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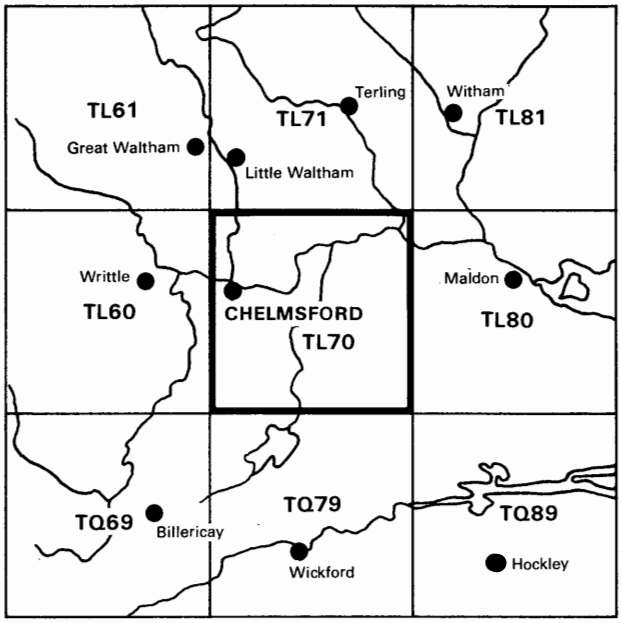

The sand and gravel resources of the country east of Chelmsford, Essex

Description of 1:25 000 resource sheet TL 70

M. R. Clarke, BSc

London Her Majesty's Stationery Office 1975

The Institute of Geological Sciences was formed by the incorporation of the Geological Survey of Great Britain and the Museum of Practical Geology with Overseas Geological Surveys and is a constituent body of the Natural Environment Research Council.

The first twelve reports on the assessment of British sand and gravel resources appeared in the Report Series of the Institute of Geological Sciences as a subseries. Report No. 13 onward will appear in the Mineral Assessment Report Series of the Institute. Details of published reports appear at the end of this report.

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PREFACE

National resources of many industrial minerals may seem so large that stocktaking appears unnecessary, but the demand for minerals and for land for all purposes is intensifying and it has become increasingly clear in recent years that regional assessments of the resources of these minerals should be undertaken. The publication of information about the quantity and quality of deposits over large areas is intended to provide a comprehensive factual background against which planning decisions can be made.

Sand and gravel, considered together as naturally occurring aggregate, was selected as the bulk mineral demanding the most urgent attention, initially in the south-east of England, where about half the national output is won and very few sources of alternative aggregates are available. Following a short feasibility project, initiated in 1966 by the Ministry of Land and Natural Resources, the Mineral Assessment Unit began systematic surveys in 1968. The work is now being financed by the Department of the Environment and is being undertaken with the cooperation of the Sand and Gravel Association of Great Britain.

This Report describes the resources of sand and gravel of 100 km^2 of country to the east of Chelmsford, shown on the accompanying 1:25 000 resource map TL 70. The survey was conducted by the late J. D. Ambrose, by A. R. Clayton and by N. E. Bradbury in 1968-69; additional survey was carried out by M. R. Clarke in 1972. The results of a feasibility study conducted in the area during 1967 are also included in this Report. The work is based upon a geological survey at the 1:10 560 scale, by C. R. Bristow and R. D. Lake (East Anglia and South-East England Field Unit) in 1966-70. Mr J. W. Gardner CBE (Land Agent) has been responsible for negotiating access to land for drilling. The ready cooperation of landowners and tenants is gratefully acknowledged.

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CONTENTS

ILLUSTRATIONS

Page

TABLES

Summary

The geological maps of the Institute of Geological Sciences, pre-existing borehole information, 58 boreholes drilled for the Mineral Assessment Unit and 38 boreholes drilled during a feasibility study form the bases of the assessment of sand and gravel resources in the Chelmsford area, Essex.

All deposits in the area which might be potentially workable for sand and gravel have been investigated and a simple statistical method has been used to estimate their volume. The reliability of the volume estimates is given at the two-sided 95 per cent confidence level.

The 1:25 000 map is divided into four resource blocks containing from 1.1 km^2 to 12.2 km^2 of sand and gravel. The geology of the deposits in each block is described. For three of the four blocks, a statistical assessment of the sand and gravel resources is made and the mineral-bearing areas, the mean thickness of overburden and mineral and the mean grading are given. For the fourth block, an inferred assessment of mineral resources is given. Detailed borehole data are also given.

The position of the boreholes and exposures, the geology and the outlines of the blocks are shown on the accompanying map TL 70.

Sommaire

Les sources des renseignements qui constituent les bases de l'évaluation des ressources en sable et en gravier dans la région de Chelmsford, Essex, comprennent les cartes géologiques de l'Institute of Geological Sciences, des données obtenues de trous de sonde déjà en existence 58 trous de sonde forés pour le Mineral Assessment Unit et 38 trous de sonde forés pendant une étude de practicabilité.

Dans la région tous les dépôts qui pourraient être exploités pour le sable et le gravier ont été étudiés et on s'est servi d'une méthode statistique simple pour en évaluer le volume. Les évaluations de volume sont tenues d'être à 95 pour cent exactes.

La carte 1:25 000 est divisée en quatre blocs de ressources avec d'entre 1.1 a 12.2 km^2 de sable et de gravier. Pour chaque bloc on décrit la géologie des dépôts. Pour trois des quatre blocs; on a fait une évaluation statistique des ressources en sable et en gravier, et on donne l'étendue du terrain mineralisé, l'épaisseur moyenne de recouvrement et de minéral, et les triages moyens. Pour le quatrième bloc on donne une evaluation estimée des ressources en minéral. On présente aussi des données détaillées des trous de sonde et des affleurements, la géologie et les profils des blocs sont montres sur la carte TL 70.

Zusammenfassung

Die geologischen Karten vom Institute of Geological Sciences vorher-existierende Information über Bohrlochern, 58 fur die Mineral Assessment Unit gebohrten Bohrlöcher, die während einer Moglichskeitsarbeit gebohrt waren, bilden den Grund für die Einschätzung der Sand- und Schottermittel im Chelmsford Gebiet, Essex.

Alle Ablagerung im Gebiet, die möglich bearbeitbar für Sand und Schotter sind, wurden untersucht, und eine einfache statistische Methode wurde benutzt, um das Volumen zu schötzen. Man gibt die Zuverlässigkeit der Volumen: schatzungen mit zweiseitegen 95 Prozent Vertravensgrenzwerten.

Man teilt die 1:25 000 Karte in 4 Mittelsblöcke, die von 1.1 km^2 von Sand und Schotter umfassen. Man beschreibt die Geologie von den Ablagerungen in jedem Block. Für drei aus den vier Blocken wird eine statistische Einschätzung der Sand- und Schottermittel gemacht, und die mineralhaltigen Gebiete, die mittlere Dicke von Überlastung und Mineral, und die mittlere Klassifizierung werden gegeben. Ausführliche Bohrlocherdaten werden auch gegeben.

Die Lage der Bohrlöcher und Aufschlüsse und die Skizzen der Blöcke werden auf der Begleitkarte TL 70 gegeben.

The sand and gravel resources of the country east of Chelmsford, Essex

Description of 1:25 000 resource sheet TL 70

M. R. CLARKE[1], BSc.

Introduction

The survey is concerned with the estimation of resources, which include deposits that are not currently exploitable but have a foreseeable use, rather than reserves, which can only be assessed in the light of current, locally prevailing, economic considerations. Clearly, both the economic and the social factors used to decide whether a deposit may be workable in the future cannot be predicted; they are likely to change with time. Deposits not currently economically workable may be exploited as demand increases, as higher grade or alternative materials become scarce, or as improved processing techniques are applied to them. The improved knowledge of the main physical properties of the resource and their variability which this survey seeks to provide, will add significantly to the factual background against which planning policies can be decided (Archer, 1969; Thurrell, 1971).

The survey provides information at the 'indicated' level "for which tonnage and grade are computed partly from specific measurements, samples or production data and partly from projection for a reasonable distance on geological evidence. The sites available for inspection, measurement, and sampling are too widely spaced to permit the mineral bodies to be outlined completely or the grade established throughout" (Anon., 1948, p. 15).

It follows that the whereabouts of reserves must still be established and their size and quality proved by the customary detailed exploration and evaluation undertaken by the industry. However, the information provided by this survey should assist in the selection of the best targets for such further work. The following arbitrary physical criteria have been adopted:

a. The deposit should average at least 1 m in thickness.
b. The ratio of overburden to sand and gravel should be no more than 3:1.
c. The proportion of fines (particles passing the No. 200 mesh BS sieve, about 1/16 mm) should not exceed 40 per cent.
d. The deposit must lie within 25 m of surface, this being taken as the likely maximum working depth under most circumstances. It follows from the second criterion that boreholes are drilled no deeper than 18 m if no sand and gravel has been proved.

If a deposit of sand and gravel broadly meets these criteria, it is regarded as 'potentially workable' and is described and assessed as 'mineral' in this report. As the assessment is at the indicated level, parts of such a deposit may not satisfy all the criteria.

For the particular needs of assessing sand and gravel resources, a grain-size classification based on the geometric scale 1/16 mm, 1/4 mm, 1 mm, 4 mm, 16 mm has been adopted. The boundaries between fines (that is, the clay and silt fractions) and sand, and between sand and gravel grade material, are placed at 1/16 mm and 4 mm respectively (see Appendix C).

The volume and other characteristics are assessed within resource blocks, each of which, ideally, contains approximately 10 km^2 of sand and gravel. No account is taken of any factors, for example, roads, villages and high agricultural or landscape value, which might stand in the way of sand and gravel being exploited, although towns are excluded. The estimated total volume therefore bears no simple relationship to the amount that could be extracted in practice.

> It must be emphasised that the assessment applies to the resource block as a whole. Valid conclusions cannot be drawn about the mineral in parts of a block, except in the immediate vicinity of the sample points.

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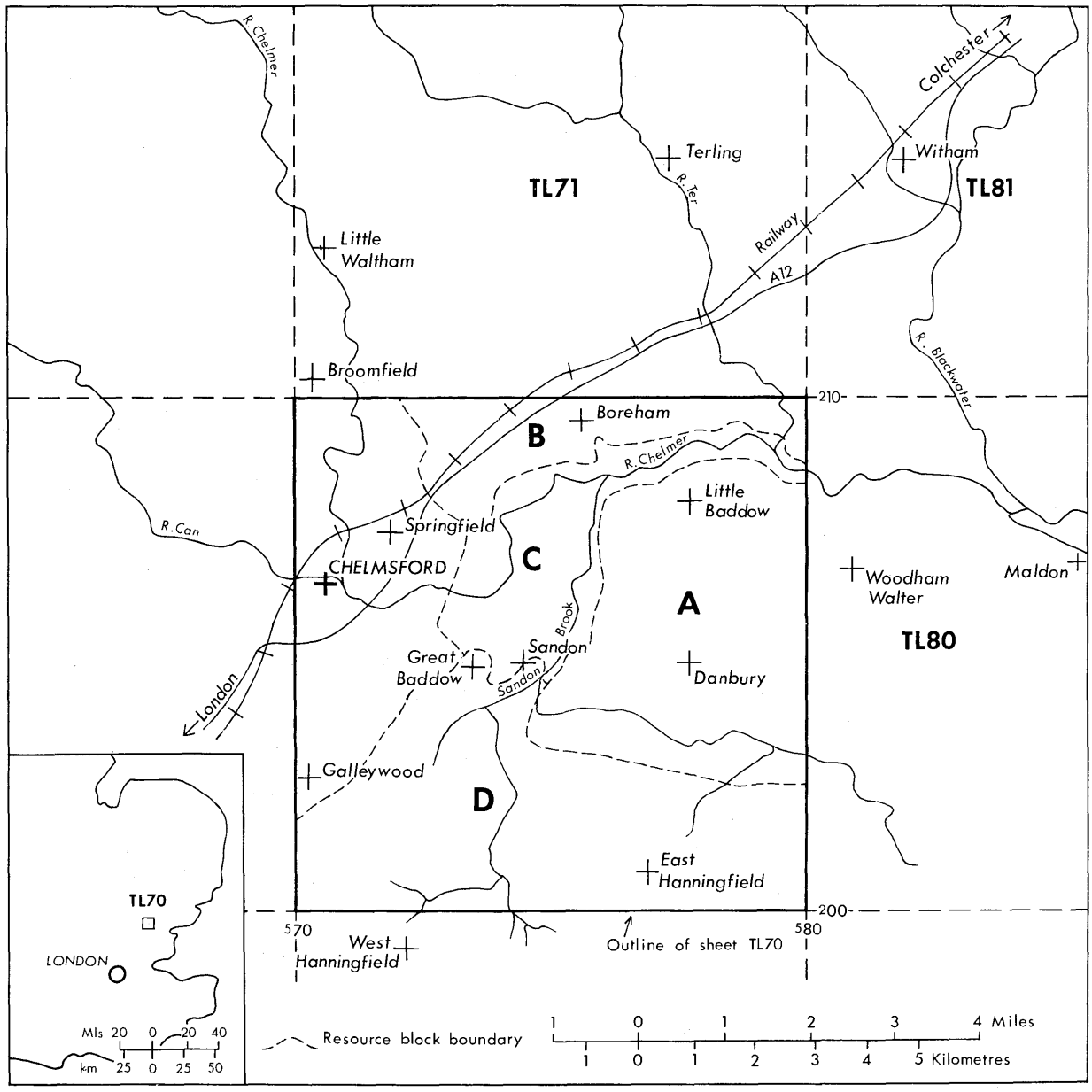


Fig. 1. Location sketch map for sheet TL 70, showing the resource block boundaries

Description of Sheet TL 70

GENERAL

Apart from the built-up urban area of Chelmsford (23.0 km^2), the county town of Essex, the area of sheet TL 70 is characterised by agricultural development. Small communities exist at Boreham, Sandon, Little Baddow, Danbury and East Hanningfield (Fig. 1). No significant quantities of mineral are present in the southern part of the sheet (32.3 km^2), but 28.9 km^2 of the remaining 44.7 km^2 (65 per cent) contains potentially workable deposits of sand and gravel (Table 3), which are divided into four resource blocks, outlined in Fig. 1.

A statistical assessment of the sand and gravel resources has been made for blocks A, B, and C, which comprise Danbury Gravels, Chelmsford Gravels and terrace and suballuvium gravels of the River Chelmer respectively. An inferred assessment is given for the deposits in block D which are smaller and geologically more complex than those seen elsewhere in the area.

TOPOGRAPHY

The sheet may be divided into three main physiographic units: the Chelmer valley, Danbury Hill and the plateau area to the south (Fig. 2).

The River Chelmer enters the area at Broomfield and flows southwards for approximately 2 miles before changing its course at Chelmsford, to flow eastwards across the northern part of the sheet area. Here, the river meanders across a broad floodplain, flanked by well developed terraces which stand at approximately 1.5 m (5 ft), 4.5 m (15 ft) and 9.1 m (30 ft) above the present-day alluvium. The valley is widest in the area between Sandon, Boreham and Springfield, where the flood plain lies at about +15.2 m OD (+50 ft OD). The river has been canalised along part of its course to form the Chelmer and Blackwater Navigation System, built in the eighteenth century to link the coastal port of Maldon with its hinterland. To the south-east of the Chelmer, the ground rises rapidly to form the northern and western slopes of Danbury Hill, reaching over +106.7 m (+350 ft) OD and forming a picturesque, well-wooded landmark. The detailed relief of Danbury Hill, comprising radial ridges and intervening ravines, appears to be largely controlled by the distribution and structure of the glacial sand and gravel deposits and their relation to the London Clay bedrock. The Danbury Hill feature is a detached part of the Danbury-Tiptree ridge (see Haggard, 1972).

On the southern side of Danbury Hill, the slopes are less steep and are interrupted by a small stream which flows westwards into Sandon Brook.

The predominantly clayey country in the southern part of the area is dissected by the northward-flowing tributaries of Sandon Brook. The land surface rises gently to form an undulating plateau at about +61.0 m OD (+200 ft OD), but attaining +91.4 m OD (+300 ft OD) in the south-west corner of the area, near West Hanningfield.

GEOLOGY

The geological classification of deposits seen in the area is given in Table 1; Eocene; deposits are overlain by Pleistocene and Recent drift deposits. Deep boreholes drilled in the area prove older Lower London Tertiary and Cretaceous strata below the London Clay, for example, borehole 241/141 drilled at Moulsham [705 040][1].

London Clay

London Clay, the oldest formation seen at outcrop, forms the bedrock over most of the sheet; Claygate and Bagshot beds occupy the remaining areas in the south (Fig. 3). The maximum thickness of London Clay proved within the sheet area is 125.9 m (413 ft) in borehole 241/127 at Stock [7054 0045] (see map), where the complete sequence of London Clay has been preserved beneath a cover of younger solid strata. Elsewhere the thickness of London Clay depends upon the amount removed by denudation and whether or not there is a protective capping of drift or solid strata (for example, see boreholes 241/97 and 241/118).

When unweathered, the London Clay is a stiff bluish-grey clay, silty in parts, with 'cementstone' nodules at some horizons. In the weathered zone, the clay becomes a firm, mottled, greyish-brown clay and at or near the surface is commonly an orange-brown colour. The depth of weathering varies considerably according to local conditions, but in boreholes is usually seen to range from about 0.9 m (3 ft) to 3.0 m (10 ft).

The contour map of the London Clay surface (Fig. 3), based upon borehole information and field evidence, indicates the extent of two buried channels proved in the area; one below the present-day Chelmer valley, the other near Sandon. A borehole [7435 0658] drilled for a road scheme in the Chelmer valley penetrated 50 m (164 ft) of channel-fill deposits consisting of soft grey silty clay and boulder clay, without proving bedrock. Similarly, excavations to a depth of over 18.3 m (60 ft) in the Sandon area, have not proved bedrock. Relatively large scale frost-heave phenomena have affected the London Clay surface and, in places, appear to control the distribution and structure of the drift deposits, as seen at St Clere's Hall Pit, Danbury [766 056]

1 National Grid References in this publication all lie within the 100 km grid square TL (52).

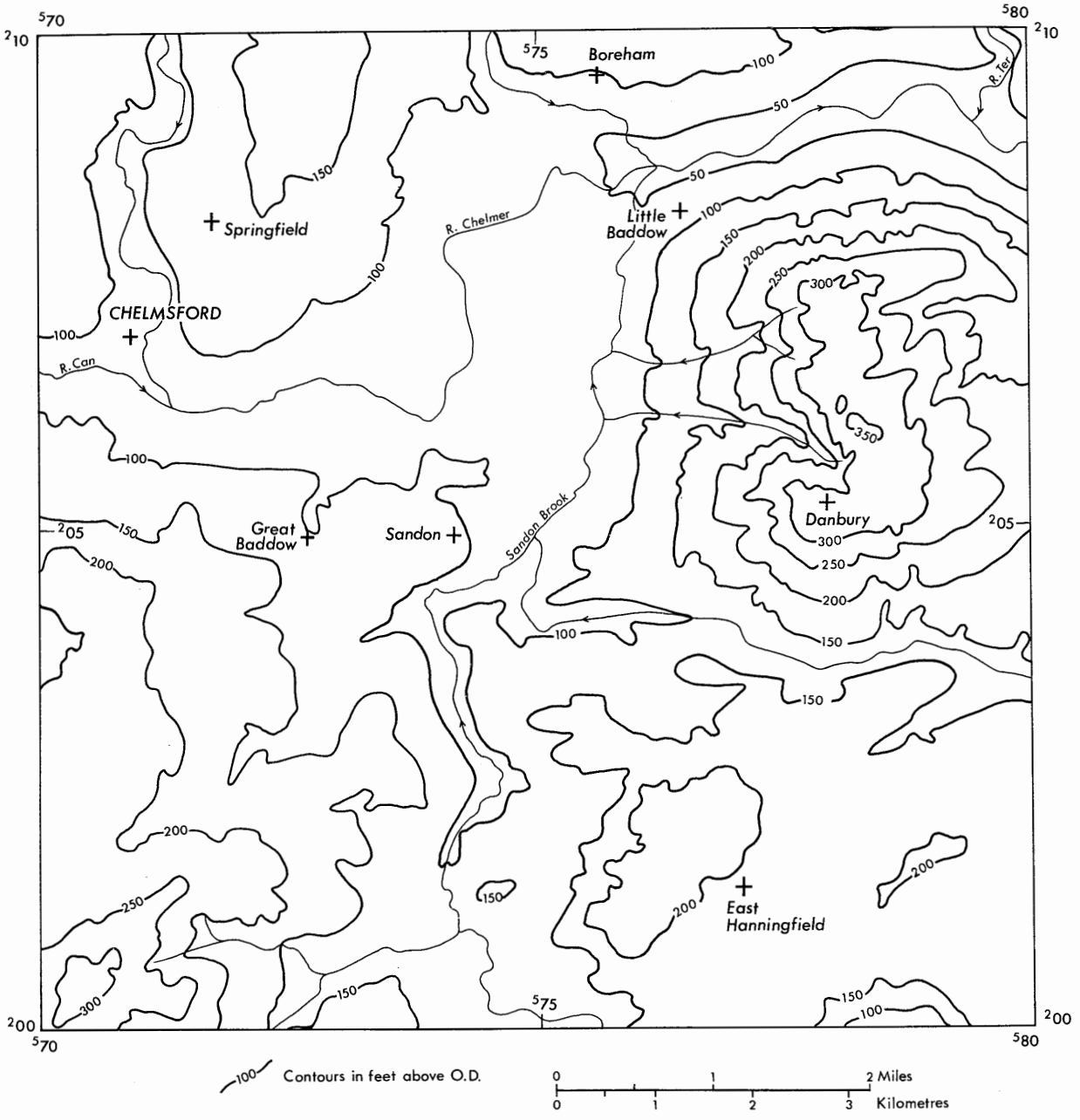


Fig. 2. Sketch diagram showing the topography of sheet TL 70

Table 1. Geological classification of deposits on TL 70.

		Description
DRIFT		
PLEISTOCENE AND RECENT	Alluvium, and three river terraces	Clayey silts, sands and gravels
	Head	Mixed solifluction deposits; silty clay with sand and pebbles
	Brickearth	Fine silty clays and silts with scattered pebbles
	Glacial lake and channel-fill deposits	Grey and buff silts and clays, often laminated
	Chalky Boulder Clay	Stiff bluish-grey clay with pebbles of chalk and flint
	Glacial Sand and Gravel	Flint, quartzite and vein quartz sands and gravels of variable composition
SOLID		
EOCENE	Bagshot Pebble Beds	Sandy pebbly clays
	Bagshot Beds	Fine sands and silts with clay partings
	Claygate Beds	Firm dark grey silty clays with fine sand partings
	London Clay	Stiff bluish-grey clay, fissured, silty in parts with occasional cementstone nodules
EOCENE*	Oldhaven Beds Woolwich and Reading Beds Thanet Sands	
CRETACEOUS*	Upper Chalk	

*Proved in deep boreholes

and in the Sandon area (see Plates 1 and 2 and p. 6).

Claygate Beds

The Claygate Beds, a series of dark greyish-brown silty clays, with three horizons of fine sand, have a maximum thickness in the area of about 19.0 m (62.5 ft). At outcrop these beds, despite their siltiness, are very similar in appearance to the London Clay which they overlie. However, the boundary between them is often well marked by a line of small springs which occur at about +53.3 m (+175 ft) OD in the East Hanningfield area and at about +45.7 m (+150 ft) OD in the West Hanningfield area.

Bagshot Beds and Bagshot Pebble Beds

These strata outcrop in the south-west and are present below thin deposits of head and boulder clay in the south-eastern corner of the area. They comprise a series of fine sands and silts up to 23.0 m (75.5 ft) in thickness. Grading analyses of Bagshot Beds sands found in boreholes drilled to the south of this sheet area show that they consist mainly of silt and fine sand. They are regarded as non-mineral for the purposes of this survey, although similar beds in other areas of south-east England have been used for

specialist industrial uses.

The overlying Bagshot Pebble Beds comprise rounded flint pebbles set in a clayey, sandy matrix.

Chalky Boulder Clay

Representing part of the Great Chalky Boulder Clay of East Anglia, the boulder clay is a stiff greyish-brown till, sometimes sandy, with pebbles of chalk, quartzite and flint. It is decalcified in the weathered zone, where it is seen as an orange-brown to buff, sandy clay with pebbles. The greatest thickness of boulder clay was proved to the east of Springfield in borehole NW 67 [7263 0869], which was stopped at 18.3 m (60 ft), without reaching the base of the deposit.

The main spread of boulder clay (Springfield Till) found on the northern side of the Chelmer valley is underlain by an almost continuous spread of Glacial Sand and Gravel (Chelmsford Gravels), but a second boulder clay (Maldon Till), which underlies the Chelmsford Gravels in other areas (see Haggard, 1972), has not been proved. Small patches of boulder clay occur in the southern part of the area, but there are no significant deposits of Glacial Sand and Gravel associated with them. Spreads of pebbly clay, the Hanningfield Till of Clayton (1957), seen at Galleywood [705 028], are probably head deposits (Bristow and Cox, 1973).

Glacial Sand and Gravel

The Glacial Sand and Gravel is found at two main topographic levels within the sheet area; either on the slopes of Danbury Hill rising to a height of +106.7 m (+350 ft) OD or on the surrounding areas rising to heights of up to +45.7 m (+150 ft) OD.

The sand and gravel on Danbury Hill forms a frost-heaved, dissected capping on the London Clay bedrock. The deposit contains pebbles of subrounded to angular flint, quartzite and vein quartz, with occasional pebbles of exotic igneous rock types. The sands are mainly composed of angular to subrounded quartz and flint.

Grading analyses and field descriptions of Mineral Assessment Unit borehole samples of the Danbury Gravels are very similar to those for the Chelmsford Gravels and a similar and possibly contemporaneous glacial origin for both deposits is suggested (but see Gregory, 1915; Clayton, 1957).

The thickness of the Danbury deposits varies considerably. Exceptional thicknesses of 14.7 m (48.0 ft) and 21.3 m (70.0 ft) proved in boreholes NE 49 [7839 0592] and NE 37 [7719 0780] respectively, probably owe their preservation and distribution to frost-heave or channelling phenomena. Their mean thickness calculated from 23 sample-points is 6.1 m (20.0 ft).

Evidence for frost heaving on Danbury Hill is seen in the sides of St Clere's Hall Pit [766 057], where the near vertical junction with the London Clay bedrock is imitated by vertical bedding in the adjacent Glacial Sand and Gravel deposits. This bedding assumes the normal horizontal attitude as one moves away from the frost-heaved zone, demonstrating that the deposits were originally laid down horizontally. Exposures at Sandon [748 043] (Plate 2), suggest that frost heaving was also a contributory factor in the structure and distribution of the Glacial Sand and Gravel deposits in that area.

In contrast to the Danbury deposits, the spreads of Glacial Sand and Gravel (Chelmsford Gravels) found on the lower lying parts of the sheet area have a more uniform distribution. Their average thickness is only about 3.0 m (10.0 ft) and they consist of subrounded pebbles of flint, quartzite and vein quartz, and angular to subrounded flint and quartz sands. The sand and gravel deposits in the buried channel at Sandon have a similar appearance, but in their lower part shell debris and pebbles of chalk and Kimmeridge Clay become more abundant. The southern limit of the drift-filled channel at Sandon may have coincided with the former position of an ice margin, and a tunnel-valley mechanism for the origin of the buried channel is suggested (Woodland, 1970). Northwards, behind the ice margin, the channel is infilled with soft grey silty clay (see p. 14), as seen in boreholes NE 27 [7569 0658] and NE 28 [7567 0534], which was probably derived from the boulder clay.

River Terrace and Suballuvium Deposits

Sand and gravel occurs in the terrace and suballuvium deposits of the River Chelmer and Sandon Brook. The terrace gravels are very similar in composition to the river gravels proved below a thin cover of alluvium, and may have the same mode of origin. Both deposits comprise angular to subrounded flint and quartzite pebbles and quartz sands, probably largely derived from the Glacial Sand and Gravel which covers the surrounding hillsides. They both have average thicknesses of about 2.3 m (7.5 ft) and have very similar mean grading results (see Fig. 5).

Three terraces are developed within the Chelmer valley: the Third Terrace lies between +22.9 m to +30.5 m (+75 ft to 100 ft) OD, the Second Terrace between +15.2 m to +22.9 m (+50 ft to +75 ft) OD and the First Terrace at or near +15.2 m (+50 ft) OD, the last named being some 1.0 m to 3.0 m (3.5 ft to 10.0 ft) above the flood plain. Boreholes NE 55 [7839 0931] and NW 95

[7443 0690] proved thin peat bands within the suballuvium deposits at heights of +6.9 m (+22.5 ft) OD and +14.1 m (+46.5 ft) OD respectively.

Other Deposits

Other deposits found in the area include glacial lake and channel-fill deposits, brickearth, head and alluvium.

Glacial lake deposits, mapped in the Springfield and Sandon areas, and on the western slopes of Danbury Hill, were also proved in borehole NE 46 [7647 0790]. They usually consist of buff or pale grey fine silts and clays, often showing laminations. The maximum thicknesses of these deposits proved by boreholes were 18.0 m (59 ft) and 10.4 m (34 ft) in the Sandon [755 046] and Springfield [745 090] areas respectively.

The deposits found in the buried channels below the present-day Chelmer valley and in the Sandon area are characterised by soft grey sometimes laminated clays, and are similar in appearance to the glacial lake deposits with which they are classified. They are of remarkably uniform character through large thicknesses (up to 40 m (131.5 ft) proved and are thought to have been formed subglacially, by 'wash' material derived from boulder clay and the London Clay bedrock (Woodland, 1970).

Brickearth, mapped to the north of the Chelmer Valley, is recognised as an orange/brown fine silt, probably of aeolian or lacustrine origin.

Head, irregularly distributed throughout the area, comprises thin, poorly sorted superficial deposits derived by solifluction from the local solid and drift deposits. The head is characteristically stony clay and silt becoming sandy and pebbly where it is derived from adjacent deposits of sand and gravel.

Alluvium, typically a clayey silt with occasional pebbles of flint and quartzite, covers most of the River Chelmer and Sandon Brook flood plains (where it conceals spreads of suballuvium gravels described in block C) and parts of the First and Second terraces. The maximum thickness proved was 3.0 m (10 ft) in boreholes NW 95 [7443 0690] and NE 31 [7625 0856].

COMPOSITION OF THE SAND AND GRAVEL

The potentially workable sand and gravel is Glacial Sand and Gravel in blocks A, B and D, and terrace or suballuvium gravel in block C.

Glacial Sand and Gravel

The Glacial Sand and Gravel consists of angular to subrounded flint, quartzite and vein-quartz gravels, and angular to subrounded quartz-rich sands. Pebbles of chert and exotic igneous rock types are occasionally found. The weighted mean grading results are shown in Fig. 5; they show that these deposits contain up to 10 per cent fines, 45 per cent sand and the remainder gravel, having roughly equal amounts of fine and coarse grades. Medium sand makes up 28 per cent of the deposit.

A composite sample of Glacial Sand and Gravel was taken from borehole NE 49 [7839 0592] and the 10 to 14 mm size material was tested for specific gravity and 10 per cent fines value as set out in BS 812 (Anon., 1967b). The results of these tests are shown in Table 2. Although this borehole was selected randomly, the results are unlikely to be representative of the deposits throughout the area.

Pebble counts of the +4.75 mm to -14 mm size material in samples collected from assessment boreholes show that the Danbury Gravels, Chelmsford Gravels and river gravels have similar amounts of flint (77 per cent) and quartz/quartzite (20 per cent).

The Glacial Sand and Gravel on the south side of Danbury Hill is noticeably sandier than the other glacial deposits in the area (Fig. 6). This is reflected by the weighted mean grading of block A, which is sandier than any other block (Fig. 5).

Terrace and suballuvium deposits

The terrace and suballuvium gravels are very similar in composition to the Glacial Sand and Gravel deposits, being composed of angular to subrounded flints and quartzite pebbles and angular to subrounded quartz sands. The weighted mean grading of these deposits is also similar to the Glacial Sand and Gravel, but the terrace gravels contain more fines (16 per cent) than the glacial deposits and less medium sand (19 per cent). Compared with the terrace gravels, the suballuvium gravels have less fines and fine sand and more medium sand (28 per cent). Gravel makes up 48 per cent of both the terrace and suballuvial deposits, with roughly equal amounts of the fine and coarse fractions.

THE MAP

The sand and gravel resource map is folded into the pocket at the end of this report. The base map is the Ordnance Survey 1:25 000 Outline Edition in grey, on which the topography is shown by contours in green, the geological data in black and the mineral resource information in shades of red.

Geological Data

The geological boundary lines, symbols, etc. shown are taken from the geological map of this area,

Table 2. Results of specific gravity and 10 per cent fines tests on a composite sample taken from Borehole NE 49.

Test 1. Specific gravities of 10 to 14 mm size material			
Weight of material for test. Oven dry (g)	1709	1538	Mean
Specific gravity - apparent	2.624	2.627	2.625
- saturated surface dry	2.562	2.562	2.562
- oven dry	2.525	2.522	2.524
Absorption (per cent)	1.50	1.58	1.54

Test 2. 10 per cent fines value			
Weight of material for test (g)	2875	2875	Mean
Per cent of 'natural'material for test	66	66	
Per cent of 'crushed' material for test	34	34	
(x) applied load (tons)	27.6	27.6	
(y) per cent passing No. 7 sieve	10.04	10.91	10.48
10 per cent fine value = $\frac{14\ x}{y + 4}$ tons			26.7

which was surveyed at the scale of 1:10 560. This information was obtained by detailed application of field mapping techniques by the field staff in the Institute's East Anglia and South-East England Unit. Borehole data, which include the stratigraphic relations and mean particle size distribution of the sand and gravel samples collected during the assessment survey, are also shown.

The geological boundaries show the best available interpretation of the information available at the time of survey. However, it is inevitable, particularly with glacial deposits (such as those included in the area of sheet TL 70) which change rapidly vertically and laterally, that local irregularities or discrepancies will be revealed by some boreholes (for example, at borehole NE 33). These are taken into account in the assessment of resources (see below and Appendix B).

Mineral Resource Information

The mineral-bearing ground is subdivided into resource blocks (see Appendix A). Within a resource block the mineral is subdivided into areas where it is 'exposed' and areas where it is present in continuous (or almost continuous) and discontinuous spreads beneath overburden. The

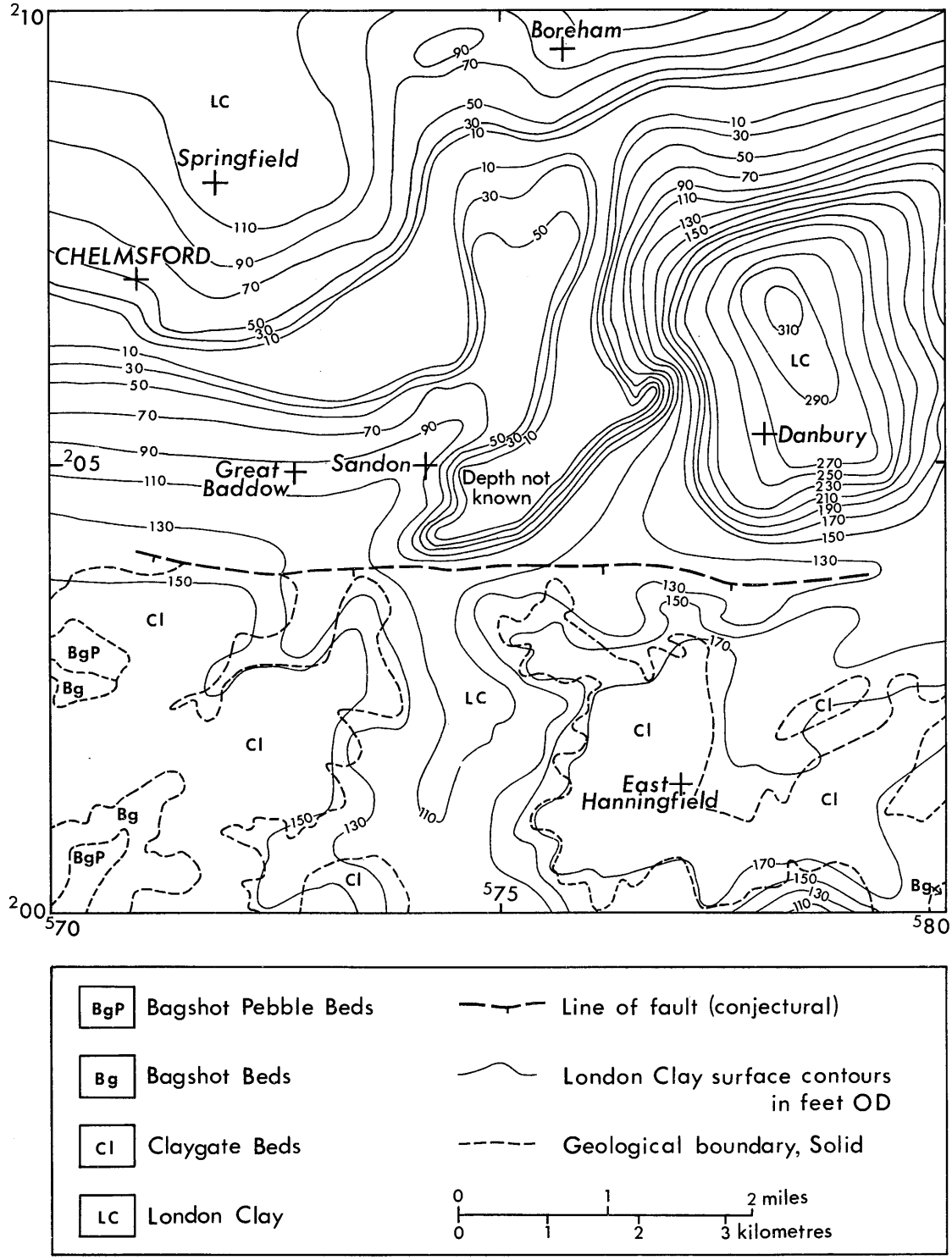


Fig. 3. Sketch diagram showing the solid geology and the London Clay surface contours of sheet TL 70

recognition of these categories is dependent upon the importance attached to the proportion of boreholes which did not find potentially workable sand and gravel and the distribution of barren boreholes within a block. The mineral is described as 'almost continuous' if it is present in 75 per cent or more of the boreholes in a resource block. The 'discontinuous' category has not been recognised on the present sheet.

Areas where bedrock outcrops, where boreholes indicate absence of sand and gravel beneath cover and where sand and gravel beneath cover is interpreted to be not potentially workable are uncoloured on the Map; where appropriate the relevant criterion is noted. In such areas it has been assumed that mineral is absent except in infrequent and relatively minor patches which can neither be outlined nor assessed quantitatively in the context of this survey. Areas of unassessed sand and gravel, for example, built-up areas, are indicated by a red stipple.

The area of the exposed sand and gravel is measured from the mapped geological boundary lines. The whole of this area is considered as mineral, although it may include small areas where sand and gravel is not present or is not potentially workable. Inferred boundaries have been inserted where sand and gravel beneath cover is interpreted to be not potentially workable or absent. Such boundaries (for which a distinctive symbol is used) are drawn primarily for the purpose of volume estimation. The symbol is intended to convey an approximate location within a likely zone of occurrence rather than to represent the breadth of the zone, its size being limited only by cartographic considerations. For the purpose of measuring areas the centre line of the symbol is used.

RESULTS

The calculation of the mineral resources is based upon a simple statistical procedure explained in Appendix B. The results of the statistical analysis and inferred assessment are set out in Table 3, and the weighted particle size distribution results are shown in Fig. 5.

Accuracy of Results

For the three resource blocks A, B and C, assessed statistically, the accuracy of the results at the 95 per cent confidence level (that is, the probability that 19 times out of 20 the true volume present lies within the given limits) varies between 22 per cent and 40 per cent. However, the true values are more likely to be nearer the figure estimated than either of the limits. Moreover, it is probable that roughly the same percentage limits would apply for the estimate of volume of a very much smaller parcel of ground (say 200 acres) containing similar sand and gravel deposits, if the results from the same number of sample-points (as provided by, say, ten boreholes) were used in the calculation. Thus if closer limits are needed for quotation of reserves of part of a block, it can be expected that the data from more sample-points would be required, even if the area were quite small.

Although the calculation of the total volume of potentially workable Glacial Sand and Gravel deposits in blocks A and B (92.7 million m^3) is based on data from 50 sample-points, the limits are ± 31 per cent at the 95 per cent confidence level. This relatively small reduction in the confidence limits is due to the very variable nature of the deposits concerned.

It must be emphasised that the quoted volume of sand and gravel has no simple relationship with the amount that could be extracted in practice, as, apart from the exclusion of the Chelmsford urban area from the calculations, no allowance has been made for any restraints (such as existing buildings and roads) on the use of land for mineral working.

NOTES ON RESOURCE BLOCKS

Block A

Overburden comprises a thin discontinuous cover of head (sandy clay with pebbles), usually derived largely from the Glacial Sand and Gravel, which a occupies 12.2 km^2 (53 per cent) of the block area. An almost continuous cover of head is mapped on the south-eastern part of Danbury Hill. Generally, the overburden tends to be thinnest on the areas of high surface relief and thicker on the lower slopes. Frost-heave phenomena have caused further dissection and re-distribution of the head as shown by the assessment boreholes, in which these deposits range up to 4.6 m (15.0 ft) in thickness with a mean of 2.3 m (7.5 ft). It is not known whether mineral deposits generally underlie the glacial lake deposits mapped on the western side of Danbury Hill, although they have been proved locally; Glacial Sand and Gravel was found below soft pale blue plastic clay (?glacial lake deposits) in borehole NE 46 [7647 0790].

The Glacial Sand and Gravel rests upon the uneven surface of the London Clay bedrock which forms Danbury Hill (Figs. 3 and 4), at elevations ranging from 22.9 m to over 106.7 m OD (75 ft to over 350 ft OD). The thicknesses proved range from 1.8 m (6 ft) to 21.3 m (70 ft) with a mean of 6.1 m (20.0 ft), while at boreholes NE 33 [7663 0717] and SE 5 [7783 0463] 'nil' thicknesses are recorded, illustrating the very considerable variations in the thickness of these deposits, probably caused by large scale frost-heave phenomena including mass movement and

Plate 1. Worked-out pit in Glacial Sand and Gravel, Danbury, Essex.

Extraction of the thick deposits of sand and gravel (lighter colour background) has revealed a depression in the London Clay surface, the form of which is that of the pit itself. London Clay can be seen in the sides and bottom of the pit. Water collecting on the impermeable bedrock is pumped away to allow dry working of the sand and gravel. Restoration of the worked-out ground is in progress.

Plate 2. Glacial Sand and Gravel deposits at Sandon, Essex.
Deposited horizontally, these well-bedded fine sands with occasional gravelly bands, have been faulted and folded during the Pleistocene, by frost-heaving and collapse due to ice-wedging in the flanking clays (not shown) aided perhaps by differential loading of the deposits.

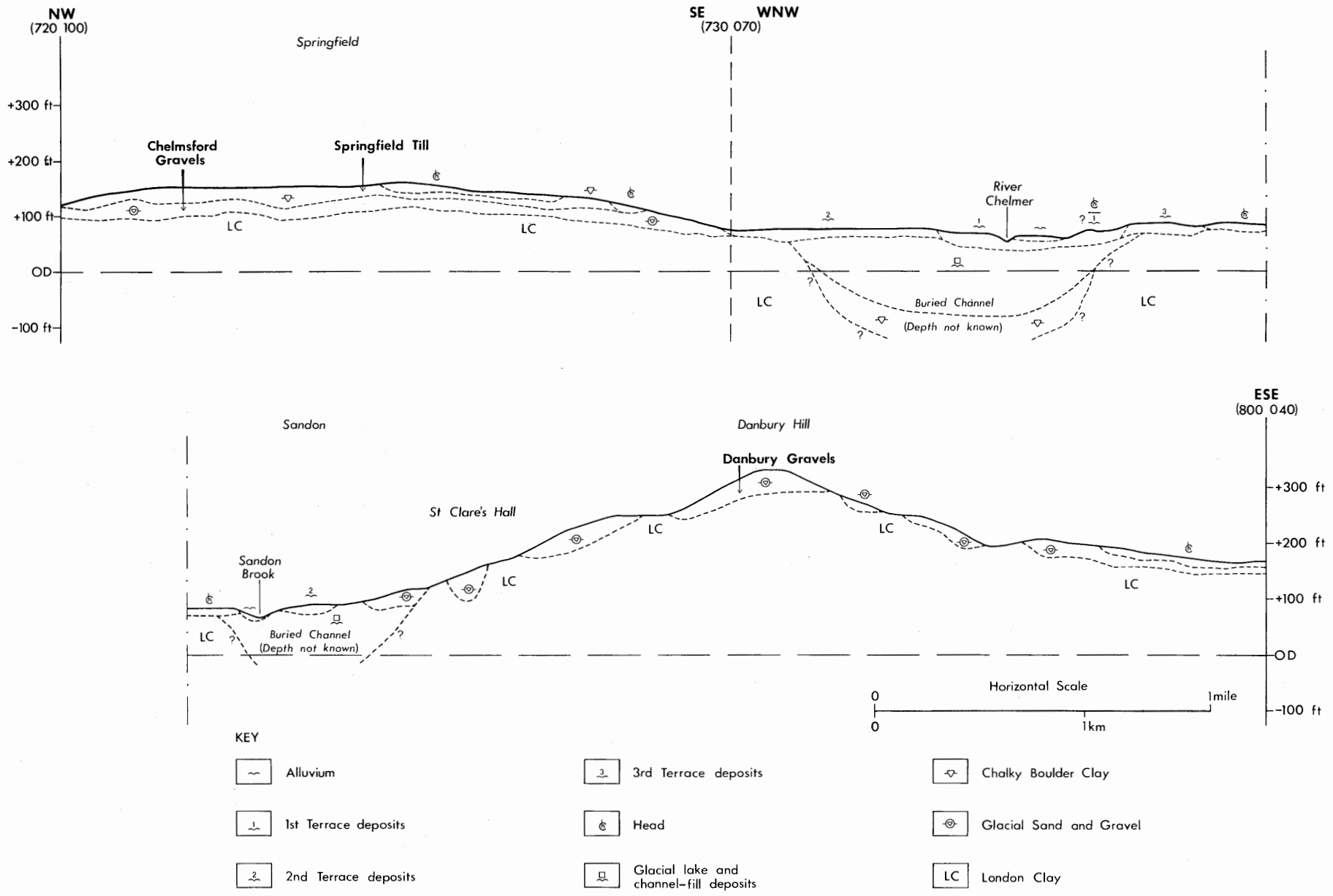


Fig. 4. Geological sketch section across the area of sheet TL 70

Table 3. The sand and gravel resources of sheet TL 70
Statistical assessment of Glacial Sand and Gravel - blocks A and B

Resource block	Area		Mean thickness		Volume of mineral				Mean grading percentages		
	Block km^2	Mineral km^2	Overburden m (ft)	Mineral m (ft)	million m^3 (yd^3)		limits at 95% confidence level		Fines -1/16 mm	Sand +1/16-4 mm	Gravel +4-64 mm
							±%	± Volume million m^3			
A(23)*	23.2	12.2	2.3 (7.5)	6.1 (20.0)	74.4	(97.3)	40	29.8	9	49	42
B(27)*	8.1	5.9	1.7 (5.5)	3.1 (10.0)	18.3	(23.9)	36	6.6	10	37	53
A+B(50)*	31.3	18.1	2.1 (7.0)	5.1 (17.0)	92.7	(121.3)	31	28.7	10	45	45

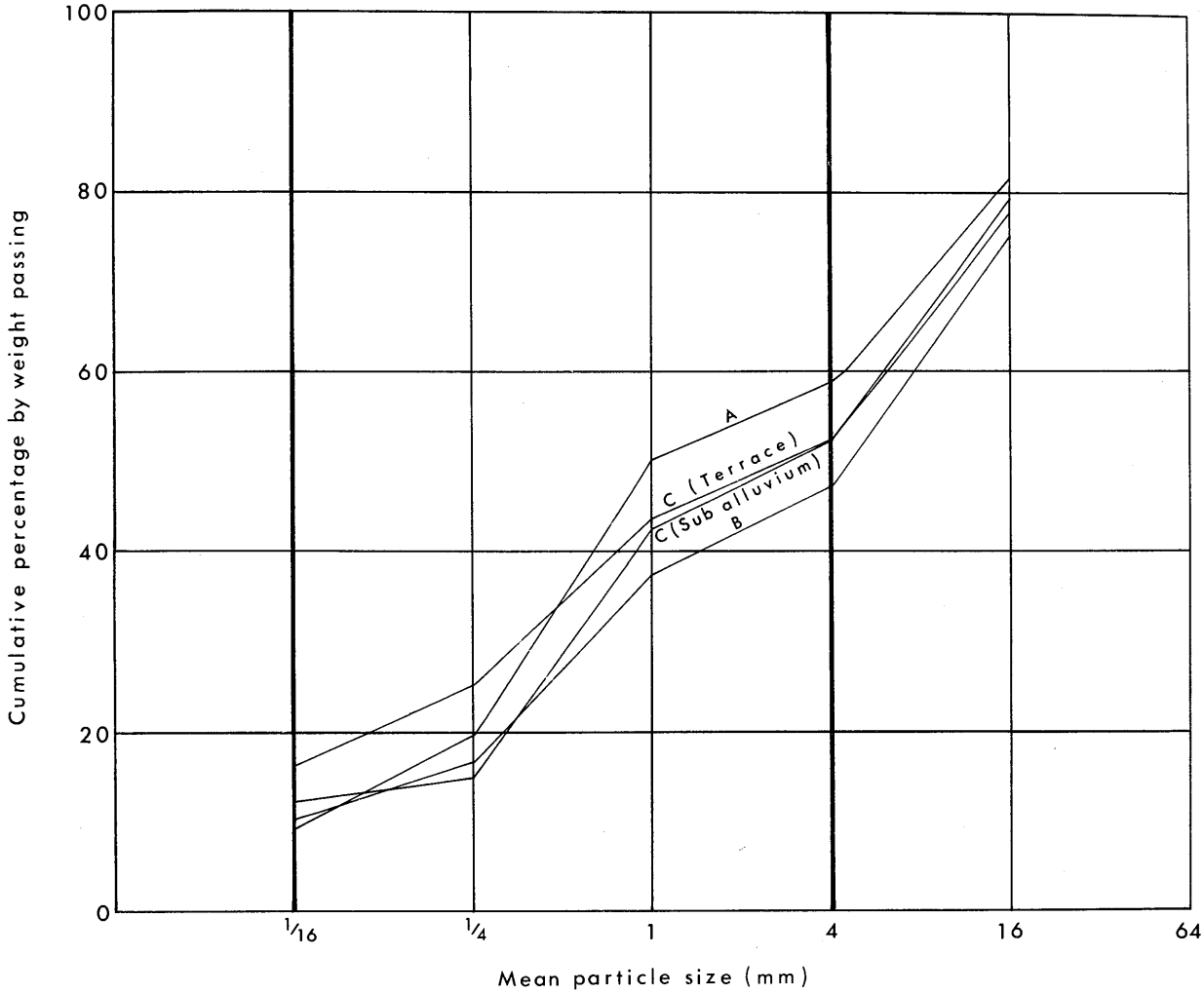
Statistical assessment of terrace and suballuvium deposits: block C

C Suballuvium gravels(11)*	12.1	4.1	1.8 (6.0)	2.3 (7.5)	9.4	(12.3)	55	5.2	12	40	48
C Terrace gravels(22)*	12.1	5.6	1.5 (5.0)	2.3 (7.5)	12.9	(16.9)	23	3.0	16	36	48
C Total(33)*	12.1	9.7	1.6 (5.0)	2.3 (7.5)	22.3	(29.2)	22	4.9	15	37	48

Inferred assessment: block D

Inside channel area	33.6	0.4	4.6 (15.0)	21.1 (69.0)	8.4	(11.0)	Not applicable	None	
Outside channel area	33.6	0.7	1.4 (4.5)	7.0 (23.0)	4.9	(6.4)	Not applicable	None	
D Total	33.6	1.1	2.6 (8.5)	12.1 (39.5)	13.3	(17.4)	Not applicable	None	

*The figures in brackets show the total number of sample-points used in the statistical assessment of the sand and gravel resources for each resource block (see p. 28).



Resource Block	Cumulative percentage by weight passing					
	1/16 mm	1/4 mm	1mm	4mm	16mm	64mm
A	9	20	50	58	82	100
B	10	16	38	47	75	100
A + B Glacial Sand and Gravel	10	19	47	55	80	100
C Terrace gravels	16	25	44	52	77	100
C Suballuvium gravels	12	15	43	52	79	100
Total	15	22	44	52	78	100

Fig. 5. Particle size distribution for the assessed sand and gravel resources of sheet TL 70

slumping. Excavations at St Clere's Hall Pit [766 056] have proved over 27.4 (90 ft) of Glacial Sand and Gravel in a deep depression in the London Clay, which may have been caused by subglacial erosion or frost-heaving or a combination of these processes (Plate 1). The presence of similar depressions may explain the unexpectedly thick deposits proved in boreholes NE 37 [7719 0780] and NE 49 [7839 0592].

On the south side of Danbury Hill, sand and gravel deposits have been assigned to the Second Terrace of the Chelmer, but because of the lack of borehole information, they are here considered as reworked Glacial Sand and Gravel and assessed together with the main body of these deposits.

Borehole SE 4 [7664 0377] proved 2.7 m (9.0 ft) of mineral below head, although Glacial Sand and Gravel is nowhere exposed at this locality. The lateral extent of this mineral is unknown and therefore an inferred boundary has been drawn around the deposit.

The estimated volume of mineral in this block is 74.4 million m^3 (97.3 million yd^3) ±40 per cent at the 95 per cent confidence level. The weighted mean grading is fines 9 per cent sand 49 per cent and gravel 42 per cent.

Block B

In this block, overburden, comprising Chalky Boulder Clay, head and brickearth, forms an irregular cover over the Glacial Sand and Gravel which occupies (as exposed and concealed deposits) 5.9 km^2 (73 per cent) of the total area of 8.1 km^2. The overburden has been proved up to 10.1 m (33 ft) in thickness with a mean of 1.7 m (5.5 ft). The presence of glacial lake deposits (laminated brown, buff and grey silts and clays) is confirmed by numerous boreholes to the east of Springfield. Within the area outlined by the zig-zag symbol on the map, no mineral has been proved beneath these lake deposits, which are 8.8 m (29 ft) thick in borehole NW 15 [7444 0906], although at their northern margin they overlap Glacial Sand and Gravel.

The Glacial Sand and Gravel forms an irregular cover on the London Clay bedrock, the surface of which slopes gently towards the Chelmer valley (Figs. 3 and 4). The mineral ranges in thickness from 1.0 m to 10.1 m (3.5 ft to 33.0 ft) with a mean of 3.1 m (10.0 ft) and from the data available appears to increase in thickness northwards beneath boulder clay overburden.

The estimated volume of mineral in this block is 18.3 million m^3 (23.9 million yd^3) ±36 per cent at the 95 per cent confidence level. The weighted mean grading for the block is fines 10 per cent, sand 37 per cent, gravel 53 per cent.

Block C

The potentially workable sand and gravel in this block is found beneath the flood-plain alluvium of the River Chelmer and Sandon Brook (the suballuvium gravels) and in the three terraces of the River Chelmer. Overburden, consisting of fine clayey silts and sands, ranges up to 3.4 m (11.0 ft) in thickness, with a mean of 1.8 m (6.0 ft).

All of the MAU boreholes drilled in the flood plain proved sand and gravel, ranging in thickness from 0.8 m to 6.6 m (2.5 ft to 21.5 ft) with a mean of 2.3 m (7.5 ft). Site investigation boreholes drilled to the east of Brookend Sewage Works [740 068], show that the suballuvium gravels are almost continuous. Based on the data from nine boreholes, the volume of suballuvium gravels is estimated to be 9.4 million m^3 (12.3 million yds^3) ± 55 per cent at the 95 per cent confidence level.

The terrace gravels, which make up the First, Second and Third terraces of the River Chelmer, range in height from 15.2 m to over 22.9 m (50 ft to over 75 ft) OD. Both the First and Second terraces are well developed, the Second being the more extensive. The area of the Third Terrace, mapped in the area around Rumbold's Farm [747 063] and to the south, lies at about 22.9 m (75 ft) OD. It is thought that only the deposits in the southern area are likely to be of mineral quality.

The grading data for all three terraces are very similar and for the purposes of this survey the three terraces are assessed as one unit. These mineral deposits range from 0.9 m to 3.8 m (3.0 ft to 12.5 ft) in thickness, with a mean of 2.3 m (7.5 ft).

The estimated volume of terrace gravels is 12.9 million m^3 (16.9 million yd^3) ± 23 per cent at the 95 per cent confidence level.

Overburden consisting of irregular head and brickearth deposits ranges in thickness from 0.3 m to 5.5 m (1.0 ft to 18.0 ft) with a mean of 1.5 m (5.0 ft).

The absence of mineral in the area near Rumbold's Farm and extending north-eastwards as outlined on the resource map is unexpected; it may never have been deposited or it may have been removed by an overflow channel of the River Chelmer. Glacial lake deposits are mapped in the Grace's Cross area [743 053], and borehole information confirms that these deposits are buff and grey silty clays as seen elsewhere.

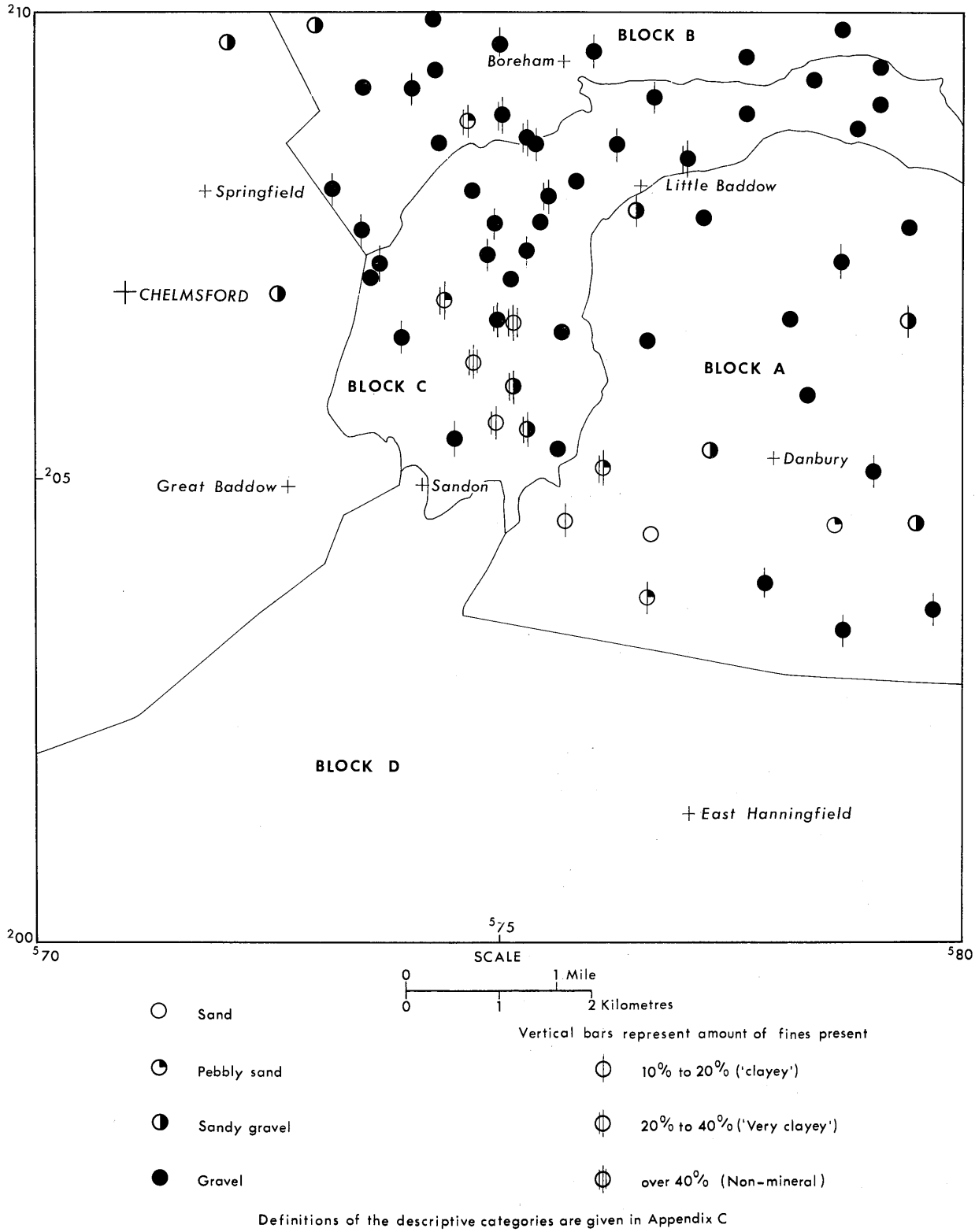


Fig. 6. Grading characteristics of the sand and gravel deposits of sheet TL 70

Boreholes also show that they exceed 18.0 m (59.0 ft) in thickness near the centre of the deposits, and that they overlie a buried channel which continues into the Sandon area. The estimated total volume of mineral in this block is 22.3 million m^3 (29.2 million yd^3 ± 22 per cent at the 95 per cent confidence level. The weighted mean grading results are fines 15 per cent, sand 37 per cent, gravel 48 per cent.

Block D

The small area of sand and gravel deposits in the northern part of this block has been separately assessed because of the geological complexity of the deposits in this area. Based upon a limited amount of information obtained from site investigation boreholes, an inferred boundary has been drawn to delineate the southern limit of mineral in this block. South of this inferred boundary there are no significant deposits of mineral. Bagshot Beds and Bagshot Pebble Beds, which outcrop in the south-west corner of the area are regarded as non-mineral (see p. 5).

The buried channel proved by boreholes below the glacial lake deposits in block C, continues into the Sandon area. The volume of mineral both inside and outside this channel is inferred separately. Exposures in Sandon Pit [747 043] show 6.1 m to 9.1 (20 ft to 30 ft) of orange-stained Glacial Sand and Gravel overlying an unknown thickness (but in excess of 9.1 m (30 ft), of pale grey sand and gravel (see p. 6). The limited amount of borehole information available in blocks A, C and D indicates the approximate northern and southern margins of the channel, but the positions of the eastern and western limits have been inferred.

Information obtained from site investigation boreholes and exposures suggests that inside the channel area the mean thicknesses of overburden and mineral are about 4.6 m (15.0 ft) and 21.1 m (69.0 ft) respectively. The inferred volume of mineral present inside the channel area is 8.4 million m^3 (11.0 million yd^3).

Outside the channel, spreads of Glacial Sand and Gravel exist below a thin cover of head. From the restricted subsurface information available, the average thicknesses of overburden and mineral are estimated to be 1.4 m (4.5 ft) and 7.0 m (23.0 ft) respectively, and the total volume of mineral is about 4.9 million m^3 (6.4 million yd^3).

The total inferred volume of mineral in this block is therefore 13.3 million m^3 (17.4 million yd^3). No confidence limits can be given, and no grading information is available.

Appendix A: Field Procedure

Trial and error during initial studies of the complex and variable glacial deposits of East Anglia and Essex showed that an absolute minimum of five sample points evenly distributed across the sand and gravel are needed to provide a worthwhile statistical assessment, but that, where possible, there should be not less than ten. Sample points are any points for which adequate information exists about the nature and thickness of the deposit and may include boreholes other than those drilled during the survey and exposures. In particular, the cooperation of sand and gravel operators ensures that boreholes are not drilled where reliable information is already available; although this may be used in the calculations, it is held confidentially by the Institute and cannot be disclosed.

The mineral shown on each 1:25 000 sheet is divided into resource blocks. The arbitrary size selected, 10 km^2, is a compromise to meet the aims of the survey by providing sufficient sample points in each block. As far as possible the block boundaries are determined by geological boundaries so that, for example, glacial and river terrace gravels are separated. Otherwise division is by arbitrary lines, which may bear no relationship to the geology. The blocks are drawn provisionally before drilling begins.

A reconnaissance of the ground is carried out to record any exposures and inquiries are made to ascertain what borehole information is available. Borehole sites are then selected to provide an even pattern of sample points at a density of approximately one per square kilometre. However, because broad trends are independently overlain by smaller scale characteristically random variations, it is unnecessary to adhere to a square grid pattern. Thus such factors as ease of access and the need to minimise disturbance to land and the public are taken into account in siting the holes; at the same time it is necessary to guard against the possibility that ease of access (that is, the positions of roads and farms) may reflect particular geological conditions, which may bias the drilling results.

The drilling machine employed should be capable of providing a continuous sample representative of all unconsolidated deposits, so that the in-situ grading can be determined, if necessary, to a depth of 30 m (100 ft) at a diameter of about 200 mm (8 in), beneath different types of overburden. It should be reliable, quiet, mobile and relatively small (so that it can be moved to sites of difficult access). Shell and auger rigs have proved to be almost ideal.

The rigs are modified to enable deposits above the water table to be drilled 'dry', instead of with water added to facilitate the drilling, to minimise the amount of material drawn in from outside the limits of the hole. The samples thus obtained are representative of the in-situ grading, and satisfy one of the most important aims of the survey. Below the water-table the rigs are used conventionally, although this may result in the loss of some of the fines fraction and the pumping action of the bailer tends to draw unwanted material into the hole from the sides or the bottom.

A continuous series of bulk samples is taken throughout the sand and gravel. Ideally samples are composed exclusively of the whole of the material encountered in the borehole between stated depths. However, care is taken to discard, as far as possible, material which has caved or has been pumped from the bottom of the hole. A new sample is commenced whenever there is an appreciable lithological change within the sand and gravel, or at every 1 m (3.3 ft) depth. The samples each weighing between 25 and 45 kg (55 and 100 lb), are despatched in heavy duty polythene bags to a laboratory for grading. The grading procedure is based on British Standard 1377 (Anon., 1967). Random checks on the accuracy of the grading are made in the laboratories of the Institute's Geochemical Division.

All data, including mean grading analysis figures calculated for the total thickness of the mineral, are entered on standard record sheets, abbreviated copies of which are reproduced in Appendix F.

Detailed records may be consulted at the appropriate offices of the Institute, upon application to the Head, Mineral Assessment Unit.

Appendix B: Statistical Procedure

STATISTICAL ASSESSMENT

1. A statistical assessment is made of an area of mineral greater than 2 km^2, if there is a minimum of five evenly spaced boreholes in the resource block (for smaller areas see para. 12 below).

2. The simple methods used in the calculations are consistent with the amount of data provided by the survey. Conventional symmetrical confidence limits are calculated for the 95 per cent probability level. That is there is a 5 per cent or one in twenty

chance of a result falling outside the stated limits.

3. The volume estimate (V) for the mineral in a given block is the product of the two variables, the sampled areas (A) and the mean thickness ($\bar{l}_m$) calculated from the individual thicknesses at the sample points. The standard deviations for these variables are related such that

$$S_V = \sqrt{S_A^2 + S_{\bar{l}_m}^2} \quad \ldots\ldots(1)$$

4. The above relationship may be transposed such that

$$S_V = S_{\bar{l}_m} \sqrt{1 + \frac{S_A^2}{S_{\bar{l}_m}^2}} \quad \ldots\ldots(2)$$

From this it can be seen that as $\frac{S_A^2}{S_{\bar{l}_m}^2}$ tends to 0, S_V tends to $S_{\bar{l}_m}$.

If, therefore, the standard deviation for area is small with respect to that for mean thickness, the standard deviation for volume approximates to that for mean thickness.

5. Given that the number of approximately evenly spaced sample points in the sampled area is n, with mineral thickness measurements l_{m_1}, l_{m_2}, ... l_{m_n}, then the best estimate of mean thickness, $\bar{l}_m = \frac{\sum (l_{m_1} + l_{m_2} \ldots\ldots l_{m_n})}{n}$

For groups of closely spaced boreholes a discretionary weighting factor may be applied to avoid bias (see note on weighting below). The standard deviation for mean thickness, $S_{\bar{l}}$ expressed as a proportion of the mean thickness is given by

$$S_{\bar{l}} = \frac{1}{\bar{l}_m} \sqrt{\frac{(l_m - \bar{l}_m)^2}{(n - 1)}}$$

where l_m is any value in the series l_{m_1} to l_{m_n}.

6. The sampled area in each resource block is coloured pink on the map. Wherever possible, calculations relate to the mineral within mapped geological boundaries (which may not necessarily correspond to the limits of a deposit). Where the area is not defined by a mapped boundary, that is, where the boundary is inferred, a distinctive symbol is used. Experience suggests that the errors in determining area are small relative to those in thickness.
The relationship

$\frac{S_A}{S_{\bar{l}_m}} \leqslant 1/3$ is assumed in all cases

It follows from equation (2) that

$$S_{\bar{l}_m} \leqslant S_V \leqslant 1.05\ S_{\bar{l}_m} \quad \ldots\ldots(3)$$

7. The limits on the estimate of mean thickness of mineral, $L_{\bar{l}_m}$, may be expressed in absolute units

$$\pm \frac{t}{\sqrt{n}} \times S_{\bar{l}_m}$$

or as a percentage

$$\pm \frac{t}{\sqrt{n}} \times S_{\bar{l}_m} \times \frac{100}{\bar{l}_m} \text{ per cent}$$

where t is Student's t at the 95 per cent probability level for (n - 1) degrees of freedom, evaluated by reference to statistical tables. (In applying Student's t it is assumed that the measurements are distributed normally).

8. Values of t at the 95 per cent probability level for values of n up to 20 are as follows:

n	t	n	t
1	∞	11	2.228
2	12.706	12	2.201
3	4.303	13	2.179
4	3.182	14	2.160
5	2.776	15	2.145
6	2.571	16	2.131
7	2.447	17	2.120
8	2.365	18	2.110
9	2.306	19	2.101
10	2.262	20	2.093

(from Table 12, Biometrika Tables for Statisticians, Volume 1, Second Ed. Cambridge University Press, 1962). When n is greater than 20, 1.96 is used (the value of t when n is infinity).

9. In calculating confidence limits for volume, L_V, the following inequality corresponding to equation (3) is applied:

$$L_{\bar{l}_m} \leqslant L_V \leqslant 1.05\ L_{\bar{l}_m}$$

Block Calculation — 1:25 000 Block } Fictitious

Area
- Block: 11.08 km^2
- Mineral: 8.32 km^2

Volume
- Overburden: 21 million m^3
- Mineral: 54 million m^3

Mean Thickness
- Overburden: 2.5 m
- Mineral: 6.5 m

Confidence limits of the estimate of mineral volume at the 95 per cent probability level: ± 20 per cent
That is, the volume of mineral (with 95 per cent probability): 54 ± 11 million m^3

Thickness estimate: measurements in metres
l_o = overburden thickness l_m = mineral thickness

Sample point	Weighting w	Overburden l_o	Overburden wl_o	Mineral l_m	Mineral wl_m	Remarks
SE 14	1	1.5	1.5	9.4	9.4	MAU boreholes
SE 18	1	3.3	3.3	5.8	5.8	
SE 20	1	nil	-	6.9	6.9	
SE 22	1	0.7	0.7	6.4	6.4	
SE 23	1	6.2	6.2	4.1	4.1	
SE 24	1	4.3	4.3	6.4	6.4	
SE 17	½	1.2	1.6	9.8	7.2	Hydrogeological Dept record
123/45	½	2.0		4.6		
1	¼	2.7	2.5	7.3	5.8	Close group of four boreholes (commercial)
2	¼	4.5		3.2		
3	¼	0.4		6.8		
4	¼	2.8		5.9		
Totals	$\Sigma w = 8$	$\Sigma wl_o = 20.1$		$\Sigma wl_m = 52.0$		
Means		$\bar{l}_o = 2.5$		$\bar{l}_m = 6.5$		

Calculation of confidence limits

l_m	$(l_m - \bar{l}_m)$	$(l_m - \bar{l}_m)^2$
9.4	2.9	8.41
5.8	0.7	0.49
6.9	0.4	0.16
6.4	0.1	0.01
4.1	2.4	5.76
6.4	0.1	0.01
7.2	0.7	0.49
5.8	0.7	0.49

$\Sigma(l_m - \bar{l}_m)^2 = 15.82$

$n = 8$

$t = 2.365$

L_V is calculated as

$$1.05 \times \frac{t}{\bar{l}_m} \sqrt{\frac{\Sigma(l_m - \bar{l}_m)^2}{n(n-1)}} \times 100$$

$$= 1.05 \times \frac{2.365}{6.5} \sqrt{\frac{15.82}{8 \times 7}} \times 100$$

$$= 20.3$$

$$\simeq 20 \text{ per cent}$$

Fig. 7. Example of resource block assessment: calculation and results

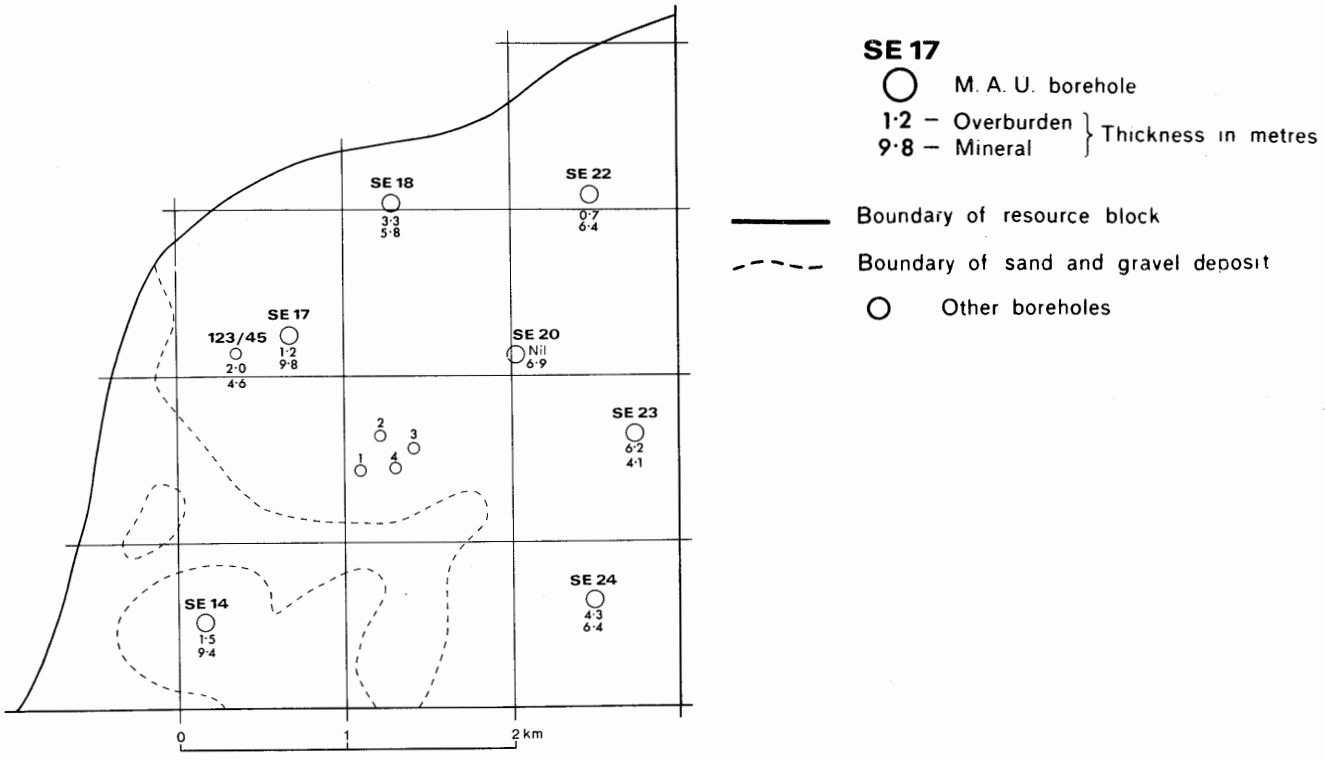
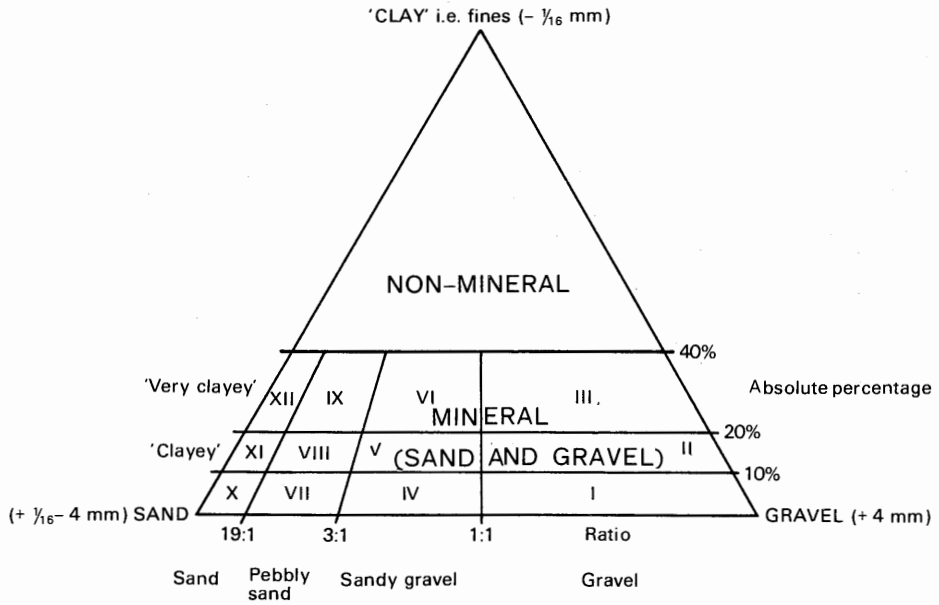


Fig. 8. Example of resource block assessment map of fictitious block



I	Gravel	IV	Sandy gravel	VII	Pebbly sand	X	Sand
II	'Clayey' gravel	V	'Clayey sandy gravel	VIII	'Clayey' pebbly sand	XI	'Clayey' sand
III	'Very clayey' gravel	VI	'Very clayey' sandy gravel	IX	'Very clayey' pebbly sand	XII	'Very clayey' sand

Fig. 9. Diagram to show the descriptive categories used in the classification of sand and gravel.

10. In summary, for values of n between 5 and 20, L_V is calculated as

$$\frac{1.05 \times t}{\bar{l}_m} \times \sqrt{\frac{\Sigma(l_m - \bar{l}_m)^2}{n(n-1)}} \times 100 \text{ per cent}$$

and when n is greater than 20, as

$$\frac{1.05 \times 1.96}{\bar{l}_m} \times \sqrt{\frac{\Sigma(l_m - \bar{l}_m)^2}{n(n-1)}} \times 100 \text{ per cent}$$

11. The application of this procedure to a fictitious area is illustrated in Figs. 7 and 8.

INFERRED ASSESSMENT

12. If the sampled area of mineral in a resource block is between 0.25 km^2 and 2 km^2 an assessment is inferred, based on geological and topographical information usually supported by the data from one or two boreholes. The volume of mineral is calculated as the product of the area, measured from field data, and the estimated thickness. Confidence limits are not calculated.

13. In some cases a resource block may include an area left uncoloured on the map, within which mineral (as defined) is interpreted to be generally absent. If there is reason to believe that some mineral may be present, an inferred assessment may be made.

14. No assessment is attempted for an isolated area of mineral less than 0.25 km^2.

15. Note on Weighting
The thickness of a deposit at any point may be governed solely by the position of the point in relation to a broad trend. However, most sand and gravel deposits also exhibit a random pattern of local, and sometimes considerable, variation in thickness. Thus the distribution of sample points need be only approximately regular and in estimating the mean thickness only simple weighting is necessary. In practice, equal weighting can often be applied to thicknesses at all sample points. If, however, there is a distinctly unequal distribution of points, bias is avoided by dividing the sampled area into broad zones, to each of which a value roughly proportional to its area is assigned. This value is then shared between the data points within the zone as the weighting factor.

Appendix C: Classification and Description of Sand and Gravel

For the purposes of assessing resources of sand and gravel a classification should take account of economically important characteristics of the deposit, in particular the absolute content of fines and the ratio of sand to gravel.

The terminology commonly used by geologists when describing sedimentary rocks (Wentworth, 1922) is not entirely satisfactory for this purpose. For example, Wentworth proposed that a deposit should be described as a 'gravelly sand' when it contains more sand than gravel and there is at least 10 per cent of gravel, provided that there is less than 10 per cent of material finer than sand (less than 1/16 mm) and coarser than pebbles (more than 64 mm diameter). Because deposits containing more than 10 per cent fines are not embraced by this system a modified binary classification based on Willman (1942) has been adopted.

When the fines content exceeds 40 per cent the material is not considered to be potentially workable and falls outside the definition of mineral. Deposits which contain 40 per cent fines or less are classified primarily on the ratio of sand to gravel but qualified in the light of the fines content, as follows: less than 10 per cent fines - no qualification; 10 per cent or more but less than 20 per cent fines - 'clayey'; 20 to 40 per cent fines - 'very clayey'.

The term 'clay' (as written, with single quote marks) is used to describe all material passing 1/16 mm. Thus it has no mineralogical significance and includes particles falling within the size range of silt. The normal meaning applies to the term clay where it does not appear in single quotation marks.

The ratio of sand to gravel defines the boundaries between sand, pebbly sand, sandy gravel and gravel (at 19:1, 3:1 and 1:1).

Thus it is possible to classify the mineral into one of twelve descriptive categories (see Fig. 8). The procedure is as follows:

1. Classify according to ratio of sand to gravel;
2. Describe fines.

For example, a deposit grading 11 per cent gravel, 70 per cent sand and 19 per cent fines is classified as 'clayey' pebbly sand. This short description is included in the borehole log (see Note 11, p. 36).

Many differing proposals exist for the classification of the grain size of sediments (Atterberg, 1905; Udden, 1914; Wentworth, 1922; Wentworth, 1935; Allen, 1936; Twenhofel, 1937; Lane and others, 1947). As Archer (1970a, b) has emphasised, there is a

pressing need for a simple metric scale acceptable to both scientific and engineering interests, for which the class limit sizes correspond closely with certain marked changes in the natural properties of mineral particles. For example, there is an important change in the degree of cohesion between particles at about the 1/16 mm size, which approximates to the generally accepted boundary between silt and sand. These and other requirements are met by a system based on Udden's geometric scale and a simplified form of Wentworth's terminology (Table 4), which is used in this Report.

The fairly wide intervals in the scale are consistent with the general level of accuracy of the qualitative assessments of the resource blocks. Three sizes of sand are recognised, fine (-$\frac{1}{4}$ +1/16 mm), medium (-1 +$\frac{1}{4}$ mm) and coarse (-4 +1 mm). The boundary at 16 mm distinguishes a range of finer gravel (-16 +4 mm), often characterised by abundance of worn tough pebbles of vein quartz, from larger pebbles often of notably different materials. The boundary at 64 mm, distinguishes pebbles from cobbles. The term 'gravel' is used loosely to denote both pebble-sized and cobble-sized material.

The size distribution of borehole samples is determined by sieve analysis, which is presented by the laboratory as logarithmic cumulative curves (see, for example, British Standard 1377 (Anon., 1967). In this report the grading is tabulated on the borehole record sheets (Appendix F), the intercepts corresponding with the simple geometric scale 1/16 mm, $\frac{1}{4}$ mm, 1 mm, 4 mm, 16 mm and so on as required. Original sample grading curves are available for reference at the appropriate office of the Institute.

Each bulk sample is described, subjectively, by a geologist at the borehole site. Being based on visual examination, the description of the grading is inexact, the accuracy depending on the experience of the observer. The descriptions recorded are modified, as necessary, when the laboratory results become available.

The relative proportions of the rock types present in the gravel fraction are indicated by the use of the words 'and' or 'with'. For example, 'flint and quartz' indicates very approximate equal proportions with neither constituent accounting for less than about 25 per cent of the whole; 'flint with quartz' indicates that flint is dominant and quartz, the principal accessory rock type, comprises 5 to 25 per cent of the whole. Where the accessory material accounts for less than 5 per cent of the whole, but is still readily apparent, the phrase 'with some' has been used. Rare constituents are referred to as 'trace'.

The terms used in the field to describe the degree of rounding of particles, which is concerned with the sharpness of the edges and corners of a clastic fragment and not the shape (after Pettijohn, 1957), are as follows.

Angular: showing little or no evidence of wear; sharp edges and corners.

Subangular: showing definite effects of wear. Fragments still have their original form but edges and corners begin to be rounded off.

Subrounded: showing considerable wear. The edges and corners are rounded off to smooth curves. Original grain shape is still distinct.

Rounded: original faces almost completely destroyed, but some comparatively flat surfaces may still remain. All original edges and corners have been smoothed off to rather broad curves. Original shape is still apparent.

Well-rounded: no original faces, edges or corners left. The entire surface consists of broad curves; flat areas are absent. The original shape is suggested by the present form of the grain.

Table 4. Classification of gravel, sand and fines

Size limits	Grain size description	Qualification	Primary classification
64 mm	Cobble		Gravel
16 mm	Pebble	Coarse	
4 mm		Fine	
1 mm	Sand	Coarse	Sand
¼ mm		Medium	
1/16 mm		Fine	
	Fines (silt and clay)		Fines

Appendix D: Explanation of the Borehole Records

ANNOTATED EXAMPLE

TL 70 NE 55[1] 7839 0931[2] near World's End Cottage, Hatfield Peverel Block C[3]

Surface level (+12.2 m) +40 ft[4]
Water struck at +10.8 m (+35 ft)[5]
Shell and auger, 6 inch diameter[6]
October 1972

Overburden[7] 0.4 m (1.5 ft)
Mineral 3.8 m (12.5 ft)
Waste 1.6 m (5.5 ft)
Bedrock 1.2 m+ (4.0 ft+)[9]

LOG

		Thickness m	Thickness ft	Depth[8] m	Depth[8] ft
Soil		0.4	(1.5)	0.4	(1.5)
[10]Suballuvium deposits	Gravel[11] Gravel: fine to coarse, subrounded (with some subangular) flints and quartzite Sand: medium and coarse, subangular to subrounded quartz; orange	3.8	(12.5)	4.2	(14.0)
	Dark brown clay, with gravel	0.4	(1.5)	4.6	(15.0)
	Dark brown clay with gravel, peat and shell debris	0.7	(2.5)	5.3	(17.5)
	Dark brown clay with flints	0.5	(1.5)	5.8	(19.0)
London Clay	Firm dark brown clay becoming dark grey clay	1.2+	(4.0+)	7.0	(23.0)

GRADING

	%	mm		%
[14]Gravel	70	+16	:	26
		-16+4	:	44
		-4+1	:	11
Sand	23	-1+$\frac{1}{4}$	:	12
		-$\frac{1}{4}$+1/16	:	0
Fines	7	-1/16	:	7

Depth below[12] surface (m)	Percentage[13] Fines	Sand	Gravel
0.4 - 1.4	11	38	51
1.4 - 2.4	3	17	80
2.4 - 3.4	6	13	81
3.4 - 4.2	6	25	69

The numbered paragraphs below correspond with the annotations given on the specimen record above.

1. Borehole Registration Number
Each Mineral Assessment Unit (MAU) borehole is identified by a Registration Number. This consists of two statements.

1) The number of the 1:25 000 sheet on which the borehole lies, for example TL 70.

2) The quarter of the 1:25 000 sheet on which the borehole lies and its number in a series for that quarter, for example NE 55.

Thus the full Registration No. is TL 70 NE 55. Usually this is abbreviated to NE 55 in the text.

2. The National Grid Reference
All National Grid References in this publication lie within the 100 km square TL unless otherwise

stated. Grid references are given to eight figures, accurate to within 10 m for borehole locations. (In the text, six-figure grid references are used for more approximate locations, for example, for farms).

3. Location
The position of the borehole is generally referred to the nearest named locality on the 1:25 000 base map and the resource block in which it lies is stated.

4. Surface Level
The surface level at the borehole site is given in metres and feet above Ordnance Datum. All measurements were made in feet; approximate conversions to metres are given in brackets.

5. Groundwater Conditions
If groundwater was present the level at which it was encountered is normally given (in metres and feet above Ordnance Datum).

6. Type of Drill and Date of Drilling
Two types of drilling machine have been used in this survey; a shell and auger rig and a Wirth (a cased power auger). The type of machine, the external diameter of the casing used, and the month and year of completion of the borehole are stated.

7. Overburden, Mineral, Waste and Bedrock
Mineral is sand and gravel which, as part of a deposit, falls within the arbitrary definition of potentially workable material (see p. 1). Bedrock is the 'formation', 'country rock' or 'rock head' below which potentially workable sand and gravel will not be found. Waste is any material other than bedrock or mineral. Where waste occurs between the surface and mineral it is classified as overburden.

8. Thickness and Depth
Although most measurements were made in feet, some were recorded in metres; the conversions appear in brackets. Metric conversions, the thicknesses of beds and the depth from the surface of their bases have been rounded off to the nearest 0.1 m because quotation to two places of decimals would imply a higher order of accuracy than could be justified by the original figures. Similarly conversions from metres to feet have been rounded off to the nearest 0.5 ft. Where figures have been rounded in this way there may be a discrepancy between the sum of the thicknesses and the recorded depths.

9. The plus sign (+) indicates that the base of the deposit was not reached during drilling.

10. Geological Classification
The geological classification (Table 1) is given whenever possible.

11. Lithological Description
When sand and gravel is recorded a general description based on the mean grading characteristics (for details see Appendix C) is followed by more detailed particulars. The description of other rocks is based on visual examination, in the field.

12. Sampling
A continuous series of bulk samples is taken throughout the thickness of sand and gravel. A new sample is commenced whenever there is an appreciable lithological change within the sand and gravel or at every 3 ft or 1 m of depth.

13. Grading Results
The limits are as follows: gravel, +4 mm; sand, -4+1/16 mm; fines, -1/16 mm.

14. Mean Grading
The grading of the full thickness of the mineral horizon identified in the log is the mean of the individual sample gradings weighted by the thicknesses represented, if these vary. The classification used is shown in Table 4.

Fully representative sampling of sand and gravel is difficult to achieve particularly where groundwater levels are high. Comparison between boreholes and adjacent exposures suggests that in borehole samples the proportion of sand may be higher and the proportions of fines and coarse gravel (+16 mm) may be lower.

Appendix E: List of Boreholes Used in the Assessment of Resources

MINERAL ASSESSMENT UNIT BOREHOLES

Borehole No. by sheet quadrants		Grid Reference (all fall in 100 km square TL)
TL 70 NW		
Pages 29-53	13	7430 0936
	14	7475 0931
	15	7444 0906
	16	7405 0867
	17	7437 0860
	18	7323 0808
	19	7361 0797
	20	7350 0763
	21	7372 0727
	22	7494 0775
	23	7487 0740
	24	7499 0671
	25	7474 0627
	26	7499 0616
	27	7447 0594
	28	7406 0554
	29	7454 0543
	30	7500 0560
	31	7466 0881
	32	7375 0888
	33	7423 0569
	35	7424 0545
	36	7406 0917
	66	7209 0968
	67	7263 0869
	68	7266 0697
	69	7306 0992
	70	7369 0717
	94	7399 0651
	95	7443 0690
	96	7472 0810
	97	7355 0918
	98	7434 0994
TL 70 NE		
Pages 53-91	1	7666 0956
	2	7546 0940
	3	7502 0889
	4	7541 0890
	5	7528 0863
	6	7583 0820
	7	7554 0803
	8	7544 0777
	9	7528 0744
	10	7580 0728
	11	7515 0714
	12	7518 0670
	13	7546 0662
	14	7519 0600
	15	7534 0553
	27	7569 0658
	28	7567 0534

Borehole No. by sheet quadrants		Grid Reference (all fall in 100 km square TL)
TL 70 NE (Cont)		
	29	7668 0910
	31	7625 0856
	32	7703 0843
	33	7663 0717
	34	7661 0648
	35	7764 0952
	36	7764 0893
	37	7719 0780
	38	7731 0533
	39	7869 0984
	40	7885 0878
	42	7813 0675
	43	7909 0945
	44	7942 0773
	45	7965 0590
	46	7647 0790
	47	7869 0735
	48	7940 0673
	49	7839 0592
	50	7618 0511
	51	7908 0515
	52	7500 0961
	53	7600 0960
	54	7540 0858
	55	7839 0931
	56	7908 0903
TL 70 SW		
Pages 92-95	2	7052 0306
	3	7052 0168
	5	7123 0415
	7	7263 0408
	8	7332 0315
	9	7430 0460
	10	7474 0349
TL 70 SE		
Pages 95-102	1	7574 0458
	2	7540 0326
	3	7666 0442
	4	7664 0377
	5	7783 0463
	7	7772 0220
	8	7864 0456
	9	7846 0348
	11	7952 0461
	12	7971 0365
	13	7994 0296
	14	7788 0394
	15	7874 0341

OTHER BOREHOLES

1. Hydrogeological Department Boreholes (Davies and Standon-Batt, 1965) 241/97, 241/118, 241/125. (Details of the list are held in the National Well Record collection of the Hydrogeological Department of the Institute and may be inspected upon application to the Director, Institute of Geological Sciences, Exhibition Road SW7 2DE).

2. Site Investigation Borehole results have been taken from the following site investigation reports: Gt Baddow Bypass; Springfield-Boreham Bypass; London-Gt Yarmouth Trunk Road (A12-Chelmsford Bypass).

Table 5. The numbers of boreholes used in the assessment of resources for each resource block

Block	MAU Boreholes	Hydrogeological Department Boreholes	Site Investigation Boreholes
A	22	2	-
B	19	-	25
C Terrace Suballuvium	19 8	- 1	10 15
D	-	-	13

The term 'sample-point' as used in Table 3 may include a number of closely spaced site investigation boreholes which, in the calculations, have been given a collective weighting factor of one. Therefore, the number of sample-points used in the assessment of resources may be less than the total number of borehole records available for the block.

Appendix F: Mineral Assessment Unit Borehole Records

TL 70 NW 13 7430 0936 Near Little Generals, Boreham Block B

Surface level (+32.0 m) +105 ft
Water not struck
Continuous flight power auger, 6-in diameter (approx)
April 1967

Overburden (1.5m) 5 ft
Mineral (3.4 m) 11 ft
Bedrock (4.3 m +) 14 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.6)	2	(0.6)	2
Head	Brown sandy clay	(0.9)	3	(1.5)	5
Glacial Sand and Gravel	Gravel Gravel: fine to coarse subangular. Sand: medium and coarse, a little fine. Brown.	(3.4)	11	(4.9)	16
London Clay	Brown Clay	(4.3+)	14+	(9.1)	30

Grading

	%	mm	%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64 :	0	5 - 16	8	26	66
Gravel	66	-64+16 :	32				
		-16+4 :	34				
		-4+1 :	11				
Sand	26	-1+$\frac{1}{4}$:	12				
		-$\frac{1}{4}$+1/16 :	3				
Fines	8	-1/16 :	8				

TL 70 NW 14 7475 0931 Near Boreham House, Boreham Block B

Surface level (+25.6 m) +84 ft
Water level not recorded
Continuous flight power auger, 6-in diameter
April 1967

Waste (6.4 m) 21 ft
Bedrock (4.3 m+) 14 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.6)	2	(0.6)	2
Chalky Boulder Clay	Brown silty clay with chalk fragments.	(5.8)	19	(6.4)	21
London Clay	Stiff bluish-grey clay.	(4.3+)	14+	(10.7)	35

TL 70 NW 15 7444 0906 Near Boreham House, Boreham Block B

Surface level (+26.5 m) +87 ft
Water struck at (+24.1 m) +79 ft
Continous flight power auger, 6-in diameter
April 1967

Waste (8.8 m) 29 ft
Bedrock (1.2 m+) 4 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.3)	1	(0.3)	1
Glacial lake deposits	Brown sandy clay.	(2.4)	8	(2.7)	9
	Brown soft sandy clay.	(2.7)	9	(5.5)	18
	Grey-yellow clay.	(3.4)	11	(8.8)	29
London Clay	Brown clay.	(1.2+)	4+	(10.1)	33

TL 70 NW 16 7405 0867 Near Sheepcotes, Springfield Block B

Surface level (+20.1 m) +66 ft
Water struck at (+19.2 m) +63 ft
Continuous flight power auger, 6-in diameter
April 1967

Waste (1.2 m) 4 ft
Bedrock (2.4 m+) 8 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.6)	2	(0.6)	2
Head	Stony silty clay.	(0.6)	2	(1.2)	4
London Clay	Brown clay.	(1.2)	4	(2.4)	8
	Grey clay.	(1.2+)	4+	(3.7)	12

TL 70 NW 17 7437 0860 Near Sheepcotes, Springfield Block B

Surface level (+17.4 m) +57 ft
Water struck at (+16.5 m) +54 ft
Continuous flight power auger, 6-in diameter
April 1967

Overburden (2.4 m) 8 ft
Mineral (1.5 m) 5 ft
Bedrock (0.6 m+) 2 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.6)	2	(0.6)	2
Head	Soft brown clay.	(1.8)	6	(2.4)	8
Glacial Sand and Gravel	'Clayey' gravel Gravel: fine to coarse subangular flints. Sand: medium and coarse, a little fine. Clayey.	(1.5)	5	(4.0)	13
London Clay	Brown clay.	(0.6+)	2+	(4.6)	15

Grading

	%	mm		%
		+64	:	0
Gravel	64	-64+16	:	37
		-16+4	:	27
		-4+1	:	9
Sand	24	-1+$\frac{1}{4}$	:	12
		-$\frac{1}{4}$+1/16	:	3
Fines	12	-1/16	:	12

Depth below surface (ft)	Percentage Fines	Sand	Gravel
8 - 13	12	24	64

TL 70 NW 18 7323 0808 Dairy Farm, Springfield Block B

Surface level (+39.3 m) +129 ft
Water struck at (+36.9 m) +121 ft
Continuous flight power auger, 6-in diameter
April 1967

Overburden (1.5 m) 5 ft
Mineral (1.5 m) 5 ft
Bedrock (0.6 m+) 2 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.6)	2	(0.6)	2
Head	Brown stony clay.	(0.9)	3	(1.5)	5
Glacial Sand and Gravel	'Clayey' gravel Gravel: fine to coarse subangular flints. Sand: medium and coarse, a little fine. Clayey.	(1.5)	5	(3.0)	10
London Clay	Brown clay.	(0.6+)	2+	(3.7)	12

Grading

	%	mm	%	Depth blow surface (ft)
		+64	: 0	5 - 10
Gravel	64	-64+16	: 34	
		-16+4	: 30	
		-4+1	: 10	
Sand	26	-1+$\frac{1}{4}$	: 13	
		-$\frac{1}{4}$+1/16	: 3	
Fines	10	-1/16	: 10	

Percentage		
Fines	Sand	Gravel
10	26	64

TL 70 NW 19 7361 0797 Cuton Hall, Springfield Block B

Surface level (+28.3 m) +93 ft
Water not struck
Continuous flight power auger, 6-in diameter
April 1967

Waste (1.5 m) 5 ft
Bedrock (4.9 m+) 16 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.6)	2	(0.6)	2
Head	Brown stony clay.	(0.9)	3	(1.5)	5
London Clay	Brown clay.	(3.1)	10	(4.6)	15
	Grey clay.	(1.8+)	6+	(6.4)	21

TL 70 NW 20 7350 0763 New Barnes, Springfield Block C

Surface level (+30.5 m) +100 ft
Water struck at (+27.7 m) +91 ft
Continuous flight power auger, 6-in diameter
April 1967

Overburden (1.2 m) 4 ft
Mineral (3.7 m) 12 ft
Bedrock (2.4 m+) 8 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.6)	2	(0.6)	2
Head	Stony clay.	(0.6)	2	(1.2)	4
Glacial Sand and Gravel	'Clayey' gravel Gravel: fine to coarse subangular. Sand: medium with fine and coarse. Clayey.	(3.7)	12	(4.9)	16
London Clay	Brown clay.	(1.5)	5	(6.4)	21
	Grey clay.	(0.9+)	3+	(7.3)	24

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	4 - 10	16	43	41
Gravel	45	-64+16	:	23	10 - 16	13	39	48
		-16+4	:	22				
		-4+1	:	7				
Sand	41	-1+$\frac{1}{4}$	:	27				
		-$\frac{1}{4}$+1/16	:	7				
Fines	14	-1/16	:	14				

TL 70 NW 21 7372 0727 Near Brookend, Springfield Block C

Surface level (+17.4 m) +57 ft
Water level struck at (+15.5 m) +51 ft
Continuous flight power auger, 6-in diameter
April 1967

Overburden (0.6 m) 2 ft
Mineral (1.5 m) 5 ft
Bedrock (0.6 m+) 2 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.6)	2	(0.6)	2
2nd Terrace of the Chelmer	'Clayey' gravel Gravel: fine to coarse. Sand: medium and coarse, clayey.	(1.5)	5	(2.1)	7
London Clay	Brown clay.	(0.6+)	2+	(2.7)	9

Grading

	%	mm		%
		+64	:	0
Gravel	66	-64+16	:	33
		-16+4	:	33
		-4+1	:	8
Sand	23	-1+$\frac{1}{4}$	:	13
		-$\frac{1}{4}$+1/16	:	2
Fines	11	-1/16	:	11

Depth below surface (ft)	Percentage Fines	Sand	Gravel
2 - 7	11	23	66

TL 70 NW 22 7494 0775 Near Whitwells Farm, Little Baddow Block C

Surface level (+17.1 m) +56 ft
Water struck at (+14.9 m) +49 ft
Continuous flight power auger, 6-in diameter
March 1967

Overburden (2.1 m) 7 ft
Mineral (1.2 m) 4 ft
Bedrock (1.2 m+) 4 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.3)	1	(0.3)	1
River brickearth	Silty brown clay.	(1.8)	6	(2.1)	7
1st Terrace of the Chelmer	'Clayey' gravel Gravel: fine to coarse subangular to subrounded. Sand: medium and coarse, some fine. Clayey.	(1.2)	4	(3.4)	11
London Clay	Brown clay.	(1.2+)	4+	(4.6)	15

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	7 - 11	16	35	49
Gravel	49	-64+16	:	15				
		-16+4	:	34				
		-4+1	:	11				
Sand	35	-1+$\frac{1}{4}$	:	18				
		-$\frac{1}{4}$+1/16	:	6				
Fines	16	-1/16	:	16				

TL 70 NW 23 7487 0740 Near Whitwells Farm, Little Baddow Block C

Surface level (+19.5 m) +64 ft
Water struck at (+18.6 m) +61 ft
Continuous flight power auger, 6-in diameter
March 1967

Overburden (0.9 m) 3 ft
Mineral (2.4 m) 8 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.3)	1	(0.3)	1
? River brickearth	Silty brown clay.	(0.6)	2	(0.9)	3
2nd Terrace of the Chelmer	'Clayey' gravel Gravel: fine to coarse subangular. Sand: medium and coarse, some fine. Clayey.	(2.4)	8	(3.4)	11
London Clay	Brown clay.	(0.9+)	3+	(4.3)	14

Grading

	%	mm		%	Depth below surface (ft)	Fines	Percentage Sand	Gravel
		+64	:	0	3 - 6	14	29	57
Gravel	57	-64+16	:	25	6 - 9	10	27	63
		-16+4	:	32	9 - 11	14	38	48
		-4+1	:	11				
Sand	31	-1+$\frac{1}{4}$	:	15				
		-$\frac{1}{4}$+1/16	:	5				
Fines	12	-1/16	:	12				

TL 70 NW 24 7499 0671 Grace's Walk, Little Baddow Block C

Surface level (+21.3 m) +70 ft
Water level not recorded
Continuous flight power auger, 6-in diameter
March 1967

Overburden (1.8 m) 6 ft
Mineral (2.7 m) 9 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.3)	1	(0.3)	1
Head	Brown silty clay.	(1.5)	5	(1.8)	6
2nd Terrace of the Chelmer	'Very clayey' gravel Gravel: fine to coarse. Sand: fine with medium, a little coarse. Very clayey.	(2.7)	9	(4.6)	15
London Clay	Brown clay.	(0.9+)	3+	(5.5)	18

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	6 - 11	2	26	72
Gravel	40	-64+16	:	25	11 - 15	69	23	8
		-16+4	:	15				
		-4+1	:	5				
Sand	25	-1+$\frac{1}{4}$	:	8				
		-$\frac{1}{4}$+1/16	:	12				
Fines	35	-1/16	:	35				

TL 70 NW 25 7474 0627 Rumbold's Farm, Danbury Block C

Surface level (+27.1 m) +89 ft
Water struck at (+20.7 m) + 68 ft
Continuous flight power auger, 6-in diameter
March 1967

Waste (11.9 m) 39 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.3)	1	(0.3)	1
Head	Brown silty clay.	(0.9)	3	(1.2)	4
Channel-fill deposits	Brown soft clayey sand.	(4.9)	16	(6.1)	20
	Brown soft sand.	(2.7)	9	(8.8)	29
	Grey soft sand.	(3.0)	10	(11.9)	39
London Clay	Brown clay.	(0.9+)	3+	(12.8)	42

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	4 - 10	22	75	3
Gravel	1	-64+16	:	0	10 - 16	50	50	0
		-16+4	:	1	16 - 22	73	27	0
					22 - 28	66	44	0
		-4+1	:	0	28 - 34	66	44	0
Sand	45	-1+$\frac{1}{4}$	:	12	34 - 39	49	51	0
		-$\frac{1}{4}$+1/16	:	33				
Fines	54	-1/16	:	54				

TL 70 NW 26 7499 0616 Near Rumbold's Farm, Danbury Block C

Surface level (+23.5 m) +77 ft
Water struck at (+22.3 m) +73 ft
Continuous flight power auger, 6-in diameter
March 1967

Waste (4.0 m) 13 ft
Bedrock (0.6 m+) 2 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.6)	2	(0.6)	2
Head	Brown silty clay.	(2.7)	9	(3.4)	11
2nd Terrace of the Chelmer	Gravel.	(0.6)	2	(4.0)	13
London Clay	Brown clay.	(0.6+)	2+	(4.6)	15

TL 70 NW 27 7447 0594 Hammonds Road, Sandon Block C

Surface level (+22.3 m) +73 ft
Water struck at (+17.7 m) +58 ft
Continuous flight power auger, 6-in diameter
March 1967

Waste (6.4 m) 21 ft
Bedrock (1.8 m+) 6 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.3)	1	(0.3)	1
Channel-fill deposits	Brown silty clay.	(2.1)	7	(2.4)	8
	Brown sandy clay.	(2.1)	7	(4.6)	15
	Brown soft sand.	(1.8)	6	(6.4)	21
London Clay	Grey clay.	(1.8+)	6+	(8.2)	27

TL 70 NW 28 7406 0554 Hammonds Road, Danbury Block C

Surface level (+33.2 m) +109 ft
Water level not recorded
Continuous flight power auger, 6-in diameter
March 1967

Waste (10.1 m) 33 ft
Bedrock (1.8 m+) 6 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.3)	1	(0.3)	1
? Glacial lake deposits	Brown sandy clay.	(2.1)	7	(2.4)	8
	Soft brown clay.	(7.6)	25	(10.1)	33
London Clay	Brown clay.	(1.8+)	6+	(11.9)	39

TL 70 NW 29 7454 0543 Near White House, Sandon Block C

Surface level (+30.5 m) +100 ft
Water struck at (+28.3 m) +93 ft
Continuous flight power auger, 6-in diameter
March 1967

Overburden (1.5 m) 5 ft
Mineral (1.5 m) 5 ft
Bedrock (3.4 m+) 11 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.3)	1	(0.3)	1
Head	Brown silty clay.	(1.2)	4	(1.5)	5
3rd Terrace of the Chelmer	'Clayey' gravel Gravel: fine to coarse. Sand: fine, medium and coarse. Clayey.	(1.5)	5	(3.0)	10
London Clay	Brown clay.	(3.4+)	11+	(6.4)	21

Grading

	%	mm		%	Depth below surface (ft)
		+64	:	0	5 - 10
Gravel	68	-64+16	:	35	
		-16+4	:	33	
		-4+1	:	4	
Sand	12	-1+$\frac{1}{4}$	:	5	
		-$\frac{1}{4}$+1/16	:	3	
Fines	20	-1/16	:	20	

Percentage		
Fines	Sand	Gravel
20	12	68

TL 70 NW 30 7500 0560 Near Potash Farm, Sandon Block C

Surface level (+25.0 m) +82 ft
Water struck at (+22.9 m) +75 ft
Continuous flight power auger, 6-in diameter
March 1967

Overburden (1.2 m) 4 ft
Mineral (6.4 m) 21 ft
Bedrock (1.5 m+) 5 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.3)	1	(0.3)	1
Head	Brown silty clay.	(0.9)	3	(1.2)	4
? Glacial Sand and Gravel	'Very clayey' sand Sand: medium and fine, a little coarse. Brown. Clayey.	(6.4)	21	(7.6)	25
London Clay	Brown clay.	(1.5+)	5+	(9.1)	30

Grading

	%	mm		%	Depth below surface (ft)	Fines	Percentage Sand	Gravel
		+64	:	0	4 - 9	8	83	9
Gravel	4	-64+16	:	2	9 - 14	52	48	0
		-16+4	:	2	14 - 19	20	74	6
					19 - 25	17	83	0
		-4+1	:	3				
Sand	72	-1+$\frac{1}{4}$	:	38				
		-$\frac{1}{4}$+1/16	:	31				
Fines	24	-1/16	:	24				

TL 70 NW 31 7466 0881 Near Boreham House, Boreham Block B

Surface level (+17.7 m) +58 ft
Water struck at (+16.8 m) +55 ft
Continuous flight power auger, 6-in diameter
April 1967

Overburden (0.9 m) 3 ft
Mineral (1.8 m) 6 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.3)	1	(0.3)	1
Head	Stony clay.	(0.6)	2	(0.9)	3
Glacial Sand and Gravel	'Very clayey' pebbly sand Gravel: fine to coarse subangular. Sand: medium and fine, a little coarse. Very clayey.	(1.8)	6	(2.7)	9
London Clay	Brown clay.	(0.9+)	3+	(3.7)	12

Grading

	%	mm		%
		+64	:	0
Gravel	4	-64+16	:	2
		-16+4	:	2
		-4+1	:	4
Sand	60	-1+$\frac{1}{4}$	:	31
		-$\frac{1}{4}$+1/16	:	25
Fines	36	-1/16	:	36

Depth below surface (ft)	Percentage Fines	Sand	Gravel
3 - 9	36	60	4

TL 70 NW 32 7375 0888 Roman Road, Springfield Block B

Surface level (+30.8 m) +101 ft
Water not struck
Continuous flight power auger, 6-in diameter
April 1967

Waste (4.0 m) 13 ft
Bedrock (1.5 m+) 5 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.6)	2	(0.6)	2
Glacial lake deposits	Silty clay.	(2.1)	7	(2.7)	9
	Soft brown clay.	(1.2)	4	(4.0)	13
London Clay	Brown clay.	(1.5+)	5+	(5.5)	18

TL 70 NW 33 7423 0569 Hammonds Road, Sandon Block C

Surface level (+28.3 m) +93 ft
Water struck at (+25.9 m) +85 ft
Continuous flight power auger, 6-in diameter
April 1967

Waste (4.0 m) 13 ft
Bedrock (1.5 m+) 5 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.6)	2	(0.6)	2
Head	Silty clay.	(2.7)	9	(3.4)	11
? 2nd Terrace of the Chelmer	Gravel.	(0.6)	2	(4.0)	13
London Clay	Brown clay.	(1.5+)	5+	(5.5)	18

No samples available.

TL 70 NW 35 7424 0545 Near Grace's Cross, Sandon Block C

Surface level (+30.5 m) +100 ft
Water level not recorded
Continuous flight power auger, 6-in diameter
April 1967

Waste (4.6 m) 15 ft
Bedrock (1.8 m+) 6 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.6)	2	(0.6)	2
Glacial lake deposits	Silty clay.	(2.4)	8	(3.0)	10
	Soft brown clay.	(1.5)	5	(4.6)	15
London Clay	Brown clay.	(1.8+)	6+	(6.4)	21

TL 70 NW 36 7406 0917 Roman Road, Boreham Block B

Surface level (+26.2 m) +86 ft
Water struck at (+25.0 m) +82 ft
Continuous flight power auger, 6-in diameter
April 1967

Overburden (0.6 m) 2 ft
Mineral (7.9 m) 26 ft
Bedrock (1.5 m+) 5 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.6)	2	(0.6)	2
Glacial Sand and Gravel	'Clayey' gravel Gravel: fine to coarse subangular. Sand: medium with fine and coarse. Clayey.	(7.9)	26	(8.5)	28
London Clay	Brown clay.	(1.5+)	5+	(10.1)	33

Grading

	%	mm		%
		+64	:	0
Gravel	51	-64+16	:	27
		-16+4	:	24
		-4+1	:	8
Sand	37	-1+$\frac{1}{4}$	:	18
		-$\frac{1}{4}$+1/16	:	11
Fines	12	-1/16	:	12

Depth below surface (ft)	Percentage Fines	Sand	Gravel
2 - 7	31	48	21
7 - 13	14	42	44
13 - 18	7	23	70
18 - 23	3	37	60
23 - 28	7	33	60

TL 70 NW 66 7209 0968 Nabbott's Farm, Springfield

Surface level (+46.3 m) +152 ft
Water struck at (+35.1 m) +115 ft
Wirth BO, 8-in diameter
July 1968

Overburden (7.6 m) 25 ft
Mineral (9.1 m) 30 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(1.2)	4	(1.2)	4
Chalky Boulder Clay	Brown Clay	(6.4)	21	(7.6)	25
Glacial Sand and Gravel	Sandy gravel Gravel: fine to coarse subangular flints, some subrounded quartz. Sand: fine and medium, a little coarse, subangular. Brown.	(9.1)	30	(16.8)	55
London Clay	Brown clay.	(0.9+)	3+	(17.7)	58

Grading

	%	mm		%	Depth below surface (ft)	Fines	Percentage Sand	Gravel
		+64	:	0	25 - 28	4	90	6
Gravel	41	-64+16	:	15	28 - 31	4	76	20
		-16+4	:	26	31 - 34	2	41	57
					34 - 37	2	81	17
		-4+1	:	8	37 - 40	2	64	34
Sand	57	-1+$\frac{1}{4}$	:	30	40 - 43	1	53	46
		-$\frac{1}{4}$+1/16	:	19	43 - 46	1	57	42
					46 - 49	2	27	71
Fines	2	-/16	:	2	49 - 52	0	40	60
					52 - 55	0	46	54

TL 70 NW 67 7263 0869 Bowers Farm, Springfield

Surface level (+46.9 m) +154 ft
Water struck at (+32.9 m) +108 ft
Wirth BO, 8-in diameter
July 1969

Waste (18.3 m+) 60 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(1.2)	4	(1.2)	4
Chalky Boulder Clay	Brown and grey clay, silty in parts with occasional stony layers.	(17.1+)	56+	(18.3)	60

TL 70 NW 68 7266 0697 Sandford Mill Road, Springfield

Surface level (+29.9 m) +98 ft
Water struck at (+21.3 m) +70 ft
Wirth BO, 8-in diameter
July 1969

Overburden (4.9 m) 16 ft
Mineral (4.6 m) 15 ft
Bedrock (0.9 m+) 3 ft +

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(1.2)	4	(1.2)	4
Chalky Boulder Clay	Brown, silty clay, gravelly near base.	(3.7)	12	(4.9)	16
Glacial Sand and Gravel	Sandy gravel Gravel: fine to coarse subangular and subrounded flints, some subrounded quartzite. Sand: Mainly medium with a little fine and coarse subangular and subrounded. Rusty brown.	(4.6)	15	(9.4)	31
London Clay	Brown clay.	(0.9+)	3+	(10.4)	34

Grading

	%	mm		%
		+64	:	0
Gravel	38	-64+16	:	16
		-16+4	:	22
		-4+1	:	6
Sand	60	-1+$\frac{1}{4}$	:	43
		-$\frac{1}{4}$+1/16	:	11
Fines	2	-1/16	:	2

Depth below surface (ft)	Percentage Fines	Sand	Gravel
16 - 19	9	49	42
19 - 22	0	58	42
22 - 25	2	63	35
25 - 28	0	71	29
28 - 31	0	60	40

TL 70 NW 69 7306 0992 Old Lodge Farm, Springfield Block B

Surface level (+50.6 m) +166 ft
Water struck at (+32.9 m) +108 ft
Wirth BO, 8-in diameter
July 1969

Overburden (9.1 m) 30 ft
Mineral (10.1 m) 33 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(1.2)	4	(1.2)	4
Chalky Boulder Clay	Brown silty clay.	(7.9)	26	(9.1)	30
Glacial Sand and Gravel	Sandy gravel Gravel: fine to coarse subangular to subrounded flints, and large subangular flints. Sand: fine, medium and coarse. Brown.	(10.1)	33	(19.2)	63
London Clay	Brown clay.	(0.9+)	3+	(20.1)	66

Grading

	%	mm	:	%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	30 - 33	2	56	42
Gravel	47	-64+16	:	18	33 - 36	0	39	61
		-16+4	:	29	36 - 39	1	39	60
					39 - 42	3	61	36
		-4+1	:	10	42 - 45	6	88	6
Sand	52	-1+$\frac{1}{4}$	:	31	45 - 48	2	53	45
		-$\frac{1}{4}$+1/16	:	11	48 - 51	0	28	72
					51 - 54	0	44	56
Fines	1	-1/16	:	1	54 - 57	2	83	15
					57 - 60	0	38	62
					60 - 63	0	43	57

TL 70 NW 70 7369 0717 Brookend, Springfield Block C

Surface level (+18.6 m) +61 ft
Water struck at (+12.2 m) +40 ft
Wirth BO, 8-in diameter
July 1969

Waste (7.0 m) 23 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Made ground		(0.6)	2	(0.6)	2
Soil		(1.2)	4	(1.8)	6
Chalky Boulder Clay	Brown silty clay.	(3.7)	12	(5.5)	18
2nd Terrace of the Chelmer	Gravel. Gravel: fine to coarse subrounded flints some subangular. Sand: Medium and coarse, clayey. Brown.	(1.5)	5	(7.0)	23
London Clay	Brown clay.	(0.9+)	3+	(7.9)	26

Grading

	%	mm		%
		+64	:	0
Gravel	67	-64+16	:	34
		-16+4	:	33
		-4+1	:	13
Sand	32	-1+$\frac{1}{4}$	:	18
		-$\frac{1}{4}$+1/16	:	1
Fines	1	-1/16	:	1

Depth below surface (ft)	Percentage Fines	Sand	Gravel
18 - 21	0	29	71
21 - 23	2	36	62

TL 70 NW 94 7399 0651 Brookend Sewage Works, Springfield Block C

Surface level (+19.2 m) +63 ft
Water struck at +17.6 m (+58 ft)
Shell and auger, 6-in diameter
October 1972

Overburden 0.6 m (2.0 ft)
Mineral 3.5 m (11.5 ft)
Waste 4.9 m+ (16.0 ft+)

Log

		Thickness m	(ft)	Depth m	(ft)
Made ground		0.4	(1.5)	0.4	(1.5)
Soil	Old topsoil	0.2	(0.5)	0.6	(2.0)
1st Terrace of the Chelmer	'Clayey' gravel Gravel: fine to coarse, subangular to subrounded flints with quartzite Sand: medium with coarse subangular to subrounded, grey-brown, clayey.	3.5	(11.5)	4.1	(13.5)
Channel-fill deposits	Soft, light grey, silty clay	4.9+	(16.0+)	9.0	(29.5)

Grading

	%	mm		%
		+16	:	21
Gravel	56	-16+4	:	35
		-4+1	:	11
Sand	30	-1+$\frac{1}{4}$	:	18
		-$\frac{1}{4}$+1/16	:	1
Fines	14	-1/16	:	14

Depth below surface (m)	Fines	Percentage Sand	Gravel
0.6 - 1.6	24	35	41
1.6 - 2.6	11	38	51
2.6 - 3.6	10	16	74
3.6 - 4.1	9	33	58

TL 70 NW 95 7443 0690 Near Brookend Sewage Works, Springfield Block C

Surface level (+17.4 m) +57 ft
Water struck at +14.1 m (+46 ft)
Shell and auger, 6-in diameter
October 1972

Overburden 3.3 m (11.0 ft)
Mineral 6.6 m (22.0 ft)
Waste 8.4 m+ (27.5 ft+)

Log

		Thickness m	(ft)	Depth m	(ft)
Soil		0.3	(1.0)	0.3	(1.0)
Alluvium	Soft mottled light-brown/grey clayey silt with peat and gravel near base.	3.0	(10.0)	3.3	(11.0)
Sub-alluvium deposits	'Very clayey' pebbly sand Gravel: fine to coarse, angular to subangular flints. Sand: medium with some fine subangular to subrounded quartz; orange, clayey.	6.6	(22.0)	9.9	32.5)
Channel-fill deposits	Soft light grey silty clay.	8.4+	(27.5+)	18.3	(60.0)

Grading

	%	mm		%
		+16	:	7
Gravel	12	-16+4	:	5
		-4+1	:	3
Sand	65	-1+$\frac{1}{4}$	:	54
		-$\frac{1}{4}$+1/16	:	8
Fines	23	-1/16	:	23

Depth below surface (m)	Percentage Fines	Sand	Gravel
3.3 - 4.3	1	17	82
4.3 - 5.3	10	87	3
5.3 - 6.3	25	75	0
6.3 - 7.3	26	74	0
7.3 - 8.3	19	81	0
8.3 - 9.3	39	61	0
9.3 - 9.9	40	60	0

TL 70 NW 96 7472 0810 Near Stonham's Lock, Springfield Block C

Surface level (+16.8 m) +55 ft
Water struck at +14.6 m (+48 ft)
Shell and auger, 6-in diameter
October 1972

Overburden 1.8 m (6.0 ft)
Mineral 2.5 m (8.0 ft)
Waste 4.7 m (15.5 ft)
Bedrock 1.1 m+ (3.5 ft+)

Log

		Thickness m	Thickness (ft)	Depth m	Depth (ft)
Soil		0.3	(1.0)	0.3	(1.0)
Alluvium	Soft light brown silty clay	1.5	(5.0)	1.8	(6.0)
Sub-alluvium deposits	Gravel Gravel: fine to coarse, subrounded (with some subangular) flints and quartzite. Sand: medium with coarse, subangular to subrounded quartz; light grey/brown.	2.5	(8.0)	4.3	(14.0)
Channel-fill deposits	Soft light grey laminated silty clay.	4.7	(15.5)	9.0	(29.5)
London Clay	Firm dark grey clay.	1.1+	(3.5+)	10.1	(33.0)

Grading

	%	mm	:	%	Depth below surface (m)	Fines	Percentage Sand	Gravel
Gravel	59	+16	:	24	1.8 - 2.8	4	38	58
		-16+4	:	35	2.8 - 4.3	1	38	61
Sand	38	-4+1	:	14				
		-1+$\frac{1}{4}$	:	23				
		-$\frac{1}{4}$+1/16	:	1				
Fines	3	-1/16	:	3				

TL 70 NW 97 7355 0918 Near Winsford Hall, Springfield Block B

Surface level (+40.2 m) +132 ft
Water struck at +36.0 m (+118 ft)
Shell and auger, 6-in diameter
October 1972

Overburden 0.6 m (2.0 ft)
Mineral 7.7 m (25.5 ft)
Bedrock 1.2 m+ (4.0 ft+)

Log

		Thickness m	Thickness (ft)	Depth m	Depth (ft)
Soil		0.6	(2.0)	0.6	(2.0)
Glacial Sand and Gravel	Gravel Gravel: fine to coarse, subangular to subrounded flints and quartzite. Sand: medium with coarse, subangular to subrounded quartz; orange.	7.7	(25.5)	8.3	(27.5)
London Clay	Firm brown clay becoming firm dark grey clay.	1.2+	(4.0+)	9.5	(31.0)

Grading

	%	mm		%	Depth below surface (m)	Fines	Percentage Sand	Gravel
Gravel	62	+16	:	30	0.6 - 1.6	13	38	49
		-16+4	:	32	1.6 - 2.6	11	28	61
					2.6 - 3.6	21	43	36
		-4+1	:	9	3.6 - 4.6	16	38	46
Sand	29	-1+$\frac{1}{4}$	:	18	4.6 - 5.6	3	28	69
		-$\frac{1}{4}$+1/16	:	2	5.6 - 6.6	4	22	74
					6.6 - 7.6	3	3	94
Fines	9	-1/16	:	9	7.6 - 8.3	2	30	68

TL 70 NW 98 7434 0994 Near The Generals, Boreham Block B

Surface level (+31.7 m) +104 ft
Water struck at +28.7 m (+94 ft)
Shell and auger, 6-in diameter
October 1972

Overburden 1.4 m (4.5 ft)
Mineral 4.0 m (13.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

Log

		Thickness m	(ft)	Depth m	(ft)
Soil		0.6	(2.0)	0.6	(2.0)
? Head	Mottled orange/brown clay with flints	0.8	(2.5)	1.4	(4.5)
Glacial Sand and Gravel	Gravel Gravel: fine to coarse, subangular to subrounded flints with quartzite. Sand: medium with coarse subangular to subrounded quartz; light brown.	4.0	(13.0)	5.4	(17.5)
London Clay	Soft orange-brown clay becoming firm dark grey clay.	1.0+	(3.5+)	6.4	(21.0)

Grading

	%	mm		%	Depth below surface (m)	Fines	Percentage Sand	Gravel
		+16	:	32	1.4 - 2.4	16	32	52
Gravel	65	-16+4	:	33	2.4 - 3.4	7	30	63
					3.4 - 4.4	5	28	67
		-4+1	:	11	4.4 - 5.4	1	19	80
Sand	28	-1+$\frac{1}{4}$	:	15				
		-$\frac{1}{4}$+1/16	:	2				
Fines	7	-1/16	:	7				

TL 70 NE 1 7666 0956 Culvert's Cottages, Boreham Block B

Surface level (+32.0 m) +105 ft
Water not struck
Continuous flight power auger, 6-in diameter
April 1967

Waste (0.6 m) 2 ft
Bedrock (7.9 m+) 26 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.6)	2	(0.6)	2
London Clay	Brown clay.	(6.7)	22	(7.3)	24
	Grey clay.	(1.2+)	4+	(8.5)	28

TL 70 NE 2 7546 0940 Near South Barn, Boreham Block B

Surface level (+24.1 m) +79 ft
Water not struck
Continuous flight power auger, 6-in diameter
April 1967

Waste (0.6 m) 2 ft
Bedrock (11.6 m+) 38 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.6)	2	(0.6)	2
London Clay	Brown clay.	(7.6)	25	(8.2)	27
	Grey clay.	(4.0+)	13+	(12.2)	40

TL 70 NE 3 7502 0889 Near Boreham Hall, Boreham Block B

Surface level (+19.8 m) +65 ft
Water struck at (+18.0 m) +59 ft
Continuous flight power auger, 6-in diameter
April 1967

Overburden (2.7 m) 9 ft
Mineral (1.8 m) 6 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.6)	2	(0.6)	2
? Head	Brown clay silty in parts.	(2.1)	7	(2.7)	9
Glacial Sand and Gravel	'Very clayey' gravel Gravel: fine to coarse. Sand: medium with coarse, and traces of fine. Very clayey.	(1.8)	6	(4.6)	15
London Clay	Brown clay.	(0.9+)	3+	(5.5)	18

Grading

	%	mm		%	Depth below surface (ft)
		+64	:	0	9 - 15
Gravel	53	-64+16	:	20	
		-16+4	:	33	
		-4+1	:	7	
Sand	23	-1+$\frac{1}{4}$	:	13	
		-$\frac{1}{4}$+1/16	:	3	
Fines	24	-1/16	:	24	

Percentage

Fines	Sand	Gravel
24	23	53

TL 70 NE 4 7541 0890 Boreham Hall, Boreham Block B

Surface level (+22.2 m) +73 ft
Water level not recorded
Continuous flight power auger, 6-in diameter
April 1967

Waste (1.2 m) 4 ft
Bedrock (11.0 m+) 36 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.6)	2	(0.6)	2
Glacial Sand and Gravel	'Clayey' gravel	(0.6)	2	(1.2)	4
London Clay	Brown clay.	(4.3)	14	(5.5)	18
	Grey clay.	(6.7+)	22+	(12.2)	40

TL 70 NE 5 7528 0863 Near Boreham Hall, Boreham Block B

Surface level (+16.5 m) +54 ft
Water level not recorded
Continuous flight power auger, 6-in diameter
April 1967

Overburden (0.6 m) 2 ft
Mineral (1.2 m) 4 ft
Bedrock (10.4 m+) 34 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.6)	2	(0.6)	2
Glacial Sand and Gravel	'Very clayey' gravel Gravel: fine to coarse. Sand: medium and coarse, very clayey.	(1.2)	4	(1.8)	6
London Clay	Brown clay.	(3.7)	12	(5.5)	18
	Grey clay.	(6.7+)	22+	(12.2)	40

Grading

	%	mm		%	Depth below surface (ft)
		+64	:	0	2 - 6
Gravel	41	-64+16	:	17	
		-16+4	:	24	
		-4+1	:	10	
Sand	32	-1+$\frac{1}{4}$	:	20	
		-$\frac{1}{4}$+1/16	:	2	
Fines	27	-1/16	:	27	

Percentage

Fines	Sand	Gravel
27	32	41

TL 70 NE 6 7583 0820 Hammonds Road, Little Baddow Block C

Surface level (+14.9 m) +49 ft
Water struck at (+14.0 m) +46 ft
Continuous flight power auger, 6-in diameter
March 1967

Overburden (1.2 m) 4 ft
Mineral (2.7 m) 9 ft
Bedrock (0.6 m+) 2 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.3)	1	(0.3)	1
River brickearth	Brown clay.	(1.0)	3	(1.2)	4
1st Terrace of the Chelmer	Gravel. Gravel: fine to coarse. Sand: medium with some coarse.	(2.7)	9	(4.0)	13
London Clay	Brown clay.	(0.6+)	2+	(4.6)	15

Grading

	%	mm		%	Depth below surface (ft)	Fines	Percentage Sand	Gravel
		+64	:	0	4 - 6	14	39	47
Gravel	71	-64+16	:	34	6 - 13	4	23	73
		-16+4	:	37				
		-4+1	:	7				
Sand	23	-1+$\frac{1}{4}$	:	13				
		-$\frac{1}{4}$+1/16	:	3				
Fines	6	-1/16	:	6				

TL 70 NE 7 7554 0803 Hammonds Road, Little Baddow Block C

Surface level (+16.8 m) +55 ft
Water struck at (+15.5 m) +51 ft
Continuous flight power auger, 6-in diameter
March 1967

Overburden (1.2 m) 4 ft
Mineral (2.1 m) 7 ft
Bedrock (1.2 m+) 4 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.3)	1	(0.3)	1
River brickearth	Brown Clay.	(1.0)	3	(1.2)	4
2nd Terrace of the Chelmer	'Very clayey' gravel Gravel: fine to coarse. Sand: medium with coarse and some fine.	(2.1)	7	(3.4)	11
London Clay	Brown clay.	(1.2+)	4+	(4.6)	15

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	4 - 6	31	36	33
Gravel	43	-64+16	:	13	6 - 11	25	27	48
		-16+4	:	30				
		-4+1	:	9				
Sand	30	-1+$\frac{1}{4}$	:	15				
		-$\frac{1}{4}$+1/16	:	6				
Fines	27	-1/16	:	27				

TL 70 NE 8 7544 0777 Hammonds Road, Little Baddow Block C

Surface level (+17.7 m) +58 ft
Water struck at (+16.8 m) +55 ft
Continuous flight power auger, 6-in diameter
March 1967

Overburden (0.6 m) 2 ft
Mineral (2.4 m) 8 ft
Bedrock (0.6 m+) 2 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.6)	2	(0.6)	2
2nd Terrace of the Chelmer	Gravel Gravel: fine to coarse. Sand: medium and coarse.	(2.4)	8	(3.0)	10
London Clay	Brown clay.	(0.6+)	2+	(3.7)	12

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	1	2 - 6	4	27	69
Gravel	70	-64+16	:	35	6 - 10	2	27	71
		-16+4	:	34				
		-4+1	:	11				
Sand	27	-1+$\frac{1}{4}$	:	13				
		-$\frac{1}{4}$+1/16	:	3				
Fines	3	-1/16	:	3				

TL 70 NE 9 7528 0744 Hurrells Lane, Little Baddow Block C

Surface level (+19.2 m) +63 ft
Water struck at (+17.4 m) +57 ft
Continuous flight power auger, March 1967

Overburden (1.5 m) 5 ft
Mineral (3.0 m) 10 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.3)	1	(0.3)	1
River brickearth	Brown clay.	(1.3)	4	(1.5)	5
2nd Terrace of the Chelmer	'Clayey' gravel Gravel: fine to coarse. Sand: medium with coarse, clayey.	(3.0)	10	(4.6)	15
London Clay	Brown clay.	(0.9+)	3+	(5.5)	18

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	5 - 10	10	38	52
Gravel	52	-64+16	:	28				
		-16+4	:	24				
		-4+1	:	13				
Sand	38	-1+$\frac{1}{4}$	:	23				
		-$\frac{1}{4}$+1/16	:	2				
Fines	10	-1/16	:	10				

TL 70 NE 10 7580 0728 Hurrells Lane, Little Baddow Block C

Surface level (+19.2 m) +63 ft
Water not struck
Continuous flight power auger, 6-in diameter
March 1967

Waste (1.3 m) 4 ft
Bedrock (4.3 m+) ft+

	Log	Thickness (m)	ft	Depth (m)	ft
Soil		(0.3)	1	(0.3)	1
Head	Brown silty clay.	(1.0)	3	(1.2)	4
London Clay	Brown clay.	(2.4)	8	(3.7)	12
	Grey clay.	(1.8)	6+	(5.5)	18

TL 70 NE 11 7515 0714 Hammonds Cottages, Little Baddow Block C

Surface level (+20.1 m) +66 ft
Water struck at (+18.6 m) +61 ft
Continuous flight power auger, 6-in diameter
March 1967

Overburden (1.2 m) 4 ft
Mineral (2.7 m) 9 ft
Bedrock (0.6 m+) 2 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.3)	1	(0.3)	1
Head	Brown silty clay.	(0.9)	3	(1.2)	4
2nd Terrace of the Chelmer	Gravel. Gravel: fine to coarse. Sand: medium with coarse.	(2.7)	9	(4.0)	13
London Clay	Brown clay.	(0.6+)	2+	(4.6)	15

Grading

	%	mm	%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64 :	1	4 - 8	8	34	58
Gravel	77	-64+16 :	43	8 - 13	4	15	81
		-16+4 :	33				
		-4+1 :	6				
Sand	18	-1+¼ :	8				
		-¼+1/16:	4				
Fines	5	-1/16 :	5				

TL 70 NE 12 7518 0670 Grace's Walk, Little Baddow Block C

Surface level (+23.5 m) +77 ft
Water struck at (+21.6 m) +71 ft
Continuous flight power auger, 6-in diameter
April 1967

Waste (7.0 m) 23 ft
Bedrock (1.2 m+) 4 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.6)	2	(0.6)	2
Head	Brown silty clay.	(1.2)	4	(1.8)	6
? Channel-fill deposits	Soft yellow and grey sand. Very clayey.	(5.2)	17	(7.0)	23
London Clay	Brown clay.	(1.2+)	4+	(8.2)	27

Grading

	%	mm	%	Depth below surface (ft)	Fines	Percentage Sand	Gravel
		+64	: 0	6 - 12	45	55	0
Gravel	0	-64+16	: 0	12 - 18	72	28	0
		-16+4	: 0	18 - 23	25	75	0
		-4+1	: 1				
Sand	53	-1+$\frac{1}{4}$	: 19				
		-$\frac{1}{4}$+1/16	: 33				
Fines	47	-1/16	: 47				

TL 70 NE 13 7546 0662 Grace's Walk, Little Baddow Block C

Surface level (+20.4 m) +67 ft
Water not struck
Continuous flight power auger, 6-in diameter
April 1967

Waste (3.0 m) 10 ft
Bedrock (1.5 m+) 5 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.3)	1	(0.3)	1
? Head	Brown silty clay.	(2.7)	9	(3.0)	10
London Clay	Brown clay.	(1.5+)	5+	(4.6)	15

TL 70 NE 14 7519 0600 Near Sandon House School, Sandon Block C

Surface level (+23.8 m) +78 ft
Water struck at (+18.9 m) +62 ft
Continuous flight power auger, 6-in diameter
April 1967

Overburden (0.6 m) 2 ft
Mineral (0.9 m) 3 ft
Bedrock (4.9m+) 16 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.6)	2	(0.6)	2
2nd Terrace of the Chelmer	'Very clayey' sandy gravel Gravel: fine to coarse. Sand: medium with fine and coarse. Very clayey.	(0.9)	3	(1.5)	5
London Clay	Brown clay.	(3.0)	10	(4.6)	15
	Chalky concretions.	(0.6)	2	(5.2)	17
	Grey clay.	(1.2+)	4+	(6.4)	21

Grading

	%	mm	%	Depth below surface (ft)
		+64	: 0	2 - 5
Gravel	26	-64+16	: 12	
		-16+4	: 14	
		-4+1	: 8	
Sand	42	-1+$\frac{1}{4}$	: 26	
		-$\frac{1}{4}$+1/16	: 8	
Fines	32	-1/16	: 32	

Percentage		
Fines	Sand	Gravel
32	42	26

TL 70 NE 15 7534 0553 Sandon House School, Sandon Block C

Surface level (+21.0 m) +69 ft
Water struck at (+19.5 m) +64 ft
Continuous flight power auger, 6-in diameter
March 1967

Overburden (2.4 m) 8 ft
Mineral (3.0 m) 10 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.6)	2	(0.6)	2
Head	Brown clay silty patches.	(1.8)	6	(2.4)	8
2nd Terrace of the Chelmer	'Very clayey' sandy gravel. Gravel: fine to coarse Sand: medium with fine and a little coarse, very clayey.	(3.0)	10	(5.5)	18
London Clay	Brown clay.	(0.9+)	3+	(6.4)	21

Grading

	%	mm	%
		+64	: 0
Gravel	24	-64+16	: 8
		-16+4	: 16
		-4+1	: 7
Sand	53	-1+$\frac{1}{4}$	: 33
		-$\frac{1}{4}$+1/16	: 13
Fines	23	-1/16	: 23

Depth below surface (ft)	Percentage Fines	Sand	Gravel
8 - 13	30	29	41
13 - 18	16	76	8

TL 70 NE 27 7569 0658 Grace's Walk, Little Baddow Block C

Surface level (+18.9 m) +62 ft
Water not struck
Wirth BO, 8-in diameter
December 1968

Overburden (2.1 m) 7 ft
Mineral (0.9 m) 3 ft
Waste (6.1 m) 20 ft
Bedrock (6.1 m+) 20 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.6)	2	(0.6)	2
Alluvium	Brown clay sandy patches.	(1.5)	5	(2.1)	7
Suballuvium deposits	Gravel. Gravel: fine to coarse subangular to subrounded dark flints, and subrounded coarse flints. Traces of fine subrounded quartz. Sand: coarse with subangular flints and occasional sub-rouned quartz. Grey.	(0.9)	3	(3.0)	10
Channel-fill deposits	Grey plastic clay, well laminated.	(6.1)	20	(9.1)	30
London clay	Solid grey clay.	(6.1+)	20+	(15.2)	50

Grading

	%	mm	%
		+64	: 0
Gravel	89	-64+16	: 28
		-16+4	: 61
		-4+1	: 9
Sand	11	-1+$\frac{1}{4}$	: 2
		-$\frac{1}{4}$+1/16	: 0
Fines	0	-1/16	: 0

Depth below surface (ft)	Percentage Fines	Sand	Gravel
7 - 10	0	11	89

TL 70 NE 28 7567 0534 Sandon Bridge, Sandon Block C

Surface level (+22.9 m) +75 ft
Water struck at (+21.6 m) +71 ft
Wirth BO, 8-in diameter
November 1968

Overburden (1.2 m) 4 ft
Mineral (2.4 m) 8 ft
Waste (14.6 m+) 48 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
? Head	Brown clay with stones.	(1.2)	4	(1.2)	4
2nd Terrace of the Chelmer	'Clayey' gravel. Gravel: fine to coarse subangular and subrounded flints. Traces of fine subrounded quartz. Sand: coarse and medium subrounded quartz. Clayey. Brown.	(2.4)	8	(3.7)	12
Channel-fill deposits	Grey silty clays.	(14.6+)	48+	(18.3)	60

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	4 - 7	12	22	66
Gravel	63	-64+16	:	30	7 - 10	18	22	60
		-16+4	:	33	10 - 12	17	19	64
		-4+1	:	10				
Sand	21	-1+¼	:	8				
		-¼+1/16	:	3				
Fines	16	-1/16	:	16				

TL 70 NE 29 7668 0910 Culverts Farm, Boreham Block C

Surface level (+18.3 m) +60 ft
Water struck at (+16.5 m) +54 ft
Wirth BO, 8-in diameter
November 1968

Overburden (0.3 m) 1ft
Mineral (2.1 m) 7 ft
Waste (15.8 m+) 52 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.3)	1	(0.3)	1
2nd Terrace of the Chelmer	'Clayey' gravel. Gravel: fine to coarse subangular flints. Sand: medium with coarse and a little fine. Clayey.	(2.1)	7	(2.4)	8
Channel-fill deposits	Brown clay sandy lenses.	(0.9)	3	(3.4)	11
	Grey silty clay, very plastic.	(14.9+)	49+	(18.3)	60

Grading

	%	mm		%	Depth below surface (ft)	Fines	Percentage Sand	Gravel
		+64	:	0	1 - 3	32	32	34
Gravel	50	-64+16	:	22	3 - 5	13	31	56
		-16+4	:	28	5 - 8	8	36	56
		-4+1	:	9				
Sand	34	-1+$\frac{1}{4}$	:	20				
		-$\frac{1}{4}$+1/16	:	5				
Fines	16	-1/16	:	16				

TL 70 NE 31 7625 0856 Church Road, Little Baddow Block C

Surface level (+14.6 m) +48 ft
Water struck at (+12.8 m) +42 ft
Wirth BO, 8-in diameter
November 1968

Waste (18.3 m+) 60 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.3)	1	(0.3)	1
Alluvium	Brown clay sandy lenses.	(1.5)	5	(1.8)	6
	Grey clay traces of coarse gravel.	(1.5)	5	(3.4)	11
Suballuvium deposits	'Clayey' gravel. Gravel: fine to coarse subangular flints with sub-rounded quartz. Sand: medium and coarse subangular. Clayey. Dark grey.	(0.9)	3	(4.3)	14
Channel-fill deposits	Grey clay, poorly laminated, silty patches.	(14.0+)	46+	(18.3)	60

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	11 - 14	11	29	60
Gravel	60	-64+16	:	23				
		-16+4	:	37				
		-4+1	:	17				
Sand	29	-1+$\frac{1}{4}$	:	11				
		-$\frac{1}{4}$+1/16	:	1				
Fines	11	-1/16	:	11				

TL 70 NE 32 7703 0843 Near Chelmer Cottage, Little Baddow Block C

Surface level (+19.2 m) +63 ft
Water struck at (+17.4 m) +57 ft
Wirth BO, 8-in diameter
November 1968

Overburden (2.4 m) 8 ft
Mineral (0.9 m) 3 ft
Bedrock (1.8 m+) 6 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.3)	1	(0.3)	1
River brickearth	Brown clay sandy lenses.	(2.1)	7	(2.4)	8
2nd Terrace of the Chelmer	'Very clayey' gravel Gravel: fine to coarse subrounded flints with traces of subangular flints, and occasional fine subrounded quartz. Sand: coarse and medium subangular. Very clayey. Brown.	(0.9)	3	(3.4)	11
London Clay	Brown clay, traces of gravel.	(0.9)	3	(4.3)	14
	Brown clay.	(0.9+)	3+	(5.2)	17

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	8 - 11	21	21	58
Gravel	58	-64+16	:	28				
		-16+4	:	30				
		-4+1	:	12				
Sand	21	-1+$\frac{1}{4}$	:	9				
		-$\frac{1}{4}$+1/16	:	0				
Fines	21	-1/16	:	21				

TL 70 NE 33 7663 0717 New Lodge, Little Baddow Block A

Surface level (+44.8 m) +147 ft
Water not struck
Wirth BO, 8-in diameter
November 1968

Waste (2.4 m) 8 ft
Bedrock (3.0 m+) 10 ft+

	Log	Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.3)	1	(0.3)	1
	Brown clay sandy patches.	(1.8)	6	(2.1)	7
? Head	Brown clay traces of sand and gravel.	(0.3)	1	(2.4)	8
	Clayey mudstone with cream concretions.	(0.3)	1	(2.7)	9
London Clay	Brown clay, bluish-grey mottle.	(1.8)	6	(4.6)	15
	Brown clay.	(0.9+)	3+	(5.5)	18

TL 70 NE 34 7661 0648 Great Graces Farm, Little Baddow Block A

Surface levle (+45.4 m) +149 ft
Water struck at (+41.1 m) +135 ft
Wirth BO, 8-in diameter
December 1968

Overburden (1.5 m) 5 ft
Mineral (5.2 m) 17 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.9)	3	(0.9)	3
Head	Brown sandy clay.	(0.6)	2	(1.5)	5
Glacial Sand and Gravel	Gravel. Gravel: fine to coarse subrounded dark flints. Traces of fine subrounded quartz. Sand: medium with coarse and fine, subangular flint with occasional subrounded quartz. Clayey in parts. Brown.	(5.2)	17	(6.7)	22
London Clay	Brown clay.	(0.9+)	3+	(7.6)	25

Grading

	%	mm	%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	: 0	5 - 8	12	26	62
Gravel	69	-64+16	: 37	8 - 11	7	27	66
		-16+4	: 32	11 - 14	No sample		
				14 - 17	No sample		
		-4+1	: 8	17 - 20	3	28	69
Sand	25	-1+$\frac{1}{4}$	: 12	20 - 22	2	13	85
		-$\frac{1}{4}$+1/16	: 5				
Fines	6	-1/16	: 6				

TL 70 NE 35 7764 0952 Near Brakey Wood, Hatfield Peverel Block B

Surface level (+25.3 m) +83 ft
Water struck at (+23.2 m) +76 ft
Wirth BO, 8-in diameter
November 1968

Overburden (0.3 m) 1 ft
Mineral (2.4 m) 8 ft
Bedrock (1.5 m+) 5 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
? Brickearth	Brown clay.	(0.3)	1	(0.3)	1
Glacial Sand and Gravel	Gravel. Gravel: fine to coarse subangular to subrounded flint, with some subrounded quartz. Sand: medium with some coarse and fine subangular. Brown.	(2.4)	8	(2.7)	9
London Clay	Brown clay with silty lenses.	(0.6)	2	(3.4)	11
	Brown clay.	(0.9+)	3+	(4.3)	14

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	1 - 4	5	32	63
Gravel	63	-64+16	:	26	4 - 7	No sample		
		-16+4	:	37	7 - 9	7	30	63
		-4+1	:	4				
Sand	31	-1+$\frac{1}{4}$	:	21				
		-$\frac{1}{4}$1/16	:	6				
Fines	6	-1/16	:	6				

TL 70 NE 36 7764 0893 Near Husketts Mills, Little Baddow Block C

Surface level (+13.1 m) +43 ft
Water struck at (+11.3 m) +37 ft
Wirth BO, 8-in diameter
November 1968

Overburden (1.8 m) 6 ft
Mineral (2.7 m) 9 ft
Waste (13.7 m+) 45 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.3)	1	(0.3)	1
Alluvium	Brown sandy clay.	(1.5)	5	(1.8)	6
Suballuvium deposits	Gravel. Gravel: fine to coarse, subangular flints, with traces of fine subrounded quartz. Occasional cobbles of flint. Sand: coarse and medium subangular flint with traces of coarse subrounded flint and fine subrounded quartz. Clayey in parts. Grey/brown.	(2.7)	9	(4.6)	15
	Grey plastic clay with silt.	(10.7)	35	(15.2)	50
Channel-fill deposits	Grey plastic clay, silty with carbonaceous specks.	(3.0+)	10+	(18.3)	60

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	6 - 9	0	23	77
Gravel	69	-64+16	:	36	9 - 12	2	29	69
		-16+4	:	33	12 - 15	10	29	61
		-4+1	:	16				
Sand	27	-1+$\frac{1}{4}$	:	10				
		-$\frac{1}{4}$+1/16	:	1				
Fines	4	-1/16	:	4				

TL 70 NE 37 7719 0780 Hollybred Farm, Little Baddow Block A

Surface level (+53.0 m) +174 ft
Water struck at (+50.6 m) +166 ft
Wirth BO, 8-in diameter
November 1968

Overburden (0.9 m) 3 ft
Mineral (21.3 m) 70 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.9)	3	(0.9)	3
Glacial Sand and Gravel	Gravel. Gravel: fine to coarse subangular flints with subrounded quartz, and traces of quartzite. Sand: medium with coarse and a little fine, subangular flint with traces of subrounded quartz. Clayey in parts. Brown.	(21.3)	70	(22.3)	73
London Clay	Brown clay.	(0.9+)	3+	(23.2)	76

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	3 - 5	0	45	55
Gravel	59	-64+16	:	29	5 - 8	14	70	16
		-16+4	:	30	8 - 11	12	28	60
					11 - 14	0	16	84
		-4+1	:	11	14 - 17	0	45	55
Sand	37	-1+$\frac{1}{4}$	:	20	17 - 20	2	23	75
		-$\frac{1}{4}$+1/16	:	6	20 - 23	1	51	48
					23 - 26	6	36	58
Fines	4	-1/16	:	4	26 - 29	1	30	69
					29 - 32	8	61	31
					32 - 35	1	80	19
					35 - 38	8	21	71
					38 - 41	0	24	76
					41 - 44	0	10	90
					44 - 47	No sample		
					47 - 50	No sample		
					50 - 53	17	29	54
					53 - 56	6	40	54
					56 - 59	11	25	64
					59 - 62	5	32	63
					62 - 65	1	35	64
					65 - 68	1	26	73
					68 - 71	1	19	80
					71 - 73	0	83	17

TL 70 NE 38 7731 0533 Bell Inn, Danbury Block A

Surface level (+79.6 m) +261 ft
Water struck at (+77.1 m) +253 ft
Wirth BO, 8-in diameter
November 1968

Overburden (2.4 m) 8 ft
Mineral (7.3 m) 24 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.3)	1	(0.3)	1
Head	Brown silty clay with pebbles	(2.1)	7	(2.4)	8
Glacial Sand and Gravel	Sandy gravel. Gravel: fine to coarse, subangular flints with traces of fine to coarse subrounded quartz. Sand: medium with some fine and coarse subangular (mainly flint). Brown.	(7.3)	24	(9.8)	32
London Clay	Brown clay.	(0.9+)	3+	(10.7)	35

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	8 - 11	29	36	35
Gravel	32	-64+16	:	15	11 - 14	10	66	24
		-16+4	:	17	14 - 17	No sample		
					17 - 20	7	56	37
		-4+1	:	8	20 - 23	2	88	10
Sand	60	-1/+$\frac{1}{4}$	:	40	23 - 26	0	77	23
		-$\frac{1}{4}$+1/16	:	12	26 - 29	0	60	40
					29 - 32	6	41	53
Fines	8	-1/16	:	8				

TL 70 NE 39 7869 0984 Gardeners Farm, Hatfield Peverel Block B

Surface level (+25.6 m) +84 ft
Water struck at (+24.1 m) +79 ft
Wirth BO, 8-in diameter
November 1968

Overburden (0.3 m) 1 ft
Mineral (4.6 m) 15 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil	Stony soil	(0.3)	1	(0.3)	1
Glacial Sand and Gravel	Gravel. Gravel: fine to coarse subangular flint. Sand: medium with coarse and fine subangular. Brown.	(4.6)	15	(4.9)	16
London Clay	Brown clay.	(0.9+)	3+	(5.8)	19

Grading

	%	mm		%	Depth below surface (ft)	Fines	Percentage Sand	Gravel
		+64	:	0	1 - 4	13	56	31
Gravel	54	-64+16	:	28	4 - 7	3	34	63
		-16+4	:	26	7 - 10	2	36	62
					10 - 13	5	39	56
		-4+1	:	10	13 - 16	2	38	60
Sand	41	-1+$\frac{1}{4}$	:	26				
		-$\frac{1}{4}$+1/16	:	5				
Fines	5	-1/16	:	5				

TL 70 NE 40 7885 0878 Bassett's Farm, Danbury Block C

Surface level (+16.8 m) +55 ft
Water struck at (+14.9 m) +49 ft
Wirth BO, 8-in diameter
November 1968

Overburden (0.9 m) 3 ft
Mineral (0.9 m) 3 ft
Waste (1.2 m) 4 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.3)	1	(0.3)	1
River Brickearth	Brown clay, sandy lenses.	(0.6)	2	(0.9)	3
2nd Terrace of the Chelmer	Gravel. Gravel: fine to coarse subangular flint. Occasional fine subrounded quartz. Sand: medium and coarse subangular. Brown	(0.9)	3	(1.8)	6
	Brown sandy clay with bluish-grey streaks.	(1.2)	4	(3.0)	10
London Clay	Brown clay.	(0.9+)	3+	(4.0)	13

Grading

	%	mm	%
		+64	: 0
Gravel	63	-64+16	: 34
		-16+4	: 29
		-4+1	: 11
Sand	33	-1+$\frac{1}{4}$	: 20
		-$\frac{1}{4}$+1/16	: 2
Fines	4	-1/16	: 4

Depth below surface (ft)	Percentage Fines	Sand	Gravel
3 - 5	1	33	66
5 - 6	11	31	58

TL 70 NE 42 7813 0675 Near Long Wood, Little Baddow Block A

Surface level (+101.2 m) +332 ft
Water struck at (+98.5 m) +323 ft
Wirth BO, 8-in diameter
November 1968

Overburden (0.6 m) 2 ft
Mineral (4.6 m) 15 ft
Bedrock (0.9 m+) 3 ft+

	Log	Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.6)	2	(0.6)	2
Glacial Sand and Gravel	Gravel. Gravel: fine to coarse subangular flint occasional fine subrounded quartz. Sand: medium and coarse subangular. Traces of bluish-grey clay. Brown.	(4.6)	15	(5.2)	17
London Clay	Brown clay.	(0.9+)	3+	(6.1)	20

Grading

	%	mm		%	Depth below surface (ft)	Fines	Percentage Sand	Gravel
		+64	:	0	2 - 5	2	40	58
Gravel	58	-64+16	:	28	5 - 7	2	43	55
		-16+4	:	30	7 - 10	2	38	60
					10 - 13	7	32	61
		-4+1	:	13	13 - 16	17	31	52
Sand	36	-1+$\frac{1}{4}$	:	17	16 - 17	6	30	64
		-$\frac{1}{4}$+1/16	:	6				
Fines	6	-1/16	:	6				

TL 70 NE 43 7909 0945 Near Gardeners Grove, Hatfield Peverel Block C

Surface level (+12.5 m) +41 ft
Water struck at (+10.4 m) +34 ft
Wirth BO, 8-in diameter
November 1968

Overburden (3.0 m) 10 ft
Mineral (1.8 m) 6 ft
Waste (1.2 m) 4 ft
Bedrock (1.2 m+) 4 ft+

Log

		Thickness (m)	Thickness ft	Depth (m)	Depth ft
Soil		(0.6)	2	(0.6)	2
Alluvium	Brown flinty clay.	(0.6)	2	(1.2)	4
	Grey silty clay and sandy patches.	(0.9)	3	(2.1)	7
	Clayey sand.	(0.3)	1	(2.4)	8
	Brown stony clay.	(0.6)	2	(3.0)	10
Suballuvium deposits	Gravel. Gravel: fine to coarse angular flints. Traces of clay. Sand: coarse and medium subangular. Brown.	(1.8)	6	(4.9)	16
	Grey soft clay, silty in parts.	(1.2)	4	(6.1)	20
London Clay	Brown clay.	(1.2+)	4+	(7.3)	24

Grading

	%	mm	%
		+64	: 0
Gravel	60	-64+16	: 23
		-16+4	: 37
		-4+1	: 18
Sand	31	-1+$\frac{1}{4}$	: 12
		-$\frac{1}{4}$+1/16	: 1
Fines	9	-1/16	: 9

Depth below surface (ft)	Percentage Fines	Sand	Gravel
10 - 13	2	28	70
13 - 16	16	33	51

TL 70 NE 44 7942 0773 The Chalet, Little Baddow Block A

Surface level (+63.4 m) +208 ft
Water not struck
Wirth BO, 8-in diameter
November 1968

Overburden (0.9 m) 3 ft
Mineral (1.5 m) 5 ft
Bedrock (3.4 m+) 11 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Made ground		(0.3)	1	(0.3)	1
? Head	Brown clay, traces of sand.	(0.6)	2	(0.9)	3
Glacial Sand and Gravel	Gravel. Gravel: fine to coarse subangular flint. Traces of coarse subangular flint and subrounded quartz. Sand: fine, medium and coarse subangular. Clayey. Brown.	(1.5)	5	(2.4)	8
London Clay	Brown clay, with bluish-grey mottle.	(2.4)	8	(4.9)	16
	Brown clay.	(0.9+)	3+	(5.8)	19

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	3 - 5	1	38	61
Gravel	51	-64+16	:	24	5 - 8	8	47	45
		-16+4	:	27				
		-4+1	:	10				
Sand	44	-1+$\frac{1}{4}$	:	19				
		-$\frac{1}{4}$+1/16	:	15				
Fines	5	-1/16	:	5				

TL 70 NE 45 7965 0590 Brocks Farms, Danbury Block A

Surface level (+66.1 m) +217 ft
Water not struck
Wirth BO, 8-in diameter
Novermber 1968

Waste (2.7 m) 9 ft
Bedrock (4.9 m+) 16 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.6)	2	(0.6)	2
Head	Brown clay sandy patches.	(2.1)	7	(2.7)	9
London Clay	Brown clay with bluish-grey flecks, and occasional pebbles.	(4.0)	13	(6.7)	22
	Bluish-grey clay.	(0.9+)	3+	(7.6)	25

TL 70 NE 46 7647 0790 Little Baddow Hall Farm, Little Baddow Block A

Surface level (+27.4 m) +90 ft
Water struck at +23.1 m (+76 ft)
Shell and auger, 6-in diameter
October 1972

Overburden 4.3 m (14.0 ft)
Mineral 6.8 m (22.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

Log

		Thickness m	(ft)	Depth m	(ft)
Soil		0.6	(2.0)	0.6	(2.0)
? Head	Orange-brown clay with grey mottle.	1.2	(4.0)	1.8	(6.0)
Glacial Sand and Gravel	Sandy gravel; orange.	0.2	(0.5)	2.0	(6.5)
? Glacial lake deposits	Very plastic light grey silty clay with pale brown mottle.	2.3	(7.5)	4.3	(14.0)
Glacial Sand and Gravel	'Clayey' sandy gravel Gravel: fine to coarse, subangular to subrounded flint and quartzite. Sand: medium with coarse subangular to subrounded quartz; orange; clayey in parts.	6.8	(22.5)	11.1	(36.5)
London Clay	Firm brown clay becoming firm dark grey clay.	1.0+	(3.5+)	12.1	(39.5)

Grading

	%	mm		%	Depth below surface (m)	Percentage Fines	Sand	Gravel
		+16	:	19	4.3 - 5.4	9	90	1
Gravel	42	-16+4	:	23	5.4 - 6.4	27	35	38
					6.4 - 7.4	5	26	69
		-4+1	:	10	7.4 - 8.4	6	48	46
Sand	47	-1+$\frac{1}{4}$	:	34	8.4 - 9.4	8	52	40
		-$\frac{1}{4}$+1/16	:	3	9.4 - 10.4	4	35	61
					10.4 - 11.1	21	38	41
Fines	11	-1/16	:	11				

TL 70 NE 47 7869 0735 Duke's Orchard, Danbury Block A

Surface level (+86.3 m) +283 ft
Water not struck
Shell and auger, 6-in diameter
October 1972

Overburden 1.6 m (5.0 ft)
Mineral 9.8 m (32.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

Log

		Thickness m	(ft)	Depth m	(ft)
Soil	Soil (gravelly)	0.2	(0.5)	0.2	(0.5)
? Head	Hard orange clay becoming mottled orange-grey clay with flints.	1.4	(4.5)	1.6	(5.0)
Glacial Sand and Gravel	'Clayey' gravel, with clay band from 5.0 - 5.7 m (16.5 - 18.5 ft) depth. Gravel: fine to coarse, sub-angular to subrounded flint and quartzite. Sand: medium with some coarse subangular to subrounded quartz, yellow, orange and grey, silty in parts.	9.8	(32.0)	11.4	(37.5)
London Clay	Firm brown clay becoming firm dark grey clay.	1.0+	(3.5+)	12.4	(40.5)

Grading

	%	mm		%	Depth below surface (m)	Percentage Fines	Sand	Gravel
Gravel	51	+16	:	23	1.6 - 2.7	35	28	37
		-16+4	:	28	2.7 - 3.7	9	53	38
					3.7 - 5.0	10	32	58
		-4+1	:	8	5.0 - 5.7	Clay band		
Sand	36	-1+¼	:	27	5.7 - 6.7	14	33	53
		-¼+1/16	:	1	6.7 - 7.7	7	40	53
					7.7 - 8.7	6	50	44
Fines	13	-1/16	:	13	8.7 - 9.7	10	28	62
					9.7 - 10.7	10	30	60
					10.7 - 11.4	12	36	52

TL 70 NE 48 7940 0673 Golf Club, Woodham Walter Block A

Surface level (+68.6 m) +225 ft
Water struck at +63.8 m (+209 ft)
Shell and auger, 6-in diameter
October 1972

Overburden 0.2 m (0.5 ft)
Mineral 7.0 m (23.0 ft)
Bedrock 2.1 m+ (7.0 ft+)

Log

		Thickness m	(ft)	Depth m	(ft)
Soil		0.2	(0.5)	0.2	(0.5)
Glacial Sand and Gravel	'Clayey' sandy gravel Gravel: fine to coarse, subangular to subrounded flints with quartzite. Sand: medium with fine, subangular to subrounded quartz, orange and yellow, silty.	7.0	(23.0)	7.2	(23.5)
London Clay	Soft brown clay becoming firm brown clay.	2.1+	(7.0+)	9.3	(30.5)

Grading

	%	mm		%	Depth below surface (m)	Percentage Fines	Sand	Gravel
Gravel	26	+16	:	11	0.2 - 1.2	7	50	43
		-16+4	:	15	1.2 - 2.2	10	51	39
					2.2 - 3.2	8	41	51
		-4+1	:	5	3.2 - 4.2	10	51	39
Sand	58	-1+$\frac{1}{4}$	:	37	4.2 - 5.2	18	81	1
		-$\frac{1}{4}$+1/16	:	16	5.2 - 6.2	18	76	6
					6.2 - 7.2	42	58	0
Fines	16	-1/16	:	16				

TL 70 NE 49 7839 0592 Little Baddow Road, Danbury Block A

Surface level (+107.3 m) +352 ft
Water struck at +101.0 m (+331 ft)
Shell and auger, 6-in diameter
October 1972

Overburden 2.5 m (8.0 ft)
Mineral 14.7 m (48.5 ft)
Bedrock 1.1 m+ (3.5 ft+)

Log

		Thickness m	(ft)	Depth m	(ft)
Made ground		0.9	(3.0)	0.9	(3.0)
? Head	Orange-red clay with grey mottle and flints	1.6	(5.0)	2.5	(8.0)
Glacial Sand and Gravel	Gravel Gravel: fine to coarse, subangular to subrounded flints and quartzite, with occasional subrounded exotic rock pebbles. Sand: medium with coarse subangular to subrounded quartz orange, yellow and grey.	14.7	(48.5)	17.2	(56.5)
London Clay	Firm brown clay becoming firm dark grey clay.	1.1+	(3.5+)	18.3	(60.0)

Grading

	%	mm		%
Gravel	63	+16	:	13
		-16+4	:	50
		-4+1	:	8
Sand	29	-1+$\frac{1}{4}$	:	19
		-$\frac{1}{4}$+1/16	:	2
Fines	8	-1/16	:	8

Depth below surface (m)	Fines	Percentage Sand	Gravel
2.5 - 3.5	41	35	24
3.5 - 4.5	13	39	48
4.5 - 5.5	13	30	57
5.5 - 6.5	8	29	63
6.5 - 7.5	4	28	68
7.5 - 8.5	4	30	66
8.5 - 9.5	7	35	58
9.5 - 10.5	2	36	62
10.5 - 11.5	4	32	64
11.5 - 12.5	1	9	90
12.5 - 13.5	1	31	68
13.5 - 14.5	3	29	68
14.5 - 15.5	4	14	82
15.5 - 16.5	4	21	75
16.5 - 17.2	10	36	54

TL 70 NE 50 7618 0511 Danbury Park, Danbury Block A

Surface level (+35.7 m) +117 ft
Water struck at +31.3 m (+103 ft)
Shell and auger, 6-in diameter
October 1972

Overburden 2.4 m (8.0 ft)
Mineral 6.0 m (20.0 ft)
Bedrock 2.1 m+ (7.0 ft+)

Log

		Thickness m	(ft)	Depth m	(ft)
Soil		0.5	(1.5)	0.5	(1.5)
? Head	Mottled orange-grey silty clay.	1.5	(5.0)	2.0	(6.5)
	Black plastic clay with flints.	0.4	(1.0)	2.4	(8.0)
Glacial Sand and Gravel	'Very clayey' pebbly sand Gravel: fine to coarse, subangular to subrounded to subrounded flint with quartzite; grey clay bands. Sand: medium with fine subangular to subrounded quartz; orange, silty.	6.0	(20.0)	8.4	(28.0)
London Clay	Orange-brown clay becoming firm dark grey clay.	2.1+	(7.0+)	10.5	(34.5)

Grading

	%	mm		%
Gravel	5	+16	:	1
		-16+4	:	3
		-4+1	:	5
Sand	68	-1+$\frac{1}{4}$	:	51
		-$\frac{1}{4}$+1/16	:	13
Fines	27	-1/16	:	27

Percentage

Depth below surface (m)	Fines	Sand	Gravel
2.4 - 3.7	31	45	24
3.7 - 4.7	28	71	1
4.7 - 5.7	51	49	0
5.7 - 6.7	30	70	0
6.7 - 7.7	15	84	1
7.7 - 8.4	9	90	1

TL 70 NE 51 7908 0515 Near Runsell Green, Danbury Block A

Surface level (+86.6 m) +284 ft
Water not struck
Shell and auger, 6-in diameter
October 1972

Overburden 1.2 m (4.0 ft)
Mineral 2.0 m (6.5 ft)
Waste 0.1 m (0.5 ft)
Bedrock 1.2 m+ (4.0 ft+)

Log

		Thickness m	(ft)	Depth m	(ft)
Soil		0.2	(0.5)	0.2	(0.5)
Made ground		1.0	(3.5)	1.2	(4.0)
Glacial Sand and Gravel	'Clayey' gravel Gravel: fine to coarse, subangular to subrounded flint with some quartzite. Sand: medium, subangular to subrounded quartz, grey-brown, clayey.	2.0	(6.5)	3.2	(10.5)
	Brown clay with flint gravel.	0.1	(0.5)	3.3	(11.0)
London Clay	Firm brown clay, slight bluish-grey mottle near surface.	1.2+	(4.0+)	4.5	(15.0)

Grading

	%	mm		%
Gravel	66	+16	:	39
		-16+4	:	27
Sand	21	-4+1	:	6
		-1+¼	:	12
		-¼+1/16	:	3
Fines	13	-1/16	:	13

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.2 - 2.2	13	22	65
2.2 - 3.2	12	20	68

TL 70 NE 52 7500 0961 Near Boreham House, Boreham Block B

Surface level (+31.7 m) +104 ft
Water not struck
Shell and auger, 6-in diameter
October 1972

Overburden 0.8 m (2.5 ft)
Mineral 1.2 m (4.0 ft)
Bedrock 2.0 m+ (6.5 ft+)

Log

		Thickness m	(ft)	Depth m	(ft)
Soil		0.2	(0.5)	0.2	(0.5)
? Head	Orange-brown clay	0.6	(2.0)	0.8	(2.5)
Glacial Sand and Gravel	'Clayey' gravel Gravel: fine to coarse, subrounded flint with quartzite. Sand: medium with coarse, subangular to subrounded quartz; orange, clayey.	1.2	(4.0)	2.0	(6.5)
London Clay	Firm brown clay.	2.0+	(6.5+)	4.0	(13.0)

Grading

	%	mm		%	Depth below surface (m)	Percentage Fines	Sand	Gravel
Gravel	64	+16	:	39	0.8 - 2.0	14	22	64
		-16+4	:	25				
Sand	22	-4+1	:	6				
		-1+¼	:	14				
		-¼+1/16	:	2				
Fines	14	-1/16	:	14				

TL 70 NE 53 7600 0960 Culvert's Chase, Boreham Block B

Surface level (+34.8 m) +114 ft
Water struck at +30.8 m (+101 ft)
Shell and auger, 6-in diameter
October 1972

Overburden 1.3 m (4.0 ft)
Mineral 7.9 m (26.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

Log

		Thickness m	(ft)	Depth m	(ft)
Soil		0.5	(1.5)	0.5	(1.5)
? Head	Orange-brown clay with flints	0.8	(2.5)	1.3	(4.5)
Glacial Sand and Gravel	'Clayey' gravel Gravel: fine to coarse, subangular to subrounded flints and quartzite. Sand: medium with coarse subangular to subrounded quartz; yellow and grey, clayey in parts.	7.9	(26.0)	9.2	(30.0)
London Clay	Firm orange-brown clay becoming firm dark brown clay.	1.0+	(3.5+)	10.2	(33.5)

Grading

	%	mm		%	Depth below surface (m)	Percentage Fines	Sand	Gravel
Gravel	48	+16	:	23	1.3 - 2.1	32	50	18
		-16+4	:	25	2.1 - 3.1	16	54	30
					3.1 - 4.1	17	33	50
		-4+1	:	10	4.1 - 5.1	4	54	42
Sand	42	-1+$\frac{1}{4}$	:	29	5.1 - 6.1	5	37	58
		-$\frac{1}{4}$+1/16	:	3	6.1 - 7.1	3	44	53
					7.1 - 8.1	1	22	77
Fines	10	-1/16	:	10	8.1 - 9.2	3	42	55

TL 70 NE 54 7540 0858 Near Boreham Hall, Boreham Block C

Surface level (+14.3 m) +47 ft
Water struck at +12.9 m (+42 ft)
Shell and auger, 6-in diameter
October 1972

Waste 9.7 m (32.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

Log

		Thickness m	(ft)	Depth m	(ft)
Soil		0.3	(1.0)	0.3	(1.0)
Alluvium	Soft, mottled brown/grey silty clay.	1.1	(3.5)	1.4	(4.5)
Suballuvium deposits	'Clayey gravel Gravel: fine to coarse, subangular to subrounded flint and quartzite. Sand: medium with coarse; orange, clayey.	0.7	(2.5)	2.1	(7.0)
? Glacial lake deposits	Laminated silty clays with flints, becoming orange-brown clay with flints.	0.8	(2.5)	2.9	(9.5)
Channel-fill deposits	Soft light grey silty clay.	6.8	(22.5)	9.7	(32.0)
London Clay	Firm dark grey clay.	1.0+	3.5+)	10.7	(35.0)

Grading

	%	mm		%
Gravel	63	+16	:	38
		-16+4	:	25
Sand	22	-4+1	:	8
		-1+¼	:	13
		-¼+1/16	:	1
Fines	15	-1/16	:	15

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.4 - 2.1	15	22	63

TL 70 NE 55 7839 0931 Near World's End Cottage, Hatfield Peverel Block C

Surface level (+12.2 m) +40 ft
Water struck at +10.8 m (+35 ft)
Shell and auger, 6-in diameter
October 1972

Overburden 0.4 m (1.5 ft)
Mineral 3.8 m (12.5 ft)
Waste 1.6 m (5.0 ft)
Bedrock 1.2 m+ (4.0 ft+)

Log

		Thickness m	Thickness (ft)	Depth m	Depth (ft)
Soil		0.4	(1.5)	0.4	(1.5)
Suballuvium deposits	Gravel. Gravel: fine to coarse, subrounded (with some subangular) flint and quartzite. Sand: medium and coarse, subangular to subrounded quartz; orange.	3.8	(12.5)	4.2	(14.0)
	Dark brown clay, with gravel.	0.4	(1.5)	4.6	(15.0)
	Dark brown clay with gravel, peat and shell debris.	0.7	(2.5)	5.3	(17.5)
	Dark brown clay with flints.	0.5	(1.5)	5.8	(19.0)
London Clay	Firm dark brown clay becoming firm dark grey clay.	1.2+	(4.0+)	7.0	(23.0)

Grading

	%	mm		%
Gravel	70	+16	:	26
		-16+4	:	44
Sand	23	-4+1	:	11
		-1+$\frac{1}{4}$	:	12
		-$\frac{1}{4}$+1/16	:	0
Fines	7	-1/16	:	7

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 1.4	11	38	51
1.4 - 2.4	3	17	80
2.4 - 3.4	6	13	81
3.4 - 4.2	6	25	69

TL 70 NE 56 7908 0903 Near Bassett's Farm, Woodham Walter Block C

Surface level (+11.0 m) +36 ft
Water struck at +9.3 m (+30 ft)
Shell and auger, 6-in diameter
October 1972

Waste 2.4 m (8.0 ft)
Bedrock 1.6 m+ (5.0 ft+)

Log

		Thickness m	(ft)	Depth m	(ft)
Soil		0.3	(1.0)	0.3	(1.0)
Alluvium	Mottled orange/brown silty clay with flints, becoming sandy brown clay with flints.	1.3	(4.5)	1.6	(5.0)
Suballuvium deposits	Gravel. Gravel: fine to coarse, subangular flints with some subangular to subrounded flints and quartzite. Sand: medium and coarse, subangular to subrounded quartz, grey-brown.	0.8	(2.5)	2.4	(8.0)
London Clay	Mottled bluish-grey/brown clay becoming firm grey clay.	1.6+	(5.0+)	4.0	(13.0)

Grading

	%	mm		%	Depth below surface (m)	Percentage Fines	Sand	Gravel
Gravel	66	+16	:	29	1.9 - 2.4	6	28	66
		-16+4	:	37				
Sand	28	-4+1	:	11				
		-1+¼	:	16				
		-¼+1/16	:	1				
Fines	6	-1/16	:	6				

TL 70 SW 2 7052 0306 Galleywood Reservoir, Great Baddow

Surface level (+79.2 m) +260 ft
Water struck at (+71.6 m) +235 ft
Wirth BO, 8-in diameter
July 1969

Waste (1.2 m) 4 ft
Bedrock (11.3 m+) 37 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(1.2)	4	(1.2)	4
Bagshot Beds	Brown clays with silty and gravelly layers.	(10.4)	34	(11.6)	38
Claygate Beds	Brown-grey clay.	(0.9+)	3+	(12.5)	41

LT 70 SW 3 7052 0168 Galleywood Common, Great Baddow Block D

Surface level (+65.8 m) +216 ft
Water struck at (+56.4 m) +185 ft
Wirth BO, 8-in diameter
July 1969

Waste (1.2 m) 4 ft
Bedrock (9.8 m+) 32 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(1.2)	4	(1.2)	4
Claygate Beds	Brown clay with silty layers.	(8.8)	29	(10.1)	33
London Clay	Brown clay becoming bluish-grey at depth.	(0.9+)	3+	(11.0)	36

TL 70 SW 5 7123 0415 Lathcoats, Great Baddow

Surface level (+58.8 m) + 193 ft
Water struck at (+43.3 m) +142 ft
Wirth BO, 8-in diameter
July 1969

Waste (16.2 m) 53 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(1.2)	4	(1.2)	4
Chalky Boulder Clay	Grey and brown clay with silty and stony layers.	(14.9)	49	(16.2)	53
London Clay	Brown clay becoming bluish-grey at depth.	(0.9+)	3+	(17.1)	56

TL 70 SW 7 7263 0408 Little Seabrights, Great Baddow

Surface level (+44.5 m) +146 ft
Water struck at (+39.3 m) +129 ft
Wirth BO, 8-in diameter
July 1969

Waste (6.7 m) 22 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Made ground		(0.9)	3	(0.9)	3
Soil		(1.2)	4	(2.1)	7
Chalky Boulder Clay	Brown stony clay, gravelly near base.	(4.6)	15	(6.7)	22
London Clay	Brown clay.	(0.9+)	3+	(7.6)	25

TL 70 SW 8 7332 0315 Mascalls, Great Baddow Block D

Surface level (+47.5 m) +156 ft
Water struck at (+41.8 m) +137 ft
Wirth BO, 8-in diameter
July 1969

Waste (1.2 m) 4 ft
Bedrock (8.5 m+) 28 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(1.2)	4	(1.2)	4
Claygate Beds	Stiff brown clay, silty base.	(7.6)	25	(8.8)	29
London Clay	Brown clay becoming bluish-grey at depth.	(0.9+)	3+	(9.7)	32

TL 70 SW 9 7430 0460 Near Lower Green, Sandon Block C

Surface level (+30.5 m) +100 ft
Water not struck
Wirth B1, 8-in diameter
February 1970

Waste (4.0 m) 13 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.5)	1.5	(0.5)	1.5
Glacial lake deposits	Stiff grey clay, stony at base.	(3.5)	11.5	(4.0)	13
London Clay	Brown clay.	(0.9+)	3.0+	(4.9)	16

TL 70 SW 10 7474 0349 Near Howe Green, Sandon Block D

Surface level (+40.8 m) +134 ft
Water level not recorded
Wirth BO, BO, 8-in diameter
July 1969

Waste (1.2 m) 4 ft
Bedrock (4.3 m+) 14 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(1.2)	4	(1.2)	4
London Clay	Brown clay.	(4.3+)	14+	(5.5)	18

TL 70 SE 1 7574 0458 Dealtrees Farm, Sandon Block A

Surface level (+33.2 m) +109 ft
Water struck at (+29.9 m) +98 ft
Wirth B1, 8-in diameter
February 1970

Overburden (0.9 m) 3 ft
Mineral (1.8 m) 6 ft
Waste (0.6 m) 2 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Made ground		(0.6)	2	(0.6)	2
Head	Silty clay.	(0.3)	1	(0.9)	3
Glacial Sand and Gravel	'Clayey' sand Sand: medium and fine subangular to subrounded quartz. Clayey. Yellow/brown.	(1.8)	6	(2.7)	9
	Clayey silt.	(0.6)	2	(3.4)	11
London Clay	Grey clay.	(0.9+)	3+	(4.3)	14

Grading

	%	mm		%
		+64	:	0
Gravel	1	-64+16	:	0
		-16+4	:	1
		-4+1	:	2
Sand	81	-1+$\frac{1}{4}$	:	40
		-$\frac{1}{4}$+1/16	:	39
Fines	18	-1/16	:	18

Depth below surface (ft)	Percentage Fines	Sand	Gravel
3 - 6	11	88	1
6 - 9	25	75	0

TL 70 SE 2 7540 0326 Near Bungalow Farm, Sandon Block D

Surface level (+46.9 m) +154 ft
Water not struck
Wirth BO, 8-in diameter
July 1969

Waste (1.2 m) 4 ft
Bedrock (2.4 m+) 8 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(1.2)	4	(1.2)	4
? Claygate Beds	Brown clay silty in parts.	(1.5)	5	(2.7)	9
London Clay	Brown clay.	(0.9+)	3+	(3.7)	12

TL 70 SE 3 7666 0442 Woodhill Common, Sandon Block A

Surface level (+42.7 m) +140 ft
Water not struck
Wirth BO, 8-in diameter
June 1969

Overburden (1.2 m) 4 ft
Mineral (6.4 m) 21 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(1.2)	4	(1.2)	4
Glacial Sand and Gravel	Pebbly sand. Gravel: fine to coarse subangular to subrounded flints. Sand: medium and fine. Brown.	(6.4)	21	(7.6)	25
London Clay	Brown clay.	(0.9+)	3+	(8.5)	28

Grading

	%	mm	%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	: 0	4 - 7	4	95	1
Gravel	11	-64+16	: 4	7 - 10	5	77	18
		-16+4	: 7	10 - 13	2	98	0
				13 - 16	1	91	8
		-4+1	: 2	16 - 19	1	84	15
Sand	82	-1+$\frac{1}{4}$	: 43	19 - 22	3	81	16
		-$\frac{1}{4}$+1/16	: 37	22 - 25	33	51	16
Fines	7	-1/16	: 7				

TL 70 SE 4 7664 0377 Levetts Farm, Sandon Block A

Surface level (+41.5 m) +136 ft
Water not struck
Wirth B1, 8-in diameter
February 1970

Overburden (2.7 m) 9 ft
Mineral (2.7 m) 9 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Made ground		(0.3)	1	(0.3)	1
Head	Brown silty clay.	(2.5)	8	(2.7)	9
Glacial Sand and Gravel	'Clayey' pebbly sand. Gravel: fine to coarse, subangular to rounded flints, a little quartz. Sand: medium and fine subrounded quartz. Clay bands. Brown.	(2.7)	9	(5.5)	18
London Clay	Brown clay.	(0.9+)	3+	(6.4)	21

Grading

	%	mm	%	Depth below surface (ft)	Fines	Sand	Gravel
		+64	0	9 - 12	19	79	2
Gravel	7	-64+16	2	12 - 15	23	75	2
		-16+4	5	15 - 18	19	64	17
		-4+1	3				
Sand	73	-1+$\frac{1}{4}$	41				
		-$\frac{1}{4}$+1/16	29				
Fines	20	-1/16	20				

Percentage

TL 70 SE 5 7783 0463 Near Cricketers' Arms, Danbury Block A

Surface level (+83.2 m) +273 ft
Water not struck
Wirth B1, 8-in diameter
February 1970

Waste (11.3 m) 37 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.9)	3	(0.9)	3
? Head	Brown clay, silty and gravelly in parts.	(10.4)	34	(11.3)	37
London Clay	Brown clay.	(0.9+)	3+	(12.2)	40

TL 70 SE 7 7772 0220 Near South Gibcracks, E. Hanningfield Block D

Surface level (+51.8 m) +170 ft
Water not struck
Wirth BO, 8-in diameter
July 1969

Waste (4.6 m) 15 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(1.2)	4	(1.2)	4
? Head	Brown clay silty in parts.	(3.4)	11	(4.6)	15
London Clay	Brown clay.	(0.9+)	3+	(5.5)	18

TL 70 SE 8 7864 0456 Gay Bowers Farm, Danbury Block A

Surface level (+75.0 m) +246 ft
Water struck at (+64.0 m) +210 ft
Wirth BO, 8-in diameter
August 1969

Overburden (2.7 m) 9 ft
Mineral (9.1 m) 30 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil	Gravelly soil.	(1.2)	4	(1.2)	4
Head	Clayey gravel.	(1.5)	5	(2.7)	9
Glacial Sand and Gravel	Pebbly sand. Gravel: fine to coarse subangular flints, a little subangular quartz. Sand: medium and fine subrounded. Rusty-brown.	(9.1)	30	(11.9)	39
London Clay	Brown clay.	(0.9+)	3+	(12.8)	42

Grading

	%	mm		%
		+64	:	0
Gravel	10	-64+16	:	2
		-16+4	:	8
		-4+1	:	7
Sand	88	-1+$\frac{1}{4}$	:	51
		-$\frac{1}{4}$+1/16	:	30
Fines	2	-1/16	:	2

Depth below surface (ft)	Percentage Fines	Sand	Gravel
9 - 12	6	94	0
12 - 15	5	95	0
15 - 18	5	95	0
18 - 21	1	93	6
21 - 24	1	87	12
24 - 27	2	78	20
27 - 30	1	81	18
30 - 33	0	88	12
33 - 36	0	77	23
36 - 39	No sample		

TL 70 SE 9 7846 0348 Near Overshot Bridge, Danbury Block A

Surface level (+47.2 m) +155 ft
Water not struck
Wirth BO, 8-in diameter
July 1969

Waste (2.7 m) 9 ft
Bedrock (0.9 m+) 3ft+.

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(1.2)	4	(1.2)	4
Head	Very clayey gravel.	(1.5)	5	(2.7)	9
London Clay	Brown clay.	(0.9+)	3+	(3.7)	12

TL 70 SE 11 7952 0461 Hyde Lane, Danbury Block A

Surface level (+62.8 m) +206 ft
Water struck at (+56.4 m) +185 ft
Wirth BO, 8-in diameter
August 1969

Overburden (4.6 m) 15 ft
Mineral (5.8 m) 19 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(0.9)	3	(0.9)	3
Head	Brown clay and red sandy clay.	(3.7)	12	(4.6)	15
Glacial Sand and Gravel	Sandy gravel. Gravel: fine to coarse subangular to subrounded flints. Sand: medium with some fine and coarse. Red-brown.	(5.8)	19	(10.4)	34
London Clay	Brown clay.	(0.9+)	3+	(11.3)	37

Grading

	%	mm		%	Depth below surface (ft)	Percentage Fines	Sand	Gravel
		+64	:	0	15 - 18	2	97	1
Gravel	26	-64+16	:	10	18 - 21	0	77	23
		-16+4	:	16	21 - 24	15	74	11
					24 - 27	1	63	36
		-4+1	:	14	27 - 30	0	45	55
Sand	67	-1+$\frac{1}{4}$	:	43	30 - 33	23	49	28
		-$\frac{1}{4}$+1/16	:	10	33 - 34	18	49	33
Fines	7	-1/16	:	7				

TL 70 SE 12 7971 0365 Hyde Lane, Danbury Block A

Surface level (+45.7 m) +150 ft
Water not struck
Wirth BO, 8-in diameter
August 1969

Overburden (2.1 m) 7 ft
Mineral (2.1 m) 7 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(1.2)	4	(1.2)	4
Head	Brown flinty clay.	(0.9)	3	(2.1)	7
Glacial Sand and Gravel	'Clayey' gravel Gravel: fine to coarse subangular flint, some cobbles of flint and quartzite. Sand: medium with fine and some coarse. Pale brown.	(2.1)	7	(4.3)	14
London Clay	Brown clay.	(0.9+)	3+	(5.2)	17

Grading

	%	mm		%	Depth below surface (ft)	Fines	Percentage Sand	Gravel
		+64	:	0	7 - 10	6	21	73
Gravel	55	-64+16	:	29	10 - 13	11	46	43
		-16+4	:	26	13 - 14	22	43	35
		-4+1	:	6				
Sand	35	-1+$\frac{1}{4}$		20				
		-$\frac{1}{4}$+1/16	:	9				
Fines	10	-1/16	:	10				

TL 70 SE 13 7994 0296 Jackletts Farm, Danbury Block A

Surface level (+46.9 m) +154 ft
Water not struck
Wirth BO, 8-in diameter
August 1969

Waste (4.6 m) 15 ft
Bedrock (0.9 m+) 3 ft+

Log

		Thickness (m)	ft	Depth (m)	ft
Soil		(1.2)	4	(1.2)	4
? Head	Brown clay with silty patches.	(3.4)	11	(4.6)	15
London Clay	Brown clay.	(0.9+)	3+	(5.5)	18

TL 70 SE 14 7788 0394 Ludgores Farm, Danbury Block A

Surface level (+51.2 m) +168 ft
Water struck at +45.4 m (+149 ft)
Shell and auger, 6-in diameter
October 1972

Overburden 0.3 m (1.0 ft)
Mineral 5.5 m (18.0 ft)
Bedrock 1.9 m+ (6.0 ft+)

Log

		Thickness m	Thickness (ft)	Depth m	Depth (ft)
Soil		0.3	(1.0)	0.3	(1.0)
Glacial Sand and Gravel	'Clayey' gravel. Gravel: fine to coarse, subangular to subrounded flints with quartzite. Sand: medium with coarse subangular to subrounded quartz, orange, clayey.	5.5	(18.0)	5.8	(19.0)
London Clay	Orange-brown clay becoming firm dark grey clay	1.9+	(6.0+)	7.7	(25.5)

Grading

	%	mm		%	Depth below surface (m)	Fines	Percentage Sand	Gravel
Gravel	50	+16	:	21	0.3 - 1.3	10	26	64
		-16+4	:	29	1.3 - 2.3	15	37	48
					2.3 - 3.3	17	34	49
		-4+1	:	8	3.3 - 4.3	11	36	53
Sand	35	-1+$\frac{1}{4}$	:	23	4.3 - 5.3	14	41	45
		-$\frac{1}{4}$+1/16	:	4	5.3 - 5.8	24	36	40
Fines	15	-1/16	:	15				

TL 70 SE 15 7874 0341 Peartree Farm, Danbury Block A

Surface level (+47.9 m) +157 ft
Water not struck
Shell and auger, 6-in diameter
October 1972

Waste 3.1 m (10 ft)
Bedrock 1.2 m+ (4.0 ft+)

Log

		Thickness m	(ft)	Depth m	(ft)
Soil		0.2	(0.5)	0.2	(0.5)
? Head	Hard, fawn silty clay becoming firm orange-grey mottled silty clay with some flint and quartzite pebbles.	2.1	(7.0)	2.3	(7.5)
Glacial Sand and Gravel	'Clayey' gravel. Gravel: fine to coarse, subangular to subrounded flints with quartzite. Sand: medium with some fine and coarse subrounded to subangular quartz, orange, clayey.	0.8	(2.5)	3.1	(10.0)
London Clay	Orange-brown clay becoming firm dark brown clay.	1.2+	(4.0+)	4.3	(14.0)

Grading

	%	mm		%	Depth below surface (m)	Percentage Fines	Sand	Gravel
Gravel	46	+16	:	22	2.3 - 3.1	16	38	46
		-16+4	:	24				
Sand	38	-4+1	:	6				
		-1+¼	:	29				
		-¼+1/16	:	3				
Fines	16	-1/16	:	16				

Appendix G: List of Workings

In 1972, only two pits were being worked in the area although there are numerous small disused pits; for many, no details are recorded.

Working Pits

Name	Location	Grid Reference
St Clere's Hall	Danbury	765 058
Sandon (Hall)	Sandon	745 043

The Main Disused Pits

Wedlock Green (restored)	Little Baddow	787 077
Clark's Farm (restored)	Danbury	791 061
Baddow Hall (restored)	Great Baddow	736 052
Moulsham Schools (restored)	Moulsham	706 052
Pit at Eves Corner	Danbury	787 052
Pit at Runsell Green	Danbury	791 051
Bell Lane (restored)	Danbury	775 051
Mayes Farm	Sandon	752 043

Appendix H: Conversion Table, Metres to Feet (to nearest 0.5 ft)

m	ft	m	ft	m	ft	m	ft	m	ft
0.1	0.5	6.1	20	12.1	39.5	18.1	59.5	24.1	79
0.2	0.5	6.2	20.5	12.2	40	18.2	59.5	24.2	79.5
0.3	1	6.3	20.5	12.3	40.5	18.3	60	24.3	79.5
0.4	1.5	6.4	21	12.4	40.5	18.4	60.5	24.4	80
0.5	1.5	6.5	21.5	12.5	41	18.5	60.5	24.5	80.5
0.6	2	6.6	21.5	12.6	41.5	18.6	61	24.6	80.5
0.7	2.5	6.7	22	12.7	41.5	18.7	61.5	24.7	81
0.8	2.5	6.8	22.5	12.8	42	18.8	61.5	24.8	81.5
0.9	3	6.9	22.5	12.9	42.5	18.9	62	24.9	81.5
1.0	3.5	7.0	23	13.0	42.5	19.0	62.5	25.0	82
1.1	3.5	7.1	23.5	13.1	43	19.1	62.5	25.1	82.5
1.2	4	7.2	23.5	13.2	43.5	19.2	63	25.2	82.5
1.3	4.5	7.3	24	13.3	43.5	19.3	63.5	25.3	83
1.4	4.5	7.4	24.5	13.4	44	19.4	63.5	25.4	83.5
1.5	5	7.5	24.5	13.5	44.5	19.5	64	25.5	83.5
1.6	5	7.6	25	13.6	44.5	19.6	64.5	25.6	84
1.7	5.5	7.7	25.5	13.7	45	19.7	64.5	25.7	84.5
1.8	6	7.8	25.5	13.8	45.5	19.8	65	25.8	84.5
1.9	6	7.9	26	13.9	45.5	19.9	65.5	25.9	85
2.0	6.5	8.0	26	14.0	46	20.0	65.5	26.0	85.5
2.1	7	8.1	26.5	14.1	46.5	20.1	66	26.1	85.5
2.2	7	8.2	27	14.2	46.5	20.2	66.5	26.2	86
2.3	7.5	8.3	27	14.3	47	20.3	66.5	26.3	86.5
2.4	8	8.4	27.5	14.4	47	20.4	67	26.4	86.5
2.5	8	8.5	28	14.5	47.5	20.5	67.5	26.5	87
2.6	8.5	8.6	28	14.6	48	20.6	67.5	26.6	87.5
2.7	9	8.7	28.5	14.7	48	20.7	68	26.7	87.5
2.8	9	8.8	29	14.8	48.5	20.8	68	26.8	88
2.9	9.5	8.9	29	14.9	49	20.9	68.5	26.9	88.5
3.0	10	9.0	29.5	15.0	49	21.0	69	27.0	88.5
3.1	10	9.1	30	15.1	49.5	21.1	69	27.1	89
3.2	10.5	9.2	30	15.2	50	21.2	69.5	27.2	89
3.3	11	9.3	30.5	15.3	50	21.3	70	27.3	89.5
3.4	11	9.4	31	15.4	50.5	21.4	70	27.4	90
3.5	11.5	9.5	31	15.5	51	21.5	70.5	27.5	90
3.6	12	9.6	31.5	15.6	51	21.6	71	27.6	90.5
3.7	12	9.7	32	15.7	51.5	21.7	71	27.7	91
3.8	12.5	9.8	32	15.8	52	21.8	71.5	27.8	91
3.9	13	9.9	32.5	15.9	52	21.9	72	27.9	91.5
4.0	13	10.0	33	16.0	52.5	22.0	72	28.0	92
4.1	13.5	10.1	33	16.1	53	22.1	72.5	28.1	92
4.2	14	10.2	33.5	16.2	53	22.2	73	28.2	92.5
4.3	14	10.3	34	16.3	53.5	22.3	73	28.3	93
4.4	14.5	10.4	34	16.4	54	22.4	73.5	28.4	93
4.5	15	10.5	34.5	16.5	54	22.5	74	28.5	93.5
4.6	15	10.6	35	16.6	54.5	22.6	74	28.6	94
4.7	15.5	10.7	35	16.7	55	22.7	74.5	28.7	94
4.8	15.5	10.8	35.5	16.8	55	22.8	75	28.8	94.5
4.9	16	10.9	36	16.9	55.5	22.9	75	28.9	95
5.0	16.5	11.0	36	17.0	56	23.0	75.5	29.0	95
5.1	17	11.1	36.5	17.1	56	23.1	76	29.1	95.5
5.2	17	11.2	36.5	17.2	56.5	23.2	76	29.2	96
5.3	17.5	11.3	37	17.3	57	23.3	76.5	29.3	96
5.4	17.5	11.4	37.5	17.4	57	23.4	77	29.4	96.5
5.5	18	11.5	37.5	17.5	57.5	23.5	77	29.5	97
5.6	18.5	11.6	38	17.6	57.5	23.6	77.5	29.6	97
5.7	18.5	11.7	38.5	17.7	58	23.7	78	29.7	97.5
5.8	19	11.8	38.5	17.8	58.5	23.8	78	29.8	98
5.9	19.5	11.9	39	17.9	58.5	23.9	78.5	29.9	98
6.0	19.5	12.0	39.5	18.0	59	24.0	78.5	30.0	98.5

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The following reports of the Institute relate particularly to sand and gravel resources:

REPORTS OF THE INSTITUTE OF GEOLOGICAL SCIENCES

Assessment of British Sand and Gravel Resources

No. 1 The sand and gravel resources of the country south-east of Norwich, Norfolk: Description of 1 : 25 000 resource sheet TG 20. By E. F. P. Nickless. Price £1.15. Report No. 71/20

No. 2 The sand and gravel resources of the country around Witham, Essex: Description of 1 : 25 000 resource sheet TL 81. By H. J. E. Haggard. Price £1.20. Report No. 72/6

No. 3 The sand and gravel resources of the area south and west of Woodbridge, Suffolk: Description of 1 : 25 000 resource sheet TM 24. By R. Allender and S. E. Hollyer. Price £1.70. Report No. 72/9

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INSTITUTE OF GEOLOGICAL SCIENCES

MINERAL ASSESSMENT UNIT

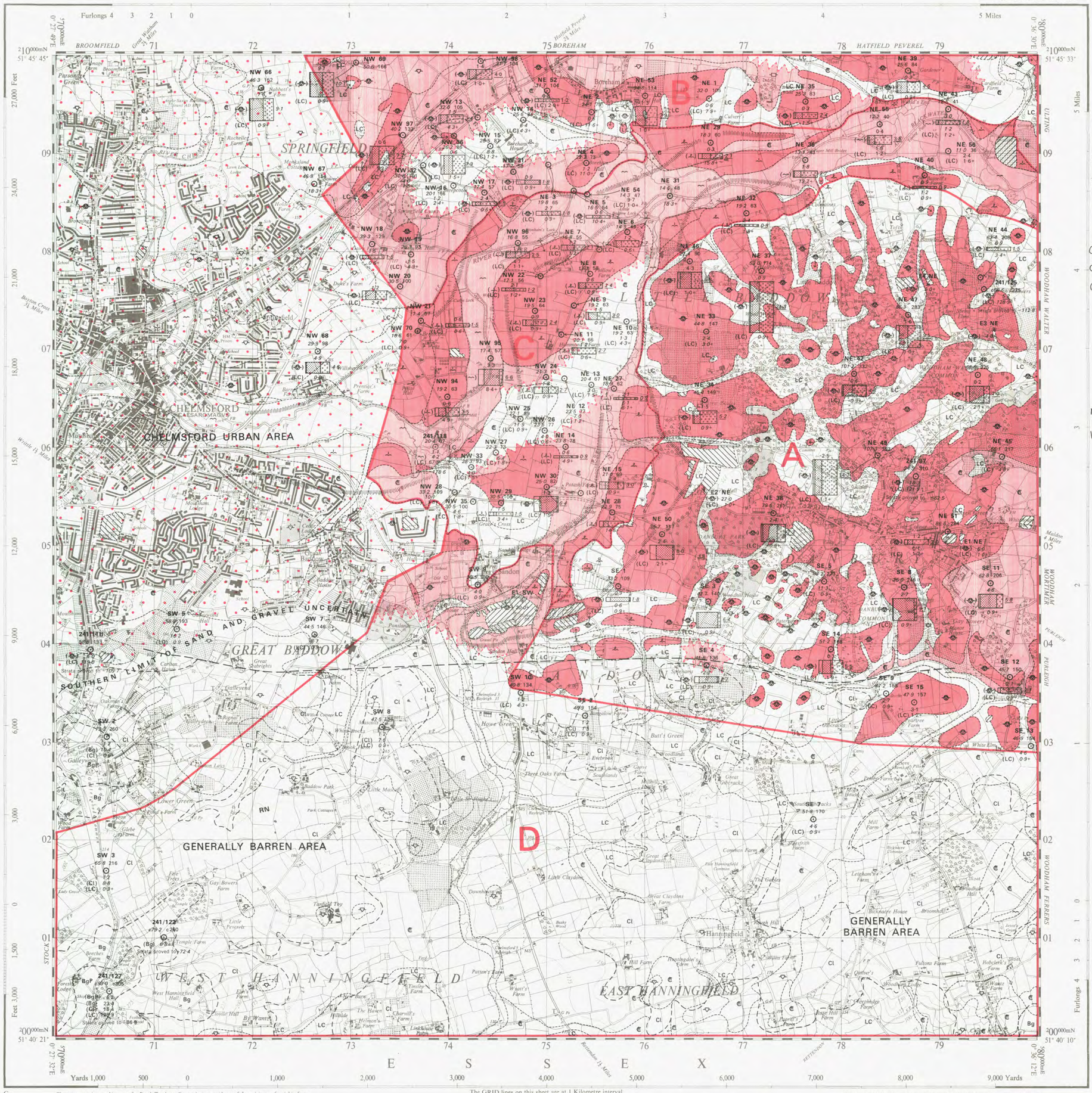
THE SAND & GRAVEL RESOURCES OF SHEET TL 70 (CHELMSFORD, ESSEX.)

Scale 1:25 000 or about 2½ Inches to 1 Mile

ORDNANCE SURVEY
SHEET TL 70
PROVISIONAL EDITION

This map should be read in conjunction with the accompanying Report which contains details of the assessment of resources.

13



EXPLANATION OF SYMBOLS AND ABBREVIATIONS

DRIFT

A-6	~	**Alluvium** - clayey silt and sand, often overlying sand and gravel.
1T-5	⊥	**1st Terrace of River Chelmer**
2T-1	⊥	**2nd Terrace of River Chelmer** } clayey flint and quartzite river gravels.
3T-2	⊥	**3rd Terrace of River Chelmer**
H-3	∈	**Head** - silty and sandy clays with stones, derived by solifluction from adjacent deposits.
B-1	▭	**Brickearth** - fine, sandy and silty loams with scattered pebbles.
GL-1	⊥	**Glacial Lake and Channel-Fill Deposits** - brown, buff and grey plastic clays and silts, often laminated.
CBC-3	⊹	**Chalky Boulder Clay** - brown and grey silty clay with numerous pebbles of chalk, flint and quartzite.
GS-4	⊹	**Glacial Sand and Gravel** - flint, quartzite and vein-quartz gravels and pebbly sands, (including the Chelmsford and Danbury Gravels).

RECENT AND PLEISTOCENE

SOLID

BgP	**Bagshot Pebble Beds** - fine sands with pebbles, with a clayey matrix.
Bg	**Bagshot Beds** - light brown sands with occasional clay partings.
Cl	**Claygate Beds** - dark greyish-brown silty clays with three fine sand horizons.
LC	**London Clay** - bluish-grey clay weathering to brown, with occasional cementstone nodules.

EOCENE

MG-2	**Made Ground**
WO-4	**Worked-out Ground** (sand and gravel)

BOUNDARY LINES

- Geological boundary, Drift.
- Geological boundary, Solid. Broken line denotes uncertainty.
- Line of fault, (conjectural); crossmark indicates downthrow side.
- Limits of buried, (Drift-filled), channel.
- Inferred boundary between categories of deposits recognized.
- Resource Block boundary.

BOREHOLE DATA

SITE LOCATIONS

⊙ Mineral Assessment Unit (M.A.U.) Boreholes.

⊙ Other Boreholes.

M.A.U. BOREHOLES

Borehole Registration Number → NE 55
12·2 40 ← Surface level in metres and feet above O.D. (Newlyn).
Borehole Site →
0·4 ← Overburden
Grading Diagram →
3·8 ← Mineral (sand and gravel).
1·6 ← Waste.
Geological classification → (LC) 1·2+ ← Bedrock.

Note:
1. Figures underlined denote thicknesses used in the assessment of resources.
2. The + sign indicates that the base of the deposit was not reached.
3. The figures in *italics* are conversions to metres of measurements recorded in feet.
4. The Geological Classification is given only for mineral and bedrock.

Borehole Registration Number

Each M.A.U. borehole is identified by a Registration Number, eg NE 55. The letters refer to the quarter sheet and the figures to the I.G.S. serial number for that quarter. The unique designation for borehole NE 55 is TL 70 NE 55.

Grading Diagrams

Each grading diagram shows the mean particle size distribution of a deposit of sand and gravel.

Sand (+1/16–4mm)
Fines (−1/16mm) Gravel (+4mm)

The height of the diagram is proportional to the mineral thickness.

The widths of the divisions show the proportions of **Fines, Sand** and **Gravel.**

OTHER BOREHOLES

The layout of information is the same as for M.A.U. boreholes, although data available may not be as comprehensive. They are registered in the same series, except for records in the Hydrogeological Department: for example **241/97** signifies Hydrogeological Department borehole 97 on New Series One-Inch Geological Sheet 241. The final depth of deep boreholes is given in metres above (+) or below (−) Ordnance Datum.

EXPOSURE RECORDS

Information from the inspection of exposures is shown in the same way as for boreholes, but they are located by an asterisk, thus ✳. Reference number and details of thickness are shown.

CATEGORIES OF DEPOSITS

- **Exposed mineral, assessed.** CAT - E2
- **Continuous or almost continuous spreads of mineral beneath overburden.** CAT - C1
- **Sand and Gravel either not potentially workable (see Report) or absent.** CAT - A2
- **Sand and Gravel not assessed.** CAT - N1

RESOURCE BLOCKS

For the purpose of assessment, the mineral-bearing land is divided into Resource Blocks (see Report). Each is designated by a letter.

Detailed records may be consulted on application to the Head, Mineral Assessment Unit, Institute of Geological Sciences, Exhibition Road, London. SW7 2DE

Made and printed for the Institute of Geological Sciences by the Director General of the Ordnance Survey, Southampton.

The representation on this map of a Road, Track, or Footpath, is no evidence of the existence of a right of way.

Geological lines from a six-inch survey by C. R. Bristow in 1966-70 and R. D. Lake in 1969-70. S. C. A. Holmes, District Geologist. Included in 1:50 000 Geological sheet 241

Sand and Gravel Survey by J. D. Ambrose, N. E. Bradbury and A. R. Clayton in 1968-69. Additional Survey by M. R. Clarke in 1972. R. G. Thurrell, Head, Mineral Assessment Unit.

1:25 000 Sand and Gravel Resource Sheet published 1975.
Sir Kingsley Dunham, D.Sc., F.R.S., *Director, Institute of Geological Sciences, incorporating the Geological Survey of Great Britain, the Museum of Practical Geology and Overseas Geological Surveys.*
2050/75

The GRID lines on this sheet are at 1 Kilometre interval.
Heights are in feet above Mean Sea Level at Newlyn.
Contour values are in feet.
1 square inch on this map represents 99·639 acres on the ground.

Data quoted for an individual borehole refer strictly to that site: reliable conclusions cannot be drawn about the thickness and grading elsewhere in the deposit, particularly in material as variable as sand and gravel. However, estimates of the volume and mean grading of the mineral as a whole in each Resource Block are given in the Report.

Compiled from 6" sheets last revised 1919.
Other partial systematic revision 1938-1954 has been incorporated.
Building development revised 1962-67.
Major roads revised 1972.

Made and published by the Director General of the Ordnance Survey, Southampton. Reprinted with the addition of new major roads.

Diagram showing the relation of the National Grid 1:25 000 sheets with the 1:50 000 Geological Sheets 240 and 241.