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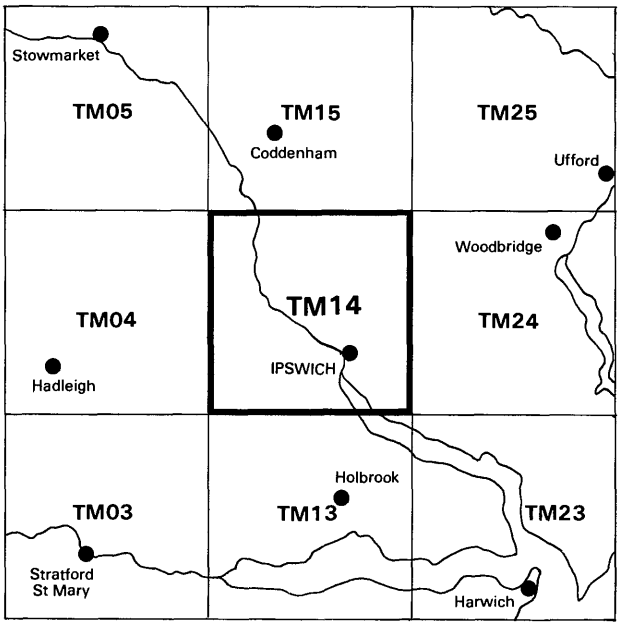

The sand and gravel resources of the country around Ipswich, Suffolk

Description of 1:25 000 resource sheet TM 14

R. Allender and S. E. Hollyer

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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 13 and subsequent reports appear as Mineral Assessment Reports 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 Industrial Minerals Assessment Unit (formerly 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 around Ipswich, Suffolk, shown on the accompanying 1:25 000 resource map. The survey was conducted by Dr R. Allender, Mr S. E. Hollyer, Mr S. J. Booth and Mr S. Machin in 1969–71. Mr M. R. Clarke, Mr M. P. Hawkins, Mr J. W. Merritt and Mr E. J. Raynor have helped with the preparation of this report. The work is based on a 1:63 360 scale geological survey published in 1881–1883, and reprinted (with minor corrections) in 1927 as the New Series one-inch Sheet 207.

Mr J. W. Gardner, CBE (Land Agent), was responsible for negotiating access to land for drilling. The ready cooperation of landowners and tenants is gratefully acknowledged.

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SUMMARY

The assessment of the sand and gravel resources in the Ipswich area is based upon the geological maps of the Institute of Geological Sciences, pre-existing borehole information and 68 boreholes drilled for the Industrial Minerals Assessment Unit.

All deposits in the area that 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 symmetrical 95 per cent probability level.

The 1:25 000 map is divided into five resource blocks containing between 6.6 and 12.1 km^2 of potentially workable sand and gravel. For each block the geology of the deposits is described and the mineral-bearing area, the mean thickness of overburden and mineral and the mean gradings are stated. Detailed borehole data are also given. The geology, the position of the boreholes and the outlines of the resource blocks are shown on the accompanying map TM 14.

Note

All National Grid references in this report lie within the 1:25 000 sheet TM 14.

Bibliographical reference

ALLENDER, R. and HOLLYER, S. E. 1981. The sand and gravel resources of the country around Ipswich, Suffolk. *Miner. Assess. Rep. Inst. Geol. Sci.*, No. 55.

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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; Harris and others, 1974).

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 or otherwise inappropriately spaced to permit the mineral bodies to be outlined completely or the grade established throughout" (Bureau of Mines and Geological Survey, 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. 240 mesh BS sieve, about $\frac{1}{16}$ mm) should not exceed 40 per cent.
d The deposit should lie within 25 m of the 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.

A deposit of sand and gravel which broadly meets these criteria 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 $\frac{1}{16}$ mm, $\frac{1}{4}$ mm, 1 mm, 4 mm, 16 mm has been

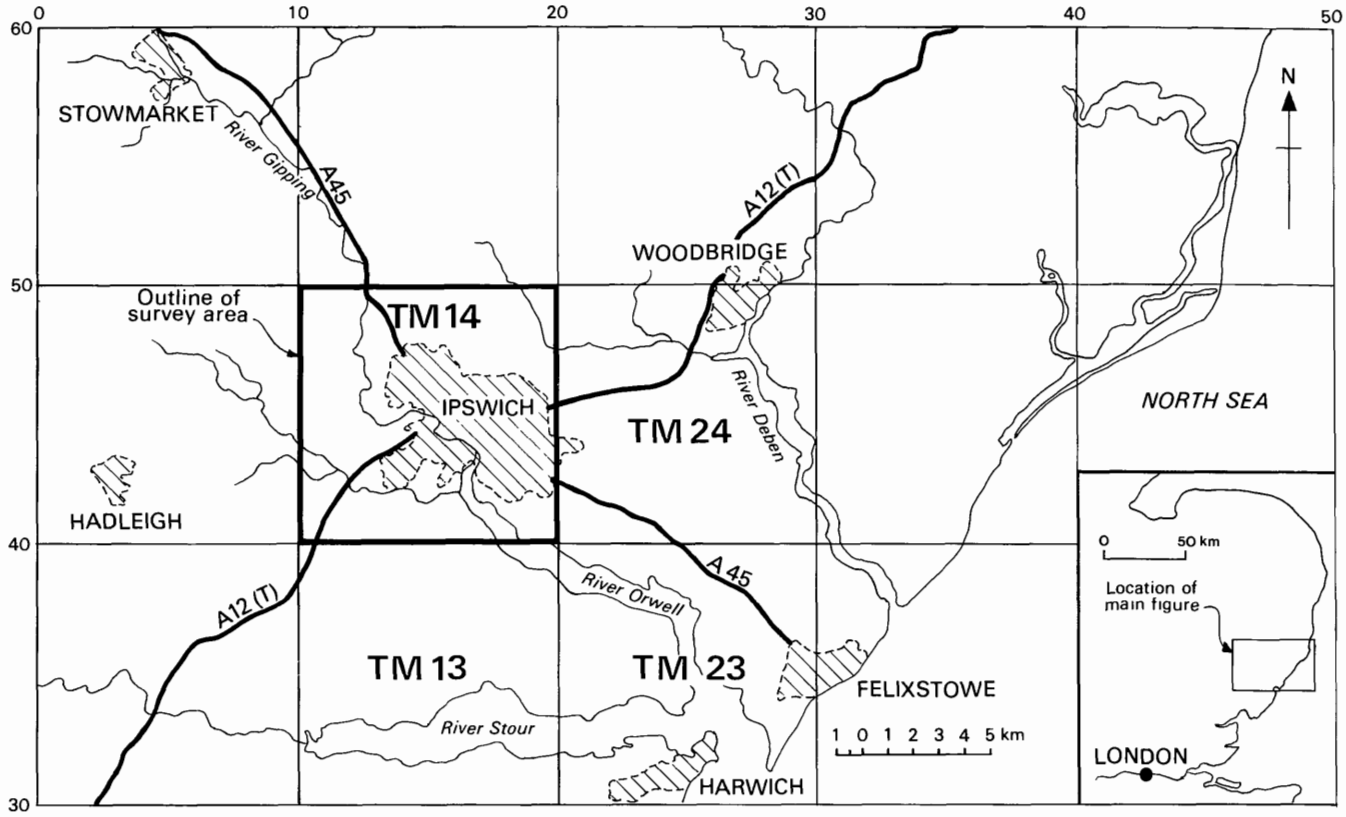


Figure 1 Location of the survey area and its relation to the adjacent survey areas (TM 13, 23 and 24) for which reports have been published

adopted. The boundaries between fines (that is, the clay and silt fractions) and sand, and between sand and gravel grade material, are placed at $\frac{1}{16}$ 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 km² 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 actual sample points.

DESCRIPTION OF THE DISTRICT

GENERAL

This report outlines an assessment of the sand and gravel resources of both the Drift and the Solid formations of 100 km² of ground around Ipswich, Suffolk (Figure 1). No assessment had been made of the deposits that lie within the urban area of Ipswich (30.1 km²) nor within the estuary of the River Orwell (2.2 km²). The remaining 67.7 km² of the sheet area is divided into five resource blocks (A to E), which contain a total of 47.6 km² of mineral.

TOPOGRAPHY

The main feature of the area is the valley of the River Gipping, which flows southwards from Claydon through Bramford and Sproughton, before meandering south-eastwards through Ipswich. To the south of Ipswich docks, this river is called the River Orwell and flows south-eastwards in a broad tidal estuary (Figure 1). The principal tributary is Belstead Brook, which joins the Orwell from the west at Bourne Bridge [162 419]. A smaller stream flowing south-east from Little Blakenham joins the Gipping near Bramford [122 475] and, in the north-eastern corner of the area, the River Fynn flows southwards through Tuddenham St Martin. The plateaux between the valleys generally lie at heights of 45 to 53 m above Ordnance Datum; but in the extreme north-west, at Little Blakenham, the highest ground in the area rises to over +60 m Ordnance Datum.

GEOLOGY

The geological classification of the deposits is given in Table 1, and a brief description of each is given below. A more detailed account of the nature and occurrence of these strata is given in the Geological Survey Memoir for the Ipswich area (Boswell, 1927). It should be noted that the geological lines on the accompanying map were reproduced from geological surveys published at the 1 inch to 1 mile (1:63 360) scale in 1881–83. Although this does not significantly affect the assessment of resources in this report, the boreholes have shown that in places the original geological lines do not always accurately delineate the superficial deposits.

Table 1 Geological classification of deposits

DRIFT	
Pleistocene and Recent	Alluvium
	Brickearth
	River Terrace Deposits
	Boulder Clay
	Glacial Sand and Gravel
	Channel-fill deposits
SOLID	
Pleistocene	Chillesford Beds (of Chillesford)*
	Red Crag
Eocene	London Clay
Palaeocene	Lower London Tertiaries
	Reading Beds
	Thanet Beds*
Cretaceous	Upper Chalk

* Proved in boreholes only

SOLID

Upper Chalk

This is the oldest formation that crops out on the resource sheet and comprises soft white limestone with flint nodules. It forms the bedrock under the Drift deposits in the north-west quadrant of the area, and is also proved beneath the Channel-fill Deposits and most of the River Terrace Deposits associated with the Gipping Valley. It is estimated as 70–80 m thick in this district although not more than 2.5 m was proved by IMAU boreholes. Commonly, where overlain by Drift the weathered top of the Chalk comprises a very soft greyish white clay, often referred to as 'putty chalk'; the thickness of this weathered zone is variable.

The surface of the Upper Chalk is irregular and penetrated by numerous solution hollows or 'pipes' filled with a variety of deposits, the most common being material derived from the Bullhead Bed (see below).

Lower London Tertiaries

These are represented within the area by the Thanet Beds and by the overlying Reading Beds. Their outcrop forms a narrow strip of country between the Upper Chalk, which they overlie, and the London Clay, beneath which they pass to the south-east (see Figure 2). They total about 12 m thick in this district; the Thanet Beds are only about 4 m thick, and have therefore been grouped with the Reading Beds on the accompanying map.

Thanet Beds: These beds rest unconformably on the Upper Chalk. The basal Bullhead Bed consists of green-coated nodular flint pebbles, set in a greyish green sandy matrix. Above is a series of green and red glauconitic sands with interbedded silts and clays, which were proved by borehole NW 39.

Reading Beds: These consist of alternations of blue, red, brown and pale grey clay with yellow and green sand, and were proved beneath Drift deposits in four assessment boreholes: NW 21, NW 26, NE 20 and in borehole NE 16, where 5.4 m+ of Reading Beds were encountered beneath 10.6 m of London Clay.

London Clay

The London Clay forms the bedrock to the Drift deposits over about half of the sheet area, where it is over 10 m thick. When proved in boreholes it typically consisted of olive to bluish grey clay, usually weathered to brown silty clay near the surface. Deeply weathered orange and brown silty clay (often with crystals of selenite) is usually seen at outcrop. Cementstones (nodular calcareous mudstone) are present in parts of the sequence and locally a thin pebble bed is developed at the base.

The surface of the London Clay is gently undulating, and decreases in height towards the south and east, from +30.8 m Ordnance Datum in borehole SW 16 to +15.5 m Ordnance Datum in borehole SE 82. Where directly overlain by glacial deposits, the London Clay surface is more irregular in shape and shows no consistent direction of slope; this probably is the result of local channelling by glacial action.

Red Crag

The Red Crag consists of reddish brown and yellow iron-stained medium sand; it is commonly shelly, and has scattered pebbles throughout but with a concentration of pebbles (including abundant phosphatic nodules) at the base of the deposit. It was proved in 24 assessment boreholes, where the thickness ranged from 2.7 m in NE 18 to 13.4 m in SW 24, but with a mean thickness of 7.4 m. The deposits proved are divisible (in all boreholes except SW 17) into upper (non-shelly) and lower (shelly) parts.

The upper part of the Red Crag ranged in thickness from 0.9 m in boreholes NE 18, SW 22 and SW 26 to 8.7 m in SE 81, with a mean of 3.6 m. The lower, shelly Crag ranged from 1.5 m in borehole NE 36 to 8.1 m in SE 82 with a mean of 3.8 m. These divisions of the Red Crag may represent two distinct phases of deposition as the non-shelly division may not simply be decalcified shelly Crag (see Allender and Hollyer, 1972, 1973 and Hollyer, 1974).

Chillesford Beds

Pale grey and green, micaceous, fine and medium sands and interbedded laminated clays with quartzite gravel were proved in seven assessment boreholes and are classified as the Chillesford Beds of Chillesford. They have not so far been recognised at the surface in the resource sheet area.

The recorded thickness of these beds ranges from 1.9 to 5.5 m in assessment boreholes, where they were shown to overlie Red Crag (and London Clay in borehole NW 19) and to be overlain themselves by glacial deposits. At a pit at Tuddenham St Martin [192 492] the sands have been worked as a source of moulding sand.

DRIFT

Channel-fill Deposits

A deep Drift-filled channel, hidden by the superficial deposits, occurs approximately beneath the present-day course of the Gipping River. The channel, which was encountered only in borehole SE 78, has a maximum proved depth of 56.7 m (in Hydrogeological Unit borehole record 207/194b) and is characteristically filled with grey silts and thin pebble beds. No assessment of these deposits has been attempted.

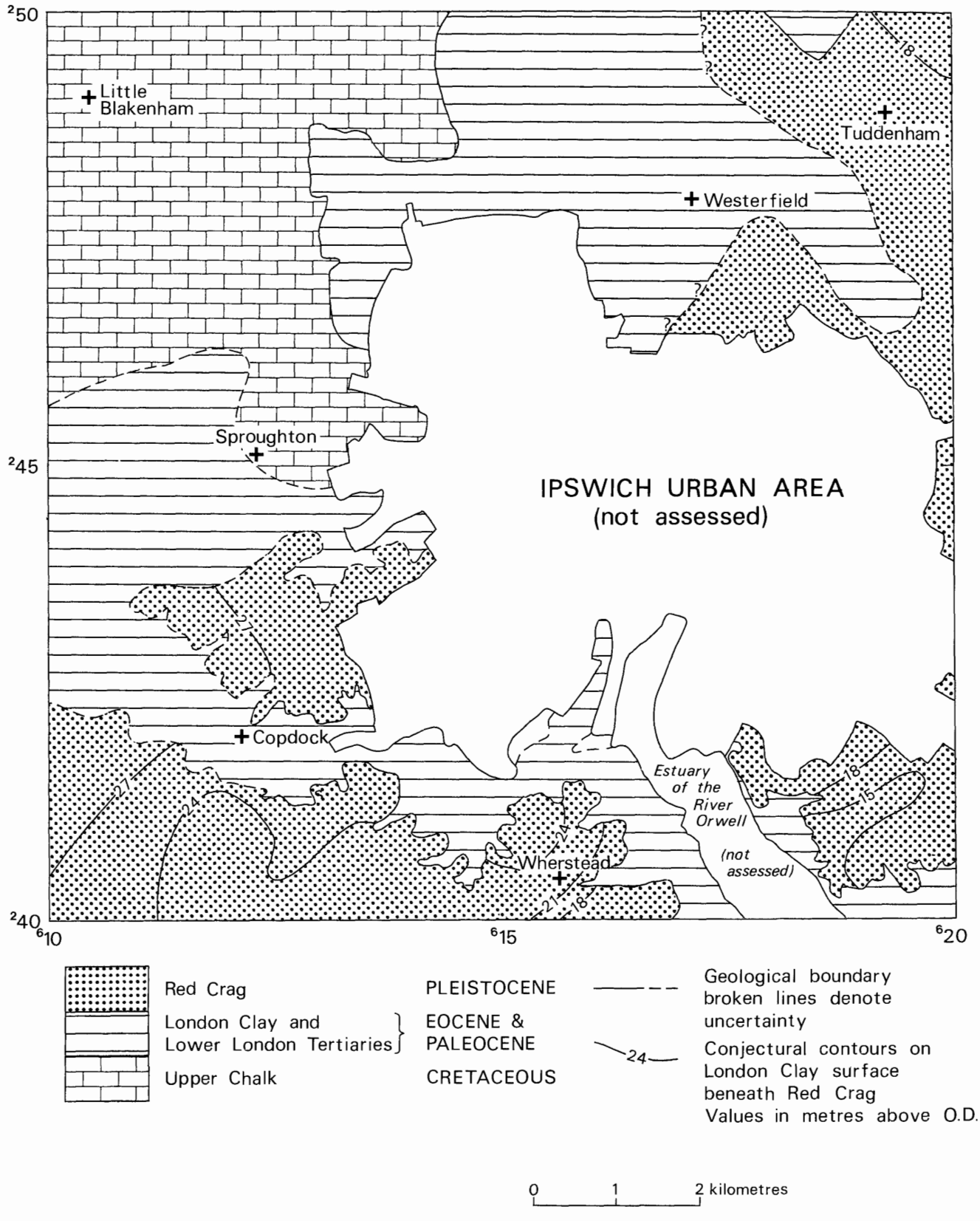


Figure 2 Generalised sub-drift (solid) geology

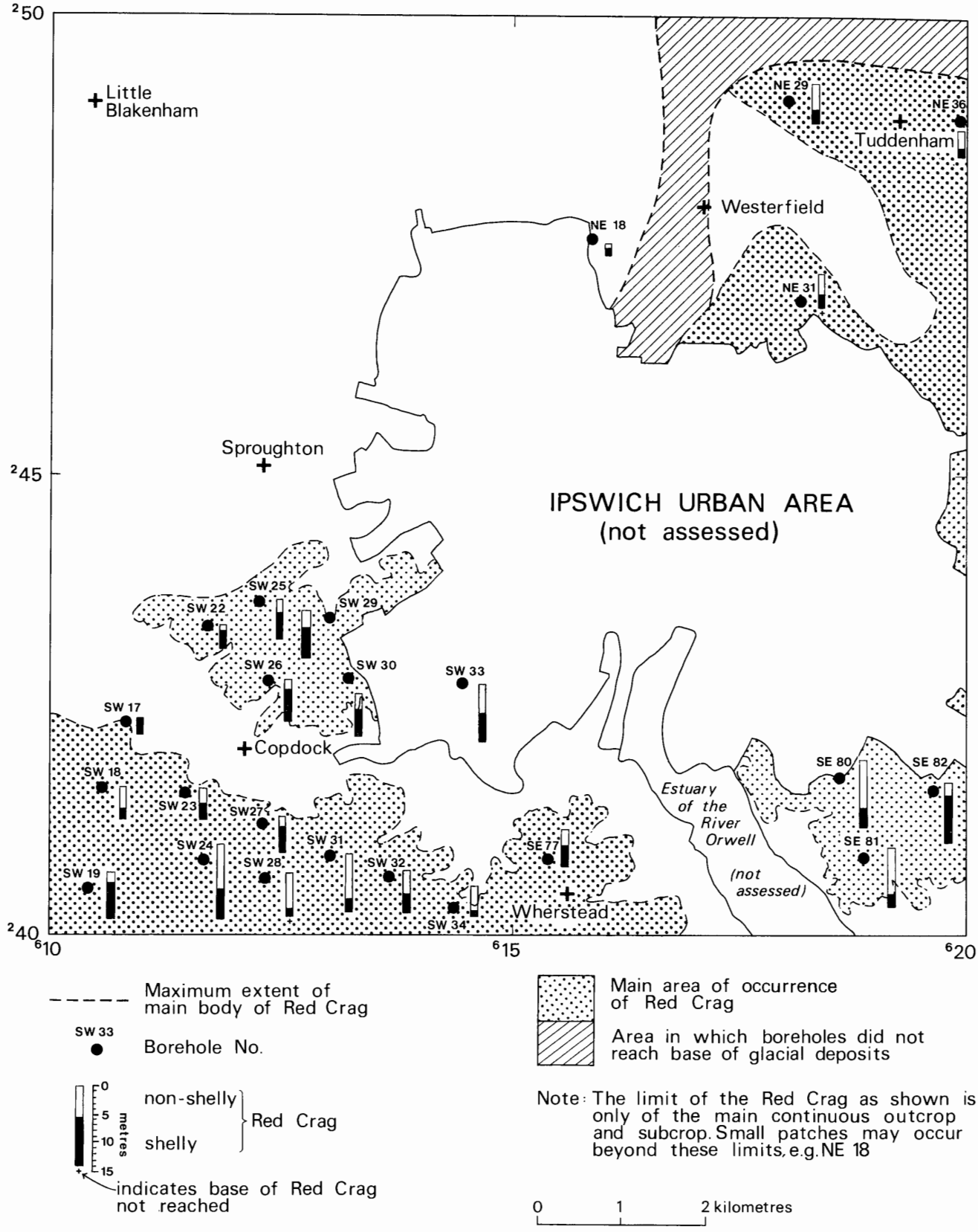


Figure 3 The thicknesses of the Red Crag proved in 24 assessment boreholes

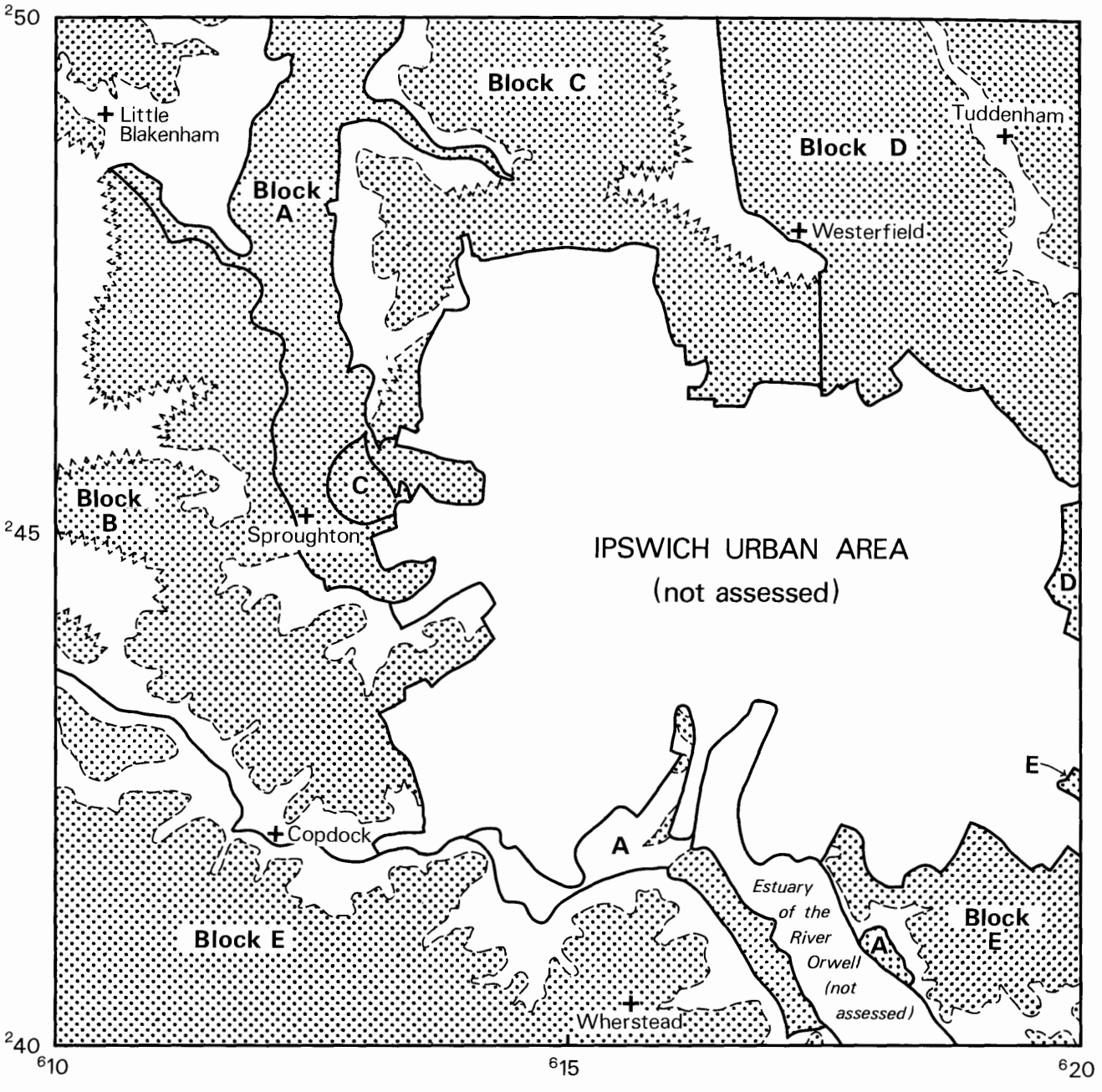


Figure 4 The main areas of mineral and their relationship to the resource block boundaries

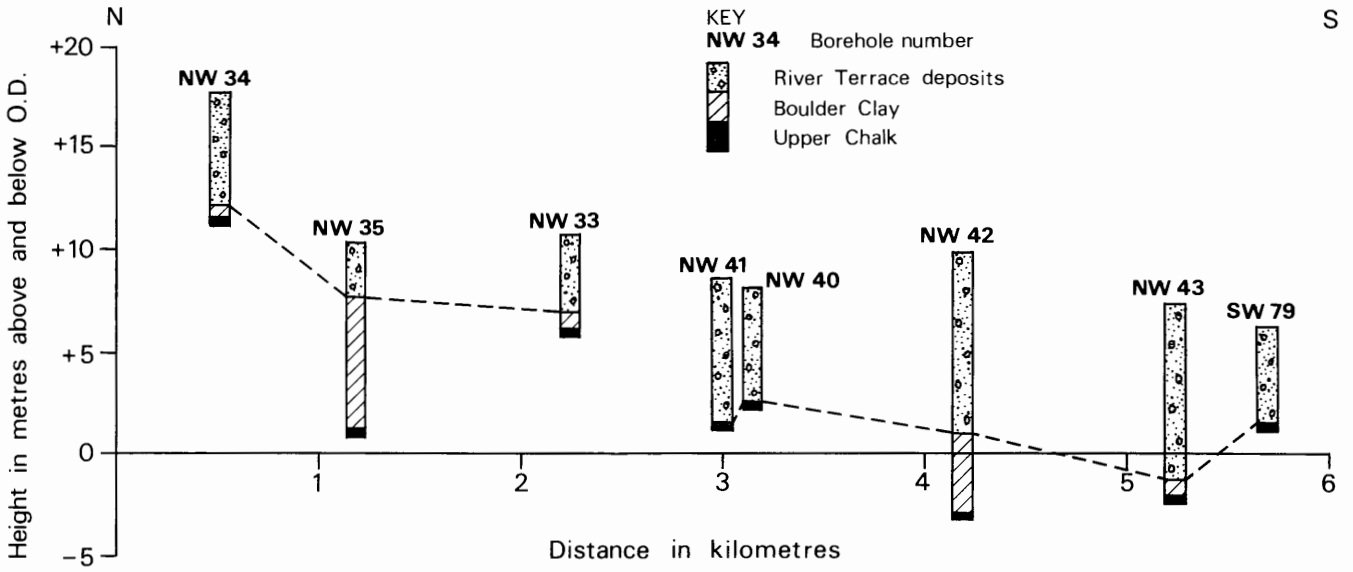


Figure 5 North to south longitudinal section of the northern part of the Gipping Valley

Glacial Sand and Gravel

The Glacial Sand and Gravel is a medium to fine sand with some gravel (see p.8) and is pale yellow to brown in colour, although locally it may be dark reddish brown, especially where it incorporates reworked Red Crag. It was proved in 40 assessment boreholes ranging in thickness from 0.6m in NW19 to 21.3m+ in NE32. The mean thickness based on assessment boreholes, and including six boreholes in which the base of the deposit was not reached, is 8.8m. In three boreholes (NE22, 30 and SW21) the Glacial Sand and Gravel is divided by thick seams (2.1m, 1.1m and 1.2m respectively) of clay.

Although mapped as being exposed over much of the sheet area, only seven IMAU boreholes proved Glacial Sand and Gravel at the surface. At most other sites the deposit is overlain by Boulder Clay.

Boulder Clay

Unweathered Boulder Clay is recognised as firm bluish grey clay containing pebbles mainly of chalk, flint, vein-quartz and quartzite but with some pebbles of Jurassic limestone and exotic igneous and metamorphic rocks. In some boreholes, particularly in the south-west, the Boulder Clay was shown to be mainly brown, sandy clay, for example in boreholes SW16, and SW21. Generally the Boulder Clay overlies the Glacial Sand and Gravel, but in places (for example borehole NW22) it was also proved underneath.

Locally the Boulder Clay rests upon bedrock as proved in boreholes NE17 and NE20, north-west of Westerfield, and in borehole SW15 to the west of Sproughton, where the geological map showing Boulder Clay overlying London Clay [105 435] was confirmed.

In the Gipping Valley, Boulder Clay of similar lithology to that on higher ground, was found beneath River Terrace Deposits, overlying Upper Chalk.

River Terrace Deposits

Sand and gravel classified as River Terrace Deposits is found principally in the Gipping Valley, but smaller patches are associated with Belstead Brook (south-west of Ipswich) and also with the River Fynn (near Tuddenham St Martin).

The terraces in the Gipping Valley north of Ipswich flank the present-day flood-plain alluvium, forming almost flat ground but elevated a few metres above the flood-plain; towards the back of the terraces the deposit rises gently up the valley sides.

The ten assessment boreholes proving these deposits to the north of Ipswich show that the sand and gravel occurs at two distinct levels as shown in Figure 5.

Brickearth

Orange-brown pebbly sandy clays with silts and fine sands (as proved in borehole SW24) typify the Brickearth deposits mapped within the sheet area. However, some local variation in lithology is seen, for example, at Westerfield, where borehole NE27 proved 4.3m of Brickearth, comprising soft to firm silty clay. It ranged in colour from pale bluish grey near the top, through grey to black at the base.

Alluvium

The floodplain of the River Gipping contains the major spreads of Alluvium with only narrow and thin patches occurring in the minor valleys. The deposits are mainly non-mineral, comprising pebbly clays and silts with occasional thin pebbly and sandy beds. Site investigation boreholes drilled for the Needham Market by-pass, west of Claydon, proved up to 5.6m of peaty clay and clayey peat overlying the River Terrace Deposits.

COMPOSITION OF THE SAND AND GRAVEL

There are four potentially workable sources of sand and gravel within the sheet area:

River Terrace Deposits
Glacial Sand and Gravel
Chillesford Beds
Red Crag

River Terrace Deposits

The River Terrace Deposits (including those deposits beneath the Alluvium) have a mean grading of fines 6 per cent, sand 48 per cent and gravel 46 per cent. The gravel content ranges from 74 per cent in borehole NW42 to 23 per cent in boreholes NW34 and SE78.

There is no apparent geographical pattern to the variation of mean grading, apart from a general tendency for the terrace deposits to be more gravelly in the south, and to contain a higher percentage of medium sand in the north. Thus the weighted mean grading of the four most northerly boreholes (NW17, 33, 34 and 35) shows that they contain 30 per cent medium sand and 37 per cent gravel, compared with figures of 18 per cent and 51 per cent respectively for the remaining boreholes.

The gravel fraction is composed principally of angular to subrounded flint with subordinate amounts of subrounded to rounded quartz and quartzite in the fine gravel fraction. Scattered chalk pebbles are also present. The sand fraction is composed mainly of quartz, usually iron stained, giving a yellow or pale reddish brown colour. Layers of silty clay sometimes occur within the deposits (for instance in boreholes NW17 and 42).

Glacial Sand and Gravel

The mean grading for the Glacial Sand and Gravel is fines 7 per cent, sand 78 per cent and gravel 15 per cent. There is a great variation in the percentage of gravel in individual boreholes from 1 per cent in borehole SW18 to 39 per cent in borehole SW27. There does not appear to be a consistent regional pattern to this variation in grading and there is little difference between the mean grading results for each resource block (see Figure 7).

The gravel fraction of the deposit comprises angular to subrounded flint with some subrounded quartz and quartzite, especially in the fine gravel. Rarely, scattered pebbles of chalk, Jurassic limestones and various metamorphic and igneous rocks occur. The sand fraction is predominantly quartz, usually iron stained giving the deposit a yellow to pale brown colour.

Chillesford Beds

The Chillesford Beds are composed mainly of fine and medium quartz sands with scattered pebble beds (see p.3). The mean grading of these sandy beds is fines 11 per cent, sand 83 per cent, gravel 6 per cent. However, these figures include the very coarse material found in boreholes SE81 and 82. In places, the deposits show extreme variation in texture; for instance the mean grading for boreholes SE81 and 82 is fines 3 per cent, sand 62 per cent and gravel 35 per cent, whereas the mean for the other five boreholes proving these beds is fines 12 per cent, sand 84 per cent and gravel 2 per cent.

Red Crag

The mean grading for this deposit is fines 8 per cent, sand 87 per cent and gravel 5 per cent; the sand fraction comprises 32 per cent fine sand, 45 per cent medium sand and 10 per cent coarse sand. The highest percentages of gravel were found in boreholes SW23 and SW26, where the mean gravel content for the total thickness of Red Crag proved was 12 per cent in each borehole.

Table 2, below, gives the mean grading for the lower (shelly) and upper (non-shelly) Crag, based on 168 samples from 22 assessment boreholes.

Table 2 The mean grading of upper and lower parts of the Red Crag

	Grading percentage by weight					
	Fines	Sand			Gravel	
	$-\frac{1}{16}$ mm	$+\frac{1}{16}-\frac{1}{4}$ mm	$+\frac{1}{4}-1$ mm	$+1-4$ mm	$+4-16$ mm	$+16$ mm
Non-shelly (upper) Red Crag	7	35	47	7	3	1
Shelly (lower) Red Crag	7	27	46	14	4	2

Although the fines, medium sand and gravel percentages for the two deposits are similar there is a significant difference in the percentage of fine and coarse sand in each.

The gravel fraction of the Red Crag consists mainly of rounded to subrounded brown and black flint with scattered rounded quartz and quartzite pebbles. At the base of the deposit there is often a concentration of black flints, together with rounded, highly polished brown phosphatic nodules and large unbroken shells.

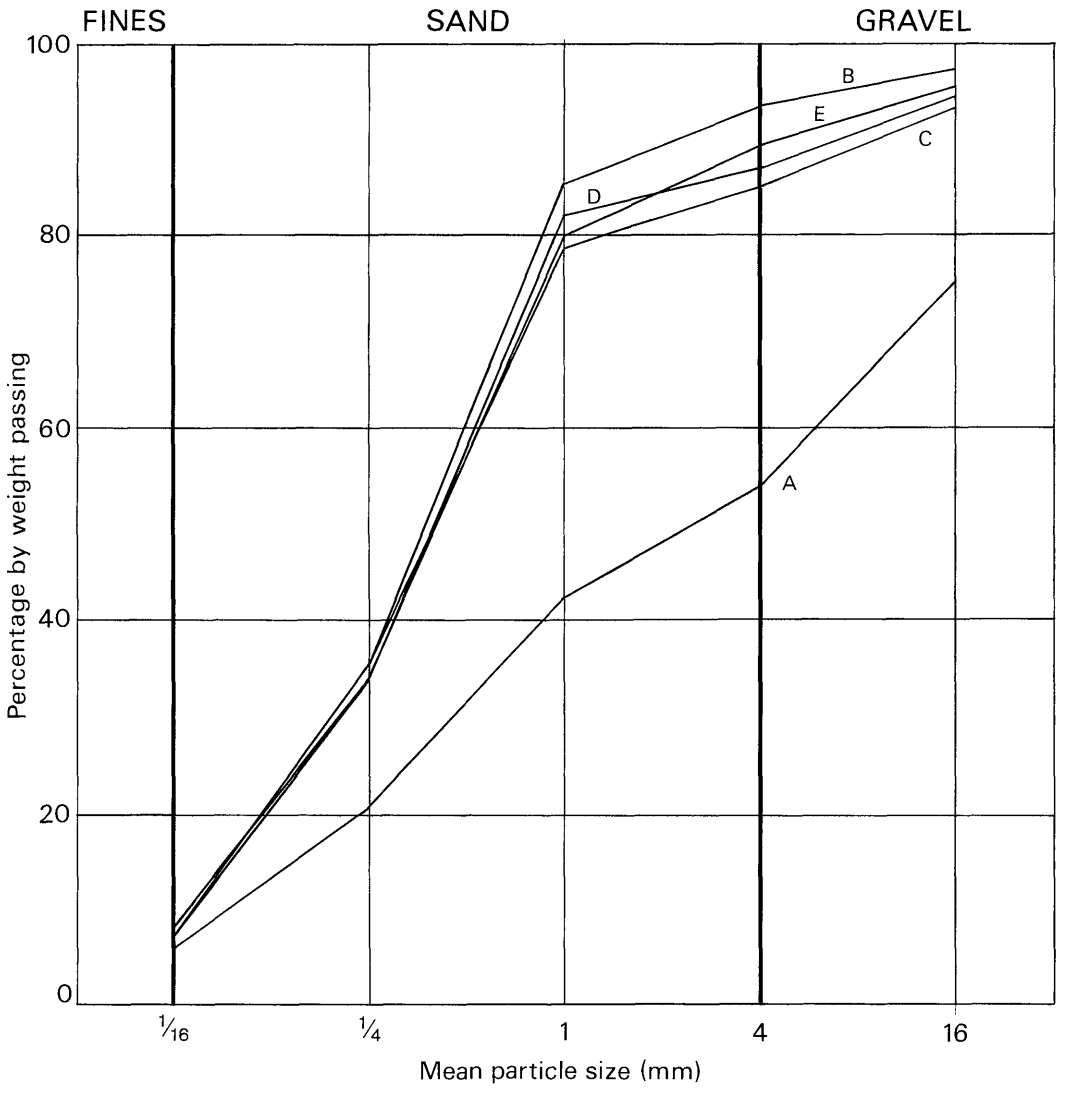
The sand fraction is composed principally of rounded quartz grains; medium sand is dominant and in addition to quartz, the sands contain various micas, feldspars and garnet.

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 1:25000 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 and symbols are taken from the published one-inch Geological Sheet 207 (Ipswich). This map is based on 'Old Series' surveys on the one-inch scale carried out in 1881–3; because no six-inch geological survey has been carried out in the area, the new borehole data, (which include the statigraphical relations and particle-size analyses of the sand and gravel samples collected during the assessment survey), reveal some, mainly minor, inconsistencies in the original geological mapping.

Nevertheless, the geological boundaries are the best interpretation of the information available at the time of survey and it is inevitable, particularly with deposits such as those included in the area of sheet TM14, that local discrepancies will be revealed by some boreholes (as for example, at borehole SW17). Where necessary, these are taken into account in the assessment of resources.



Block	Percentage by weight passing				
	$\frac{1}{16}$ mm	$\frac{1}{4}$ mm	1 mm	4 mm	16 mm
A	6	21	43	54	75
B	7	37	85	93	97
C	7	37	79	85	93
D	7	35	82	87	94
E	8	35	80	89	95

Figure 6 Mean particle-size distributions for the mineral in resource blocks A to E

Table 3 The sand and gravel resources of sheet TM14

Block	Area		Mean thickness		Volume of mineral			Mean grading percentages					
	Block	Mineral	Over-burden	Mineral		Limits at the 95% confidence level		Fines	Sand			Gravel	
	km^2	km^2	m	m	$m^3 \times 10^6$	±%	$\pm m^3 \times 10^6$	$-\frac{1}{16}$ mm	$+\frac{1}{16}-\frac{1}{4}$ mm	$+\frac{1}{4}-1$ mm	+1–4 mm	+4–16 mm	+16 mm
A	7.5	6.6	1.1	4.4	29	20	6	6	14	23	11	21	25
B	19.0	10.4	3.3	9.6	99	25	25	7	31	47	8	4	3
C	12.1	7.9	7.4	8.6	68	35	24	7	30	42	6	8	7
D	11.5	10.6	6.3	14.8	157	28	44	7	28	47	5	7	6
E	17.6	12.1	3.5	14.6	177	21	37	8	28	44	9	6	5
A–E	67.7	47.6	4.4	11.1	530*	–	–	8	26	43	8	8	7

The urban area of Ipswich (30.1 km^2) and the estuary of the River Orwell (2.2 km^2) have not been assessed.
* By addition

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 beneath overburden. The mineral is identified as 'exposed' where the overburden, commonly consisting only of soil and subsoil, averages less than 1.0m in thickness. Beneath overburden the mineral may be continuous (or almost continuous) or discontinuous. The recognition of these categories is dependent upon the importance attached to the proportion of boreholes that 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 crops out and where the available evidence suggests that sand and gravel is not potentially workable or is absent, are uncoloured on the Map; where appropriate the reason is given (e.g. north-west of Westerfield). 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 drawn between categories of deposits recognised. Such boundaries (for which a distinctive symbol is used) are used 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 statistical results are summarised in Table 3. Fuller grading particulars are shown in Figure 7.

Accuracy of results: For the five resource blocks, the accuracy of the results at the symmetrical 95 per cent probability level varies between 20 per cent and 35 per cent (that is, it is probable that nineteen times out of twenty the true volumes present lie within these limits). However, the true values are more likely to be nearer the figures estimated than the limits. Moreover, it is probable that in each block roughly the same percentage limits would apply for the estimate of volume of a very much smaller parcel of ground (say, 100 hectares) 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 the quotation of reserves of part of a block, it can be expected that data from more than ten sample points will be required, even if the area is quite small. This point can be illustrated by considering the potentially workable sand and gravel in blocks B–E on this sheet. The volume (501 million m^3) can be estimated to limits of ±13 per cent at the 95 per cent probability level, by a calculation based on the data from all the sample points in the five resource blocks.

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

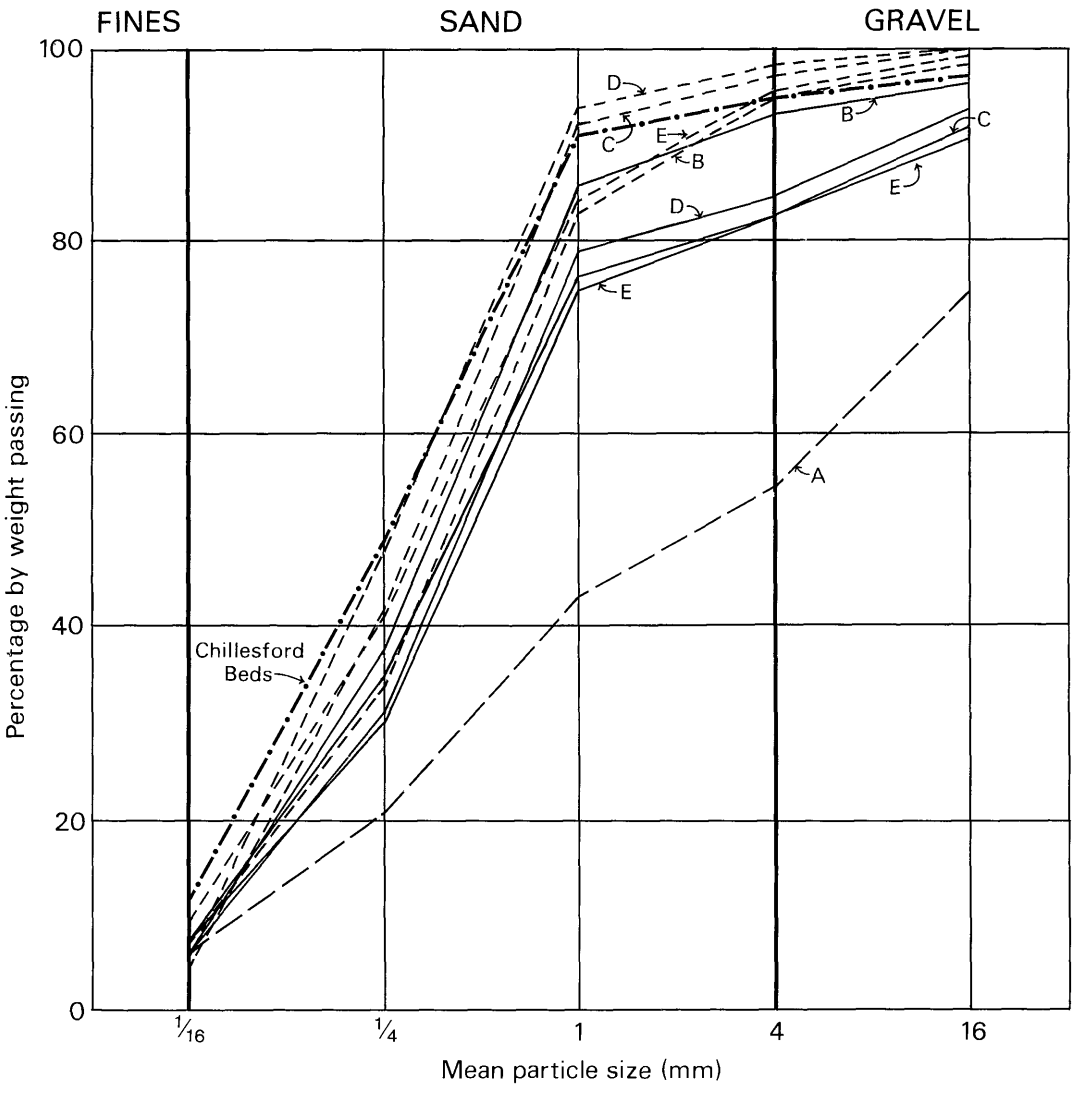
NOTES ON RESOURCE BLOCKS

The mineral on this sheet has been split into five resource blocks, lettered A to E. Block A contains all the assessed River Terrace Deposits. The remaining blocks include Red Crag, Chillesford Beds and Glacial Sand and Gravel, which have been assessed as a single mineral body for the purpose of this survey. The Glacial Sand and Gravel forms the largest mineral resource on the sheet.

Block A

This block, covering an area of 7.5 km^2, of which 6.6 km^2 is mineral-bearing, includes all the assessed deposits of River Terrace Deposits. The assessment is based on twelve IMAU boreholes, eleven Hydrogeological Unit records and 44 site investigation records associated with the construction of the Ipswich By-pass.

The block is in three parts, the largest being in the Gipping Valley to the west and north-west of Ipswich; the two other parts of the block are south of Ipswich on either side of the Orwell Estuary.



Block	Deposit	Percentage by weight passing				
		$\frac{1}{16}$ mm	$\frac{1}{4}$ mm	1 mm	4 mm	16 mm
A	Terrace Sand and Gravel	6	21	43	54	75
B	Glacial Sand and Gravel	6	38	86	92	96
	Red Crag	7	34	83	94	98
C	Glacial Sand and Gravel	7	35	77	83	92
	Red Crag	5	42	92	97	100
D	Glacial Sand and Gravel	6	32	79	85	94
	Red Crag	6	48	94	98	100
E	Glacial Sand and Gravel	7	31	76	83	91
	Red Crag	10	41	84	95	99
B, C, D and E	Chillesford Beds	12	49	91	94	97

KEY

- Terrace Sand and Gravel
- Chillesford Beds
- Glacial Sand and Gravel
- Red Crag

Figure 7 Comparison of the particle-size distributions of the mineral deposits in blocks A to E

For the block as a whole, overburden is principally the alluvial silty clays that site investigation and well records have shown to locally attain a thickness of up to 5.6 m; the mean is 1.1 m. The mineral which occurs beneath the alluvium and as exposed River Terrace Deposits, has a mean thickness of 4.4 m (the maximum proved was 8.6 m). Of the ten IMAU boreholes drilled in the northern part of the block, six proved Boulder Clay underlying the River Terrace Deposits, and one borehole (NW 37) sited on the line of the Ipswich Buried Channel failed to reach bedrock.

The two parts of the block south of Ipswich contain a small patch of terrace deposits on the east side of the River Orwell and a larger spread of terrace deposits on the west bank. These are assessed together with some small areas of alluvium and terrace deposits in the valley of Belstead Brook. Two IMAU boreholes (SE 78 and 79) were drilled in the terrace on the west bank of the River Orwell. Only the upper part of the sand and gravel in borehole SE 78 has been used in assessment calculations, as the lower part is considered to represent part of the Channel-fill Deposits (see p.3). Three IGS boreholes drilled for the East Anglia and South-east England Field Unit and one well record in the valley of Belstead Brook have been used in the assessment calculations.

The estimated mineral volume in the block is 29 million m^3 ± 20 per cent, which has a mean grading of fines 6 per cent, sand 48 per cent and gravel 46 per cent.

Block B

This block includes all mineral deposits west of the Gipping Valley and north of Belstead Brook. The block covers an area of 19.0 km^2, of which 10.4 km^2 is mineral-bearing. The assessment of mineral in this block is based on nine IMAU boreholes and eight Hydrogeological Unit records. Five other IMAU boreholes drilled in this block proved no mineral.

Red Crag was found in 5 assessment boreholes, and Glacial Sand and Gravel in seven. Chillesford Beds were proved only in boreholes SW 26 and 29.

The main areas of mineral are found between the River Gipping and Belstead Brook and on the west flank of the Gipping Valley; a small area of mineral also occurs on the high ground to the north of Little Blakenham. On the western margin of the sheet the Boulder Clay overburden is generally either excessive (as in boreholes NW 29 and 31) or sand and gravel is absent (as shown by boreholes SW 14 and 15). Inferred boundaries have been drawn to indicate the expected extent of mineral beneath overburden.

Although mapped as Glacial Sand and Gravel at outcrop, the mineral in the area to the north of Belstead Brook was proved, in boreholes SW 21, 22, 25 and 26, to be overlain in places by overburden up to 5.5 m thick; the calculated mean thickness is 3.4 m.

Bedrock in the northern part of the block is Upper Chalk but south of grid-line northing 460 (approximately) the Drift deposits overlie Lower London Tertiaries and London Clay.

The estimated volume of mineral is 99 million m^3 ± 25 per cent at the 95 per cent confidence level. The mean grading of the combined mineral deposits is fines 7 per cent, sand 86 per cent and gravel 7 per cent.

Block C

This block contains 12.1 km^2 of ground, of which 7.9 km^2 is mineral-bearing. The mean mineral thickness for the deposits in this block is 8.6 m. The high confidence limits of ± 35 per cent reflect the low number of sample points and the variability of the mineral deposits which range in thickness from 1.7 m in borehole NW 22 to 15.2 m in NE 24. The assessment of mineral in the block is based on eight IMAU boreholes and five Hydrogeological Unit records.

Red Crag does not crop out in the block but was proved beneath Glacial Sand and Gravel in borehole NE 18. Chillesford Beds have been recorded in borehole NW 19 and Glacial Sand and Gravel was present in all eight asessment boreholes that proved mineral (although in borehole NW 19 it was only 0.4 m thick).

Five boreholes in the block were barren; four of them (NW 21, 25, NE 17 and 20) proved Boulder Clay overlying bedrock. The other (NE 27), drilled to a depth of 18.3 m, on the outcrop of Brickearth which extends north-west of Westerfield, did not penetrate the thick Boulder Clay in that area. In two other boreholes, NE 23 and 24, (drilled to 24.1 m and 24.4 m respectively), bedrock also was not reached and both boreholes were stopped in Glacial Sand and Gravel. Bedrock in the block is either Upper Chalk, Lower London Tertiaries or London Clay. The sub-crop boundaries are not shown on the resource map.

On the north-east edge of the block an area of ground is delineated, where sand and gravel is either absent (as in boreholes NE 17 and NE 20) or concealed beneath excessive overburden (as inferred from borehole NE 27).

The estimated volume of mineral is 68 million m^3 ± 35 per cent at the 95 per cent confidence level. It has a mean grading of fines 7 per cent, sand 78 per cent and gravel 15 per cent.

Block D

The deposits of Glacial Sand and Gravel in this block form an almost continuous spread, and thus most (10.6 km^2) of the area of this block (11.5 km^2) is mineral-bearing. The only barren areas are restricted to the valley of the River Fynn where bedrock is exposed. The assessment of resources is based on eleven IMAU boreholes and four Hydrogeological Unit records.

Of the thirteen IMAU boreholes drilled, only two (NE 28 and NE 35) did not prove mineral; borehole NE 28 was abandoned at 10.1 m because of a rock obstruction and borehole NE 35 proved 21.9 m of Boulder Clay overburden on sand and gravel. In only six of the boreholes which found mineral was bedrock reached, the remaining five being stopped either through difficult drilling conditions or because the final depth (24.4 m) was reached whilst still in sand and gravel. Bedrock within the block is mainly London Clay although it is probable that in the extreme north, the bedrock is Lower London Tertiaries.

The mean thickness (14.8 m) of mineral in the block is the greatest for any block on the resource sheet and the deposits are in places at least 22.6 m thick (as proved in borehole NE 31). Glacial Sand and Gravel was found in eleven boreholes (and probably is present beneath Boulder Clay in NE 35). Red Crag has only one small outcrop (in the valley of the River Fynn), but was proved in three IMAU boreholes (NE 29, 31 and 36). Chillesford Beds were found in borehole NE 31, and are also to be seen in a sand pit [193 492] north of Tuddenham St Martin. Locally the Boulder Clay overburden becomes excessively thick (for example as proved in borehole NE 35).

The estimated volume of mineral is 157 million m^3 ± 28 per cent at the 95 per cent confidence level. The mean grading for all the deposits in the block is fines 7 per cent, sand 80 per cent and gravel 13 per cent.

The Glacial Sand and Gravel which forms the major resource has a mean grading of fines 6 per cent, sand 79 per cent and gravel 13 per cent, whereas the mean grading of the Red Crag (based on only three boreholes) is fines 6 per cent, sand 92 per cent and gravel 2 per cent.

Block E

This block which covers 17.6 km^2 contains the largest area (12.1 km^2) of mineral on the resource sheet. The block is in two parts, the larger being to the west of the River Orwell, the remainder to the east.

Glacial Sand and Gravel and Red Crag are found in both parts of the block but Chillesford Beds were proved only in the eastern part in boreholes SE81 and SE82. The assessment is based on fifteen IMAU boreholes and seven Hydrogeological Unit boreholes.

All assessment boreholes drilled in the block proved mineral which has a mean thickness of 14.6 m, but ranges in thickness from 3.3 m in SW78 to 21.1 m in SE82. Two boreholes, SW18 and SW28, failed to reach bedrock, which is formed of London Clay throughout the block area. Deposits of Glacial Sand and Gravel and Red Crag were proved in all boreholes except borehole SW16.

Seven assessment boreholes sited on exposed Glacial Sand and Gravel proved overburden ranging from 1.2 m in borehole SW24 to 7.0 m in borehole SW16, where brown sandy clay has been classified as ?Boulder Clay; this may be regarded as an outlying remnant of the boulder clay plateau to the south-west. All mineral in the block east of the River Orwell is 'exposed' with a mean thickness of overburden (based on 3 boreholes) of 0.6 m.

The estimated volume of mineral is 177 million m^3 ± 21 per cent at the 95 per cent confidence level. The mean grading for the block as a whole is fines 8 per cent, sand 81 per cent and gravel 11 per cent.

APPENDIX A

FIELD AND LABORATORY PROCEDURES

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.

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 at a diameter of about 200 mm, 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). Although uncased continuous flight power augers can meet these requirements in some ground they fail either below the water table or in some clay-free sands and gravels when the mineral will not stay on the flights. In such circumstances materials can be recovered by bailing. However, not only is this method slow, but there is a tendency for the pumping action to draw unwanted material into the hole either from the sides or the bottom. On the area covered by the sheet here described, the German Wirth B1 drill (or B0 modified) has been used extensively. With this machine, casing can be advanced at the same time as the hole is being drilled, thus minimising disturbance to the ground, and avoiding contamination and caving. In difficult ground a bailer can be substituted for the auger. Shell and auger rigs as well as power auger rigs have been used in this survey.

The shell and auger 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 depth. The samples, each weighing between 25 and 45 kg are despatched in heavy duty polythene bags to a laboratory for grading. The grading procedure is based on British Standard 1377 (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, Industrial Minerals 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 paragraph 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

$$S_V = \sqrt{(S_A^2 + S_{\bar{l}_m}^2)} \qquad [1]$$

4 The above relationship may be transposed such that

$$S_V = S_{\bar{l}_m}\sqrt{(1 + S_A^2/S_{\bar{l}_m}^2)} \qquad [2]$$

From this it can be seen that as $S_A^2/S_{\bar{l}_m}^2$ 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 $l_{m_1}, l_{m_2}, \ldots l_{m_n}$, then the best estimate of mean thickness, $\bar{l}_m$, is given by

$$\Sigma(l_{m_1} + l_{m_2} \ldots l_{m_n})/n.$$

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, $S_{\bar{l}_m}$, expressed as a proportion of the mean thickness is given by

$$S_{\bar{l}_m} = (1/\bar{l}_m)\sqrt{[\Sigma(l_m - \bar{l}_m)^2/(n-1)]}$$

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 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 $S_A/S_{\bar{l}_m} \leq 1/3$ is assumed in all cases. It follows from equation [2] that

$$S_{\bar{l}_m} \leq S_V \leq 1.05\, S_{\bar{l}_m}. \qquad [3]$$

Block calculation **1:25 000** **Block** } Fictitious

Area
Block: 11.08 km²
Mineral: 8.32 km²

Mean thickness
Overburden: 2.5 m
Mineral: 6.5 m

Volume
Overburden: 21 million m³
Mineral: 54 million m³

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 m³

Thickness estimate {measurements in metres}
l_o = overburden thickness l_m = mineral thickness

Sample points	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	IMAU 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	Hydrogeology Unit record
123/45	½	2.0		4.6		
1	¼	2.7	2.6	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	$\Sigma w = 8$	$\Sigma wl_o = 20.2$		$\Sigma wl_m = 52.0$		
Means		$\overline{wl_o} = 2.5$		$\overline{wl_m} = 6.5$		

Calculation of confidence limits

wl_m	$\lvert(wl_m - \overline{wl_m})\rvert$	$(wl_m - \overline{wl_m})^2$
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

$\Sigma(wl_m - \overline{wl_m})^2 = 15.82$
$n = 8$
t = 2.365

L_v is calculated as

$$1.05(t/\overline{wl_m})\sqrt{[\Sigma(wl_m - \overline{wl_m})^2/n(n-1)]} \times 100$$
$$= 1.05 \times (2.365/6.5)\sqrt{[15.82/(8 \times 7)]} \times 100$$
$$= 20.3$$
$$\simeq 20 \text{ per cent}$$

Figure 8 Example of resource block assessment: calculation and results

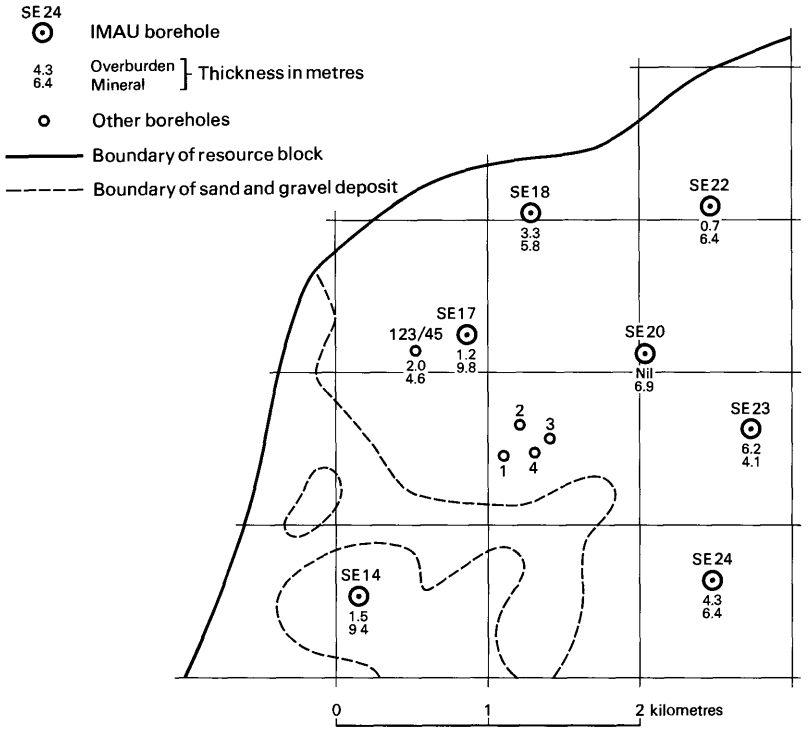


Figure 9 Example of resource block assessment: map of fictitious block

7 The limits on the estimate of mean thickness of mineral, $L\bar{l}_m$, may be expressed in absolute units $\pm(t/\sqrt{n})\times S\bar{l}_m$ or as a percentage $\pm(t/\sqrt{n})\times S\bar{l}_m \times (100/\bar{l}_m)$ 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	infinity	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 Edition, 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: $L\bar{l}_m \leq L_v \leq 1.05L\bar{l}_m$.

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

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

per cent, and when n is greater than 20, as

$$[(1.05\times 1.96)/\bar{l}_m]\times[\sqrt{\Sigma(l_m-\bar{l}_m)^2/n(n-1)}]\times 100$$

per cent (weighting factors may be included: see paragraph 15).

11 The application of this procedure to a fictitious area is illustrated in Figures 8 and 9.

Inferred assessment

12 If the sampled area of mineral in a resource block is between 0.25 km² and 2 km² 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 km².

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 $\frac{1}{16}$ mm) and coarser than pebbles (more than 64 mm in 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 $\frac{1}{16}$ 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 Figure 10). 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 10, Appendix D).

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 $\frac{1}{16}$-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 ($+\frac{1}{16}$ $-\frac{1}{4}$ mm), medium ($+\frac{1}{4}-1$ mm) and coarse ($+1-4$ mm). The boundary at 16 mm distinguishes a range of finer gravel ($+4$ -16 mm), often characterised by abundance of worn tough pebbles of vein-quartz, from larger pebbles often of notably different materials. The boundary of 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: 1967). In this report the grading is tabulated on the borehole record sheets (Appendix D), the intercepts

corresponding with the simple geometric scale $\frac{1}{16}$ 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, 1975), 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
	Cobble		Gravel
64 mm –			
	Pebble	Coarse	
16 mm –			
		Fine	
4 mm –			
		Coarse	Sand
1 mm –			
	Sand	Medium	
$\frac{1}{4}$ mm –			
		Fine	
$\frac{1}{16}$ mm –			
	Fines (silt and clay)		Fines

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

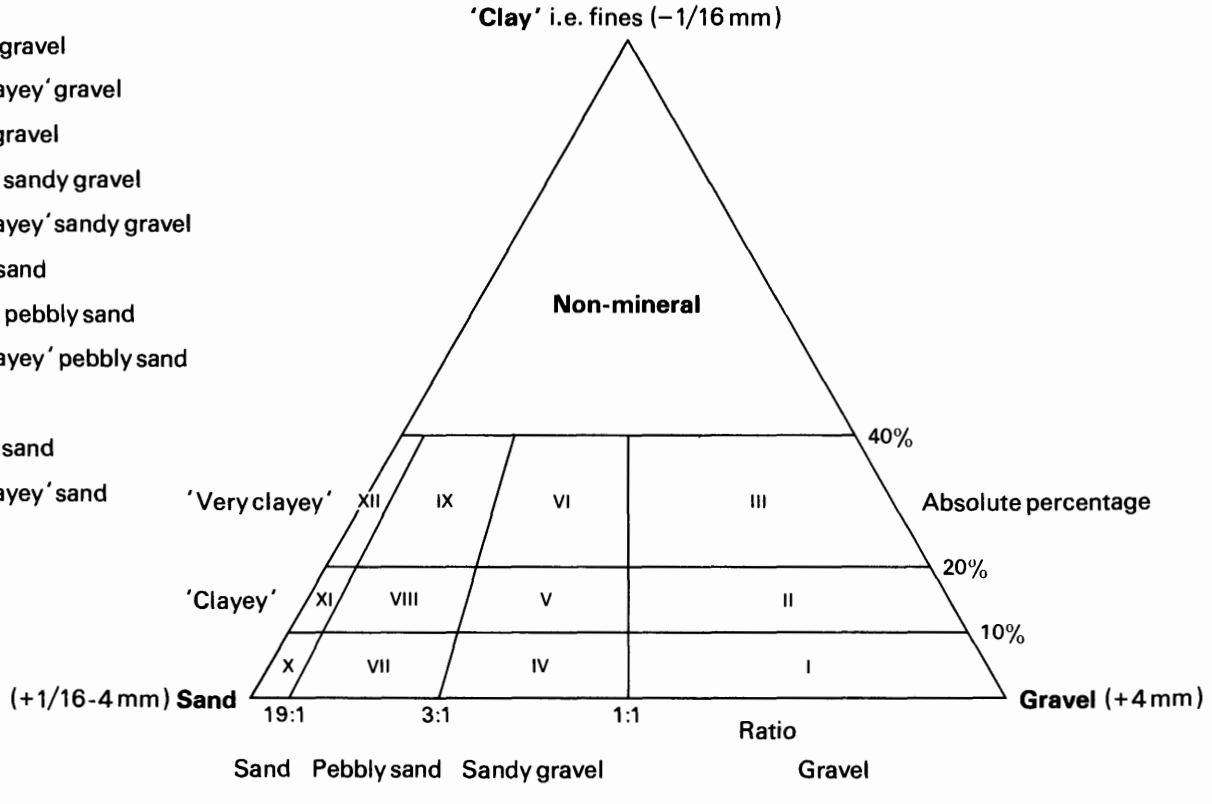


Figure 10 Diagram to show the descriptive categories used in the classification of sand and gravel

APPENDIX D

EXPLANATION OF THE BOREHOLE RECORDS

Annotated example

TM 14 SW 28[1] **1246 4057**[2] **near Blacksmith's Corner, Belstead**[3] **Block E**

Surface level (+43.3 m) +142 ft[4]
Water struck at (+28.3 m) +93 ft[5]
Wirth B0, 8-in diameter[6]
April 1970

Overburden[7] 3.0 m
Mineral 15.9 m+[8]

LOG

Geological classification[9]	Lithology[10]	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Clay, brown, with flint and occasional chalk to 1.8 m, becoming brown clayey gravel	2.4	3.0
Glacial Sand and Gravel	**a** Pebbly sand Sand: brown or yellow-brown, fine to medium, with rounded to subrounded flint and rounded quartz pebbles	8.3	11.3
Red Crag	**b** Sand Sand: with a little gravel	6.4	17.7
	Sand: grey, brown or yellow, fine to medium Sand: brown, shelly	1.2+	18.9

GRADING

	Mean for deposit[13] *percentages*			Depth below[11] surface (m)	*percentages*[12]					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	7	75	18	3.0–3.9	10	8	45	5	8	24
				3.9–4.9	8	12	45	5	12	18
				4.9–5.8	14	30	39	2	9	6
				5.8–6.7	3	19	55	4	12	7
				6.7–7.6	6	42	34	5	9	4
				7.6–8.5	3	26	66	3	2	0
				8.5–9.4	3	25	60	7	4	1
				9.4–10.3	9	16	51	9	11	4
				10.3–11.3	6	15	42	6	10	21
				Mean	7	21	49	5	9	9
b	8	89	3	11.3–12.2	12	31	51	2	4	0
				12.2–13.1	7	32	55	3	2	1
				13.1–14.0	6	36	56	2	0	0
				14.0–14.9	5	28	62	2	2	1
				14.9–15.8	17	41	40	1	1	0
				15.8–16.7	10	48	34	5	3	0
				16.7–17.7	5	41	44	5	4	1
				17.7–18.9	5	40	45	6	4	0
				Mean	8	37	49	3	3	0

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

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

1 The number of the 1:25000 sheet on which the borehole lies, for example TM 14.

2 The quarter of the 1:25000 sheet on which the borehole lies and the number of the borehole in a series for that quarter, for example SW 28.

Thus the full Registration Number is TM 14 SW 28. Usually this is abbreviated to SW 28 in the text.

2 The National Grid reference
All National Grid references in this publication lie within the 100 km square 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.

5 Groundwater conditions
Four kinds of entry are made: the record indicates the level at which groundwater stood on completion of drilling (in metres and feet above or below Ordnance Datum); or that water was encountered but its level not recorded; or that water was not encountered; or that no note of groundwater conditions was made.

6 Type of drill and date of drilling
The type of machine, and the 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 The plus sign (+) indicates that the base of the deposit was not reached during drilling.

9 Geological classification
The geological classification is given wherever possible.

10 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 of the gravel and/or sand fractions. The description of other rocks is based on visual examination, in the field.

11 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.

12 Grading results
The limits are as follows: gravel, +4 mm; sand, $-4+\frac{1}{16}$ mm; fines, $-\frac{1}{16}$ mm.

13 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. Unless otherwise stated all the material passes the 64 mm sieve.

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

Borehole number*	Grid reference†
IMAU BOREHOLES	
pp.21-31	
NW 17	1325 4985
NW 19	1347 4785
NW 21	1382 4736
NW 22	1396 4992
NW 25	1463 4836
NW 26	1500 4973
NW 29	1029 4825
NW 30	1067 4740
NW 31	1029 4644
NW 32	1027 4507
NW 33	1192 4811
NW 34	1220 4986
NW 35	1217 4916
NW 37	1409 4533
NW 39	1152 4640
NW 40	1222 4722
NW 41	1260 4736
NW 42	1242 4617
NW 43	1266 4514
pp.32-37	
NE 15	1515 4890
NE 16	1537 4798
NE 17	1608 4968
NE 18	1588 4760
NE 20	1631 4872
NE 22	1700 4840
NE 23	1664 4739
NE 24	1688 4693
pp.38–46	
NE 25	1739 4943
NE 26	1752 4856
NE 27	1729 4767
NE 28	1751 4663
NE 29	1811 4911
NE 30	1859 4821
NE 31	1828 4696
NE 32	1844 4741
NE 33	1803 4680
NE 34	1910 4752
NE 35	1965 4984
NE 36	1992 4879
NE 37	1968 4677
pp.46-59	
SW 14	1059 4457
SW 15	1068 4396
SW 16	1053 4298
SW 17	1079 4229
SW 18	1057 4159
SW 19	1042 4038
SW 20	1135 4484
SW 21	1150 4379
SW 22	1174 4337
SW 23	1165 4151
SW 24	1179 4080
SW 25	1234 4369
SW 26	1260 4280
SW 27	1230 4115
SW 28	1246 4057
pp.60–65	
SW 29	1323 4329
SW 30	1341 4280
SW 31	1313 4073
SW 32	1368 4048
SW 33	1454 4275
SW 78	1460 4014
SW 79	1281 4466
pp.66-71	
SE 77	1540 4072
SE 78	1671 4098
SE 79	1699 4058
SE 80	1859 4163
SE 81	1900 4090
SE 82	1960 4166

OTHER BOREHOLES

a Hydrogeological Unit Records

207/67, 141, 159, 165, 198, 201, 216, 221, 233, 255, 257, 285, 351, 354, 358, 362, 376, 377, 397, 416, 566, 573, 582, 595, 651, 659, 689, 700, 720, 735, 747, 751, 771, 776, 785, 843, 856a,

b Site investigation records

Ipswich By-pass – Southern and Western sectors.

c Other IGS registered boreholes

TM 14 NW 111

*By sheet quadrant
†All fall within TM 14

APPENDIX F

INDUSTRIAL MINERALS ASSESSMENT UNIT BOREHOLE RECORDS

TM 14 NW 17 **1325 4985** **near School, Claydon** **Block A**

Surface level (+12.8 m) +42 ft
Groundwater conditions not recorded
Pilcon shell, 6 in diameter
December 1970

Overburden 1.6 m
Mineral 1.6 m
Waste 1.6 m
Mineral 3.5 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground and soil	1.6	1.6
River Terrace Deposits (1st Terrace)	**a** Sandy gravel Sand: pale brown, fine to medium, slightly clayey Gravel: mainly subangular to rounded flint with some quartz and quartzite	1.6	3.2
	Clay, brown to orange-brown, silty. Laminated in parts	1.6	4.8
	b Sandy gravel Sand: yellow-brown, mainly medium clayey in upper 2.0 m Gravel: subangular to rounded flint with occasional rounded quartzite. Some chalk pebbles	3.5	8.3
Upper Chalk	Chalk with flints	0.7+	9.0

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	8	64	28	1.6–2.6	No grading information available					
				2.6–3.2	8	30	27	7	11	17
b	5	54	41	4.8–5.8	5	24	33	5	15	18
				5.8–6.8	8	15	33	8	10	26
				6.8–7.8	2	8	29	16	20	25
				7.8–8.3	3	6	18	10	30	33
				Mean	5	14	30	10	17	24
a+b	6	57	37		6	19	29	9	15	22

TM 14 NW 19 1347 4785 near Brickworks, Whitton **Block C**

Surface level (+46.0 m) +151 ft
Groundwater conditions not recorded
Pilcon shell, 6 in diameter
December 1970

Overburden 6.4 m
Mineral 4.4 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, pale brown, sandy to 0.7 m, then orange-brown chalky clay with some flint pebbles	5.8	6.0
Glacial Sand and Gravel	Sand, orange-brown, very clayey with occasional large flints	0.4	6.4
	a Sandy gravel Sand: yellowish brown, with gravel Gravel: mainly angular to subangular flint, some quartz	0.2	6.6
Chillesford Beds	**b** 'Clayey' sand Sand: pale green and brown, mainly fine, clayey, with bands of laminated green and brown clay. Some flint and quartzite gravel	4.2	10.8
London Clay	Clay, brown, becoming bluish grey downwards	0.5+	11.3

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	3	70	27	6.4–6.6	3	5	50	15	10	17
b	14	83	3	6.8–7.5	12	46	37	2	1	2
				7.5–8.5	5	60	34	0	1	0
				8.5–9.5	No grading information available					
				9.5–10.8	25	43	30	1	0	1
				Mean	15	49	33	1	1	1
a+b	14	83	3		14	47	34	2	1	2

TM 14 NW 21 1382 4736 near Corporation Farm, Whitton **Block C**

Surface level (+32.9 m) +108 ft
Water struck at +20.4 m
Wirth, B0 8 in diameter
February 1970

Waste 12.8 m
Bedrock 2.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
Boulder Clay	Clay, brown or grey, chalky in places	11.9	12.8
Lower London Tertiaries (Reading Beds)	Sand, yellow-orange, becoming more clayey towards base, mottled red and blue	2.7+	15.5

TM 14 NW 22 1396 4992 near Chalk Pit, Claydon **Block C**

Surface level (+37.5 m) +123 ft
Groundwater conditions not recorded
Shell (152 mm) 6 in diameter
November 1971

Overburden 1.9 m
Mineral 1.7 m
Waste 5.2 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil, brown clay	0.5	0.5
Boulder Clay	Silty clay, pale brown, with pebbles of chalk, flint and quartzite	1.4	1.9
Glacial Sand and Gravel	'Clayey' sandy gravel Sand: fine to coarse, silty Gravel: subrounded to angular flint with scattered rounded chalk and quartzite pebbles	1.7	3.6
Boulder Clay	Clay, pale brown, with chalk and flint pebbles	5.2	8.8
Upper Chalk	Chalk	0.3+	9.1

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
12	44	44	1.9–2.9	6	13	13	12	12	44
			2.9–3.6	21	20	21	13	11	14
			Mean	12	16	16	12	12	32

TM 14 NW 25 1463 4863 Rise Hall, Akenham **Block C**

Surface level (+26.5 m) +87 ft
Water struck at +22.2 m
Pilcon shell, 8 in diameter
December 1970

Waste 5.5 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown or grey, with chalk	5.2	5.5
Upper Chalk	Chalk, soft, becoming hard and blocky downwards	0.8+	6.3

TM 14 NW 26 1500 4973 Claydon Farm, Claydon **Block C**

Surface level (+47.5 m) +156 ft
Groundwater conditions not recorded
Pilcon shell, 6 in diameter
October 1971

Overburden 8.7 m
Mineral 10.0 m
Bedrock 1.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Clay, brown, becoming grey, with chalk and flints	8.7	8.7
Glacial Sand and Gravel	Pebbly sand Sand: brown, fine to medium, pebbly in upper 4.0 m and between 14.7 m and 15.7 m Gravel: angular to subrounded flint and quartzite, with some chalk	10.0	18.7
Lower London Tertiaries (Reading Beds)	Sand, orange-brown, medium, with occasional pebbles, passing down into brown and orange clay	1.7+	20.4

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
5	87	8	8.7–9.7	4	16	62	5	6	7
			9.7–10.7	5	45	36	6	3	5
			10.7–11.7	2	18	61	5	4	10
			11.7–12.7	4	18	59	4	3	12
			12.7–13.7	2	20	76	2	0	0
			13.7–14.7	4	51	43	2	0	0
			14.7–15.7	3	42	25	2	6	22
			15.7–16.7	15	80	3	2	0	0
			16.7–17.7	6	81	12	1	0	0
			17.7–18.7	4	29	63	3	1	0
			Mean	5	40	44	3	2	6

TM 14 NW 29 1029 4825 near Little Blakenham Hall, Little Blakenham **Block B**

Surface level (+26.8 m) +88 ft
Water not struck
Wirth B0 (203 mm) 8 in diameter
March 1970

Waste 18.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.6	0.6
Boulder Clay	Clay, brown with chalk pebbles	8.2	8.8
	Clay, grey with chalk pebbles, becoming sandy and including large flint cobbles towards base	9.4+	18.3

TM 14 NW 30 1067 4740 Back Lane, Bramford **Block B**

Surface level (+43.6 m) + 143 ft
Water not struck
Wirth B0 8 in diameter
May 1970

Overburden 8.8 m
Mineral 3.7 m
Waste 2.7 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
Boulder Clay	Clay, brown with abundant chalk and flints	7.9	8.8
Glacial Sand and Gravel	'Clayey' sand, with scattered flints Sand: yellow-brown	2.7	11.6
?Chillesford Beds	Sand: grey or green with high silt and clay content. Occasional chalk and flint pebbles	0.9	12.5
	Clay, grey-green, silty with occasional chalk and flint pebbles	2.7	15.2
Upper Chalk	Chalk	0.6+	15.8

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
12	83	5	8.8–9.8	6	30	62	1	1	0
			9.8–10.7	3	22	61	6	6	2
			10.7–11.6	6	30	52	6	5	1
			11.6–12.5	31	37	23	4	4	1
			Mean	12	30	49	4	4	1

TM 14 NW 31 1029 4644 near Bullenhall Farm, Bramford **Block B**

Surface level (+50.0 m) + 164 ft
Water not struck
Wirth B1, 8 in diameter
March 1970

Waste 19.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown or grey, chalky, with occasional sand lenses	19.5+	19.8

TM 14 NW 32 1027 4507 Burstall Hall, Burstall **Block B**

Surface level (+50.9 m) +167 ft
Groundwater conditions not recorded
Pilcon shell, 6 in diameter
December 1970

Overburden 6.7 m
Mineral 6.5 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Clay, brown and grey, chalk becoming abundant in lower 0.6 m	6.1	6.7
Glacial Sand and Gravel	Sandy gravel Sand: pale brown Gravel: mainly subangular flint, with concentrations of quartzite in places; 0.2 m clay band present at 8.8 m	6.5	13.2
London Clay	Clay, brown, becoming bluish grey	0.9+	14.1

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
3	72	25	6.7–7.7	No grading information available					
			7.7–8.8	4	26	60	4	3	3
			9.0–10.0	4	16	52	11	7	10
			10.0–11.0	4	18	66	2	1	9
			11.0–12.0	0	9	36	6	19	30
			12.0–13.0	1	7	32	20	15	25
			13.0–13.2	1	7	37	7	16	32
			Mean	3	15	48	9	9	16

TM 14 NW 33 1192 4811 near Lower Dairy Farm, Bramford **Block A**

Surface level (+10.7 m) +35 ft
Groundwater conditions not recorded
Pilcon shell, 8 in diameter
May 1970

Overburden 0.6 m
Mineral 3.2 m
Waste 0.8 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
River Terrace Deposits (1st Terrace)	Sandy gravel Sand: brown, medium without gravel in upper 0.9 m then gravel with sand Gravel: mainly angular flint with some quartzite	3.2	3.8
Boulder Clay	Brown silty clay with chalk	0.8	4.6
Upper Chalk	Chalk	0.9+	5.5

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
4	54	42	0.6–1.6	10	25	54	11	0	0
			1.6–2.5	1	9	22	13	33	22
			2.5–3.3	3	12	21	11	34	19
			3.3–3.8	1	3	5	10	55	26
			Mean	4	14	29	11	27	15

TM 14 NW 34 1220 4986 Lodge Farms, Claydon **Block A**

Surface level (+17.7 m) +58 ft
Water not struck
Pilcon shell, 8 in diameter
May 1970

Overburden 0.9 m
Mineral 4.6 m
Waste 0.6 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
River Terrace Deposits (1st Terrace)	'Clayey' sandy gravel Sand: brown, clayey Gravel: subrounded flint and rounded quartz	4.6	5.5
Boulder Clay	Clay, brown, sandy, with some chalk	0.6	6.1
Upper Chalk	Chalk	0.3+	6.4

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
13	64	23	0.9–1.9	5	13	13	7	23	39
			1.9–2.8	12	30	31	7	16	4
			2.8–3.7	28	22	35	7	6	2
			3.7–4.6	10	20	47	10	11	2
			4.6–5.5	11	23	46	10	8	2
			Mean	13	22	34	8	13	10

TM 14 NW 35 1217 4916 Broomvale Farm, Claydon **Block A**

Surface level (+10.4 m) +34 ft
Groundwater conditions not recorded
Pilcon shell, 6 in diameter
May 1970

Overburden 0.3 m
Mineral 2.4 m
Waste 6.4 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
River Terrace Deposits (1st Terrace)	Sandy gravel Sand: medium to coarse, reddish Gravel: mainly subangular to subrounded flint, with rounded quartz in finer fraction	2.4	2.7
Boulder Clay	Clay, chalky brown to 3.0 m, bluish grey below	6.4	9.1
Upper Chalk	Rubbly chalk	0.9+	10.1

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
3	51	46	0.3–1.2	3	13	26	13	25	20
			1.2–2.2	2	8	26	9	35	20
			2.2–2.7	4	16	30	13	20	17
			Mean	3	12	27	12	27	19

TM 14 NW 37 1409 4533 Boss Hall, Ipswich **Block C**

Surface level (+9.4 m) +31 ft
Water struck at (+4.6 m) +15 ft
Pilcon shell, 6 in diameter
December 1970

Overburden 0.9 m
Mineral 6.7 m
Waste 4.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil and made ground	0.9	0.9
River Terrace Deposits (1st Terrace)	Sandy gravel Sand: yellow or brown, fine to medium Gravel: subangular to rounded flint and some chalk	6.7	7.6
Boulder Clay	Clay, bluish grey, sandy with chalk	4.6+	12.2

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
2	61	37	0.9–1.9	3	37	24	5	18	13
			1.9–2.9	No grading information available					
			2.9–3.9	1	5	12	11	24	47
			3.9–4.9	No grading information available					
			4.9–5.9	1	17	34	13	15	17
			5.9–6.9	3	23	53	9	7	5
			6.9–7.6	2	15	37	9	8	29
			Mean	2	20	32	9	15	22

TM 14 NW 39 1152 4640 Bullen Lane, Bramford **Block B**

Surface level (+26.8 m) +88 ft
Water not struck
Pilcon shell, 8 in diameter
October 1971

Waste 7.6 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown or bluish grey, sandy, with chalk	7.3	7.6
Lower London Tertiaries (Thanet Sand)	Sand, grey-green and red, silty with clay bands	0.7	8.3
Upper Chalk	Chalk	0.3+	8.6

TM 14 NW 40 1222 4722 near Ruthouse Barn, Bramford **Block A**

Surface level (+8.2 m) +27 ft
Groundwater conditions not recorded
Pilcon shell, 6 in diameter
October 1971

Overburden 1.1 m
Mineral 4.5 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.1	1.1
River Terrace Deposits (1st Terrace)	Sandy gravel Sand: yellow-brown, mainly fine, silty in top 1 m Gravel: angular to subrounded flint, with occasional rounded quartz and some chalk	4.5	5.6
Upper Chalk	Chalk	0.6+	6.2

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
6	58	36	1.1–2.1	13	44	13	5	11	14
			2.1–3.1	4	41	19	9	8	19
			3.1–4.1	4	16	15	15	15	35
			4.1–5.1	2	23	20	11	18	26
			5.1–5.6	No grading information available					
			Mean	6	31	17	10	13	23

TM 14 NW 41 **1260 4736** **near Papermill Lane, Whitton** **Block A**

Surface level (+8.5 m) +28 ft
Groundwater conditions not recorded
Pilcon shell, 6 in diameter
October 1971

Overburden 0.9 m
Mineral 6.0 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
River Terrace Deposits (1st Terrace)	Gravel Sand: yellow or orange-brown Gravel: angular to rounded flint and rounded quartz	6.0	6.9
Upper Chalk	Chalk	0.1+	7.0

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
2	38	60	0.9–1.9	6	34	21	6	13	20
			1.9–2.9	1	2	3	10	24	60
			2.9–3.9	1	11	22	12	22	32
			3.9–4.8	1	4	12	15	43	25
			5.1–6.1	1	6	18	10	25	40
			Mean	2	12	15	11	25	35

TM 14 NW 42 **1242 4617** **near Runcion Farm, Bramford** **Block A**

Surface level (+9.8 m) +32 ft
Groundwater conditions not recorded
Pilcon shell, 6 in diameter
October 1971

Overburden 1.5 m
Mineral 7.2 m
Waste 3.7 m
Bedrock 2.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil, sandy	1.5	1.5
River Terrace Deposits (1st Terrace)	Gravel Sand: brown, medium to coarse Gravel: subangular to subrounded flint, with some quartzite. 0.3 m of brown silty clay between 6.9 and 7.2 m	7.2	8.7
Boulder Clay	Clay, brown, becoming grey downwards, with chalk and flint	3.7	12.4
Upper Chalk	Soft white chalk	2.5+	14.9

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
1	25	74	1.5–2.5	3	8	5	9	20	55
			2.5–3.5	1	3	8	13	36	39
			3.5–4.5	1	3	21	20	31	24
			4.5–5.5	1	1	5	13	20	60
			5.5–6.9	1	3	16	10	21	49
			7.2–8.2	1	2	6	11	30	50
			8.2–8.7	1	1	3	10	27	58
			Mean	1	3	10	12	26	48

TM 14 NW 43 1266 4514 near Sproughton Manor, Bramford **Block A**

Surface level (+7.3 m) +24 ft
Groundwater conditions not recorded
Pilcon shell, 6 in diameter
October 1971

Overburden 1.0 m
Mineral 7.5 m
Waste 0.6 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.0	1.0
River Terrace Deposits (1st Terrace)	Gravel Sand: medium to coarse, brown Gravel: subangular to subrounded flints, with some quartzite and chalk pebbles	7.5	8.5
Boulder Clay	Clay, with chalk pebbles	0.6	9.1
Upper Chalk	Chalk	0.3+	9.4

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
4	37	59	1.0–2.6	1	14	21	10	19	35
			2.6–3.6	2	3	9	12	36	38
			3.6–4.6	4	6	30	13	33	14
			4.6–5.6	1	4	12	18	31	34
			5.6–6.9	1	4	18	12	30	35
			6.9–7.4	1	5	15	9	22	48
			7.4–8.5	15	3	17	19	22	24
			Mean	4	6	18	13	27	32

TM 14 NE 15 1515 4890 near Glebe Farm, Akenham **Block C**

Surface level (+43.0 m) +141 ft
Water struck at (+30.8 m) +101 ft
Wirth B0, 8 in diameter
February 1970

Overburden 4.3 m
Mineral 11.3 m
Bedrock 2.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.3	0.3
Boulder Clay	Clay, brown, chalk: becomes sandy downwards, with flint and quartz pebbles	4.0	4.3
Glacial Sand and Gravel	Sand	11.3	15.5
	Sand: pale grey and yellow to deep yellow, or orange, with a little flint and quartz gravel. Chalk pellets present between 8.0 m and 9.8 m		
London Clay	Brown clay, becoming bluish grey	2.1+	17.7

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
4	95	1	4.3–5.2	11	11	71	4	3	0
			5.2–6.1	No grading information available					
			6.1–7.0	3	55	40	1	1	0
			7.0–8.0	9	56	33	2	0	0
			8.0–8.9	2	69	28	1	0	0
			8.9–9.8	2	52	46	0	0	0
			9.8–10.7	5	57	38	0	0	0
			10.7–11.6	2	48	49	1	0	0
			11.6–12.5	1	54	44	1	0	0
			12.5–13.4	2	86	11	1	0	0
			13.4–14.3	No grading information available					
			14.3–15.2	3	32	60	4	1	0
			15.2–15.5	9	31	53	3	2	2
			Mean	4	50	43	2	1	0

TM 14 NE 16 1537 4798 near Datchet House, Whitton **Block C**

Surface level (+37.5 m) +123 ft
Groundwater conditions not recorded
Wirth B0, 8 in diameter
February 1970

Overburden 2.1 m
Mineral 3.7 m
Bedrock 16.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Clay, brown, sandy, with flints for 0.6 m, then 0.3 m of brown, medium sand, then 0.6 m of brown chalky clay	1.5	2.1
Glacial Sand and Gravel	Sandy gravel Sand: brown, medium with gravel Gravel: subrounded flint and rounded quartz	3.7	5.8
London Clay	Clay, brown	1.5	7.3
	Clay, bluish grey	8.2	15.5
	Clay, bluish green	0.9	16.5
Lower London Tertiaries (Reading Beds)	Clay, red to maroon, with bands of greyish brown sand	1.2	17.7
	Clay, brown, with powdery white inclusions (?gypsum)	0.3	18.0
	Clay, pale brown and bluish grey variegated, with inclusions as above	2.1	20.1
	Clay, friable, brown and white	1.2	21.3
	Sand, fine, grey and green	0.6+	21.9

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
7	68	25	2.1–3.0	7	7	17	10	21	38
			3.0–3.9	2	7	65	6	8	12
			3.9–4.9	7	8	69	6	8	2
			4.9–5.8	13	10	62	5	10	0
			Mean	7	8	53	7	12	13

TM 14 NE 17 1608 4968 near Akenham Hall, Akenham **Block C**

Surface level (+39.0 m) +128 ft
Groundwater conditions not recorded
Wirth B0, 8 in diameter
February, 1970

Waste 13.7 m
Bedrock 7.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Clay, brown, becoming grey, with abundant chalk	13.7	13.7
London Clay	Clay, bluish grey	7.9+	21.6

TM 14 NE 18 1588 4760 near Sparrowe's Nest, Ipswich **Block C**

Surface level (+45.4 m) +149 ft
Water struck at (+26.8 m) +88 ft
Wirth B0, 8 in diameter
February 1970

Overburden 11.9 m
Mineral 8.5 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
Boulder Clay	Clay,brown, becoming grey, chalky, with some sand lenses	11.0	11.9
Glacial Sand and Gravel	**a** Sand: yellow to orange-brown, with a little flint gravel	5.8	17.7
Red Crag	**b** Sand		
	Sand: dark red-brown, clayey	0.9	18.6
	Sand: dark orange-brown, shelly	1.8	20.4
London Clay	Clay, brown, becoming bluish grey	0.6+	21.0

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	2	93	5	13.7–14.6	5	20	70	3	2	0
b	5	92	3	17.7–18.6	5	38	51	4	2	0
				18.6–19.5	5	36	50	6	3	0
				19.5–20.4	No grading information available					
				Mean	5	37	50	5	3	0

TM 14 NE 20 1631 4872 Hill Farm, Akenham **Block C**

Surface level (+31.7 m) +104 ft
Groundwater conditions not recorded
Wirth B0, 8 in diameter
February 1970

Waste 10.7 m
Bedrock 6.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.3	0.3
Boulder Clay	Clay, brown to 2.1 m then bluish grey with chalk pebbles	10.4	10.7
Lower London Tertiaries (Reading Beds)	Clay, mottled red and brown with thin, bluish green sand partings	6.4+	17.1

TM 14 NE 22 1700 4840 near Old Sand Pit, Westerfield **Block D**

Surface level (+50.3 m) +165 ft
Groundwater conditions not recorded
Elmat E2, 6 in diameter
February 1970

Overburden 1.2 m
Mineral 11.0 m
Waste 2.1 m
Mineral 10.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.2	1.2
Glacial Sand and Gravel	**a** Pebbly sand Sand: mainly medium, pale yellow, brown or orange Gravel: rounded quartz, subangular flints	11.0	12.2
Boulder Clay	Clay, brown, with quartz and flint pebbles	2.1	14.3
Glacial Sand and Gravel	**b** Sandy gravel Sand: medium, yellow and brown Gravel: most abundant between 14.3 and 18.9 m, mainly subangular flint with some rounded quartz. Occasional chalk pebbles	10.1+	24.4

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	4	85	11	1.2–2.1	2	10	65	7	10	6
				2.1–3.0	1	13	53	7	12	14
				3.0–3.9	5	10	62	9	6	8
				3.9–4.9	2	5	77	6	7	3
				4.9–5.8	4	6	69	6	10	5
				5.8–6.7	4	26	65	2	2	1
				6.7–7.6	2	23	71	3	1	0
				7.6–8.5	5	37	42	4	4	8
				8.5–9.4	6	29	50	3	7	5
				9.4–10.3	4	39	47	2	5	3
				10.3–11.3	3	32	55	5	4	1
				11.3–12.2	4	32	59	5	0	0
				Mean	4	21	59	5	6	5
b	3	64	33	14.3–15.2	2	6	19	5	14	54
				15.2–16.1	2	6	25	11	16	40
				16.1–17.0	5	10	26	10	15	34
				17.0–18.0	2	8	27	10	18	35
				18.0–18.9	1	17	42	6	12	22
				18.9–19.8	5	29	49	5	7	5
				19.8–20.7	5	15	49	9	15	7
				20.7–21.6	3	16	55	3	10	13
				21.6–22.5	2	10	72	6	8	2
				22.5–23.4	3	12	63	9	5	8
				23.4–24.4	1	7	55	10	13	14
				Mean	3	12	44	8	12	21
a+b	4	75	22		4	17	52	6	9	13

TM 14 NE 23 1664 4739 near Mill Farm, Westerfield **Block C**

Surface level (+37.8 m) +124 ft
Water not struck
Wirth B0, 8 in diameter
May 1970

Overburden 11.9 m
Mineral 12.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Clay, brown, chalky, becoming grey downwards. Layer of brown medium sand with shell fragments between 6.7 and 7.6 m	11.3	11.9
Glacial Sand and Gravel	Pebbly sand Sand: fine to medium, brown or yellowish brown Gravel: rounded to subangular flint, rounded quartz and occasional chalk pebbles	12.2+	24.1

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
7	70	23	11.9–12.8	8	27	33	4	8	20
			12.8–13.7	14	26	35	7	9	9
			13.7–14.6	9	29	43	6	6	7
			14.6–15.5	5	21	34	5	12	23
			15.5–16.4	No grading information available					
			16.4–17.3	5	15	41	8	13	18
			17.3–18.3	No grading information available					
			18.3–19.2	7	19	53	7	8	6
			19.2–20.1	4	26	50	9	7	4
			20.1–21.0	6	16	32	7	13	26
			21.0–21.9	5	21	40	8	8	18
			21.9–22.8	5	40	33	3	6	13
			22.8–24.1	No grading information available					
			Mean	7	24	40	6	9	14

TM 14 NE 24 1688 4693 near Mill Farm, Westerfield **Block C**

Surface level (+38.7 m) +127 ft
Groundwater conditions not recorded
Wirth B1, 6 in diameter
May 1970

Overburden 9.1 m
Mineral 15.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Top soil and made ground	1.8	1.8
Boulder Clay	Clay, bluish grey, with numerous chalk pebbles and large irregular flints	7.3	9.1
Glacial Sand and Gravel	Pebbly sand Sand: mainly medium, clayey, brown Gravel: subangular to angular flint and rounded to subangular quartz	15.2+	24.4

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
9	67	24	9.1–10.0	12	9	55	8	9	7
			10.0–10.9	11	7	37	13	30	2
			10.9–11.9	15	21	39	7	12	6
			11.9–12.8	7	15	37	7	20	14
			12.8–13.7	7	13	31	11	25	13
			13.7–14.6	6	6	27	17	32	12
			14.6–15.5	12	9	39	17	20	3
			15.5–16.4	7	17	61	7	3	5
			16.4–17.3	6	22	64	5	3	0
			17.3–18.3	8	22	58	6	4	2
			18.3–19.2	7	13	51	11	12	6
			19.2–20.1	No grading information available					
			20.1–21.0	7	13	33	15	32	0
			21.0–21.9	5	10	32	13	34	6
			21.9–24.4	No grading information available					
			Mean	9	14	42	11	18	6

TM 14 NE 25 1739 4943 Wenns Farm, Witnesham **Block D**

Surface level (+53.6 m) +176 ft
Water struck at (+33.2 m) +109 ft
Wirth B1, 8 in diameter
May 1970

Overburden 11.3 m
Mineral 11.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Clay, brown, with occasional chalk pebbles to (3.0 m), then clay, bluish grey with numerous chalk pebbles	10.7	11.3
Glacial Sand and Gravel	Pebbly sand Sand: fine to medium, brown,yellow or red-brown Gravel: subangular to angular flint, rounded quartz	11.9+	23.1

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
5	75	20	11.3–12.2	7	23	30	7	13	20
			12.2–13.1	6	15	29	9	12	29
			13.1–14.0	5	15	39	8	13	20
			14.0–14.9	2	11	35	6	13	33
			14.9–15.8	1	11	51	10	9	18
			15.8–16.7	2	13	48	7	12	18
			16.7–17.7	7	6	53	12	17	5
			17.7–18.6	4	37	49	4	4	2
			18.6–19.5	10	34	47	4	4	1
			19.5–20.4	5	10	58	7	6	14
			20.4–21.3	5	29	63	2	1	0
			21.3–22.2	3	22	73	1	1	0
			22.2–23.1	2	47	49	1	1	0
			Mean	5	21	48	6	8	12

TM 14 NE 26 1752 4856 Westerfield Hall, Westerfield **Block D**

Surface level (+47.2 m) +155 ft
Water struck at (+28.7 m) +94 ft
Wirth B1, 6 in diameter
May 1970

Overburden 5.8 m
Mineral 16.2 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, with occasional chalk and flint pebbles to 3.0 m,then bluish grey clay with abundant chalk pebbles	5.5	5.8
Glacial Sand and Gravel	Pebbly sand Sand: fine to medium, brown or yellow-brown Gravel: rounded to subangular flint, rounded quartz. Occasional chalk pebbles. Gravel most abundant in upper 10.4 m	16.2	21.9
London Clay	Clay, bluish grey	1.5+	23.5

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
8	74	18	5.8–6.7	25	19	33	5	7	11
			6.7–7.6	12	11	47	9	10	11
			7.6–8.5	8	11	40	7	14	20
			8.5–9.4	13	11	38	9	14	15
			9.4–10.3	2	7	37	11	21	22
			10.3–11.3	1	11	53	7	16	12
			11.3–12.2	2	13	46	11	16	12
			12.2–13.1	2	15	49	9	13	12
			13.1–14.0	5	25	45	7	13	5
			14.0–14.9	8	38	34	5	8	7
			14.9–15.8	5	19	38	1	35	2
			15.8–16.8	8	35	51	1	4	1
			16.8–17.7	5	79	10	4	1	1
			17.7–18.6	5	80	12	2	1	0
			18.6–19.5	9	76	13	1	1	0
			19.5–20.4	4	81	11	1	1	2
			20.4–21.3	23	38	36	2	1	0
			21.3–21.9	No grading information available					
			Mean	58	34	35	5	10	8

TM 14 NE 27 1729 4767 near School, Westerfield **Block C**

Surface level (+31.7 m) +104 ft
Water not struck
Wirth B1, 8 in diameter
December 1969

Waste 18.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil and made ground	2.1	2.1
Brickearth	Clay, silty pale bluish grey, soft	2.4	4.6
	Clay, silty dark grey, friable	0.6	5.2
	Clay, silty dark grey, stiff	0.6	5.8
	Clay, silty black, stiff	0.6	6.4
Boulder Clay	Clay, bluish grey, with abundant chalk pebbles	11.9+	18.3

TM 14 NE 28 1751 4663 Redhouse Farm, Ipswich **Block D**

Surface level (+42.1 m) +138 ft
Groundwater conditions not recorded
Wirth B1, 8 in diameter
May 1970

Waste 10.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, becoming bluish grey at 5.5 m. Chalk and flint pebbles present	10.1+	10.4
	Further progress prevented by rock obstruction		

TM 14 NE 29 1811 4911 Cowslip Farm, Witnesham **Block D**

Surface level (+50.3 m) +165 ft
Water struck at (+30.5 m) +100 ft
Wirth B1, 8 in diameter
December 1969

Overburden 10.7 m
Mineral 12.8 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown to 2.7 m, bluish grey below, with flint and chalk pebbles	10.4	10.7
Glacial Sand and Gravel	**a** Pebbly sand Sand: mainly medium, yellowish brown Gravel: of subrounded flint and quartz, with chalk pebbles between 10.7 and 11.6 m	5.8	16.5
Red Crag	**b** Sand Sand: fine to medium brown with occasional pebbles	4.3	20.8
	Sand: brown, fine to medium, shelly	2.7	23.5
London Clay	Clay	0.9+	24.4

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	7	76	17	10.7–11.6	5	15	53	5	10	12
				11.6–12.5	24	11	45	10	9	1
				12.5–13.4	4	36	40	2	10	8
				13.4–14.3	2	18	72	3	3	2
				14.3–15.2	4	12	52	8	9	15
				15.2–16.5	2	13	48	15	10	12
				Mean	7	18	51	7	9	8
b	5	93	2	16.5–17.1	2	32	61	3	2	0
				17.1–18.0	4	40	50	3	3	0
				18.0–18.9	5	41	47	5	2	0
				18.9–19.8	2	39	51	3	4	1
				19.8–20.7	6	35	53	4	2	0
				20.7–21.6	6	29	57	7	1	0
				21.6–22.5	5	28	57	8	2	0
				22.5–23.5	6	32	54	7	1	0
				Mean	5	35	53	5	2	0

TM 14 NE 30 1859 4821 Poplar Farm, Tuddenham **Block D**

Surface level (+46.6 m) +153 ft
Water struck at (+30.5 m) +100 ft
Wirth B1, 6 in diameter
September 1969

Overburden 2.4 m
Mineral 8.1 m
Waste 1.1 m
Mineral 10.3 m
Bedrock 2.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil and made ground	1.2	1.2
Boulder Clay	Clay, brown, chalky	1.2	2.4
Glacial Sand and Gravel	**a** Pebbly sand Sand: mainly medium, yellowish brown, clayey in parts Gravel: subrounded to angular flints and rounded quartz	8.1	10.5
	Clay, brown, sandy, with flint and quartz pebbles	1.1	11.6
	b Sand Sand: yellow or brown, silty	10.3	21.9
London Clay	Clay, bluish grey	2.1+	24.1

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	7	74	19	2.4–3.3	20	32	32	4	8	4
				3.3–4.2	8	17	57	6	8	4
				4.2–5.1	6	22	52	4	4	12
				5.1–6.1	3	27	61	5	3	1
				6.1–7.0	5	15	40	5	15	20
				7.0–7.9	4	20	48	5	9	14
				7.9–8.8	5	21	58	4	10	2
				8.8–9.7	9	19	53	6	11	2
				9.7–10.5	7	13	33	9	18	20
				Mean	7	21	48	5	10	9
b	7	90	3	11.6–12.5	17	10	59	9	4	1
				12.5–13.4	12	46	30	7	4	1
				13.4–14.3	7	31	45	7	6	4
				14.3–15.2	6	34	57	2	1	0
				15.2–16.1	5	39	54	1	1	0
				16.1–17.0	4	69	26	1	0	0
				17.0–18.0	5	63	30	1	1	0
				18.0–18.9	No grading information available					
				18.9–19.8	4	39	56	1	0	0
				19.8–20.7	4	26	65	4	1	0
				20.7–21.9	No grading information available					
				Mean	7	40	46	4	5	5
a+b	7	83	10		7	32	47	4	5	5

TM 14 NE 31 1828 4696 Westerfield House, Westerfield **Block D**

Surface level (+47.9 m) +157 ft
Water struck at (+25.9 m) +85 ft
Wirth B1, 6 in diameter
September 1969

Overburden 1.8 m
Mineral 22.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, with chalk pebbles	1.5	1.8
Glacial Sand and Gravel	**a** 'Clayey' pebbly sand Sand: mainly medium, brown or yellowish brown, clayey in upper 3.6 m Gravel: subrounded flint and rounded quartz, with occasional chalk pebbles	11.0	12.8
Chillesford Beds	**b** 'Clayey' sand Sand: fine to medium, brown, yellow, pale fawn and grey, clayey	5.5	18.3
Red Crag	**c** Sand Sand: red-brown, fine to medium, clayey	3.3	21.6
	Sand: red-brown, shelly	2.8+	24.4

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	10	72	18	1.8–2.8	10	65	22	2	1	0
				2.8–3.7	25	11	30	7	15	12
				3.7–4.6	22	17	20	8	14	19
				4.6–5.5	12	20	36	8	20	4
				5.5–6.4	8	12	48	12	16	4
				6.4–7.3	6	14	50	10	16	4
				7.3–8.2	No grading information available					
				8.2–9.1	No grading information available					
				9.1–10.0	4	32	59	2	3	0
				10.0–10.9	2	28	8	6	4	2
				10.9–11.9	5	12	54	9	16	4
				11.9–12.8	7	19	33	9	28	4
				Mean	10	23	42	7	13	5
b	20	79	1	12.8–13.7	40	42	13	1	3	1
				13.7–14.6	32	30	33	4	1	0
				14.6–15.5	24	34	40	1	1	0
				15.5–16.4	10	24	63	2	1	0
				16.4–17.3	8	32	58	1	1	0
				17.3–18.3	5	35	58	1	1	0
				Mean	20	33	44	2	1	0
c	7	92	1	18.3–19.2	3	24	71	1	1	0
				19.2–20.1	6	37	55	1	1	0
				20.1–21.0	5	56	37	1	1	0
				21.0–21.9	6	39	53	1	1	0
				21.9–22.8	8	38	49	3	2	0
				22.8–23.7	10	41	45	4	0	0
				23.7–24.4	9	33	52	4	2	0
				Mean	7	38	52	2	1	0

TM 14 NE 32 1844 4741 near The Croft, Westerfield **Block D**

Surface level (+48.5 m) +159 ft
Water struck at (+28.0 m) +92 ft
Wirth B1, 6 in diameter
October 1969

Overburden 3.0 m
Mineral 21.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, with chalk	2.7	3.0
Glacial Sand and Gravel	Pebbly sand Sand: fine to medium, yellow, brown or orange Gravel: rounded to subrounded flint and quartz, with some chalk pebbles	21.3+	24.3

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
5	83	12	3.0–3.9	6	9	24	6	11	44
			3.9–4.9	6	10	39	8	13	24
			4.9–5.8	2	8	37	9	9	35
			5.8–6.7	5	16	49	7	16	7
			6.7–7.6	5	14	59	10	9	3
			7.6–8.5	No grading information available					
			8.5–9.4	4	16	64	8	8	0
			9.4–10.3	4	12	68	9	7	0
			10.3–11.3	3	21	55	6	9	6
			11.3–12.2	7	28	55	4	6	0
			12.2–13.1	15	34	35	5	7	4
			13.1–14.0	7	23	49	6	11	4
			14.0–14.9	8	21	50	7	11	3
			14.9–15.8	7	52	36	2	3	0
			15.8–16.7	9	35	51	1	4	0
			16.7–17.7	4	57	35	3	1	0
			17.7–18.6	6	50	40	1	2	1
			18.6–19.5	2	29	66	2	1	0
			19.5–20.4	3	24	70	1	1	1
			20.4–21.3	2	20	74	3	1	0
			21.3–22.2	3	24	70	2	1	0
			22.2–23.1	3	27	68	1	1	0
			23.1 -24.3	No grading information available					
			Mean	5	25	53	5	6	6

TM 14 NE 33 1803 4680 near Westerfield House, Westerfield **Block D**

Surface level (+50.6 m) +166 ft
Groundwater conditions not recorded
Wirth B1, 6 in diameter
September 1969

Overburden 7.3 m
Mineral 5.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
Boulder Clay	Clay, brown, with chalk and flint	6.4	7.3
Glacial Sand and Gravel	Pebbly sand Sand: brown, with some flint gravel	5.5+	12.8
	Borehole abandoned at 12.8 m because of rock obstruction. No samples taken		

TM 14 NE 34 1910 4752 near Rosemary Bridge, Tuddenham **Block D**

Surface level (+28.3 m) +93 ft
Groundwater conditions not recorded
Wirth B1, 6 in diameter
November 1969

Overburden 1.2 m
Mineral 5.5 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.2	1.2
Glacial Sand and Gravel	Pebbly sand Sand: brown, fine to medium, with some flint gravel	5.5	6.7
London Clay	Clay, bluish grey	0.9+	7.6

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
7	83	10	1.2–2.1	11	40	34	2	9	4
			2.1–3.0	6	48	35	2	5	4
			3.0–3.9	9	17	38	8	12	16
			3.9–4.9	6	26	62	4	1	1
			4.9–5.8	5	37	50	3	5	0
			5.8–6.7	6	27	56	10	1	0
			Mean	7	33	45	5	6	4

TM 14 NE 35 1965 4984 near Hillbrow, Tuddenham **Block D**

Surface level (+51.5 m) +169 ft
Groundwater conditions not recorded
Elmat E2, 6 in diameter
December 1969

Waste 21.9 m
Mineral just touched

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Brown and grey clay, with abundant chalk pebbles and flint	21.9	21.9
Glacial Sand and Gravel	No recovery	Just touched	

NB This borehole was drilled to 21.9 m, at which depth Glacial Sand and Gravel was encountered

TM 14 NE 36 1992 4879 near Badgers Hill, Tuddenham **Block D**

Surface level (+36.6 m) +119 ft
Groundwater conditions not recorded
Elmat E2, 6 in diameter
November 1969

Overburden 0.6 m
Mineral 15.2 m
Bedrock just touched

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Glacial Sand and Gravel	**a** Sand Sand: yellow and orange-brown, with traces flint and quartz gravel	10.1	10.7
Red Crag	**b** Sand Sand: orange-brown and brown, shelly below 14.3 m	5.1	15.8
?London Clay	Cementstone, hard	Just touched	

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	5	88	7	0.6–1.5	10	24	55	5	6	0
				1.5–2.4	2	23	69	5	1	0
				2.4–3.3	4	18	70	2	1	5
				3.3–4.2	2	12	48	13	9	16
				4.2–5.1	8	47	27	3	4	11
				5.1–6.1	4	57	23	2	3	11
				6.1–7.0	5	74	18	1	2	0
				7.0–7.9	10	44	44	1	1	0
				7.9–8.8	2	67	26	1	2	2
				8.8–9.7	5	37	56	1	0	1
				9.7–10.7	6	55	36	2	1	0
				Mean	5	42	43	3	3	4
b	5	92	3	10.7–11.6	2	59	37	1	1	0
				11.6–12.5	2	79	16	2	1	0
				12.5–13.4	5	77	17	1	0	0
				13.4–14.3	8	80	11	0	1	0
				14.3–15.2	3	29	56	8	2	2
				15.2–15.8	10	23	50	7	4	6
				Mean	5	58	31	3	2	1

TM 14 NE 37 1968 4677 Hill Farm, Tuddenham **Block D**

Surface level (+46.6 m) +153 ft
Water struck at (+26.8 m) +88 ft
Wirth B1, 6 in diameter
September 1969

Overburden 7.0 m
Mineral 16.5 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, chalky, becoming sandy	6.7	7.0
Glacial Sand and Gravel	Pebbly sand Sand: brown, clayey in upper 0.9 m Gravel: angular to subrounded flints, rounded quartz and traces chalk	16.5	23.5
London Clay	Clay	0.3+	23.8

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
7	75	18	7.0–7.9	18	22	49	5	6	0
			7.9–8.8	4	15	50	5	11	15
			8.8–9.7	6	14	50	9	12	9
			9.7–10.6	3	42	54	1	0	0
			10.6–11.6	7	21	63	5	3	1
			11.6–12.5	6	23	65	2	4	0
			12.5–13.4	5	15	63	6	8	3
			13.4–14.3	6	23	60	5	5	1
			14.3–15.2	7	22	53	7	8	3
			15.2–16.1	6	20	56	6	10	2
			16.1–17.0	8	16	41	9	24	2
			17.0–18.0	6	17	34	17	25	1
			18.0–18.9	11	15	33	10	23	8
			18.9–19.8	7	11	32	14	31	5
			19.8–20.7	8	9	45	14	21	3
			20.7–21.6	6	10	41	16	26	1
			21.6–22.5	5	13	38	9	32	3
			22.5–23.5	No grading information available					
			Mean	7	18	49	8	15	3

TM 14 SW 14 1059 4457 near Hill Farm, Bunstall **Block B**

Surface level (+43.6 m) +143 ft
Water (probably from fissures in clay) from just below surface
Elmat E2, 6 in diameter
March 1970

Waste 16.5 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Clay, brown or grey, chalky	14.6	14.6
	Gravel: chalky, with silt and clay, some large chalk cobbles	1.9	16.5
London Clay	Clay, bluish grey	0.6+	17.1

TM 14 SW 15 1068 4396 near Fen Farm, Bunstall **Block B**

Surface level (+28.7 m) +94 ft
Groundwater conditions not recorded
Wirth B0, 8 in diameter
March 1970

Waste 6.1 m
Bedrock 2.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
Boulder Clay	Clay, brown, chalky	5.2	6.1
London Clay	Clay, bluish grey	2.4+	8.5

TM 14 SW 16 1053 4298 near Cookshop Corner, Washbrook **Block E**

Surface level (+42.4 m) +139 ft
Groundwater conditions not recorded
Wirth B1, 8 in diameter
March 1970

Overburden 7.0 m
Mineral 4.6 m
Bedrock 1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.6	0.6
?Boulder Clay	Clay, brown, sandy	6.4	7.0
Glacial Sand and Gravel	Pebbly sand Sand: fine to medium, yellow or reddish brown Gravel: subangular flints, most common between 7.9 and 8.8 m	4.6	11.6
London Clay	Clay, brown	0.6	12.2
	Clay, bluish grey	0.6+	12.8

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
7	86	7	7.0–7.9	3	55	37	3	2	0
			7.9–8.8	10	25	43	7	12	3
			8.8–9.7	6	34	47	10	3	0
			9.7–10.6	6	33	42	10	7	2
			10.6–11.6	8	42	37	3	3	7
			Mean	7	38	41	7	5	2

TM 14 SW 17 **1079 4229** **Wood's Hill, Washbrook** **Block E**

Surface level (+41.5 m) +136 ft
Water struck at (+31.4 m) +103 ft
Wirth B1, 8 in diameter
March 1970

Overburden 3.0 m
Mineral 10.1 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
?Boulder Clay	Clay, brown, becoming sandy	2.5	3.0
Glacial Sand and Gravel	**a** Pebbly sand Sand: dark reddish brown with some flint gravel	6.1	9.1
Red Crag	**b** Pebbly sand Sand: dark reddish brown, with silt and shell fragments	4.0	13.1
London Clay	Clay, brown, becoming bluish grey	0.3+	13.4

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	8	85	7	3.0–3.9	12	6	59	8	13	2
				3.9–4.9	8	7	77	5	2	1
				4.9–5.8	11	14	57	6	6	6
				5.8–6.4	9	45	34	3	3	6
				6.4–7.3	6	66	20	2	1	5
				7.3–8.2	9	59	29	2	1	0
				8.2–9.1	4	32	51	7	3	3
				Mean	8	32	48	5	4	3
b	8	84	8	9.1–10.0	7	28	50	11	2	2
				10.0–10.9	8	35	32	12	7	6
				10.9–11.6	6	34	43	8	7	2
				11.6–12.5	12	19	51	9	6	3
				12.5–13.1	7	41	42	7	2	1
				Mean	8	31	43	10	5	3

TM 14 SW 18 1057 4159 near Barrens Farm, Washbrook **Block E**

Surface level (+48.5 m) +159 ft
Water struck at (+32.6 m) +107 ft
Wirth B0, 8 in diameter
April 1970

Overburden 11.3 m
Mineral 8.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
Boulder Clay	Clay, brown silty for 1.8 m, then brown chalky clay to 10.4 m, then 0.9 m of gravelly clay	10.4	11.3
Glacial Sand and Gravel	**a** Sand	2.7	14.0
	Sand: fine, orange-brown;occasional pebbles		
Red Crag	**b** 'Clayey' sand		
	Sand: fine to medium, brown. Black pebbles at base	3.7	17.7
	Sand: brown, shelly	1.8+	19.5

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	4	95	1	11.3–12.2	No grading information available					
				12.2–13.1	4	84	10	1	1	0
				13.1–14.0	3	72	24	1	0	0
				Mean	4	77	17	1	1	0
b	13	84	3	14.0–15.0	6	77	15	1	1	0
				15.0–15.8	5	50	32	11	2	0
				15.8–16.7	42	41	15	1	1	0
				16.7–17.7	4	32	50	8	4	2
				17.7–18.6	6	55	28	5	4	2
				18.6–19.5	No grading information available					
				Mean	13	51	28	5	2	1

TM 14 SW 19 1042 4038 near Redhouse Farm, Copdock **Block E**

Surface level (+45.1 m) +148 ft
Water struck at (+34.4 m) +113 ft
Pilcon shell, 6 in diameter
October 1971

Overburden 4.0 m
Mineral 14.9 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, orange-brown, stiff, with some carbonaceous material and a few pebbles for 1.8 m, then clay, pale brown with numerous chalk pebbles and flint and quartz pebbles towards the base	3.8	4.0
Glacial Sand and Gravel	**a** Pebbly sand Sand: fine to medium, yellowish brown Gravel: angular to subrounded flint, with rounded quartz	6.5	10.5
Red Crag	**b** Pebbly sand Sand: orange-brown, mainly medium	1.5	12.0
	Sand: orange-brown, with numerous shelly fragments. Black pebbles numerous	6.9	18.9
London Clay	Clay, bluish grey	0.8+	19.7

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	2	83	15	4.0–5.0	1	26	65	6	2	0
				5.0–6.0	6	32	59	2	1	0
				6.0–7.0	2	28	51	5	7	7
				7.0–8.0	1	10	45	12	13	19
				8.0–9.0	1	14	39	7	13	26
				9.0–10.5	1	55	39	3	1	1
				Mean	2	28	49	6	9	6
b	5	88	7	10.5–11.0	14	36	47	2	1	0
				11.0–12.0	2	32	56	4	2	4
				12.0–13.0	5	8	53	28	5	1
				13.0–14.0	2	11	52	27	7	1
				14.0–15.0	2	18	46	22	9	3
				15.0–16.0	11	12	57	15	4	1
				16.0–17.0	6	9	64	16	5	0
				17.0–18.0	2	14	59	13	6	6
				18.0–18.9	1	19	61	13	4	2
				Mean	5	18	54	16	5	2

TM 14 SW 20 1135 4484 Burstall Lane, Sproughton **Block B**

Surface level (+43.9 m) +144 ft
Water struck at (+31.1 m) +102 ft
Wirth B0, 8 in diameter
March 1970

Overburden 2.7 m
Mineral 11.0 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Silty clay with flint and chalk pebbles	2.1	2.7
Glacial Sand and Gravel	Sand, pebbly towards base Sand: fine to medium, yellow or reddish brown	11.0	13.7
London Clay	Clay, bluish grey	0.9+	14.6

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
4	93	3	2.7–3.6	17	53	29	1	0	0
			3.6–4.5	1	26	69	4	0	0
			4.5–5.5	3	43	53	1	0	0
			5.5–6.4	1	30	68	1	0	0
			6.4–7.3	2	21	74	2	1	0
			7.3–8.2	2	27	64	5	2	0
			8.2–9.1	2	35	46	4	5	8
			9.1–10.0	2	80	17	1	0	0
			10.0–10.9	3	39	55	2	1	0
			10.9–11.9	5	23	59	7	4	2
			11.9–12.8	3	10	65	10	9	3
			12.8–13.7	1	14	73	6	4	2
			Mean	4	33	56	4	2	1

TM 14 SW 21 1150 4379 Ivywell Farm, Sproughton **Block B**

Surface level (+44.8 m) +147 ft
Groundwater conditions not recorded
Wirth B1, 8 in diameter
March 1970

Overburden 5.5 m
Mineral 1.8 m
Waste 1.2 m
Mineral 6.4 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
?Boulder Clay	Clay, brown	4.9	5.5
Glacial Sand and Gravel	**a** Sand Sand: dark brown, with some flint gravel	1.8	7.3
	Clay, grey, silty	1.2	8.5
	b Sand: yellow or brown, with some gravel (mainly rounded quartz)	6.4	14.9
London Clay	Clay, bluish grey	0.6+	15.5

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	2	92	6	5.5–6.4	No grading information available					
				6.4–7.3	2	13	67	12	5	1
b	7	89	4	8.5–9.4	6	36	40	5	5	8
				9.4–10.3	7	87	5	1	0	0
				10.3–11.3	12	61	19	2	3	3
				11.3–12.2	No grading information available					
				12.2–13.1	5	63	24	4	3	1
				13.1–14.0	1	96	3	0	0	0
				14.0–14.9	8	84	6	1	1	0
				Mean	7	71	16	2	2	2

TM 14 SW 22 1174 4337 Valley Farm, Sproughton **Block B**

Surface level (+44.8 m) +147 ft
Water struck at (+31.1 m) +102 ft
Wirth B1, 8 in diameter
March 1970

Overburden 3.7 m
Mineral 12.8 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Sand, brown, silty to 0.3 m, then clay, brown with flints	3.1	3.7
Glacial Sand and Gravel	**a** Pebbly sand Sand: brown, yellowish brown or orange-brown, mainly medium Gravel: rounded white quartzite and subrounded to angular brown flint	8.2	11.9
Red Crag	**b** Sand		
	Sand: brown with traces of gravel	0.9	12.8
	Sand: brown, shelly with traces of gravel	3.7	16.5
London Clay	Clay, bluish grey	0.6+	17.1

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	5	84	11	3.7–4.5	11	33	43	7	4	2
				4.5–5.5	No grading information available					
				5.5–6.4	5	10	43	16	14	12
				6.4–7.3	5	12	61	11	8	3
				7.3–8.2	No grading information available					
				8.2–9.1	2	13	74	7	3	1
				9.1–10.0	3	10	53	11	9	14
				10.0–10.9	2	23	68	5	2	0
				10.9–11.9	3	42	49	5	1	0
				Mean	4	20	56	9	6	5
b	7	91	2	11.9–12.8	5	31	56	6	2	0
				12.8–13.7	7	21	59	10	3	0
				13.7–14.6	7	27	54	11	1	0
				14.6–15.5	7	26	52	14	1	0
				15.5–16.5	7	26	52	13	2	0
				Mean	7	26	54	11	2	0

TM 14 SW 23 1165 4151 near West Hill, Copdock **Block E**

Surface level (+47.5 m) +156 ft
Water struck at (+32.3 m) +106 ft
Wirth B0, 8 in diameter
April 1970

Overburden 2.7 m
Mineral 20.2 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
?Boulder Clay	Clay, brown, sandy	2.4	2.7
Glacial Clay and Gravel	**a** 'Clayey' pebbly sand Gravel: mainly flint, rounded to subrounded. 0.6 m of soft brown chalky clay at base of deposit Sand: dark orange-brown, fine to medium, clayey or silty matrix	13.7	16.4
Red Crag	**b** 'Clayey' pebbly sand		
	Sand: brown, silty with some flint and gravel	3.4	19.8
	Sand: brown, silty with shell fragments	3.1	22.9
London Clay	Clay, bluish grey	0.6+	23.5

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	11	69	20	2.7–3.6	2	36	44	6	7	5
				3.6–4.5	18	27	32	3	11	9
				4.5–5.5	16	16	39	6	13	10
				5.5–6.4	11	20	43	6	10	10
				6.4–7.3	7	17	49	7	14	6
				7.3–8.2	No grading information available					
				8.2–9.1	10	16	45	8	12	9
				9.1–10.0	10	15	48	9	9	9
				10.0–10.9	No grading information available					
				10.9–11.9	16	15	36	7	12	14
				11.9–12.8	19	21	41	4	8	7
				12.8–13.7	7	14	46	8	5	20
				13.7–14.6	9	27	41	6	10	7
				14.6–15.5	7	19	44	7	9	14
				15.5–16.4	13	23	45	6	10	3
				Mean	11	21	42	6	10	10
b	19	69	12	16.4–18.0	No grading information available					
				18.0–18.9	18	32	30	6	6	8
				18.9–19.8	24	32	35	4	5	0
				19.8–20.7	15	31	41	6	5	2
				20.7–21.6	18	28	36	3	9	6
				21.6–22.5	18	22	38	7	8	7
				22.5–22.9	No grading information available					
				Mean	19	29	35	5	7	5

TM 14 SW 24 1179 4080 Oakfield Road, Belstead **Block E**

Surface level (+44.2 m) +145 ft
Groundwater conditions not recorded
Wirth B1, 8 in diameter
March 1970

Overburden 1.2 m
Mineral 19.8 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Brickearth	Clay, orange-brown, sandy with quartz and flint pebbles	0.9	1.2
Glacial Sand and Gravel	**a** Sandy gravel Gravel: subangular to subrounded flint, subrounded quartz and quartzite Sand: orange-brown, clayey	6.4	7.6
Red Crag	**b** Pebbly sand Sand: fine to medium, brown Gravel: fine subrounded quartz and quartzite, and subangular flint. Silt band between 14.9 and 15.2 m	8.2	15.8
	Sand: orange-brown, shelly with some quartz and flint gravel	5.2	21.0
London Clay	Clay, bluish grey	0.9+	21.9

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	9	58	33	1.2–2:1	16	42	28	7	5	2
				2.1–3.0	11	15	32	15	19	8
				3.0–3.9	7	9	45	14	12	13
				3.9–4.9	5	11	36	8	12	28
				4.9–5,8	7	11	30	12	17	23
				5.8–6.7	13	14	16	8	39	10
				6.7–7.6	2	10	32	8	10	38
				Mean	9	16	32	10	16	17
b	5	88	7	7.6–8.6	4	17	62	7	8	2
				8.6–9.4	3	27	52	6	5	7
				9.4–10.3	3	34	52	5	3	3
				10.3–11.3	1	32	45	10	7	5
				11.3–12.2	1	23	65	4	5	2
				12.2–13.1	1	18	67	8	6	0
				13.1–14.0	3	12	74	7	4	0
				14.0–14.9	4	35	49	8	3	1
				14.9–15.8	No grading information available					
				15.8–16.7	18	35	33	6	7	1
				16.7–17.7	4	29	42	10	11	4
				17.7–18.6	7	27	58	4	3	1
				18.6–19.5	4	31	47	8	6	4
				19.5–20.4	8	30	55	4	1	2
				20.4–21.0	5	30	54	6	3	2
				Mean	5	27	54	7	5	2

TM 14 SW 25 1234 4369 near Springvale, Sproughton **Block B**

Surface level (+38.4 m) +126 ft
Water struck at (+31.4 m) +103 ft
Wirth B1, 8 in diameter
April 1970

Overburden 0.6 m
Mineral 12.2 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.6	0.6
Glacial Sand and Gravel	**a** Pebbly sand Gravel: (mainly between 1.5 and 3.4 m) angular to subrounded flint, clayey Sand: orange or reddish-brown,mainly medium	4.6	5.2
Red Crag	**b** Sand		
	Sand: dark red-brown, with a little fine gravel	1.8	7.0
	Sand: yellow-brown, shelly, with a little fine gravel	5.8	12.8
London Clay	Clay, bluish grey	0.9+	13.7

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	5	87	8	0.6–1.5	5	10	80	3	1	1
				1.5–2.4	3	4	63	12	9	9
				2.4–3.3	10	20	52	3	7	8
				3.3–4.2	5	35	54	3	3	0
				4.2–5.2	4	54	37	3	2	0
				Mean	5	25	57	5	4	4
b	7	89	4	5.2–6.1	2	35	47	11	4	1
				6.1–7.0	5	36	31	21	6	1
				7.0–7.9	4	51	36	8	1	0
				7.9–8.8	3	51	30	11	4	1
				8.8–9.7	2	31	45	18	4	0
				9.7–10.6	3	43	40	11	3	0
				10.6–11.6	5	31	40	19	5	0
				11.6–12.5	31	31	30	6	2	0
				12.5–12.8	7	40	41	9	2	1
				Mean	7	39	37	13	4	0

TM 14 SW 26 1260 4280 near Wright's Corner, Washbrook **Block B**

Surface level (+39.9 m) +131 ft
Groundwater conditions not recorded
Wirth B1, 8 in diameter
March 1970

Overburden 2.4 m
Mineral 10.1 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Boulder Clay	Clay, brown, stony, sandy in parts	1.9	2.4
Chillesford Beds	**a** 'Clayey' sand Sand: mainly fine, white to pale brown with bands of silt	2.8	5.2
Red Crag	**b** Pebbly sand Gravel: subrounded quartz and quartzite and subangular flint Sand: reddish brown, clayey	0.9	6.1
	Sand: red or brown, with abundant shell fragments, with subrounded quartz and subangular flint pebbles	6.4	12.5
London Clay	Clay, brown	0.9+	13.4

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	11	88	1	2.4–3.3	7	73	17	2	1	0
				3.3–4.2	10	65	21	3	1	0
				4.2–5.2	15	30	53	1	1	0
				Mean	11	56	30	2	1	0
b	6	82	12	5.2–6.1	5	35	44	10	5	1
				6.1–7.0	4	24	55	15	2	0
				7.0–7.9	5	23	50	14	6	2
				7.9–8.8	10	35	46	7	2	0
				8.8–9.7	6	27	39	12	3	13
				9.7–10.6	5	15	38	13	17	12
				10.6–11.6	5	17	46	15	12	5
				11.6–12.5	4	17	48	13	12	6
				Mean	6	24	46	12	7	5

TM 14 SW 27 1230 4115 Oakfield Road, Belstead **Block E**

Surface level (+41.5 m) +136 ft
Groundwater conditions not recorded
Wirth B1, 8 in diameter
April 1970

Overburden 2.4 m
Mineral 14.7 m
Bedrock 1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Clay, brown, sandy	2.4	2.4
Glacial Sand and Gravel	**a** Sandy gravel Sand: mainly medium, dark brown or chocolate Gravel: fine to coarse, rounded flints	8.3	10.7
Red Crag	**b** 'Clayey' sand Sand: dark red-brown, fine to medium, with a little gravel	1.8	12.5
	Sand: red-brown, shelly	4.6	17.1
London Clay	Clay, bluish grey	1.2+	18.3

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	5	56	39	2.4–4.2	No grading information available					
				4.2–5.1	7	6	20	9	19	39
				5.1–6.1	No grading information available					
				6.1–7.0	5	3	13	12	17	50
				7.0–7.9	5	3	40	22	18	12
				7.9–8.8	4	8	48	18	14	8
				8.8–9.7	4	13	55	11	13	4
				9.7–10.7	4	24	59	8	4	1
				Mean	5	7	35	14	16	23
b	14	82	4	10.7–11.6	1	32	52	9	5	1
				11.6–12.5	6	40	37	8	7	2
				12.5–13.4	17	39	34	6	3	1
				13.4–14.3	15	40	37	7	1	0
				14.3–15.2	13	37	44	5	1	0
				15.2–16.1	30	41	27	1	1	0
				16.1–17.1	No grading information available					
				Mean	14	38	38	6	3	1

TM 14 SW 28 1246 4057 near Blacksmith's Corner, Belstead **Block E**

Surface level (+43.3 m) +142 ft
Water struck at (+28.3 m) +93 ft
Wirth B0, 8 in diameter
April 1970

Overburden 3.0 m
Mineral 15.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Clay, brown, with flint and occasional chalk to 1.8 m, becoming brown clayey gravel	2.4	3.0
Glacial Sand and Gravel	**a** Pebbly sand Sand: brown or yellow-brown, fine to medium, with rounded to subrounded flint and rounded quartz pebbles	8.3	11.3
Red Crag	**b** Sand Sand: with a little gravel Sand: grey, brown or yellow fine to medium	6.4	17.7
	Sand: brown, shelly	1.2+	18.9

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	7	75	18	3.0–3.9	10	8	45	5	8	24
				3.9–4.9	8	12	45	5	12	18
				4.9–5.8	14	30	39	2	9	6
				5.8–6.7	3	19	55	4	12	7
				6.7–7.6	6	42	34	5	9	4
				7.6–8.5	3	26	66	3	2	0
				8.5–9.4	3	25	60	7	4	1
				9.4–10.3	9	16	51	9	11	4
				10.3–11.3	6	15	42	6	10	21
				Mean	7	21	49	5	9	9
b	8	89	3	11.3–12.2	12	31	51	2	4	0
				12.2–13.1	7	32	55	3	2	1
				13.1–14.0	6	36	56	2	0	0
				14.0–14.9	5	28	62	2	2	1
				14.9–15.8	17	41	40	1	1	0
				15.8–16.7	10	48	34	5	3	0
				16.7–17.7	5	41	44	5	4	1
				17.7–18.9	5	40	45	6	4	0
				Mean	8	37	49	3	3	0

TM 14 SW 29 **1323 4329** **near Sprite's Lane, Sproughton** **Block B**

Surface level (+39.9 m) +131 ft
Groundwater conditions not recorded
Wirth B1, 8 in diameter
April 1970

Overburden 2.4 m
Mineral 11.9 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Boulder Clay	Clay, pale brown, chalky	1.9	2.4
Chillesford Beds	**a** Sand Sand: fine to medium, white, pale green or pale brown, with a little rounded quartz gravel	3.7	6.1
Red Crag	**b** Sand Sand: fine to medium, red to red-brown, with a little quartz and flint gravel	2.7	8.8
	Sand: fine to medium, shelly	5.5	14.3
London Clay	Clay, bluish grey	0.9+	15.2

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	2	96	2	2.4–3.3	4	37	55	2	2	0
				3.3–4.2	2	36	58	3	1	0
				4.2–5.1	2	33	63	1	1	0
				5.1–6.1	1	19	74	2	3	1
				Mean	2	31	63	2	2	0
b	6	89	5	6.1–7.0	2	16	74	4	3	1
				7.0–7.9	5	18	65	9	3	0
				7.9–8.8	12	13	65	8	2	0
				8.8–9.7	6	18	61	13	2	0
				9.7–10.6	6	21	60	11	2	0
				10.6–11.6	4	30	46	16	4	0
				11.6–12.5	4	28	47	12	7	2
				12.5–13.4	8	31	43	12	5	1
				13.4–14.3	Sample contaminated: not used					
				Mean	6	22	56	11	4	1

TM 14 SW 30 1341 4280 Stone Lodge Lane, Ipswich **Block B**

Surface level (+42.5 m) +139 ft
Water struck at (+30.2 m) +99 ft
Wirth B1, 8 in diameter
March 1970

Overburden 1.8 m
Mineral 14.0 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.6	0.6
Boulder Clay	Clay, brown, becoming sandy	1.2	1.8
Glacial Sand and Gravel	**a** 'Clayey' pebbly sand Gravel: white subrounded to rounded quartz in fine fraction, subangular to angular flint in coarser fraction. 0.3 m of pale brown clay at 4.6 m depth Sand: orange-brown, fine to medium	5.8	7.6
Red Crag	**b** Pebbly sand Sand: dark brown, with flint and quartz pebbles	2.8	10.4
	Sand: dark brown, silty with shell fragments abundant	5.4	15.8
London Clay	Clay, grey-brown	0.9+	16.7

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	15	79	6	1.8–2.7	14	41	35	4	2	4
				2.7–3.6	12	28	49	7	2	2
				3.6–4.5	10	6	65	6	6	7
				4.5–5.5	12	14	56	5	6	7
				5.5–6.4	34	31	33	1	1	0
				6.4–7.6	9	41	44	3	2	1
				Mean	15	28	47	4	3	3
b	9	85	6	7.6–8.5	2	13	63	4	5	13
				8.5–9.4	1	34	59	4	2	0
				9.4–10.3	15	19	48	7	5	6
				10.3–11.3	9	21	55	12	3	0
				11.3–12.2	8	21	52	16	3	0
				12.2–13.1	20	20	49	8	3	0
				13.1–14.0	8	30	43	17	1	1
				14.0–14.9	9	38	35	14	3	1
				14.9–15.8	No grading information available					
				Mean	9	25	50	10	3	3

TM 14 SW 31 **1313 4073** **Street Farms, Belstead** **Block E**

Surface level (+43.9 m) +144 ft
Water struck at (+30.1 m) +99 ft
Wirth B0, 8 in diameter
April 1970

Overburden 2.7 m
Mineral 18.0 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
Glacial Sand and Gravel	Gravel, brown, silty	1.8	2.7
	a Pebbly sand Sand: fine to medium, brown, with subrounded flint and occasional rounded quartz pebbles	7.4	10.1
Red Crag	**b** 'Clayey' sand Sand: brown, silty	7.9	18.0
	Sand: brown, shelly	2.7	20.7
London Clay	Clay, bluish grey	9.3+	30.0

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	9	78	13	2.7–3.6	9	14	54	6	4	13
				3.6–4.5	8	14	51	7	7	13
				4.5–5.5	6	18	47	11	8	10
				5.5–6.4	6	20	61	6	5	2
				6.4–7.3	6	47	43	3	1	0
				7.3–8.2	15	50	30	1	3	1
				8.2–9.1	4	26	43	7	10	10
				9.1–10.1	16	32	37	3	8	4
				Mean	9	27	45	6	6	7
b	11	88	1	10.1–10.9	41	39	18	1	1	0
				10.9–11.9	4	43	52	0	1	0
				11.9–12.8	19	21	57	2	1	0
				12.8–13.7	4	51	38	5	2	0
				13.7–14.6	7	59	32	2	0	0
				14.6–15.5	4	66	28	1	1	0
				15.5–16.4	8	57	33	1	1	0
				16.4–17.3	4	28	29	37	1	1
				17.3–18.0	10	37	46	5	2	0
				18.0–20.7	No grading information available					
				Mean	11	45	37	6	1	0

TM 14 SW 32 1368 4048 near Spinney Wood, Belstead **Block E**

Surface level (+37.8 m) +124 ft
Water struck at (+25.6 m) +84 ft
Wirth B0, 8 in diameter
April 1970

Overburden 3.0 m
Mineral 13.5 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	1.2	1.2
?Boulder Clay	Clay, brown, silty	1.8	3.0
Glacial Sand and Gravel	**a** Pebbly sand Sand: mainly fine to medium, brown to yellow-brown, with some flint gravel		
Red Crag	**b** Sand:		
	Sand: brown, earthy	4.6	13.1
	Sand: brown, shelly	3.4	16.5
London Clay	Clay, bluish grey	0.3+	16.8

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	9	83	8	3.0–3.9	5	30	55	3	6	1
				3.9–4.9	17	17	38	8	13	7
				4.9–5.8	14	21	60	2	3	0
				5.8–6.7	8	26	55	5	2	4
				6.7–7.6	2	32	59	6	1	0
				7.6–8.5	6	25	56	6	3	4
				Mean	9	25	53	5	5	3
b	6	91	3	8.5–9.4	5	36	53	5	1	0
				9.4–10.3	7	18	62	12	1	0
				10.3–11.3	6	26	58	9	1	0
				11.3–12.2	4	34	50	10	2	0
				12.2–13.1	8	37	41	7	6	1
				13.1–14.0	7	28	42	17	5	1
				14.0–14.9	7	32	45	13	3	0
				14.9–15.8	7	31	43	15	4	0
				15.8–16.5	No grading information available					
				Mean	6	30	50	11	3	0

TM 14 SW 33 1454 4275 Waste Cottages, Ipswich

Surface level (+40.8 m) +134 ft
Water struck at (+25.0 m) +82 ft
Wirth B0, 8 in diameter
April 1970

Overburden 0.9 m
Mineral 4.6 m
Waste 0.9 m
Mineral 10.1 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
Chillesford Beds	**a** Sand Sand: fine to medium, pale brown with a little flint gravel	4.6	5.5
	Clay, laminated, brown and grey	0.9	6.4
Red Crag	**b** Sand Sand: fine to medium, orange or brown with a little flint gravel	5.5	11.9
	Sand: brown, shelly	4.6	16.5
London Clay	Clay, bluish grey	0.6+	17.1

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	7	89	4	0.9–1.8	5	20	67	5	1	2
				1.8–2.7	4	26	62	5	3	0
				2.7–3.6	18	56	21	1	2	2
				3.6–4.5	4	33	57	3	3	0
				4.5–5.5	6	29	53	4	7	0
				Mean	7	33	52	4	3	1
b	8	88	4	6.4–7.3	7	69	21	1	2	0
				7.3–8.2	8	42	43	3	4	0
				8.2–9.1	6	38	43	9	2	2
				9.1–10.0	4	37	45	11	3	0
				10.0–10.9	6	31	53	7	2	1
				10.9–11.9	5	36	50	6	3	0
				11.9–12.8	6	28	37	23	3	3
				12.8–13.7	5	12	55	26	2	0
				13.7–14.6	6	29	37	23	4	1
				14.6–15.5	7	39	32	16	6	0
				15.5–16.1	9	38	31	18	4	0
				16.1–16.5	23	17	47	10	3	0
				Mean	8	34	44	10	3	1

TM 14 SW 78 1460 4014 near Wherstead Hall, Wherstead **Block E**

Surface level (+28.7 m) +94 ft
Water struck at (+23.2 m) +76 ft
Wirth B0, 8 in diameter
April 1970

Overburden 3.4 m
Mineral 3.3 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
?Red Crag	Clay, brown, silty	2.1	3.0
	Gravel, silty	0.4	3.4
Red Crag	Pebbly sand		
	Sand: red-brown, with a little gravel	0.9	4.3
	Sand: brown, with shelly fragments	2.4	6.7
London Clay	Clay, bluish grey	0.9+	7.6

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
8	84	8	3.4–4.2	11	20	50	15	4	0
			4.2–5.1	No grading information available					
			5.1–6.1	7	9	64	11	9	0
			6.1–6.7	5	23	47	16	7	2
			Mean	8	17	53	14	7	1

TM 14 SW 79 1281 4466 Redgate Farm, Wherstead **Block A**

Surface level (+6.1 m) +20 ft
Groundwater conditions not recorded
Pilcon shell, 6 in diameter
October 1971

Overburden 0.6 m
Mineral 4.0 m
Bedrock 1.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
River Terrace Deposits (1st Terrace)	Gravel	4.0	4.6
	Gravel: pebbles of flint and quartzite, occasional chalk pebbles. Angular to subrounded		
Upper Chalk	Soft chalk	1.7+	6.3

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
7	31	62	0.6–1.6	3	5	5	11	41	35
			1.6–2.6	8	8	19	10	23	32
			2.6–3.6	11	10	13	5	21	40
			3.6–4.6	6	9	20	10	26	29
			Mean	7	8	14	9	28	34

TM 14 SE 77 1540 4072 near School, Wherstead **Block E**

Surface level (+40.2 m) +132 ft
Water struck at +26 m
Pilcon shell, 6 in diameter
October 1971

Overburden 3.0 m
Mineral 12.8 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground and soil	1.5	1.5
	Clay, brown with pebbles	1.5	3.0
Glacial Sand and Gravel	**a** Pebbly sand Sand: fine to medium, brown with some gravel, mainly flint	5.0	8.0
Red Crag	**b** Pebbly sand Sand: orange to dark brown, silty with ironstone bands with some flint gravel	3.3	11.3
	Sand: chocolate brown, shelly. Black phosphatic pebbles at base	4.5	15.8
London Clay	Clay, bluish grey	0.7+	16.5

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	6	87	7	3.0–4.0	6	15	58	6	5	10
				4.0–5.0	11	15	52	6	9	7
				5.0–6.0	4	54	37	1	3	1
				6.0–7.0	5	66	28	1	0	0
				7.0–8.0	6	76	17	1	0	0
				Mean	6	45	39	3	3	4
b	9	85	6	8.0–9.0	17	20	59	4	0	0
				9.0–10.0	6	30	48	11	4	1
				10.0–11.0	6	10	74	9	1	0
				11.0–12.0	9	19	54	14	4	0
				12.0–13.0	6	10	55	28	1	0
				13.0–14.0	17	37	26	14	4	2
				14.0–15.0	2	15	49	19	9	6
				15.0–15.8	6	26	42	12	8	6
				Mean	9	21	50	14	4	2

TM 14 SE 78 1671 4098 Wherstead Hall, Wherstead **Block A**

Surface level (+7.6 m) +25 ft
Groundwater conditions not recorded
Pilcon shell, 6 in diameter
October 1971

Overburden 0.9 m
Mineral 12.0 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.9	0.9
River Terrace Deposits (1st Terrace)	**a** 'Very clayey' sandy gravel Gravel: angular to subrounded flints and occasional rounded quartz Sand: brown and yellow, silty with carbonaceous material	5.0	5.9
Channel-fill Deposits	**b** Sandy gravel Gravel: angular to subrounded flint, rounded white quartz Sand: mainly medium	7.0	12.9
Upper Chalk	Chalk with flints	0.6+	13.5

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	21	56	23	0.9–1.9	21	19	18	14	18	10
				1.9–2.9	29	24	23	8	20	6
				2.9–3.9	18	18	22	15	20	7
				3.9–4.9	19	27	21	11	15	7
				4.9–5.9	18	27	26	7	9	13
				Mean	21	23	22	11	14	9
b	2	56	42	5.9–6.9	1	6	31	16	26	20
				6.9–7.9	1	4	30	7	24	34
				7.9–8.9	2	3	36	19	23	17
				8.9–9.9	3	4	46	20	21	6
				9.9–10.9	3	5	41	23	17	11
				10.9–11.9	1	8	43	10	21	17
				11.9–12.9	2	3	27	11	19	38
				Mean	2	5	36	15	22	20
a+b	10	56	34		10	13	30	13	19	15

TM 14 SE 79 1699 4058 Redgate Farm, Wherstead **Block A**

Surface level (+5.1 m) +17 ft
Groundwater conditions not recorded
Pilcon shell, 6 in diameter
October 1971

Overburden 0.9 m
Mineral 2.6 m
Bedrock 1.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
River Terrace Deposits (1st Terrace)	Sandy gravel Gravel: angular to subrounded flints, with some rounded quartz and quartzite Sand: silty in upper 1 m, pale brown	2.6	3.5
London Clay	Clay, brown to 4.0 m then bluish grey	1.9+	5.4

GRADING

Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
6	50	44	0.9–1.9	10	30	18	8	13	21
			1.9–2.9	1	5	20	19	30	25
			2.9–3.5	No grading information available					
			Mean	6	17	19	14	21	23

TM 14 SE 80 1859 4163 near Otter House, Ipswich **Block E**

Surface level (+38.4 m) +128 ft
Groundwater conditions not recorded
Pilcon shell, 6 in diameter

Overburden 0.6 m
Mineral 18.1 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Topsoil	0.6	0.6
Glacial Sand and Gravel	**a** Pebbly sand Sand: pale yellow-brown, with some laminated clay, and a brown and grey clay band between 6.6 and 7.0 m, with scattered flint gravel	6.4	7.0
Red Crag	**b** Sand Sand: red-brown, clayey, with traces of fine gravel	8.0	15.0
	Sand: red-brown, shelly	3.7	18.7
London Clay	Clay, bluish grey	0.5+	19.2

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	4	77	19	0.6–1.6	6	24	51	6	4	9
				1.6–2.6	4	5	32	13	19	27
				2.6–3.6	8	26	57	6	3	0
				3.6–4.6	3	14	47	9	10	17
				4.6–5.6	3	14	66	10	5	2
				5.6–6.6	2	11	62	5	8	12
				Mean	4	16	53	8	8	11
b	8	91	1	7.0–8.0	14	36	41	8	1	0
				8.0–9.0	8	31	53	7	1	0
				9.0–10.0	7	29	54	9	1	0
				10.0–11.0	8	25	56	9	2	0
				11.0–12.0	10	35	30	23	1	1
				12.0–13.0	10	29	44	15	2	0
				13.0–14.0	7	24	61	8	0	0
				14.0–15.0	7	35	43	4	1	0
				15.0–16.0	7	33	55	3	2	0
				16.0–17.0	4	38	41	16	1	0
				17.0–18.7	2	36	44	16	2	0
				Mean	8	32	48	11	1	0

TM 14 SE 81 1900 4090 near Bridge Wood, Ipswich **Block E**

Surface level (+37.8 m) +124 ft
Groundwater conditions not recorded
Pilcon shell, 6 in diameter
October 1971

Overburden 0.6 m
Mineral 8.5 m
Waste 1.3 m
Mineral 11.2 m
Bedrock 1.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Glacial Sand and Gravel	**a** Pebbly sand Sand: brown, clayey Gravel: rounded quartz and subangular flint. Brown clay with wood fragments noted at 6.7 m	8.5	9.1
Chillesford Beds	Clay, green, stiff	1.3	10.4
	b Gravel Gravel: subrounded to subangular quartz and rounded flints	0.6	11.0
Red Crag	**c** Sand Sand: reddish brown with occasional pebbles and ironstone bands	8.7	19.7
	Sand: brown with shell fragments. Black phosphatic pebbles at base	1.9	21.6
London Clay	Clay, brown, becoming bluish grey	1.3+	22.9

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	7	75	18	0.6–1.6	8	10	34	11	13	24
				1.6–2.6	7	10	35	11	13	24
				2.6–3.6	5	7	43	9	14	22
				3.6–5.1	9	21	47	12	8	3
				5.1–6.1	7	20	61	7	5	0
				6.1–7.1	4	21	63	9	3	0
				7.1–8.1	3	15	65	5	2	10
				8.1–9.1	14	21	55	4	4	2
				Mean	7	16	50	9	8	10
b	3	48	49	10.4–11.0	3	9	28	11	25	24
c	9	87	4	11.0–12.0	8	31	51	7	2	1
				12.0–13.0	7	36	42	9	4	2
				13.0–14.0	12	41	37	6	3	1
				14.0–15.0	17	27	34	12	5	5
				15.0–16.0	12	24	41	13	8	2
				16.0–17.0	9	28	55	4	4	0
				17.0–18.0	9	26	53	10	2	0
				18.0–19.0	7	23	57	11	2	0
				19.0–20.0	6	21	55	16	2	0
				20.2–21.6	4	5	53	35	3	0
				Mean	9	25	48	14	3	1

TM 14 SE 82 1960 4166 near Iron Works, Ipswich **Block E**

Surface level (+37.2 m) +122 ft
Water struck at +23.1 m
Pilcon shell, 6 in diameter
October 1971

Overburden 0.6 m
Mineral 21.1 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Glacial Sand and Gravel	**a** Pebbly sand Sand: pale brown, fine to medium Gravel: angular to subrounded flints, rounded quartz	8.8	9.4
Chillesford Beds	**b** Sandy gravel Gravel: subangular to subrounded flint, subrounded to rounded quartz Sand: green, mainly medium, with green sandy clay between 9.4 and 9.6 m	2.0	11.4
Red Crag	**c** Pebbly sand Sand: reddish brown, with a little gravel	2.2	13.6
	Sand: brown, with shell fragments Black pebbles between 17.6 m and 18.6 m, and at base	8.1	21.7
London Clay	Clay, brown, becoming bluish grey	0.6+	22.3

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16$
a	4	87	9	0.6–1.6	8	19	46	7	6	14
				1.6–2.6	6	10	50	6	9	19
				2.6–3.6	3	27	60	8	2	0
				3.6–4.6	3	24	66	5	2	0
				4.6–5.6	3	19	56	5	6	11
				5.6–6.6	3	25	67	3	2	0
				6.6–7.6	3	36	54	5	2	0
				7.6–8.6	3	20	67	5	2	3
				8.6–9.4	8	34	50	6	2	0
				Mean	4	24	57	6	4	5
b	3	67	30	9.6–10.6	3	14	36	14	16	17
				10.6–11.4	3	18	41	12	9	17
				Mean	3	16	38	13	13	17
c	3	92	5	11.4–12.4	5	43	39	11	2	0
				12.4–13.4	3	36	36	20	5	0
				13.4–14.4	4	39	35	17	4	1
				14.4–15.4	2	40	35	20	3	0
				15.4–16.4	2	28	42	23	5	0
				16.4–17.4	6	29	45	16	4	0
				17.4–18.4	2	13	45	33	6	1
				18.4–19.4	2	16	53	25	4	0
				19.4–20.4	3	11	55	27	4	0
				20.4–21.7	2	21	45	25	5	2
				Mean	3	27	43	22	4	1

APPENDIX G

LIST OF WORKINGS

Locality	*Deposits worked*	*Grid reference*
1 Pits working sand and gravel		
Tuddenham	Glacial Sand and Gravel Chillesford Beds	193 492
Broom Hill	Glacial Sand and Gravel Chillesford Beds Red Crag	131 482
Valley Farm	Glacial Sand and Gravel Chillesford Beds Red Crag	116 435
Blood Hill	Glacial Sand and Gravel	113 485
Lone Barn	River Terrace Deposits	138 454
2 Abandoned pits with sections in sand and gravel		
Bramford Common	River Terrace Deposits	121 479
Grove Pit	Red Crag (on London Clay, which rests on Reading Beds)	130 478
Westerfield	Glacial Sand and Gravel	178 476
3 Pits worked for chalk, but showing overlying sand and gravel		
Great Blakenham	Chillesford Beds	111 499
Claydon Hill Pit	Chillesford Beds	136 498

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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INDUSTRIAL MINERALS ASSESSMENT UNIT

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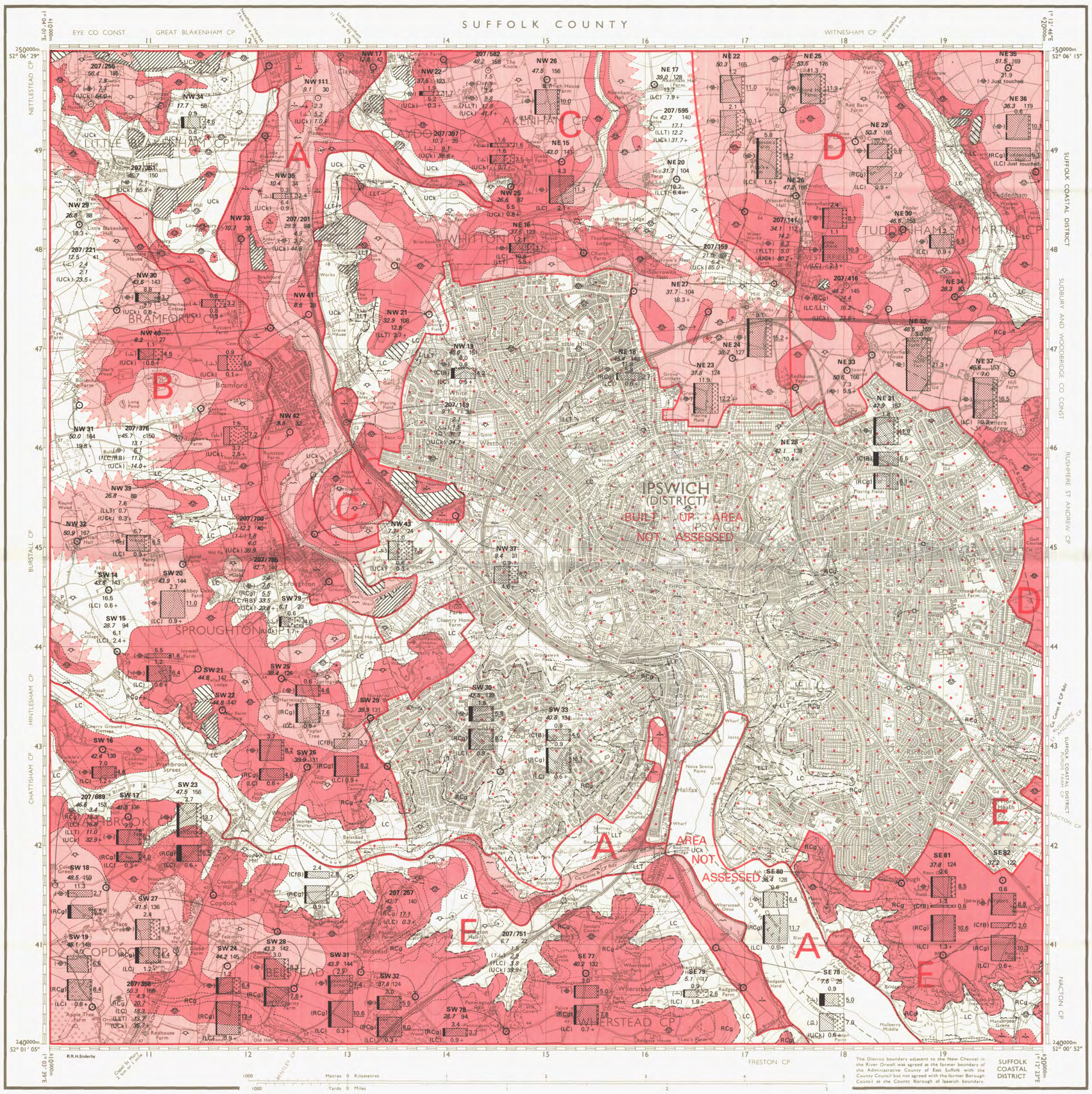
ORDNANCE SURVEY
Scale 1:25 000 Second Series

SHEET TM 14



R.R.H.Enderby

The representation on this map of any other road, track or path is no evidence of the existence of a right of way

Geological lines from geological surveys on the One-Inch to 1 mile (1:63 360) scale by F.J.Bennett, J.H.Blake and W.Whitaker. Published on Old Series Sheets 48 and 50 in 1881, 1882 and 1883. Transferred to New Series Sheet 207 with minor corrections and published in 1927.

Sand and Gravel Survey by R.Allender, S.J.Booth, S.E.Hollyer and S.Machin in 1969-1971. R.G.Thurrell, Head, Industrial Minerals Assessment Unit.

1:25, 000 sand and gravel resource sheet published in 1980.
G. M. Brown, D.Sc, F.R.S, *Director, Institute of Geological Sciences.*

1100/80

Surface heights are to the nearest metre above mean sea level
Contour values are in metres

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 1:10 560 or 1:10 000 scale maps
last fully revised 1951-70
Date of survey 1951-70
Revised for significant changes 1974
Contours were not surveyed at these dates but were taken from 1:25 000 Provisional Edition
Major roads revised 1975

The District boundary adjacent to the New Channel in the River Orwell was agreed as the former boundary of the Administrative County of East Suffolk with the County Council but not agreed with the former Borough Council as the County Borough of Ipswich boundary.

	190	
TM 05	TM 15	TM 25
TM 04	207 TM 14	TM 24
TM 03	TM 13 224	TM 23

Diagram showing the relation of the National Grid 1:25,000 sheets with the New Series One-Inch Geological sheets 190, 207 and 224.

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

55

EXPLANATION OF SYMBOLS AND ABBREVIATIONS

DRIFT (RECENT AND PLEISTOCENE)

- **Alluvium** - mainly pebbly clay and silt with peat. A-37
- **Brickearth** - dark grey silty clay and orange-brown sandy clay with scattered flint pebbles. B-11
- **River Terrace Deposits** - flint,quartz and quartzite gravel with yellow or reddish brown sand. RT-16
- **Boulder Clay** - stiff bluish grey clay with mainly chalk and flint pebbles. BC-4
- **Glacial Sand and Gravel** - yellow or brown sand with variable amounts of flint, quartz and quartzite gravel. GS-32
- **Channel-fill Deposits** - coarse sand with flint gravel; proved in one I.M.A.U. borehole (SE 78) only. CD-1

SOLID (PALAEOCENE: PLEISTOCENE, EOCENE, CRETACEOUS)

- CfB **Chillesford Beds (of Chillesford)** - pale grey and green, micaceous, clayey silty sand with quartzite gravel and interbedded laminated clay (proved in boreholes only).
- RCg **Red Crag** - deep reddish brown sand, shelly in lower part, and in places with basal pebble bed.
- LC **London Clay** - bluish grey clay with cementstone nodules.
- LLT **Lower London Tertiaries (Reading and Thanet Beds)** - interbedded clay, silt and sand; pale grey, green, red and brown with pebble bed at base.
- UCk **Upper Chalk** - soft, white limestone with flint nodules.

Worked-out Ground (sand and gravel) WO-4

Made Ground MG-2

BOUNDARY LINES

- Geological boundary, Drift.
- Geological boundary, Solid.
- Inferred boundary between recognised categories of deposits.
- Resource Block boundary.

Broken lines denote uncertainty.

BOREHOLE DATA

SITE LOCATIONS

- Industrial Minerals Assessment Unit (I.M.A.U.) Boreholes.
- Other Boreholes.

I.M.A.U. BOREHOLES

Borehole Registration Number → SW 33
40.8 134 ← Surface level in metres and feet above O.D.
Borehole Site →
Overburden → 0.9 ← Grading Diagram
(CfB) 4.6 ← Mineral (sand and gravel)
Waste → 0.9
Geological Classification → (RCg) 10.1 ← Mineral (sand and gravel)
(LC) 0.6+ ← Bedrock
Thicknesses in metres

Note:
(i) Figures underlined denote thicknesses used in the assessment of resources.
(ii) The + sign indicates that the base of the deposit was not reached.
(iii) The figures in *italics* are the metric conversions of the measurements recorded in feet.
(iv) The Geological Classification is given only for mineral and bedrock.

Borehole Registration Number

Each I.M.A.U. borehole is identified by a Registration Number, e.g. SW 33. 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 SW 33 is TM 14 SW 33.

Grading Diagrams

Each grading diagram shows the mean particle size distribution of a distinct deposit of mineral.

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 I.M.A.U. boreholes, although data available may not be as comprehensive. They are registered in the same series, exept for records in the Hydrogeological Department; for example, 207/416 signifies Hydrogeological Department borehole 416 on the New Series One-Inch Geological Sheet 207. The final depth of deep boreholes is quoted in metres above or below O.D.

CATEGORIES OF DEPOSITS

- **Exposed mineral** CAT-E6
- **Continuous or almost continuous spreads of mineral beneath overburden.** CAT-C1
- **Sand and gravel not assessed.** CAT-N1
- **Sand and gravel absent or not potentially workable.** CAT-A2

Where appropriate on other sheets a category: 'Discontinuous spreads of mineral beneath overburden' is recognised.

RESOURCE BLOCKS

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

Detailed records may be consulted on application to the Head, Industrial Minerals Assessment Unit, Institute of Geological Sciences, Keyworth, Nottingham. NG12 5GG.

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