+17	+ 1	Fill
O6	+ 1	− 3	Sand, gravel, silt
	− 3	−10	Hard yellow clay, sand
	−10	−13	Yellow clay, little sand, stones
320	+14	+ 9	Fill
O6	+ 9	+ 4	Fine yellow sand, silt
	+ 4	− 9	Little clay, fine yellow sand, silt
	− 9	−20	Hard yellow clay
	−20	−42	Soft yellow clay
	−42	−53	Clay, sand, stones
	−53	−65	Fine yellow sand
321	−16	−20	Silt
O7	−20	−40	Clay
	−40	−50	Clay, sand, gravel
322	+16	+ 9	Fill
N7	+ 9	− 8	Gravel, mud
	− 8 and below		Clay
323	+16	+ 9	Fill
N7	+ 9	− 8	Gravel, mud
	− 8 and below		Clay
324	−13	−16	Soft black silt
P5	−16	−17	Sand
	−17	−19	Hard yellow clay
	−19	−20	Sand
	−20	−26	Hard yellow clay
325	+22	+18	Fill
O5	+18	+ 8	Yellow clay, stones
	+ 8	− 8	Hard clay, stones
326	+16	+ 0	Fill
O5	+ 0	− 4	Soft black silt
	− 4	− 8	Sand, gravel
	− 8	−12	Hard yellow clay

No. and location	Elevations or depths From	To	Formation
327	+16	− 4	Fill
O5	− 4	− 6	Soft black silt
	− 6	−14	Sand, gravel
328	+17	+12	Fill
O6	+12	+ 9	Clay, sandy gravel
	+ 9	+ 2	Hard yellow clay, sand, gravel
	+ 2	− 1	Soft yellow clay, sand, gravel
	− 1	− 5	Hard yellow clay, sand, gravel
	− 5	−10	Clay, sand, coarse gravel; hard
329	+17	−20	Water
L1	−20	−35	Mud
	−35	−39	Sand, gravel
	−39	−46	Yellow clay
330	+17	−21	Water
L1	−21	−33	Mud
	−33	−34	Gravel
	−34	−36	Sand, silt
	−36	−39	Clay, gravel
	−39	−43	Blue clay
331	+18	−21	Water
L1	−21	−29	Mud
	−29	−35	Gravel
332	+17	−21	Water
L1	−21	−32	Mud
	−32	−40	Gravel
	−40	−43	Hard yellow clay
333	+17	−17	Water
L1	−17	−29	Mud
	−29	−32	Gravel
	−32	−44	Yellow clay
	−44	−45	Blue clay
334	+16	−17	Water
M1	−17	−32	Mud
	−32	−33	Sand, gravel; stone
335	+16	−13	Water
M1	−13	−14	Mud
	−14	−15	Sand, shells
	−15	−20	Yellow clay, gravel
	−20	−23	Gravel
	−23	−31	Hard clay; stone
336	+16	− 3	Water
M1	− 3	−11	Mud
	−11	−13	Sand, shells
	−13	−20	Clay, gravel
	−20	−21	Gravel
	−21	−23	Hard blue clay
337	+16	− 6	Water
M2	− 6	− 8	Mud
	− 8	−10	Sand, shells
	−10	−14	Yellow clay
	−14	−20	Hard blue clay
338	+16	− 6	Water
M2	− 6	− 9	Mud
	− 9	−12	Clay, gravel
	−12	−23	Hardpan, shale (rotten slate)
339	+16	− 6	Water
M2	− 6	− 9	Mud
	− 9	−12	Sand mud
	−12	−15	Yellow clay
	−15	−32	Yellow clay, gravel
	−32	−34	Hardpan
340	+16	− 8	Water
M2	− 8	−14	Sand mud
	−14	−21	Hard yellow clay
	−21	−26	Yellow clay, gravel
	−26	−27	Hardpan
341	+15	−13	Water
N2	−13	−16	Sand, silt
	−16	−26	Yellow clay
	−26	−32	Blue clay, gravel
342	+15	− 8	Water
N2	− 8	−12	Mud
	−12	−15	Sand, silt
	−15	−23	Blue clay
	−23	−32	Yellow clay, gravel
	−32	−36	Hard blue clay
343	+16	− 9	Water
N2	− 9	−12	Mud
	−12	−15	Sand, silt
	−15	−17	Blue clay
	−17	−23	Yellow clay
	−23	−29	Yellow clay, gravel
	−29	−31	Hard blue clay
344	+15	− 5	Water
N2	− 5	−12	Mud
	−12	−21	Blue clay
	−21	−23	Clay, gravel
345	+15	−10	Water
N2	−10	−16	Sand, silt
	−16	−20	Sand, shells
	−20	−21	Blue clay
	−21	−22	Clay, gravel
346	+15	− 8	Water
N2	− 8	−12	Mud
	−12	−20	Sand, silt
	−20	−28	Sand, shells
	−28	−32	Clay, gravel
	−32	−33	Blue shale; rock
347	+15	− 7	Water
N1	− 7	− 9	Mud
	− 9	−27	Sand, shells
	−27	−28	Blue shale (?); rock
348	+15	− 5	Water
N1	− 5	− 9	Mud
	− 9	−16	Sandy silt
	−16	−25	Sand, shells
	−25	−29	Clay, silt
	−29	−33	Blue clay
	−33	−34	Hard blue clay
349	+15	− 2	Water
N1	− 2	− 3	Mud
	− 3	−14	Silt
	−14	−19	Sand, shells
	−19	−22	Very hard clay
350	Surface	15	Fill
N5	15	30	Gravel, clay; very soft from 11′ to 15′

No. and location	Elevations or depths From	To	Formation
351 I6	Surface	4	Fill
	4	9	Sand, clay
	9	14	Sand, clay
	14	40	Soft clay
352 L7	Surface	10	Sand and fill
	10	14	Soft mud
	14	38	Clay
353 C6	Surface	8	Fill
	8	22	Loose sand, stones
	22	25	Hard packed sand, stones
354 J8	Surface	8	Fill
	8	22	Hard clay
	22	26	Clay, quite soft
	26	30	Clay, gravel
355 K3	Surface	6	Fill
	6	8	Clay fill
	8	11	Sand, gravel
	11	15	Clay
	15	46	Clay
356 K8	+17	+ 3	Mud and fill
	3	— 2	Gravel
	— 2	— 6	Soft clay
357 L6	Surface	24	Sand, gravel
	24	34	Clay, sand
358 N5	Surface	18	Hard clay
	18	30	Clay, stones
359 L6	Cellar bottom	7	Black silt (dock mud)
	7 and below		Stiff clay
360 H6	0	— .67	Cinder drive
	— .67	— 6.00	Rubbish fill
	— 6.00	— 8.00	Stiff clay; yellow with traces of blue
361 M2	+17	—10	Overburden; rock at —10
362 H7	+13.2	+ 7.2	Fill
	+ 7.2	— 5.8	Yellow clay
	— 5.8	—22.8	Blue clay
	—22.8	—37.8	Very fine sand
	—37.8	—42.8	Fine sharp sand
363 H6	+18	+ 2	Fill
	+ 2	— 2	Yellow clay
	— 2	— 9	Clay, fine sand
	— 9	—15	Fine sand
	—15	—22	Blue clay
364 H5	+15	— 9	Fill
	— 9	—16.5	Fine sand
	—16.5	—20.8	Blue clayey sand
	—20.8	—24.8	Fine sand
365 I6	+21.0	+17.5	Fill
	+17.5	+15.5	Coarse sand, gravel
	+15.5	— 5.0	Sand, gravel; passing to till
	— 5.0	— 6.0	Fine sand
366 L6	+39.0	+29.0	Fill
	+29.0	+24.0	Yellow clay
	+24.0	+15.5	Yellow till (boulder clay)
	+15.5	+13.5	Sand, gravel
	+13.5	+ 1.5	Blue clay, sand
	+ 1.5	— 0.5	Sand, gravel
367 J9	At —65		Ends in blue clay
368 I9	Surface	20	Fill
	20	—15	Silty sand
	—15	—23	Hard yellow sand
	—23	—32	Hard blue clay
	—32	—115	Soft blue clay
	—115	—117	Ends on rock
369 H5	Surface	14	Fill
	14	22	Mud, sand
	22	29	Fine sand
	29	47	Hard clay
370 I4	Cellar floor	17	Fill
	17	44	Mud
	44	55	Fine sand, clay, stones
371 F2	3	101	Sand and gravel fill; mud, sand, shells; gravel and stones, hard
372 E2	Surface	10	Fill
	10	23	Dock mud
	23	34	Gravel, rocks
	34	51	Clay
373 F6	Surface	14	Fill
	14	34	Fine silty sand, mud
	34	50	Hard blue clay
374 G9	Surface	18	Fill
	18	26	Fine silty sand, mud
	26	39	Hard yellow clay
375 M4	Surface	10	Fill
	10	23	Fill, wood, mud, etc.
	23	38	Fine silty sand, mud
	38	50	Hard blue clay
377 J3	Near El. 0		Bedrock
378 I4	At —10		Bedrock
379 I4	At —15		Bedrock
380 J3	— 5.3	—12.8	Mud
	—12.8	—29.4	Sandy mud
	—29.4	—32.1	Gravel
	—32.1	—39.3	Clay
381 L6	+33	+21	Fill
	+21	+17	Coarse sand, gravel
	+17	+ 5	Sand, coarse gravel, little clay
	+ 5	+ 1	Yellow sand, little gravel
	+ 1	— 2	Sand, coarse gravel, little clay
	— 2	— 6	Hard clay, little sand, gravel

No. and location	Elevations or depths From	To	Formation
382 N4	Surface 9	9 19	Fill Clay and stones (hardpan)
384	+19	+ 4	Hard clay, sand, gravel
K8	+ 4	−35	Loose sand, gravel, clay
	−35	−45	Hard clay, sand, gravel, stone
385 H4	Surface 23 33	23 33 50	Sand fill Fine silty sand, mud Hard yellow clay
386 E3	Surface 2 19 27	2 19 27 40	Loam Fill; sand, gravel Fine silty sand, mud Hard packed sand, gravel
387 K9	+21	+ 4	Fill; sand, gravel, cinders
	+ 4	− 6	Silt, sand, gravel, wood
	− 6	−12	Silt
	−12	−37	Soft blue clay
	−37	−39.5	Sand, gravel, clay; rock, probably boulder
388 L2			Series of rock readings (See files in Society room)
389 L2			Series of rock readings (See files in Society room)
390 L7	Surface 4	4 32	Sand Clay
391 E8	Surface 6 7 11	6 7 11 25	Fill Fill; sand, gravel Mud Blue clay
392 G8	Surface 7 20	7 20 28	Fill Mud Blue clay
393 L6	Cellar 3 22	3 22 28	Wood Hard clay Clay, stiff
394 K7	Cellar 5 15	5 15 42	Fill Clay, sand Clay
395 K4	Surface 12 15 22	12 15 22 30	Fill Sand, clay Clay, stones Hard clay
396 K8	+20	+12	Fill; sand, gravel, cinders
	+12	+ 4	Fine sand, little clay fill
	+ 4	− 1	Silt
	− 1	−11	Stiff blue clay
	−11	−27	Clay, sand, gravel
	−27	−34	Sand, gravel, little clay
	−34	−50	Very hard blue clay, little sand

No. and location	Elevations or depths From	To	Formation
397	Surface	8	Fill; ash, clay, gravel
F8	8	9	Fill; wood
	9	15	Peat mud
	15	35	Medium blue clay
398 L5	Surface 5 18	5 18 20	Fill Sand Clay
399 J8	Cellar 6 20 31	6 20 31 46	Fill Peat mud Fine silty sand, mud Hard blue clay
400	2' below basement	−12	Fill
L3	−12	−19	Clay, stones, mixed with sand
	−19	−31	Clay, stones (hardpan)
401 C9	+11.3	+ 8.3	Cinders and gravel fill
	+ 8.3	+ 3.3	Silt, little sand, gravel
	+ 3.3	− 4.7	Peat, little silt
	− 4.7	−20.7	Silty sand, gravel
	−20.7	−23.7	Stiff blue clay
402 F4	+19 +16	+16 − 4	Loam Loose sand and gravel fill
	− 4	−20	Silt
	−20	−22	Silty peat, little fine sand
	−22	−24	Silty clay, little fine sand
	−24	−27	Fine dry hard sand
	−27	−34	Rather soft blue clay
403 G4	+18 +14 + 3	+14 + 3 − 3	Loam, hard gravel Loose sand, gravel Softer silty sand, gravel
	− 3	− 5	Silt, little peat, fine sand
	− 5	−19	Silt, little fine sand
	−19	−20	Peat, little fine sand
	−20	−25	Stiff blue clay, little peat
	−25	−30	Blue clay, not so stiff
404 G5	+18 + 6 + 0 − 7 −12	+ 6 + 0 − 7 −12 −18	Sand and gravel fill Fine yellow sand Fine silty sand Silt, little fine sand Stiff blue clay, little peat and silt
	−18	−32	Fine yellow sand, little clay
	−32	−34	Very fine sand, little clay
	−34	−40	Stiff blue clay, little sand and gravel

No. and location	Elevations or depths From	To	Formation
405 H5	+18	+ 5	Sand and gravel fill
	+ 5	+ 3	Fine yellow sand
	+ 3	+ 1	Silty sand, gravel
	+ 1	− 4	Silty blue clay, little sand and peat
	− 4	− 5	Fine sand, clay
	− 5	−12	Fine sand, little gravel and clay
	−12	−15	Same, softer
	−15	−18	Very fine sand, little clay
	−18	−19	Stiff blue clay, little gravel
406 I9	+17	+ 0	Sand fill, miscellaneous
	+ 0	−16	Silt, very little sand
	−16	−18	Peat
	−18	−24	Stiff blue clay
	−24	−53	Medium stiff blue clay
407 J8	+16	+ 8	Hard gravel fill
	+ 8	+ 2	Soft silt, little gravel
	+ 2	− 4	Silt, little peat
	− 4	− 7	Soft blue clay, little gravel
	− 7	−13	Stiff clay, fine sand
	−13	−34	Medium stiff blue clay
408 J8	+17	+ 9	Fill
	+ 9	+ 6	Soft blue clay, little gravel
	+ 6	+ 0	Stiff blue clay, little sand
	+ 0	−17	Medium stiff blue clay
	−17	−29	Sand, gravel, clay; very hard
409 K8	+20	+ 7	Fill; sand, gravel, brick
	+ 7	−23	Hard yellow clay, sand, gravel
	−23	−26	Fine sand, little clay
	−26	−30	Hard blue clay, little fine sand
410 J8	+28	+26.5	Paving
	+26.5	+22	Sand, gravel, clay
	+22	+15	Hard yellow clay
	+15	+ 7	Hard yellow clay, gravel, sand
	+ 7	−27	Stiff blue clay, sand, gravel
411 D2	+17	− 7	Sand
	− 7	−25	Sand, very little gravel
	−25	−33	Fairly stiff blue clay
412 E2	Surface	6	Sand, gravel, little clay
	6	12	Very fine yellow sand
	12	14	Fill
	14	17	Fine silty sand
	17	21	Loose sand, gravel, little clay
	21	26	Fairly stiff blue clay
	26	28	Fine sand, little gravel and clay
	28	49	Fine blue sand, clay
	49	54	Fairly firm blue clay, very little sand
	54	60	Fairly stiff blue clay

No. and location	Elevations or depths From	To	Formation
413 F4	+17	+ 0	Yellow sand, gravel, very little clay
	+ 0	− 5	Fine blue sand
	− 5	−21	Silt, little sand
	−21	−32	Stiff blue clay
	−32	−122	Soft blue clay
	−122	−126	Hard clay, sand, gravel
414 F4	+17	− 1	Yellow sand, gravel, very little clay
	− 1	−18	Silt, very little clay
	−18	−21	Coarse sand, little gravel, very little clay
	−21	−29	Stiff blue clay
	−29	−43	Soft blue clay
415 F4	Surface	15	Yellow sand, gravel
	15	18	Blue silty sand
	18	40	Silt, little sand
	40	46	Peat, silt
	46	60	Stiff blue clay
416 K7	Surface	5	Coarse sand, little gravel
	5	11	Stiff dry yellow clay, very little sand
	11	18	Hard dry yellow clay, sand, gravel
	18	60	Hard blue clay, sand, little gravel
417 J7	Surface	6	Coarse sand, gravel
	6	19	Stiff dry yellow clay, sand, gravel
	19	46	Stiff dry blue clay, sand, gravel
	46	57	Hard dry blue clay, sand, gravel
	57	60	Hard dry blue clay sand, coarse gravel
418 N4	−16	−28	Hardpan
	−28	?	Rock
419 N4	−28	−33	Hardpan
	−33	?	Rock
420 N3		At −33	Rock
421 N3	−33	−40	Hardpan
	−40	?	Ledge
422 N3		At −12	Struck rock
423 N3		−16	Stops in gravel
424 N3		−64	Stops in hardpan
425 N3		At −91	Struck rock
426 N3	−32	−45	Till
	−45	−49	Rock (bluestone)
427 N3	−17	−22	Soft black silt
	−22	−28	Black sandy silt
	−28	−30	Sand, gravel
	−30	−40	Stiff bluish yellow clay
	−40	−59	Bluish yellow clay, sand, gravel; very hard (till)

No. and location	Elevations or depths From	To	Formation
428	+56	+52	Loam
J5	+52	+24	Sand, gravel, clay
	+24	+16	Sand, little gravel
	+16	− 2	Gravel, sand, little clay
	− 2	− 9	Yellow clay, sand
	− 9	−15	Fine sand, little clay
429	+74	+66	Sand, gravel
J5	+66	+44	Yellow sand, clay, gravel
	+44	+35	Sand, gravel
	+35	+ 9	Sand, gravel, streaks of blue clay
	+ 9	+ 4	Clay, gravel, little sand
430	+92	+34	Yellow clay, sand, gravel
J5	+34	+18	Blue clay, sand, gravel
	+18	+ 8	Fine sand, little clay
	+ 8	+ 2	Clay, little sand
431	+104	+98	Gravel and clay (till)
J5	+98	+90	Fine sand
	+90	+63	Yellow clay, some sand and fine gravel
	+63	+54	Gravel, little yellow clay
	+54	+36	Sand, gravel, blue clay
	+36	+26	Gravel, yellow clay
	+26	+13	Fine sand, very little clay
	+13	+ 8	Mostly yellow clay, little sand
432	+102	+58	Yellow clay, sand, gravel
J4	+58	+52	Sand, fine gravel
	+52	+42	Yellow clay, sand, gravel
	+42	+12	Blue clay, sand, gravel
433	+79	+51	Sand, gravel, yellow clay
J4	+51	+46	Gravel, little sand and clay
	+46	+34	Sand, gravel, yellow clay
	+34	+28	Mostly yellow clay, some sand
	+28	+14	Blue clay, sand, gravel
434	+46	+41	Sand, clay, gravel
J4	+41	+38	Coarse gray sand, little clay
	+38	+22	Yellow clay, gravel, sand
	+22	+14	Stiff blue clay, little sand, gravel
	+14	+10	Coarse sand, gravel, little clay
	+10	+ 6	Hard blue clay, sand, gravel
435	+15.5	+14.5	Sand fill
D7	+14.5	+ 7.5	Fine gray sand
	+ 7.5	− 2.5	Medium brown sand

No. and location	Elevations or depths From	To	Formation
436	+17	+ 5	Loose sand, very little gravel
E2	+ 5	− 6	Loose sand, very little gravel, very little clay
	− 6	− 8	Silty sand
	− 8	−25	Loose sand, very little gravel, very little clay
	−25	−29	Very fine sand, clay
	−29	−32	Very firm clay, sand
	−32	−38	Fairly stiff blue clay
437	Start	13	Fill
H5	13	32	Mud
	32	33	Sand
	33	45	Hard clay
438	Cellar floor	10	Sand fill
H5	10	20	Fine loose sand
	20	35	Hard blue clay
439	+14.5	+ 5.0	Clay fill
F4	+ 5.0	−15.0	Sand, little mud fill
	−15.0	−38.5	Fine silty sand, mud
	−38.5	−45.0	Medium blue clay
440	Surface	5.0	Fill
G4	5.0	15.6	Sand fill, little mud
	15.6	38.7	Fine silty sand, mud
	38.7	55.0	Medium blue clay
441	Surface	16.8	Sand and gravel fill
E2	16.8	27.5	Fine silty sand, mud
	27.5	35.0	Hard packed sand, gravel
	35.0	45.0	Hard clay
442	Surface	16.6	Fill
G5	16.6	30.5	Fine silty sand, mud
	30.5	45.0	Medium yellow clay
443	Surface	20.0	Fill
H6	20.0	34.8	Sand, rocks (may be fill)
	34.8	39.6	Clay, sand, clam shells
	39.6	43.0	Hard packed sand, gravel
444	Surface	15	Fill
G5	15	37	Fine silty sand, mud
	37	44	Hard blue clay
	44	50	Soft blue clay
	50	80	Soft blue clay, stones
445	Surface	5.0	Fill
C5	5.0	18.0	Sand and gravel fill
	18.0	25.5	Sand and gravel fill
	25.5	31.3	Fine silty sand, mud
	31.3	40.0	Hard packed sand
446	Surface	19.0	Fill
C8	19.0	31.4	Mud
	31.4	42.0	Medium clay
447	Surface	15.0	Fill
K3	15.0	17.0	Hard packed gravel, rocks
	17.0	20.0	Sand, gravel, clay
	20.0	35.0	Hard clay, rocks

No. and location	Elevations or depths From	To	Formation
448 D3	+21	+10	Yellow sand, little gravel
	+10	+ 0	Fine yellow sand
	+ 0	− 3	Peat
	− 3	−10	Sand, gravel, very little clay
	−10	−21	Blue clay, very little gravel
	−21	−39	Fairly stiff blue clay
449 C8	+15.5	+ 9.5	Fill
	+ 9.5	+ 4.5	Sand, gravel, clay
	+ 4.5	− 2.5	Peat
	− 2.5	− 7.5	Yellow clay
450 E7	Cellar floor	3.3	Fill
	3.3	11.0	Fine silty sand, mud
	11.0	30.0	Medium clay
451 M4	Top of floor	17.6	Fill; sand, mud, brick
	17.6	39.6	Silty sand, shells
	39.6	44.10	Silty peat
	44.10	47.4	Fine silty sand
	47.4	50.6	Hard coarse sand, gravel
	50.6	62.4	Medium blue clay
	62.4	66.6	Clay, sand, gravel; hard
452 K8	Surface	9.6	Sand and gravel fill
	9.6	17.0	Hard yellow clay, little fine sand
	17.0	22.0	Medium blue clay, fine sand
	22.0	28.0	Hard clay, sand, little gravel
	28.0	36.6	Hard clay, sand, little gravel
453 L6	2′ above street	2.6	Loam
	2.6	7.6	Sand, gravel; brick, wood
	7.6	11.0	Mud
	11.0	16.6	Hard yellow clay
454 K7	0	12.6	Soft clay, fine sand
	12.6	35.0	Soft blue clay
	35.0	62.6	Soft blue clay
	62.5	71.6	Hardpan
455 K6	Winter St. grade to Start		
	4.5	13.5	Hard fine sand, little gravel
	13.5	27.5	Hard fine sand
	27.5	31.5	Hard pan
456 I3	0.8′ below Pickney St. sidewalk	18.8	Loose sand, gravel and cinder fill
	18.8	22.8	Soft silt, fine sand
	22.8	36.8	Hard fine sand, gravel, clay
457 K4	1′ below curb	8	Fill
	8	16	Hard yellow clay
	16	24	Hard yellow clay, sand
458 J7	+32.7	+14.7	Loose fine sand
	+14.7	+ 3.1	Firm fine yellow sand, little clay
	+ 3.1	−10.3	Medium blue clay
	−10.3	− 13.9	Hard fine blue clay, sand, gravel
459 H7	7′ below Tremont	18	Sand and gravel fill
	18	32	Hard yellow clay, gravel
460 I8	17.2	13.6	Sand and gravel fill
	13.6	17.1	Silt, little fine sand
	17.1	21.8	Peat
	21.8	30.4	Medium silt, shells
	30.4	31.8	Soft blue clay
	31.8	40.7	Hard yellow clay
	40.7	59.0	Very soft blue clay
461 I6	Tremont St. level to Start		
	10.5	11.5	Fill
	11.5	16.5	Hard sand, clay
	16.5	25.5	Medium yellow clay, sand
	25.5	31.5	Sharp fine sand
	31.5	42.5	Sharp medium sand
	42.5	50.0	Medium blue clay
462 L2	Nashua St. level	7.6	Fill
	7.6	21.4	Silty sand fill
	21.4	26.0	Silt
	26.0	27.6	Coarse silty sand, gravel
	27.6	33.0	Hard blue clay
463 K3	Surface	13	Fill
	13	20	Peat, mud
	20	21	Sand
	21	35	Medium blue clay
464 K4	5.4 below curb	10.4	Fill
	10.4	21.9	Hard yellow clay
	21.9	27.9	Hard yellow clay, sand, gravel
465 K4	5 below curb	11	Fill
	11	20	Hard yellow clay
	20	40	Hard blue clay, fine gravel
466 K3	18	19	Ash and rubbish fill
	19	34	Medium silt, little fine sand, peat
	34	45	Hard blue clay, part yellow
467 M6	North St. sidewalk level	10.5	Loose sand and brick fill
	10.5	13.4	Soft blue clay
	13.4	20.0	Hard yellow clay
468 M2	−16.4 River bed	−24.0	Black mud
	−24.0	−30.0	Silty sand, shells
	−30.0	−33.8	Coarse hard sand, gravel
	−33.8	− 55.0	Medium blue clay, little fine sand
	−55.0	−61.0	Hard compact sand, little clay

No. and location	Elevations or depths From	To	Formation
469 L5	+27	+25	Fill; clay, sand, brick
	+25	+18	Hard yellow clay, little fine sand
	+18	+12	Fine blue sand
	+12	+ 9	Hard blue clay, little fine sand
	+ 9	+ 0	Hard blue sand
	+ 0	− 4	Hard blue clay, sand, little fine gravel
	− 4	−12	Hard sand, gravel, clay
	−12	−21	Hard yellow clay, gravel
	−21	−32	Slate
470 M6	Bottom of pit 8.6	8.6	Fine gray sand
	8.6	35.0	Soft blue clay
471 L2	Surface	13.0	Fill
	13.0	23.9	Fine silty sand, mud
	23.9	26.0	Coarse loose sand
	26.0	38.6	Hard blue clay
472 K9	+15.0	− 5.0	Water and air
	− 5.0	−13.2	Soft mud
	−13.2	−47.9	Soft blue clay
	−47.9	−68.8	Hard sand, gravel, clay
	−68.8	−72.8	Very fine cemented sand
473 O5	2.4 below Commercial Street	14.4	Loose coarse sand and gravel fill (riprap)
	14.4	16.0	Hard yellow clay, gravel
	16.0	19.4	Hard fine sand, gravel, clay (hardpan)
474 K6	+45.0	+40.5	Sand, gravel, little clay
	+40.5	+29.0	Hard clay, little fine sand
	+29.0	+23.0	Hardpan
475 K7	33.0	31.5	Paving
	31.5	22.0	Bricks, little clay, sand
	22.0	18.0	Sand, little clay
	18.0	− 8.0	Stiff blue clay
	− 8.0	−15.0	Hard clay, sand, gravel
	−15.0	−17.0	Hard clay, coarse gravel and sand
476 O5	Start	8	Clay fill, little gravel
	8	13	Medium yellow clay, little sand
	13	23	Hard yellow clay, little gravel and sand
477 I7	Surface	6	Fill
	6	14	Mud and little fill
	14	30	Hard yellow clay
478 I7	5.5 below sidewalk	15.5	Fill
	15.5	17.5	Soft black mud
	17.5	19.5	Compact fine sand
	19.5	24.5	Hard yellow clay
479 I7	1.3 above Knapp St. sidewalk	10.5	Fill; clay, rubbish
	10.5	13.1	Silt, little fine sand and shells
	13.1	16.9	Wood, stone
	16.9	20.9	Hard blue clay
	20.9	24.3	Hard yellow clay, little fine sand
480 G9	Grade of sidewalk on Thayer St. Surface	8.6	Fill
	8.6	30.6	Medium silt, very little fine sand
	30.6	38.0	Stiff blue clay
481 H8	Start 15.0 below curb = 0	3.0	Fill
	3.0	22.0	Medium silt, peat
	22.0	30.0	Hard blue clay
482 I4	3.4	20.4	Cinder fill
	20.4	23.6	Silt, little fine sand
	23.6	41.4	Silty sand, shells
	41.4	44.6	Hard coarse sand and gravel
	44.6	48.4	Hard blue clay
483 H3	Surface	9.6	Sand and gravel fill
	9.6	13.0	Silty peat
	13.0	14.6	Coarse sand and gravel
	14.6	21.0	Peat
	21.0	22.6	Silty sand
	22.6	44.0	Silt, shells
	44.0	47.0	Coarse sand, gravel
	47.0	49.6	Medium blue clay
	49.6	59.0	Medium yellow clay
484 F3	+ 5.2	−17.3	Loose sand and clay fill
	−17.3	−23	Soft silt
	−23	−30	Firm coarse sand and gravel
	−30	−33	Hard blue clay
	−33	−80	Soft blue clay
485 G3	5′ below sidewalk	8	Sand and gravel fill
	8	38	Fine silty sand, little shells
	38	40	Sand, little fine gravel
	40	48	Medium blue clay
486 G3	Surface	8	Fill
	8	15	Mud
	15	46	Fine silty sand, mud
	46	55	Hard packed sand and gravel
487 H5	+10.5	− 6.5	Firm coarse sand and gravel fill
	− 6.5	− 7.5	Soft silty sand
	− 7.5	−11.5	Sharp fine sand
	−11.5	−19.5	Soft clay, fine sand
	−19.5	−32.5	Soft blue clay
	−32.5	−34.5	Hard coarse sand and gravel

No. and location	Elevations or depths From	To	Formation
488 G5	Surface	15	Sand and gravel fill
	15	25	Fine sand, silt
	25	35	Medium blue clay
489 G5	Surface	15	Fill
	15	30	Fine silty sand, mud
	30	33	Medium sand
	33	43	Hard blue clay
490 G4	+14	− 1.6	Sand fill
	− 1.6	−18.6	Silty sand
	−18.6	−23.0	Medium sand, little clay
	−23.0	−28.6	Medium yellow clay
	−28.6	−37.0	Soft blue clay
491 G4	Surface	13.3	Fill
	13.3	32.2	Fine silty sand, mud
	32.2	45.0	Hard blue clay
492 G4	+19.5	− 2.5	Sand fill
	− 2.5	−20.5	Silty sand
	−20.5	−24.5	Silt
	−24.5	−30.5	Medium blue clay
	−30.5	−46.5	Soft blue clay
493 E3	Surface	13	Fill
	13	21	Fine sand fill
	21	22	Mud
	22	35	Compact medium sand and rocks
494 H6	Bottom of pit	15.6	Soft clay, fine sand
	15.6	19.6	Hard packed sand and gravel
	19.6	26.0	Fine compact sand
495 H5	8	9	Fill; cinders, sand, gravel
	9	21	Soft silt, fine sand, shells
	21	27	Silty sand
	27	31	Medium sharp dark sand, little gravel
	31	42	Medium blue clay and fine sand
	42	52	Fine sharp gray sand
	52	55	Soft blue sand and clay, little gravel
496 G6	22.0	22.6	Fill; cinders, sand, gravel
	22.6	40.9	Silt, fine sand
	40.9	47.6	Medium blue clay, little fine sand
	47.6	53.3	Soft blue clay, little fine sand
	53.3	61.6	Medium blue clay, sand and gravel
	61.6	80.0	Soft blue clay, little fine sand
497 F5	Surface	19.5	Not reported
	19.5	22.0	Loose sand and gravel fill
	22.0	44.0	Silt, little fine sand
	44.0	48.0	Sand, gravel, clay
	48.0	72.0	Medium blue clay

No. and location	Elevations or depths From	To	Formation
498 C5	4' below curb	14	Fill; cinders, sand, gravel
	14	31	Silt, fine sand, shells
	31	37	Soft blue clay, little fine sand
	37	50	Soft blue clay and fine sand
499 G5	10.5	15	Fill
	15	37	Fine silty sand, mud
	37	44	Hard blue clay
	44	50	Medium blue clay
	50	65	Soft blue clay
	65	80	Soft blue clay, stones
500 H5	Start	12	Fill; gravel, rocks
	12	20	Gravel, rocks
	20	22	Sand, shells, traces of mud
	22	37	Hard yellow clay
501 B6	+ 8	+ 5	Peat
	+ 5	+ 4	Sand, gravel, clay
	+ 4	−18	Hard yellow clay
502 D3	Surface of street	12	Sand and gravel fill
	12	19	Medium peat
	19	30	Medium coarse sand, gravel
503 K7	+30	+28.5	Paving
	+28.5	+20	Coarse sand and gravel; very hard
	+20	+11	Fine sand, little clay
	+11	+ 7	Sand, little clay, old timber
	+ 7	− 1	Medium stiff blue clay
	− 1	−12	Fine sand, little clay
	−12	−22	Medium stiff blue clay
	−22	−30	Very hard sand, gravel and clay
504 I9	+19	+ 4	Sand and gravel fill
	+ 4	− 2	Sand, gravel, very little clay
	− 2	− 9	Silty sand, shells
	− 9	−14	Hard silty sand
	−14	−20	Firm fine sand and clay
	−20	−42	Stiff blue clay
	−42	−63	Medium stiff blue clay
505 F4	+17	− 1	Fill; sand, gravel, clay
	− 1	− 6	Very loose wet sand and gravel
	− 6	−10	Silt
	−10	−15	Peat
	−15	−21	Fine sand
	−21	−24	Fine sand, little clay
	−24	−27	Stiff blue clay

No. and location	Elevations or depths From	To	Formation
506 F5	+18	− 5	Loose coarse sand and gravel fill
	− 5	−14	Medium silt, fine sand, shells
	−14	−24	Medium silt
	−24	−25	Fine compact sand, little clay
	−25	−28	Fine sharp gray sand, stratum of clay
	−28	−33	Medium blue clay, fine sand
	−33	−60	Medium blue clay, very little sand
	−60	−66	Medium blue clay, stratum of sand
	−66	−69	Fine blue sand, little clay and gravel
	−69	−89	Medium blue clay
	−89	−100	Stiff blue clay, little gravel
507 G5	Sidewalk	30	Fill
	30	41	Silt, little fine sand
	41	47	Medium yellow clay, little fine sand
	47	51	Fine blue sand and clay
	51	52	Fine blue sand
	52	58	Medium blue clay, little fine sand and gravel
	58	85	Medium blue clay
	85	87	Hard sand and gravel, little clay
	87	103	Loose coarse sand and coarse gravel
	103	124	Hard coarse sand, gravel, little clay
	124	126	Hard fine sand, little clay
	126	131	Clay, sand, little gravel
	131	134	Medium blue clay
	134	136	Medium fine sand, little clay
	136	139	Hard coarse sand, little fine gravel
	139	140	Hardpan
508 F6	Surface	5	Fill
	5	18	Sand and gravel fill
	18	33	Fine silty sand, mud
	33	39	Hard blue clay
	39	51	Medium yellow clay
509 F3	+13	− 8.3	Loose sand and gravel fill
	− 8.3	−14.6	Silty sand, shells
	−14.6	−16.6	Silty peat
	−16.6	−22.7	Loose coarse sand and coarse gravel
	−22.7	−32.0	Firm fine blue sand
510 H6	Surface	12.6	Fill
	12.6	19.6	Mud
	19.6	30.0	Hard yellow clay
511 H6	7.0 below sidewalk = start	9.0	Fill
	9.0	12.0	Very soft, silt and sand
	12.0	13.6	Fine sand, very little clay
	13.6	15.6	Medium blue sand, little clay
	15.6	16.6	Medium yellow clay, sand, gravel
	16.6	18.6	Hard yellow clay, little sand, little gravel
512 I6	12.1 below sidewalk = 0	25.2	Hard yellow sand
	25.2	27.6	Medium blue clay
	27.6	32.8	Hard yellow sand
	32.8	38.6	Hard yellow sand, little gravel
	38.6	42.3	Hard fine yellow sand
	42.3	46.2	Medium blue clay
	46.2	52.1	Hard blue sand
	52.1	63.6	Medium blue clay
	63.6	74.6	Hard sand, gravel, clay (hardpan); rock or boulder
513 O7	+16.0	− 1.6	Hard coarse sand fill
	− 1.6	−16.0	Loose coarse sand fill
	−16.0	−21.5	Hard yellow clay
514 H4	7.0 below surface	32	Sand and gravel fill
	32	34	Soft silt and fine sand
	34	37	Medium sharp blue sand
	37	48	Hard yellow clay, layers of fine sand
515 I8	6.0 below sidewalk	10.5	Soft mud
	10.5	24.0	Soft silt
	24.0	31.0	Hard yellow clay
	31.0	39.0	Medium yellow clay
	39.0	80.0	Soft blue clay
	80.0	81.8	Fine sand, little gravel
	81.8	88.8	Hard coarse sand and coarse gravel, little clay
516 D3	+31	+29	Cinders, fill
	+29	+ 5	Fill; sand, clay, gravel, rubbish
	+ 5	− 4	Silty peat and fine sand
	− 4	− 9	Silty sand and gravel
	− 9	−24	Fine silty sand and gravel; hard
	−24	−27	Stiff blue clay
517 O7	0	−19	Water
	−19	−20	Silt
	−20	−40	Blue clay
	−40	−59	Boulder clay
	−59		No rock

No. and location	Elevations or depths From	To	Formation
518 P6	At −79		No boulder clay (hardpan) No rock
519 P6	Surface	−23	Water
	−23	−27	Soft black silt
	−27	−40	Stiff blue clay
	−40	−75	Hard sand, gravel and clay (boulder clay)
520 O6	Surface		
	+14	+ 3	Fill
	+ 3	0	Sand and gravel
	0	−19	Sand, gravel, clay (till)
	−19	−23	Clay
	−23	−37	Sand, gravel
	−37	−75	Till
		−75	Rock
521 O5	Surface		
	+23	− 3	Not reported
	− 3	−24	Till
		−24	No rock
522 N6			
523 M6	Surface		
	+20	+ 8	Not reported
	+ 8	−30	Till
		−30	No rock
524 N6	Surface		
	+25	+ 4	Not reported
	+ 4	−18	Till
		−18	No rock
525 N6	Surface		
	+20	+11	Not reported
	+11	−12	Till
		−12	No rock
526 O6	Surface		
	+16	+ 3	Not reported
	+ 3	−57	Till
		−57	No rock
527 O7	0	−28	Water
	−28	−30	Silt
	−30	−61	Blue clay
	−61	−82	Boulder clay. No rock
528 P7	0	−30	Water
	−30	−32	Black silt
	−32	−69	Blue clay
	−69	−86	Boulder clay
529 O7	0	−32	Water
	−32	−35	Soft black silt
	−35	−71	Stiff blue clay, little sand
	−71	−75	Boulder clay
	−75	−76	Slate rock
530 O7	Harbor bottom	−75	No boulder clay
	−75	−76	Slate bedrock

No. and location	Elevations or depths From	To	Formation
531 O7	0	−54	?
	−54	−90	Boulder clay—no rock
532 O7	−19	−31	Boulder clay
	−31	−35	Till, chiefly fine sand
	−35	−39	Till, chiefly fine sand
	−39	−45	Till, much clay
	−45	−49	Till, much clay
	−49	−61	Sandy boulder clay
	−61	−66	Fine sand
	−66	−72	Boulder clay
533 L3		At 20	Rock—slate
534 L3	0	6	Overburden
	6	9.5	Rock
535 P8	At −74		Till—no rock
536 O8	At −78		Till—no rock
537 O8	At −75		Till—no rock
538 O8	At −75		Till—no rock
539 O8	At −91		No rock or till
540 O8	At −80		Boulder clay
541 N8	At −73		Till
542 N8	At −80		No till or bedrock
543 M7	At −66		No till. No rock
544 L6	At −30		Clay, sand, gravel; hard
545 L6	At −25		Blue clay, gravel, sand. No till
546 L6	+39	+28	Clay, sand, gravel
	+28	+24	Hard yellow clay
	+24	+20	Sand, gravel
	+20	+16	Yellow clay, gravel, hard
	+16	+11	Sand, gravel
	+11	+ 1	Hard blue clay, sand
	+ 1	− 1	Sand, gravel
547 O7	− 8	−12	Black silt
	−12	−41	Blue clay
	−41	−51	Boulder clay
	−51	−51.5	Boulder
	−51.5	−54	Coarse sand
	−54	−60	Blue clay (slightly sandy but no gravel)
548 I8	Surface	5	Fill
	5	10	Fill (clay)
	10	23	Mud
	23	31	Hard clay

No. and location	Elevations or depths From	To	Formation
549 L7	Surface	25	Clay
	25	30	Clay, sand
550 H9	+14	− 9	Water
	− 9	−18	Soft silt, little sand, old timbers
	−18	−24	Stiff blue clay, little fine sand
	−24	−62	Medium stiff blue clay, very little fine sand
	−62	−70	Soft blue clay and fine sand
	−70	−85.5	Medium stiff blue clay
551 M7	At −115		No ledge
552 M8	At −55		Blue clay
553 I4	0	7.3	Sand and gravel fill
	7.3	19	Silt, fine sand
	19	25.5	Soft silt and fine sand
	25.5	28.4	Peat
	28.4	29.7	Clay, fine sand, little gravel
	29.7	33	Hard blue clay
554 J8	Start	6	Mud
	6	−28	Clay
	−28	−31	Gravel
556 G9	River bed		
	=0	−26	Dock mud
	−26	−40	Soft blue clay
557 J6	Surface	70	Clay and rocks; very hard
	70	75	Clay, sand
	75	78	Clay, rocks
558 I6	Basement floor	6	Fill—ash
	6	18	Mud
	18	30	Hard packed coarse gravel and sand
559 I6	Surface	4	Clay
	4	7	Coarse sand
	7	31	Clay
	31	45	Fine sand
560 L7	Surface	11	Fill
	11	14	Mud
	14	22	Hard yellow clay
	22	50	Medium hard blue clay
561 F3	16.5	0.5	Fill
	0.5	− 5.5	Dock mud
	− 5.5	−15.5	Coarse sand and gravel
562 N6	Surface	15	Fill
	15	35	Clay, rocks (till)
563 J8	Surface	9	Fill
	9	30	Hard clay
564 K9	+20	+ 2	Fill; sand, gravel, cinders
	+ 2	− 4	Silty sand, gravel, wood
	− 4	− 8	Clay, little sand
	− 8	−13	Soft blue clay and sand
	−13	−20	Very soft blue clay
	−20	−38	Soft blue clay
	−38	−57	Clay, sand, gravel; hard
	−57	−70	Clay, blue, little sand; very hard
565 K9	+15	−13	Water
	−13	−15	Black silt
	−15	−18	Sand, gravel, shells
	−18	−28	Silt, sand
	−28	−40	Blue clay (stiff)
	−40	−48	Clay, sand, gravel
	−48	−64	Coarse sand and gravel, very little clay
	−64	−85	Blue clay, little sand and gravel; very hard
566 I9	+15	+13	Fill; cinders, gravel
	+13	− 2	Fill; sand, gravel, stone
	− 2	−15	Silt, very little fine sand
	−15	−31	Stiff blue clay, little fine sand
	−31	−52	Medium stiff blue clay, little fine sand
	−52	−85	Stiff blue clay, very little gravel
567 H9	+16	−19	Water and air
	−19	−26	Very fine silt, sand, shells
	−26	−85	Soft blue clay
568 C9	Surface	9	Fill
	9	29	Mud
	29	50	Hard clay
569 H4	Surface	12	Fill
	12	35	Sand, mud
	35	38	Sand, mud
570 J3	− 2.5	− 8	Hard gravel fill
	− 8	−10	Soft silt
	−10	−19	Hard gravel
	−19	−27	Silt
	−27	−43	Coarse gravel, silt
	−43	−50	Hard gravel
571 K2	− 2.5	−10	Gravel fill
	−10	−20	Silt, gravel
	−20	−30	Silt, fine sandy clay
572 K2	− 2.5	− 8.5	Hard gravel and fine sand
	− 8.5	−24.0	Soft silt
	−24.0	−44.0	Hard gravel
573 K2	− 2.5	−10	Hard gravel
	−10	−15	Loose gravel
	−15	−21	Coarse gravel
	−21	−24	Gravel and silt
	−24	−29	Clay and gravel (ends in stiff clay)

No. and location	Elevations or depths From	To	Formation
574 K2	At −40		Ends in clay
575 I7	+20	+15	Fill
	+15	+ 0	Hard yellow clay
	+ 0	− 3	Clay, brown sand
	− 3	−31	Hard blue clay
576 I8	+11.0	+ 7.5	Mud and wood fill
	+ 7.5	− 0.3	Soft black mud
	− 0.3	−12.1	Soft silt
	−12.1	−15.3	Medium blue clay
	−15.3	−22.5	Hard yellow clay
	−22.5	−30.1	Medium yellow clay
	−30.1	−79.0	Soft blue clay
	−79.0	−84.4	Hard coarse sand, coarse gravel, little clay. Refusal rock or boulder
577 I9	Surface −120		Overburden
	−120		Bedrock
578 J9	Surface	5	Fill; sand, gravel
	5	13	Fill; clay, sand, gravel
	13	20	Cinders fill
	20	43	Silt, little sand
	43	50	Silty sand
	50	78	Soft blue clay
	78	86	Hard blue clay, sand and gravel. Rock?
579 J9	+15	−10	Fill
	−10	−22	Mud
	−22	−51	Soft clay
	−51	−61	Hard clay
580 J9	+14	− 5	Fill
	− 5	−13	Mud
	−13	−31	Gravel, mud
	−31	−60	Sand, gravel, mud
581 J9	+14	−14	Fill
	−14	−29	Mud, sand
	−29	−39	Gravel
	−39	−46	Gravel, mud
	−46	−59	Sand, gravel, mud
	−59	−60	Hard clay, stones
582 J9	+15	− 8	Fill
	− 8	−11	Mud
	−11	−16	Gravel
	−16	−21	Mud, gravel
	−21	−60	Gravel, mud. Ledge or boulder
583 J9	+15	+ 2	Fill
	+ 2	+ 0	Sand, mud
	+ 0	− 5	Hard mud
	− 5	−15	Gravel
	−15	−24	Mud, gravel
	−24	−25	Hard mud and gravel
	−25	−30	Hard blue clay
584 J9	+15	+ 3	Fill
	+ 3	− 5	Sand, mud
	− 5	−10	Hard mud
	−10	−19	Gravel, mud
	−19	−24	Hard blue clay
585 J9	+15	+ 4	Fill
	+ 4	− 4	Soft mud
	− 4	−15	Hard mud
	−15	−20	Blue sand and clay
586 K8	+19	+ 2	Fill
	+ 2	− 1	Mud and fill
	− 1	−10	Soft clay
	−10	−18	Clay, gravel
587 K9	+18	+ 7	Fill
	+ 7	− 9	Mud and fill
	− 9	−19	Soft clay and gravel
	−19	−22	Hard clay and gravel, shells
588 K9	+16	+ 5	Fill
	+ 5	−10	Mud and fill
	−10	−12	Soft clay
	−12	−21	Hard clay
	−21	−32	Soft gravel, shells
589 K9	+16	+ 6	Fill
	+ 6	−10	Mud and fill
	−10	−18	Hard blue clay
	−18	−32	Soft clay and gravel, shells
590 K9	+16	+ 9	Fill
	+ 9	− 8	Mud
	− 8	−11	Soft clay
	−11	−19	Hard blue clay
	−19	−39	Mud, gravel, soft clay
591 K9	+ 5	−10	Mud
	−10	−20	Hard blue clay
	−20	−27	Soft sand and clay
	−27	−33	Soft gravel
	−33	−39	Hard clay and gravel
592 H4	+15	+14	Road bed
	+14	− 2	Fill
	− 2	−26	Sand, silt
	−26	−33	Sand, gravel
593 H4	+15	+14	Road bed
	+14	+ 0	Fill
	+ 0	−26	Sand, silt
	−26	−31	Sand, gravel
594 H4	+15	+14	Road bed
	+14	+ 5	Fill
	+ 5	− 5	Sand, silt
	− 5	−11	Sand, gravel
595 H3	+15	+14	Road bed
	+14	+ 4	Fill
	+ 4	− 4	Sand, silt
	− 4	− 9	Sand, gravel
596 H3	+15	+14	Road bed
	+14	+ 5	Fill
	+ 5	− 4	Sand, silt
	− 4	− 8	Sand, gravel
597 H3	+13	+12	Road bed
	+12	+ 5	Fill
	+ 5	+ 2	Brown peat
	+ 2	− 4	Sand, silt
	− 4	−12	Sand, gravel

No. and location	Elevations or depths From	To	Formation
598	+13	+12	Road bed
H3	+12	+ 5	Fill
	+ 5	+ 2	Brown peat
	+ 2	− 6	Sand, silt
	− 6	−11	Sand, gravel
599	+13	+12	Road bed
G3	+12	+ 3	Fill
	+ 3	− 5	Sand, silt
	− 5	−11	Sand, gravel
600	+13	+ 1	Fill; sand, gravel, ash
G3	+ 1	− 4	Sand, silt
	− 4	−10	Sand, gravel
601	+13	− 1	Fill; sand, gravel, ash
G3	− 1	−26	Sand, silt
	−26	−30	Sand, gravel
602	+13	+ 0	Fill; sand, gravel, ash
G3	+ 0	−31	Sand, silt
	−31	−34	Sand, gravel
603	+13	+ 1.5	Fill; sand, gravel, ash
G3	+ 1.5	−30	Sand, silt
	−30	−34	Sand, gravel
604	+13	− 4	Fill; sand, gravel, ash
G3	− 4	−25	Sand, silt
	−25	−31	Sand, gravel
605	+13	− 6	Fill; sand, gravel, ash
G3	− 6	−26	Sand, silt
	−26	−31.5	Sand, gravel
606	+13	− 9	Fill; sand, gravel, ash
F2	− 9	−19	Sand, silt
	−19	−23	Sand, gravel
607	+13	− 6	Fill; sand, gravel, ash
F2	− 6	−19	Sand, silt
	−19	−24	Sand, gravel
608	+14	− 2	Fill; sand, gravel, ash
F2	− 2	−18	Sand, silt
	−18	−22	Sand, gravel
609	+14	− 2	Fill; sand, gravel, ash
F2	− 2	−19	Sand, silt
	−19	−23	Sand, gravel
610	+13	− 2	Fill; sand, gravel, ash
F2	− 2	− 9	Sand, silt
	− 9	−14	Sand, gravel
611	+13	− 1	Fill; sand, gravel, ash
F2	− 1	− 9	Sand and silt
	− 9	−13	Sand and gravel
612	+13	− 3	Fill; sand, gravel, ash
E2	− 3	− 7	Sand, silt
	− 7	−12	Sand, gravel
613	+13	− 3	Fill; sand, gravel, ash
E2	− 3	− 8	Sand, silt
	− 8	−13	Sand, gravel
614	+14.5	− 1	Fill; sand, gravel, ash
E2	− 1	− 7	Sand, silt
	− 7	−11	Sand, gravel
615	+16	+ 1	Fill; sand, gravel, ash
E2	+ 1	− 9	Sand, silt
	− 9	−12	Sand, gravel
616	+10.5	+ 4.5	Fill; sand, gravel, ash
F7	+ 4.5	− 2.5	Silt, sand
	− 2.5	−14.5	Hard blue clay
617	+ 8.5	+ 3.5	Fill; sand, gravel, ash
F7	+ 3.5	− 1.5	Silt, sand
	− 1.5	−11.5	Hard blue clay and sand
618	+ 9.0	+ 3.5	Fill; sand, gravel, ash
F7	+ 3.5	− 2.5	Silt, sand
	− 2.5	− 9.5	Stiff blue clay
619	+10.0	+ 3.0	Fill; sand, gravel, ash
F8	+ 3.0	+ 0.5	Silt, sand
	− .5	− 5.0	Stiff blue clay
620	+17.0	+15.5	Broken stone
B5	+15.5	+12.0	Sand and gravel fill
	+12.0	+ 6.0	Silt soft
	+ 6.0	− 4.0	Stiff brown peat
	− 4.0	−12.0	Stiff blue clay and sand
621	+17.5	+16.5	Broken stone
B5	+16.5	+14.5	Sand and gravel fill
	+14.5	+ 4.5	Silt
	+ 4.5	− 4.5	Stiff brown peat
	− 4.5	−10.5	Stiff blue clay and sand
622	+17	+14	Road bed
B5	+14	− 2.5	Fill; sand, gravel, ash
	− 2.5	− 7.0	Stiff brown peat
	− 7.0	−13.5	Stiff blue clay
623	+17.0	+ 1.5	Fill; sand, gravel, ash
C5	+ 1.5	− 5.5	Silt
	− 5.5	−10.0	Stiff brown peat
	−10.0	−16.0	Stiff blue clay and sand
624	+16.0	+ 4.0	Fill; sand, gravel, ash
E9	+ 4.0	− 9.0	Blue sand, gravel
	− 9.0	−27.0	Silt, shells
	−27.0	−32.0	Stiff blue clay
625	+ 7.0	− 4.0	Fill; sand, gravel, ash
E9	− 4.0	−12.0	Blue sand fill
	−12.0	−32.0	Silt, shells
	−32.0	−37.5	Stiff blue clay
626	+14	+ 3	Ash fill
F9	+ 3	−10	Sand, gravel
	−10	−23	Silt, shells
	−23	−28	Stiff blue clay
627	+11	− 1	Fill; sand, gravel, ash
F9	− 1	−23	Silt, shells
	−23	−28	Stiff blue clay
628	+ 9.0	+ 4.0	Fill; sand, gravel, ash
F9	+ 4.0	−15.5	Silt, sand, shells
	−15.5	−20.0	Stiff blue clay
629	+ 0.0	− 3.5	Water
F9	− 3.5	− 7.5	Silt
	− 7.5	−18.0	Brown peat
	−18.0	−23.0	Blue clay

No. and location	Elevations or depths From	To	Formation
630	+14.5	+ 6.0	Fill
C8	+ 6.0	+ 4.0	Fill; sand, gravel
	+ 4.0	−12.0	Silt
	−12.0	−17.0	Yellow clay
631	+11.5	+ 4.5	Fill
C8	+ 4.5	+ 2.5	Fill; sand, gravel
	+ 2.5	− 8.5	Silt
	− 8.5	−14.0	Yellow clay
632	+13.0	+ 6.0	Fill
C8	+ 6.0	+ 5.0	Fill; sand, gravel
	+ 5.0	+ 2.0	Peat
	+ 2.0	− 0.5	Silt
	− 0.5	− 5.0	Yellow clay
633	+16.5	+15.5	Paving
K3	+15.5	+10.5	Sand and gravel fill
	+10.5	+ 6.0	Silty clay fill
	+ 6.0	+ 4.5	Coarse silty sand
	+ 4.5	− 2.5	Fine silty sand
	− 2.5	− 4.5	Silty sand, gravel, very little clay
	− 4.5	−10.5	Stiff blue clay
634	+16.5	+15.5	Paving
K3	+15.5	+13.5	Sand and gravel fill
	+13.5	+ 7.2	Soft black silt
	+ 7.2	+ 2.0	Stiff brown silt
	+ 2.0	+ 1.0	Silty sand and gravel
	+ 1.0	− 2.5	Stiff brown silt
	− 2.5	− 4.0	Silty sand and gravel
	− 4.0	− 9.2	Stiff brown peat
	− 9.2	−10.0	Coarse sand, little clay
	−10.0	−11.0	Coarse silty sand, shells
	−11.0	−17.0	Stiff blue clay
635	+16.5	+15.5	Paving
K3	+15.5	+13.0	Sand and gravel fill
	+13.0	+10.0	Soft black silt
	+10.0	+ 8.5	Soft silty clay
	+ 8.5	− 1.0	Silty sand, shells, little gravel
	− 1.0	− 5.5	Stiff brown silt
	− 5.5	− 7.0	Silty clay
	− 7.0	−13.5	Stiff blue clay
636	+17.5	+16.5	Paving
K3	+16.5	+10.5	Sand and gravel fill
	+10.5	+ 3.5	Silt
	+ 3.5	− 0.5	Silty sand, shells
	− 0.5	− 2.0	Silty clay
	− 2.0	− 6.7	Stiff blue clay
637	+17.0	+16.0	Paving
K3	+16.0	+12.0	Sand and gravel fill
	+12.0	+ 5.5	Silty sand and gravel
	+ 5.5	+ 1.5	Soft black silt
	+ 1.5	+ 0.5	Coarse silty sand and gravel
	+ 0.5	− 5.0	Stiff blue clay
638	+16.5	+15.5	Paving
K3	+15.5	+11.2	Fill; sand, gravel, clay
	+11.2	+ 2.5	Silt, little gravel
	+ 2.5	− 1.5	Hard yellow clay

No. and location	Elevations or depths From	To	Formation
639	+16.0	+ 5	Fill; sand, gravel, stones
J8	+ 5	+ 1	Silt, sand, wood
	+ 1	− 2	Peat
	− 2	− 4	Peat, silt, sand
	− 4	−11	Stiff yellow clay and sand
	−11	−16	Stiff yellow clay
	−16	−44	Soft blue clay
640	+15.5	+ 7.0	Fill; gravel, sand
J8	+ 7.0	+ 6.0	Silty sand, some peat
	+ 6.0	+ 4.0	Stiff blue clay, little gravel
	+ 4.0	− 2.0	Silty sand, very little peat
	− 2.0	− 4.0	Peat
	− 4.0	− 8.0	Fine blue sand, little clay
	− 8.0	−15.0	Hard yellow clay
	−15.0	−22.5	Stiff blue clay
	−22.5	−43.0	Soft blue clay
641	Surface	10	Sand, gravel
E5	10	16	Brown sand
	35	40	Soft blue clay
642	Surface	13	Fill
E5	13	14	Fine gray sand
	14	15	Silty sand, some gravel, shells
	15	28	Silt, few shells
	28	30	Stiff blue clay, little sand and gravel
	30	35	Stiff blue clay
643	+16.0	+ 7.0	Fill; gravel, sand
I7	+ 7.0	+ 0.5	Silty sand
	+ 0.5	− 2.0	Brown peat
	− 2.0	− 3.0	Blue sand, gravel
	− 3.0	− 9.0	Stiff yellow clay
	− 9.0	−15.0	Stiff yellow clay and sand
	−15.0	−24.0	Soft blue clay and sand
	−24.0	−38.0	Soft blue clay
644	+17	+ 7	Fill
K4	+ 7	+ 3	Clay
645	+16.0	+ 2.5	Fill; sand, gravel
G3	+ 2.5	− 7.5	Coarse sand
	− 7.5	−14.5	Fine sand
	−14.5	−22.7	Silt, shells
	−22.7	−26.5	Sand; shells
	−26.5	−29.5	Sand, gravel; very hard
646	+17.0	+ 3.5	Fill; sand, gravel
G3	+ 3.5	+ 1.5	Sand, gravel
	+ 1.5	− 7.7	Coarse sand
	− 7.7	−11.0	Peat
	−11.0	−14.7	Fine sand
	−14.7	−23.0	Silt
	−23.0	−26.0	Sand, gravel; very hard
647	+17.0	+ 4.5	Fill; sand, gravel
G3	+ 4.5	+ 1.5	Coarse sand
	+ 1.5	−14.5	Silt
	−14.5	−26.5	Fine sand (loose)
	−26.5	−29.5	Coarse sand (hard)

No. and location	Elevations or depths From	To	Formation
648	+17.0	+ 5.0	Fill; sand, gravel
F4	+ 5.0	+ 3.0	Fine sand
	+ 3.0	−14.0	Silt
	−14.0	−17.0	Fine sand
	−17.0	−22.0	Stiff clay
649	+17.0	+ 6.0	Fill; sand, gravel, ash
F4	+ 6.0	+ 2.0	Sand, gravel
	+ 2.0	−18.0	Silt, shells (very soft)
	−18.0	−22.0	Fine sand
	−22.0	−26.5	Stiff blue clay
650	+34	+30	Mud
I6	+30	+24	Sand, gravel; hard
	+24	+20	Hard yellow clay, sand
	+20	+17	Fine clay and sand
	+17	+14	Wet sand
	+14	+ 7	Fine clay and sand
	+ 7	+ 5	Fine wet sand
651	+39	+36	Sand, gravel
I6	+36	+32	Clay, sandy gravel
	+32	+26	Coarse sand, gravel
	+26	+22	Hard blue clay, sand
	+22	+15	Brown sand
	+15	+12	Hard blue clay
	+12	+ 5	Fine sand
652	+39	+36	Sand, mud
J6	+36	+32	Fine sand and gravel
	+32	+15	Sand, gravel
	+15	+12	Clay, sandy gravel
653	+38	+35	Brown sand, mud
J6	+35	+28	Sand, gravel, stones
	+28	+ 5	Sand, gravel
	+ 5	+ 2	Fine sand and gravel
	+ 2	− 1	Sand, gravel
654	+37	+33	Sand, gravel
J6	+33	+28	Clay, sandy gravel
	+28	+26	Sand, gravel
	+26	+22	Fine sand
	+22	+17	Sand, gravel
	+17	+ 7	Coarse sand and gravel
655	+37	+31	Brown sand, mud
J6	+31	+25	Wet sand
	+25	+19	Sand
	+19	+ 8	Sand, gravel
	+ 8	+ 2	Wet sand
656	+37	+30	Sand, mud
J6	+30	+26	Sand, gravel
	+26	+12	Fine sand
657	+40	+27	Sand, gravel
J6	+27	+24	Yellow clay, sand
	+24	+ 5	Clay, sand, gravel; hard
	+ 5	+ 1	Fine sand
	+ 1	− 3	Sand, gravel
658	+42	+36	Sand, gravel, mud
J6	+36	+32	Fine sand
	+32	+25	Yellow clay, gravel; hard
	+25	+10	Fine sand
	+10	+ 7	Coarse wet sand
	+ 7	+ 3	Yellow clay, gravel; hard
	+ 3	− 1	Fine clay, sand
659	+52	+48	Yellow sand, mud
J6	+48	+45	Sand, gravel; hard
	+45	+43	Fine sand
	+43	+37	Clay, sand, gravel, stones
	+37	+30	Fine wet sand
	+30	+27	Fine sand
	+27	+24	Yellow clay, sand, gravel; hard
660	+58	+48	Fill
K6	+48	+41	Clay, sand, gravel; hard
661	+52	+48	Fill
K6	+48	+34	Clay, sand, gravel; hard
	+34	+30	Hard yellow clay, sand, gravel, stones
	+30	+21	Clay, sand, gravel; hard
662	+57	+50	Fill
K6	+50	+46	Hard yellow clay, sand
	+46	+43	Fine sand
	+43	+31	Sand, gravel; hard
663	+55	+37	Sand, gravel
K6	+37	+30	Yellow clay, sand, gravel
	+30	+26	Fine sand, gravel
	+26	+14	Coarse sand and gravel
	+14	+10	Fine sand and gravel
664	+55	+46	Fill
L6	+46	+37	Hard yellow clay, fine sand
	+37	+25	Clay, sand, gravel; hard
	+25	+21	Fine wet sand
	+21	+18	Fine sand, gravel
	+18	+15	Coarse sand, gravel; hard
	+15	+11	Sand, gravel; hard
	+11	+ 8	Fine sand and gravel
665	+54	+38	Fine sand and gravel
L6	+38	+30	Yellow clay, sand, gravel; hard
	+30	+20	Coarse sand, gravel; hard
	+20	+ 8	Sand, gravel
666	+50	+44	Fill
L6	+44	+33	Fine sand and gravel
	+33	+ 2	Yellow clay, coarse sand and gravel; hard
	+ 2	− 2	Clay, sandy gravel
	− 2	−10	Coarse sand
	−10	−14	Sand, gravel
667	+39	+31	Fill
L5	+31	+28	Hard blue clay, sand, gravel
	+28	+21	Yellow clay, sand, coarse gravel
	+21	+12	Hard blue clay, sand, gravel
	+12	+ 8	Wet sand and gravel
	+ 8	+ 2	Yellow clay, sand, gravel
	+ 2	− 3	Hard blue clay, sand and gravel

No. and location	Elevations or depths From	To	Formation
668	+29	+20	Fill
L5	+20	+17	Clay, sand
	+17	+12	Hard blue clay
	+12	+ 4	Clay, sand
	+ 4	− 9	Hard blue clay
	− 9	−12	Clay, coarse sand and gravel; hard
669	+24	+19	Fill
L5	+19	+16	Yellow clay, sand
	+16	+10	Hard yellow clay, sand
	+10	+ 7	Yellow sand
	+ 7	+ 4	Hard blue clay
	+ 4	− 4	Clay, sand
	− 4	− 7	Hard blue clay
670	+28	+21	Fill
L5	+21	+10	Hard blue clay
	+10	+ 2	Clay, sand, gravel
	+ 2	− 1	Clay, sand
	− 1	− 5	Hard blue clay
671	+23	+19	Fill
L5	+19	+16	Hard blue clay, fine sand
	+16	+11	Hard yellow sand
	+11	− 1	Fine clay, sand
	− 1	−18	Hard blue clay
672	+21	+14	Fill
M6	+14	+ 6	Yellow clay, sand
	+ 6	− 2	Clay, sandy gravel
	− 2	−16	Hard blue clay
	−16	−24	Soft blue clay
673	+18	+ 7	Fill
M6	+ 7	− 4	Hard yellow clay
	− 4	−11	Fine blue sand
	−11	−20	Hard blue clay
	−20	−29	Fine blue sand
	−29	−31	Hard blue clay
674	+21	+11	Fill
M6	+11	+ 9	Yellow clay, gravel
	+ 9	+ 5	Stone
	+ 5	−11	Hard blue clay, sand
	−11	−15	Hard blue clay
675	+21	+18	Fill
M6	+18	+ 9	Hard yellow clay
	+ 9	+ 3	Clay, sandy gravel
	+ 3	− 2	Hard blue clay, little gravel
	− 2	−29	Little clay, sand, gravel; soft
676	+23	+20	Fill
M6	+20	− 3	Hard yellow clay and sand
	− 3	− 7	Clay, sand, gravel; hard
			Hardpan
677	+26	+21	Fill
M6	+21	+18	Sand, gravel
	+18	+11	Hard yellow clay
	+11	+ 8	Hard blue clay
	+ 8	+ 4	Fine sand
	+ 4	−28	Clay, sand, gravel; hard

No. and location	Elevations or depths From	To	Formation
678	+28	+25	Fill
N6	+25	+12	Yellow clay, gravel
	+12	−12	Hard yellow clay and fine sand
679	+30	+27	Sand
N5	+27	+21	Clay, sand, stones; hard
	+21	+13	Hard clay, stones
	+13	+ 9	Hard blue clay
	+ 9	−26	Clay, sand, stones; hard
680	+29	+26	Fill
N5	+26	+ 2	Hard yellow clay, sand
	+ 2	− 1	Hard clay, gravel
681	+29	+25	Fill
N6	+25	+20	Yellow clay, gravel
	+20	+12	Hard yellow clay
	+12	−21	Hard blue clay, sand and gravel
682	+26	+23	Fill
O5	+23	+ 8	Hard yellow clay
	+ 8	− 3	Clay, sand, gravel; hard
683	+28	+22	Clay, fine blue sand; wet
O5	+22	+12	Clay, sand, stones
	+12	+ 2	Blue clay, stones
	+ 2	− 2	Clay, fine sand
684	+23	+13	Fill
O5	+13	+ 7	Gravel
	+ 7	− 2	Hard blue clay
	− 2	−21	Hard clay, little sand and stones
685	+17	− 1	Fill
O6	− 1	−14	Hard blue clay
	−14	−34	Clay, sand, gravel; hard
686	+15	− 2	Fill
O6	− 2	−19	Clay, sandy gravel
	−19	−25	Hard blue clay, fine sand
	−25	−38	Fine wet sand and gravel
	−38	and below	Clay, sand, gravel, stones; hard
687	+14	+ 5	Fill
O6	+ 5	− 3	Silty sand and gravel
	− 3	−25	Clay, sand, gravel; hard
	−25	−30	Soft blue clay
	−30	−43	Clay, sand, gravel; hard
688	+15	+ 4	Fill
O6	+ 4	− 2	Mud
	− 2	− 6	Fine yellow sand
	− 6	−21	Hard clay, stones
	−21	−27	Blue clay
	−27	−41	Yellow sand, stones; wet
	−41	−45	Yellow sand, fine stones

No. and location	Elevations or depths From	To	Formation
689 O6	+15	− 2	Fill
	− 2	−23	Clay, sand, gravel; hard
	−23	−31	Soft blue clay
	−31	−43	Hard blue clay, sand and gravel
	−43	−51	Hard blue clay, sand
	−51	−64	Clay, sand, gravel; hard
690 O6	− 1	− 5	Soft black silt
	− 5	− 9	Silty sand and gravel
	− 9	−13	Yellow clay, sand, gravel; hard
	−13	−28	Clay, sand, gravel; hard
	−28	−49	Hard blue clay
	−49	−59	Clay, sand, gravel; hard
691 O6	0	− 3	Gravel
	− 3	− 7	Black silt
	− 7	−18	Hard yellow clay, sand and gravel
	−18	−29	Hard blue clay, sand, gravel
	−29	−39	Hard blue clay
	−39	−52	Hard blue clay, sand, gravel
	−52	−60	Yellow clay, sand, gravel; hard
692 O6	−14	−17	Soft black silt
	−17	−26	Hard yellow clay
	−26	−30	Hard clay and gravel
	−30	−43	Soft blue clay
	−43	−50	Clay, sand, gravel; hard
	−50	−56	Hard blue clay
693 P6	−12	−15	Soft black silt
	−15	−30	Hard yellow clay
	−30	−38	Hard blue clay
	−38	−60	Hard clay and gravel
694 J7	+16	+ 5	Fill
	+ 5	+ 2	Fine sand, mud
	+ 2	− 3	Hard yellow clay and sand
	− 3	−10	Hard blue clay
	−10	−19	Soft blue clay
	−19	−23	Clay, sand
	−23	−39	Soft blue clay
695 J8	+17	+ 8	Fill
	+ 8	+ 6	Soft silty sand
	+ 6	− 1	Hard silty sand
	− 1	− 4	Blue sand and gravel
	− 4	−14	Hard yellow clay, little sand
	−14	−29	Soft blue clay
	−29	−34	Hard clay and gravel
	−34	−41	Hard blue clay
696 J8	+16	+ 4	Fill
	+ 4	− 1	Soft silt and shells
	− 1	− 7	Hard silty sand
	− 7	−12	Soft brown mud
	−12	−15	Hard blue clay, little sand
	−15	−25	Hard blue clay
	−25	−38	Soft blue clay, little sand
697 J8	+16	+ 8	Fill
	+ 8	+ 5	Silty sand and gravel
	+ 5	+ 1	Mud
	+ 1	− 4	Sand, silt, mud
	− 4	−12	Soft blue clay
	−12	−15	Mud
	−15	−20	Hard yellow clay
	−20	−30	Hard blue clay
	−30	−45	Soft blue clay
698 J8	+17	+ 9	Fill
	+ 9	+ 6	Sand, silt, mud
	+ 6	+ 3	Hard blue clay, little gravel
	+ 3	− 1	Sand, silt, mud
	− 1	− 4	Mud
	− 4	− 7	Little clay, fine blue sand
	− 7	−14	Hard yellow clay, little sand
	−14	−32	Soft blue clay
699 J8	+18	+ 7	Fill
	+ 7	+ 4	Fine sand, mud
	+ 4	− 1	Hard yellow clay, little sand
	− 1	− 5	Little clay, sand, coarse gravel
	− 5	−17	Hard blue clay and sand
	−17	−28	Hard blue clay
	−28	−35	Hard clay, sand and gravel
700 I5	+16	+ 0	Fill
	+ 0	−12	Peat
	−12	−31	Clay, loose blue sand
	−31	−40	Fairly stiff yellow clay, little sand and gravel
	−40	−46	Fairly stiff yellow clay, little sand
	−46	−53	Stiff blue clay, little sand
701 N5	+12	+ 8	Fill
	+ 8	+ 0	Silty sand
	+ 0	− 5	Soft silty peat
	− 5	−14	Hard yellow clay
	−14	−17	Stiff blue clay
702 K6	+57	+46	Fine sand
	+46	+40	Little sand, hard silt
	+40	+26	Clay, sand, stones
	+26	+23	Wet sand and gravel
	+23	+20	Sand, gravel, stones
	+20	+17	Clay, sand, gravel, stones; hard
703 K6	+58	+49	Sand, gravel
	+49	+39	Clay, sand, gravel, stones
	+39	+36	Sand, gravel
	+36	+30	Fine sand and gravel
	+30	+17	Clay, sand, gravel, stones; hard
	+17	+13	Clay, sand, gravel; hard
704 K6	+61	+51	Fill
	+51	+39	Clay, sand, gravel; hard

No. and location	Elevations or depths From	To	Formation
705 J8	+19	+ 9	Fill
	+ 9	+ 4	Hard yellow clay
	+ 4	+ 0	Soft blue clay
	+ 0	− 7	Soft yellow clay, sand
	− 7	−11	Soft blue clay
	−11	−28	Little coarse, hard fine sand and gravel
706 K8	+18	+ 4	Fill
	+ 4	+ 0	Clay, coarse sand, gravel
	+ 0	−19	Yellow clay, sand, gravel
707 K8	+18	+10	Fill
	+10	− 2	Hard blue clay
	− 2	−32	Hard blue clay, little sand and gravel
708 K8	+18	+ 8	Fill
	+ 8	+ 0	Silty sand
	+ 0	− 5	Little sand, hard silt
	− 5	−15	Hard blue clay
	−15	−30	Clay, sandy gravel
709 L8	+19	+ 3	Fill
	+ 3	−11	Clay, sand, gravel; hard
710 L8	+20	+ 2	Fill
	+ 2	−12	Clay, sand, gravel; hard
711 L8	+19	+13	Fill
	+13	+ 9	Hard yellow clay and sand
	+ 9	+ 4	Clay, sandy gravel
	+ 4	+ 0	Hard blue clay, sand and gravel
	+ 0	−13	Hard clay and gravel
712 M8	+18	+ 5	Fill
	+ 5	+ 2	Silty sand, gravel
	+ 2	−19	Clay, sand, gravel; hard
713 M8	+15	+ 0	Fill
	+ 0	− 5	Clay, sandy gravel
	− 5	−19	Soft yellow clay, sand and gravel
	−19	−26	Silty sand, gravel
	−26	−32	Hard yellow clay
	−32	−45	Soft blue clay
714 M7	+15	+ 1	Fill
	+ 1	− 4	Clay, mud
	− 4	−11	Black gravel and mud
	−11	−14	Clay, mud
	−14	−19	Clay, sand
715 M7	+15	− 4	Fill
	− 4	− 9	Black gravel
	− 9	−15	Gravel, mud
			Clay, gravel
716 M7	+15	− 4	Fill
	− 4	−10	Clay, gravel, mud
	−10	−17	Clay, sand
	−17	−21	Blue clay
	−21	−25	Hard blue clay
717 N7	+16	− 7	Fill
	− 7	−16	Fine silty sand, shells
	−16	−20	Brown mud
	−20	−31	Blue clay, yellow clay, sand, mud
	−31	−35	Clay, fine wet sand
718 N7	+15	+ 8	Fill
	+ 8	− 7	Clay, gravel
	− 7	−10	Soft blue clay
	−10	−13	Mud
			Blue clay
719 N7	+16	−10	Fill
	−10	−15	Mud
			Blue clay
720 N6	+16	+ 2	Fill
	+ 2	− 2	Silty sand, little mud, shells
	− 2	−25	Clay, sand, gravel
721 N6	+16	+11	Fill
	+11	+ 1	Sand, mud, stones
	+ 1	− 4	Stone
	− 4	−39	Clay, sand, stones; hard
722 O6	+17	+ 9	Fill
	+ 9	+ 5	Sharp wet sand, shells
	+ 5	+ 2	Yellow clay, gravel
	+ 2	−55	Clay, sand, stones
723 O6	+17	+ 3	Fill
	+ 3	+ 0	Sand, gravel, silt, mud, shells
	+ 0	− 2	Hard yellow clay, sand, gravel, shells
	− 2	−10	Hard yellow clay
	−10	−14	Hard yellow clay, sand, gravel
	−14	−18	Fine sand
	−18	−33	Hard blue clay, fine sand, gravel
724 O6	+18	+ 1	Fill
	+ 1	− 2	Hard yellow clay
	− 2	− 6	Little clay, sand, coarse gravel
	− 6	−13	Hard yellow clay
	−13	−21	Soft blue clay
	−21	−25	Hard blue clay, little gravel
	−25	−28	Clay, sand, gravel
725 O5	+19	+14	Fill
	+14	+ 9	Hard yellow clay
	+ 9	+ 2	Hard blue clay
	+ 2	− 2	Hard blue clay, little gravel
	− 2	−21	Hard blue clay, sand
726 O5	+18	+ 9	Fill
	+ 9	+ 2	Clay, sand, stones
	+ 2	− 2	Blue clay
	− 2	−12	Blue clay, stones
	−12	−15	Fine sand
	−15	−19	Hard clay, coarse sand
	−19	−22	Stones
	−22	−30	Hardpan

No. and location	Elevations or depths From	To	Formation
727	+23	+19	Fill
O5	+19	+ 4	Clay, sandy gravel
	+ 4	+ 0	Clay, fine brown sand
	+ 0	− 4	Little clay, sand, gravel; soft
	− 4	−10	Hard blue clay, sand and gravel
728	+19	+ 7	Fill
O4	+ 7	+ 2	Sand, coarse gravel
	+ 2	−11	Clay, sand, gravel; hard
729	+20	+13	Fill
N4	+13	+ 7	Clay, sand, gravel; hard
	+ 7	+ 4	Silty sand and gravel; hard
	+ 4	+ 0	Hard clay and gravel Stones
730	−21	−25	Black silt
N8	−25	−37	Clay, sand
	−37	−69	Blue clay
	−69	−81	Clay, sandy gravel
731	−16	−20	Black silt
N8	−20	−81	Blue clay
732	+14	−20	Fill
N8			Hard blue clay
733	+14	− 6	Fill
N8	− 6	−20	Silty sand
			Hard blue clay
734	−10	−16	Black silt
N8	−16	−71	Blue clay
735	− 9	−21	Black silt
N7	−21	−25	Silt, mud
	−25	−69	Blue clay
736	−12	−16	Black silt
N8	−16	−74	Blue clay
	−74	−78	Clay, sandy gravel
737	−12	−20	Black silt
N7	−20	−30	Hard blue clay
	−30	−49	Soft blue clay
	−49	−54	Little clay, sand
	−54	−81	Clay, little sand
738	+ 1	− 2	Black silt
N7	− 2	−20	Silty sand
	−20	−75	Blue clay
739	+ 5	− 1	Black silt
N7	− 1	−19	Silty sand
	−19	−64	Blue clay
	−64	−77	Clay, sandy gravel
740	− 5	− 8	Black silt
M7	− 8	−17	Silty sand
	−17	−79	Blue clay
741	+16	− 8	Fill
M7	− 8	−17	Silty clay, sand, shells
	−17	−64	Blue clay

No. and location	Elevations or depths From	To	Formation
742	+16	−10	Fill
M7	−10	−19	Silty clay, sand, shells
	−19	−65	Hard blue clay, little sand
743	+14	+ 0	Fill
M7	+ 0	− 9	Silty clay, sand, shells
	− 9	−66	Blue clay, little fine sand
744	+15	+ 1	Fill
M7	+ 1	− 1	Black silt
	− 1	− 6	Silty clay, sand, shells
	− 6	−65	Blue clay, little fine sand
745	+17	+ 2	Fill
L7	+ 2	−35	Blue clay
746	+20	+16	Fill
L7	+16	+ 3	Blue clay, fine sand
	+ 3	+ 0	Hard blue clay, little sand and gravel
	+ 0	− 4	Clay, blue sand
	− 4	− 8	Clay, sandy gravel
747	+23	+18	Fill
L6	+18	+12	Hard yellow sand
	+12	+ 8	Hard blue clay, little gravel
	+ 8	+ 1	Little clay, sand, gravel
	+ 1	− 5	Little clay, fine sand
748	+21	+18	Fill
L6	+18	+ 5	Clay, sand, gravel
	+ 5	− 8	Little clay, blue sand
	− 8	−17	Hard blue clay, sand
	−17	−22	Hard blue clay, little sand
	−22	−32	Clay, sand, gravel; hard
749	+30	+10	Little clay, sand, gravel
L6	+10	− 7	Clay, sandy gravel
	− 7	−11	Blue clay
	−11	−24	Clay, sand
750	+38	+20	Clay, sand, gravel; hard
L6	+20	+15	Clay, sandy gravel
	+15	+11	Coarse sand
	+11	+ 8	Clay, sandy gravel Stone
751	+44	+38	Fill
L6	+38	+17	Sand, gravel; hard
	+17	+11	Clay, sandy gravel
	+11	−17	Little clay, sand, gravel
752	+42	+37	Fill
L6	+37	+31	Clay, sand, gravel; hard
	+31	+28	Hard yellow clay
	+28	+25	Fine sharp sand
	+25	+17	Sand, gravel; hard
	+17	+13	Fine sharp sand

No. and location	Elevations or depths From	To	Formation
753	+42	+37	Coarse sand
L6	+37	+31	Hard gravel
	+31	+28	Coarse sand
	+28	+23	Hard blue clay
	+23	+19	Coarse sand
	+19	+16	Hard blue clay, sand, gravel
	+16	+ 8	Coarse sand
	+ 8	+ 3	Clay, gravel
	+ 3	+ 0	Sand
754	+38	+27	Fill
L5	+27	+15	Hard blue clay, little fine sand
	+15	+12	Stone
755	+31	+28	Fill
L5	+28	+19	Hard yellow clay, sand, gravel
	+19	+15	Hard yellow clay, fine sand
	+15	+11	Clay, sandy gravel
756	+29	+26	Sand, gravel
L5	+26	+18	Hard blue clay, sand
	+18	+16	Yellow clay, sand
	+16	+12	Fine yellow sand
	+12	+ 9	Fine blue sand
	+ 9	+ 4	Hard blue clay, little fine sand
757	+22	+18	Clay, sandy gravel
L5	+18	+10	Fine yellow sand
	+10	− 2	Hard blue clay, little fine sand
758	+18	+ 8	Fill
L5	+ 8	− 2	Hard blue clay, little gravel
759	+18	+ 9	Fill
M5	+ 9	+ 5	Hard black silt
	+ 5	+ 1	Sand, gravel, timber
	+ 1	− 2	Hard black silt
	− 2	−10	Mud
	−10	−20	Hard blue clay
760	+17	+10	Fill
M5	+10	+ 6	Fine sand, silt
	+ 6	+ 2	Sand, mud
	+ 2	−10	Hard black silt
	−10	−20	Hard blue clay
761	+16	+11	Fill
M5	+11	+ 8	Fine sand, shells
	+ 8	− 5	Fine sand, silt, shells
	− 5	− 9	Hard blue clay
	− 9	−12	Blue clay
	−12	−18	Hard blue clay
762	+17	+ 6	Fill
M4	+ 6	− 8	Silty sand, mud, shells
	− 8	−11	Hard blue clay, fine sand
	−11	−15	Hard yellow clay
763	+16	+11	Fill
M4	+11	−14	Fine silty sand, shells
	−14	−25	Hard blue clay

No. and location	Elevations or depths From	To	Formation
764	+15	+10	Fill
M4	+10	+ 6	Fine sand
	+ 6	+ 2	Sand, mud
	+ 2	−20	Fine sand, silt, shells
	−20	−29	Hard blue clay
765	+16	+ 9	Fill
M4	+ 9	− 9	Fine silty sand, shells
	− 9	−19	Fine silty sand
	−19	−33	Hard blue clay
766	+17	+ 2	Fill
M4	+ 2	− 1	Soft yellow sand
	− 1	−20	Fine sand, silt, shells
	−20	−24	Silty sand, shells
	−24	−28	Hard yellow clay
	−28	−31	Hard clay, gravel
	−31	−36	Hard blue clay
	−36	−40	Hard clay, gravel
767	+18	+ 7	Sand, gravel
M4	+ 7	−21	Fine sand, silt, shells
	−21	−31	Hard blue clay
768	+22	+14	Fill
H7	+14	− 3	Hard yellow clay
	− 3	−29	Hard blue clay
769	+26	+21	Fill
I7	+21	+10	Clay, gravel, stones; hard
	+10	−11	Hard blue clay, sand
	−11	−14	Little clay, fine blue sand
	−14	−26	Hard blue clay
770	+17	+10	Sand, gravel
I7	+10	+ 4	Hard yellow clay
	+ 4	+ 0	Hard blue clay
	+ 0	− 5	Blue clay, little fine sand
	− 5	−10	Clay, fine sand
	−10	−28	Soft blue clay
	−28	−34	Clay, fine blue sand
771	+17	+ 8	Sand, gravel
I7	+ 8	− 1	Brown sand
	− 1	−21	Hard blue clay
	−21	−25	Sand, gravel; hard
	−25	−33	Clay, fine sand
772	+25	+18	Fill
I7	+18	+ 8	Hard yellow clay
	+ 8	−15	Blue clay
	−15	−26	Hard fine blue sand
773	+29	+18	Fill
J7	+18	+13	Hard yellow clay
	+13	+ 0	Hard blue clay
	+ 0	− 9	Fine blue sand
	− 9	−14	Fine brown and blue sand
	−14	−21	Brown sand
	−21	−24	Hard blue clay
774	+36	+26	Fill
J6	+26	+22	Clay, sand
	+22	+12	Brown sand
	+12	+ 3	Hard blue clay
	+ 3	−15	Little clay, sand, gravel; hard

No and location	Elevations or depths From	To	Formation
775	+38	+31	Fill
K6	+31	− 7	Brown sand
	− 7	−10	Hard fine blue sand
776	+38	+32	Fill
K6	+32	+20	Clay, brown sand, gravel; hard
	+20	−11	Clay, sand, gravel; hard
777	+37	+33	Fill
K6	+33	+20	Yellow clay
	+20	+17	Yellow clay, stones
	+17	+ 7	Sand, little stones
	+ 7	− 7	Hard clay, stones Stones
778	+37	+21	Fill
L6	+21	+ 8	Yellow sand, gravel
	+ 8	+ 2	Fine yellow sand
	+ 2	− 1	Sand, gravel
	− 1	−12	Clay, sand
779	+37	+29	Fill
L6	+29	+14	Coarse sand
	+14	+10	Clay, fine yellow sand
	+10	+ 7	Clay, sandy gravel
	+ 7	+ 0	Fine blue sand
	+ 0	− 3	Coarse gravel Sand, stones
780	+36	+30	Yellow gravel
L6	+30	+21	Yellow sand
	+21	+16	Clay, yellow sand
	+16	+12	Coarse yellow sand
	+12	+ 6	Fine blue clay, sand
	+ 6	+ 2	Blue sand
	+ 2	− 6	Yellow sand, gravel
	− 6	−11	Coarse gravel
	−11	−15	Sand
781	+30	+25	Fill
L6	+25	+20	Yellow clay, sand
	+20	+ 4	Sand, gravel
	+ 4	−10	Clay, sand, gravel; hard
	−10	−19	Hard blue clay
	−19	−22	Blue sand
782	+28	+23	Fill
L6	+23	+19	Hard yellow clay
	+19	+10	Clay, sand, gravel; hard
	+10	+ 7	Fine sand
	+ 7	+ 0	Clay, sand, gravel; hard
	+ 0	− 4	Hard blue clay
783	+27	+17	Fill
L6	+17	+12	Hard yellow clay, sand
	+12	+ 0	Clay, sand, gravel; hard
784	+25	+17	Fill
L6	+17	+13	Hard yellow clay, sand
	+13	+10	Hard yellow clay
	+10	+ 7	Clay, sand, gravel; hard
	+ 7	− 2	Sand, gravel
	− 2	− 6	Clay, sand, gravel; hard

No. and location	Elevations or depths From	To	Formation
785	+20	+10	Clay, sandy gravel
L6	+10	+ 2	Hard blue clay, fine sand
	+ 2	−10	Hard blue clay
786	+20	+15	Fill
L6	+15	+10	Fine sand, gravel
	+10	−10	Hard clay, gravel
	−10	−20	Hard blue clay
787	+18	+16	Fill
M5	+16	+ 1	Hard yellow clay
	+ 1	− 1	Hard yellow clay, sand and gravel
	− 1	− 5	Hard blue clay, sand and gravel
	− 5	− 9	Hard blue clay, fine sand
	− 9	−12	Clay, fine sand; wet
788	+18	+10	Fill
M5	+10	+ 6	Clay, sand, fine gravel
	+ 6	+ 1	Sand, gravel
	+ 1	− 2	Sand, silt, mud
	− 2	−13	Hard blue clay
	−13	−20	Clay, sand, gravel
	−20	−23	Hard blue clay
789	+33	+23	Fill
L6	+23	+18	Sand, gravel; wet
	+18	+15	Fine sand, fine gravel
	+15	+ 4	Hard blue clay
790	+29	+23	Fill
L6	+23	+19	Sand, gravel; wet
	+19	−10	Hard blue clay
	−10	−13	Clay, sandy gravel
791	+20	+12	Fill
L6	+12	− 6	Hard blue clay
	− 6	−12	Blue clay
	−12	−29	Blue clay, stones
792	+11	+ 4	Fill
L7	+ 4	− 5	Mud
	− 5	− 9	Clay, coarse sand, gravel
	− 9	−19	Hard blue clay
793	+24	+17	Fill
K7	+17	−27	Hard blue clay
	−27	−41	Coarse sand and gravel
794	+29	+20	Fill
J7	+20	+11	Hard yellow clay, sand
	+11	+ 5	Coarse sand, gravel
	+ 5	− 8	Clay, sandy gravel
	− 8	−37	Blue clay, sand, gravel, stones
795	+20	+17	Fill
J7	+17	+ 9	Hard yellow clay, sand
	+ 9	− 2	Clay, fine blue sand
	− 2	−17	Hard blue clay, sand
	−17	−30	Sand
	−30	−40	Blue clay, sand, gravel, stones

No. and location	Elevations or depths From	To	Formation
796	+25	+17	Fill
J7	+17	+12	Hard blue clay
	+12	+ 6	Hard blue clay, sand
	+ 6	− 8	Clay, sandy gravel
	− 8	−36	Clay, coarse sand, gravel
	−36	−45	Little clay, blue sand, gravel
797	+17	+ 5	Fill
I7	+ 5	+ 1	Silty sand
	+ 1	− 4	Hard blue clay
	− 4	−10	Hard blue clay, sand
	−10	−13	Fine blue sand
	−13	−33	Hard blue clay
798	+16	+12	Fill
M7	+12	+ 8	Hard yellow clay
	+ 8	+ 0	Soft wet blue clay
	+ 0	− 4	Fine silty sand, shells
	− 4	−14	Hard yellow clay
	−14	−23	Hard blue clay
	−23	−27	Clay, hard blue sand, gravel
799	+25	+18	Fill
N6	+18	− 5	Blue clay
	− 5	−13	Hard clay and gravel
800	+28	+25	Sand, gravel
N6	+25	+21	Sand, gravel, black mud
	+21	− 7	Hard yellow clay, sand and gravel
	− 7	−11	Hard yellow clay, fine sand and gravel
	−11	−14	Hard yellow clay, sand and gravel
801	+25	+10	Fill
N6	+10	+ 7	Hard yellow clay
	+ 7	−10	Hard yellow clay, sand and gravel
	−10	−13	Yellow sand
	−13	−17	Blue sand and gravel
	−17	−25	Clay, sand, gravel; hard
802	+28	+24	Fill
N6	+24	−15	Hard clay, stones
	−15	−19	Fine sand
	−19	−28	Hard clay, stones
803	+14	+ 6	Fill
O6	+ 6	−15	Fine yellow sand, silt
	−15	−31	Hard yellow clay
	−31	−39	Soft blue clay
	−39	−56	Clay, little sand, stones
	−56	−60	Clay, sand, little stones
804	− 8	−11	Silt
O7	−11	−45	Blue clay
	−45	−61	Clay, gravel, stones
805	− 6	−11	Silt
O6	−11	−37	Blue clay
	−37	−49	Clay, sand, gravel
	−49	−52	Sand
			Clay, sand, gravel; hard

No. and location	Elevations or depths From	To	Formation
806	+19	− 3	Fill
G5	− 3	− 6	Sand, gravel, silt
	− 6	−10	Silt, mud, shells
	−10	−13	Hard blue clay
	−13	−21	Hard yellow clay
807	+16	+12	Fill
H5	+12	+ 1	Sand, gravel
	+ 1	− 8	Silt, mud, shells
	− 8	−11	Hard yellow clay, fine sand
	−11	−16	Clay, sand, gravel; hard
808	+16	+ 0	Fill
H5	+ 0	− 4	Sand, silt, mud
	− 4	−10	Mud, shells
	−10	−16	Mud
	−16	−20	Clay, sand, shells
	−20	−23	Hard blue clay, little fine sand
	−23	−28	Fine blue clay, sand
809	+16	− 4	Fill
H5	− 4	−15	Mud
	−15	−18	Clay, sand
	−18	−21	Hard blue clay
	−21	−25	Clay, sand, coarse gravel
810	+15	+ 7	Fill
H5	+ 7	+ 0	Coarse sand and gravel
	+ 0	− 2	Mud
	− 2	−19	Fine sand, silt, mud, shells
	−19	−21	Mud
	−21	−27	Hard clay, gravel
811	+15	+ 2	Fill
H6	+ 2	− 1	Brown silt, mud
	− 1	− 4	Coarse sand
	− 4	− 9	Hard yellow clay
	− 9	−26	Fine sand
812	+15	+ 1	Fill
H5	+ 1	−19	Brown mud
	−19	−22	Clay, sand
	−22	−28	Hard blue clay
813	+17	+ 7	Fill
I5	+ 7	+ 3	Hard blue silt
	+ 3	− 3	Brown mud
	− 3	−10	Clay, sand
	−10	−13	Hard blue clay
814	+21	+18	Sand, mud
I6	+18	+14	Coarse sand and gravel
	+14	− 4	Sand, gravel
	− 4	− 8	Fine sand
815	+27	+22	Sand, gravel, stones; hard
I6	+22	+ 8	Sand, gravel
	+ 8	+ 0	Coarse sand, fine gravel
	+ 0	− 3	Clay, sandy gravel
816	+31	+22	Sand, gravel; hard
I6	+22	+19	Sand, gravel
	+19	+16	Coarse sand, fine gravel
	+16	+ 4	Sand
	+ 4	− 5	Fine sand
	− 5	− 8	Hard yellow clay

No. and location	Elevations or depths From	To	Formation
817	+11	− 3	Fill
F7	− 3	−31	Hard yellow clay
818	+ 0	− 8	Mud
L2	− 8	−16	Soft blue clay
	−16	−27	Clay, fine sand, fine gravel
	−27	−40	Fine wet sand
	−40	−43	Blue clay
819	− 4	−11	Mud
K2	−11	−22	Fine sand, mud
	−22	−23	Gravel
	−23	−38	Clay, sand
	−38	−40	Clay, gravel
	−40	−48	Clay, sand
	−48	−51	Blue clay
820	− 9	−18	Soft black silt
J3	−18	−30	Sand, gravel, silt, mud, shells
	−30	−32	Sand, gravel
	−32	−37	Hard blue clay
	−37	−41	Hard blue clay, little sand and gravel
	−41	−45	Clay, sand, gravel; hard
	−45	−53	Sand and gravel; hard
821	− 8	−19	Hard black silt
J3	−19	−28	Fine silty sand
	−28	−31	Clay, sand, gravel; hard
	−31	−35	Yellow clay, sand, gravel
	−35	−38	Hard blue clay, little gravel
	−38	−41	Clay, sand, gravel; hard
822	− 1	− 9	Soft black silt
I9	− 9	−28	Fine sand, silt, shells
	−28	−34	Soft blue clay, little sand
	−34	−43	Hard blue clay
823	− 4	− 9	Soft black silt
I9	− 9	−11	Hard black silt
	−11	−21	Fine silty sand, shells
	−21	−29	Sand, mud
	−29	−32	Coarse sand
	−32	−53	Hard blue clay
824	− 8	−18	Soft black silt
J9	−18	−20	Fine silty sand
	−20	−28	Hard blue clay
	−28	−61	Hard yellow clay
			Stone
825	−11	−14	Soft black silt
J9	−14	−33	Fine silty sand
	−33	−40	Hard blue clay
	−40	−41	Clay, sand, gravel; hard
	−41	−56	Hard blue clay
	−56	−60	Clay, sand, gravel; hard
826	− 7	−10	Soft black silt
K9	−10	−12	Fine clay, sand
	−12	−15	Hard blue clay, sand
	−15	−18	Hard yellow clay
	−18	−20	Clay, sand
	−20	−42	Hard yellow clay
827	− 9	−11	Silt
K9	−11	−12	Sand
	−12	−39	Hard blue clay
828	− 9	−12	Soft black silt
K9	−12	−15	Hard black silt
	−15	−20	Hard blue clay, sand
	−20	−36	Hard blue clay
829	−10	−17	Soft black silt
K9	−17	−20	Hard black silt
	−20	−28	Soft blue clay
	−28	−42	Hard blue clay
	−42	−44	Clay, sandy gravel
	−44	−54	Clay, sand, gravel; hard
830	−10	−12	Soft black silt
K9	−12	−18	Fine sharp sand
	−18	−20	Clay, sand, gravel, stones; hard
	−20	−27	Hard yellow clay, sand
	−27	−30	Hard yellow clay
	−30	−46	Hard blue clay
	−46	−56	Clay, sand, gravel; hard
831	− 6	−10	Soft black silt
K9	−10	−11	Hard black silt
	−11	−30	Soft blue clay
	−30	−43	Hard blue clay
	−43	−54	Clay, sand, gravel, stones; hard
832	− 1	− 3	Soft black silt
K9	− 3	− 9	Hard black silt
	− 9	−13	Hard blue clay, sand
	−13	−38	Hard blue clay
833	−15	−18	Soft black silt
K9	−18	−39	Soft blue clay
	−39	−46	Hard blue clay, sand and gravel
834	+14	+ 1	Fill
N4	+ 1	− 2	Soft silt, sand, clay
	− 2	− 7	Silty sand
	− 7	−23	Fine sand
	−23	−27	Sand, gravel, silt, mud, shells
	−27	−35	Hard blue clay
	−35	−37	Clay, sand, gravel; hard
835	+16	+10	Fill
N4	+10	+ 0	Clay, silty sand, gravel
	+ 0	−14	Clay, sand, gravel; hard
836	+14	− 3	Gravel
G5	− 3	−22	Sand, mud, shells
	−22	−27	Blue clay
	−27	−30	Soft blue clay, sand

No. and location	Elevations or depths From	To	Formation
837	+22	− 3	Gravel
G5	− 3	− 9	Coarse sand
	− 9	−16	Sand, gravel, mud
	−16	−22	Sand, mud, shells
	−22	−28	Blue clay
838	+16	+ 0	Fill
O5	+ 0	− 2	Silty sand, gravel
	− 2	−13	Hard yellow clay
839	+15	− 4	Fill
O4	− 4	− 6	Soft black silt
	− 6	−10	Sand, gravel
	−10	−12	Hard yellow clay
840	+10	− 2	Fill
O5	− 2	−10	Hard yellow clay
841	−15	−17	Soft black silt
P4	−17	−18	Sand
	−18	−27	Hard yellow clay
842	− 9	−11	Soft black silt
P4	−11	−24	Sand
843	+20	+ 0	Fill
I9	+ 0	− 6	Silty sand
	− 6	−16	Fine blue sand
	−16	−23	Hard yellow clay, sand
	−23	−38	Hard blue clay
	−38	−115	Soft blue clay
	−115	−118	Clay, sand, gravel; hard
			Rock
844	+21	− 6	Fill
I9	− 6	−20	Silty sand, shells
	−20	−30	Hard blue clay
	−30	−119	Soft blue clay
	−119	−124	Clay, sand, gravel; hard
845	+18	− 2	Fill
I9	− 2	−11	Silt, shells
	−11	−25	Hard yellow clay
	−25	−34	Hard blue clay
	−34	−108	Soft blue clay
	−108	−112	Clay, sand, gravel; hard
846	− 7	−15	Soft black silt
I9	−15	−29	Silt, shells
	−29	−117	Soft blue clay
	−117	−121	Clay, sand, gravel; hard
847	−16	−26	Silt, shells
H9	−26	−32	Hard blue clay
	−32	−118	Soft blue clay
	−118	−126	Clay, sand, gravel; hard
848	− 9	−18	Silt, shells
I9	−18	−30	Hard blue clay
	−30	−114	Soft blue clay
	−114	−124	Clay, sand, gravel; hard
			Rock
849	+17	+11	Fill
I9	+11	+ 0	Sand, gravel, silt
	+ 0	−12	Silt, shells
	−12	−29	Silty sand
	−29	−45	Hard blue clay

No. and location	Elevations or depths From	To	Formation
850	+16	+ 8	Fill
H9	+ 8	+ 5	Silt, mud
	+ 5	+ 0	Fine silty sand, shells
	+ 0	− 9	Silt, mud
	− 9	−19	Hard blue clay
851	+14	+ 4	Fill
H9	+ 4	+ 1	Silty sand, gravel
	+ 1	− 8	Brown silt, hard
	− 8	−20	Hard yellow clay
852	− 7	−11	Soft black silt
H9	−11	−22	Hard yellow clay
853	+11	+ 9	Fill
H8	+ 9	− 8	Gravel
	− 8	−22	Blue clay
854	+17	+ 6	Gravel
H8	+ 6	+ 5	Stone
	+ 5	+ 0	Mud
	+ 0	−17	Blue clay
855	+20	+16	Fill
H6	+16	+ 1	Yellow clay, sand, gravel
	+ 1	− 1	Stiff blue clay
	− 1	− 4	Clay, sand
	− 4	− 9	Little clay, sand
	− 9	−13	Yellow sand
	−13	−19	Blue clay
	−19	−20	Stiff blue clay
856	+18	+ 5	Fill
H6	+ 5	+ 0	Stiff blue clay
	+ 0	− 3	Little clay, sand
	− 3	−14	Yellow sand
	−14	−22	Stiff blue clay
857	+18	+12	Fill
G5	+12	+ 0	Fine sand, little gravel
	+ 0	− 4	Fine sand
	− 4	−12	Soft black silt
	−12	−22	Hard blue clay
	−22	−32	Stiff blue clay
858	+12	− 4	Fine sand, little gravel
G5			
	− 4	−16	Fine silty sand
	−16	−20	Clay, fine sand
	−20	−25	Stiff blue clay, little sand
	−25	−31	Clay, sand, gravel
	−31	−37	Stiff blue clay
859	+17	+10	Fill
G5	+10	+ 6	Fine sand, little gravel
	+ 6	+ 0	Fine sand
	+ 0	−19	Fine silty sand
	−19	−30	Stiff blue clay
	−30	−32	Clay, fine sand
	−32	−35	Hard clay, gravel
860	+18	+ 0	Fill
F5	+ 0	−20	Soft dark mud
	−20	−58	Stiff blue clay
861	+13	−10	Fill
F5	−10	−27	Silt
	−27	−33	Stiff blue clay

No. and location	Elevations or depths From	To	Formation
862	+15	− 7	Fill
F5	− 7	−27	Silt
	−27	−32	Stiff blue clay
863	+12	− 5	Fill
F5	− 5	−37	Little sand, silt
	−37	−68	Stiff blue clay
864	+15	− 3	Fill
G3	− 3	−25	Mud, shells, sand
	−25	−30	Peat, mud
	−30	−32	Sand, gravel
	−32	−43	Blue clay
865	+15	− 7	Fill
H3	− 7	−20	Mud, shells
	−20	−25	Clay, sand, stones
	−25	−31	Sand, gravel
	−31	−41	Blue clay
866	+16	+ 9	Fill
I4	+ 9	+ 0	Silty sand and gravel
	+ 0	−58	Fine sand, silt
	−58	−64	Fairly stiff blue clay, little sand and gravel
867	+17	+ 8	Fill
I4	+ 8	+ 0	Mud
	+ 0	−18	Mud, sand
	−18	−39	Clay, sand
868	+56	+52	Loam
J5	+52	+23	Clay, sand, gravel
	+23	+17	Yellow sand, little gravel
	+17	+16	Stone
	+16	+ 9	Yellow sand, little clay
	+ 9	− 8	Yellow clay
	− 8	− 9	Coarse sand
	− 9	−14	Fine yellow sand, little clay
869	+55	+50	Loam
J6	+50	+42	Yellow clay, sand, gravel
	+42	+38	Fine yellow sand
	+38	+29	Gravel, sand, brown clay
	+29	+17	Gravel, sand, blue clay
	+17	+ 5	Yellow sand, gravel
870	+45	+41	Sand, gravel, little clay
J6	+41	+30	Hard clay, little fine sand
	+30	+24	Hardpan
871	+30	+28	Paving
K7	+28	+20	Coarse sand, gravel
	+20	+11	Fine sand, little clay
	+11	+ 8	Sand, little clay
	+ 8	+ 0	Medium stiff blue clay
	+ 0	−12	Fine sand, little clay
	−12	−21	Medium stiff blue clay
	−21	−30	Sand, gravel, clay; hard
872	+30	+29	Paving
K7	+29	+21	Fill
	+21	+15	Stiff yellow clay
	+15	+ 9	Fine yellow clay, little sand
	+ 9	+ 1	Soft blue clay
	+ 1	+ 0	Little sand, silt
	+ 0	− 9	Soft blue clay
	− 9	−11	Sand, gravel, clay; hard
			Boulder
873	+30	+29	Paving
K7	+29	+25	Coarse sand, gravel
	+25	+16	Stiff dry yellow clay, sand and gravel
	+16	+13	Fine yellow sand, little clay
	+13	+ 9	Fine gray sand, little clay
	+ 9	+ 0	Stiff blue clay
	+ 0	− 9	Hard blue clay, sand, gravel
874	+28	+27	Paving
J7	+27	+19	Fill
	+19	+ 5	Yellow clay, gravel, sand
	+ 5	− 4	Blue sand, gravel, little clay
	− 4	− 5	Fine blue sand
875	+27	+26	Paving
K8	+26	+ 8	Hard yellow sand, gravel, little clay
	+ 8	−11	Blue clay, sand, gravel
	−11	−21	Hard blue clay, sand and gravel
			Rock
876	+26	+25	Paving
K8	+25	+12	Fairly stiff yellow clay, little sand and gravel
	+12	+ 5	Hard blue clay, sand and gravel
	+ 5	−16	Hard blue dry clay, sand and gravel
877	+22	+21	Paving
K8	+21	+17	Fill
	+17	+ 8	Stiff yellow clay
	+ 8	+ 7	Sand, gravel
	+ 7	−10	Blue clay, sand, gravel
	−10	−14	Fine gray sand, little gravel
	−14	−20	Stiff blue clay, little sand and gravel
	−20	−26	Stiff blue clay, sand. Little gravel
878	+19	+18	Paving
K8	+18	+ 9	Fill
	+ 9	− 5	Blue clay, sand, gravel
879	+20	+19	Paving
K8	+19	+ 4	Hard clay, sand, gravel
	+ 4	−35	Loose sand, gravel, clay
	−35	−45	Hard clay, sand, gravel
			Rock

No. and location	Elevations or depths From	To	Formation
880	+ 6	−51	Blue clay
K8	−51	−58	Clay, sand, stones
881	+23	+20	Sand, gravel, stones
K7	+20	+18	Stiff blue clay
	+18	+10	Hard blue sand, gravel
	+10	− 8	Hard blue clay, little gravel
882	+20	+ 6	Soft blue clay
K7	+ 6	− 5	Gravel
	− 5	−11	Sand, clay
	−11	−16	Hardpan
	−16	−22	Clay, sand
	−22	−30	Blue clay and sand
	−30	−32	Soft blue clay
	−32	−34	Gravel, clay
			Fine sand, clay
883	+10	+ 3	Fill
K7	+ 3	− 2	Hard blue clay
	− 2	−19	Blue clay
884	+22	+10	Fill
L7	+10	+ 8	Sand, little clay
	+ 8	− 1	Sand, clay
885	+19	+14	Fill
L7	+14	+ 4	Soft blue clay
	+ 4	− 1	Stiff blue clay
	− 1	− 9	Soft yellow clay
	− 9	−51	Soft blue clay
886	+19	+14	Fill
L7	+14	+ 4	Soft blue clay
	+ 4	+ 0	Stiff blue clay
	+ 0	− 8	Soft yellow clay
	− 8	−45	Soft blue clay
	−45	−47	Blue clay, little gravel, very fine sand
887	+ 7	− 1	Fill
L7	− 1	−12	Hard yellow clay
	−12	−23	Blue clay
	−23	−40	Soft blue clay
888	+15	+ 1	Fill
M7	+ 1	−88	Blue clay
	−88	−90	Boulder
	−90	−91	Sand
	−91	−93	Boulder
	−93	−99	Sand, clay, gravel
	−99	−114	Hard clay
	−114	−119	Hard wet blue clay
889	+10	+ 0	Mud, stones
N6	+ 0	−20	Clay, stones
890	+15	+ 2	Silt, shells
O6	+ 2	−19	Hard yellow clay
891	+50	+48	Yellow sand
L6	+48	+29	Stiff blue clay
	+29	+ 6	Clay, gravel, sand; very hard
892	+68	+39	Hard dry compact sand
K5	+39	+37	Hard clay, stones
893	+16	+ 9	Sand, gravel
K3	+ 9	+ 5	Silty clay
	+ 5	− 3	Fine silty sand
	− 3	− 5	Clay, silty sand, gravel
	− 5	−12	Stiff blue clay
894	+16	+11	Sand, gravel
K3	+11	+ 6	Soft black silt
	+ 6	− 3	Brown silt (hard)
	− 3	− 4	Silty sand, gravel
	− 4	−12	Brown silt, gravel
	−12	−13	Silty sand, shells
	−13	−19	Stiff blue clay
895	+16	+10	Sand, gravel
K3	+10	+ 4	Silty sand, gravel
	+ 4	− 1	Soft black silt
	− 1	− 6	Stiff blue clay
896	+16	+10	Clay, sand, gravel
K3	+10	+ 6	Sand, gravel
	+ 6	+ 4	Silt, little gravel
	+ 4	− 3	Hard yellow clay
897	+15	+ 4	Fill
M5	+ 4	−17	Soft fine silty sand, shells
	−17	−21	Hard blue clay
898	− 6	− 9	Soft black silt
G2	− 9	−15	Soft fine silty sand, shells
	−15	−22	Stiff silty sand
	−22	−28	Stiff blue clay
899	− 8	−10	Soft black silt
I3	−10	−19	Fine silty sand
	−19	−28	Silt
	−28	−30	Coarse silty sand
	−30	−33	Stiff blue clay
900	−11	−13	Silt
J2	−13	−22	Fine silty sand
	−22	−30	Silt
	−30	−33	Silty sand, coarse gravel
	−33	−38	Stiff blue clay
901	−27	−30	Silt
L1	−30	−33	Coarse black sand
	−33	−38	Fairly stiff blue clay
	−38	−56	Stiff blue clay
	−56	−72	Soft blue clay
			Yellow clay, sand, gravel
902	−23	−28	Silt
L2	−28	−32	Sand, gravel
	−32	−44	Stiff blue clay
	−44	−50	Soft blue clay
903	− 3	− 9	Fill
L2	− 9	−11	Silt
	−11	−18	Silty sand
	−18	−27	Stiff yellow clay
	−27	−30	Stiff blue clay
			Yellow clay, sand, gravel
904	−28	−41	Soft black silt
P6	−41	−51	Stiff blue clay, little sand
	−51	−89	Stiff blue clay

No. and location	Elevations or depths From	To	Formation
905	−27	−41	Soft black silt
P6	−41	−86	Stiff blue clay, little sand
	−86	−88	Sand, gravel, clay; hard
906	−22	−24	Silt
O7	−24	−50	Blue clay
	−50	−61	Sand, clay, gravel
			Rock
907	−27	−30	Soft black silt
O7	−30	−60	Stiff blue clay
	−60	−75	Stiff blue clay, little sand, stones
	−75	−76	Slate
908	0	−29	Water
P7	−29	−41	Soft black silt
	−41	−78	Stiff blue clay, little silt
	−78	−79	Soft black slate
909	−25	−26	Soft black silt
O8	−26	−36	Fine silty sand, fine gravel
	−36	−65	Stiff blue clay
910	+20	− 1	Fill
K9	− 1	− 4	Very soft black silt, little sand and gravel
	− 4	−34	Medium stiff blue clay
	−34	−49	Clay, little sand, little gravel
	−49	−56	Hard sand, clay, little gravel
	−56	−58	Indurated clay Hardpan
911	+40	+35	Fill
L5	+35	+27	Blue clay, little sand and gravel
	+27	+24	Blue clay
	+24	+ 9	Fine sand, gravel; hard
	+ 9	− 9	Stiff blue clay
912	+41	+39	Paving
L5	+39	+31	Yellow sand, little clay
	+31	+20	Yellow clay
	+20	+ 7	Sand, little clay
	+ 7	+ 1	Blue clay, streaks of yellow sand
913	+43	+33	Fill
L4	+33	+26	Yellow clay
	+26	+ 8	Blue clay
914	+44	+33	Fill
L4	+33	+26	Yellow clay
	+26	+24	Yellow and blue clay, mixed
	+24	+19	Stiff blue clay
	+19	+15	Stiff blue clay, yellow sand
	+15	+ 9	Yellow sand, little clay
915	+39	+36	Coarse black sand
K4	+36	+26	Stiff yellow clay
	+26	+25	Yellow sand, clay
	+25	+23	Yellow sand, coarse gravel, very little clay
	+23	+ 4	Sand, coarse gravel, clay
916	+29	+28	Paving
K4	+28	+15	Sand, little gravel, clay
	+15	+ 0	Stiff blue clay
	+ 0	− 3	Sand, little gravel, clay
	− 3	− 5	Clay, little gravel
917	+17	− 1	Fill
H9	− 1	−15	Silt, little fine sand
	−15	−30	Stiff blue clay, little fine sand
	−30	−51	Fairly stiff blue clay and fine sand
	−51	−81	Stiff blue clay, little gravel
918	+20	+ 4	Fill
I9	+ 4	− 2	Sand, gravel, very little clay
	− 2	− 8	Silty sand, shells
	− 8	−14	Hard silty sand
	−14	−20	Firm sand and clay; very fine
	−20	−41	Stiff blue clay
	−41	−62	Medium stiff blue clay
919	+18	+ 0	Fill
I9	+ 0	−16	Silt, little sand
	−16	−18	Peat
	−18	−24	Stiff blue clay
	−24	−53	Medium stiff blue clay
920	+16	+ 8	Fill
J8	+ 8	+ 2	Soft silt, little gravel
	+ 2	− 4	Silt, little gravel
	− 4	− 8	Soft blue clay, some gravel
	− 8	−13	Fairly stiff blue clay, fine sand
	−13	−35	Medium stiff blue clay
921	+17	+ 8	Fill
J8	+ 8	+ 6	Soft clay, little gravel
	+ 6	+ 0	Stiff clay, little sand
	+ 0	−17	Medium stiff blue clay
	−17	−29	Sand, gravel, clay; hard
922	Surface	13	Fill
H6	13	16	Fine sand, mud
	16	25	Hard yellow clay
	25	36	Hard blue clay, some stones
923	Surface	22.5	Fill
D5	22.5	33.7	Fine silty sand, mud
	33.7	39.2	Hard packed coarse sand
	39.2	43.0	Compact medium sand

No. and location	Elevations or depths From	To	Formation
924 H4	Surface	22.2	Fill
	22.2	35.0	Fine silty sand, mud
	35.0	39.0	Compact coarse sand
	39.0	57.0	Medium blue clay
925 C8	Surface	1.5	Loam
	1.5	12.0	Sand and gravel fill
	12.0	27.5	Fine silty sand, mud
	27.5	35.0	Hard yellow clay
	35.0	50.0	Medium blue clay
926 N6	Surface	6.0	Fill and mud
	6.0	14.7	Soft clay, sand and silt
	14.7	25.0	Compact clay and fine sand
927 K3	Surface	20	Fill
	20	42	Fine silty sand and mud
	42	48	Hard packed coarse sand
	48	65	Soft blue clay
928 D9	Surface	6.5	Fill
	6.5	22.5	Fine silty sand, mud
	22.5	23.5	Loose fine sand
	23.5	46.0	Medium blue clay
929 G5	Surface	24	Sand and gravel fill
	24	33	Fine silty sand, mud
	33	55	Hard yellow clay
	55	70	Medium yellow clay
	70	80	Soft blue clay, some rock
	80	100	Soft blue clay
930 L8	Surface	8	Fill; clay, brick, stone
	8	11.5	Loamy peat
	11.5	20.7	Soft blue clay, little fine sand
	20.7	23.5	Hard blue clay, sand, and gravel
	23.5	34.5	Hard blue clay, sand, gravel and boulders
	34.5	38.0	Hard clay, sand and gravel
	38.0	43.0	Hard compact sand
	43.0	52.2	Hardpan
	52.2	66.0	Hard sand and clay
	66.0	73.4	Hard sand, little gravel, boulders
	73.4	82.2	Hardpan
	82.2	99.4	Hard fine sand, boulders
	99.4	101.0	Hard fine sand, little clay
931 O5	Sidewalk	6.5	Cinder and brick fill
	6.5	7.7	Hard fine yellow sand
	7.7	14.2	Hard yellow clay
	14.2	22.0	Medium yellow clay
932 F5	Surface	23.2	Loose coarse sand and gravel fill
	23.2	32.0	Medium silt, fine sand, shells
	32.0	41.5	Medium silt
	41.5	43.0	Fine compact sand, little clay
	43.0	46.0	Sharp gray sand, strata of clay
	46.0	51.0	Medium blue clay, fine sand
	51.0	77.5	Medium blue clay, very little sand
	77.5	84.0	Medium blue clay, strata of sand
	84.0	87.0	Firm blue sand, little clay and gravel
	87.0	107.2	Medium blue clay
	107.2	118.0	Stiff blue clay, little gravel
933 F3	Surface	12.5	Fill; sand, gravel, clay, ash
	12.5	27.8	Silty sand
	27.8	34.5	Firm coarse sand, gravel
	34.5	40.5	Hard yellow clay
934 C4	+18	+6	Gravel
	+6	−2	Mud
	−2	−6	Gravel
	−6	−8	Sand
935 J8	0.5 below sidewalk	1.8	Paving
	1.8	6.7	Sand and gravel fill
	6.7	11.7	Rip-rap
	11.7	18.0	Sand and mud fill
	18.0	27.0	Soft silt
	27.0	29.5	Medium blue clay
	29.5	34.0	Hard yellow clay
	34.0	39.0	Medium yellow clay
	39.0	49.0	Soft blue clay
936 J8	0.5 below sidewalk	1.5	Paving
	1.5	6.0	Miscellaneous fill
	6.0	15.5	Mud and stone fill, wood
	15.5	17.0	Medium blue clay
	17.0	22.0	Hard yellow clay
937 K8	0.5 below sidewalk	1.0	Paving
	1.0	7.5	Ashes and brick fill
	7.5	11.3	Clay fill
	11.3	15.0	Hard sand, gravel Hardpan
938 N6	Surface	5.3	Brick and rubbish fill
	5.3	15.5	Hard yellow clay, sand and little coarse gravel
	15.5	29.3	Hard blue clay, sand, fine gravel
939 M2	Surface	14.5	Sand, little gravel and clay fill
	14.5	19.0	Silt, fine sand
	19.0	21.7	Hard yellow clay, little fine gravel
	21.7	28.0	Hard pan, sand, coarse gravel, little clay
940 O4	Bottom of 15' test pit	3.0	Sand and gravel till
	3.0	6.0	Soft silt
	6.0	9.9	Hard coarse blue sand, gravel
	9.9	18.5	Hard coarse yellow sand, gravel

No. and location	Elevations or depths From	To	Formation
941 J3	Sidewalk	18.7	Fill; sand, gravel, rubbish
	18.7	31.6	Silty sand, little shells
	31.6	43.3	Hard blue clay
	43.3	65.0	Soft blue clay
942 O5	1.5 below curb	4.0	Brick and rubbish fill
	4.0	4.5	Sharp yellow sand
	4.5	6.5	Hard blue clay, little sand
	6.5	14.0	Hard yellow clay, little sand
	14.0	18.0	Medium blue clay
	18.0	26.0	Medium blue clay, little sand and gravel
943 G6	Sidewalk	18.5	Fill; sand, gravel, brick
	18.5	30.5	Silt, shells
	30.5	35.0	Clay, sand, gravel
944 B9	Surface	10	Fill; hard sand, brick, clay
	10	14	Dry peat
	14	20	Hard yellow clay
945 H7	Surface	7.0	Fill; cinder, sand, brick
	7.0	11.5	Fill; clay, gravel, brick
	11.5	20.0	Hard yellow clay
	20.0	21.7	Medium blue clay, little fine sand
	21.7	23.5	Firm fine yellow sand, little clay
	23.5	28.0	Soft blue clay, little fine sand
946 F7	Surface	15.5	Fill; sand, gravel, clay, brick
	15.5	23.2	Coarse sand and gravel fill
	23.2	33.0	Silt, very little fine sand
	33.0	34.7	Medium blue clay
	34.7	40.0	Hard blue clay
947 B9	Surface	10.7	Loose sand and gravel fill
	10.7	28.0	Silty peat
	28.0	35.0	Medium blue clay
948 D6	Surface	10.0	Fill; cinder, ash, sand
	10.0	17.5	Clay and sand fill
	17.5	19.0	Hard yellow clay
949 B8	Surface	12.5	Fill, mud
	12.5	32.0	Fine silt, sand, mud
	32.0	48.0	Hard blue clay
950 L5	Surface	10	Fill
	10	18	Fine compact sand
	18	26	Hard blue clay, some sand and gravel
	26	28	Hard packed sand and gravel
	28	38	Hard blue clay, sand and gravel
951 F4	Surface	21.3	Loose coarse sand fill
	21.3	35.3	Fine silty sand, mud
	35.3	36.3	Compact medium sand
	36.3	47.0	Hard yellow clay
	47.0	52.0	Medium blue clay
952 C3	Surface	16.0	Loose fill
	16.0	19.0	Very soft clay
	19.0	36.5	Hard packed sand and gravel
	36.5	62.0	Medium blue clay
	62.0	101.0	Soft blue clay
			Struck rock
953 L2	Surface	9.5	Fill
	9.5	14.8	Fine silty sand, mud
	14.8	15.2	Gravel, clay, rocks, hardpan
			Struck rock
954 K8	Basement	1.5	Fill
	1.5	26.0	Medium blue clay
	26.0	50.0	Hard clay, sand, rocks
955 E1	0	− 6	Mud
	− 6	−12	Sand
	−12	−17	Clay
	−17	−21	Sand, gravel
	−21	−25	Clay
956 E1	−11	−14	Mud
	−14	−21	Sand, gravel
	−21	−28	Clay
957 F2	0	− 5	Mud
	− 5	−10	Silty sand
	−10	−27	Sand, gravel
	−27	−37	Clay
958 F2	0	− 9	Mud
	− 9	−10	Silty sand
	−10	−31	Sand, gravel
	−31	−35	Clay
959 G2	− 3	−11	Mud
	−11	−15	Silty sand
	−15	−28	Sand, gravel
	−28	−37	Clay
960 G2	− 5	−15	Silty sand
	−15	−27	Sand, gravel
	−27	−32	Clay
961 H3	− 6	− 9	Mud
	− 9	−25	Silty sand
	−25	−32	Sand, gravel
	−32	−38	Clay
962 H3	− 8	−13	Mud
	−13	−28	Silty sand
	−28	−32	Sand, gravel
	−32	−38	Clay
963 H3	−12	−16	Mud
	−16	−29	Silty sand
	−29	−31	Sand, gravel
	−31	−41	Clay
964 I3	−13	−21	Mud
	−21	−31	Silty sand
	−31	−34	Sand, gravel
	−34	−42	Clay

No. and location	Elevations or depths From	To	Formation
965	−15	−19	Mud
I3	−19	−25	Silty sand
	−25	−28	Sand, gravel
	−28	−43	Clay
966	−10	−18	Mud
J2	−18	−24	Silty sand
	−24	−32	Sand, gravel
	−32	−38	Clay
967	− 9	−17	Mud
K2	−17	−27	Silty sand
	−27	−33	Sand, gravel
	−33	−38	Clay
968	−11	−19	Mud
K2	−19	−26	Silty sand
	−26	−32	Sand, gravel
	−32	−37	Clay
969	− 1	− 3	Mud
E1	− 3	−12	Silt
	−12	−28	Sand, gravel
	−28	−34	Clay
970	− 2	− 4	Mud
F1	− 4	−15	Silt
	−15	−32	Sand, gravel
	−32	−38	Clay
971	− 3	− 6	Mud
F1	− 6	−21	Silty sand
	−21	−30	Sand, gravel
	−30	−37	Clay
972	− 3	− 6	Mud
G1	− 6	−15	Silty sand
	−15	−22	Sand, gravel
	−22	−27	Clay
973	−15	−22	Mud
G2	−22	−28	Silty sand
	−28	−32	Sand, gravel
	−32	−33	Clay
974	− 7	−19	Silty sand
G2	−19	−34	Sand, gravel
	−34	−38	Clay
975	− 9	−12	Mud
H2	−12	−17	Sand, gravel
	−17	−38	Clay
976	−19	−22	Mud
H2	−22	−23	Sand, gravel
	−23	−43	Clay
977	−16	−19	Mud
I3	−19	−27	Sand, gravel
	−27	−42	Clay
978	−19	−23	Mud
I2	−23	−26	Sand and gravel
	−26	−42	Clay
979	−17	−25	Mud
I2	−25	−31	Sand and gravel
	−31	−43	Clay
980	−10	−17	Mud
J2	−17	−27	Silty sand
	−27	−33	Sand and gravel
	−33	−38	Clay

No. and location	Elevations or depths From	To	Formation
981	−12	−21	Mud
K2	−21	−26	Silty sand
	−26	−31	Sand and gravel
	−31	−38	Clay
982	−18	−26	Mud
K1	−26	−31	Sand and gravel
	−31	−35	Clay
983	+22	+13	Fill
E5	+13	+ 7	Coarse silty sand
	+ 7	−10	Silt
	−10	−13	Silty sand
	−13	−15	Stiff or tough blue clay
984	+16	+ 3	Fill
E9	+ 3	+ 1	Peat
	+ 1	−22	Fairly stiff silt
	−22	−27	Stiff or tough blue clay
	−27	−85	Medium stiff blue clay
	−85	−94	Clay, sand, coarse gravel, hard
985	+16	+11	Fill
E9	+11	+ 4	Black silt, little sand and gravel, very soft
	+ 4	−16	Fairly stiff silt
	−16	−21	Stiff or tough blue clay
	−21	−93	Medium stiff blue clay
	−93	−100	Clay, little sand, coarse gravel
986	+22	+12	Sand, gravel
E5	+12	+ 7	Coarse sand
	+ 7	−13	Black sand, silt
	−13	−18	Soft blue clay
987	+16	+ 5	Sand and gravel fill
N7	+ 5	−10	Blue clay and gravel
	−10	−13	Silt, mud, very soft
	−13	−22	Stiff blue clay
988	+16	+ 4	Sand and gravel fill
N7	+ 4	− 4	Blue clay, gravel
	− 4	−10	Mud, silt, peat
	−10	−14	Stiff blue clay
989	+16	+ 3	Sand and gravel fill
M7	+ 3	− 2	Silt, peat
	− 2	− 5	Blue clay, gravel
	− 5	− 9	Stiff blue clay
990	+16	+ 5	Sand and gravel fill
M6	+ 5	+ 0	Silt, peat
	+ 0	− 6	Blue clay
	− 6	− 8	Yellow clay
991	+15	+ 0	Fill; ash, sand, brick
M6	+ 0	− 8	Hard blue clay
992	+15	+ 6	Ash and sand fill
M6	+ 6	−14	Fine sand, clay
	−14	−25	Blue clay
993	+24	− 2	Fill
G6	− 2	− 8	Sand, gravel
	− 8	−29	Mud
	−29	−33	Blue clay

No and location	Elevations or depths From	To	Formation
994	+20	− 3	Fill
G6	− 3	− 7	Sand, gravel
	− 7	−26	Mud
	−26	−30	Blue clay
995	+20	+ 2	Fill
G6	+ 2	− 5	Sand, gravel
	− 5	−23	Mud
	−23	−29	Blue clay
996	+19	− 3	Fill
G6	− 3	−22	Mud
	−22	−27	Blue clay
997	+22	− 1	Fill, mostly sand and gravel
G6	− 1	− 8	Sand, gravel
	− 8	−20	Mud
	−20	−25	Blue clay
998	+20	+ 1	Fill; mostly sand and gravel
G6	+ 1	− 4	Sand and gravel
	− 4	−21	Mud
	−21	−25	Blue clay
999	+19	− 1	Fill; mostly sand and gravel
G6	− 1	− 6	Sand and gravel
	− 6	−17	Mud
	−17	−22	Blue clay
1000	+18	− 1	Sand, gravel
G6	− 1	−11	Mud
	−11	−16	Blue clay
1001	+17	+14	Sand and gravel fill
E7	+14	− 4	Fill; sand, clay, gravel
	− 4	− 7	Soft silt
	− 7	−11	Stiff clay, little sand or gravel
1002	+18	− 2	Fill; sand, gravel, clay
E6	− 2	− 7	Soft silt
	− 7	−11	Stiff yellow clay
1003	+17	+ 4	Fill; sand, gravel, clay
E6	+ 4	− 1	Little sand, gravel, soft mud
	− 1	− 3	Soft silt
	− 3	− 6	Stiff yellow clay
1004	+16	0	Fill; sand, gravel, clay, wood, brick
E6	0	− 4	Stiff yellow clay
1005	+17	0	Fill; sand, gravel, clay, wood, brick
E6	0	− 5	Stiff yellow clay
1006	+ 8	0	Fill; sand, gravel, brick (soft, wet)
E6	0	− 4	Stiff yellow clay
1007	+10	+ 2	Fill; sand, gravel, ash (soft, wet)
D6	+ 2	− 1	Clay, little sand and gravel
	− 1	− 5	Stiff yellow clay

No. and location	Elevations or depths From	To	Formation
1008	+11	+ 0	Fill; sand, gravel, clay (wet)
D6	+ 0	− 4	Stiff yellow clay
1009	+18.0	+ 1.0	Fill
J3	+ 1.0	−12.0	Mud
	−12.0	−16.0	Hard clay
1010	+11.0	+ 1.5	Fill
J3	+ 1.5	− 2.0	Mud
	− 2.0	− 8.0	Hard clay
1011	+15	+ 3	Fill; sand, gravel, clay, ash
D6	+ 3	0	Stiff yellow clay
1012	+16.0	− 3.5	Fill; sand, gravel, clay, brick
F7	− 3.5	− 8.0	Soft silt
	− 8.0	−12.0	Stiff yellow clay
1013	+18	− 9	Fill; sand gravel, clay, brick
E9	− 9	−23	Soft silt
	−23	−28	Stiff blue clay
1014	+17	+11	Sand and gravel fill
E9	+11	+ 4	Fill; clay, sand, gravel
	+ 4	− 2	Silty sand and clay fill
	− 2	−20	Fairly stiff silt
	−20	−26	Stiff blue clay
	−26	−85	Fairly soft blue clay
	−85	− x	Hard clay, sand, gravel
1015	+17	+ 9	Fill; sand, gravel, clay
E9	+ 9	+ 4	Silty sand, clay
	+ 4	+ 2	Peat
	+ 2	−21	Fairly stiff silt
	−21	−27	Stiff blue clay
	−27	−85	Fairly soft blue clay
	−85	− x	Hard clay, sand, gravel
1016	+13	+ 8	Sand and gravel fill
E9	+ 8	+ 2	Soft sandy silt
	+ 2	−19	Fairly stiff silt
	−19	−23	Stiff blue clay
	−23	−94	Fairly soft blue clay
	−94	− x	Hard clay, sand, gravel
1017	−12	−21	Fairly soft silt
E9	−21	−24	Stiff blue clay
	−24	−91	Fairly soft blue clay
	−91	− x	Hard clay, sand, gravel
1018	+16.5	+ 3.5	Fill
K3	+ 3.5	+ 1.5	Mud
	+ 1.5	− 4.0	Hard clay
1019	+17.0	+ 5.0	Fill
K3	+ 5.0	+ 0.5	Hard clay
1020	+18	+13	Sand and loam
E5	+13	+11	Fine red sand
	+11	+ 7	Coarse red sand and gravel

No. and location	Elevations or depths From	To	Formation
1021 E5	+17.0	+ 9.5	Dirt fill, some sand
	+ 9.5	+ 8.0	Fine red sand
	+ 8.0	+ 4.0	Coarse red sand and gravel
1022 E5	+11	+10	Ash fill
	+10	+ 8	Fill; dirt, sand, stone
	+ 8	+ 4	Coarse red sand and gravel
	+ 4	− 1	Fine red sand, some silt
	− 1	− 9	Fine blue sand, some silt
	− 9	−11	Gravel, hardpan
1023 E5	+17	+ 8	Dirt fill
	+ 8	+ 4	Coarse red sand
	+ 4	− 7	Fine blue sand
	− 7	−10	Coarse sand, gravel
1024 E5	+12	+ 7	Dirt and ashes
	+ 7	+ 0	Coarse red sand, some silt
	+ 0	− 7	Fine blue sand, some silt
	− 7	−10	Coarse red sand, gravel
1025 E5	+14	+ 9	Dirt and ash fill
	+ 9	+ 1	Fine blue sand, silt
	+ 1	− 1	Coarse red sand, gravel
1026 D5	+18	+12	Dirt fill
	+12	+ 2	Fine red sand
	+ 2	− 1	Coarse blue sand
1027 M4	+ 15	+ 5	Granite block, concrete base, hard dirt fill
	+ 5	0	Sand, gravel
1028 M4	+16	+ 2	Through granite block and concrete base, then hard dirt, rubble and clay fill
	+ 2	− 4	Hard clay, sand
1029 M4	+17	+ 3	Through granite block and concrete base, hard dirt, rubble and clay fill
	+ 3	− 8	Hard clay
1030 M5	+16	+ 8	Through granite block and concrete base, hard dirt and rubble fill
	+ 8	1	Sand and yellow clay
1031 F5	+26	− 4	Fill
	− 4	−19	Dock mud
	−19	− x	Blue clay to unknown depth
1032 F5	+20	− 7	Fill
	− 7	−20	Dock mud
	−20	− x	Hard blue clay to unknown depth
1033 F5	+26	− 6	Fill
	− 6	−21	Dock mud
	−21	− x	Blue clay to unknown depth
1034 N4	+15	+ 8	Fill; sand, gravel, brick
	+ 8	−31	Silt, little fine sand, shells
	−31	−35	Sand, little fine gravel, silt
	−35	−40	Soft blue clay
1035 N4	+15	+ 7	Fill
	+ 7	−21	Silt, fine sand, shells
	−21	−27	Soft blue clay
1036 N4	+17	+ 6	Fill
	+ 6	+ 2	Fine sand, silt
	+ 2	−11	Silt, fine sand, little peat
	−11	−18	Soft blue clay
1037 E4	+30	− 8	Sand and gravel fill
	− 8	−22	Silt
	−22	−28	Hard blue clay
1038 F5	+15	− 2	Sand and gravel fill
	− 2	−25	Silt
	−25	−29	Fine sand, little gravel, clay
	−29	−35	Medium blue clay
1039 F5	+22	− 3	Sand and gravel fill
	− 3	−27	Silt
	−27	−32	Hard blue clay
1040 D9	+17	− 7	Fill
	− 7	−14	Silt, fine sand
	−14	−15	Peat
	−15	−21	Hard clay
1041 E9	+18	− 3	Paving and fill
	− 3	−13	Silt, fine sand
	−13	−14	Peat
	−14	−23	Hard yellow clay
1042 E9	+17	− 5	Paving and fill
	− 5	−15	Silt, fine sand
	−15	−18	Peat
	−18	−19	Fine silty sand
	−19	−26	Hard clay
1043 E8	+16	+ 0	Fill; sand, gravel, rubbish
	+ 0	−13	Silt, fine sand
	−13	−17	Peat
	−17	−25	Hard yellow clay
1044 E8	+14	+ 4	Paving, sand and gravel fill
	+ 4	+ 0	Clay fill
	+ 0	− 6	Peat
	− 6	− 8	Sharp silty sand
	− 8	−15	Hard yellow clay
1045 E8	+19	+14	Paving, sand and gravel
	+14	+12	Hard yellow clay
	+12	+11	Sand, gravel, clay
	+11	− 2	Hard clay

No. and location	Elevations or depths From	To	Formation
1046 M4	+16	+13	Gravel
	+13	+ 3	Loose gravel
	+ 3	— 4	Soft mud, gravel
	— 4	— 7	Gravel, mud
	— 7	—18	Mud, sand
1047 C9	+17.0	+10.0	Gravel
	+10.0	+ 7.0	Soft mud
	+ 7.0	—22.0	Fill or mud
	—22.0	—32.5	Clay
1048 D5	+13	+ 9	Dirt fill
	+ 9	+ 0	Coarse red sand, some silt
	+ 0	— 4	Coarse red sand, gravel
1049 D5	+13	+ 9	Dirt fill.
	+ 9	+ 3	Coarse red sand
	+ 3	+ 0	Fine blue sand
	+ 0	— 4	Coarse red sand, some clay
1050 E5	+12	+ 4	Dirt fill
	+ 4	— 6	Gravel fill
	— 6	—13	Silt
	—13	—18	Silty sand
	—18	—23	Blue clay
1051 E5	+12	+ 4	Fill
	+ 4	— 3	Coarse gravel
	— 3	—13	Silt
	—13	—18	Dock mud
	—18	—26	Blue clay
1052 E5	+13	+ 9	Fill
	+ 9	+ 5	Coarse sand
	+ 5	+ 1	Fine blue sand
	+ 1	— 5	Coarse sand, gravel
1053 E5	+13	+ 7	Fill
	+ 7	+ 6	Fine sand
	+ 6	— 2	Coarse sand, gravel
1054 E5	+13	+ 6	Ash fill
	+ 6	— 1	Coarse sand
	— 1	—12	Dock mud
	—12	—17	Fine silty sand
	—17	—22	Blue clay
1055 K9	+17	+ 7	Ash and sand fill
	+ 7	— 4	Fill and mud
	— 4	—11	Mud
	—11	—20	Hard yellow clay
1056 K9	+14	— 2	Fill
	— 2	— 3	Mud
	— 3	—14	Medium yellow clay
1057 K8	+15	+ 4	Fill
	+ 4	+ 2	Mud
	+ 2	— 8	Medium yellow clay
1058 K8	16	— 4	Fill
	— 4	— 5	Mud
	— 5	—15	Medium yellow clay
1059 M6	+16	+ 1	Dirt fill
	+ 1	— 3	Dark mud
	— 3	— 6	Hard yellow clay
1060 M6	+15	— 5	Dirt fill
	— 5	—10	Stiff yellow clay
1061 M7	+16	+13	Sand
	+13	— 1	Soft mud
	— 1	— 4	Hard yellow clay
	— 4	—16	Fine sand, little clay
	—16	—21	Soft blue clay
1062 M7	+17	+13	Sand, rocks
	+13	— 6	Soft mud
	— 6	—12	Hard yellow clay
	—12	—21	Soft blue clay
1063 M6	+17	+ 2	Soft fill; ashes, mud, rock
	+ 2	— 2	Hard yellow clay
	— 2	—21	Soft blue clay
1064 M6	+17	+ 4	Fill; sand, mud, rock
	+ 4	— 3	Hard yellow clay
	— 3	—19	Soft blue clay
1065 J8	+16	+ 8	Fill
	+ 8	—14	Soft mud
	—14	—20	Blue clay
1066 I8	+15	+ 8	Fill
	+ 8	—15	Soft mud
	—15	—19	Blue clay
1067 I8	+15	+ 8	Fill
	+ 8	—15	Soft mud
	—15	—21	Blue clay
1068 I8	+15	+ 7	Fill
	+ 7	—14	Soft mud
	—14	—19	Blue clay
1069 I8	+15	+ 7	Fill
	+ 7	—12	Soft mud
	—12	—17	Blue clay
1070 I7	+15	+ 9	Fill
	+ 9	— 6	Soft mud
	— 6	—12	Blue clay
1071 I7	+15	+ 4	Fill
	+ 4	— 4	Soft mud
	— 4	— 9	Blue clay
1072 I7	+17	+ 3	Fill
	+ 3	— 4	Blue clay
1073 I7	+16	— 4	Clay fill
1074 N6	+16	+ 7	Fill
	+ 7	— 1	Mud
	— 1	— 9	Clay
1075 N6	+17	+ 6	Fill
	+ 6	— 6	Mud
	— 6	—11	Clay
1076 M6	+17	+ 9	Fill
	+ 9	— 4	Mud
	— 4	— 9	Clay
1077 M5	+19	+ 5	Fill; sand, ash, mud
	+ 5	— 6	Blue clay
1078 M5	+19.5	+ 8.5	Ash, sand
	+ 8.5	+ 2.5	Clay, gravel

No. and location	Elevations or depths From	To	Formation
1079 M6	+20	+11	Ash and gravel fill
	+11	− 6	Hard yellow clay, small stones
1080 M6	+17	+ 8	Fill; ash, sand, clay
	+ 8	−13	Blue clay
1081 M6	+15	− 4	Ash and mud fill
	− 4	− 7	Fine sand, clay
	− 7	−28	Blue clay
1082 M6	+14.5	− 6.5	Ash and mud fill
	− 6.5	−27.5	Hard blue clay
1083 N6	+16.0	+ 9.0	Sand, gravel, clay
	+ 9.0	− 2.5	Soft mud
	− 2.5	− 7.0	Hard clay
1084 N6	+16.5	+ 7.0	Fill
	+ 7.0	− 3.5	Mud
	− 3.5	− 8.5	Clay
1085 N6	+17.0	+10.5	Hard fill; gravel, sand, rocks
	+10.5	− 1.5	Soft fill; mud and sand
	− 1.5	− 3.5	Hard clay
1086 N6	+18.5	+10.5	Fill; gravel, rock
	+10.5	+ 1.5	Soft mud
	+ 1.5	− 6.0	Hard clay
1087 N6	+22.5	+20.5	Fill; sand
	+20.5	+ 7.5	Hard clay
1088 D4	+13.5	+ 5.5	Ash, sand
	+ 5.5	− 1.5	Peat, mud
	− 1.5	−11.5	Coarse sand
1089 D4	+13.0	+ 6.0	Ash, sand
	+ 6.0	+ 2.5	Peat
	+ 2.5	− 7.5	Coarse sand
1090 C3	+13.5	+ 6.5	Ash, sand
	+ 6.5	+ 1.5	Little peat
	+ 1.5	− 5.5	Sand, gravel
1091 F7	+13.5	+ 6.5	Fill; soft ash
	+ 6.5	+ 1.0	Soft clay, little sand
	+ 1.0	−13.5	Hard yellow clay
1092 F7	+ 8.0	+ 2.5	Soft fill
	+ 2.5	−11.0	Hard yellow clay
1093 F7	+13.5	+ 3	Soft fill
	+ 3	0	Fine fill
	0	−14	Hard yellow clay
	−14	−18	Stiff blue clay
1094 F7	+13.5	+ 4.0	Fill
	+ 4.0	+ .5	Silt, fine sand
	+ .5	−11.5	Hard blue clay
1095 F7	+ 8.0	+ 1.5	Fill
	+ 1.5	+ 0.5	Silty sand
	+ 0.5	−11.0	Hard clay
1096 F7	+13.0	+ 2.0	Fill
	+ 2.0	+ 0.5	Silt, fine sand
	+ 0.5	− 1.0	Hard clay
	− 1.0	− 2.0	Sand, clay, gravel
	− 2.0	−10.0	Hard clay
1097 H9	+ 0.5	− 1.5	Black mud
	− 1.5	− 7.0	Silty sand, shells
	− 7.0	−12.0	Hard clay, fine sand
1098 H9	+15.0	+ 5.0	Fill; sand, gravel, cinder
	+ 5.0	− 7.5	Silty peat
	− 7.5	−12.5	Hard clay, little fine sand
1099 H9	+16.0	+ 5.0	Fill; sand, gravel, cinder
	+ 5.0	− 8.5	Silty peat
	− 8.5	−14.0	Hard blue clay, little sand
1100 N4	+16.0	+ 6.0	Fill; sand, gravel, clay
	+ 6.0	−29.5	Fine sand, silt, shells
	−29.5	−32.0	Silty sand, gravel
	−32.0	−37.0	Medium blue clay, fine sand
1101 N4	+16.0	− 1.5	Fill
	− 1.5	−26.5	Fine sand, silt
	−26.5	−28.0	Hard black sand
	−28.0	−30.0	Hard gravel, little clay
1102 N4	+16.0	+ 6.5	Sand and gravel fill
	+ 6.5	− 2.5	Clay and silt fill
	− 2.5	−25.0	Silty sand, shells
	−25.0	−27.5	Silty sand, gravel
	−27.5	−31.0	Hard sand, gravel
1103 O5	+18.5	+ 7.0	Sand and gravel fill
	+ 7.0	+ 5.5	Hard yellow clay and gravel fill
	+ 5.5	− 1.5	Hard yellow clay, fine sand
1104 O5	+16.0	+ 3.5	Sand and gravel fill
	+ 3.5	− 1.0	Silty sand, shells
	− 1.0	− 6.0	Hard yellow clay
1105 O5	+14.0	− 1.5	Fill; sand, gravel, stone. −1.5 top of boulder
1106 O5	+14.0	+ 1.0	Sand and gravel fill
	+ 1.0	− 5.5	Silt
	− 5.5	−11.5	Silty sand
	−11.5	−16.0	Hard yellow clay
1107 J3	+19.0	− 2.0	Fill
	− 2.0	−11.0	Mud
	−11.0	−18.5	Hard blue clay
1108 J3	+18.0	+ 5.0	Fill (loose)
	+ 5.0	+ 0.5	Loose sand, gravel, little clay
	+ 0.5	− 6.5	Hard blue clay
1109 J3	+19.5	+ 7.0	Fill
	+ 7.3	+ 5.0	Hard gravel, clay
	+ 5.0	− 2.0	Hard blue clay, stone
1110 J3	+11.0	+ 1.0	Fill
	+ 1.0	− 6.0	Hard clay
1111 K3	+17	+ 4	Fill
	+ 4	+ 0.5	Hard clay, little rock

No. and location	Elevations or depths From	To	Formation
1112	+17	+ 9	Fill
K4	+ 9	+ 4	Clay
1113	+17	+ 7	Fill
K4	+ 7	+ 4	Hard clay
1114	+17.5	+10.5	Ash fill
G6	+10.5	+ 3.5	Gravel, clay
	+ 3.5	− 2.5	Coarse gravel
1115	+18.0	+ 9.0	Ash fill
F6	+ 9.0	+ 4.0	Gravel and clay fill
	+ 4.0	− 0.5	Blue clay
1116	+18	+ 9	Gravel, clay and sand fill
F7	+ 9	+ 2	Yellow clay, blue mixed
	+ 2	− 4	Yellow clay
1117	+18	+11	Sand, clay
G7	+11	+ 6	Fine sand, gravel
	+ 6	+ 3	Gravel, clay
	+ 3	− 2	Yellow clay
1118	+19.5	+13.5	Sand, gravel
G7	+13.5	+ 8.5	Clay, mud, shells
	+ 8.5	+ 3.5	Fine sand, little clay
	+ 3.5	− 1.5	Sand, blue clay, mixed
	− 1.5	− 6.5	Yellow clay
1119	+16.5	+12.5	Water
M3	+12.5	− 0.5	Sand and gravel fill
	− 0.5	− 3.5	Fine silty sand
	− 3.5	− 6.0	Coarse mica sand
	− 6.0	− 8.0	Hard yellow clay, little fine sand
			Boulder
1120	+16.5	+12.5	Water
M3	+12.5	+ 0.5	Stone and gravel fill
	+ 0.5	− 2.5	Fine silty sand
	− 2.5	− 5.5	Coarse sand, gravel, little clay
			Boulder
1121	+19.0	+14.0	Rubbish
M3	+14.0	+11.5	Fill
	+11.5	+ 1.5	Loose coarse sand
	+ 1.5	− 2.0	Fine sand, silt
	− 2.0	− 3.5	Loose dirty sand
1122	+17.5	+ 4.0	Sand and gravel fill
M2	+ 4.0	− 3.0	Fine sand, silt
	− 3.0	− 4.5	Coarse silty sand, gravel
	− 4.5	− 7.5	Medium blue clay
	− 7.5	− 9.5	Hard yellow clay, little fine gravel
1123	+15.5	+ 9.0	Sand and gravel fill
M2	+ 9.0	+ 4.5	Water
	+ 4.5	− 3.5	Fill; silt, brick, little gravel
	− 3.5	− 7.0	Silt, little fine sand
	− 7.0	−10.5	Coarse silty sand, gravel
	−10.5	−18.0	Hard yellow clay, little sand, coarse gravel

No. and location	Elevations or depths From	To	Formation
1124	+17.5	+ 9.5	Fill
L2	+ 9.5	+ 8.5	Water
	+ 8.5	− 4.0	Silty sand fill
	− 4.0	− 9.0	Coarse silty sand, gravel
	− 9.0	−18.0	Hard blue clay
1125	+15.5	+ 7.5	Sand and gravel fill (water)
N4	+ 7.5	− 6.0	Sand and gravel fill
	− 6.0	−19.5	Silt, fine sand
	−19.5	−23.0	Soft blue clay
	−23.0	−29.5	Medium blue clay
1126	+16.0	+ 8.0	Sand and gravel fill (water)
M3	+ 8.0	− 6.0	Sand and gravel fill (loose)
	− 6.0	−40.5	Silt, fine sand
	−40.5	−44.0	Sand, gravel, clay
	−44.0	−52.0	Hard blue clay, little fine sand, gravel
1127	+16.0	+14.5	Concrete
M3	+14.5	+ 7.5	Fill; sand, gravel, clay (water)
	+ 7.5	− 3.5	Fill; sand, gravel, clay
	− 3.5	− 8.0	Fine silty sand
	− 8.0	−32.5	Silt, fine sand
	−32.5	−44.5	Soft blue clay
	−44.5	−49.0	Hard coarse sand, gravel, little clay
1128	+16.0	+14.5	Concrete
M3	+14.5	+12.0	Sand and gravel fill (water)
	+12.0	+ 5.5	Sand and gravel fill
	+ 5.5	+ 0.5	Clay and silt fill
	− 0.5	− 6.0	Silt, little fine sand
	− 6.0	−17.5	Fine silty sand
	−17.5	−19.0	Coarse sand, gravel, little clay
	−19.0	−23.0	Hard yellow clay, little fine sand
1129	+18.0	+ 6.0	Sand and gravel fill
D4	+ 6.0	− 1.0	Medium peat
	− 1.0	−12.0	Medium coarse sand, gravel
1130	+18.0	+ 4.0	Sand and gravel fill
D3	+ 4.0	− 1.5	Medium peat
	− 1.5	−14.5	Medium coarse sand, gravel
1131	+18.0	+ 4.0	Sand and gravel fill
D3	+ 4.0	− 0.5	Medium peat
	− 0.5	−14.5	Medium coarse sand, gravel
1132	+20.5	+ 5.5	Sand and gravel fill
D3	+ 5.5	− 0.5	Medium peat
	− 0.5	−12.5	Hard coarse sand, gravel
1133	+15.5	− 0.5	Fill
F9	− 0.5	−12.0	Sandy mud
	−12.0	−19.0	Hard gray clay
1134	+12.0	− 1.5	Fill
F9	− 1.5	− 8.0	Sandy mud
	− 8.0	−10.0	Hard gray clay

No. and location	Elevations or depths From	To	Formation
1135 F8	+15.0	+ 0.5	Fill
	+ 0.5	− 4.0	Hard brown clay
1136 G6	+18.5	+ 0.5	Sand and gravel fill
	+ 0.5	−12.0	Silt, fine sand, shells
	−12.0	−14.0	Medium blue clay, little fine gravel
	−14.0	−18.5	Hard yellow clay, fine sand
1137 G6	+18.0	− 0.5	Fill; sand, gravel, brick
	− 0.5	−12.5	Silt, little fine sand, shells
	−12.5	−14.0	Blue clay, sand, fine gravel
	−14.0	−25.0	Hard sand, gravel, clay
1138 G6	+18.0	− 0.5	Fill; sand, gravel, brick
	− 0.5	−12.5	Silt, shells
	−12.5	−17.0	Hard sand, gravel, clay
1139 G6	+17.5	+ 1.0	Fill; sand, gravel, brick
	+ 1.0	−12.5	Silt and shells
	−12.5	−17.5	Medium yellow clay
1140 D6	+11.5	+ 5.0	Cinders, gravel, clay, brick
	+ 5.0	+ 1.5	Brick fill
	+ 1.5	+ 0.0	Soft blue clay
	+ 0.0	− 1.5	Hard yellow clay
1141 D6	+13.5	+ 3.5	Fill; cinder, ash, sand
	+ 3.5	− 4.0	Clay and sand fill
	− 4.0	− 5.5	Hard yellow clay
1142 D6	+ 3.5	− 0.5	Fill; sand, gravel, brick
	− 0.5	− 3.5	Hard yellow clay
1143 D6	+12.5	− 1.5	Sand and cinder fill, loose sand and gravel
	− 1.5	− 3.0	Soft blue clay
	− 3.0	− 5.0	Hard yellow clay
1144 F5	+16.0	− 6.0	Sand and gravel fill
	− 6.0	−26.0	Silt
	−26.0	−32.0	Stiff blue clay
1145 F5	+15.5	− 1.0	Coarse sand, little gravel fill
	− 1.0	−25.0	Silt
	−25.0	−30.0	Stiff blue clay
1146 F5	+16.5	− 8.0	Coarse sand, little gravel fill
	− 8.0	−23.0	Silt
	−23.0	−30.0	Stiff blue clay
1147 H9	+15.0	+ 8.0	Fill; sand, gravel, brick
	+ 8.0	−11.0	Silt, peat (soft)
	−11.0	−16.0	Stiff blue clay
1148 H9	+15.0	+ 9.5	Sand and gravel fill
	+ 9.5	−11.5	Silt, peat (soft)
	−11.5	−17.5	Stiff blue clay
1149 H9	+13.5	+ 8.5	Sand and gravel fill
	+ 8.5	− 6.5	Silt, peat (soft)
	− 6.5	−12.5	Stiff blue clay
1150 H9	+14.0	+ 8.0	Sand and gravel fill
	+ 8.0	−10.0	Silt, peat (soft)
	−10.0	−16.5	Stiff blue clay
1151 H9	+14.0	+ 7.0	Sand and gravel fill
	+ 7.0	−12.0	Silt, peat (soft)
	−12.0	−18.0	Stiff blue clay
1152 F4	+17.5	+ 8.5	Sand and gravel fill
	+ 8.5	+ 1.5	Fine sand
	+ 1.5	− 4.5	Silt (soft)
	− 4.5	− 7.0	Fine sand, little gravel
	− 7.0	−24.0	Fine sand (loose)
	−24.0	−28.0	Clay
1153 F4	+22.5	+10.5	Fill; sand, gravel, ash
	+10.5	+ 5.5	Fine sand
	+ 5.5	+ 1.0	Sand, gravel
	+ 1.0	−17.0	Silt, shells (soft)
	−17.0	−21.0	Clay
1154 C9	+14.5	+ 4.0	Fill; sand, gravel, ash
	+ 4.0	+ 2.0	Very soft silt
	+ 2.0	− 2.0	Soft silt
	− 2.0	−10.5	Stiff yellow clay
1155 C9	+15.0	+ 7.0	Fill; sand, gravel, ash
	+ 7.0	− 1.5	Silty peat
	− 1.5	− 7.0	Silt, little blue clay
	− 7.0	−11.0	Stiff blue clay
1156 C9	+16.0	+ 2.0	Fill; sand, gravel, ash, clay
	+ 2.0	−16.0	Soft silt
	−16.0	−20.0	Stiff blue clay
1157 C9	+16.5	+ 2.0	Sand and gravel fill
	+ 2.0	− 3.0	Sand and gravel, silty
	− 3.0	− 8.0	Silt, peat
	− 8.0	−14.5	Soft silt
	+14.5	−25.0	Blue clay, fairly stiff
1158 I8	+15.0	+ 5.0	Ash, brick
	+ 5.0	−14.0	Mud
	−14.0	−21.0	Hard clay
1159 I8	+14.5	+ 5.5	Ash fill
	+ 5.5	−10.5	Mud
	−10.5	−16.5	Hard clay
1160 I8	+15.5	+ 5.5	Ash fill
	+ 5.5	− 6.5	Mud
	− 6.5	−11.5	Hard yellow clay
1161 I8	+15.0	+10.0	Sand
	+10.0	−15.0	Dock mud
	−15.0	−21.0	Hard blue clay, rocks

No. and location	Elevations or depths From	To	Formation
1162 O6	Surface	11.0	Hard yellow clay, sand, gravel
	11.0	18.0	Hard blue clay, sand, gravel, rocks
	18.0	26.0	Fine sand, clay, rocks
	26.0	45.5	Compact fine sand, clay, gravel, rocks
	45.5	73.0	Hard blue clay, sand, gravel, rocks
1163 C4	+11.5	+ 8.5	Gravel
	+ 8.5	+ 2.0	Mud
	+ 2.0	— 8.5	Hard gravel
1164 C4	+ 8.5	— 3.5	Mud
	— 3.5	—14.5	Hard blue gravel
1165 C4	+ 7.0	— 5.0	Mud
	— 5.0	— 7.0	Sand
	— 7.0	—12.0	Very hard gravel
1166 D4	+ 9.0	+ 7.5	Gravel
	+ 7.5	— 2.0	Mud
	— 2.0	—13.5	Hard blue gravel
1167 D3	+12.0	+10.0	Gravel
	+10.0	— 2.0	Mud
	— 2.0	—13.5	Hard blue gravel
1168 D3	+17.0	+ 3.0	Fill
	+ 3.0	— 2.0	Mud and gravel
	— 2.0	— 9.5	Hard gravel
1169 D3	+11.5	+ 9.5	Gravel
	+ 9.5	+ 4.5	Mud
	+ 4.5	—13.5	Hard gravel
1170 E2	+18.0	+14.0	Gravel
	+14.0	+ 2.0	Loose gravel, stones
	+ 2.0	— 9.0	Harder gravel
	— 9.0	—11.5	Hard sand
1171 E2	+19.0	— 7.5	Gravel
	— 7.5	—10.0	Hard sand
1172 F3	—18.0	— 8.5	Gravel
	— 8.5	—12.0	Sand
1173 E4	+10.5	— 0.5	Gravel
	— 0.5	— 7.5	Mud
	— 7.5	—24.5	Sand
1174 E4	+10.5	+ 0.5	Gravel
	+ 0.5	— 5.5	Mud
	— 5.5	—25.5	Sand
1175 E4	+ 9.0	+ 0.5	Gravel
	+ 0.5	— 4.5	Mud
	— 4.5	—31.5	Sand
1176 E4	+16.0	+ 3.5	Gravel
	+ 3.5	— 1.0	Mud
	— 1.0	—17.0	Sand
1177 E3	+17	— 4	Gravel
	— 4	— 6	Mud
	— 6	—20	Sand
1178 E3	+17.5	— 9.5	Gravel
	— 9.5	—11.5	Mud
	—11.5	—18.5	Sand
1179 C4	+17.0	+ 6.5	Gravel
	+ 6.5	— 2.0	Mud
	— 2.0	— 5.5	Gravel
	— 5.5	— 8.0	Sand
1180 D4	+17.0	+ 1.5	Gravel
	+ 1.5	— 7.0	Mud
	— 7.0	—12.5	Gravel
1181 D4	+16.5	— 3.0	Gravel
	— 3.0	— 6.5	Mud
	— 6.5	—12.5	Gravel
	—12.5	—19.5	Sand
1182 D4	+16.5	— 2.5	Gravel
	— 2.5	— 7.0	Mud
	— 7.0	— 9.5	Gravel
	— 9.5	—19.5	Sand
1183 D4	+17.5	— 1.0	Gravel
	— 1.0	— 8.0	Mud
	— 8.0	—12.5	Sand
1184 E4	+18.0	— 2.0	Gravel
	— 2.0	— 7.5	Mud
	— 7.5	—19.0	Sand
1185 J3	+17.5	— 5.5	Gravel, loam
	— 5.5	—14.5	Mud
	—14.5	—18.5	Gravel, clay
	—18.5	—22.5	Clay
1186 J3	+18	+ 7	Fill
	+ 7	— 1	Gravel, mud
	— 1	— 7	Sand, mud
	— 7	— 8	Hardpan
	— 8	—27	Mud, sand
	—27	—29.5	Sand
1187 K3	+17.5	+ 6.5	Fill
	+ 6.5	+ 2.5	Mud
	+ 2.5	—22.5	Mud, gravel
	—22.5	—28.5	Gravel
1188 K3	+17.5	+ 5.5	Fill
	+ 5.5	— 0.5	Mud, sand
	— 0.5	— 7.5	Mud
	— 7.5	—24.5	Sand, mud
	+24.5	—30.5	Sand, clay
1189 K3	+17.5	+12.5	Fill
	+12.5	+10.0	Mud, gravel
	+10.0	+ 9.0	Gravel
	+ 9.0	— 3.5	Mud, gravel
	— 3.5	— 7.0	Mud
	— 7.0	—22.5	Gravel, mud
	—22.5	—31.0	Gravel
1190 K3	+17.5	+ 9.5	Gravel, sand
	+ 9.5	+ 4.5	Mud, gravel
	+ 4.5	— 0.5	Gravel
	— 0.5	— 5.5	Mud, sand
	— 5.5	— 9.5	Sand
	— 9.5	—27.5	Gravel
	—27.5	—32.5	Sand, clay
1191 K2	+17.0	+ 9.5	Gravel, sand
	+ 9.5	— 6.0	Mud
	— 6.0	—26.0	Gravel, mud
	—26.0	—33.0	Gravel

No. and location	Elevations or depths From	To	Formation
1192 K2	+16.5	+ 8.5	Fill
	+ 8.5	+ 3.5	Soft mud
	+ 3.5	− 1.5	Dry mud
	− 1.5	−21.5	Mud, sand
	−21.5	−30.5	Sand, clay, stones
1193 K2	+17.0	+11.0	Hard gravel
	+11.0	+ 6.0	Loose gravel
	+ 6.0	− 1.0	Coarse gravel
	− 1.0	−13.0	Gravel, mud
	−13.0	−18.0	Clay, gravel
	−18.0	−21.0	Clay
1194 K2	+17.0	+ 7.0	Hard gravel
	+ 7.0	+ 2.0	Loose gravel
	+ 2.0	− 3.0	Mud
	− 3.0	− 4.0	Hardpan
	− 4.0	−18.0	Sand
	−18.0	−21.5	Clay
1195 K2	+17.0	− 2.5	Gravel, stones, clay, loam
	− 2.5		Struck rock
1196 L2	+16.5	0	Gravel, clay, mud
			Struck rock
1197 L2	+17	+ 3.5	Gravel, sand, clay, loam
1198 L2	+16	− 1	Gravel, clay, sand. At −1.0 struck rock
1199 L2	+15.5	+ 4.5	Gravel, stones
	+ 4.5	− 1.5	Mud
	− 1.5	− 4.5	Clay, gravel
	− 4.5	−11.5	Clay
			At −11.5 struck rock
1200 L2	+15.0	+10.0	Gravel
	+10.0	− 0.5	Mud
	− 0.5	− 3.0	Gravel
	− 3.0	−15.0	Clay
1201 L2	+15.25	+ 6.5	Gravel, stones
	+ 6.5	− 1.0	Mud
	− 1.0	−12.75	Clay
			Rock beyond
1202 L2	+17.0	+ 7.75	Gravel, stones
	+ 7.75	+ 4.75	Soft mud
	4.75	− 3.5	Clay
			Rock beyond
	(Two similar borings about 40 feet apart)		
1203 L2	+17.5	+ 7.5	Gravel
	+ 7.5	+ 4.5	Mud
	+ 4.5	+ 2.25	Sand, mud
	+ 2.25	+ 0.5	Clay
			Rock beyond
1204 L2	+17.5	+ 9.0	Gravel
	+ 9.0	+ 3.0	Clay
			Rock beyond
1205 L2	+18.0	+10.5	Gravel, clay, stones
	+10.5	+ 5.5	Gravel, mud
	+ 5.5	+ 0	Fine sand
			Rock beyond

No. and location	Elevations or depths From	To	Formation
1206 M2	+14.75	+ 9.75	Gravel
	+ 9.75	+ 4.75	Mud, gravel
	+ 4.75	+ 2.5	Gravel, stones
			Rock beyond
1207 M3	+17.5	+ 6.5	Gravel, stones
	+ 6.5	− 5.5	Gravel, clay
	− 5.5	−11.0	Clay
			Rock beyond
1208 M3	+18	+ 8	Gravel
	+ 8	− 2	Loose gravel
	− 2	− 3	Stones
	− 3	− 5	Sand
	− 5	− 9	Sand, clay
	− 9	−17	Clay
1209 M3	+18	+11	Hard gravel, stones
	+11	+ 6	Loose gravel, stones
	+ 6	− 5	Hard gravel
	− 5	− 8	Sand
	− 8	−10	Sand, clay
	−10	−14.5	Clay
1210 M3	+17	+11	Hard gravel, clay
	+11	+ 5	Loose gravel
	+ 5	+ 3	Stones
	+ 3	− 2	Hard clay, gravel
1211 M3	+17.0	+ 9.0	Clay, gravel, stones
	+ 9.0	+ 5.5	Mud, clay
	+ 5.5	− 3.0	Coarse gravel
	− 3.0	−10.5	Clay, gravel
	−10.5	−14.0	Clay
1212 M3	+17.0	+ 4.5	Gravel, stones
	+ 4.5	− 8.0	Gravel, mud
	− 8.0	−19.0	Clay
1213 L3	+16.5	+ 4.0	Hard gravel, clay, stone
	+ 4.0	− 4.0	Loose gravel, mud
	− 4.0	− 5.0	Stone
	− 5.0	−10.0	Gravel, clay
	−10.0	−14.0	Clay
1214 L3	+16	+ 8	Gravel, stones
	+ 8	+ 5	Mud
	+ 5	− 6	Mud, stone
	− 6	−14	Clay
1215 L4	+16	− 6	Gravel, clay
	− 6	−12	Mud
	−12	−25	Clay, sand
1216 L4	+16	+ 6	Fill
	+ 6	− 9	Sand, mud
	− 9	−15	Sand, clay
1217 M4	+16.0	+14.0	Gravel
	+14.0	+12.0	Loose gravel
	+12.0	+ 6.5	Gravel, stones
	+ 6.5	−17.5	Wet clay, gravel
1218 M4	+15.5	+12.5	Fill
	+12.5	+ 0.5	Mud
	+ 0.5	−17.5	Sand, mud
	−17.5	−23.0	Clay
1219 M4	+15	+10	Fill
	+10	+ 4	Mud, gravel
	+ 4	−34	Mud
	−34	−39±	Clay

No. and location	Elevations or depths From	To	Formation
1220 M4	+16.5	+ 9.5	Fill
	+ 9.5	+ 5.5	Gravel, mud
	+ 5.5	−25.5	Mud
	−25.5	−30.5	Sand, mud
	−30.5	−34.5	Hard gravel
1221 M4	+16	+13	Fill
	+13	+ 7	Gravel, mud
	+ 7	−27	Mud, some gravel
	−27	−34	Sand, mud
1222 N4	+15.75	+ 9.5	Fill
	+ 9.5	−22.5	Mud, wood beyond
1223 N4	+15.5	+11.5	Fill
	+11.5	−12.5	Mud, stone
	−12.5	−15.0	Coarse gravel
	−15.0	−16.5	Fine gravel
	−16.5	−25.0	Gravel, clay
1224 N4	+15.0	+12.2	Fill
	+12.2	+ 9.5	Gravel, mud
	+ 9.5	+ 7.5	Mud, gravel
	+ 7.5	+ 2.5	Mud
	+ 2.5	−27.5	Sand, mud
	−27.5	−35.0	Fine sand
1225 N4	+15.0	+12.5	Fill
	+12.5	+ 7.5	Gravel, mud
	+ 7.5	+ 1.0	Mud
	+ 1.0	− 7.0	Sand, mud
	− 7.0	−30.0	Sand, mud
	−30.0	−34.0	Sand
1226 N4	+15	+12	Fill
	+12	+ 8	Gravel, mud
	+ 8	+ 1	Mud
	+ 1	−12	Mud, sand
	−12	−14	Clay
	−14	−17	Clay
1227 N4	+17	+11	Fill
	+11	+ 1.5	Clay, gravel, stones
			Rock beyond
1228 F5	+17.5	+12.2	Hard coarse sand and gravel fill
	+12.2	− 5.7	Loose gravel and sand fill
	− 5.7	−11.5	Stiff silt, fine sand
1229 G5	+18.0	+13.5	Hard coarse gravel and sand fill
	+13.5	− 4.0	Coarse gravel and sand fill
	− 4.0	− 5.0	Silty peat
	− 5.0	− 9.5	Stiff silt, fine sand
1230 G5	+21.5	+17.5	Hard coarse gravel and sand fill
	+17.5	− 2.5	Coarse gravel and sand fill
	− 2.5	− 6.5	Stiff silt, fine sand
1231 G5	+18.5	+12.0	Hard coarse gravel and sand fill
	+12.0	+ 8.0	Hard gravel and sand fill
	+ 8.0	− 7.0	Very loose wet sand fill
	− 7.0	−11.0	Stiff silt, fine sand
	−11.0	−18.0	Very stiff blue clay

No. and location	Elevations or depths From	To	Formation
1232 H5	+17.5	+16.0	Hard coarse gravel and sand fill
	+16.0	− 3.0	Fairly hard sand and gravel fill
	− 3.0	− 6.0	Stiff silt, fine sand
	− 6.0	−12.0	Very stiff fine sand
1233 H5	+15.5	+ 1.7	Hard sand and gravel fill
	+ 1.7	− 2.5	Hard silt, sand
	− 2.5	−10.5	Very stiff yellow clay
1234 I4	+16.5	− 3.0	Fill, ashes, gravel
	− 3.0	− 8.0	Soft mud
	− 8.0	−12.0	Fine sand, clay
	−12.0	−14.0	Gravel, clay
1235 I4	+17.0	+ 2.5	Fill
	+ 2.5	−22.5	Soft mud
	−22.5	−26.5	Sand
	−26.5	−28.0	Hard gravel
1236 I4	+16.0	+12.0	Gravel, hard fill
	+12.0	− 7.5	Ash, soft fill, mud
	− 7.5	−29.5	Soft mud
	−29.5	−30.0	Stiff clay
1237 I3	+15.5	− 1.5	Ash and shell, fill
	− 1.5	−11.5	Sand, gravel
	−11.5	−25.5	Soft mud
	−25.5	−28.5	Stiff sand, gravel
1238 G6	+22.5	+12.5	Fill
	+12.5	− 2.5	Sand, gravel
	− 2.5	−16.5	Soft mud
	−16.5	−20.5	Blue clay
1239 G6	+23.0	+ 6.5	Fill
	+ 6.5	+ 4.5	Gravel, sand
	+ 4.5	− 4.0	Sand
	− 4.0	−18.0	Soft mud
	−18.0	−22.5	Blue clay
1240 G6	+23.5	+ 5.0	Fill
	+ 5.0	− 5.5	Sand
	− 5.5	−24.0	Soft mud
	−24.0	−27.0	Blue clay
1241 E9	+17.5	−18.5	Fill; sand, gravel, little clay (very wet)
	−18.5	−26.5	Soft silt
	−26.5	−32.5	Stiff blue clay
1242 E9	+17.5	− 9.5	Fill; sand, gravel, clay, brick
	− 9.5	−22.5	Soft silt
	−22.5	−26.5	Stiff blue clay
1243 E9	+17.5	− 8.0	Fill; sand, gravel, clay
	− 8.0	−17.5	Soft silt
	−17.5	−22.5	Stiff blue clay
1244 E9	+16.5	− 4.0	Fill; sand, gravel, clay, brick
	− 4.0	−11.0	Soft silt and sand
	−11.0	−18.5	Stiff blue clay
1245 E8	+15.0	−10.5	Fill; sand, gravel, brick, boulder
	−10.5	−13.5	Peat
	−13.5	−14.5	Soft silt, peat
	−14.5	−20.5	Stiff blue clay

No. and location	Elevations or depths From	To	Formation
1246 E8	+14.0	+ 1.5	Fill; sand, gravel, clay, brick
	+ 1.5	−16.5	Silt, peat
	−16.5	−21.5	Stiff blue clay
1247 E8	+15.5	+ 2.0	Fill; sand, gravel, loam
	+ 2.0	− 5.0	Silty peat
	− 5.0	− 9.5	Stiff blue clay
1248 E8	+15.5	+ 9.0	Fill; sand, gravel, brick
	+ 9.0	+ 5.0	Stiff yellow clay
	+ 5.0	−10.0	Fairly stiff yellow clay
1249 E8	+16.0	+ 4.0	Ash fill
	+ 4.0	−10.0	Stiff yellow clay
1250 E7	+15.0	+ 3.0	Fill; sand, gravel, ash fill
	+ 3.0	−10.5	Yellow clay
1251 E7	+15.5	+ 0.5	Fill; sand, gravel, ash, little clay
	+ 0.5	− 9.5	Yellow clay
1252 E7	+16.5	+ 0	Fill; sand, gravel oyster shell fill
	+ 0	− 8.5	Yellow clay
1253 E7	+16.5	− 0.5	Fill; sand, gravel, ash
	− 0.5	− 8.5	Yellow clay
1254 C7	+16.5	+15.5	Tar concrete
	+15.5	+ 8.0	Brown sand, gravel
	+ 8.0	− 2.0	Blue clay
1255 C7	+16.0	+15.0	Sand fill
	+15.0	− 1.5	Gray sand
1256 M7	+15.5	+ 2.5	Sand and gravel fill
	+ 2.5	− 7.5	Silt, peat
	− 7.5	−11.5	Stiff blue clay
1257 M7	+15.5	− 0.5	Fill; sand, gravel, mud
	− 0.5	− 9.5	Silt, peat
	− 9.5	−14.5	Very hard blue clay
1258 M7	+15.0	− 1.0	Sand and gravel fill
	− 1.0	− 8.0	Silt, peat
	− 8.0	−13.0	Stiff blue clay
1259 N7	+15	− 4	Sand and gravel fill
	− 4	−21	Silt, shells, peat
	−21	−25	Stiff blue clay
1260 C9	+17.0	+ 3.0	Gravel
	+ 3.0	−15.5	Mud
	−15.5	−17.5	Gravel
	−17.5	−28.0	Clay
1261 C9	+17.0	+ 1.0	Gravel
	+ 1.0	− 1.0	Mud
	− 1.0	−17.0	Not given
	−17.0	−27.5	Clay
1262 C9	+17.0	− 5.0	Gravel
	− 5.0	−23.0	Clay
1263 C9	+17.0	− 4.0	Gravel
	− 4.0	− 5.0	Hard mud
	− 5.0	−22.5	Clay
1264 D9	+17.0	− 3.0	Gravel
	− 3.0	−20.5	Clay
1265 D9	+17.0	− 8.0	Gravel
	− 8.0	−20.5	Hard clay
1266 D9	+17.0	− 4.5	Gravel
	− 4.5	− 8.0	Mud
	− 8.0	−22.5	Clay
1267 B9	+17.0	+ 9.5	Gravel
	+ 9.5	+ 4.0	Soft mud
	+ 4.0	−13.0	Hard mud
	−13.0	−23.0	Clay
1268 C9	+17.0	+10.0	Gravel
	+10.0	+ 4.0	Soft mud
	+ 4.0	−17.0	Hard mud
	−17.0	−25.5	Clay
1269 C9	+17.0	+11.0	Gravel
	+11.0	+ 7.0	Soft mud
	+ 7.0	+ 5.0	Gravel
	+ 5.0	− 5.5	Soft mud
	− 5.5	−17.5	Hard mud
	−17.5	−27.5	Clay
1270 C9	+17.0	+11.0	Gravel
	+11.0	+ 7.0	Soft mud
	+ 7.0	− 5.5	Hard mud
	− 5.5	−13.0	Gravel, mud
	−13.0	−20.5	Gravel
	−20.5	−28.0	Clay
1271 C9	+17.0	+ 5.0	Gravel
	+ 5.0	+ 3.0	Soft mud
	+ 3.0	− 8.0	Hard mud
	− 8.0	−13.5	Soft mud
	−13.5	−19.0	Gravel
	−19.0	−27.5	Clay
1272 C9	+17.0	+10.0	Gravel
	+10.0	+ 7.0	Soft mud
	+ 7.0	− 8.5	Hard mud
	− 8.5	−18.5	Gravel, mud
	−18.5	−29.5	Clay
1273 D9	+17.0	− 3.5	Gravel
	− 3.5	− 5.0	Mud
	− 5.0	−14.0	Hard clay
	−14.0	−22.5	Soft clay
1274 D9	+17.0	+ 9.0	Gravel
	+ 9.0	+ 4.0	Mud
	+ 4.0	− 5.0	Gravel
	− 5.0	−23.0	Sand
1275 D9	+17.0	+10.0	Gravel
	+10.0	+ 4.5	Mud
	+ 4.5	− 7.5	Gravel
	− 7.5	− 9.5	Fine sand
	− 9.5	−12.5	Gravel
	−12.5	−23.0	Fine sand
1276 D9	+17.0	+ 9.0	Gravel
	+ 9.0	+ 4.0	Mud
	+ 4.0	−22.5	Gravel

No. and location	Elevations or depths From	To	Formation
1277 D9	+17.0	+10.0	Fill
	+10.0	+ 3.5	Mud
	+ 3.5	− 9.5	Gravel
	− 9.5	−18.0	Hard sand
	−18.0	−23.0	Clay, sand
1278 D9	+17.0	+11.5	Fill
	+11.5	+ 5.0	Mud
	+ 5.0	+ 2.0	Gravel
	+ 2.0	+ 0.5	Stone
	+ 0.5	− 8.0	Gravel
	− 8.0	−20.5	Sand
	−20.5	−32.5	Clay
1279 D9	+17.0	+10.0	Gravel
	+10.0	+ 4.0	Mud
	+ 4.0	−10.0	Gravel
	−10.0	−32.5	Clay
1280 D9	+16.5	+ 3.5	Gravel
	+ 3.5	− 0.5	Mud
	− 0.5	−10.0	Gravel
	−10.0	−23.0	Clay
1281 D9	+16.5	+10.0	Gravel
	+10.0	+ 4.0	Mud
	+ 4.0	−10.0	Gravel
	−10.0	−22.5	Clay
1282 F9	+16.5	+10.5	Gravel
	+10.5	+ 7.5	Soft mud
	+ 7.5	−21.0	Gravel, mud
	−21.0	−23.0	Clay
1283 F9	+16.5	+ 8.5	Gravel
	+ 8.5	+ 3.5	Soft mud
	+ 3.5	−18.0	Dry mud
	−18.0	−28.0	Clay
1284 F9	+16.5	+10.5	Gravel
	+10.5	+ 4.0	Soft mud
	+ 4.0	−17.0	Dry mud
	−17.0	−31.0	Hard clay
1285 G9	+16.5	+11.5	Gravel
	+11.5	− 0.5	Soft mud
	− 0.5	−17.0	Dry mud
	−17.0	−28.0	Clay
1286 G9	+17.0	+10.0	Gravel
	+10.0	+ 4.0	Soft mud
	+ 4.0	−18.5	Dry mud
	−18.5	−28.5	Clay
1287 G9	+17.5	+ 7.5	Gravel
	+ 7.5	+ 5.5	Soft mud
	+ 5.5	−21.5	Dry mud
	−21.5	−30.0	Clay
1288 G9	+17.5	+ 8.5	Gravel
	+ 8.5	+ 5.5	Soft mud
	+ 5.5	−17.5	Mud, gravel
	−17.5	−27.0	Clay
1289 F9	+16.5	+10.5	Gravel
	+10.5	+ 5.0	Soft mud
	+ 5.0	−28.5	Gravel, mud
	−28.5	−39.0	Clay
1290 E9	+16.5	+10.5	Gravel
	+10.5	+ 4.0	Soft mud
	+ 4.0	− 5.5	Hard mud
	− 5.5	−15.0	Sand
	+15.0	−28.0	Clay
1291 E9	+16.5	+ 9.5	Gravel
	+ 9.5	+ 5.0	Mud
	+ 5.0	+ 1.0	Gravel, mud
	+ 1.0	−13.0	Gravel
	−13.0	−26.0	Hard clay
1292 E9	+16.5	+ 8.5	Gravel
	+ 8.5	+ 4.5	Mud
	+ 4.5	−11.0	Gravel
	−11.0	−23.0	Clay
1293 E9	+16.5	+10.5	Gravel
	+10.5	−10.5	Mud
	−10.5	−13.5	Sand, clay
	−13.5	−23.5	Clay
1294 E9	+16.5	+10.5	Gravel
	+10.5	− 9.5	Mud
	− 9.5	−12.5	Gravel
	−12.5	−23.0	Clay
1295 E9	+16.5	+10.5	Gravel
	+10.5	+ 2.5	Mud
	+ 2.5	−14.0	Gravel, mud
	−14.0	−18.0	Gravel
	−18.0	−28.5	Clay
1296 E9	+16.5	+ 9.5	Gravel
	+ 9.5	−10.5	Stone, mud
	−10.5	−20.0	Gravel
	−20.0	−30.0	Clay
1297 E9	+16.5	+ 9.5	Gravel
	+ 9.5	+ 4.5	Mud
	+ 4.5	−21.5	Gravel, mud
	−21.5	−28.5	Clay
1298 E9	+16.5	+ 9.5	Gravel
	+ 9.5	+ 4.5	Mud
	+ 4.5	−20.0	Dry mud
	−20.0	−33.0	Hard clay
1299 E9	+16.5	+10.0	Gravel
	+10.0	+ 5.5	Mud
	+ 5.5	−22.5	Dry mud
	−22.5	−32.0	Clay
1300 F9	+16.5	+10.0	Gravel
	+10.0	+ 5.0	Soft mud
	+ 5.0	−32.5	Dry mud
	−32.5	−35.0	Soft clay
1301 F9	+16.5	+10.0	Gravel
	+10.0	+ 3.0	Soft mud
	+ 3.0	−31.5	Dry mud
	−31.5	−40.0	Soft clay
1302 F9	+16.5	+10.5	Gravel
	+10.5	+ 0.5	Soft mud
	+ 0.5	−23.0	Mud, gravel
	−23.0	−33.0	Clay
1303 F9	+16.5	+12.5	Gravel
	+12.5	+10.5	Soft mud
	+10.5	−33.0	Dry mud
	−33.0	−35.0	Soft clay
1304 F9	+16.5	+ 9.5	Gravel
	+ 9.5	+ 3.5	Soft mud
	+ 3.5	−29.5	Dry mud
	−29.5	−35.0	Soft clay

No. and location	Elevations or depths From	To	Formation
1305 F9	+16.5	+ 9.5	Gravel
	+ 9.5	+ 5.5	Soft mud
	+ 5.5	−23.0	Mud, gravel
	−23.0	−27.0	Sand
	−27.0	−38.5	Clay
1306 B8	+18.5	+18.0	Macadam
	+18.0	+13.5	Sand fill
	+13.5	+ 2.5	Hard rubble fill
	+ 2.5	− 4.5	Coarse sand, gravel
	− 4.5	− 6.5	Gravel hardpan
1307 B8	+20.5	+20.0	Macadam
	+20.0	+10.5	Sand fill
	+10.5	+ 5.5	Dirt, sand
	+ 5.5	+ 1.5	Sand, blue clay
	+ 1.5	+ 0.5	Hard yellow clay
1308 B7	+22.0	+21.5	Macadam
	+21.5	+16.0	Dirt fill
	+16.0	+ 8.0	Hard yellow clay
1309 J2	+ 5.5	− 0.4	Coarse sand, gravel
	− 0.4	− 7.0	Stiff black silt
	− 7.0	−26.0	Silty sand, shells
	−26.0	−35.0	Gravel, clay
	−35.0	−57.0	Stiff blue clay
	−57.0	−61.0	Clay, gravel, sand (hard)
1310 J2	+ 4.0	− 4.5	Black silt, gravel
	+ 4.5	−25.0	Fine silty sand, shells
	−25.0	−32.0	Gravel, sand
	−32.0	−43.0	Stiff blue clay
	−43.0	−48.0	Clay, little gravel
	−48.0	−63.0	Gravel, sand
	−63.0	−68.0	Clay, gravel, sand
1311 J3	− 0.2	− 3.6	Soft black silt
	− 3.6	−26.3	Silty sand, shells
	−26.3	−34.8	Sand, gravel (hard)
	−34.8	−42.4	Stiff blue clay
	−42.4	−47.8	Sand, gravel, clay (hard)
1312 J2	+ 7.2	− 4.5	Black silt, sand, gravel
	− 4.5	−27.0	Silt, sand, shells
	−27.0	−31.0	Gravel, clay
	−31.0	−51.0	Stiff blue clay
	−51.0	−59.0	Clay, gravel, sand (hard)
1313 J2	+ 5.9	− 5.0	Gravel and brick fill
	− 5.0	−15.0	Silty sand
	−15.0	−33.0	Silt, shells
	−33.0	−39.0	Sand, gravel
	−39.0	−44.0	Soft blue clay
	−44.0	−57.0	Clay, little gravel
	−57.0	−62 and below	Clay, gravel, sand (hard)
1314 J2	− 0.8	−19.9	Silty sand, gravel
	−19.9	−32.0	Fine silty sand
	−32.0	−34.2	Sand, gravel
	−34.2	−40.6	Stiff blue clay
	−40.6	−55.6	Soft blue clay
	−55.6	−65.8	Sand, gravel, clay (hard)
1315 J2	−18.6	−20.6	Soft black silt
	−20.6	−35.9	Fine silty sand
	−35.9	−37.5	Sand, gravel
	−37.5	−44.2	Stiff blue clay
	−44.2	−56.7	Soft blue clay
	−56.7	−63.5	Sand, gravel, clay (hard)
1316 J2	−17.5	−24.2	Soft black silt
	−24.2	−26.5	Fine silty sand
	−26.5	−29.3	Silty sand, gravel (hard)
	−29.3	−33.7	Blue clay (hard)
	−33.7	−42.1	Stiff blue clay
	−42.1	−66.1	Soft blue clay
	−66.1	−73.5	Sand, gravel, clay (hard)
1317 J2	−15.5	−18.0	Soft black silt
	−18.0	−23.8	Fine silty sand, soft
	−23.8	−33.7	Sand, gravel (hard)
	−33.7	−37.5	Blue clay, hard
	−37.5	−43.3	Blue clay, stiff
	−43.3	−60.9	Soft blue clay
	−60.9	−69.8	Sand, gravel, clay (hard)
1318 J2	− 6.1	−14.7	Soft black silt
	−14.7	−25.4	Fine silty sand
	−25.4	−32.3	Sand, gravel
	−32.3	−50.9	Stiff blue clay
	−50.9	−56.5	Sand, gravel, clay (hard)
1319 J2	−12.2	−22.2	Soft black silt
	−22.2	−27.0	Fine silty sand
	−27.0	−31.3	Sand, gravel (hard)
	−31.3	−40.6	Sand, gravel, clay (hard)
1320 J2	−14.4	−21.8	Soft black silt
	−21.8	−26.4	Fine silty sand, some shells
	−26.4	−28.4	Sand, gravel
	−28.4	−30.4	Blue clay, hard
	−30.4	−40.5	Sand, gravel, clay (hard)
1321 J2	−13.9	−20.3	Soft black silt
	−20.3	−24.6	Soft silt, sand, shells
	−24.6	−26.7	Blue sand, some gravel
	−26.7	−31.3	Sand, gravel (hard)
	−31.3	−39.0	Stiff blue clay
	−39.0	−50.1	Sand, gravel, clay (hard)
1322 J2	−12.7	−18.2	Soft black silt
	−18.2	−23.0	Soft silt, shells
	−23.0	−31.0	Sand, gravel (hard)
	−31.0	−39.0	Stiff blue clay
	−39.0	−46.7	Soft blue clay
	−46.7	−55.7	Sand, gravel, clay (hard)
1323 J2	−13.3	−16.9	Soft black silt
	−16.9	−21.9	Soft silty peat
	−21.9	−24.3	Fine yellow sand
	−24.3	−30.4	Sand, gravel
	−30.4	−43.3	Stiff blue clay
	−43.3	−47.3	Soft blue clay
	−47.3	−51.1	Sand, gravel, clay (stiff)
	−51.1	−55.6	Sand, gravel, clay (hard)

No. and location	Elevations or depths From	To	Formation
1324	— 9.9	—14.3	Soft black silt
I2	—14.3	—23.7	Soft silty peat
	—23.7	—29.2	Sand, some gravel
	—29.2	—35.3	Stiff blue clay
	—35.3	—45.5	Soft blue clay
	—45.5	—47.3	Sand, gravel, clay (stiff)
	—47.3	—53.3	Sand, gravel, clay (hard)
1325	— 9.3	—11.6	Soft black silt
I1	—11.6	—23.5	Coarse silty sand, some gravel
	—23.5	—30.2	Stiff blue clay
	—30.2	—36.8	Soft blue clay
	—36.8	—38.5	Sand, gravel, clay (stiff)
	—38.5	—44.9	Sand, gravel, clay (hard)
1326	— 4.3	— 8.3	Soft black silt
I1	— 8.3	—19.2	Coarse sand, gravel
	—19.2	—36.3	Stiff blue clay
	—36.3	—40.3	Clayey sand, gravel (hard)
	—40.3	—44.4	Clayey sand, gravel (very hard)
1327	— 3.1	— 8.6	Soft black silt
I1	— 8.6	—13.3	Soft silty peat
	—13.3	—19.4	Coarse sand, gravel
	—19.4	—37.4	Stiff blue clay
	—37.4	—44.4	Sand, gravel, clay (hard)
1328	— 2.9	— 7.1	Soft black silt
I1	— 7.1	—11.1	Soft brown peat
	—11.1	—14.6	Fine silty sand
	—14.6	—16.5	Coarse sand, some gravel
	—16.5	—36.3	Stiff blue clay
	—36.3	—43.9	Soft blue clay
	—43.9	—50.9	Clayey sand, gravel (hard)
1329	— 3.0	— 6.3	Soft black silt
I1	— 6.3	—11.5	Fine silty sand
	—11.5	—14.7	Coarse sand, gravel
	—14.7	—18.4	Hard yellow clay
	—18.4	—46.5	Stiff blue clay
	—46.5	—49.5	Clayey sand, gravel (hard)
	—49.5	—55.1	Sand, gravel, clay (very hard)
1330	— 1.5	— 3.8	Soft black silt
I1	— 3.8	— 8.4	Fine silty sand
	— 8.4	—17.6	Coarse sand, gravel
	—17.6	—45.7	Stiff blue clay
	—45.7	—51.9	Clayey sand, gravel (hard)
1331	— 1.4	— 2.9	Soft black silt
I1	— 2.9	—13.4	Coarse sand, some gravel
	—13.4	—18.9	Hard yellow clay
	—18.9	—36.7	Stiff blue clay
	—36.7	—42.7	Soft blue clay
	—42.7	—43.2	Sand and gravel
	—43.2	—46.9	Soft blue clay
	—46.9	—50.7	Sand, gravel, clay (hard)
1332	+ 0.8	— 2.4	Soft black silt
I1	— 2.4	—12.9	Coarse sand, some gravel
	—12.9	—17.0	Hard yellow clay
	—17.0	—33.6	Stiff blue clay
	—33.6	—40.8	Soft blue clay
	—40.8	—46.0	Clayey sand, gravel (hard)
			Stone
1333	Brick walk		
I1	+16.7	+12.7	Sand, gravel
	+12.7	+ 0.2	Blue silty clay, gravel
	+ 0.2	—12.0	Sand, gravel
	—12.0	—17.5	Stiff yellow clay
	—17.5	—49.3	Stiff blue clay
	—49.3	—56.9	Sand, gravel, clay (hard)
1334	+15.8	— 2.5	Silty sand, gravel, shells
I1	— 2.5	—15.5	Sand, some gravel
	—15.5	—50.5	Stiff blue clay
	—50.5	—56.9	Sand, gravel, clay (hard)
1335	+ 0.5	— 1.2	Soft black silt
I1	— 1.2	—14.0	Coarse sand, some gravel
	—14.0	—33.5	Stiff blue clay
	—33.5	—51.9	Soft blue clay
	—51.9	—55.4	Coarse clayey sand
	—55.4	—57.9	Very fine sand
	—57.9	—64.2	Sand, gravel (hard)
1336	— 0.6	— 4.5	Soft black silt
I1	— 4.5	—15.8	Coarse sand, some gravel
	—15.8	—45.4	Stiff blue clay
	—45.4	—51.0	Soft blue clay
	—51.0	—52.6	Fine sand, gravel, clay (stiff)
	—52.6	—57.7	Sand, gravel, clay (hard)
1337	— 1.4	— 6.5	Soft black silt
I1	— 6.5	—17.0	Coarse sand, a little gravel
	—17.0	—28.5	Soft clay
	—28.5	—34.1	Soft clay
	—34.1	—34.8	Sand, gravel, clay (stiff)
	—34.8	—44.2	Soft clay
	—44.2	—50.4	Sand, gravel, clay (hard)
1338	— 2.5	— 7.0	Soft black silt
I1	— 7.0	—13.1	Coarse sand, gravel
	—13.1	—46.9	Stiff blue clay
	—46.9	—54.5	Sand, gravel, clay (hard)
1339	— 2.7	— 7.7	Soft black silt
I1	— 7.7	—16.1	Coarse silty sand with a little gravel
	—16.1	—19.1	Hard yellow clay
	—19.1	—25.9	Stiff blue clay
	—25.9	—45.4	Soft blue clay
	—45.4	—51.6	Sand, gravel, clay (hard)
			Stone, probably boulder

No. and location	Elevations or depths From	To	Formation
1340	— 2.2	— 6.5	Soft black silt
I1	— 6.5	— 9.5	Fine silty sand
	— 9.5	—15.0	Coarse sand with a little gravel
	—15.0	—20.9	Hard yellow clay
	—20.9	—29.0	Stiff blue clay
	—29.0	—45.0	Soft blue clay
	—45.0	—49.2	Sand, gravel, clay (hard)
1341	— 2.8	— 7.0	Soft black silt
I1	— 7.0	—15.0	Silty sand with a little gravel
	—15.0	—19.0	Sharp blue sand with a little gravel
	—19.0	—22.1	Hard yellow clay
	—22.1	—41.5	Stiff blue clay
	—41.5	—48.2	Sand, gravel, a little clay (hard)
1342	— 8.8	—11.8	Soft black silt
I1	—11.8	—15.8	Fine silty sand with a little gravel
	—15.8	—19.9	Fine blue sand
	—19.9	—21.5	Sand and gravel
	—21.5	—26.0	Stiff blue clay
	—26.0	—39.4	Soft blue clay
	—39.4	—47.6	Clay, sand, gravel (hard)
1343	— 9.4	—12.0	Soft black silt
I2	—12.0	—24.4	Coarse silty sand, peat
	—24.4	—28.3	Fine blue sand
	—28.3	—32.5	Hard yellow clay
	—32.5	—45.6	Stiff blue clay
	—45.6	—53.4	Clay, gravel, sand (very hard)
1344	—13.0	—14.8	Soft black silt
I2	—14.8	—25.2	Coarse silty sand, brown peat
	—25.2	—30.4	Sand, gravel (hard)
	—30.4	—42.7	Stiff blue clay
	—42.7	—52.6	Soft blue clay
	—52.6	—59.0	Sand, gravel, clay (hard)
1345	—12.3	—15.3	Soft black silt
J2	—15.3	—20.9	Fine silty sand, very soft
	—20.9	—33.1	Sand, gravel (hard)
	—33.1	—42.3	Stiff clay
	—42.3	—51.2	Soft clay
	—51:2	—56.3	Sand, gravel, clay (hard)
1346	—13.0	—19.2	Soft black silt
J2	—19.2	—25.0	Fine silty sand, soft
	—25.0	—33.0	Gravel, sand (hard)
	—33.0	—38.6	Hard clay
	—38.6	—47.8	Soft clay
	—47.8	—53.8	Sand, gravel, clay (hard)
1347	—16.4	—21.7	Soft black silt
J2	—21.7	—26.5	Fine silty sand
	—26.5	—31.4	Sand, gravel (hard)
	—31.4	—36.7	Stiff clay
	—36.7	—38.0	Sand, gravel, clay (stiff)
	—38.0	—54.4	Clayey, sand, gravel (hard)
1348	—16.0	—22.7	Soft black silt
J2	—22.7	—27.1	Fine silty sand
	—27.1	—45.3	Sand, gravel (hard)
	—45.3	—52.9	Sand, gravel, clay (very hard)
1349	— 6.1	—19.5	Soft black silt
J2	—19.5	—23.4	Fine silty sand
	—23.4	—32.2	Sand, gravel (hard)
	—32.2	—39.4	Hard clay
	—39.4	—45.8	Stiff clay, sand, some gravel
	—45.8	—53.4	Clayey sand, gravel (hard)
1350	—16.5	—17.9	Soft back silt
J2	—17.9	—24.8	Fine silty sand
	—24.8	—25.8	Black sand, gravel
	—25.8	—32.5	Sharp blue sand, some gravel
	—32.5	—34.7	Sand, gravel
	—34.7	—44.5	Hard clay
	—44.5	—61.8	Soft clay
	—61.8	—63.2	Clay, gravel (hard)
	—63.2	—68.5	Sand, gravel (very hard)
1351	—12.7	—15.0	Soft black silt
J2	—15.0	—18.0	Wood
	—18.0	—20.4	Soft black silt
	—20.4	—28.4	Fine silty sand
	—28.4	—30.4	Sand, gravel (clayey)
	—30.4	—39.7	Stiff clay
	—39.7	—61.3	Soft clay
	—61.3	—69.7	Sand, gravel, clay (hard)
1352	—16.5	—18.5	Soft black silt
J2	—18.5	—33.2	Fine silty sand
	—33.2	—36.2	Sand, gravel
	—36.2	—54.5	Soft clay
	—54.5	—56.2	Stiff gravel clay
	—56.2	—62.8	Clayey sand, gravel (very hard)
1353	— 6.0	— 9.0	Soft black silt
J2	— 9.0	—30.5	Fine silty sand
	—30.5	—32.0	Sand, gravel (clayey)
	—32.0	—46.0	Stiff clay
	—46.0	—48.0	Sand, gravel, stiff clay
	—48.0	—58.0	Clayey sand, gravel (hard)
1354	+ 1.4	— 7	Soft black silt, gravel
J2	— 7	—26	Silt, shells
	—26	—32	Fine sand, little gravel
	—32	—35	Coarse sand, gravel
	—35	—49	Stiff blue clay
	—49	—54 and below	Clay, sand, gravel
1355	— 3.0	—18.4	Soft black silt
J2	—18.4	—27.0	Fine silty sand
	—27.0	—34.0	Sand, gravel
	—34.0	—41.7	Stiff blue clay
	—41.7	—45.1	Clay, gravel
	—45.1	—46.8	Sand, gravel (hard)
	—46.8	—52.5	Sand, gravel, clay (hard)

No. and location	Elevations or depths From	To	Formation
1356 J2	— 9	—18	Soft black silt, sandy
	—18	—31	Fine silty sand
	—31	—33	Sand, gravel
	—33	—37	Stiff clay
	—37	—42	Stiff clay, some sand and gravel
	—42	—44	Sharp blue sand, gravel
	—44	—45	Sand, gravel, clay (hard)
	—45	—54	Sand, gravel (very hard)
1357 J2	—13.9	—21.2	Soft black silt
	—21.2	—34.9	Fine silty sand
	—34.9	—36.4	Sand, gravel
	—36.4	—47.2	Stiff clay
	—47.2	—48.9	Stiff clay, some gravel
	—48.9	—60.0	Clayey sand, gravel (very hard)
1358 J2	—16.5	—23.8	Soft black silt
	—23.8	—26.7	Fine silty sand
	—26.7	—29.8	Sand, gravel
	—29.8	—34.8	Hard clay
	—34.8	—40.5	Stiff clay
	—40.5	—57.5	Soft clay
	—57.5	—59.7	Stiff clay, sand, gravel
	—59.7	—64.5	Sand, gravel (very hard)
1359 J2	—10.7	—16.3	Soft black silt
	—16.3	—26.3	Fine silty sand, very soft
	—26.3	—29.6	Sand, gravel (hard)
	—29.6	—35.6	Hard clay
	—35.6	—42.8	Stiff clay
	—42.8	—55.0	Soft clay
	—55.0	—57.7	Sand, gravel, clay (stiff)
	—57.7	—61.8	Sand, gravel, clay (hard)
1360 J2	— 5.9	—15.8	Soft black silt
	—15.8	—25.0	Fine silty sand
	—25.0	—32.4	Sand, gravel (hard)
	—32.4	—35.0	Sandy clay, hard
	—35.0	—44.0	Stiff clay
	—44.0	—51.8	Sand, gravel, clay (hard)
1361 J2	—13.6	—19.8	Soft black silt
	—19.8	—25.7	Fine silty sand
	—25.7	—30.7	Sand, gravel (hard)
	—30.7	—32.3	Hard blue clay, some gravel
	—32.3	—45.8	Clayey sand, gravel (very hard)
1362 J2	—11.7	—21.4	Soft black silt
	—21.4	—27.5	Fine silty sand
	—27.5	—28.9	Clayey sand, gravel
	—28.9	—36.4	Hard clay
	—36.4	—40.8	Stiff clay
	—40.8	—45.5	Clayey sand, gravel (hard)
1363 J2	—10.3	—19.3	Soft black silt
	—19.3	—24.9	Fine silty sand, soft
	—24.9	—29.9	Sand, gravel (hard)
	—29.9	—35.5	Hard clay
	—35.5	—44.5	Stiff clay
	—44.5	—49.7	Soft clay
	—49.7	—54.7	Sand, gravel, clay (hard)
1364 I2	—10.6	—17.4	Soft black silt
	—17.4	—23.0	Fine silty sand, soft
	—23.0	—27.6	Sand, gravel (hard)
	—27.6	—34.8	Hard clay
	—34.8	—39.6	Stiff clay
	—39.6	—46.2	Soft clay
	—46.2	—51.8	Sand, gravel, clay (hard)
1365 I2	—12.6	—16.1	Soft black silt
	—16.1	—24.8	Brown silty peat
	—24.8	—30.2	Sand, gravel (hard)
	—30.2	—50.4	Stiff blue clay
	—50.4	—56.6	Sand, gravel, clay (stiff)
1366 I2	— 9.6	—12.6	Soft black silt
	—12.6	—18.8	Fine silty sand
	—18.8	—23.1	Soft silty peat
	—23.1	—25.9	Fine sand, a little gravel
	—25.9	—35.0	Stiff blue clay
	—35.0	—38.7	Soft clay
	—38.7	—47.6	Sand, gravel, clay (hard)
1367 I1	— 8.2	—12.0	Soft black silt
	—12.0	—16.9	Silty sand with a little gravel
	—16.9	—22.8	Coarse blue sand, a little gravel
	—22.8	—27.5	Stiff blue clay
	—27.5	—41.2	Soft blue clay
	—41.2	—47.9	Sand, gravel, clay (hard)
1368 I1	— 1.7	— 6.9	Soft black silt
	— 6.9	—10.2	Silty sand, a little gravel
	—10.2	—18.3	Coarse sand, a little gravel
	—18.3	—22.9	Hard yellow clay
	—22.9	—35.1	Stiff blue clay
	—35.1	—41.9	Soft clay
	—41.9	—46.4	Sand, gravel, clay (hard)
			Stone, probably a boulder
1369 I1	— 1.0	— 4.9	Soft black silt
	— 4.9	— 6.9	Fine silty sand
	— 6.9	—13.2	Coarse sand, a little gravel
	—13.2	—18.6	Fine blue sand, a very little gravel
	—18.6	—25.1	Hard yellow clay
	—25.1	—33.1	Stiff blue clay
	—33.1	—47.8	Soft clay
	—47.8	—52.5	Sand, gravel, clay (hard)

No. and location	Elevations or depths From	To	Formation
1370	— 1.1	— 7.6	Soft black silt
I1	— 7.6	—17.4	Gravel, coarse sand
	—17.4	—30.4	Stiff blue clay
	—30.4	—48.8	Soft clay
	—48.8	—56.8	Sand, gravel, clay (hard)
1371	— 1.1	— 6.1	Soft black silt
I1	— 6.1	—17.8	Gravel, coarse sand
	—17.8	—50.0	Stiff clay
	—50.0	—57.0	Sand, gravel, clay
1372	— 1.6	— 5.7	Soft black silt
I1	— 5.7	—18.1	Coarse sand, a little gravel
	—18.1	—48.0	Stiff clay
	—48.0	—54.4	Sand, gravel, clay (hard)
1373	— 0.4	— 3.2	Soft black silt
I1	— 3.2	—17.9	Coarse sand, some gravel
	—17.9	—21.6	Hard yellow clay
	—21.6	—48.8	Stiff blue clay
	—48.8	—50.6	Fine blue sand
	—50.6	—56.6	Coarse sand, gravel, some clay (hard)
1374	— 0.7	— 3.1	Soft black silt
I1	— 3.1	—16.1	Coarse sand, some gravel
	—16.1	—32.6	Stiff blue clay
	—32.6	—57.0	Soft blue sandy clay
	—57.0	—61.9	Clayey sand, gravel (hard)
1375	1.0	— 2.4	Soft black silt
I1	— 2.4	— 4.9	Silty sand, gravel
	— 4.9	—15.9	Sand, gravel
	—15.9	—18.1	Stiff blue sandy clay
	—18.1	—55.3	Soft blue clay
	—55.3	—59.4	Sand, gravel, clay (hard)
1376	+15	+ 2	Sand and gravel fill
B8	+ 2	— 5	Stiff brown peat
	— 5	—15	Peat, silt, shells
1377	+16	+11	Road bed
B8	+11	+ 2	Brown peat
	+ 2	— 4	Soft silt
	— 4	— 9	Stiff brown clay
1378	+16	+11	Road bed
B8	+11	+ 5	Brown peat
	+ 5	— 4	Stiff brown clay
1379	— 0.5	— 7	Silt
H2	— 7	—10.5	Sand, gravel
	—10.5	—13.5	Clay
1380	— 8	— 9	Mud
H2	— 9	—15	Sand, gravel
	—15	—47	Clay
1381	—17	—19	Mud
H2	—19	—23	Sand, gravel
	—23	—43	Clay
1382	— 8	—13	Mud
I2	—13	—25	Sand, gravel
	—25	—37	Clay
1383	—15	—17	Mud
I2	—17	—22	Sand, gravel
	—22	—42	Clay
1384	—10	—19	Mud
J1	—19	—28	Silt
	—28	—33	Sand, gravel
	—33	—36	Clay
1385	—13.0	—18.5	Mud
K1	—18.5	—27.5	Silt
	—27.5	—34.0	Sand, gravel
	—34.0	—36.5	Clay
1386	Surface	4.3	Sand and gravel fill
F9	4.3	14.2	Mud and ash fill
	14.2	23.0	Silt, fine sand
	23.0	25.5	Medium blue clay,
	25.5	28.0	Hard yellow clay
1387	+13.5	+ 6.5	Fill
C8	+ 6.5	+ 3.5	Fine sand, gravel
	+ 3.5	+ 1.5	Peat
	+ 1.5	— 3.5	Yellow clay
1388	— 3.3	— 6.5	Mud
I3	— 6.5	—16.0	Sandy mud
	—16.0	—28.0	Sandy clay
	—28.0	—32.4	Gravel
	—32.4	—48.0	Clay
1389	— 3.6	— 8.8	Mud
J3	— 8.8	—29.0	Sandy mud
	—29.0	—31.0	Gravel
	—31.0		Clay
1390	— 2.4	— 6.5	Mud
J3	— 6.5	—29.5	Sandy mud
	—29.5	—31.9	Gravel
	—31.9	—35.8	Clay
	—35.8	—36.8	Gravel
	—36.8	—40.5	Clay
1391	— 1.3	— 6.8	Mud
J2	— 6.8	—28.8	Sandy mud
	—28.8	—30.2	Gravel
	—30.2	—34.7	Clay
1392	— 1.5	— 7.0	Mud
J2	— 7.0	—28.7	Sandy mud
	—28.7	—31.6	Gravel
	—31.6		Clay
1393	— 1.9	— 6.2	Mud
K2	— 6.2	—28.4	Sandy mud
	—28.4	—32.9	Gravel
	—32.9	—50.9	Clay
1394	— 1.3	— 4.5	Mud
K2	— 4.5	—30.5	Sandy mud
	—30.5	—35.3	Gravel
	—35.3	—39.5	Clay
1395	— 1.6	—10.6	Mud
K2	—10.6	—27.1	Sandy clay
	—27.1	—32.8	Gravel
	—32.8	—39.0	Clay
1396	— 1.0	—10.0	Mud
K2	—10.0	—28.6	Sand, clay
	—28.6	—32.6	Gravel
	—32.6	—46.5	Clay

No. and location	Elevations or depths From	To	Formation
1397	— 0.7	—14.2	Mud
K2	—14.2	—28.1	Sandy mud
	—28.1	—31.1	Gravel
1398	— 1.4	—14.2	Mud
K2	—14.2	—28.3	Sandy clay
	—28.3	—29.0	Not given
	—29.0	—34.5	Gravel
1399	— 1.2	—16.8	Mud
K2	—16.8	—17.2	Not given
	—17.2	—30.7	Sandy clay
	—30.7	—33.7	Gravel
	—33.7	—36.9	Sand
	—36.9	—52.7	Clay
1400	— 3	—14	Mud
L1	—14	—17	Sand
	—17	—23	Mud, hard sand at —23
1401	0	—23	Mud with thin beds of sand interstratified
L1			
1402	—14	—15	Gravel
L1	—15	—20	Loose sand, mud
	—20	—24	Hard sand, mud (clay)
	—24	—25	Gravel
1403	0	—25	Water
L1	—25	—30	Loose sand, mud
	—30	—33	Fine gravel
	—33		Loose sand
1404	0	—27	Water
L1	—27	—32	Loose gravel
	—32	—35	Sand
	—35	—41	Fine sand or clay. Quicksand at —41
1405	0	—28	Water
L1	—28	—33	Loose gravel, sand
	—33	—43	Hard sand with exception of hardpan at —37
1406	0	—28	Water
L1	—28	—29	Loose gravel
	—29	—30	Hardpan
	—30	—31	Hard gravel then hardpan of gravel
1407	0	—29	Water
L2	—29	—33	Loose sand
	—33	—41	Hard fine sand
1408	0	—27	Water
M2	—27	—31	Loose sand, gravel
	—31	—33	Hard sand, some hardpan at —31
	—33	—35	Sand or hardpan
1409	0	—23	Water
M2	—23	—28	Loose sand, gravel
	—28	—32	Sand
1410	0	—19	Water
M2	—19	—25	Loose gravel
	—25	—31	Hardpan then gravel
	—31	—34	Clay with layers of sand and gravel
	—34		Rock

No. and location	Elevations or depths From	To	Formation
1411	— 3.3	—10.6	Mud
K2	—10.6	—11.9	Not given
	—11.9	—21.2	Sandy mud
	—21.2	—30.6	Sandy clay
	—30.6	—32.1	Not given
	—32.1	—34.3	Sand
	—34.3	—39.0	Sandy clay
	—39.0	—42.5	Sand
	—42.5	—52.5	Coarse sand
	—52.5	—55.6	Sand
	—55.6	—56.6	Quicksand
	—56.6	—63.0	Clay
1412	— 4.3	—11.8	Mud
K2	—11.8	—12.5	Gravel
	—12.5	—22.7	Soft sandy mud
	—22.7	—23.8	Gravel
	—23.8	—33.8	Sandy clay
	—33.8	—37.5	Sandy clay
	—37.5	—39.5	Clay, gravel
	—39.5	—47.1	Sandy clay
	—47.1	—51.6	Clay
1413	+ 1.8	— 7.0	Mud
K2	— 7.0	— 8.4	Gravel
	— 8.4	—17.0	Sandy mud
	—17.0	—26.9	Soft mud
	—26.9	—28.4	Clay
			Bedrock
1414	— 0.5	— 2.4	Mud
K2			Ledge below
1415	— 1.0	— 4.1	Mud
K2			Ledge below
1416	— 0.9	— 4.5	Mud
L2			Ledge below
1417	— 1.2	— 5.4	Mud
L2			
1418	— 0.6	— 5.7	Mud
L2	— 5.7		Ledge—bedrock
1419	— 1.5	— 5.9	Mud
L2	— 5.9	— 7.1	Gravel
			Ledge
1420	— 2.0	— 7.6	Mud
L2	— 7.6	—10.3	Gravel
	—10.3	—12.5	Sand
			Ledge
1421	— 0.5	— 7.8	Mud
L2	— 7.8	— 9.0	Not given
	— 9.0	—12.6	Gravel
	—12.6	—16.5	Clay
			Ledge
1422	— 1.3	—11.0	Mud
L2	—11.0	—12.7	Soft clay
	—12.7	—24.1	Clay
	—24.1	—25.2	Gravel
1423	— 1.5	— 7.5	Mud
L2	— 7.5	—16.0	Soft clay
	—16.0	—27.0	Clay
	—27.0	—40.0	Quicksand
	—40.0	—44.0	Clay

No and location	Elevations or depths From	To	Formation
1424 L2	— 3.8	— 7.8	Mud
	— 7.8	—16.2	Soft clay
	—16.2	—24.0	Clay
	—24.0	—26.0	Sand
	—26.0	—28.4	Clay
	—28.4	—31.9	Gravel
1425 L2	+ 4.1	— 9.5	Mud
	— 9.5	—18.4	Sandy clay
	—18.4	—26.5	Gravel and clay
	—26.5	—29.0	Gravel
1426 N4	+14	+ 2	Fill; sand, gravel, ash
	+ 2	— 4	Black silt, sand, gravel
	— 4	— 7	Fine sand, black silt
	— 7	—24	Fine sand
	—24	—26	Silt, sand, gravel, shells
	—26	—27	Sand, gravel, clay
	—27	—36	Stiff blue clay
	—36	—37	Sand, gravel, clay, stiff; till
1427 N4	+ 2	—20	Black silt
	—20	—26	Sandy silt
	—26	—34	Fine sand, shells
	—34	—38	Clay, sand, gravel
	—38	—44	Clay, sand, gravel (hard till)
1428 N3	—26	—32	Soft black silt, sand, gravel
	—32	—38	Sand, gravel, clay, silt, shells
	—38	—53	Stiff clay
	—53	—58	Hard clay, sand, gravel (till)
1429 L2	+17	+ 9	Sand, gravel
	+ 9	+ 4	Clay
	+ 4		Rock
1430 L2	+17	+ 8	Sand, gravel
			Rock
1431 L2	+16	+ 8	Sand and gravel fill
	+ 8	+ 0	Mud
	+ 0	— 1	Sand, gravel, clay (till)
	— 1		Rock
1432 L2	+15	+ 6	Gravel
	+ 6	— 1	Mud
	— 1	— 4	Clay
	— 4		Rock
1433 I9	+19.5	— 1	Fill
	— 1	—12	Silty sand, shells
	—12	—26	Fine yellow sand
	—26	—36	Stiff blue clay
	—36	—113	Soft blue clay
			Struck rock
1434 I9	+19.5	+ 4	Sand and gravel fill
	+ 4	+ 0	Soft black silt
	+ 0	— 5	Fine silty sand, shells
	— 5	—18	Fine blue sand
	—18	—28	Stiff blue clay, little sand
	—28	—102	Soft blue clay
	—102	—103	Clay, gravel, sand
			Struck rock
1435 I9	+19.6	+ 0	Gravel and sand fill
	+ 0	— 7.0	Silty sand, shells
	— 7.0	—19.8	Fine yellow sand
	—19.8	—25.0	Stiff blue clay
	—25.0	—108.5	Soft blue clay
	—108.5	—113.9	Clay, gravel, sand (hard)
1436 I9	+17.4	— 1.13	Fill; gravel, sand, wood
	— 1.3	— 9.0	Silty peat
	— 9.0	—21.0	Fine blue sand
	—21.0	—27.9	Fine blue sand, clay
	—27.9	—107.3	Soft blue clay
	—107.3	—112.0	Clay, gravel, sand (hard)
1437 I9	+16.6	— 4.0	Fill; gravel, sand, bricks, wood
	— 4.0	— 5.4	Silty sand, gravel, shells
	— 5.4	—15.5	Silt; shells
	—15.5	—24.0	Hard yellow clay, sand
	—24.0	—34.0	Stiff blue clay
	—34.0	—98.8	Soft blue clay
	—98.8	—100.7	Clay, gravel, sand (hard)
			Struck rock
1438 I9	— 8.7	—12.5	Soft black silt
	—12.5	—28.3	Silt, shells
	—28.3	—103.8	Soft blue clay
			Struck rock
1439 H9	—11.0	—18.5	Silt, shells
	—18.5	—24.5	Hard yellow clay
	—24.5	—29.5	Stiff blue clay
	—29.5	—104.6	Soft blue clay
	—104.6	—105.7	Clay, gravel, sand (hard)
			Struck rock
1440 I9	—12.9	—23.0	Silt, shells
	—23.0	—26.0	Hard blue clay
	—26.0	—32.0	Stiff blue clay
	—32.0	—118.0	Soft blue clay
	—118.0	—119.1	Clay, gravel, sand
1441 I9	— 5.6	—18.9	Silt, shells
	—18.9	—23.6	Hard yellow clay
	—23.6	—28.9	Stiff blue clay
	—28.9	—109.3	Soft blue clay
	—109.3	—114.9	Clay, gravel, sand
1442 H9	+16.4	+ 7.9	Wharf, timber, water
	+ 7.9	—20.1	Silt, shells
	—20.1	—25.1	Hard blue clay
	—25.1	—31.0	Stiff blue clay
	—31.0	—98.9	Soft blue clay
	—98.9	—103.7	Clay, gravel, sand (hard)
1443 H10	+16.1	+10.5	Fill; sand, gravel
	+10.5	— 1.8	Black silt, gravel, cinders, sand
	— 1.8	—20.2	Silt, shells
	—20.2	—25.2	Hard blue clay
	—25.2	—32.2	Stiff blue clay
	—32.2	—93.4	Soft blue clay
	—93.4	—98.4	Clay, gravel, sand (hard)

No and location	Elevations or depths From	To	Formation
1444	+29	+27	Fill
N6	+27	+10	Stiff clay
1445	+18	+16	Clay
O5	+16	+10	Clay, sand
	+10	− 1	Stiff clay
	− 1	−37	Stiff clay, gravel
1446	−22	−23	Mud
P6	−23	−60	Clay, gravel
1447	−22	−28	Mud
P6	−28	−34	Sand, clay
	−34	−72	Sand, clay, gravel
1448	−22	−27	Mud
P6	−27	−54	Clay, coarse gravel
	−54	−85	Hard clay, sand, loamy gravel
	−85	−90	Rock or boulder
1449	−35	−46	Clay, gravel
P6	−46	−57	Sand, clay
	−57	−85	Clay, gravel
	−85	−94	Clay, sand
	−94	−98	Fine sand, gravel
1450	−36	−62	Medium clay, gravel
P6	−62	−73	Clay, gravel
	−73	−81	Sand
	−81	−91	Medium clay
	−91	−100	Hard clay, sand, gravel
1451	−34	−40	Mud
P6	−40	−54	Medium clay
	−54	−58	Fine sand
	−58	−66	Clay, coarse gravel
	−66	−70	Fine sand
	−70	−102	Clay, sand, gravel
1452	+21	+10	Fill
N6	+10	+ 1	Hard clay, sand, gravel
	+ 1	−18	Stiff clay, sand, gravel Struck boulder of rock
1453	+18	+ 7	Fill
N6	+ 7	− 5	Mud, sand, stones
	− 5	−39	Clay, sand, stones
1454	+15	−17	Fill; sand, silt
O6	−17	−51	Soft clay
	−51	−60	Clay, sand, stones
1455	+13	+ 3	Fill
O6	+ 3	−15	Sand, silt
	−15	−49	Stiff clay
	−49	− 59	Clay, sand, stones
1456	−21	−26	Mud
O6	−26	−39	Medium clay
	−39	−64	Soft clay
	−64	−78	Medium clay, coarse gravel
	−78	−90	Stiff clay, gravel
	−90	−95	Slate, clay Shale rock

No. and location	Elevations or depths From	To	Formation
1457	−27	−34	Mud
P6	−34	−58	Medium clay
	−58	−95	Clay, gravel
	−95	−102	Shale rock
1458	−41	−43	Mud
P7	−43	−79	Stiff blue clay
	−79	−86	Sand
	−86	−98	Sand, gravel, clay
1459	−38	−42	Mud
P6	−42	−90	Stiff blue clay
1460	−38	−43	Mud
P6	−43	−90	Stiff blue clay
1461	−42	−46	Mud
P6	−46	−85	Stiff blue clay
	−85	−93	Stiff clay, some gravel
1462	−41	−45	Mud
P6	−45	−92	Stiff blue clay
1463	+33	+25	Fill
N6	+25	+ 6	Hard yellow clay, sand, gravel, stones
	+ 6	−30	Hard blue clay, sand, gravel, stones
1464	+20	+ 4	Fill
O6	+ 4	− 1	Hard yellow clay, some sand
	− 1	−10	Medium blue clay
	−10	−54	Hard blue clay, sand, gravel, stones
1465	+17	+ 5	Fill
O6	+ 5	− 2	Hard yellow clay, sand, gravel
	− 2	−14	Medium blue clay
	−14	−48	Hard blue clay, sand, gravel, stones
	−48	−59	Bed rock
1466	+17	+ 4	Fill
O6	+ 4	+ 1	Silt, sand, gravel
	+ 1	−13	Hard yellow clay, some sand
	−13	−19	Medium hard yellow clay, some sand
	−19	−30	Soft blue clay
	−30	−62	Hard blue clay, sand, gravel, stones Rock obstruction
1467	+18	+ 8	Fill
O6	+ 8	− 3	Fine silty sand, mud
	− 3	−16	Hard yellow clay, gravel
	−16	−21	Medium blue clay
	−21	−41	Soft blue clay
	−41	−58	Hard blue clay, gravel
	−58	−68	Bed rock
1468	+18	+ 2	Fill
O6	+ 2	− 5	Loose fine sand
	− 5	−17	Hard yellow clay, sand, gravel
	−17	−38	Soft blue clay
	−38	−74	Hard blue clay, sand, gravel, stones Rock obstruction

No. and location	Elevations or depths From	To	Formation
1469	−18	−21	Silty sand, mud
P6	−21	−26	Hard yellow clay
	−26	−45	Medium blue clay
	−45	−96	Hard blue clay, sand, gravel
1470	Cellar		
B7	bottom	62	Clay
	62	105	Clay
	105	131	Fine gray sand
1471	− 5	−12	Soft black silty sand
L1	−12	−17	Sharp blue sand
	−17	−57	Stiff blue clay
	−57	−61	Clay, sand, gravel (hard)
			Rock
1472	− 9	−14	Soft black silt
L1	−14	−20	Silty sand
	−20	−25	Silty peat
	−25	−28	Silty sand
	−28	−50	Stiff blue clay
	−50	−62	Soft blue clay
	−62	−69	Clay, gravel, sand (hard)
1473	−27	−30	Soft black silt
L1	−30	−36	Coarse silty sand, little gravel
	−36	−60	Stiff blue clay
	−60	−67	Fine blue sand, very soft
	−67	−84	Soft blue clay
	−84	−89	Clay, gravel, sand (hard)
1474	−27	−31	Soft black silt
L1	−31	−33	Coarse gravel, sand, stones
	−33	−52	Stiff blue clay
	−52	−86	Soft blue clay
	−86	−92	Clay, gravel, sand (hard)
1475	−25	−28	Soft black silt
L2	−28	−34	Coarse gravel, sand, stones
	−34	−51	Stiff blue clay
	−51	−69	Soft blue clay
	−69	−76	Clay, gravel, sand
1476	−21	−25	Soft black silt
L2	−25	−29	Coarse gravel, sand, stones
	−29	−41	Stiff blue clay
	−41	−61	Soft blue clay
	−61	−64	Clay, gravel, sand
1477	−17	−24	Soft black silt
L2	−24	−27	Coarse gravel, sand, stones
	−27	−44	Stiff blue clay
	−44	−55	Soft blue clay
	−55	−62	Clay, gravel, sand
1478	−25	−27	Soft black silt
L2	−27	−33	Coarse gravel, sand
	−33	−51	Stiff blue clay, sand
	−51	−67	Soft blue clay
	−67	−76	Clay, gravel, sand
1479	−16	−24	Soft black silt
L2	−24	−27	Coarse gravel, sand
	−27	−30	Hard yellow clay
	−30	−51	Stiff blue clay, sand
	−51	−54	Clay, gravel, sand
1480	− 5	−14	Soft black silt
L2	−14	−18	Silty sand
	−18	−21	Hard blue clay, little gravel, sand
	−21	−28	Hard yellow clay
	−28	−35	Stiff blue clay, sand
	−35	−39	Gravel, sand, little clay
	−39	−48	Clay, gravel, sand
1481	−16	−26	Soft black silt
L2	−26	−30	Hard coarse gravel, sand
	−30	−36	Stiff blue clay
	−36	−38	Clay, gravel, sand
			Hardpan—rock
1482	−15	−20	Soft black silt
L2	−20	−26	Hard coarse gravel, sand
	−26	−28	Hard yellow clay
	−28	−34	Clay, gravel, sand
			Hardpan—rock
1483	− 8	−16	Soft black silt
L2	−16	−18	Fine sand, gravel
	−18	−24	Stiff blue clay
	−24	−28	Clay, gravel, sand (hard)
1484	−18	−30	Soft black silt
L2	−30	−36	Coarse, gravel, sand, little clay (very hard)
	−36	−42	Coarse blue sand
	−42	−46	Fine blue sand
	−46	−49	Coarse gravel, sand
	−49	−52	Fine sand, gravel, little clay
1485	−14	−17	Soft black silty sand
L2	−17	−23	Fine silty sand
	−23	−27	Coarse gravel, sand, little clay (very hard)
	−27	−31	Fine blue sand
	−31	−37	Coarse gravel, sand (hard)
1486	− 7	−14	Soft black silty sand
L2	−14	−18	Hard yellow clay
	−18	−30	Coarse gravel, sand, little clay (very hard)
	−36	−37	Clay, gravel, sand (hard)
1487	− 3	−10	Soft black silt
L2	−10	−20	Coarse gravel, hard sand
	−20	−29	Yellow sand, little gravel
	−29	−32	Coarse gravel, sand, little clay
	−32	−42	Very hard clay, little sand, gravel

No. and location	Elevations or depths From	To	Formation
1488 L1	+ 1	−14	Soft black silt
	−14	−17	Coarse sand, gravel
	−17	−24	Brown peat
	−24	−28	Coarse sand, gravel
	−28	−44	Stiff blue clay
	−44	−67	Soft blue clay, sand
	−67	−73	Clay, gravel, sand
1489 L1	−21	−23	Soft black silt
	−23	−28	Coarse sand, gravel
	−28	−47	Stiff blue clay
	−47	−81	Soft blue clay, sand
	−81	−84	Clay, gravel, sand
1490 L2	−26	−30	Soft black silt
	−30	−36	Coarse gravel, sand
	−36	−55	Stiff blue clay
	−55	−84	Soft blue clay, sand
	−84	−90	Clay, gravel, sand
1491 L2	−19	−28	Soft black silt
	−28	−30	Coarse gravel, sand
	−30	−44	Stiff blue clay
	−44	−55	Soft blue clay, sand
	−55	−64	Clay, gravel, sand
1492 M2	−17	−22	Soft black silt
	−22	−28	Coarse gravel, sand (hard)
	−28	−46	Stiff blue clay
	−46	−56	Clay, gravel, sand
1493 L2	+ 2	− 1	Soft black silt
	− 1	− 9	Fill
	− 9	−17	Fine silty sand
	−17	−23	Hard yellow clay
	−23	−26	Stiff blue clay
	−26	−38	Clay, gravel, sand (hard)
1494 G6	+ 5.7	− 1.8	Fill; ash, sand, gravel
	− 1.8	−27.6	Mud, medium stiff silt
	−27.6	−33.3	Medium blue clay
	−33.3	−75.3	Soft blue clay
	−75.3	−103.0	Compact clay, sand, gravel, rocks, boulders. Core drilling began at 75.3
	−103.0	−112.3	Soft blue clay
	−112.3	−118.3	Sand, rocks, boulders
	−118.3	−126.0	Bed rock
1495 G6	+10.0	− 3.0	Fill; sand, gravel
	− 3.0	−26.7	Silt (slightly compressed), mud
	−26.7	−110.7	Soft blue clay
	−110.7		Rock obstruction, probably boulder
1500 N9	27.9	28.8	Gravel
	28.8	37.2	Mud
1501 O7	22.3	35.2	Clay
1502 P6	24.4	37.4	Hard clay

No. and location	Elevations or depths From	To	Formation
150 G5	+20.0±	+ 4.5	Fill; firm sand, gravel, brick
	+ 4.5	− 3.0	Firm sand and gravel fill
	− 3.0	−11.5	Silty sand, shells
	−11.5	−21.0	Silt, shells
	−21.0	−28.0	Medium blue clay
	−28.0	−50.0	Soft blue clay
	−50.0	−53.5	Hard sand, gravel, clay
	−53.5	−113.5	Soft blue clay, strata of fine sand
	−113.5	−120.0	Hard fine compact sand, gravel
	−120.0	−132.0	Hard sand, gravel, clay, hardpan
	−132.0	−152.0	Bed rock slate (recovered 8 ft. of core)
1504 L2	+15.6	−10.6	Fill
	−10.6	−17.6	Mud
	−17.6	−20.6	Yellow and gray clay, broken stone
1505 L2	+15	0	Fill
	0	−12	Fine sand, dark gray clay, gravel
	−12	−15	Fine yellow clay
1506 L2	+15	+ 5	Fill
	+ 5	−14	Gray clay, little gravel
	−14	−28	Sand, gravel, little clay
	−28	−29	Soft dark gray shale
1507 L2	+21	+ 5	Fill
	+ 5	−10	No sample
1508 K2	+17	+ 3	Fill
	+ 3	−14	Clay, sand, gravel
	−14	−22	Hard gray brown clay
	−22	−23	Soft gray shale
1509 K2	+15	+ 8	Fill
	+ 8	+ 5	Soft brown and gray clay
	+ 5	− 7	Coarse gray sand, gravel
	− 7	−33	Gray clay
	−33	−34	Brown clay
1510 K2	+14	+ 9	Fill
	+ 9	−10	Clay
	−10	−35	Sand, gravel
	−35	−36	Stiff gray clay
1511 K2	+13	− 2	Fill
	− 2	−13	Gray clay, sand, gravel
	−13	−22	Fine gray sand, wet, sloppy
1512 J2	+12	+ 1	Sand
	+ 1	−39	Sandy clay
1513 J3	+11	− 4	Fill
	− 4	− 9	Large gravel, sand, little clay
	− 9	−14	Coarse quick sand
	−14	−24	Gray clay, sand, gravel

No. and location	Elevations or depths From	To	Formation
1514 I3	+14	+ 9	Loam, fine sand, gravel
	+ 9	− 5	Coarse sand, gravel, little clay
	− 5	−15	Black clay, coarse sand, gravel
1515 I3	+15	− 5	Fill
	− 5	−19	Sand, plastic clay
	−19	−21	Sand, clay, gravel, loose shale
1516 I3	+14.5	+ 4.5	Sand, gravel
	+ 4.5	− 5.0	Sand, clay
	− 5.0	−15.0	Clay, sand, shells, plastic
1517 H3	+11	+ 9	Loam
	+ 9	−90	Gray clay, sand
1518 H3	+11	− 6	Gray, brown sand
	− 6	−11	Black silt, little clay
	−11	−30	Clay, sand, wet
	−30	−33	Coarse sand, large gravel
	−33	−35	Gray clay, fine sand, plastic
1519 G3	+12.5	+ 7.0	Sand, small gravel (brown, loose)
	+ 7.0	+ 2.0	Gray clay, little sand
	+ 2.0	−13.0	Sand, clay, little gravel
	−13.0	−20.0	Fine gray sand, little plastic clay
1520 G2	+ 9	−16	Sand, gravel (loose)
	−16	−21	Medium gray clay, fine sand
	−21	−28	Coarse sand, gravel, clay
1521 F2	+ 4	− 1	Brown clay, stone brick
	− 1	−17	Sand, little clay, gravel
	−17	−24	Medium coarse gray, brown sand
	−24	−30	Sand, packed
	−30	−31	Soft gray clay
1522 F2	+ 9.5	+ 7.5	Sandy loam
	+ 7.5	−15.5	Fine sand, packed
	−15.5	−17.5	Stiff gray clay
	−17.5	−29.5	Hard packed brown sand
	−29.5	−34.5	Fine gray sand, clay
1523 E1	+10	+ 9	Soft sandy loam
	+ 9	− 6	Sand, gravel
	− 6	−15	Black clay, plastic
	−15	−19	Medium coarse gray sand
	−19	−24	Hard packed sand
1524 E1	+12	+11	Loam
	+11	− 3	Sand
	− 3	− 5	Sand, clay, shells
	− 5	−12	Sand, gravel
	−12	−17	Sand and clay
	−17	−23	Brown, hard packed sand

No. and location	Elevations or depths From	To	Formation
W-1 K7	20	−60	Clay
	−60	−253	Slate bedrock
W-2 H9	Surface	120	Overburden
	120	496	Bedrock
W-3 E5	18	−81	Stiff blue clay
	−81	−221	Slate bedrock
W-4 L6	20	−35±	Overburden
	−35±	−425	Bedrock, soft
W-5 I6	Surface	140±	Overburden
	140±	578	Bedrock
W-6 L5	Surface	75?	Overburden
	75?	480	Bedrock. Rock so soft did not know when it was entered
W-7 N6	Surface	108	Overburden
	108	300	Bedrock
W-8 F5	Surface	115	Clay
	115	496	Bedrock
W-9 K6	Surface	100	Clay and sand
	100	494	Bedrock
W-10 M6	0	−70	Stiff blue clay
	−70	−77	Boulder clay
	−77	−400	Slate bedrock
W-11 J6	Surface	100	Overburden
	100	509	Bedrock
W-12 L6	Surface	90	Clay, sand
	90	624	Bedrock
W-13 J6	30	−90	Clay
	−90	−570	Slate bedrock
W-15 M6	Surface	63	Overburden
	63	283	Bedrock
W-16 J7	Surface	75	Overburden
	75	600	Bedrock
W-17 M5	Surface	80	Overburden
	80	221	Bedrock
W-18 I7	Surface	120	Overburden
	120	426	Bedrock
W-19 M6	Surface	90±	Overburden
	90±	320	Bedrock
W-20 N4	15	−95	Overburden
	−95	−582	Bedrock
W-21 L9	Surface	155	Overburden
	155	497	Bedrock
W-22 M5	0	54	Drift
	54	79	Soft ledge
	79	221	Hard bedrock — slate
W-23 K3	20	−14	Gravel, etc. No clay
	−14	−280	Bedrock
W-24 L4	15	−20	Overburden
	−20	−198	Bedrock

NOTES

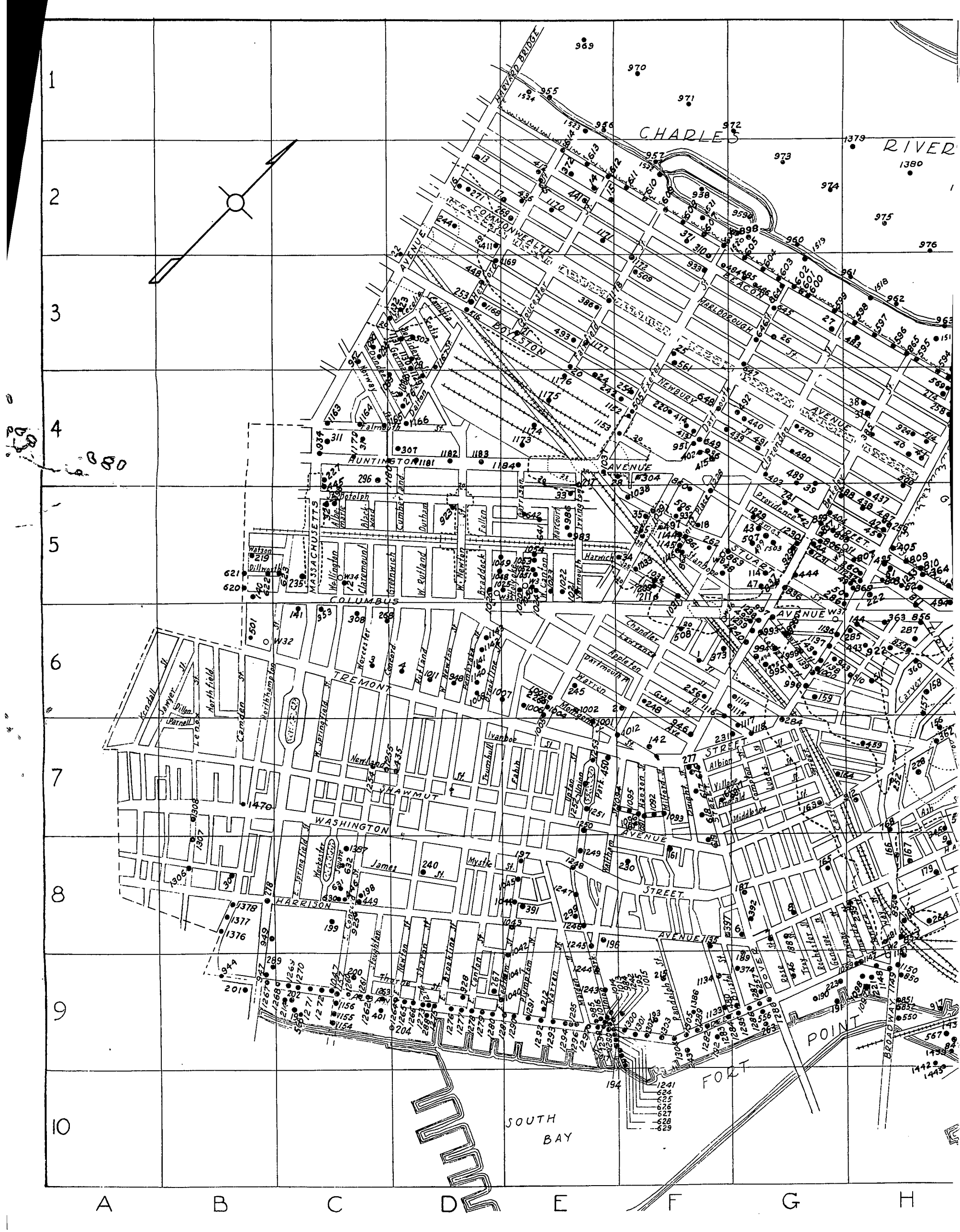
Numbers not preceded by letter refer to test borings and locations are indicated by symbol ●.
Numbers preceded by letter W refer to borings drilled into bedrock and locations are indicated by symbol o.
Numbers preceded by letter E refer to open-cut excavations.
Locations shown are approximate.
This map was originally prepared by The Emergency Planning & Research Bureau, Inc.

MAP NO. I
LOCATION OF SUBSOIL DATA
BOSTON PENINSULA
BOSTON SOCIETY OF CIVIL ENGINEERS
COMMITTEE ON SUBSOILS OF BOSTON

500 0 500 1000 1500 2000

CONTOUR INTERVAL 5 FT.
DATUM - BOSTON CITY BASE - 5.65 FT. BELOW MEAN SEA LEVEL
MAP SHOWS LOCATIONS OF DATA IN OCT. 1949 JOURNAL

I J K L M N O P


CHARLES
RIVER
HARVARD BRIDGE
COMMONWEALTH AVENUE
BOYLSTON STREET
BEACON STREET
MARLBOROUGH STREET
NEWBURY STREET
HUNTINGTON AVENUE
MASSACHUSETTS AVENUE
COLUMBUS AVENUE
TREMONT STREET
SHAWMUT AVENUE
WASHINGTON STREET
HARRISON AVENUE
DOVER STREET
ALBANY STREET
PARK SQUARE
PROVIDENCE STREET
STUART STREET
BERKELEY STREET
CLARENDON STREET
DARTMOUTH STREET
EXETER STREET
FAIRFIELD STREET
GLOUCESTER STREET
HEREFORD STREET
ARLINGTON STREET
BERKELEY STREET
CLARENDON STREET
DARTMOUTH STREET
EXETER STREET
FAIRFIELD STREET
GLOUCESTER STREET
HEREFORD STREET
ARLINGTON STREET
BROADWAY
POINT
FORT
SOUTH
BAY
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No and location	Elevations or depths From	To	Formation
W-25	20	−20	Overburden
L5	−20	−193	Bedrock
W-26	65	−28	Clay, gravel and boulders (till)
K6	−28	−61	Bedrock
W-27	30	−88	Clay, sand and gravel (probably till)
I6	−88	−100	Bedrock
W-28	10	−40	Overburden
N4	−40	−1740	Slate bedrock
W-29	17	−148	Sandy clay
H5	−148	−2486	Slate bedrock
W-30	0	83	Boulder clay
L5	83		Slate bedrock
W-32	+17.8	+12.8	Sand, clay
B6	+12.8	+ 7.8	Blue clay, peat
	+ 7.8	− 2.1	Fine sand
	− 2.1	−122.1	Clay
	−122.1	−127.1	Clay, sand, gravel
	−127.1	−141.0	Gravel, clay
	−141.0		Ledge
W-33	+33	+16	Coarse sand, gravel
L6	+16	+15	Sand
	+15	+10	Gravel, sand
	+10	+ 7	Coarse gravel, white clay
	+ 7	− 9	Stony sand, gravel, clay
	− 9	−27	Blue clay
	−27	−32	Fine sand
	−32	−44	Clay, sand and gravel (till)
	−44	−180	Hard dry nearly white shale
	−180	−195	Slate
W-34	+17.8	− 2.2	Sand
C5	− 2.2	− 7.2	Peat
	− 7.2	−47.2	Clay
	−47.2	−62.2	No sample
	−62.2	?	?
	?	−122.2	Clay
	−122.2	−127.0	Sand
	−127.0	−130.2	Black sand
	−130.2	−137.2	Firm sand
	−137.2	−141.0	Not given
	−141.0	−216.0	Ledge—gray shale
W-35	+17.8	+ 7.8	Medium sand
D5	+ 7.8	+ 2.8	Coarse sand
	+ 2.8	− 2.2	No sample
	− 2.2	− 7.2	Stiff clay
	− 7.2	−37.2	Silt
	−37.2	−42.2	No sample
	−42.2	−77.2	Silt
	−77.2	−87.2	Medium sand
	−87.2	−92.2	Fine sand
	−92.2	−92.8	Not given
	−92.8	−556.0	Ledge—blackish gray shale
W-36	+23.4	− 6.6	Medium sand
F6	− 6.6	−101.6	Fine sand
	−101.6	−104.0	Not given
	−104.0	−172.0	Ledge—black shale

No. and location	Elevations or depths From	To	Formation
W-37	+20.0	+18.2	Pavement
G6	+18.2	− 6.8	Medium sand
	− 6.8	−16.8	Silt
	−16.8	−21.8	Silt, gravel
	−21.8	−56.8	Silt
	−56.8	−86.8	Medium sand
	−86.8	−96.8	Silt
	−96.8	−103.1	Medium sand, gravel
	−103.1	−164.0	Ledge—black shale
W-38	+28.4	+23.4	Coarse sand
J6	+23.4	+19.4	Fine sand
	+19.4	+14.4	Gravel
	+14.4	+ 9.4	Medium sand
	+ 9.4	+ 4.4	Gravel
	+ 4.4	− 0.6	Medium sand
	− 0.6	−10.6	Gravel
	−10.6	−20.6	Medium sand
	−20.6	−25.6	Gravel
	−25.6	−30.6	Silt, gravel
	−30.6	−89.6	Silt
	−89.6	−572.0	White shale
W-39	+74.8	+69.8	Pavement
K5	+69.8	+59.8	Medium sand, gravel
	+59.8	+54.8	Medium sand
	+54.8	+29.8	Silt
	+29.8	+24.9	Medium sand
	+24.9	+19.9	Silt
	+19.9	− 0.1	Medium sand, gravel
	− 0.1	− 6.6	Silt, boulders
	− 6.6	−90.1	Fine sand
	−90.1	−91.8	Silt
	−91.8	−152.0	Ledge—gray shale
W-39A	+15.2	− 5.0	Cinders, old fill
L4	− 5.0	−10.0	Muck, clay
	−10.0	−25.0	Clay
	−25.0	−35.0	Clay, sandy silt
	−35.0	−51.0	Clay, shale
	−51.0	−82.1	Ledge—dark gray shale
W-40	+15.3	+13.3	Paving
N3	+13.3	+12.8	Timber
	+12.8	− 2.2	Space
	− 2.2	− 4.7	No sample
	− 4.7	−44.7	Silt
	−44.7	−53.7	Coarse sand, rotten rock at 49.7
	−53.7	−92.0	Ledge—dark gray shale
W-41	+14.8	+ 9.8	Medium sand, gravel
N3	+ 9.8	−10.1	Fine sand, gravel
	−10.1	−15.1	Medium sand, gravel
	−15.1	−50.6	Silt
	−50.6	− 4	Ledge
W-42	Surface	68	Overburden
M4	68	400	Bedrock—slate
E-1	+17	− 1	Fill
M3	− 1	− 3	Silt
	− 3	− 4	Clay
	− 4		Bedrock
E-14 L3		At 20	Bedrock
E-15 L3		At 20	Bedrock
E-16 L3		At 20	Bedrock
E-17 L3		At 20	Bedrock
E-18 L3		At 20	Bedrock

THE LIMESTONE AIR FORCE BASE

(Presented at a meeting of the Boston Society of Civil Engineers, held on May 11, 1949.)

PART I—DESIGN AND CONSTRUCTION OF RUNWAYS, TAXIWAYS AND PARKING APRON

By John E. Allen, Member*

The Limestone Air Base (Fig. 1), now under construction in northern Maine, is of interest for its size and because it represents the latest ideas of the Armed Forces in airport design. The field is being built on 9,000 acres of a rolling plateau which prior to the start of construction was covered with scrub woodland interspersed with a few hundred acres of potato fields. The preliminary studies and surveys were carried out in January 1947 when the temperature dropped to 30 degrees below zero and the snow cover averaged three feet in depth.

In the overall plan of development, provision is made for two parallel North-South runways, 1,000 feet on center and 15,000 feet long, and for an East-West runway 12,000 feet long. The initial unit of runway pavement completed to date is 10,000 feet long and 300 feet wide with graded shoulders 100 feet wide on either side and safety strips 1,000 feet in length at each end. The runway has a crown of 1.5 per cent or 27 inches normal to the center line. A taxiway with a 100-foot wide paved surface parallels the runway and connects the ends with the plane parking area and the hangar. The parking area has a width of 400 feet and a length of 2,000 feet and is designed to be widened to 700 feet and lengthened depending on future requirements. The approach glide angles are flatter than 1 on 50. Longitudinally, the runway is level for 5,200 feet and the maximum grade is one-tenth of one per cent.

The pavement is the flexible type and will ultimately consist of 6 inches of hot asphalt concrete, although only 3 inches have been placed to date on the paved areas. Until some more rational method is found for the design of flexible type pavements, the Corps of Engineers has adopted the procedure originally developed by the

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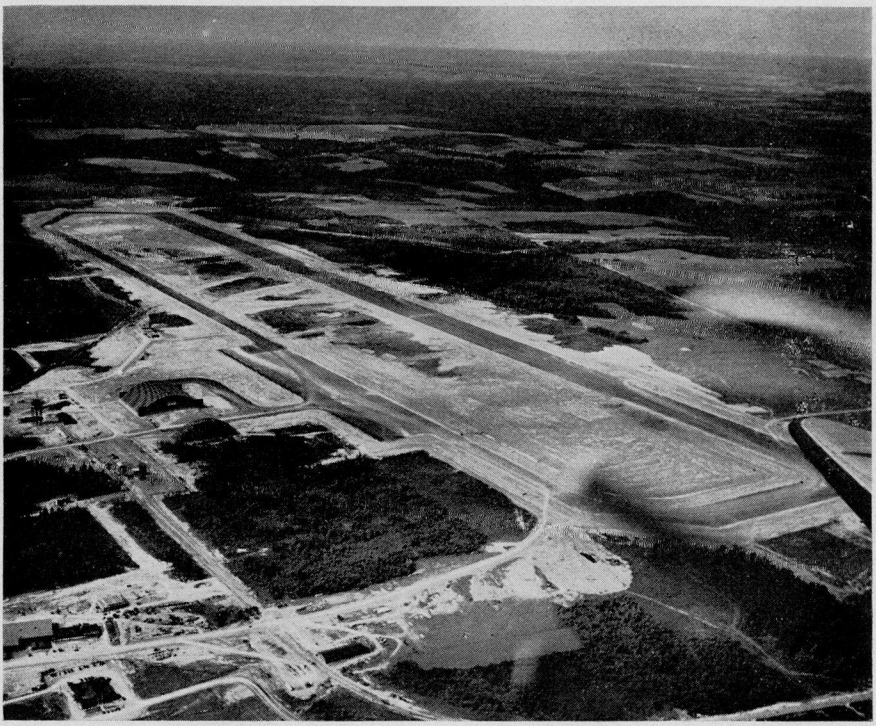

FIG. 1.—AERIAL VIEW OF AIR BASE.

State Highway Department of California which is known as the California bearing ratio or C.B.R. (Fig. 2). This method is described in detail in a symposium in the Proceedings of the American Society of Civil Engineers for January 1949. In brief, it has been found that for a certain density of compaction, any selected material such as glacial till, gravel or crushed stone will bear a determinable unit load with a given penetration. Thus it was found that a well-compacted crushed stone would support a load of 1,000 pounds per square inch with a penetration of one-tenth of an inch. This combination was taken as the standard and was assigned a C.B.R. of 100. Comparative tests indicate that a gravel base will have a C.B.R. between 40 and 100, depending on the gradation and compaction. At the lower end of the scale, tests show that a plastic material as it occurs in nature or a clayey till under adverse conditions during the frost melting period may have a C.B.R. as low as 3.

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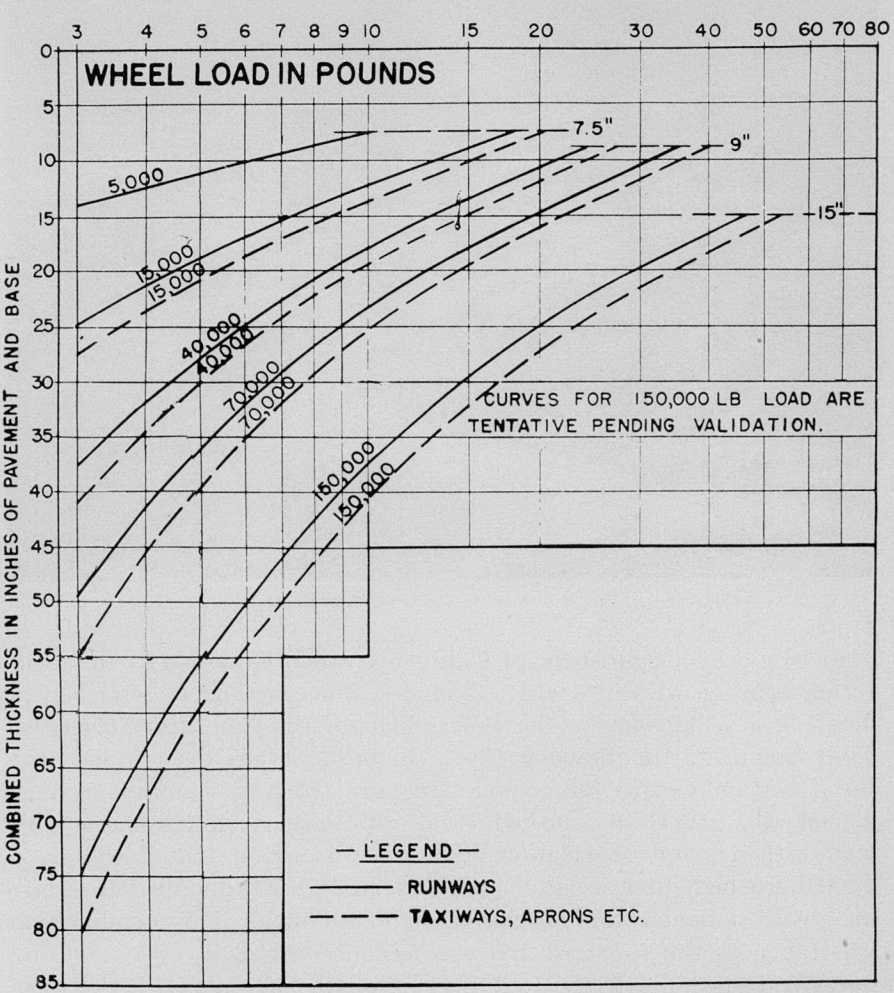
CALIFORNIA BEARING RATIO



CALIFORNIA METHOD DESIGN CURVES

FIG. 2.

A load superimposed on the pavement as in the case of an auto or airplane wheel, is distributed in the pattern of a cone with the apex at the top through the supporting media so long as the shear values of the pavement and base materials are not exceeded. After several years of field and laboratory tests, the California Highway Department developed a series of curves which indicated the depth of the cone of distribution required to spread a given load over an area which would be sufficiently large to reduce unit load to the point that a weaker soil beneath with a lesser C.B.R. could safely support that distributed load. It was determined that repetitive loads require a greater depth of base course than static loads.

Beginning in 1941, the Corps of Engineers initiated a very extensive series of full scale repetitive load tests, using wheel loads up to 200,000 pounds. As a result, curves were prepared which show the required depth of fill of superior quality to distribute a given wheel load over an inferior subgrade material of known C.B.R.

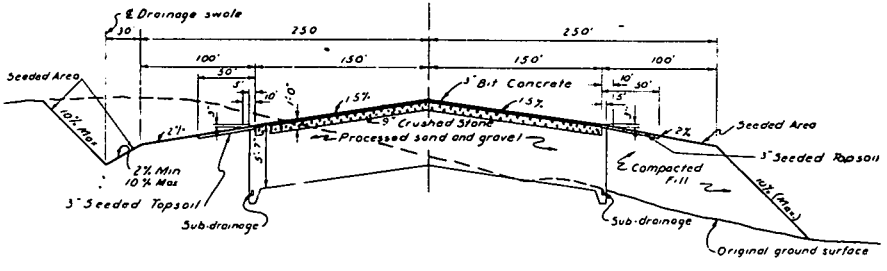
C.B.R. values were determined by field and laboratory tests for the materials existing and available at the Limestone site. The prevailing subgrade material is a glacial till. It has a C.B.R. of 21 in the saturated compacted state. This limitation requires a combined depth of base course and pavement of 27 inches for taxiways and apron and 24 inches for runways to distribute the 150,000 pound design wheel load over the subgrade. However, as the subgrade and fill contains about 33% of material finer than .02 millimeter, it is subject to frost action and resulting weakening of its bearing value. If allowed to freeze, this subgrade material might develop a C.B.R. as low as 3 or 4 during the spring melting period. Such a C.B.R. value would require a non-frost heaving base course and pavement having a combined thickness of 65 inches. Studies indicated that frost would not penetrate the gravel base course more than 70 inches in this locality. Therefore, it was decided to adopt a total thickness of base course and pavement of 70 inches in order to eliminate any uncertainties as to the bearing value of the subgrade in any season of the year.

Clearing and stripping of the airfield areas were accomplished in the fall and winter of 1947. Common excavation which followed in the Spring and Summer of 1948 was accomplished with power scrapers and with Euclid loaders which had a capacity of 500 cubic yards per hour. Gravel for the base course was obtained from a source about

two miles away. The material in its natural state included from 6 to 8 per cent of fines smaller than .02 millimeter and was considered subject to frost action. It was therefore necessary to process this gravel in order to reduce the percentage of fines smaller than .02 millimeter to 3 per cent in order to insure that frost would not soften the base course during the Spring thawing period. Since over 900,000 cubic yards of processed gravel were required for the base course, it was not physically possible to wash this amount in commercial gravel treatment plants in one working season of 5 months. Fortunately, an adequate supply of process water was available from a small stream which flowed close by the gravel bank. An existing beaver pond was enlarged and hydraulic giants were installed which directed streams of water against the face of the gravel deposit. The hydraulic jets removed the very fine material with the result that the washed gravel had a gradation within the allowable limit.

Crushed rock for the asphalt pavement and the 9-inch stone base course were obtained from a quarry which was opened about a mile from the runway. The base course material was graded from ½-inch to 3 inches in size. The stone aggregate for the asphalt pavement had a maximum size of one inch for the binder course and ¾ inch for the wearing course. Two asphalt plants having a combined output of 150 tons per hour processed the pavement mixture.

Figure 3 shows a typical cross section of the runway. The taxiway and parking apron are similar in construction except for width and crown. Fill beneath the subgrade was obtained from selected



LIMESTONE AIR FORCE BASE
LIMESTONE, MAINE
TYPICAL SECTION
FOR N-S RUNWAY
FIG. 3.

common excavation and was compacted in 6 inch layers by sheepsfoot rollers which exerted tamping pressures of 550 pounds per square inch. A density of 90% as measured by the modified A.A.S.H.O. test was considered satisfactory. The top 6 inches of the natural subgrade and the subgrade fill for a width of 310 feet were compacted with sheepsfoot rollers to 95 per cent density. This compaction produced a C.B.R. of 21.

The safety strips on either side were built up of random excavation and borrow and compacted by the passage of construction equipment.

The 55 inch thickness of gravel base course was placed in approximately 12-inch layers and compacted with pneumatic-tired rollers. Two rollers, one of which weighed 125 tons and the other 200 tons, were used. The lower 37 inch thickness of the gravel base was compacted to at least 95% of the maximum density which gave a dry weight of 138 pounds per cubic foot and a C.B.R. of 80. The upper 18 inch layer of the gravel base was compacted to 100% of maximum density which produced a dry weight of 146 pounds per cubic foot and a C.B.R. of about 100.

The 9-inch crushed stone base immediately below the pavement was compacted in two layers with the pneumatic rollers and heavy pavement rollers. Choker aggregate was applied over each layer and thoroughly worked in during the rolling process. The stone base was compacted to 100% of maximum density and reached a C.B.R. of about 100.

A tack coat of RC-2 asphalt was applied at the rate of about .2 gallon per square yard over the crushed stone base prior to spreading the asphalt pavement. The 3″ hot asphalt pavement was placed in two layers. The mixtures contained from 4 to 6% of 120-150 penetration asphalt. The pavement was compacted to densities of 90% for the binder course and 96% for the wearing course.

Asphalt coated corrugated steel perforated pipe drains were located in gravel filled trenches in the subgrade under the length of both edges of the pavement. These were installed to provide an outlet for any possible seepage and thereby to insure a dry base course. The drains discharge into the storm drainage collector system. Clean-out and inspection riser pipes are located every 300 feet along the subdrains and catch basins are provided every 900 feet.

The runway, taxiways and apron required 2,100,000 cubic yards

of excavation; 1,300,000 cubic yards of fill; 900,000 cubic yards of gravel base; 137,000 cubic yards of crushed stone and 90,000 tons of asphalt concrete. The work was largely accomplished in the summer and fall working season of 1948. Altogether construction equipment having a total value approaching $5,000,000 was required on the project. Bottom dump Euclids of 13 cubic yard capacity were used to haul gravel and much of the common excavation. The materials were spread with bulldozers.

The pneumatic-tired rollers used in consolidating the gravel and the crushed stone base courses are of comparatively recent origin. They proved very successful in obtaining a high degree of compaction for materials spread in layers up to 18 inches in thickness. One of the rollers (Fig. 4) which was developed by the Corps of Engineers

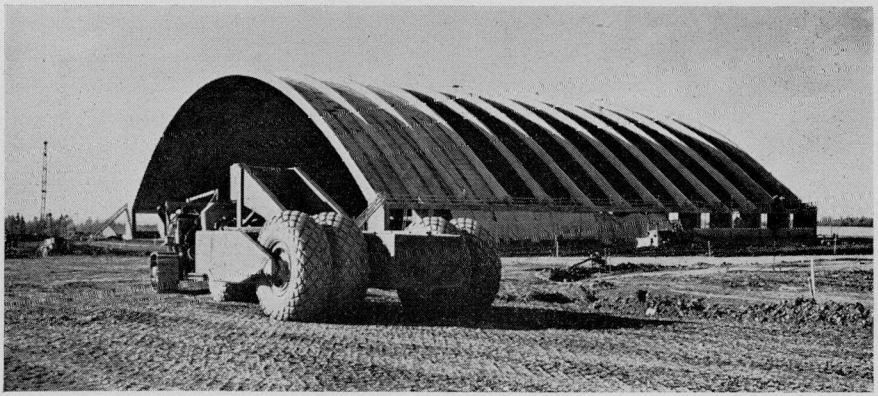


FIG. 4.—125-TON COMPACTION ROLLER.

and was borrowed for the work at Limestone weighs 125 tons loaded, is mounted on 6 pneumatic tires and is drawn by one heavy tractor. The other roller (Fig. 5), weighing 200 tons, is one of four of like size and type designed and built by O. J. Porter who was one of the pioneers in the development of the C.B.R. method. The weight is carried on 4 tires which are inflated to 150 pounds pressure. Two large tractors are required to pull this roller. About 6 passes of the roller were sufficient to obtain maximum compaction of the base course.

Other items of equipment used on the project were standard for a project of this character. The total plant requirement was noteworthy for the number of pieces of equipment required to handle such

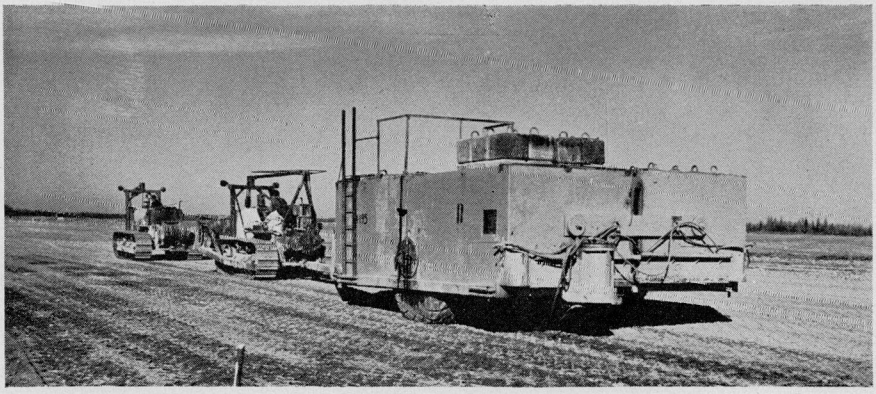


FIG. 5.—200-TON COMPACTION ROLLER.

a large volume of work in the short working season available in northern Maine. At the peak, over 30,000 cubic yards of material were moved in a working day.

The project is located about 450 miles from Boston and far from a labor market. As a result, it was necessary for the contractors to import practically all skilled mechanics and much of the common labor. To house them, barracks, mess halls and recreation buildings were moved from the abandoned war-time air base at Houlton, 65 miles away, and set up on the site. A new water supply, sewerage system, temporary power plant and fire fighting facilities were installed to serve these barracks and a trailer camp. At the peak about 1,600 men were employed, of which over 600 were housed at the site.

The runway system was designed by the Corps of Engineers and built by the Lane Construction Company of Meriden, Connecticut.

PART II—DRAINAGE, WATER SUPPLY AND SEWERAGE

By Elliot F. Childs, Member*

Drainage

Similar to the usual design of airfields, the drainage facilities at the Limestone airfield are twofold: first, provisions to remove surface water derived from rainfall, melting snow, or combination of both, and secondly, subdrainage facilities to insure a low ground water table or to intercept water that may seep into gravel bases. In past designs it was common practice to have one drain pipe serve both purposes, but it is customary today to keep these systems separate in order that storm water runoff will not be carried into the subdrains and thence into the gravel base materials. It was also difficult with the combination system to obtain satisfactory opening in large pipes that would allow seepage water to enter the pipe freely but would keep out the fines in the filter material.

The section shown on Fig. 3 is a typical cross-section of the runway and the taxiways, although the taxiways have smaller cross-sectional dimensions. The Corps of Engineers designates this type as a "boulevard" section because the slope of the runway cross-section is entirely outward from the crown at the centerline, to the outer edge of the safety strip. Drainage facilities such as inlets, manholes and pipes are minimized in the boulevard section as the emphasis for drainage is placed on sufficient grading and slope to carry storm runoff from the useable portion of the landing strip to swales or shallow ditches outside the limits of the runway. On earlier designs of airfields the slope of the pavement was 1.0% and the grass safety strips 1.5%. To insure adequate drainage the slopes in the present boulevard section are increased to 1.5% for the pavement and 2 to 3% for the safety strips. The maximum side slope of the swales is 10% to reduce the hazard to planes that may accidentally angle across the runway.

In many airports there is sufficient longitudinal slope of the runway to allow the water in the swales to flow with the natural slope

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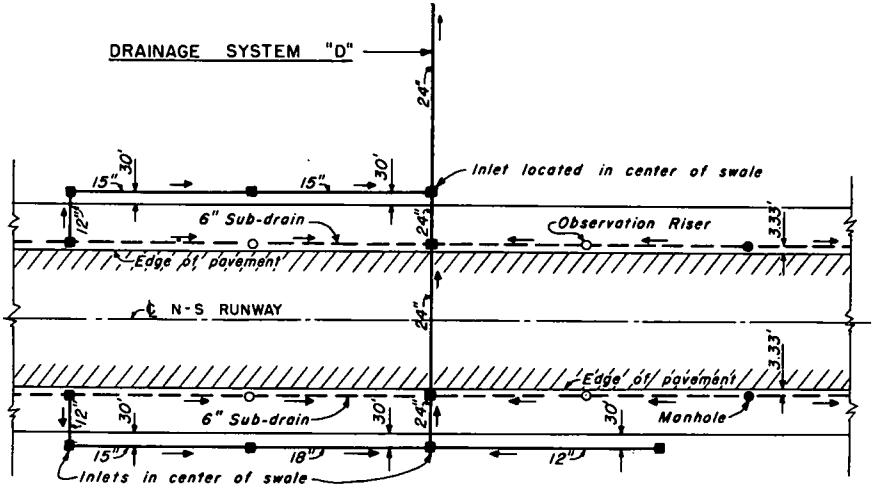
and eventually discharge into some brook or drainage course without any intercepting drains. Due to the flat terrain, however, at Limestone, there is practically no longitudinal slope whatsoever in the runway, and to obtain proper drainage it was necessary to create high and low points in the swales, and to install inlets at the low points. Fig. 6 illustrates one particular drainage system for the runway and



LIMESTONE AIR FORCE BASE
LIMESTONE, MAINE

TYPICAL RUNWAY DRAINAGE

FIG. 6.

shows location of inlets and drains located in the swales outside the limits of the safety strip. The bottom of the swales have a minimum longitudinal grade of 0.5%. The drainage system is designed assuming temporary surface storage in the swales during periods of severe rainfall intensities.

The dash lines on this plate represent the subdrains which are located around the perimeter of all paved surfaces, including the runway, taxiways, and the parking area. The subdrainage system consists entirely of 6 inch diameter, perforated, bituminous coated, corrugated metal pipe. The theoretical computed discharge capacity of the drainage course, assuming initial saturation, is 0.20 c.f.s. per 1000 feet of intercepting drain. However, due to the low groundwater

table at the airfield, and the imperviousness of the soil it is inconceivable that the gravel base will ever become saturated. The purpose of the subdrainage system is the assurance that the base material has a definite drainage outlet in case of pavement leakage, surface infiltration at the turfed shoulders, or from other unpredictable sources. Manholes are located at all angle points and a maximum distance of 1000 feet on straight lines. Manholes on the subdrains that discharge directly into the storm drainage system are provided with grated covers to serve as emergency inlets during the winter or spring when the surface runoff from melting snow or sleet storms is effectively dammed by the accumulation of plowed snow along the edge of the pavement. Cast iron observation risers, 6 inches in diameter, are spaced between manholes approximately 330 feet apart. The purpose of the risers is to be able to localize any failure or stoppage of the subdrain, and to have the means to introduce a hose, or other devices, for flushing or cleaning out the pipe.

The subdrainage system discharges into the storm drains at drop manholes located approximately 1000 feet apart. The subdrain enters the manhole a minimum distance of 2 feet above the invert of the storm drain to prevent storm runoff from backing into the subdrainage system except during very severe intensities of rainfall. The minimum slope of the subdrain is 0.0015.

The storm drains consist principally of reinforced concrete pipe. Drains, 24 inches and larger located under traffic areas are extra strength reinforced concrete pipe to provide for both the heavy wheel load of the design plane and the unusually heavy compaction equipment used during the construction. In non-traffic areas, particularly in the building areas, drains 18 inches and smaller, are either non-reinforced concrete or vitrified clay pipe. The drainage system is designed for a storm with a 2 year frequency. Based on a hydrologic study of the U. S. Weather Bureau records at Caribou, Maine (8 miles from airfield) it was determined that a storm intensity of 1.0 inch per hour could be expected every 2 years.

A detailed description of the computations involved in the determination of design discharges for the storm drains is beyond the scope of this paper. Briefly, the various factors involved in the computations consist of the variable intensities of rainfall that have the same degree of probability; rates of infiltration; rates of overland flow which are dependent on the slope, length, and nature of the

surface, that is, whether paved, gravel, or turf; volume of surface pondage permitted in the low areas, time of concentration, inlet capacity, and the hydraulics of pipe flow. Most of the variables are solved by generalized tables and graphs. For more detailed description of the hydrologic analysis of airfield drainage reference is made to the paper entitled, "Military Airfields" by James H. Stratton and Gail A. Hathaway published in the A.S.C.A. Transactions for 1945.

The discharge capacities of the storm drains are computed by Manning's Formula using a roughness coefficient "n" of 0.013 for large straight drains and 0.015 for drains with laterals and angular change of direction. The slopes of the drains are sufficient to provide a minimum velocity of 2.5 feet per second when flowing either full or half full. Sediment sumps are not provided in the drainage structures for it is expected that the velocity of flow with shaped paved inverts will insure a self-cleaning system. The cover on the drains provides 6 feet of depth to the centerline of the pipe to protect against the effect of frost penetration. The cover is also checked for the wheel load of a 300,000 pound plane. All inlets, manholes, and junction chambers are designed of reinforced concrete with cast iron frames and covers or grates.

Fig. 7 shows the general overall plan of drainage for the airfield. The heavy full lines denote the principal intercepting drains. Branch drains and subdrains are not shown. The heavy dash line indicates the limits of the drainage area contributing to the drainage system. The major part of the airfield drains in a southwesterly direction to Greenlaw Brook which follows the drainage of the natural topography very closely. As previously noted, the boulevard section was selected to minimize the scope of the drainage facilities. However, due to the flatness of the terrain and the pocketed areas between the runway, taxiways, and parking apron, it was necessary to design and construct a system of considerable magnitude,—to quote a few figures: nearly 50,000 feet of 6 inch metal pipe was used for subdrains; 32,000 feet of storm drains were used with sizes varying from 12 inch to 60 inch diameter; there were approximately 170 drainage structures such as inlets, manholes, and junction chambers, and 100 observation risers on the subdrains.

The paved parking apron, 2000 feet long and 700 feet wide, required special drainage consideration. The crown of the parking area is parallel and 100 feet from the east edge of the pavement,

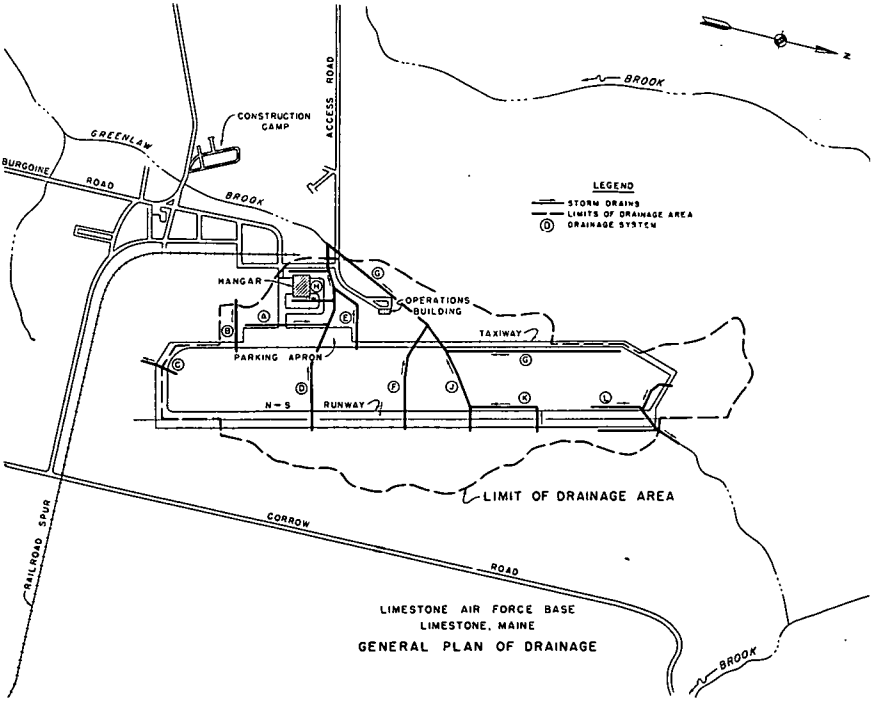


FIG 7.

resulting in the runoff from 600 feet of pavement being intercepted in a shallow gutter 25 feet from the west edge of the apron. This section follows very closely the natural topography. The apron has an appreciable longitudinal slope as well as the transverse slope of 1.5 per cent. Inlets, 10 feet long and 1'6" feet wide are spaced every 100 feet in the shallow gutter as shown on Fig. 8. The long axis of the inlet is placed normal to the line of the gutter to intercept as much of the wide shallow gutter flow as possible. A drain, located parallel and 12 feet outside of the pavement intercepts the flow from the gutter inlets. The attempt was made throughout the design of the drainage to minimize the extent of drains and trenches under paved areas.

The present drainage system is designed with full allowances for all anticipated expansions, including an increased length of the north-south runway, a second parallel north-south runway with necessary taxiways, an east-west runway, and increased parking apron facilities.

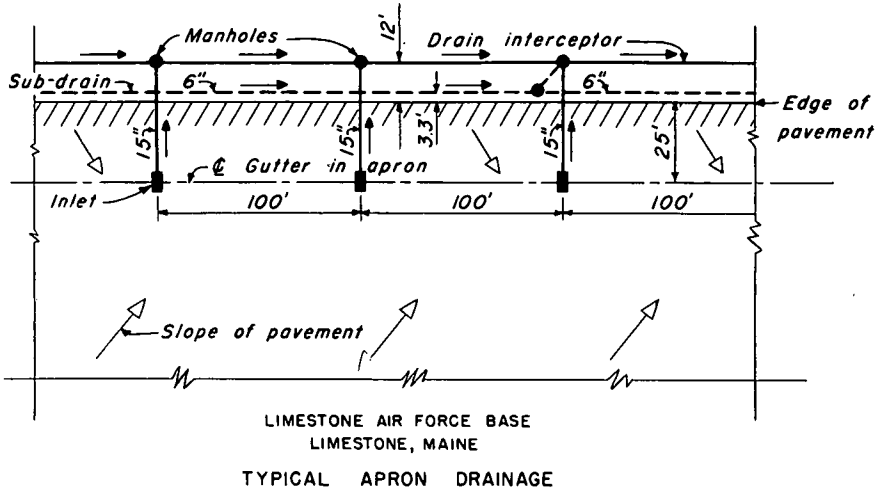


FIG. 8.

WATER SUPPLY SYSTEM

The source of water at Limestone presented quite a problem at the beginning of investigations. An early field reconnaissance of the area to be developed seemed to indicate that gravel packed wells located near the Little Madawaska River five miles from the center of the airfield might be a possibility. Test wells, however, showed an absence of both gravel and water, and only a surprisingly small depth of overburden on top of ledge rock. An investigation was then made of possible surface water supplies including several streams, but they all would involve considerable expense to develop. The most promising surface water supply was the Little Madawaska River itself. This source would require a diversion dam, treatment works, and a pumping station to pump the water to the site of the camp. This would be a very dependable supply, but estimates indicated that this method would be very costly.

During this period of investigation a temporary water supply system had been designed for the contractor's construction camp. Here two 6 inch wells had been drilled into rock for depths of 175 and 310 feet. Pump tests indicated a yield of 200 g.p.m. in the first and 80 g.p.m. in the second, which was much better than anticipated. Encouraged by the success of these two wells, it was decided to try

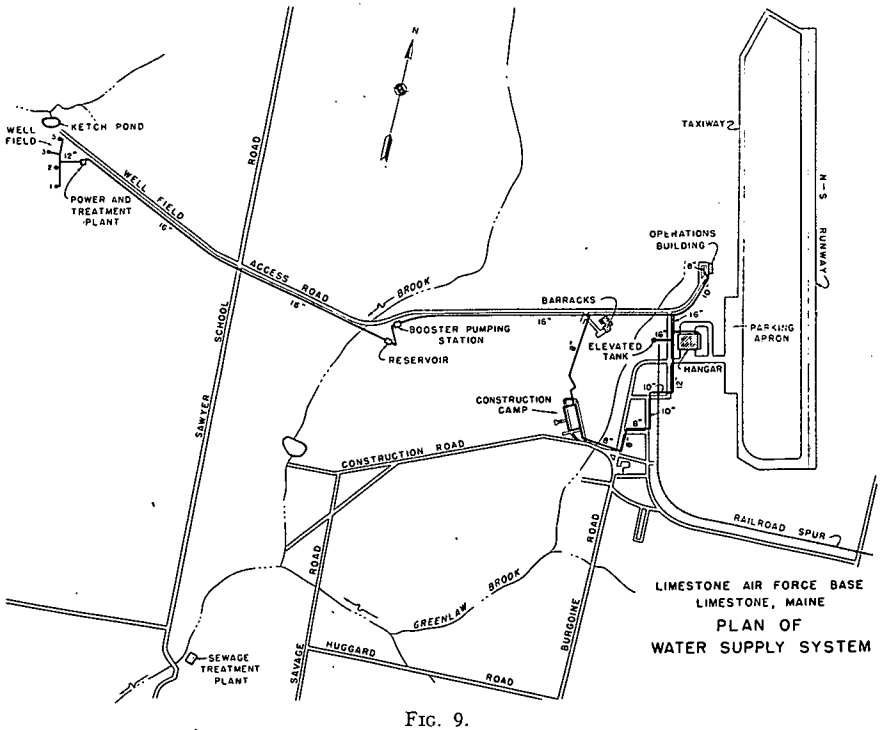


FIG. 9.

more drilled wells for a permanent water supply. An area was selected in the west section of the airfield property, as shown in Fig. 9. The area was removed from contemplated building areas, and also lay in between the camp and the Little Madawaska River and in case the well supply did not prove successful, the same supply main could be used and extended to the Little Madawaska River as originally considered. Seven wells were drilled with the depth varying between 350 and 650 feet. (See Fig. 10.) The yield of the wells varied between 80 and 400 g.p.m. The last well was drilled 650 feet deep, or approximately 60 feet below sea level on the suggestion of a visiting Canadian geologist who believed that the yield might be greater by drilling below sea level. Surprisingly enough, the yield on this particular well turned out to be over 400 g.p.m.

The deep well turbine pumps have a total specified capacity of 620 g.p.m. against an average design head of approximately 280 feet. This rate provides approximately 600,000 gallons per day for 16 hours

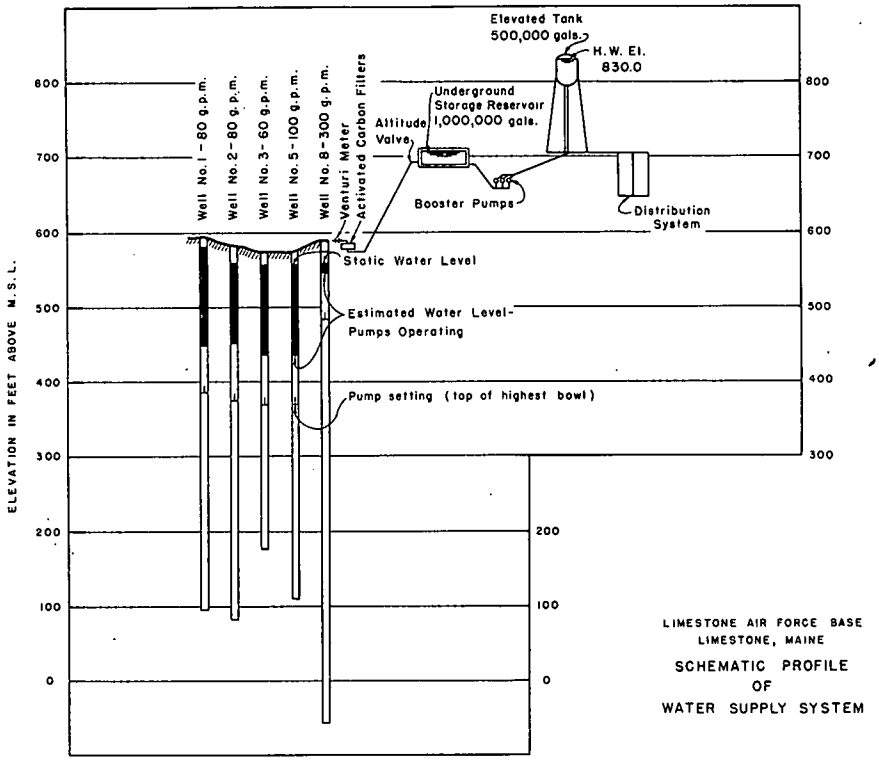


FIG. 10.

pumping per day, or 900,000 gallons per day if the pumps are operated continuously. Assuming daily consumption at the rate of 150 gallons per capita, this supply is adequate for a population of approximately 4000. Separate well houses are constructed on five of the most satisfactory wells to house deep well turbine pumps, valves and other appurtenances.

Analyses of water from the two best producing wells showed objectionable contents of hydrogen sulfide. Although the sulfide was not present in the other wells there was the possibility that it might appear with continued use and consequently it was decided to treat the water from all the wells. The treatment consists of passing the water through pressure tanks containing granulated activated carbon. The tanks are located in a separate structure adjacent to the well field. The same structure also houses an auxiliary power generator

for operation of the pumps in case of failure of the main power line from the air base.

The water is pumped direct from the deep well turbine pumps through the carbon tanks and through 7500 feet of 16 inch cast iron supply main to an underground concrete reservoir. The reservoir is divided into two compartments, each with a storage capacity of 500,000 gallons. From the underground reservoir the water passes through a booster pumping station into the distribution system. Three electric motor pumps are provided in the station: one with a capacity of 1.0 m.g.d. and two with a capacity of 1.5 m.g.d. pumps. One of the 1.5 m.g.d. pumps is also provided with a gasoline engine standby. An automatic chlorinator actuated by the differential head created by a Venturi meter chlorinates all water pumped at the booster pumping station.

An elevated steel storage tank is located approximately 500 feet west of the hangar. The tank has a capacity of 500,000 gallons with the flow line 125 feet above ground. The tank and 4 foot diameter riser pipe is provided with a 2 inch insulation blanket to protect against the low winter temperatures that are experienced at Limestone. Provision is also made for applying heat to the tank by means of a heat exchanger and a water circulating pump located in a small underground chamber adjacent to the center pier for the riser pipe. Telemeter transmitting apparatus is also located in the chamber for the automatic operation of the pumps at the booster pumping station dependent on the water level in the tank.

Water is distributed through a system consisting of cast iron pipe varying in size from 6 to 12 inch diameter. The pipes are buried to provide a cover of 6'6" in order to be below the frost penetration. The layout of the system and the selected sizes of the pipes will provide for any anticipated expansion of the base.

Sewerage System

The sewage from the base is intercepted in a collecting system as illustrated in Fig. 11 and flows in an outfall sewer down the valley of Greenlaw Brook to a site where a sewage treatment plant will be constructed. This particular site was selected for its accessability and as being far enough downstream to serve any conceivable expansion that may be developed without requiring construction of a pumping station. Complete treatment will be provided before dis-

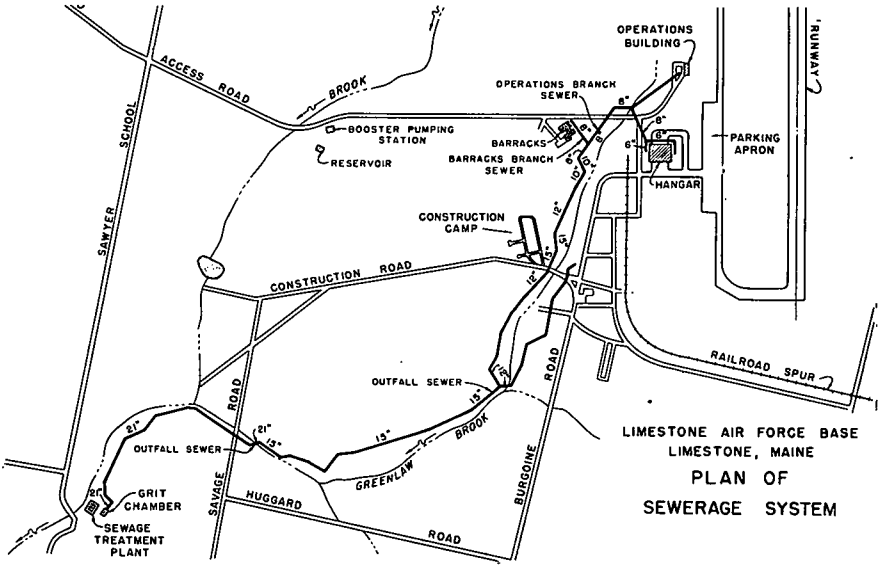


FIG. 11.

charging the effluent into Greenlaw Brook and thence into Little Madawaska River due to recent Maine legislation in respect to stream pollution.

Briefly, the plant will include the following units: grit chamber and comminutors, primary sedimentation tank, sludge digestion tank, a trickling filter with a dosing tank, final settling tank, and a chlorine contact tank. Sludge drying beds and an administration building will also be included. The plant is designed initially for a population of 4400, with provisions for doubling the capacity if required by the ultimate development of the air base. A more detailed description of the sewage treatment plant would be interesting for the sanitary engineer but is beyond the scope of this paper.

Due to limitations on the construction funds during the initial phase of the Limestone development, the construction of the outfall sewer and sewage treatment plant has been temporarily deferred. Present sewage of the base is disposed of by a simple, temporary system installed for the construction camp and consists of sedimentation tanks and chlorination of the effluent with discharge into Greenlaw Brook.

The permanent water supply and sewerage systems for the Limestone base were designed by Metcalf and Eddy, Engineers.

PART III—BUILDINGS

By John Wm. Leslie*

The Limestone Air Force Base will eventually have a personnel strength of approximately 7,000. The cost of developing an air base with its attendant housing, administrative and operational facilities for a group as large as this will cost many millions of dollars. Money to complete the entire Base was not available at once and it has therefore been necessary to plan and construct in incremental phases. For the first phase there was available $13,000,000, later increased to $17,000,000, of which about $5,500,000 was allotted to buildings. As the base could not be made fully operative at once, it was determined to select for the first phase only those structures that would make the base a maintenance until for limited use.

With this in mind, it was decided that aside from the minor component structures of the water supply system, that there should be only four buildings constructed at this time: (1) an operations building and control tower; (2) a 250-man barracks unit; (3) a Diesel electric power generating plant; and (4) a maintenance hangar. The first three buildings, which were designed by Alonzo J. Harriman of Lewiston, Maine, are shown on Fig. 12.

Operations Building

The Operations Building is to be the focal point of the base. The structure is a 2-story building with a full basement underneath and with an overall dimension of 65′×245′. A distinctive feature of the building will be the 7-story control tower rising 66′ to the floor of a glass enclosed control room which will command a clear view of the ends of the present and future runways as well as all operational areas and taxiways.

The building proper is of reinforced concrete frame, while the tower is of steel design, concrete fireproofed, with the walls carried on the frame at each floor level. The exterior walls are constructed of 4″ red water-struck face brick with 8″ terra cotta back-up, 2″ of insulation, furring and plaster. The floors are reinforced concrete

*Chief of Military Construction Branch, New England Division, Corps of Engineers, Boston.

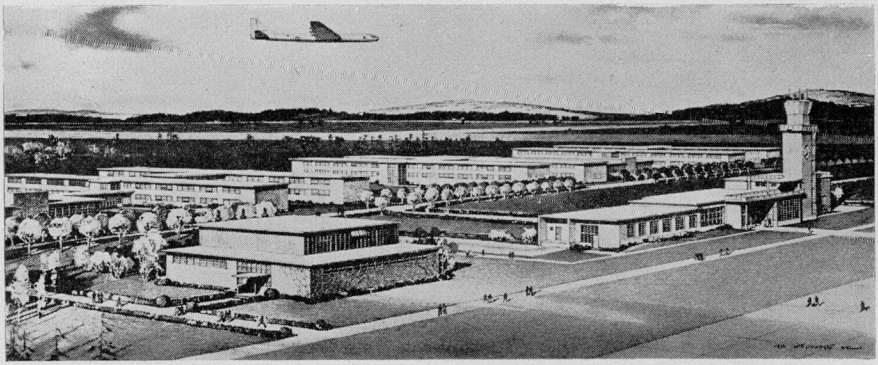


FIG. 12.—SCHEMATIC SKETCH SHOWING POWER HOUSE AND OPERATIONS BUILDING IN FOREGROUND AND BARRACKS IN BACKGROUND.

one way ribbed slab construction. The second story of the Operations Building as well as all of the floors of the tower are of cellular steel Q-floor decking as manufactured by H. H. Robertson. This deck has been installed for expedient wiring in the radio room area of the second floor and throughout the control tower. Interior partitions are 6" terra cotta with a liberal sprinkling of movable metal partitions in office areas for flexibility of future arrangement.

The basement of the building provides storage, locker and lounge facilities. The first floor will contain operational and administrative facilities, lobby and snack bar; the second floor will provide space for radio operation; and the several rooms of the control tower are designed for and will provide the latest methods of control and operation.

BARRACKS

The barracks building is designed in units of 250 men with the ultimate barracks housing 1000 men. The unit is planned in the shape of an "H" and consists of four 2-story 34-man squad room wings. These squad rooms are connected by a 2-story unit containing toilet facilities and connecting corridors. The squad room section is connected to a central unit of one story with a full basement underneath. The first floor of the central unit will contain an administrative office, a day room, a mess hall and kitchen (with facilities for 500 men). The basement is to be used for kitchen stores, general issue stores, luggage storage and sick call area. Each unit is repetitive with the exception of the kitchen and the sick call area, the latter

being included because of lack of facilities in the first phase but will become an independent unit in future phases.

The barracks building is also a reinforced concrete frame structure with exterior walls the same section as the Operations Building. All floors are reinforced concrete with asphalt tile in the squad rooms, quarry tile in the kitchen, bakery and bakery stores, and ceramic tile in the toilets. Ceilings are plastered with the exception of the squad rooms where they are merely painted. Pending the construction of a central heating plant for heating the entire base, the barracks building as well as the Operations Building will be heated with temporary plants.

Diesel Power Plant

In the original planning of the Base it was believed that sufficient electric power would be obtainable from local commercial interests to take care of the demands of the Base. This was predicated upon load demands at some of the larger military air bases in New England. However, when the full program was known, it readily became apparent that there would be need for 10,000 kilowatts of electric power. The Maine Public Service Company, which serves that area, had at the time a total capacity of only 14,000 kilowatts. As a consequence, it became necessary that the Government either subsidize the Maine Public Service Company to supplement their present facilities or build its own facilities. The Government, in order to insure required power at all times decided that it would construct its own facilities. As a result, there is now being built a Diesel Power Plant with a 3,000 kilowatt capacity to serve the present demand, with provisions for supplementing this by 7,500 kilowatts in the future. This building is of steel frame and masonry walls supplemented by the use of modern building materials in a very pleasant manner.

Hangar

The hangar, Fig. 13, is the most impressive structure of the Base. It is a concrete monolithic arch structure 314′ long with a clear width at the lean-to spring line of 340′. The interior height of the arch is 16′ at the spring line and 90′ at the center of the arch.

The external appearance of the hangar is similar to an inverted rib floor since the arch ribs are on the exterior of the hangar shell, a design which was adopted to facilitate construction.

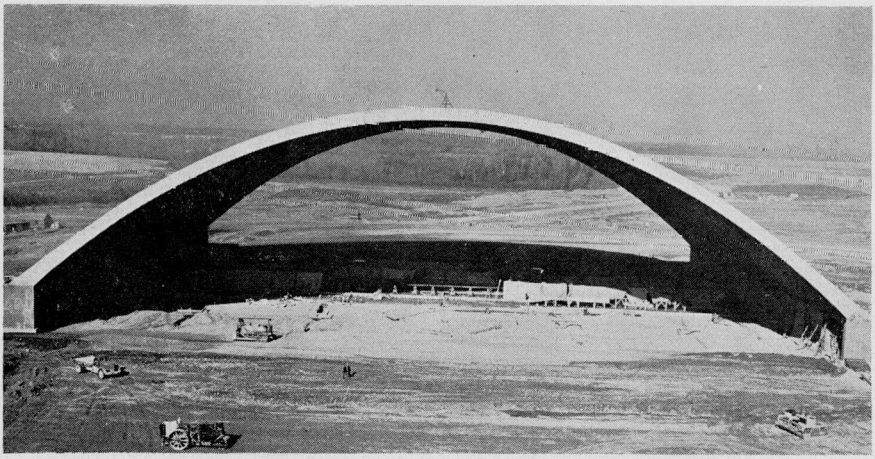


FIG. 13.—COMPLETED HANGAR SHELL.

The arches follow the shape of a catenary and are considered as compression members like long columns. The arches as ribs receive stiffness and "T" beam effect from the shell. The ribs are spaced at every 25 feet with the hangar divided into six structurally independent units 50′ long by means of five transverse expansion joints. The ribs are five feet deep and 24 inches in width. The roof slab or skin varies in thickness from 5 inches at the crown to 7 inches at the spring line.

Reinforcing is provided at top and bottom of the skin with additional diagonal reinforcing in the lower portion of the shell to provide transfer to the column of the concentration of stress which occurs in this area. Direct and moment loads are transferred from the ribs into columns and thence to a pedestal and footing pier located on rock. The floor slab consists of a center strip 100 feet in width and 24 inches thick designed for a 150,000 lb. wheel load, while the remaining slab is 18 inches thick. The slab under the lean-to is 5 inches thick.

The hangar is heated by a combination of radiant heat and space heaters. Approximately 40% of the heat is supplied by radiant heating installed in the floor slab, and the remainder from four large space heaters located one each at the ends of the doors. The hangar has doors at both ends in order to provide greater functional use of the hangar. The doors, electrically operated, are 40 feet in height

with a clear span opening of 300 feet. There is a center tail gate door 50′ in width and 25′ in height. Curtain walls above the doors and the door pocket recesses are of asphalt protected metal. Lighting is from overhead fixtures at skin height with cables running along the shell skin and thence to cable reels at the columns in order that fixtures may be lowered for replacement. There are approximately 16,000 cubic yards of concrete in the structure which was built at a cost of $2,700,000. This cost was higher than was anticipated and is largely due to the fact that much of the foundation excavation, as well as practically all of the construction of the arch abutments, were done during the winter with resulting higher costs.

As noted above, this hangar is built in six 50′ units and at the start of the job an arch centering section, Fig. 14, was built of timber frame work with a plywood skin built to the shape of the hangar.

No top forms are used on the shell. This arch centering has

FIG. 14.—FORMWORK FOR HANGAR ROOF.

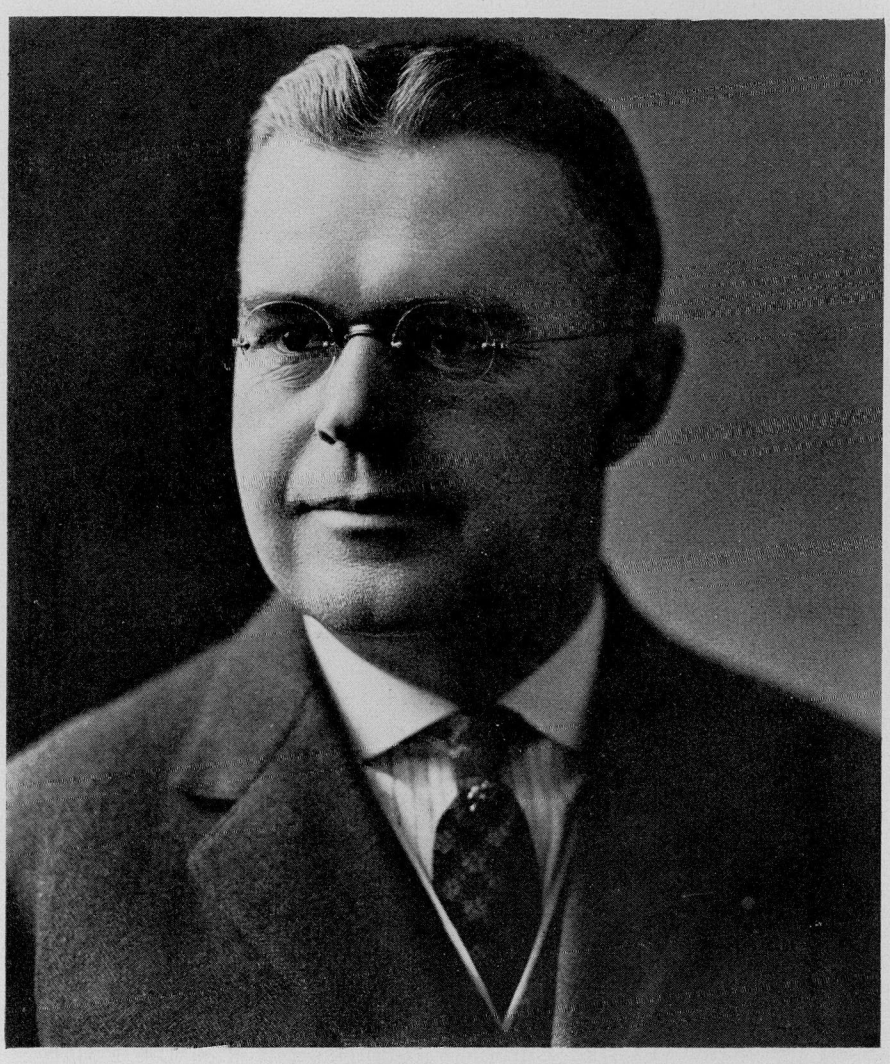
jacks at its top just below the skin truss so that the skin can be raised or lowered to the requisite elevation. The bottom of the centering is mounted on wheels so that the unit can be moved on tracks to each successive unit. Prior to pouring, the jacks are raised into position, the pour is made and the concrete allowed to set. After about 4 days, the jacks are lowered approximately two to three inches and the entire assembly moved forward along the track to the position of the next pour.

A platform on the trailing edge enables cement finishers and electricians to perform their operations. The operation then continues through each of the 6 units.

At Limestone, concrete operations were performed by cranes which lifted the concrete into hoppers at various levels then to buggies running along platforms and then chuted into place. A similar hangar such as this was constructed at Rapid City, South Dakota, and at that location towers were erected on either side and concrete raised by elevators to hoppers and then placed as above. However, at Limestone it was decided that this method was slower of operation. High early strength, air entrained concrete was used for the hangar. There were about 600 cubic yards of concrete involved in a pour and the first pour took about 38 hours. By the third pour, this time had been cut down to 18 hours.

General

Complete development of the Base will include such normal features as warehouses, shops, administrative, training facilities, barracks, family housing, schools, recreational facilities. It is expected that there will be six 1000-man barracks buildings of the design previously developed. It is contemplated that all heating with the exception of the housing facilities will be accomplished by a central heating plant. This central heating plant is now in design and will use as a medium high temperature, high pressure hot water. The distribution system will be similar in principle to a hot water heating system in one's house. This high temperature water system has been successfully used for many years in European countries but it is the first time it has ever been employed in the United States.



COLONEL CHARLES RICE GOW
1872-1949

COLONEL CHARLES RICE GOW

1872-1949

By John P. Wentworth

Colonel Charles Rice Gow, an Honorary Member and Past President of the Society, passed away on July 29, 1949 at his home 1751 Beacon Street, Brookline, Massachusetts.

He was elected a member of the Society on March 18, 1903 and an Honorary Member on January 14, 1942. He served as a Director from 1911-13, Vice President 1913-15, and President from 1915-16. He served on many committees and presented several valuable papers. In 1912 he was awarded the Desmond Fitz Gerald Medal for his paper "Methods and Cost of Construction of the Slow Sand Purification Works for the new Springfield, Mass. Water Supply." In 1922 he received the Clemens Herschel Award for his paper "The Responsibility of Organized Labor for Stagnation in the Building Industry."

He was born December 5, 1872 in Medford, Massachusetts, the son of Robert M. and Cordelia (Flynn) Gow. He attended the public schools of Medford and graduated from Tufts College in 1893 with the degree of Bachelor of Science. He worked his way through school as a newsboy and night watchman. For two years after graduation, he was employed by the city of Medford, Mass., the first year as Assistant Superintendent of the Water Department, and the second year as Assistant City Engineer.

From 1895-98 he was an assistant engineer for the Boston Transit Commission. The next year he organized his own contracting company. For about 20 years he continued this business and completed many contracts, particularly on sewer and subway construction.

From 1922-30 he practiced as a Consulting Engineer. During that time he acted as consultant to many engineers and contractors. He was consultant to several of the principal contractors on the New York and Philadelphia subways and to the Boston Transit Department on its rapid transit extensions.

In 1933 he was elected President of Warren Brothers Company

and in November 1942 he was elected Chairman of the Board, which position he held until his death.

Notwithstanding his busy professional life, he found time to take part in public work. In 1929 President Coolidge appointed him Postmaster of the Boston Postal District which served 25 cities and towns. The next year he felt it necessary to resign from his position, although President Hoover pleaded personally with him to continue this position.

In 1915-16 he was Chairman of the Boston Licensing Board, to which position he was appointed by Governor Walsh. He was the first Massachusetts State Engineer under the Federal Public Works Administration. During World War I he was Chairman of the Renegotiation Board of the New England Division, Corps of Engineers, U. S. Army.

He served on many commissions and committees among which were the following:

Commission of Water Needs of Cities and Towns of Ipswich River Valley, 1911-12, appointed by Governor Foss.

Metropolitan Water Supply Investigating Commission, 1924-25, appointed by Governor Cox.

Massachusetts Metropolitan Planning Division, 1928-34, appointed by Governor Fuller.

Joint New England Commission on St. Lawrence Waterway, 1924-25.

Because of his great ability and sterling character, many organizations desired his services. He was a director of several banks, the Franklin Foundation, and the Boston Chamber of Commerce; a former President of the Associated Industries of Masachusetts comprising some 1,600 manufacturing concerns; and Past President of the Boston City Club which at that time was the largest city club in the United States. Several years ago his doctor told him that he must give up some of his activities. On that very day he resigned from 24 commissions and committees upon which he had been actively engaged.

He was honored by several universities, having received the degree of Doctor of Science from Tufts College, and the degree of Doctor of Engineering from Worcester Polytechnic Institute and from Northeastern University.

Most members of the Boston Society of Civil Engineers are familiar with the Gow caisson pile, which he invented and which has been used so extensively in building construction.

His military career was noteworthy. He served in the Massachusetts National Guard from 1889-1908, advancing from private to lieutenant colonel of engineers. At the beginning of the Spanish-American War, he enlisted in the Fifth Massachusetts Regiment as sergeant-major and advanced to first lieutenant. In World War I he was major and lieutenant colonel in the Construction Division, and had charge of the construction of the South Boston Army Base.

About 20 years ago a group of men who had been studying college education realized that one of the great needs for a young man entering business was an understanding of personal relations. Enough money was raised for a 5-year experiment in an attempt to integrate this phase of learning within the general college program. This experiment took the form of a new course at the Massachusetts Institute of Technology, known as Humanics. Colonel Gow had lectured at Technology for many years on the subject of foundations and was chosen as pioneer leader of this new course. He was later made Professor of Humanics. He was author of two books on this subject, "Foundations for Human Engineering," and "Elements of Human Engineering." The General Electric Company paid him the high compliment of circulating among its junior executives approximately one hundred copies of the former book. This subject proved so successful that it is now a part of the curriculum of many colleges. Much of the success of this movement was due to Colonel Gow.

On June 12, 1900, he married Jeannette A. Weaving. Their children were Ralph F., Arthur R., Jeannette A. (deceased), Charles R. Jr., and Grace A. (Mrs. Robert Bruce).

Many men have had noteworthy careers in a single profession. Colonel Gow made a name for himself in many fields; as an engineer, a contractor, an inventor, a business man, a teacher, a writer, and a public administrator. He was admired and respected by men of every walk of life, from the lowest paid laborers in the trench to Presidents of the United States. His work in public affairs can be equaled but by few engineers.

Colonel Gow often referred to the help and inspiration he received in early life from his superiors and colleagues such as Howard A. Carson and Joseph R. Worcester. He in turn helped many a young man, particularly young contractors who encountered intricate engineering problems and came to him for advice. By his death the profession loses one of its most outstanding members.

OF GENERAL INTEREST

PROCEEDINGS OF THE SOCIETY

MINUTES OF MEETING
Boston Society of Civil Engineers

SEPTEMBER 28, 1949.—A regular meeting of the Boston Society of Civil Engineers was held this evening at the American Academy of Arts & Sciences, 28 Newbury Street, Boston, Mass., and was called to order by President Harrison P. Eddy, Jr., at 7:00 P.M.

President Eddy announced that the minutes of the April and May meetings had been published in the July issue of the JOURNAL and that their reading would be waived unless objection was raised. Objection was raised but the minutes were not available and they were not read.

President Eddy announced the death of the following members:

Almon L. Fales, who was elected a member June 25, 1913, and who died August 19, 1949.

Arthur W. French, who was elected a member October 21, 1914, and who died May 27, 1949.

Charles R. Gow, who was elected a member March 18, 1903, and made Honorary Member, January 14, 1942, and who died July 29, 1949.

Frank O. Holmes, who was elected a member April 21, 1920, and who died June 17, 1949.

Francis R. MacLeay, who was elected a member January 26, 1921, and who died July 21, 1949.

Oswell F. Mann, who was elected a member May 20, 1914, and who died April 18, 1949.

Charles E. Nichols, who was elected a member May 20, 1914, and who died July 3, 1949.

George G. Shedd, who was elected a member December 18, 1895, and who died August 31, 1949.

The Secretary announced that the following had been elected to membership:

Grade of Member: Malcolm G. MacInnes, Clair N. Sawyer

President Eddy stated that a Petition to B.S.C.E. for an Endorsement regarding "Recommended Procedure for Securing Professional Engineering Serivces by Public Authorities", prepared by Society's Committee on "Competitive Bidding for Engineering Services", signed by five members of the Society was considered by the Board of Government at its meeting June 8, 1949, and that this present meeting had been designated by the Board for a discussion of such an Endorsement, due notice having been given in notice sent to members dated September 14, 1949.

Mr. Ralph W. Horne, Chairman of Committee on "Competitive Bidding for Engineering Services" read the proposed form of "Recommended Procedure for Securing Professional Engineering Services by Public Authorities", which was as follows:

RECOMMENDED PROCEDURE FOR SECURING PROFESSIONAL ENGINEERING SERVICES BY PUBLIC AUTHORITIES

Engineering services are personal services and are professional in their

nature, like the services of doctors and lawyers. Engineering services should be employed on the basis of competence, integrity and mutual confidence between the public authority and the engineer. These conditions may not be fulfilled if the engineering service is selected on a price basis. Competitive price bids lose their significance unless based on precise specifications; and these cannot be written for the intangible qualities of training, experience, ability, judgment and integrity required of the engineering profession.

Consequently, it is contrary to the best public interests to procure professional engineering services on the basis of competitive prices, as practiced by a few municipalities; because this implies an obligation to employ the low bidder regardless of whether he is best qualified.

One of the principal reasons for obtaining competitive prices is the belief that the law so requires. However, the courts have ruled that competitive bidding for professional services is not required. (See McQuillan on Municipal Corporations, Vol. 2, sec. ed. Revised, p. 1182, sec. 1292.) Furthermore, the results of a survey completed last year by the Boston Society of Civil Engineers, by means of questionnaires sent to the legal counsel of all Massachusetts Municipalities having a population of 5,000 or more, showed that over 90 per cent of those who replied did not interpret their municipal ordinances to require competitive bidding for professional engineering services.

Most public works projects must start with a preliminary engineering investigation and report upon the need, the functional design and extent of the project, the cost of construction and operation, methods of financing and assessment of costs. Since the preliminary investigation may set the pattern for the ultimate success or failure of a project, it is deserving of engineering of the highest order. It is of utmost importance to the public that the cost of the preliminary studies should not be a condition in selecting the engineer for a project.

The fee for professional engineering services is but a small part of the cost of a project and the difference in the fee charged by a competent and by an incompetent engineer can be saved many times over in the entire project cost, if the project is well conceived and well executed.

It is to the best interest of the public that a Public Authority which does not already have satisfactory engineering associations engage professional engineering services by the following procedure:

1. Determine by inquiry from properly informed sources the names of one or more engineers or engineering firms, who may be qualified and available for the particular engagement.

2. Interview one or more of said engineers and examine his or their qualifications.

3. Select one engineer and negotiate with him an agreement as to the nature and extent of the services to be rendered and the basis of payment. If a question arises as to the reasonableness of the fees to be charged, the Public Authority should seek advice from recognized authorities such as the American Society of Civil Engineers. If an initial agreement for engineering services upon a project is limited to a preliminary investigation and report, then the agreement should commit the engineer as to availability and as to limiting fees, in case complete professional engineering services are desired at a later date.

A motion to defer action on the report under discussion until the report of the Committee and the Minority Report as presented at the Annual Meeting, had been published, was defeated.

It was moved and seconded that the

form of "Recommended Procedure for Securing Professional Engineering Services by Public Authorities", as prepared by the Society's Committee on Competitive Bidding for Engineering Services, and presented in petition in accordance with the By-Laws, be endorsed by the Society as circulated to the members with the notice of the Society meeting of September 29, 1949, and that publication of said procedure be authorized.

After prolonged discussion the President announced that the By-Laws require the literary exercises to begin not more than a half-hour after the meeting is called to order. It was moved, seconded and voted "that discussion cease and the literary exercises begin not later than 8:30 P.M."

After a voice vote the President stated that a majority of members present had voted in favor of the Endorsement and this matter would be referred to the members of the Society for letter ballot.

President Eddy then introduced the speaker of the evening:

Subject — "Science Rebuilds Our World."

Speaker — Dr. James Stokley, Research Laboratory, General Electric Company, Schenectady, New York.

The talk was illustrated with lantern slides and motion pictures.

A short discussion period followed after which members gathered in the Lounge where a collation was served.

Seventy-nine members and guests attended the meeting.

The meeting adjourned at 9:40 P.M.

ROBERT W. MOIR, *Secretary*

SANITARY SECTION

OCTOBER 5, 1949.—The Sanitary Section of the Boston Society of Civil Engineers met in the Society Rooms at 7:40 P.M. to listen to a discussion of the pollution of the Charles River. Seventy-five members and students attended the meeting of which 35 had dinner together at Patten's Restaurant. The start of the meeting was delayed by slowness of service at Patten's.

Reading of the Minutes of the June Meeting—an inspection trip—was dispensed with as they had been printed already. There being no business to consider, Chairman Kenneth F. Knowlton introduced Dr. Horwood, the speaker of the evening, and his associates, Messrs. Frame and McKinney, two graduate students in Sanitary Engineering at M.I.T.

A paper entitled "The Pollution of the Charles River" by Dr. Murray P. Horwood and Messrs. John D. Frame and Ross E. McKinney was presented by Dr. Murray P. Horwood, Professor of Sanitary Science, Massachusetts Institute of Technology. A lively discussion ensued led by Mr. Arthur D. Weston, with Messrs. Berrigan, Merrill, Kennison, Eliassen, Camp, Flaherty and others taking part.

Meeting adjourned at 9:40 P.M. with a rising vote of thanks to Dr. Horwood and Messrs. Frame and McKinney.

WILLIAM E. STANLEY, *Clerk*

APPLICATION FOR MEMBERSHIP

[July 1, 1948]

The By-Laws provided that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the Board in its con-

siderations. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of fifteen (15) days from the date given.

APPLICATIONS FOR MEMBERSHIP

For Admission

STANISLAW J. V. GAWLINSKI, Cambridge, Mass. (b. April 24, 1904, Krakow, Poland.) Received degrees, Civil Engineer (1928), Doctor of Technical Science (1937), Institute of Technology, Lwow, Poland; Master of Science (1943) Graduate School of Engineering, Harvard University. Experience, 1928-1930, Resident Engineer in charge of concrete weir, arched stone bridge, water supply (Poland); 1931-1939, Instructor in Highway Engineering, Testing Engineer in charge of Research Laboratory for testing building and road materials, Institute of Technology, Lwow; 1937-1939, Lecturer on Technology of concrete and properties of Building Materials, Institute of Technology, Lwow; 1943-1944, Research Engineer, Soil Mechanics Laboratory, Mass. Institute of Technology; 1945, Associated with G. B. Cabot and R. N. Mayall, Consultants, Boston, Mass.; 1946-1949, Engineer with Clifford T. Rhoades, structural engineer, Boston; 1949 to date, Engineer with G. B. Cabbot and Associates, Consultants—Site Engineers, Boston, Mass.; 1947, Registered Professional Engineer, State of Massachusetts. Other activities, Editor of the "Bulletin of Polish Building Research Laboratories"; Chairman of the Lwow Section of the Association of Polish Structural Engineers, 1938-1939. Refers to *A. Haertlein, R. N. Mayall, E. L. Spencer, D. W. Taylor.*

HAROLD J. PUBLICOVER, Milton, Mass. (b. November 9, 1924, Arlington, Mass.) Student—Mass. State College, 1942-1943; Student, University of Mass., 1946-1949; Experience, June 1949 to present, employed by Kenneth E. McIntyre, Professional Engineer, Walpole, Mass., as Associate Engineer. Refers to *K. C. McIntyre, H. Mohn.*

For Admission

FRANK E. FAHLQUIST, Barrington, Rhode Island. (b. August 5, 1898, New York, N. Y.) Graduate of Brown University, ScB (engineering) ScM (geol. sciences). Experience, 1924-1926, Field Engineer, Portland Cement Association; 1926-1936, Ass't Engineer and Senior Engineer Metropolitan Dist. Water Supply Comm; 1936-1945, Senior Geologist and Senior Engineer, War Department, U. S. Engineer Office, Providence, R. I. Head-Geology and Foundation Exploration Section. Projects involving the investigation, design, and construction of flood control dams and reservoirs and levees. Military projects involving the investigation, design and construction of fortifications, airfields and ordnance facilities; 1945 to present, Private practice as Consulting Engineer-Geologist. Projects as follows; Manizales, Columbia, S.A. Anchicaya hydroelectric project, Columbia, S.A. Several projects of the Instituto Fomento de-Industria, Columbia, S.A. Several Projects of the Valle del Cauca, Colombia, S.A. La Garcia Dam, Meddellin, Colombia, S.A. Meramec Valley Food Control, Missouri. Connecticut Valley Flood Control, New England. Lackawaxen Flood Control, Pennsylvania. Irrigation Projects, Dominican Republic. Stewart Brighe Dam, New York. City of Chester Water Supply, Pennsylvania. Golpayegan Irrigation Project, Iran. Jura-

mento, Atuel and Diamante projects, Argentina. Holyoke Water Power Co., Holyoke, Mass. Blackstone Valley Sewerage District Commission, Rhode Island. Olneyville Expressway, Providence, R. I. Water front loading facilities, Narr. Elect. Light Co., Providence, R. I. Board of Consultants, U. S. Engineers, Boston. Refers to E. S. Chase, S. M. Dore, F. A. Marston, W. F. Uhl.

PERCY L. COLEMAN, St. Louis, Missouri. (b. April 3, 1897, Randolph, Alabama). Graduated from Georgia Technical School in June, 1914. Experience, August, 1918, to March 1920, draftsman and instrumentman with Robert L. Totten, Birmingham, Alabama; April, 1920 to April 1926, Resident Engineer, J. B. McCrary Eng. Corp., Atlanta, Georgia; April, 1926 to August, 1926, Construction Engineer, Merchant & Manufacturers Railroad & Warehouse Company, St. Louis, Mo.; September, 1926 to July 1927, design engineer, Pitzman's Co., of Engineers, St. Louis, Missouri; August, 1927 to March, 1928, Construction Sup't, Taylor Construction Co., Birmingham, Alabama; April, 1928 to August, 1928, Engineer, St. Louis Public Service Co., St. Louis, Missouri; September, 1928 to September, 1929 Supervising Engineer, Mellon Construction Co., Pittsburg, Pa.; September, 1929 to July, 1931, Principal Ass't City Engineer, City of Webster Groves. Missouri; August, 1931 to September, 1933, temporary engagements, September 1933 to April, 1934, Ass't Engineer, Sewer Design Section, Board of Public Service, City of St. Louis, Mo.; May, 1934 to February, 1940, Civil Engineer, Sewer Design Section, Board of Public Service, City of St. Louis, Mo.; February, 1940 to January, 1941, Structural Designer, Koppers Company, Pittsburg, Pa.; January, 1941 to July, 1943, Structural Engineer, Albert Kahn, Inc., Associated Architects & Engineers, Detroit, Michigan; November, 1943, to present, Chief Structural Engineer, Design Section, General Engineering Dept., Monsanto Chemical Company, St. Louis, Missouri. Registered professional Engineer in the states of Missouri and Massachusetts. Refers to E. K. Hull, R. I. Hayes.

THOMAS J. ROUNER, Lincoln, Mass. (b. November 12, 1898, Smith Center, Kansas.) Civil Engineering Student at University of Colorado, 1919-1920; Civil Engineering student at University of Washington, 1923 and 1926; B.S. in C. E., University of Washington (Seattle) 1926. Experience, 1921-1922, surveying including Chief of party on layout of streets and utilities for municipal development at Longview, Washington; 1924-1925, Contract engineer for Puget Sound and Cascade Railway Company. Directed surveying parties. Laid out and supervised work of contractors engaged on railroad grading, trestle construction and track laying for Class C railroad; 1926 (Part year) with Pittsburg-Des Moines Steel Company detailing penstocks and surge tanks; 1927, January-June with U. S. Engineer Dept. Chattanooga, Tennessee; Hydrological studies and cost estimates on proposed Tennessee River developments; 1927 June-1929 New England Power Construction Company; Assistant to consulting hydraulic engineer on various hydraulic, hydro-electric, and hydrological studies; 1929-1941, Assistant to Vice-President on economics of hydro-electric power including existing and proposed facilities, New England Power Company; 1941-1946 U. S. Army; Initially on construction and subsequently on repairs and utilities at Army posts and air bases, principally in continental U. S. A. 1946 to date, presently Colonel, U. S. Engineer Reserve. Vice President, New England Power Company; Vice Presi-

dent and Director, Connecticut River Power Company; in charge of Hydro-Economics Department. Refers to, E. A. Dow, C. R. Bliss, E. G. Lee, H. M. Turner, U. F. Uhl.

ADDITIONS

Members

Arthur R. Barnes, 37 Willow Street, Reading, Mass.

C. Hugo Bergman, 65 Woodbine, Street, Auburndale, Mass.

Robert H. Brown, 47 Stinson Place, Windsor, Conn.

Arnold G. Carey, 85 School Street, Melrose, Mass.

Donald L. Cummings, 92 Ballou Street, Milton, Mass.

Stephen E. Dore, Jr., 1 DeWitt Avenue, Canton, Mass.

Gordon B. Hansen, 103 Sargent Street, Melrose, Mass.

John F. Heaney, 1631 Granger Avenue, Ann Arbor, Michigan

C. Frank Johnson, 74 Webster Street, N. Quincy, Mass.

John D. M. Luttman-Johnson, 49 Grozier Road, Cambridge, Mass.

Alexander E. Manning, 289 Thacher Street, Milton, Mass.

James C. Roberts, 17 Sycamore Lane, Hingham, Mass.

Juniors

David I. Lowell, P.O. Box 1554, New Haven, Conn.

DEATHS

ARTHUR W. FRENCH, May 27, 1949

CHARLES R. GOW, July 29, 1949

FRANK O. HOLMES, June 17, 1949

FRANCIS R. MACLEAY, July 21, 1949

OSWELL F. MANN, April 18, 1949

ANNUAL REPORTS

1948-49

(Supplement to those published in the April 1949 Journal)

REPORT OF COMMITTEE ON RELATIONS OF SECTIONS TO THE MAIN SOCIETY

Boston, Mass., March 8, 1949

To the Board of Government
Boston Society of Civil Engineers:

Two meetings of the Committee on "Relations of Sections to the Main Society" were held during the year.

Following the first meeting on May 28, 1948, a report was drafted under date of August 24, 1948 and submitted to the Board of Government. This report was discussed by the Board on October 4, and returned to the committee for minor modifications.

A second meeting of the committee was held on January 22, 1949 which resulted in considerable revision of the original report and some important additions.

The report, a copy of which is attached hereto, and hereby made a part of this report, was submitted to the Board of Government under date of February 8, 1949.

Respectfully submitted,

OLIVER G. JULIAN, *Chairman*

To the Board of Government
Boston Society of Civil Engineers:

A meeting of the committee was held on Saturday, January 22, 1949 from 10.15 a.m. to 2:30 p.m. The following members were present: Pres. Frederic N. Weaver, Charles M. Anderson, Allen J. Burdoin, William J. Downey and Committee Chairman Oliver G. Julian.

R. Newton Mayall and John G. W. Thomas were absent. They were contacted by telephone and both expressed general agreement with the preliminary report which was submitted to the Board of Government under date of August 24, 1948.

It was unanimously decided that a quorum was present, and Allen J. Burdoin was designated secretary.

As the result of considerable discussion, the following was agreed upon.

1. A considerable period of time has elapsed since the first section was founded in 1904. This period has been one of growth and evolution, with the result that irrespective of whatever purposes the members of the Society may have had in mind in founding the Sections, we should not necessarily be bound by those purposes, but should look at the situation as it exists today and from that viewpoint reappraise the purpose and functions of the Sections and the Main Society.

When we do this, we find five sections, each covering a broad field of civil engineering, and one active student section. We may conclude, therefore, that each section is composed of those members of the Main Society having a common interest in one of the specialized fields of civil engineering, and that the activities and meetings of the sections should be designed to foster and encourage such special knowledge. On the other hand, the meetings of the main society should be concerned with matters of general interest to the entire membership, including the promotion of social intercourse between members.

2. Dues of Student Members are believed to be out of line with dues of students in other societies such as the American Society of Civil Engineers. It is recommended that the dues of Students be reduced to a nominal figure, say $1 per year per student member or alternatively $10 per year per student section. It is believed that this would encourage the formation of additional active Student Sections and more students to become Student Members and ultimately Members of the Society. Student sections at various institutions might hold joint meetings among themselves.

3. To promote the special interests of the sections, it will be desirable to obtain some of our speakers from out of town. When this is done, we should offer outright to pay the speaker's expenses, and be ready to pay if called. Letters to prospective speakers should contain a statement reading approximately as follows—"The Boston Society of Civil Engineers, of course, will expect to reimburse you for expenses incident to this talk." It is suggested that the Society maintain a fund of at least $500 for this purpose. (Attention is invited to report of previous Committee on Relations of Sections to the Main Society dated December 11, 1944.)

4. In regard to Joint Meetings of Sections with the Main Society, it was held that they are in general desirable. It was pointed out that care was needed in selecting speakers for joint meetings, since the subject while falling naturally in the field covered by the section, should be so presented as to be interesting to the entire membership. It was further held that no jealousy should exist in case one section had more joint meetings with the Main Society than others, and that the Main Society should not consider this point in arranging its program. In regard to the feeling that there are too many meetings, the thought was advanced that this springs from the feelings of some members that out of loyalty they are duty bound to attend all the meetings of the Main Society and the Sections of which they are members. This would undoubtedly be a burden. It should not be incumbent on anyone to attend any meetings which do not interest him, but it is incumbent on the Sections and the Main Society to provide a program of meetings which shall interest as many as possible.

5. Special care should be taken to avoid conflict of meeting dates with other engineering, scientific and architectural societies.

6. The section chairmen should promote the preparation and publication of worthy prepared discussions of papers presented at section meetings. To this end, preprints of the papers, where suitable, should be made available to the Members either by prior publication in the JOURNAL, by the actual setting in type and publication of preprints, by the mimeographing of papers, or as a minimum, the submission of typewritten copies to several members of the sections (or others) who are well qualified to discuss the paper. This may entail substantial expense, since in some cases it may not be practicable to obtain a copy of the paper from the author in time for publication in the JOURNAL. Ample funds should be made available by the Society for this purpose.

7. It should be the duty of the section chairmen in cooperation with the Publication Committee to follow up on worthy papers and discussions presented at section meetings and urge their submission in form for publication. The first page of each paper published should bear a footnote reading approximately as follows: "Note—Written comments are invited for publication; to be considered for publication the last discussion should be submitted by ....." The final discussion should be "a closure" by the author of the original paper.

8. A paper before the Society or the Section should deliver an engineering or scientific message, preferably along original lines and should not be sales propaganda for any special product or material such as lumber, cement, steel, aluminum, admixtures, sewage plant equipment, etc., etc.

9. Every paper and discussion published in the JOURNAL should be "experted" (as is done by some other societies) by some one connected with the appropriate section. This applies to papers presented at Main Society meetings as well as section meetings. (See "#6. Duties of Officers." Paragraph 6 of By-laws amended to December 16, 1943.) For this purpose, it is recommended either that the sections be represented on the publications committee, or that active liaison be established between the publication committee and the executive committees of the sections. All papers and discussions should be carefully edited by the Editor of the JOURNAL and reviewed by the authors prior to publication. Special attention should be given to clarity of cuts and figures. A special effort should be made to have the JOURNAL delivered to members, exchanges, advertisers and others on time.

If the volume of worthy papers and discussions warrant, the JOURNAL should be issued at more frequent intervals.

10. We recommend that a section of the JOURNAL be instituted similar to sections entitled "Current Periodical Literature" in *Civil Engineering,* and "Current Reviews" in the *Journal of the American Concrete Institute,* and *Applied Mechanics Reviews* published by the American Society of Mechanical Engineers. Such a section would contain under appropriate heading, notices of books, articles in the technical press, new instruments, government reports, etc., of interest to members. We recommend that the section chairmen be responsible for supplying the publication committee with information on the above topics of interest to their sections. We suggest, furthermore, that the publication committee appoint one member of the society to consolidate and edit the material received.

11. There are a number of bodies of a research nature with which the society should be in contact either through society membership or duly appointed representatives such as the—

Column Research Council
Welding Research Council
International Congress on Large Dams
International Conference on Soil Mechanics and Foundation Engineering, etc.

It should be the duty of section chairmen from time to time to bring these matters to the attention of the Board of Government for action.

12. Each section should be represented on the Library Committee.

13. We believe there are a number of collateral benefits available to members of the B.S.C.E. which many younger members do not know about, such as the fact that members are entitled to cards on the Boston Public Library, and there may be others. We believe suitable publicity should be given to these benefits.

14. We believe furthermore that the great advantage of membership in the Boston Society over other societies lies in the opportunities for intimate acquaintance obtained through sharing in the work of the various committees and sections of the Society. Viewed from this standpoint, the sections are a real asset to the Society on account of the opportunities for work which they provide their members.

15. We believe that the section chairmen, on account of their special knowledge of one of the fields of civil engineering and of the individuals working therein, can be of great benefit to the Main Society. We believe that to unlock this knowledge, they should be consulted more frequently than in the past, especially by the Secretary and President in the matter of committee appointments.

16. Reports of committee meetings if suitable should be published in the JOURNAL promptly. Discussions of these reports should be invited by conspicuous notices in the JOURNAL. Discussions, if suitable, should be published.

17. This committee as it is presently constituted since it consists of the Society President and Section Chairmen who hold office for but one year lacks continuity. The members of the committee believe that some way of providing continuity is highly desirable. A suggestion that continuity be provided by appointing the current chairman a member of the succeeding years' committee passed unanimously (the chairman not voting).

REPORT OF COMMITTEE ON SUBSOILS OF BOSTON

Boston, Mass., March 16, 1949

To the Board of Government
Boston Society of Civil Engineers:

During the past year the Committee on Subsoils of Boston has continued work started during the previous year on preparing boring data for publication.

It is expected that the first section of data, covering the Boston peninsula, will be published soon in the JOURNAL of the Society. Good progress has been made on the preparation of the next two sections.

Respectfully submitted,

DONALD W. TAYLOR, *Chairman*

REPORT OF COMMITTEE ON QUARTERS

Boston, Mass., March 16, 1949

To the Board of Government
Boston Society of Civil Engineers:

This Committee was continued from the previous year. At the time of the last annual meeting new quarters for the Society at the Boston City Club were being investigated. Two locations were considered. One, three rooms now used as bedrooms on the ninth floor near the entrance to the large hall. These were found to be too small for the Society's needs. Another location in the City Club, in the long room opposite the main hallway on the second floor was also investigated but it was found to be unsatisfactory.

No further new quarters have been considered by the Committee. It considers that during the past few years all suitable opportunities have been investigated but this does not mean that at some later date others may not appear. It has confined its recent activities to consideration of the possible improvements in the present quarters at Tremont Temple. This investigation is not yet complete. It recommends that a committee on quarters be appointed to continue it.

Respectfully submitted,

HOWARD M. TURNER, *Chairman*

REPORT OF COMMITTEE ON INSURANCE

Boston, Mass., March 3, 1949

To the Board of Government
Boston Society of Civil Engineers:

The Insurance Committee of the Boston Society of Civil Engineers has taken no action during the past year and therefore will have no report to present.

It is suggested that Mr. Cobb, who, we understand, will be on the incoming Board of Directors, be appointed on the Insurance Committee for the coming year, as this Committee was originally formed as a result of his studies into the need for insurance.

Respectfully submitted,

FRANK L. FLOOD, *Chairman*

REPORT OF COMMITTEE ON COMPETITIVE BIDDING, FOR ENGINEERING SERVICES

Boston, Mass., March 16, 1949

To the Board of Government
Boston Society of Civil Engineers:

Our Committee's report for last year stated the results of a survey which the Committee conducted in order to determine the attitude of Massachusetts Municipalities toward competitive bidding for professional engineerng services.

The work of the Committee has been continued during the year for the purpose of preparing a statement of proper procedures for obtaining professional engineering services, and also to suggest steps by means of which to inform municipalities and their legal counsel regarding this subject.

The Committee has held several meetings and has prepared the accompanying memorandum entitled "Recommended Procedure for Securing Professional Engineering Services by Public Authorities."

The Committee makes the following recommendations:

(1) That the statement be approved and its publication be authorized either by the Board of Government or by the Main Society.

(2) That funds be allotted to print a suitable number of copies of the statement and the Committee be authorized to procure the same and mail them to the proper Municipal and State officials.

Respectfully submitted,

RALPH W. HORNE, *Chairman*

RECOMMENDED PROCEDURE FOR SECURING PROFESSIONAL ENGINEERING SERVICES BY PUBLIC AUTHORITIES

Engineering services are personal services and are professional in their nature, like the service of doctors and lawyers. Engineering services should be employed on the basis of competence, integrity and mutual confidence between the public authority and the engineer. These conditions may not be fulfilled if the engineering service is selected on a price basis. Competitive price bids lose their significance unless based on precise specifications; and these cannot be written for the intangible qualities of training, experience, ability, judgment and integrity required of the engineering profession.

Consequently, it is contrary to the best public interests to procure professional engineering services on the basis of competitive prices, as practiced by a few municipalities; because this implies an obligation to employ the low bidder regardless of whether he is best qualified.

One of the principal reasons for obtaining competitive prices is the belief that the law so requires. However, the courts have ruled that competitive bidding for professional services is not required. (See McQuillan on Municipal Corporations, Vol. 2, sec. ed. Revised, p. 1182, sec. 1292). Furthermore, the results of a survey completed last year by the Boston Society of Civil Engineers, by means of questionnaires sent to the legal counsel of all Massachusetts Municipalities having a population of 5,000 or more, showed that over 90 per cent of those who replied did not interpret their municipal ordinances to require competitive bidding for professional engineering services.

Most public works projects must start with a preliminary engineering investigation and report upon the need, the functional design, and extent of the project, the cost of construction and operation, methods of financing and assessment of costs. Since the preliminary investigation may set the pattern for the ultimate success or failure of a project, it is deserving of engineering of the highest order. It is of utmost importance to the public that the cost of the preliminary studies should not be a condition in selecting the engineer for a project.

The fee for professional engineering services is but a very small part of the cost of a project and the difference in the fees charged by a competent and by an incompetent engineer can be saved many times over in the entire project cost, if the project is well conceived and well executed.

It is to the best interest of the public for a governmental agency which does not already have satisfactory engineering associations to engage professional engineering services by the following procedure:

1. Determine by inquiry from properly informed sources the names of one or more engineers or engineering firms who may be qualified and available for the particular engagement.
2. Interview one or more of said engineers and examine his or their qualifications.
3. Select one engineer and negotiate with him an agreement as to the nature and extent of the services to be rendered and the basis of payment. If a question arises as to the reasonableness of the fees to be charged, the Public Authority should seek advice from recognized authorities such as the American Society of Civil Engineers. If an initial agreement for engineering services upon a project is limited to a preliminary investigation and report, then the agreement should commit the engineer as to availability and as to limiting fees, in case complete professional engineering services are desired at a later date.

MINORITY REPORT

Boston, Mass., March 16, 1949

To the Board of Government
Boston Society of Civil Engineers:

While I am in general agreement with the Report of the majority of the Committee, I do not feel that the three paragraphs on page two of the recommended procedure have sufficient "punch". Paragraph (1) states:

> "Determine by inquiry from properly informed sources the names of one or more engineers or engineering firms who may be qualified and available for the particular engagement."

To my mind this implies that a public authority should contact several engineers before engaging anyone, although it may not have been their practice to do so in the past. The same thought is given in a resolution of the A.S.C.E. and I believe this wording is much better than that in the proposed recommendation. I believe that the resolution of the A.S.C.E. has much more force to it and suggest that resolution, based on the A.S.C.E.'s resolution be substituted for the three paragraphs on page w of the Committee's recommended procedure.

I do not think the resolution adopted by the American Society of Civil Engineers, and quoted in a letter from George T. Seabury, Secretary to Mr. Henry W. Taylor, dated March 28, 1938, can be improved upon and suggest that a similar resolution be adopted by the Boston Society of Civil Engineers and copies forwarded to the proper municipal officers of the principal cities and towns in New England and elsewhere, as the Society may deem expedient.

Accordingly, I am submitting this minority report in which I have indicated by underlining several minor suggested revisions so that it may be compared with the majority report and recommend:

(1) That the attached recommended procedure and resolution be approved and its publication authorized either by the Board of Government or by the Main Society.

(2) That funds be allotted to print a suitable number of copies of the statement and resolution, and that the Committee be authorized to procure the same and mail them to the proper municipal and state officials.

Respectfully submitted,

GEORGE W. COFFIN

Boston, Mass., March 16, 1949

RECOMMENDED PROCEDURE FOR SECURING PROFESSIONAL ENGINEERING SERVICES BY PUBLIC AUTHORITIES

Engineering services are personal services and are professional in their nature, like the service of doctors and lawyers. (Engineering services) *Engineers* should be employed on the basis of competence, integrity and mutual confidence between the public authority and the engineer. These conditions may not be fulfilled if the (engineering service) *engineer* is selected on a price basis. Competitive price bids lose their significance unless based on precise specifications; and these cannot be written for the intangible qualities of training, experience, ability, judgment and integrity required of the engineering profession.

Consequently, it is contrary to the best public interests to procure professional engineering services on the basis of competitive prices, as practiced by a few municipalities; because this implies an obligation to employ the low bidder regardless of whether he is best qualified.

One of the principal reasons for obtaining competitive prices is the belief that the law so requires. However, the courts have ruled that competitive bidding for professional services is not required. (See McQuillan on Municipal Corporations, Vol. 2, sec. ed. Revised, p. 1182, sec. 1292). Furthermore, the results of a survey completed last year by the Boston Society of Civil Engineers, by means of questionnaires sent to the legal counsel of all Massachusetts Municipalities having a population of 5,000 or more, showed that over 90 per cent of those who replied did not interpret their municipal ordinances to require competitive bidding for professional engineering services.

Most public works projects must start with a preliminary engineering investigation and report upon the need, the functional design, and extent of the project, the cost of construction and operation, methods of financing and assessment of costs. Since the preliminary investigation may set the pattern for the ultimate success or failure of a project, it is deserving of engineering of the highest order. It is of utmost importance to the public that the cost of the preliminary studies should not be (a) *the only* condition in selecting the engineer for (a) *the* project.

The fee for professional engineering services is but a very small part of the cost of a project and the difference in the fees charged by a competent and by an incompetent engineer can be saved many times over in the entire project cost, if the project is well conceived and well executed.

Proposed resolution:

"WHEREAS, the Board of Government of the Boston Society of Civil Engineers has had brought to its attention the fact that on occasions, Public Authorities ask Engineers through advertisements or otherwise to submit in competition their terms for preparing plans for engineering projects, frequently requesting that such tenders be accompanied by an estimate of the cost of the proposed project, and,

"WHEREAS, such procedure is not in the public interest, it being contrary to recognized practice in engaging professional services, thereby asking of engineers a form of competition inconsistent with professional ethics, and consequently tending to eliminate the services of qualified engineers of high professional character, therefore be it

"RESOLVED, That the Boston Society of Civil Engineers emphatically records its disapproval of such procedure, and recommends that Public Authorities and others desiring to secure professional engineering services select an engineer from those available, on the basis of his qualifications, experience and professional reputation for work of the size and character under consideration, determining by inquiry of recognized professional authority, the appropriate basis of compensation for such services."

Respectfully submitted,

GEORGE W. COFFIN

The above recommended procedure is the same as in the majority's Report except for that in *italics* with the substitution of the proposed resolution for the last three paragraphs.

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OF

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VOLUME XXXVI

1949

CONTENTS AND INDEX

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CONTENTS

VOLUME 36, 1949

No. 1. JANUARY

PAGE

The Proposed Redevelopment of the Water Power of the Connecticut River at Wilder, Vermont. *E. G. Lee.* 1
Historical Development of Subaqueous Tunneling. *Ole Singstad.* . . . 34
The Water Supply Tunnels of the Boston Metropolitan District. *Karl R. Kennison.* 44
Headaches from Treatment of Combined Industrial Wastes and Sewage. *Stuart E. Coburn.* 64
Discussion. *Joseph A. McCarthy.* 71
Discussion. *Clair N. Sawyer.* 74
Design Features of Clark Hill Dam and Power Plant. *Robert R. Colburn.* 78
Of General Interest:
Status and Trends of Laboratory Investigations of Soils as Evidenced by the Proceedings of the Second International Conference on Soil Mechanics and Foundation Engineering. *W. J. Turnbull.* . 100
Improvements of the Mechanical Properties of Soil by Mechanical Methods. *Frank A. Marston.* 116
Proceedings of the Society. 121

No. 2. APRIL

The Second Hundred Years. Presidential Address at the Annual Meeting. *Frederic N. Weaver.* 129
Concrete Deterioration Due to Carbonic Acid. *Ruth D. Terzaghi.* . 136
Discussion. *Walter C. Voss.* 153
Discussion. *Herman G. Protze.* 154
Closing Discussion. *Ruth D. Terzaghi.* 158
Historical Background of the Blackstone Valley Sewer District. *Charles G. Hammann.* 161
The Proposed Blackstone Valley Sewage and Wastes Collection System and Treatment Works. *E. Sherman Chase.* 165
Soil Mechanics in the Design and Construction of the Logan Airport. *A. Casagrande.* 192
Ground Vibration Due to Blasting and Its Effect Upon Structures. *F. J. Crandell.* 222
Of General Interest:
Proceedings of the Society. 246
Annual Reports 258

No. 3. JULY

Localized Buckling of Structural Members. *Charles H. Norris.* . . 281
Discussion. *Eric Reissner.* 301
Discussion. *Albert Haertlein.* 302
Discussion. *John B. Wilbur.* 303
Discussion. *Dean Peabody, Jr.* 304
Discussion. *Julius Lasker.* 305
Closing Discussion. *Charles H. Norris.* 306
Water Power Storage in Maine. *Howard M. Turner.* 309
Recent Developments Concerning Timber Trusses. *James H. Carr, Jr.* . 334
Discussion. *Frederic N. Weaver.* 347
Discussion. *Ernest L. Spencer.* 348
Closing Discussion. *James H. Carr, Jr.* 356
Pollution of the Androscoggin River by Industrial Wastes and Control Measures Thereof. *E. Sherman Chase.* 357
Of General Interest:
Inspection of Logan Airport. *W. L. Hyland.* 382
Proceedings of the Society. 383

No. 4. OCTOBER

Boring Data from Greater Boston, Section 1: Boston Peninsula. *Committee on Subsoils of Boston.* 391
The Limestone Air Force Base.
Design and Construction of Runways, Taxiways, and Parking Apron. *John E. Allen.* 458
Drainage, Water Supply and Sewerage. *Elliot F. Childs.* . . . 466
Buildings. *John Wm. Leslie.* 476
Colonel Charles Rice Gow. *John P. Wentworth.* 483
Of General Interest:
Proceedings of the Society. 486
Annual Reports. 492

INDEX

VOLUME 36, 1949

Names of Authors are printed in *italics*.

Address at Annual Meeting. The Second Hundred Years. *Frederic N. Weaver.* . . . . . April, 129
Allen, John E. Memoir. . . . . Oct., 458
Androscoggin River, Pollution of, by Industrial Wastes and Control Measures Thereof. *E. Sherman Chase.* . . July, 357
Airport, Soil Mechanics in the Design and Construction of the Logan. *A. Casagrande.* . . . . . April, 192
Airport, Inspection of Logan. *W. L. Hyland.* . . . . July, 382

Blackstone Valley, The Proposed Sewage and Wastes Collection System and Treatment Works. *E. Sherman Chase.* . April, 165
Blackstone Valley, Historical Background of the, Sewer District. *Charles G. Hammann.* . . . . . April, 161
Boring Data from Greater Boston. Section 1: Boston Peninsula. *Committee on Subsoils of Boston.* . . . . Oct., 391

Carr, *James H. Jr.* Recent Developments Concerning Timber Trusses. . . . . July, 334
Casagrande, Arthur. Soil Mechanics in the Design and Construction of the Logan Airport. . . . . April, 192
Chase, E. Sherman. The Proposed Blackstone Valley Sewage and Wastes Collection System and Treatment Works. April, 165
Chase, E. Sherman. Pollution of the Androscoggin River by Industrial Wastes and Control Measures Thereof. . . July, 357
Childs, Elliot F. The Limestone Air Force Base. Drainage, Water Supply and Sewerage. . . . . Oct., 466
Coburn, Stuart E. Headaches from Treatment of Combined Industrial Wastes and Sewage. . . . . Jan., 64
Colburn, Robert T. Design Features of Clark Hill Dam and Power Plant. . . . . Jan., 78
Concrete Deterioration Due to Carbonic Acid. *Ruth D. Terzaghi.* . . . . . April, 136
Crandell, F. J. Ground Vibration Due to Blasting and Its Effect Upon Structures. . . . . April, 222

Design Features of Clark Hill Dam and Power Plant. *Robert T. Colburn.* . . . . . Jan., 78

Ground Vibration Due to Blasting and Its Effect Upon Structures. *F. J. Crandell.* . . . . . April, 222
Gow, Colonel Charles Rice. Memoir. . . . . Oct., 483

Haertlein, *Albert.* Discussion, Localized Buckling of Structural Members. . . . . July, 281
Hammann, Charles G. Historical Background of the Blackstone Valley Sewer District. . . . . April, 161
Headaches from Treatment of Combined Industrial Wastes and Sewage. *Stuart E. Coburn.* . . . . . Jan., 64
Historical Development of Subaqueous Tunneling. *Ole Singstad.* . . . . . Jan., 34
Historical Background of the Blackstone Valley Sewer District. *Charles G. Hammann.* . . . . . April, 161
Hyland, W. L. Inspection of Logan Airport. . . . . July, 382

Improvements of the Mechanical Properties of Soil by Mechanical Methods. *Frank A. Marston.* . . . . Jan., 116

Kennison, *Karl R.* The Water Supply Tunnels of the Boston Metropolitan District. . . . . Jan., 44

Lasker, *Julius.* Discussion, Localized Buckling of Structural Members. . . . . July, 305
Lee, E. G. The Proposed Redevelopment of the Water Power of the Connecticut River at Wilder, Vermont. . . . Jan., 1
Leslie, John Wm. The Limestone Air Force Base. Buildings. . Oct., 476
Limestone Air Force Base, The.
Design and Construction of Runways, Taxiways and Parking Apron. *John E. Allen.* . . . . . Oct., 458
Drainage, Water Supply and Sewerage. *Elliot F. Childs.* . Oct., 466
Buildings. *John Wm. Leslie.* . . . . . Oct., 476
Localized Buckling of Structural Members. *Charles H. Norris.* . July, 281
Logan Airport. Soil Mechanics in the Design and Construction of. *A. Casagrande.* . . . . . April, 192
Logan Airport, Inspection of. *W. L. Hyland.* . . . . July, 382

Marston, *Frank A.* Improvements of the Mechanical Properties of Soil by Mechanical Methods. . . . . Jan., 116
Metropolitan District, The Water Supply Tunnels of. *Karl R. Kennison.* . . . . . Jan., 44
McCarthy, Joseph A. Discussion, Headaches from Treatment of Combined Industrial Wastes and Sewage. . . . Jan., 71

Norris, *Charles H.* Localized Buckling of Structural Members. . July, 281

Peabody, *Dean, Jr.* Discussion, Localized Buckling of Structural Members. . July, 304
Pollution of the Androscoggin River by Industrial Wastes and Control Measures Thereof. *E. Sherman Chase.* . . July, 357
Power Plant, Design Features of Clark Hill Dam and. *R. T. Colburn.* . . . . . Jan., 78
Proposed Redevolopment of the Water Power of the Connecticut River at Wilder, Vermont. *E. G. Lee.* . . . . Jan., 1
Proposed Blackstone Valley Sewage and Wastes Collection System and Treatment Works. *E. Sherman Chase.* . . April, 165
Protze, Herman G. Discussion, Concrete Deterioration Due to Carbonic Acid. . . . . April, 154

Recent Developments Concerning Timber Trusses. *James H. Carr, Jr.* . . . . . July, 334
Reissner, Eric. Discussion, Localized Buckling of Structural Members. . . . . July, 281

S*awyer, Clair N.* Discussion, Headaches from Treatment of Combined Industrial Wastes and Sewage. . . . . Jan., 74
Sewage, Headaches from Treatment of Combined Industrial Wastes and. *Stuart E. Coburn.* . . . . . Jan., 64
Singstad, Ole. Historical Development of Subaqueous Tunneling. . . . . Jan., 34
Soil Mechanics in the Design and Construction of the Logan Airport. *A. Casagrande.* . . . . . April, 192
Spencer, Ernest L. Discussion, Recent Developments Concerning Timber Trusses. . . . . July, 348
Status and Trends of Laboratory Investigations of Soils as Evidenced by the Proceedings of the Second International Conference on Soil Mechanics and Foundation Engineering. *W. J. Turnbull.* . . . . . Jan., 100
Subsoils of Boston, Committee Report on. Boring Data from Greater Boston. Section 1: Boston Peninsula. . . . Oct., 391

T*erzaghi, Ruth D.* Concrete Deterioration Due to Carbonic Acid. . . . . April, 136
Timber Trusses, Recent Developments Concerning. *James H. Carr, Jr.* . . . . . July, 334
Tunneling, Historical Development of Subaqueous. *Ole Singstad.* . . . . . Jan., 34
Tunnels, Water Supply of the Boston Metropolitan District. *Karl R. Kennison.* . . . . . Jan., 44
Turnbull, W. J. Status and Trends of Laboratory Investigations of Soils as Evidenced by the Proceedings of the Second International Conference on Soil Mechanics and Foundation Engineering. . . . . Jan., 100
Turner, Howard M. Water Power Storage in Maine. . . . July, 309

V*oss, Walter C.* Discussion, Concrete Deterioration Due to Carbonic Acid. . . . . April, 153

Water Supply Tunnels of the Boston Metropolitan District. *Karl R. Kennison.* . . . . . Jan., 44
Water Power Storage in Maine. *Howard M. Turner.* . . . . July, 309
Weaver, Frederic N. Discussion, Recent Developments Concerning Timber Trusses. . . . . July, 347
Wilbur, John B. Discussion, Localized Buckling of Structural Members. . . . . July, 281

PROFESSIONAL SERVICES AND ADVERTISEMENTS

The advertising pages of the JOURNAL aim to acquaint readers with Professional and Contracting Services and Sources of Various Supplies and Materials. You would find it of advantage to be represented here.

Volume 36 OCTOBER, 1949 Number 4

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PROFESSIONAL SERVICES

PAGE

LISTED ALPHABETICALLY . . . . . iii & iv

INDEX TO ADVERTISERS

ALGONQUIN ENGRAVING CO., 18 Kingston St., Boston v
BUILDERS-PROVIDENCE, INC., Providence 1, R. I. xii
CHAPMAN VALVE MFG. CO., 165 Congress St. vi
CRANDALL DRY DOCK ENGINEERS, 238 Main St., Cambridge v
ELLIS, W. H. & SON CO., East Boston v
EVERSON MANUFACTURING CO., 214-6 W. Huron St., Chicago ix
GALE OIL SEPARATOR CO., INC., 52 Vanderbilt Ave., New York xi
HARDINGE CO., INC., 240 Arch St., York, Pa. ix
HAWKRIDGE BROS., 303 Congress St., Boston vii
HEFFERNAN PRESS, 150 Fremont St., Worcester xii
HUGHES, EDWARD F., COMPANY, 53 State St., Boston ix
IRVING SUBWAY GRATING CO., INC., 5097 - 27 St., Long Island City, N. Y. . . ix
JOHNSON, ANDREW T., CO., 15 Tremont Place, Boston xi
MAKEPEACE, B. L., INC., 1266 Boylston St., Boston xii
MULCARE, THOMAS, CORP., 66 Western Ave., Boston vii
NAWN, HUGH, INC., 77 Floydell St., Boston viii
NEW ENGLAND CONCRETE PIPE CORP., Newton Upper Falls, Mass. viii
NEW ENGLAND POWER SERVICE COMPANY, 441 Stuart St., Boston vi
NORTHERN STEEL COMPANY, 44 School St., Boston vi
O'CONNOR, THOMAS, & CO., 238 Main St., Cambridge v
OLD COLONY CRUSHED STONE CO., Quincy, Mass. viii
PACIFIC FLUSH TANK CO., 4241 Ravenswood Ave., Chicago x
PIPE FOUNDERS SALES CORP., 6 Beacon Street, Boston vi
PITTSBURGH PIPE CLEANER CO., 308-9 United Bldg., Boston xii
RAYMOND CONCRETE PILE CO., Park Square Building, Boston viii
STUART, T., & SON COMPANY, 70 Phillips St., Watertown vii
VOLPE CONSTRUCTION CO., 54 Eastern Ave., Malden xi
WARREN FOUNDRY & PIPE COMPANY, 55 Liberty St., N. Y. vii
WEST END IRON WORKS, Cambridge xi

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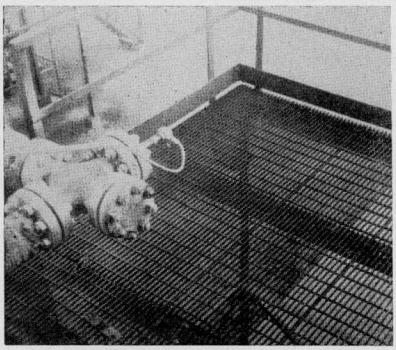

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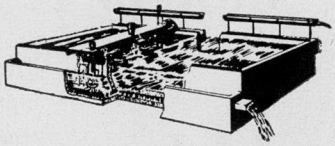

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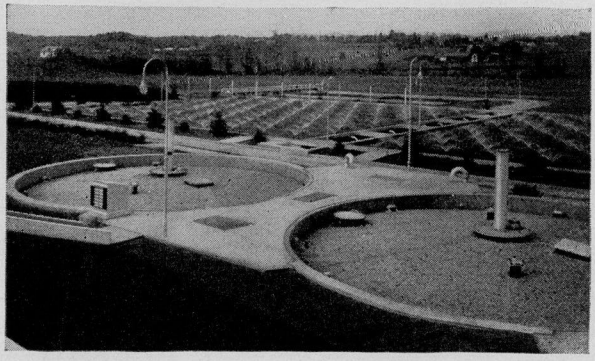

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