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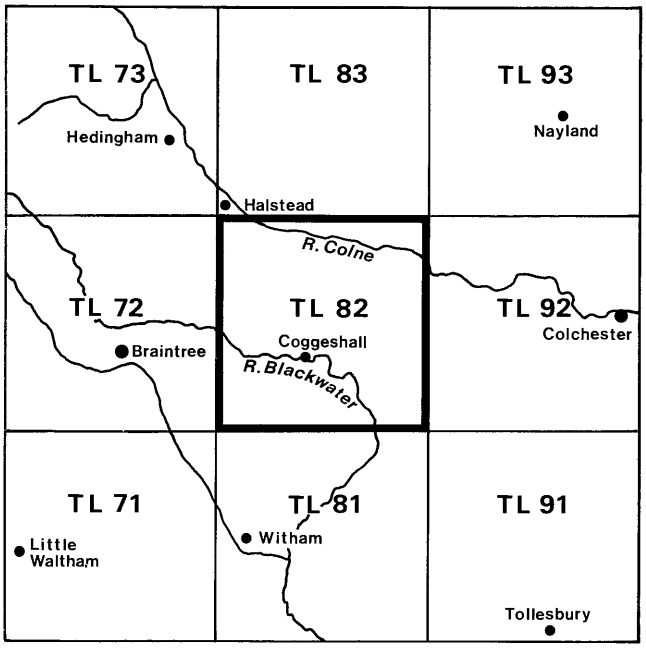

The sand and gravel resources of the country around Coggeshall, Essex

Description of 1:25 000 resource sheet TL 82

S. J. Booth and J. W. Merritt

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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 co-operation 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 Coggeshall, Essex, shown on the accompanying 1:25 000 resource map TL 82. The survey, conducted during 1970–1973, was supervised by the late J. D. Ambrose: S. J. Booth, J. W. Merritt, P. Robson, G. M. Bladon and J. A. Gray participated in the drilling and sampling programme. S. J. Booth and J. W. Merritt compiled the report.

The work is based on six-inch scale geological mapping by M. J. Heath and S. R. Mills, formerly of the Institute's East Anglia and South-Eastern England Field Unit and carried out in 1973–1974 specifically to supplement the assessment survey. The section of the report on the geology of the resource sheet area was prepared with the assistance of R. A. Ellison of the Institute's Central and South Midlands Field Unit.

J. W. Gardner, CBE (IGS Land Agent) was responsible on behalf of the Institute for negotiating access to land for drilling. The ready co-operation of landowners, tenants and gravel companies in this work and the assistance of the Anglian Water Authority, the Eastern Electricity Board, the Eastern Gas Council and Essex County Council is gratefully acknowledged.

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S. J. Booth and J. W. Merritt (with a contribution by R. A. Ellison)

SUMMARY

The geological maps of the Institute of Geological Sciences, pre-existing borehole information, and 90 boreholes drilled for the Industrial Minerals Assessment Unit, form the basis of the assessment of sand and gravel resources in the country around Coggeshall, Essex.

All deposits in the resource sheet 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 accompanying 1:25 000 map is divided into five resource blocks or sub-blocks containing between 4.6 and 35.3 km² of potentially workable sand and gravel. The geology of the deposits is described and the mineral-bearing areas within each block are distinguished. The mean thicknesses of overburden and mineral and the mean gradings, together with detailed borehole data, are also given. The geological lines and symbols, the positions of all IMAU boreholes (including grading information where available) and most other non-confidential boreholes used in the assessment and the outlines of the resource blocks are shown on the accompanying resource map.

Bibliographical reference

Booth, S. J. and Merritt, J. W. 1982. The sand and gravel resources of the country around Coggeshall, Essex. Description of 1:25 000 resource sheet TL 82. *Miner. Assess. Rep. Inst. Geol. Sci.*, No. 102.

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Note

National Grid references are given in square brackets. In this publication all lie within the 100-km square TL.

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 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, 1981; Harris and others, 1974).

In this report the assessment is in most cases calculated at the *indicated* level of assurance. However, in those areas where the available information is insufficient the assessment is conducted at the *inferred* level (see Appendix B, paragraph 12). In the former, 'tonnage and grade are computed partly from specific measurements, samples, or production data and partly from projection for a reasonable distance on geologic 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.'

At the *inferred* level 'quantitative estimates are based largely on broad knowledge of the geologic character of the deposit and for which there are few, if any, samples or measurements. The estimates are based on an assumed continuity or repetition, of which there is geologic evidence: this evidence may include comparison with deposits of similar type. Bodies that are completely concealed may be included if there is specific geologic evidence of their presence' (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

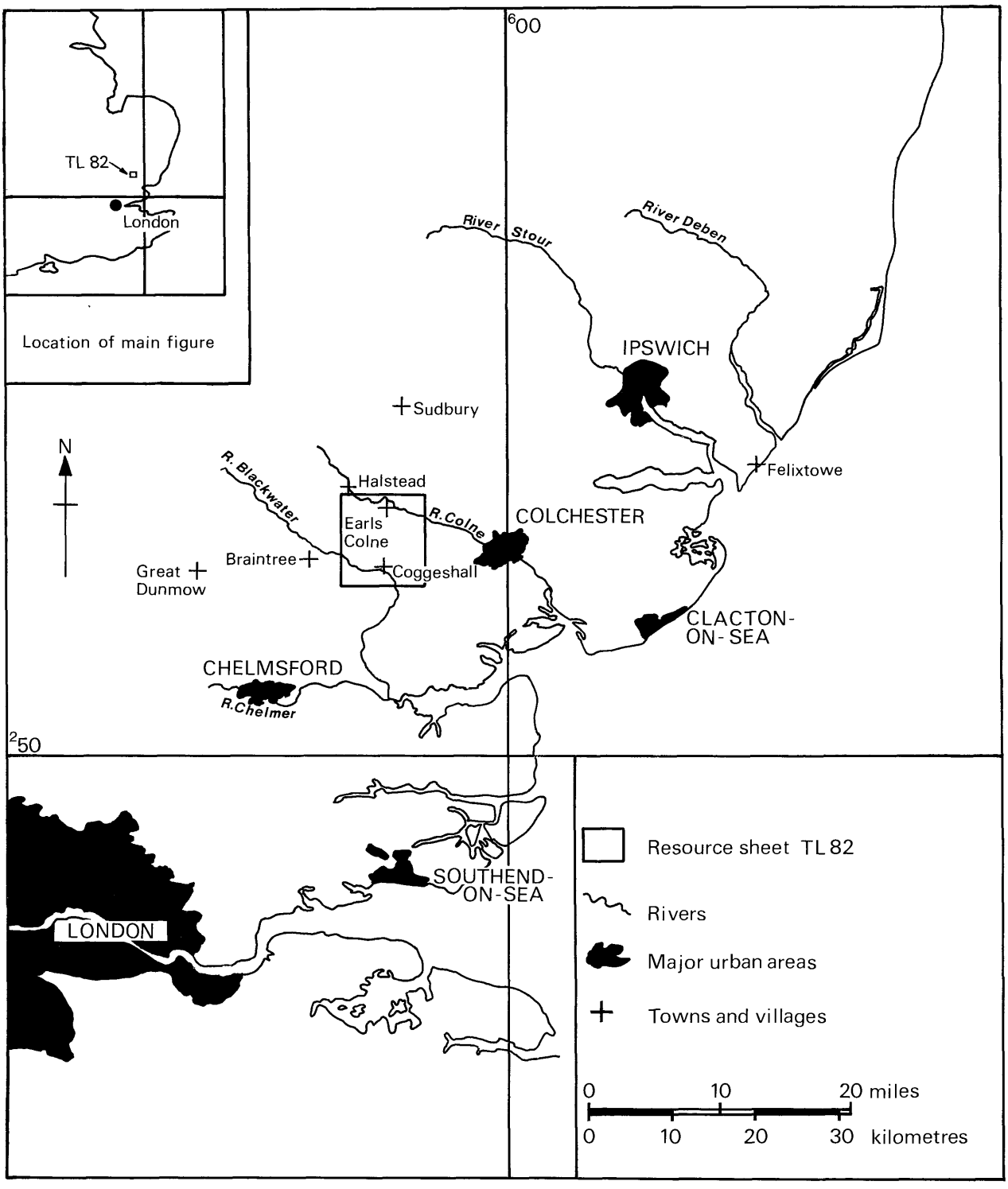


Figure 1 Locality map.

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.

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 m, 4 mm, 16 mm etc has been adopted. The boundaries between fines (that is, the clay and silt fractions) and sand, and between sand and gravel grade material, are placed at $\frac{1}{16}$ mm and 4 mm, respectively (see Appendix C).

The volume and other characteristics of the sand and gravel are assessed within resource blocks and sub-blocks, the latter distinguished by subscript numbers. In the assessment of mineral no account is taken of factors such as roads, villages and land of 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 of mineral, therefore, bears no simple relationship to the amount that could be extracted in practice.

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

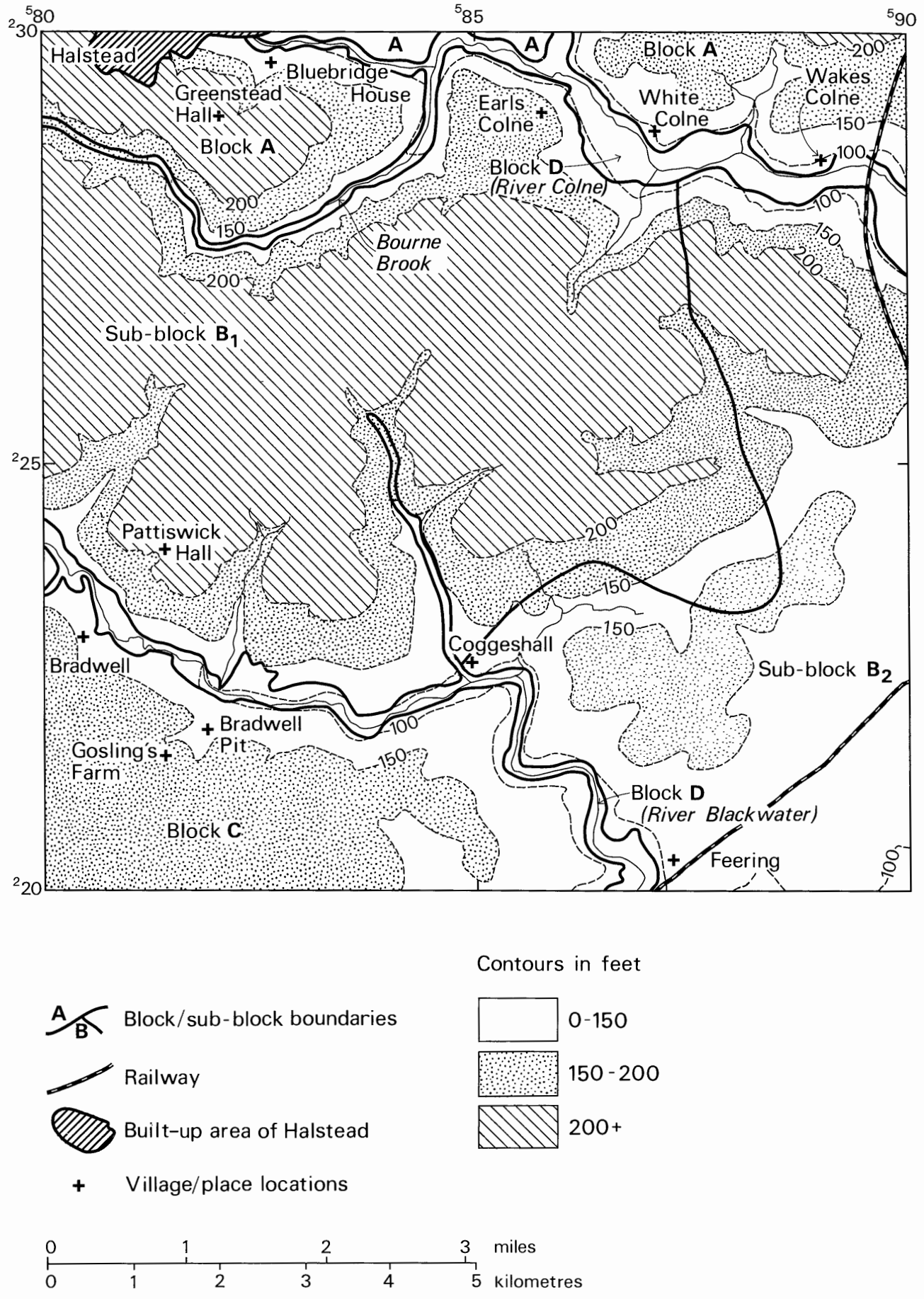


Figure 2 Topography and principal locations.

DESCRIPTION OF THE RESOURCE SHEET

GENERAL

Sheet TL 82 covers 100 km² of open countryside in north Essex characterised by widely scattered small villages and hamlets. The main areas of settlement are the southern part of Halstead [810 298] and the villages of Earls Colne [855 288] and Coggeshall [850 225], all three situated beside major roads leading to Colchester, see Figure 1.

The district lies in a region of predominantly arable farming, based on a combination of heavy soils and relatively low rainfall. Excluding the urban area of Halstead (which has not been assessed), 77.3 km² of the resource sheet area is considered to be mineral-bearing.

TOPOGRAPHY

The district forms part of the gently undulating north Essex and west Suffolk plateau which is over 76.8 m above Ordnance Datum in the extreme north-west of the resource sheet area but falls south-eastwards and is generally less than 45.7 m above Ordnance Datum to the south and east of Coggeshall where it is rather featureless (Figure 2).

The plateau is dissected by the major valleys of the River Colne in the north and the River Blackwater in the south. These rivers drain in a generally east to south-easterly direction, reflecting the regional slope of the plateau. However, the course of the River Blackwater includes a 'dog-leg' southwards at Coggeshall, a feature which is thought to be evidence of 'river capture' (Ellison, in press).

GEOLOGY

Introduction and previous work The geological sequence is summarised in Table 1 where the deposits are listed, as far as possible, in order of increasing age. The relationships between them are illustrated in generalised cross-sections (Figures 3a and 3b).

The earliest description of the geology of the district is in Old Series Geological Survey memoirs 47 (Whitaker and others, 1878) and 48 (Dalton, 1880). The geological lines shown on the 1:25 000 resource sheet (TL 82) are based on mapping (1973–74) at the scale of 1:10 560 by M. J. Heath and S. R. Mills, formerly of the Institute's East Anglia and South-Eastern England Field Unit. This work has been incorporated into a New Series 1:50 000 geological map (to be published in 1982) and memoir for Sheet 223 (Braintree) (Ellison, in press).

The following account is based on a contribution by R. A. Ellison (now of the Institute's Central and South Midlands Field Unit) and adopts a modified form of the stratigraphical nomenclature from the memoir for Sheet

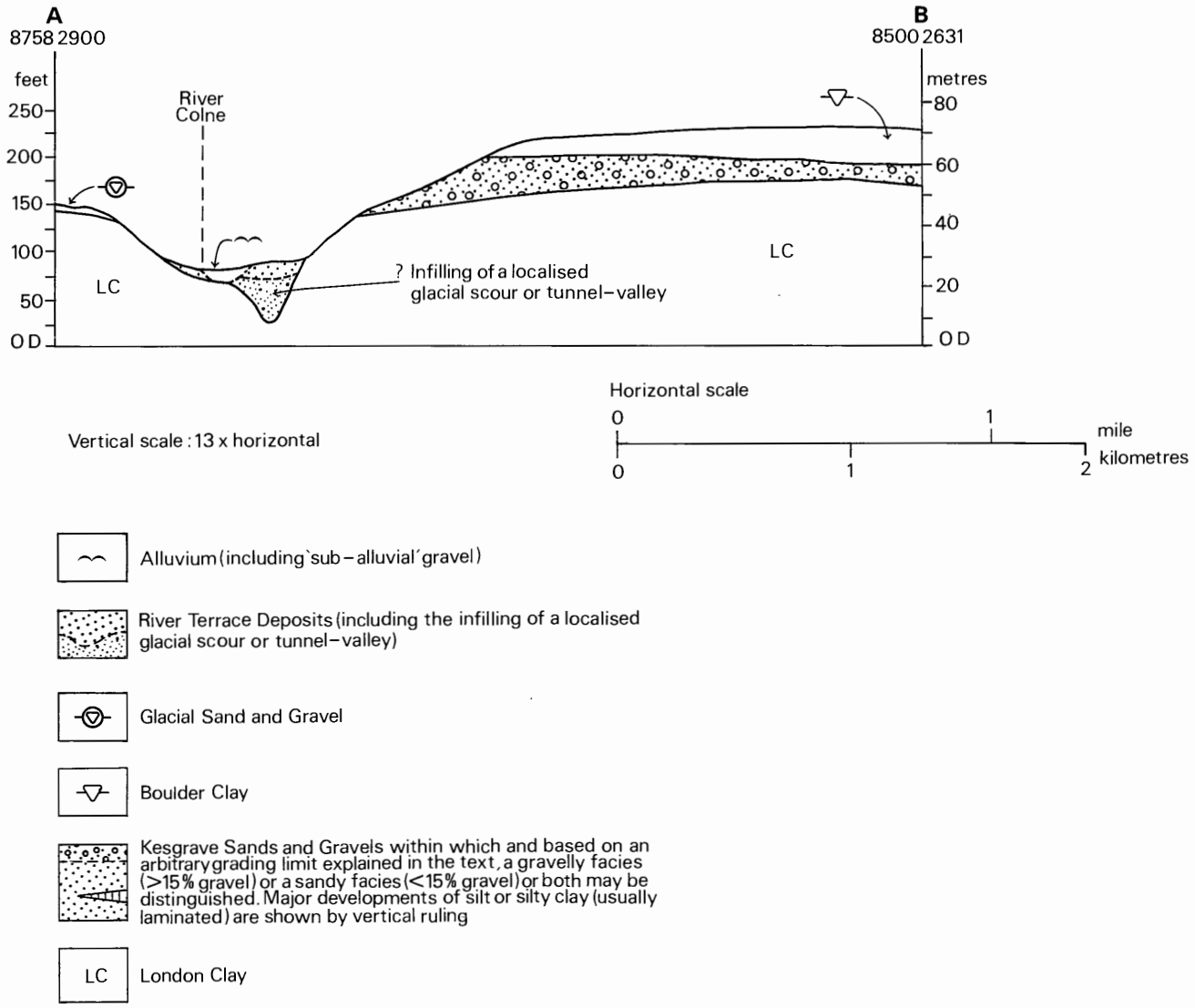
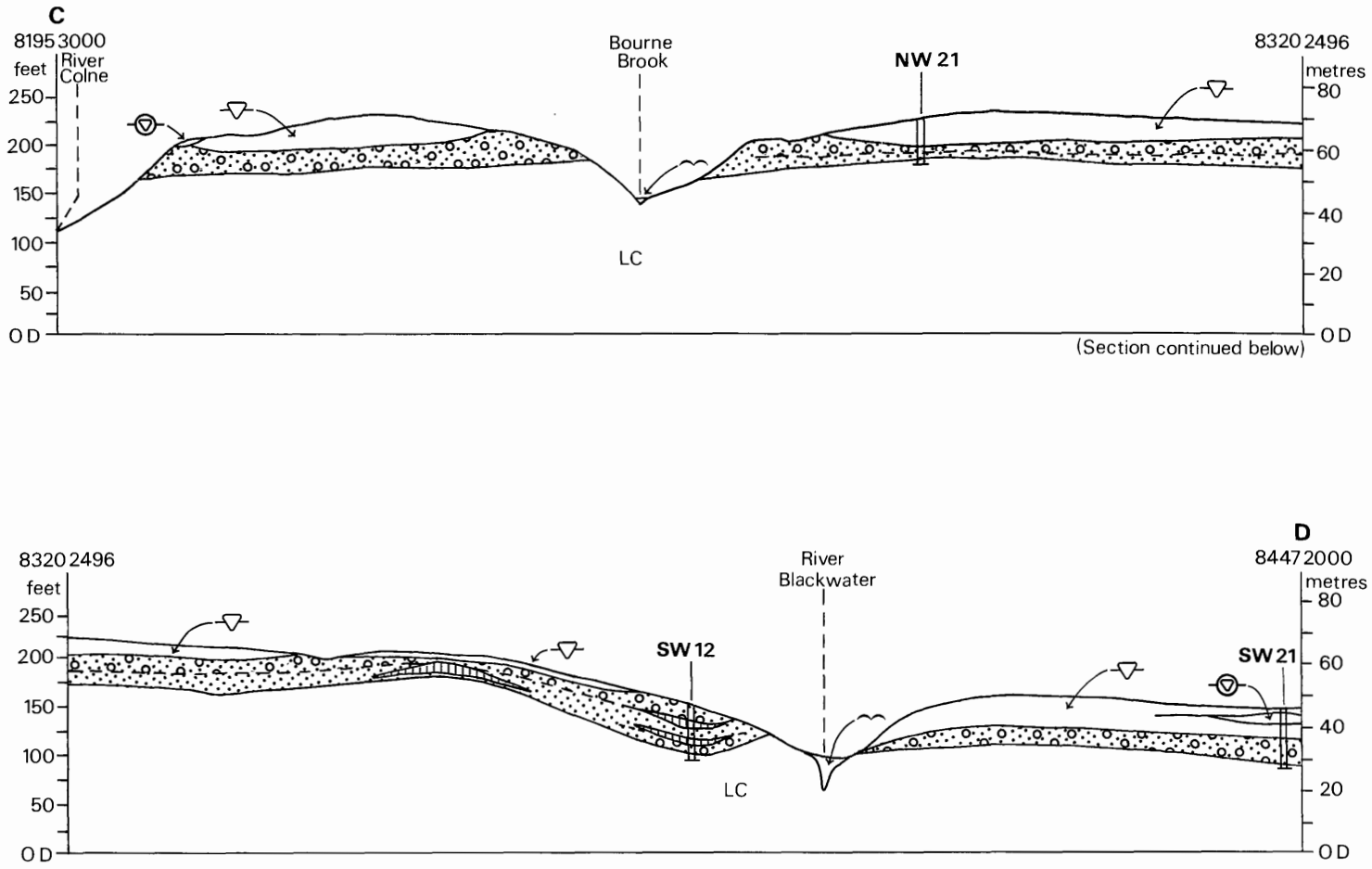


Figure 3a Generalised section across the Colne Valley.



For key see Figure 3a and for line of section see Figure 4

Figure 3b Generalised sections across the resource sheet area, approximately north–south.

Table 1 Geological succession proved at the surface and in IMAU boreholes

DRIFT	
Quaternary	
Recent (Holocene) and Pleistocene	
Peat	
Alluvium (including 'sub-alluvial' gravels)	
River Terrace Deposits	First Terrace, Second Terrace, Third Terrace
Head	
Lacustrine Deposits	
Glacial Sand and Gravel	see Table 2
Boulder Clay	see Table 2
Kesgrave Sands and Gravels	see Table 2
SOLID	
Tertiary	
Eocene	
London Clay	

223 (see Table 2). Recent work on the Drift deposits of the district, principally by Rose, Allen and Hey (1976) and Rose and Allen (1977) has resulted in a generally accepted subdivision of the former 'Glacial Sand and Gravel' (underlying the Boulder Clay) into the Barham Sands and Gravels (above) and the Kesgrave Sands and Gravels (below). However, no attempt is made here or in the borehole logs to adopt this refinement systematically although the distinction is made in two adjacent and more recently assessed resource sheet areas to the north (Marks and Merritt, 1981; Marks and Murray, 1981; see also Table 3). In this publication deposits described as Kesgrave Sands and Gravels may include, quite widely, material which correlates with the Barham Sands and Gravels of Rose and Allen (1977).

SOLID

An extensive cover of thick superficial deposits limits exposure of the solid rocks to approximately 12 km² in the river valleys; their presence elsewhere is recorded in boreholes. The district is underlain by Eocene London Clay; non-IMAU boreholes have proved Palaeocene Lower London Tertiaries and Cretaceous Upper Chalk but consideration of these is unnecessary for the purpose of this assessment.

London Clay London Clay forms the bedrock under the Drift deposits; non-IMAU boreholes show that it ranges in thickness from approximately 40 m in the north to 52 m in the south.

It is typically stiff dark greyish brown to bluish grey, slightly silty clay commonly containing septarian and pyritised nodules—the latter locally abundant. At outcrop, the clay weathers brown and orange-brown to depths ranging from 2 to 8 m, but beneath the Drift, less than a metre is commonplace. Where weathering has occurred, small calcareous nodules ('race') and small crystals of selenite are often found.

Table 2 Historical interpretation of the glacial deposits [after Ellison, in press]

Wood, 1867	Whitaker and others, 1878; Whitaker, 1885	Prestwich, 1890; Solomon, 1935	Clayton, 1957	Bristow and Cox, 1973	Mitchell and others, 1973	Rose, Allen and Hey, 1976; Rose and Allen, 1977	Ellison, in press	**This report**
Upper Glacial	Boulder Clay		Springfield Till	Chalky Boulder Clay (Springfield Till)	Springfield Till	Lowestoft Till	Boulder Clay	**Boulder Clay / Glacial Sand and Gravel**
Middle Glacial	Glacial Sand and Gravel	Glacial Sand and Gravel	Chelmsford Gravel	Glacial Sand and Gravel (Chelmsford Gravel)	Chelmsford Gravel	Barham Sands and Gravels	Glacial Sand and Gravel	**Kesgrave Sands and Gravels**
		Westleton Beds			White Ballast	Kesgrave Sands and Gravels	Kesgrave Sands and Gravels	

Table 3 Stratigraphical terminology adopted by IMAU reports for this region

1:25 000 resource sheet number*	TL71	TL72	TL73	TL81	**TL82**	TL83	TL91	TL92	TL93
REFERENCE	Eaton, 1973	Clarke and Ambrose, 1975	Marks and Murray, 1981	Haggard, 1972	**Booth and Merritt, 1982**	Marks and Merritt, 1981	Ambrose, 1973	Ambrose, 1974	Hopson, 1981
STRATIGRAPHICAL PRECEDENT (See Table 2)	After Whitaker and others, 1878; Whitaker, 1885; and incorporating Clayton, 1957	After Bristow and Cox, 1973	After Rose and Allen, 1977 in borehole logs; map display simplified after Ellison (in press)	After Clayton, 1957	**Modified after Ellison (in press)**	After Rose and Allen, 1977 in borehole logs; map display simplified after Ellison (in press)	After Whitaker and others, 1878; Whitaker, 1885	After Whitaker and others, 1878; Whitaker, 1885; slightly modified after Bristow and Cox, 1973	After Ellison (in press)

* See locality diagram on title page.

The sub-drift surface (Figure 4) slopes gently from about 62 m above Ordnance Datum in the north-west to about 26 m above Ordnance Datum in the south-east. Superimposed upon this broad regional slope is an area of steeper gradient trending west-south-west to east-north-east across the southern part of the resource sheet area, dividing the bedrock surface into two relatively flat areas at about 55 to 48 m above Ordnance Datum and 28 to 20 m above Ordnance Datum respectively. This break of slope may represent the back-feature to a terrace cut into the London Clay by the 'proto-Thames' of Wooldridge and Linton (1955, pp. 106, 117 and 133). In the Colne Valley, the bedrock elevations are known (from non-IMAU boreholes) to fall locally to around 20 m above Ordnance Datum beneath the River Terrace Deposits, suggesting the presence of a buried channel (see Woodland, 1970, p. 256; Marks and Murray, 1981); however, there are insufficient borehole data to establish the course of this channel elsewhere in the resource sheet area.

DRIFT

Recent (Holocene) and Pleistocene Almost the whole of the resource sheet area is 'blanketed' by drift deposits which are principally glacial in origin. These deposits have been the subject of several conflicting regional studies (summarised in Table 2), in which refinements to the stratigraphical nomenclature have been proposed; in this report the stratigraphical terms used are consistent with the IGS Memoir for Sheet 223 (Ellison, in press).

Kesgrave Sands and Gravels Mapping and borehole data show this formation to be widespread beneath the Boulder Clay (Figures 3a, 3b and 4) over most of the resource sheet area except in the east and south-eastern corner where it is either absent or less than 2 m thick (for example, in boreholes SE 15, SE 18, SE 20, SE 22 and NE 13). The thickness is fairly uniform about a mean recorded thickness of 6.6 m with a maximum thickness (11.8 m) proved in borehole SW 16 near Pattiswick Hall [814 241].

Within the sands and gravels underlying the Boulder Clay three distinctive lithologies have been recognised in many IMAU boreholes in adjacent areas (Marks and Merritt, 1981; and Marks and Murray, 1981) although it has not been possible to delineate them at surface. Because most of the IMAU boreholes for this survey were drilled before the general acceptance of this tripartite subdivision, the deposit is undivided in the borehole logs of this report. Nevertheless, the subdivisions have been recognised (in part) in boreholes SW 15, SW 21 and NW 22 (Figure 5) and doubtless they occur elsewhere.

Most of the Kesgrave Sands and Gravels consist of well-sorted, cross-bedded sandy gravels, the most gravelly developments occurring in the north-western

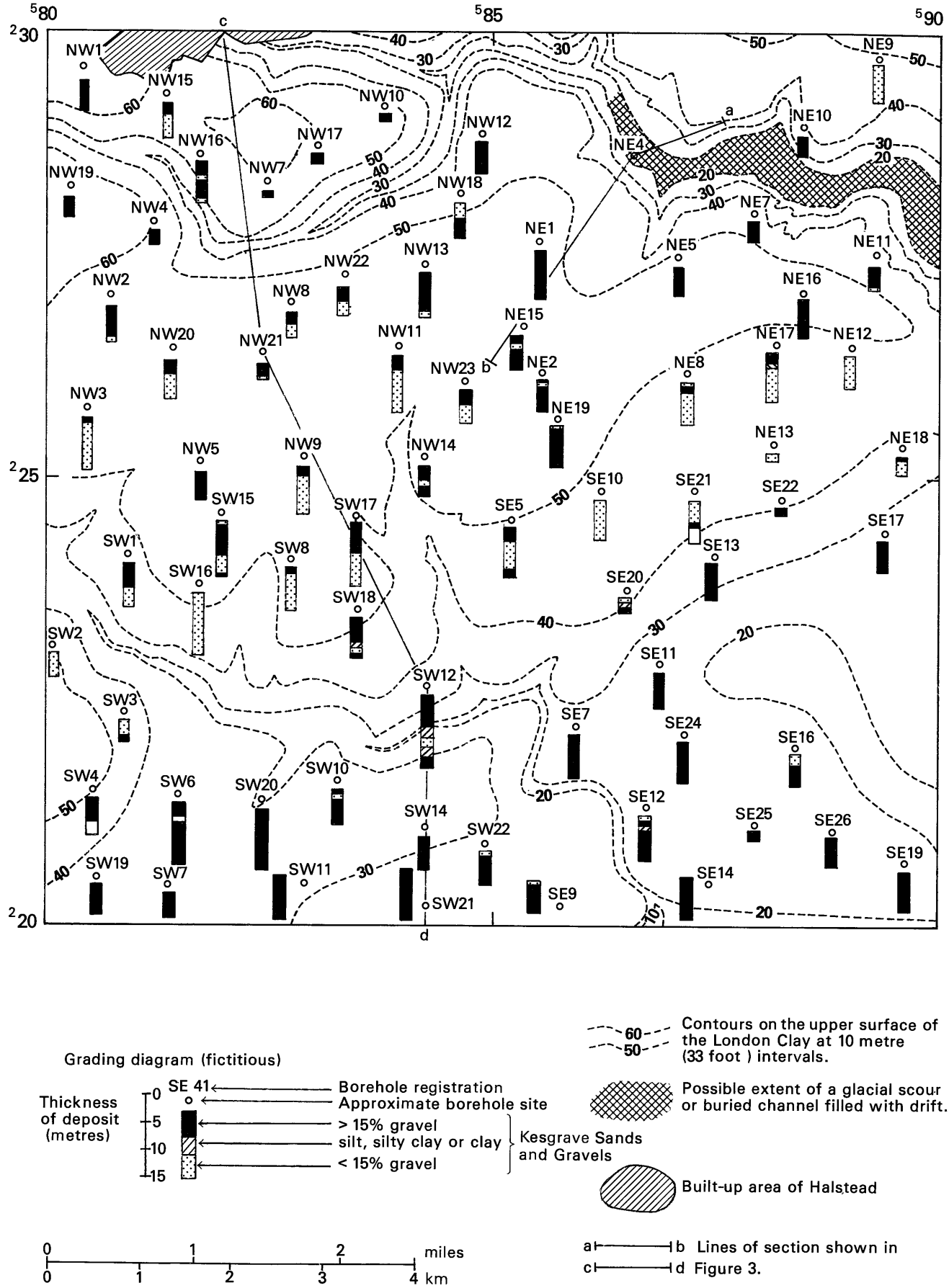
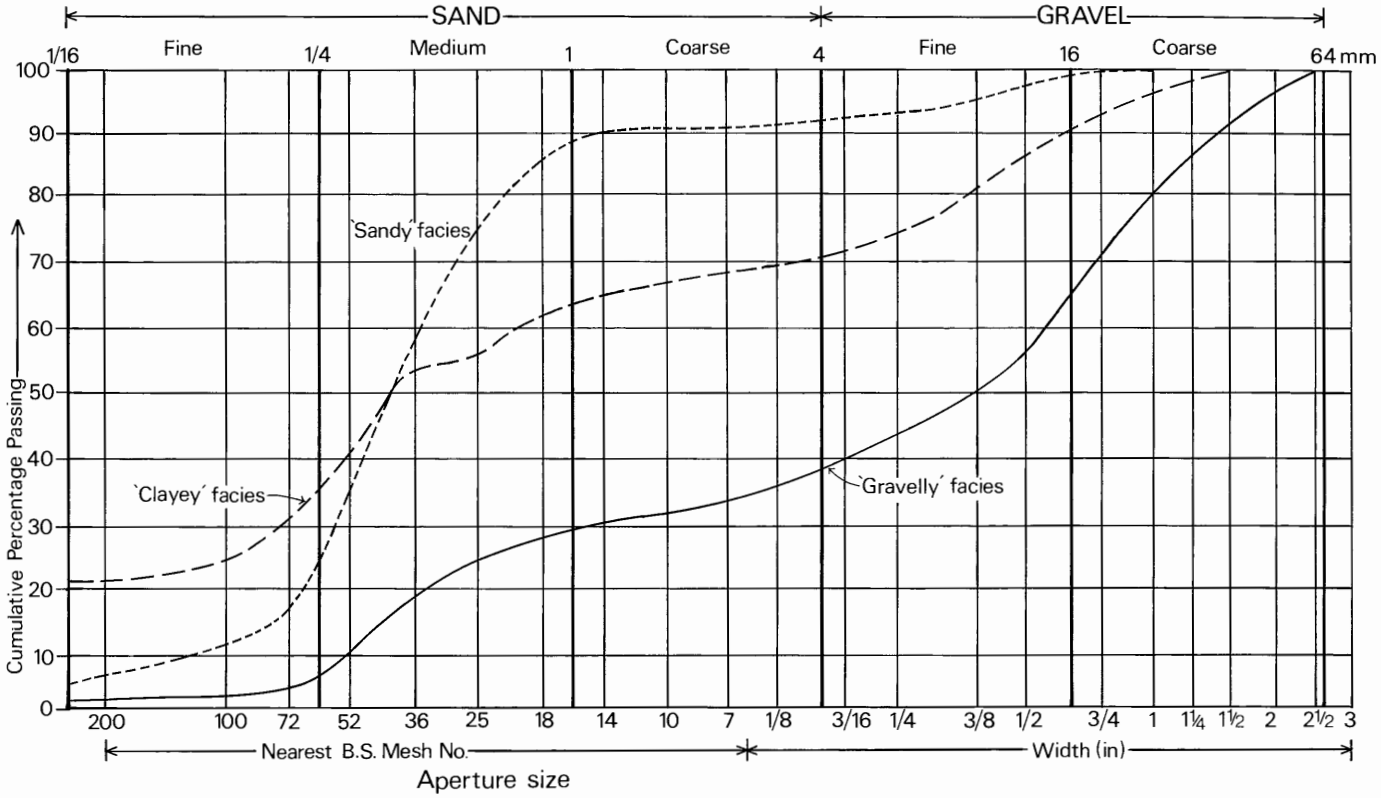


Figure 4 Sketch map showing contours of the bedrock surface and the distribution of the 'sandy' and 'gravelly' facies within the Kesgrave Sands and Gravels.



Lithological description	Sampling details		Percentage by weight passing (mean)										
	Borehole number	Depth within borehole (m)	0.063 mm	0.15 mm	0.25 mm	0.425 mm	0.6 mm	1.0 mm	2.4 mm	4.0 mm	9.5 mm	16.0 mm	37.5 mm
'Clayey' facies (possibly the Barham Sands and Gravels—see Table 2)	TL 82 SW15	3.7– 6.7	20	25	37	55	57	64	68	71	81	91	100
'Gravelly' facies (the Essex White Ballast)	TL 82 SW21	10.2–18.7	2	3	6	19	25	30	34	38	51	67	91
'Sandy' facies	TL 82 NW22	7.6– 8.6	4	10	23	57	74	88	92	93	96	98	100

Figure 5 Representative mean particle-size distributions of material from the Kesgrave Sands and Gravels.

and southern parts of the resource sheet area. The deposit is usually yellowish brown in colour but it is yellowish white in places, a variation that has given rise to the parochial term 'Essex White Ballast'. Locally, the lower part of the Kesgrave Sands and Gravels consists of finely laminated, cross-bedded, well-sorted medium-grained sands with thin (normally less than 1 cm thick) interbeds of greenish grey silty clay (Figures 3a and 3b). The basal beds are commonly heavily iron-stained and a ferruginous conglomerate is present sporadically. The highest beds of the deposit commonly consist of relatively poorly sorted clayey sands and gravels (similar in lithology to the overlying but much less widespread Glacial Sand and Gravel). These beds, which may be equivalent to the Barham Sands and Gravels of Rose and Allen (1977), form a cohesive deposit locally known as 'hoggin' and have been extracted widely for use as 'fill' with little or no processing (see Composition of Sand and Gravel).

Boulder Clay Boulder Clay is the most extensive surface deposit (approximately 67 km^2) in the area assessed and forms a 'capping' to the plateau areas. Its maximum proved thickness is 14.6 m (in borehole SE 23) east of Coggeshall but more usually it is of the order of 10 m thick as recorded in boreholes in the central parts of the resource sheet area. Erosion associated with downcutting of the valley systems has resulted in progressive thinning towards the plateau margins.

The deposit is generally stiff sandy clay, typically dark yellowish brown to dark grey in colour and contains clasts up to cobble size (>64 mm), mainly of chalk and flint. Other erratics include Cretaceous and Jurassic sandstones, limestones and shales, with quartz, quartzite and chert. The junction of the Boulder Clay with the underlying Kesgrave Sands and Gravels is usually well defined; for example at Bradwell Pit [817216] (now landscaped) a sharp, planar contact was underlain by a hard carbonate-cemented gravel up to 15 cm thick, which probably formed by the reprecipitation of calcium carbonate contained in groundwaters.

Glacial Sand and Gravel This deposit occurs above or interbedded with the Boulder Clay and is present only

locally. The principal exposure occurs [872 294] to the south of White Colne and covers an area of about 1 km^2; smaller outcrops occur [820 294] near Greenstead Hall, Pattiswick Hall [815 241] and Oldhouse [898 291]. These outcrops are associated with poorly defined 'bench' features on the valley sides.

The deposit is typically a rather poorly sorted silty and clayey sand and gravel consisting mainly of flint with subordinate amounts of quartz and quartzite and locally small amounts of chalk.

Only four boreholes (SW 21, SE 15, SE 23 and SE 25) proved beds of Glacial Sand and Gravel within the Boulder Clay, all were less than 3 m thick.

Lacustrine Deposits Lacustrine Deposits occur [887 250] in only one relatively small (0.2 km^2) area to the south of Great Tey where shelly grey silty clay showing traces of fine lamination overlies Boulder Clay. These deposits are probably laterally equivalent to the lacustrine clays which are worked for bricks at Marks Tey approximately 2 km east of the resource sheet area.

Head Small occurrences of Head have been mapped on the lower valley slopes, notably on the southern side of the River Colne east of Bluebridge House [826 297] and on the eastern side of the River Blackwater, in the parish of Feering. In general these deposits consist of heterogeneous brown pebbly clay and silt derived by solifluxion from the adjacent Kesgrave Sands and Gravels and London Clay. Except for material proved in borehole SW 9, Head contains insufficient sand and gravel and is too thin to constitute a potentially workable resource.

River Terrace Deposits River terraces (approximately 2.3 km^2 in area) occur at three distinct levels in the district; all of these are present in the valley of the River Blackwater whereas the Third Terrace is absent in the Colne Valley.

In the valley of the River Blackwater, Third Terrace occupies the greatest area (about 0.5 km^2) of the terrace deposits; three boreholes (SE 14, SE 1 and SE 2) sited on the largest of these outcrops at [875 202] proved a mean thickness of 3.8 m of pebbly sand. Other terrace deposits in the same valley are generally too small to be considered individually (see Appendix B, paragraph 12) although they have been assessed collectively in resource block D. Borehole SE 28 sited on ground mapped as First/Second Terrace at [868 205] proved 1.5 m of 'clayey' gravel beneath 0.5 m of soil and clay. No mineral extraction has been recorded in this valley.

In the Colne Valley terrace deposits occur as isolated patches on both sides of the river downstream from its confluence with Bourne Brook. The single borehole sited on Second Terrace deposits (NE 20) proved 8.5 m of material graded as gravel.

Two boreholes (NE 21 and NE 4) sited on First Terrace deposits proved 3.9 m and 18.5 m of sand and gravel respectively. The thickness proved at the latter site is apparently anomalous and, as there is no other evidence within the resource sheet area for a gravel-filled buried channel, the sequence is interpreted (Ellison, in press) as the infill of a local glacial scour. Elsewhere in the region, similarly localised occurrences of sand and gravel that are thicker than might have been expected are interpreted as buried channels (Woodland, 1970, p. 256; Marks and Murray, 1981). Gravel extraction formerly occurred in the Colne Valley, notably around [875 285].

Alluvium Approximately 3.6 km^2 of Alluvium floors the main valleys and parts of their tributary valleys. In the Colne Valley these floodplain deposits vary from very soft silty clays to clayey fine sandy silt; they are generally pale yellowish grey and mottled orange in the uppermost 2 metres, becoming a darker shade of grey with depth. The maximum recorded thickness of the silty deposits is 2.6 m in a non-IMAU borehole [8485 2972] near the former station at Earls Colne.

In the valley of the River Blackwater, the alluvial deposits are generally of a similar lithology and thickness to those in the Colne Valley; exceptionally (for example in borehole SW 24), up to 9.5 m of soft sandy silt with shell fragments was proved.

A discontinuous basal sequence of sand and gravel (described here and in the borehole logs as 'sub-alluvial' gravels) occurs in both of the main river valleys and was formerly worked in the Colne Valley. However, borehole data relating to these lower deposits are either scarce or nucleated; for example, in the valley of the River Blackwater the boreholes are concentrated mostly around Coggeshall.

COMPOSITION OF THE SAND AND GRAVEL DEPOSITS

Potentially workable sand and gravel is present principally in the Kesgrave Sands and Gravels, the River Terrace Deposits and 'sub-alluvial' gravels; local patches of Glacial Sand and Gravel resting on the Boulder Clay and lenses within the Boulder Clay constitute a relatively minor resource. Of the 77.3 km^2 of ground assessed as mineral-bearing, 72.7 km^2 or 94 per cent is underlain by the Kesgrave Sands and Gravels, which here, for convenience, include small patches of Glacial Sands and Gravel. The remaining 4.6 km^2 or 6 per cent of the mineral-bearing area comprises River Terrace Deposits and 'sub-alluvial' gravels. Lithological and compositional variations within these deposits over the resource sheet area are shown in Figures 6 to 9.

Kesgrave Sands and Gravels IMAU boreholes show that the Kesgrave Sands and Gravels range from poorly sorted 'clayey' sand and gravel to well sorted sands and sandy gravels. In several boreholes a tripartite subdivision is suggested where a 'clayey' facies overlies a more extensive and predominantly 'sandy' and/or 'gravelly' facies. For example, in boreholes SW 15, SW 21 and NW 22, an analysis of the grading data from specific depths allow a threefold subdivision of the deposits (Figure 5).

The geographical distribution of the 'sandy' and 'gravelly' facies of the Kesgrave Sands and Gravels is illustrated in Figure 4. The facies are identified on the basis of an arbitrary grading limit of 15 per cent gravel, a value which on examination of the available data was considered to represent a natural break between the 'gravelly' and the 'sandy' parts of the formation.

The Kesgrave Sands and Gravels are typically yellowish brown to yellowish white, the pale hues (giving rise to the local name 'Essex White Ballast') reflecting the preponderance of white patinated flint, vein-quartz, and pale grey quartzites forming the gravel and the virtually uncontaminated quartzose 'silver' sand matrix. No quantitative assessment was made of the possibly deleterious amounts of white flint (Roeder, 1977; Figg, 1977).

Systematic petrographical analyses were not undertaken for this survey. However, a pebble count (Table 4)

Table 4 Petrographical analyses of gravel* from Bradwell Pit [817 216] (typical 'Essex White Ballast' material from the Kesgrave Sands and Gravels)

Composition	Material passing the 1½ in* sieve but held on the ¾ in sieve		Material passing the ¾ in* sieve but held on the ⅜ in sieve	
	No. of pebbles counted	Proportion of total no. of pebbles counted (%)	No. of pebbles counted	Proportion of total no. of pebbles counted (%)
Flint: angular to subangular	26	11	32	9
Flint: angular to subrounded	85	37	139	40
Flint: rounded to well rounded	73	31	37	11
Vein-quartz	18	8	64	19
Pale grey quartzite (bleached ?Bunter pebbles)	12	5	50	15
Pale greenish grey sandstone	13	6	16	5
Exotic material including igneous and metamorphic rocks	5	2	5	1

* Although Imperial sieves were used, the 1½ in sieve corresponds roughly to the 37.5 mm, the ¾ in to the 19 mm, and the ⅜ in to the 9.5 mm metric sieves.

on a sample collected from Bradwell Pit [817216] is possibly representative of the deposit as a whole. Material of cobble size (>64 mm) and larger comprise mostly irregularly shaped, generally rounded, black and brown flint, many considerably patinated; there are minor amounts of quartzite and rare septarian nodules derived from the London Clay, 'pudding stones' and 'Sarsens' from the Reading Beds (the latter formation cropping out to the north of the resource sheet area) and clasts of igneous and metamorphic rocks. The fine gravel (4 to 8-mm) and coarse sand (1 to 4-mm) fractions generally contain large amounts of angular to subangular flint with rounded to well-rounded vein-quartz and quartzites. The sandy fractions ($\frac{1}{16}$ to 4-mm) consist mainly of fine- to medium-grade, rounded quartz sand, in many places extremely micaceous. Typically, the sand is pale yellowish grey with sporadic seams (50 to 100-mm thick) of pale greenish grey silty clay, together with laminated sequences often including fossil mud-flakes. 'Stringers' of gravel were common within the sandy sequences formerly displayed at Bradwell Pit.

Grading data are available from 71 IMAU boreholes proving the Kesgrave Sands and Gravels. Of these, 39 per cent proved sandy gravel and 24 per cent proved gravel. The remaining 37 per cent of the boreholes proved material ranging over six grading categories; however, the greater proportion of this material was either pebbly sand (14 per cent) or 'clayey' sandy gravel (10 per cent) (see Figure 6). The overall mean grading for the deposit is fines 7 per cent, sand 60 per cent and gravel 33 per cent—a classification of sandy gravel. The fines range from 1 to 19 per cent (in boreholes NW 21 and NE 8, respectively), sand from 27 to 90 per cent (in boreholes NW 4 and SE 10, respectively) and gravel from 2 to 72 per cent (in boreholes SE 10 and NW 4, respectively).

The Glacial Sand and Gravel Grading data are available from nine IMAU boreholes proving this deposit; of these, 50 per cent proved material graded as gravel, 25 per cent proved sandy gravel and 25 per cent 'clayey' sandy gravel (see Figure 6) with an overall mean grading of 6 per cent fines, 43 per cent sand and 51 per cent gravel—a classification for the deposit of gravel.

The deposit is generally rather 'clayey', boreholes proving a range of fines from 2 to 17 per cent (boreholes NE 3 and SW 21, respectively). The sand ranged from 30 per cent in borehole NW 6 to 51 per cent in borehole NE 6 whereas gravel ranged from 34 to 66 per cent (in boreholes SW 21 and NE 3, respectively).

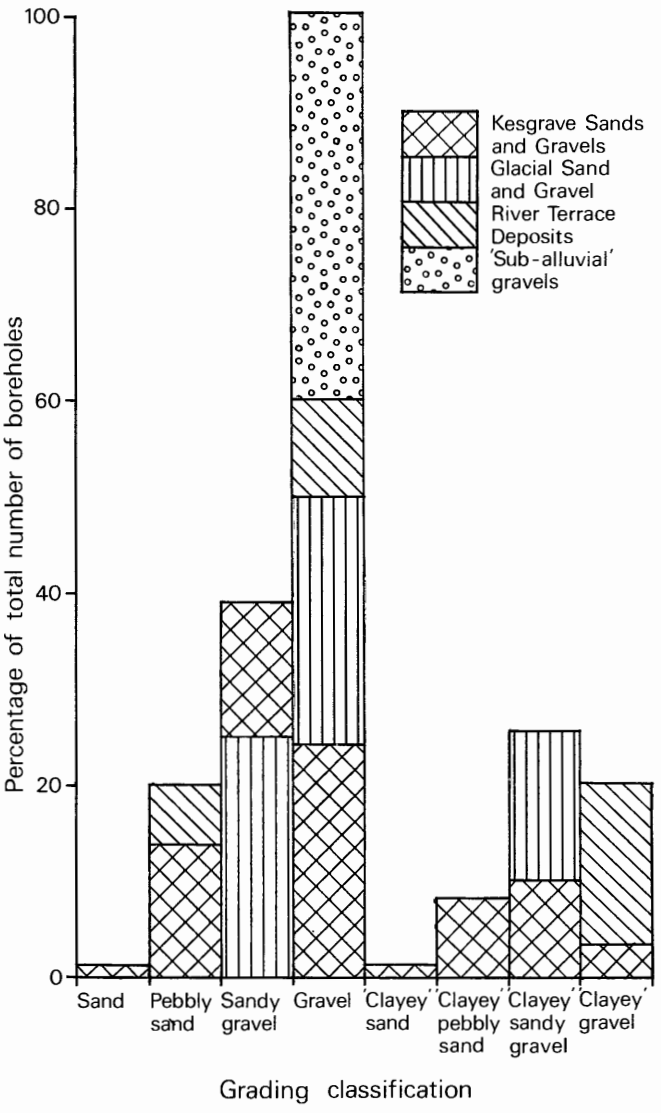


Figure 6 Percentage distribution of grading categories within the Drift lithologies.

No detailed compositional data are available but generally the gravel (4 to 64-mm) fraction comprises angular to subangular flint, with subsidiary proportions of quartzite and vein-quartz; characteristically, the deposit includes a large range of minor constituents such as chalk, limestone, derived fossils and occasionally shale fragments.

River Terrace Deposits and 'sub-alluvial' gravels These deposits are assessed collectively at the *inferred* level of assurance (see p. 1) in block D. Grading data from eight IMAU boreholes give a combined overall classification of gravel. Of the five boreholes sited on River Terrace Deposits three proved gravel, one proved pebbly sand and one proved 'clayey' gravel; the three boreholes recording 'sub-alluvial' gravels each proved mineral classified as gravel (Figure 6). The combined grading results show that the fines range from 1 to 10 per cent (in boreholes NE 4 and SE 28, respectively), the sand ranges from 25 to 77 per cent (in boreholes SW 24 and SE 14, respectively) and the gravel from 16 to 72 per cent (in boreholes SE 14 and SW 24, respectively).

The gravel consists chiefly of irregular, angular to subrounded and occasionally well rounded flint, some subrounded to well-rounded vein-quartz, quartzite and brown sandstone, and rarely, more exotic clasts such as limestone (for example in borehole NE 21). The fine gravel and coarse sand usually contain much patinated, angular to subangular flint. The sand is mainly of medium to coarse grade; in addition to abundant flint, it comprises subangular to subrounded grains of quartz. Although the fines content is variable, the deposit is usually 'clayey' near the surface and often contains thin silty seams. The 'sub-alluvial' gravels of the valley of the River Blackwater were generally 'contaminated' with black silty alluvium in the uppermost layers.

THE MAP

The sand and gravel resource map is folded into the pocket at the end of this report. The base map is the Ordnance Survey 1:25 000 Outline Edition which, together with the contours, is printed in grey. The geological lines and symbols are in black and the mineral resource information in shades of red.

Geological data The geological boundary lines shown are taken from the geological map of this district, which was surveyed recently at the scale of 1:10 560: they represent the best interpretation of the information available. However, it is inevitable, particularly with deposits (such as those represented in this resource sheet area) which change rapidly vertically and laterally, that local irregularities or discrepancies may occur. These are taken into account in the assessment of the resources (see Appendix B).

Borehole data, which include the stratigraphical relations, thicknesses and mean particle size distribution of the sand and gravel samples collected during the assessment, are also shown.

Because of changes in the stratigraphical interpretation of the region, particularly with reference to the glacial deposits (Table 2) some incompatibilities inevitably occur between TL 82 and the adjacent published sheets. Nevertheless, each published report is internally consistent and may be interpreted using Tables 2 and 3 as a guide.

Mineral resource information The mineral-bearing ground is subdivided into resource blocks and sub-blocks (see Appendix A). Within a resource block or sub-block the mineral is subdivided into areas where it is 'exposed' and areas where it is present in continuous (or almost continuous) and discontinuous spreads beneath overburden. The mineral is identified as 'exposed' where the overburden, commonly consisting only of soil and subsoil, averages less than 1.0 m 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 which did not find potentially workable sand and gravel and the distribution of barren boreholes within a block. The mineral is described as 'almost continuous' if it is present in 75 per cent or more of the boreholes in a resource block. The 'discontinuous' category is used where the number of boreholes proving mineral falls between 50 and 75 per cent.

Areas where bedrock crops out, where boreholes indicate absence of sand and gravel beneath cover and where sand and gravel beneath cover is interpreted to be not potentially workable are uncoloured on the map; where appropriate the relevant criterion is noted. In such areas it has been assumed that mineral is absent except in infrequent and relatively minor patches which can neither be outlined nor assessed quantitatively in the context of this survey.

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

Worked-out areas (sand and gravel) and made ground

The appropriate extent of known worked-out areas up to 1973 are shown including those which have been backfilled (see list of disused workings).

RESULTS

The mineral resources of the sheet are discussed in the resource block descriptions. Data used in the assessment calculations are given in Tables 6 to 10: a summary of these is presented in Table 5. Additional compositional data are shown in Figures 4 to 14.

Accuracy of the results Four of the five resource blocks or sub-blocks —A, B_1, B_2 and C have been assessed statistically at the *indicated* level (Appendix B). Within these resource blocks or sub-blocks the confidence limits at the symmetrical 95 per cent probability level range from 12 to 32 per cent (that is, it is probable that 19 times out of 20 the true volume lies within the given limits of the mean). However, the true values are more likely to be nearer the figures estimated than the limits. Where the mineral within a block or sub-block is subdivided, the limits for each subdivision are usually greater than

Table 5 The sand and gravel resources of TL 82

Resource block or sub-block	Area		Mean thickness		Volume of mineral			Mean grading percentage		
	Block	Mineral	Over-burden	Mineral		Limits at the 95% confidence level		Fines $-\frac{1}{16}$	Sand $+\frac{1}{16}-4$	Gravel $+4-64$
	km^2	km^2	m	m	10^6m^3	±%	$\pm10^6m^3$	mm	mm	mm
a. Assessment of blocks/sub-blocks A to C at the *indicated* level										
A [72]*	12.4	8.7	4.1	4.5	39	32	13	6	59	35
B_1[36]	43.7	35.3	4.9	7.3	258	12	31	7	67	26
B_2[21]	23.2	15.4	7.4	6.4	99	15	15	6	52	42
C [15]	14.4	13.3	6.4	6.6	88	28	25	5	49	46
Totals A–C [144]	93.7	72.7	5.6†	6.6†	480†	9†	43†	6†	60†	34†
b Assessment of block D at the *inferred* level										
D [29]	5.8	4.6	2.3	3.7	17			3	43	54

* Figures in square brackets show the number of sample points used in the assessment calculations.
† These totals are derived by weighting and rounding-off calculations.

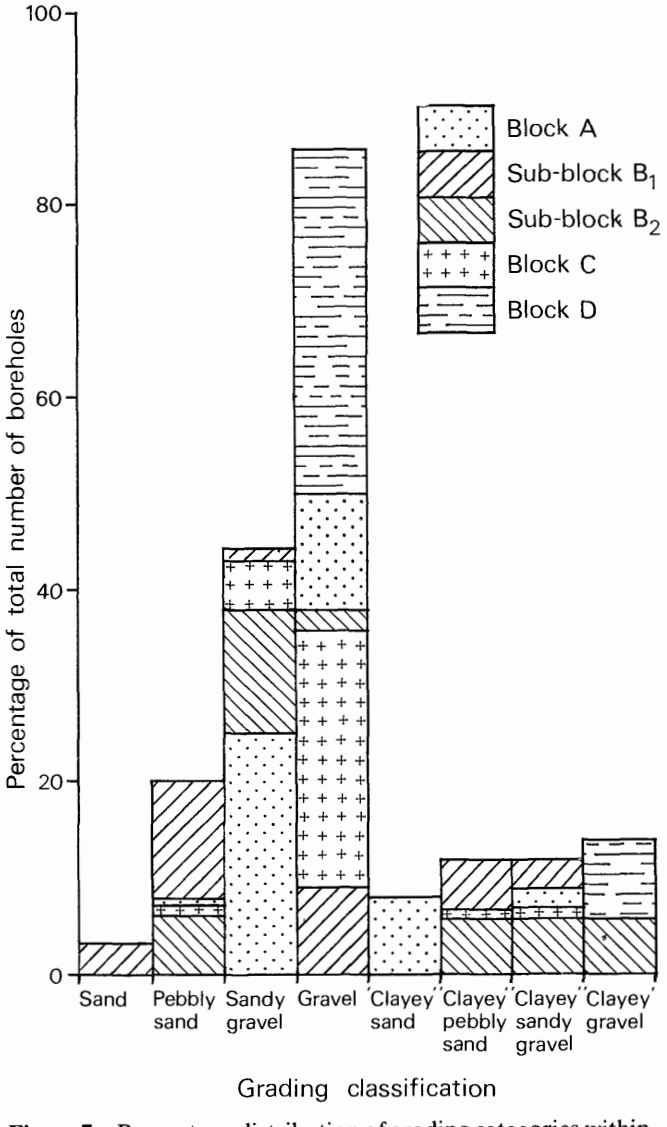


Figure 7 Percentage distribution of grading categories within the resource blocks.

for the whole, thereby reflecting the variable thickness of the respective deposits and the reduced number of sample points available for the calculation. Moreover, it is probable that in each block or sub-block approximately 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 the reserves in part of a block or sub-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 whole of the potentially workable sand and gravel associated within all of the blocks and sub-blocks in the resource sheet area. The total volume (480 million m^3) at the *indicated* level can be estimated to limits ± 9 per cent at the 95 per cent probability level by a calculation based on data from 144 sample points spread across the four resource blocks including the sub-blocks.

For block D the total volume at the *inferred* level of assessment is estimated at 17 million m^3 by a calculation based on data from 29 sample points; confidence limits are not quoted in this instance.

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 building and roads) on the use of the land for mineral working.

NOTES ON RESOURCE BLOCKS

The map is divided into four main resource blocks (A to D), the boundaries of which are determined by the two principal river valleys. Except for block D, which encompasses all river terrace, alluvial and 'sub-alluvial' deposits, the blocks comprise potentially workable Kesgrave Sands and Gravels overlain by Boulder Clay. Locally, Glacial Sand and Gravel occurs both at outcrop and within the till cover.

Taken together, the Kesgrave Sands and Gravels and Glacial Sand and Gravel underlie 72.7 km^2 of potentially mineral-bearing land of which, 15.1 km^2 or 21 per cent is shown as 'exposed' on the resource map; the remaining 57.6 km^2 or 79 per cent is shown as 'continuous or almost continuous spreads of mineral beneath overburden'. Block D contains sand and gravel assessed either as 'exposed mineral' or as 'discontinuous spreads of mineral beneath overburden'.

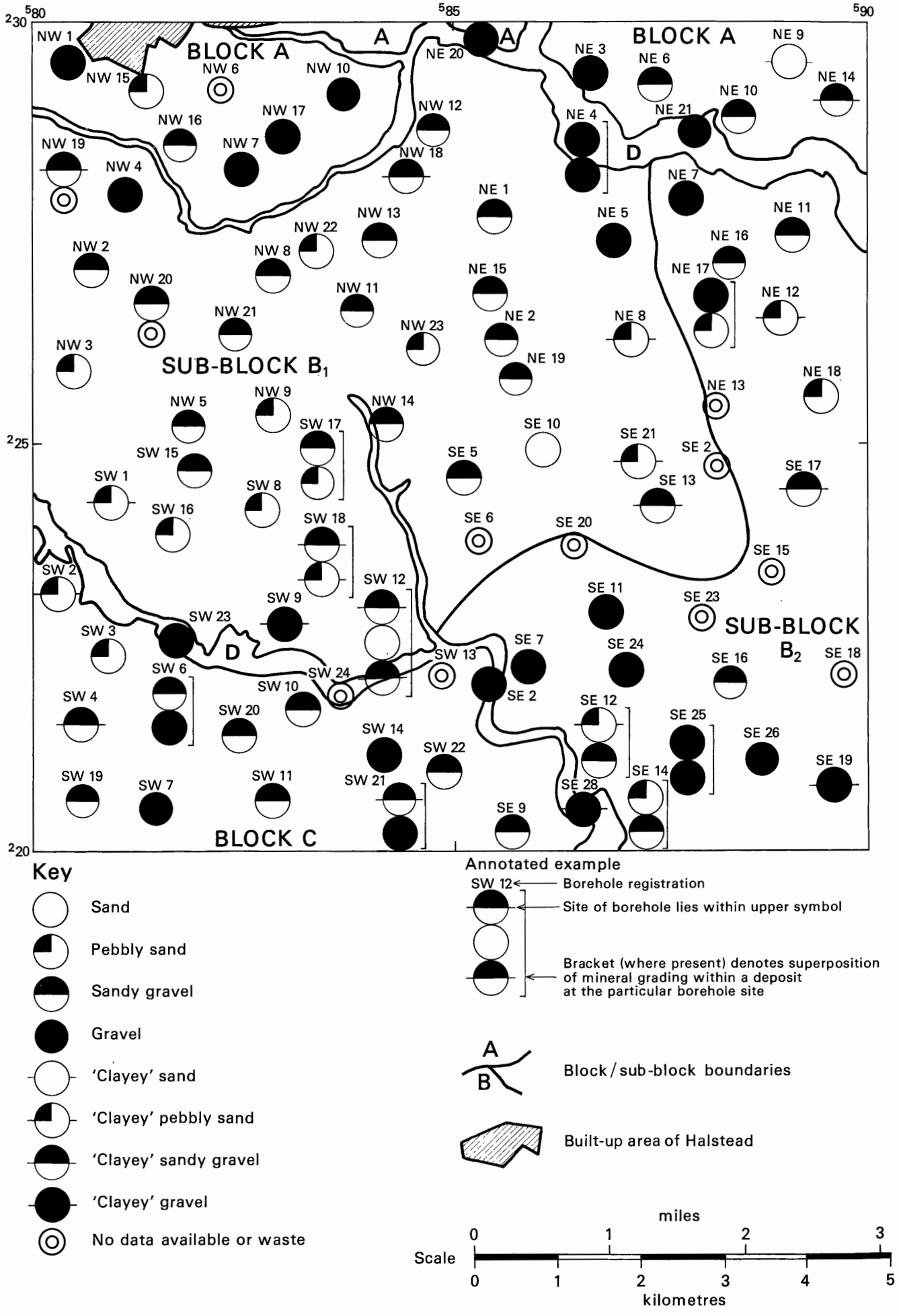


Figure 8 Mean grading characteristics of mineral proved in IMAU boreholes.

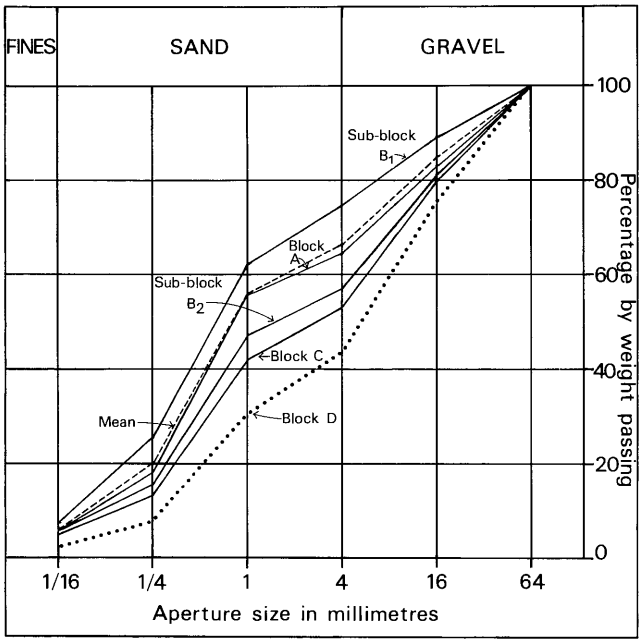


Figure 9 Mean particle-size distribution of the mineral in resource blocks A to D.

Block A

This block comprises four disconnected areas lying north of, and in part separated by, the River Colne and Bourne Brook. The block is 12.4 km² in area, of which 8.7 km² or 70 per cent is considered to be mineral-bearing. The built-up area of Halstead has been excluded.

Erosion has exposed the London Clay and the Kesgrave Sands and Gravels on the flanks of the river valleys where the base of the latter formation may be partly obscured by Boulder Clay or fan-shaped (but less extensive) spreads of Head. Above the valleys, Boulder Clay overlies much of the mineral-bearing ground which includes four outcrops [822 295, 899 291, 865 295 and 874 295] mapped as Glacial Sand and Gravel. Of these, only the first is regarded as being not potentially workable on the basis of borehole data. Mineral extraction has been limited to small-scale excavations, usually for farm track ballast, for example, at [8780 2908 and 8265 2905]. Inferred boundaries are shown at [841 287 and 857 299] where the extent of mineral beneath Head is uncertain.

The assessment is based on data from 12 IMAU boreholes (of which two did not prove mineral) and 60 others (59 of which are held on a commercial-in-confidence basis). In boreholes NW 6 and NW 7, the sand and gravel did not meet the criteria **a** or **b** of the definition of mineral (see Introduction) but nevertheless the data were used in the calculation of the resources.

The recorded thickness of overburden ranges from 0.4 to 11.6 m (in boreholes NE 3 and NW 1, respectively) and it has a mean thickness of 4.1 m. The mean proved thickness of mineral (of which, 41 per cent is considered to be exposed) is 4.5 m with a range of 0.6 to 7.3 m (in boreholes NW 6 and NW 16, respectively)—see Table 6. The mineral consists mainly of material grading as 'gravel' (proved in six boreholes); however, the range includes sandy gravel (3 boreholes) 'clayey' sandy gravel (1 borehole), pebbly sand (1 borehole) and 'clayey' sand (1 borehole)—see Table 6 and Figure 10.

The mean grading for the block is gravel 35 per cent, sand 59 per cent and fines 6 per cent—with an overall classification as sandy gravel. The volume of mineral is estimated to be 39 million m³ ± 32 per cent (±13 million m³) at the 95 per cent probability level.

Block B

Block B, the largest of the blocks (with an area of 66.9 km²) occupies the central plateau area between the valleys of the Rivers Colne and Blackwater. Kesgrave Sands and Gravels assessed as mineral form an almost continuous sheet (covering 50.7 km²) beneath Boulder Clay; the 'barren' area in the eastern part of the block results from the ratio overburden to mineral thickness exceeding 3:1. In order to make block B commensurate with the 'ideal' size of a resource block (see Appendix A), a median resource boundary line has been drawn through this area, thereby dividing the block into two sub-blocks (B_1 and B_2). Additional inferred boundaries at [801 270, 830 230 and 842 231] are also shown where the extent of mineral beneath Boulder Clay is uncertain.

Table 6 Block A: data from IMAU boreholes

Borehole No.	Recorded thickness		Mean grading percentage						Grading Classification
	Mineral m	Overburden m	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}-1$ mm	Coarse sand $+1-4$ mm	Fine gravel $+4-16$ mm	Coarse gravel $+16$ mm	
NW 1	5.9	11.6	2	11	28	10	23	26	Gravel
NW 6	(0.6)†	4.9	4	2	15	13	30	36	Gravel
NW 7	(1.0)	3.5	1	2	11	15	44	27	Gravel
NW 10	1.8	0.5	3	2	21	14	24	36	Gravel
NW 15	6.4	8.6	6	33	44	3	10	4	Pebbly sand
NW 16	7.3	8.5	3	4	56	12	19	6	Sandy gravel
NW 17	3.3	1.4	7	5	29	12	25	22	Gravel
NE 3	4.6	0.4	2	4	18	10	26	40	Gravel
NE 6	3.1	0.8	3	4	29	18	28	18	Sandy gravel
NE 9	7.2	2.1	15	18	59	6	1	1	'Clayey' sand
NE 10	3.6	0.6	5	10	28	12	25	20	Sandy gravel
NE 14	2.1	1.9	15	12	24	8	18	23	'Clayey' sandy gravel
Mean	4.5*	4.1*	6	12	37	10	18	17	Sandy gravel

* Data based on 72 boreholes.

† Brackets show that the sand and gravel in the individual borehole does not meet certain of the limiting physical criteria for the definition of mineral set out in the Introduction of this report.

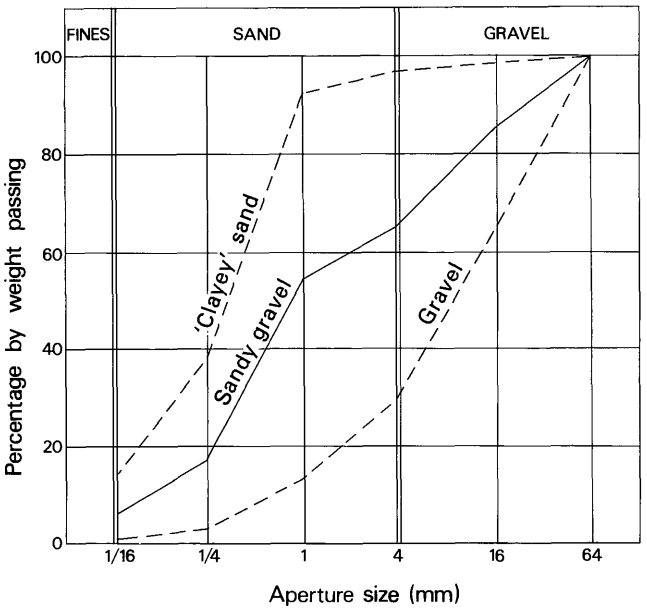


Figure 10 Grading characteristics of the resources within block A: the continuous line represents the weighted mean grading of the resource; the broken lines denote the envelope containing the mean grading curves for individual boreholes proving mineral.

The first of these areas is delineated on evidence from the adjoining resource sheet (Clarke and Ambrose, 1975). Gravel has been worked locally at [8062 2846, 8415 2360 and 8545 2325].

Sub-block B_1 This, the larger of the two sub-blocks, has an area of 43.7 km² of which 35.3 km² or 80.7 per cent is considered to be mineral-bearing. The assessment is based on 36 IMAU boreholes (of which three—NW 21, SE 6 and SE 22, proved non-mineral) and seven non-IMAU boreholes. In borehole NW 21, the sand and gravel did not meet the criteria **a** and **b** of the definition of mineral but nevertheless the data have been included in the resource calculations. Borehole SW 9, sited on Head, proved sand and gravel assessed as mineral. However, field evidence from other occurrences of Head suggest that this deposit is usually a heterogeneous pebbly clay: thus, these data are not included in the resource assessment. Glacial Sand and Gravel overlying Boulder Clay is mapped at [802 238] and is considered to be 'exposed mineral'.

The overburden ranges in thickness from 0.3 to 10.0 m (boreholes SW 12 and NE 15 respectively) and has a mean thickness of 4.9 m. The proven mineral (of which 22 per cent is considered to be 'exposed') ranges from 2.4 to 11.8 m thick (boreholes NW 4 and SW 16) and has a mean thickness of 7.3 m (Table 7).

Of the IMAU boreholes proving mineral, 15 proved sandy gravel, seven proved pebbly sand, four proved 'clayey' sandy gravel, four proved 'clayey' pebbly sand, two proved gravel and one proved sand (Table 7 and Figure 11). The mean grading data show no marked trends over the sub-block (Figure 8). However, using an arbitrary grading limit of 15 per cent gravel, a relatively sandy and usually basal facies may be distinguished having an approximate alignment south-west to north-east across the sub-block (see Composition of Sand and Gravel and Figure 4).

The mean grading for the sub-block is gravel 26 per cent, sand 67 per cent and fines 7 per cent and hence, the mineral is classified overall as sandy gravel. The volume of mineral is estimated at 258 million m³ ± 12 per cent (± 31 million m³) at the 95 per cent probability level.

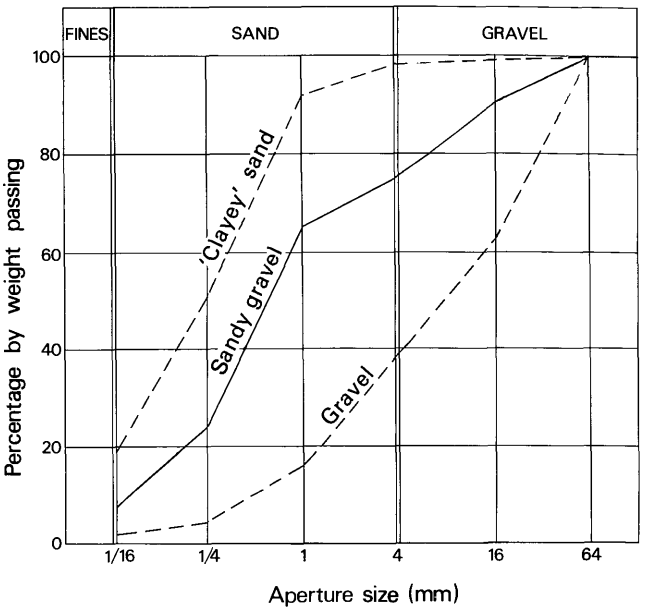


Figure 11 Grading characteristics of the resources within sub-block B_1 (for explanation, see Figure 10).

Sub-block B_2 Sub-block B_2, the easternmost part of block B, is 23.2 km² in area of which 15.4 km² or 66.3 per cent is considered to be mineral bearing. The resource is confined to three discrete areas each delineated by inferred boundaries—the limits of the intervening barren ground are based on borehole data and information from adjoining resource sheets (Ambrose, 1973, 1974; Haggard, 1972).

An area of sand and gravel at [875 205] mapped as Third Terrace is included in the resource calculations for this sub-block. Boreholes SE24, SE25, SE12, SE14 and three non-IMAU wells, sited on either the River Terrace Deposits or the glacial deposits to the north, prove an 'upper' and 'lower' mineral separated by waste. As the mineral deposits are similar in composition they have been considered together for the purposes of assessment.

The assessment is based on 21 IMAU boreholes (of which five did not prove mineral) and ten others. The overburden ranges from 0.3 to 14.1 m in thickness (in boreholes NE 7 and SE 11, respectively) and has a mean thickness of 7.4 m. The mineral of which only 8 per cent is exposed ranges from 1.9 to 12.3 m in thickness, these values being recorded from a commercial borehole and IMAU borehole SE 14, respectively; it has a mean thickness of 6.4 m (Table 8).

The mineral comprises material graded either as gravel or sandy gravel (each classification proved in six boreholes) with the remaining four boreholes, for which grading is available, proving a range from 'clayey' gravel to pebbly sand (Table 8 and Figure 12). Mineral classified as gravel is concentrated in the southern half of the sub-block; elsewhere, the grading data suggest that the deposit is rather variable (Figure 8). However, as with sub-block B_1, if an arbitrary grading limit of 15 per cent gravel is applied to the data, a sandy and usually basal facies may be distinguished, in this instance situated mainly in the northern part of the sub-block (see Composition of Sand and Gravel and Figure 4).

Table 7 Sub-block B_1: data from IMAU boreholes

Borehole No.	Recorded thickness		Mean grading percentage						Grading Classification
	Mineral m	Overburden m	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}-1$ mm	Coarse sand $+1-4$ mm	Fine gravel $+4-16$ mm	Coarse gravel $+16$ mm	
NW 2	6.8	8.2	1	12	37	15	17	18	Sandy gravel
NW 3	9.4	5.4	4	17	51	15	9	4	Pebbly sand
NW 4	2.4	2.1	1	3	12	12	34	38	Gravel
NW 5	5.0	5.4	5	12	29	16	23	15	Sandy gravel
NW 8	4.5	3.6	2	13	38	12	18	17	Sandy gravel
NW 9	8.9	6.2	9	22	43	8	9	9	Pebbly sand
NW 11	10.1	6.1	7	15	33	10	17	18	Sandy gravel
NW 12	5.6	1.6	5	11	32	12	19	21	Sandy gravel
NW 13	8.3	8.4	4	7	31	15	25	18	Sandy gravel
NW 14	5.5	2.3	7	10	45	12	15	11	Sandy gravel
NW 18	6.6	1.0	13	10	32	12	21	12	'Clayey' sandy gravel
NW 19	3.2†	1.0	13	11	44	5	13	14	'Clayey' sandy gravel
NW 20	7.3‡	2.7	8	21	35	12	15	9	Sandy gravel
NW 21	(2.9)§	9.2	1	15	34	22	19	9	Sandy gravel
NW 22	5.8	5.1	4	17	49	7	15	8	Pebbly sand
NW 23	6.2	7.6	3	12	59	10	9	7	Pebbly sand
NE 1	9.1	5.5	7	4	42	11	17	19	Sandy gravel
NE 2	4.9	9.1	2	13	38	12	18	17	Sandy gravel
NE 5	5.3	4.3	5	4	19	10	29	33	Gravel
NE 8	7.9	9.8	19	15	39	11	10	6	'Clayey' pebbly sand
NE 15	6.2	10.0	2	9	52	8	16	13	Sandy gravel
NE 19	7.9	5.6	4	5	36	19	25	11	Sandy gravel
SW 1	7.9	5.8	11	22	41	10	7	9	'Clayey' pebbly sand
SW 8	8.1	0.6	8	20	43	19	7	3	Pebbly sand
SW 9	1.6‖	2.4	11	4	17	11	25	32	'Clayey' gravel
SW 12	9.2**	0.3	13	21	32	7	13	14	'Clayey' sandy gravel
SW 15	10.7	3.7	9	14	42	9	18	8	Sandy gravel
SW 16	11.8	5.0	8	24	48	11	7	2	Pebbly sand
SW 17	11.7	6.5	7	26	41	10	11	5	Pebbly sand
SW 18	5.9††	3.8	15	28	29	7	12	9	'Clayey' pebbly sand
SE 5	9.9	6.1	2	25	30	16	16	11	Sandy gravel
SE 6	Non-mineral								
SE 10	8.2	6.7	8	44	41	5	1	1	Sand
SE 13	7.0	5.5	11	15	20	12	27	15	'Clayey' sandy gravel
SE 21	8.0	7.0	11	17	60	4	3	5	'Clayey' pebbly sand
SE 22	1.3‖	4.0	8	6	21	9	23	33	Gravel
Mean	7.3*	4.9*	7	17	39	11	15	11	Sandy gravel

* Data based on 36 Boreholes.
† Grading data available for upper 1.2 m only: mineral divided by 0.3 m waste.
‡ Grading data available for upper 6.4 m only: mineral divided by 0.3 m waste.
§ Brackets show that the sand and gravel in the individual borehole does not meet certain of the limiting physical criteria for the definition of mineral set out in the Introduction of this report.
‖ Data not used in sub-block calculations.
** Mineral divided by 2.4 m and 2.1 m waste, respectively.
†† Mineral devided by 1.0 m waste.

The mean grading of the mineral for this sub-block is gravel 42 per cent, sand 52 per cent and fines 6 per cent giving an overall classification of sandy gravel. The volume of mineral is estimated at 99 million m^3 ± 15 per cent (± 15 million m^3) at the 95 per cent probability level.

Block C

Block C occupies the ground lying south of the River Blackwater. It is 14.4 km^2 in area of which 13.3 km^2 or 92 per cent is considered to be mineral-bearing. Sand and gravel has been extracted principally from two pits; the smaller of these lies just west of Bradwell [804 230] and the larger (and more recently worked) at [817 216] near Gosling's Farm. Compositional data from the latter are given in Table 4 (see also Composition of Sand and Gravel).

The assessment is based on 14 IMAU boreholes and one other. The sand and gravel proved in borehole SW 13 does not meet the criteria **a** or **b** of the definition of mineral (see p. 1) but nevertheless the data have been used in the calculation of the resources.

The proven thicknesses of overburden range from 0.9 to 12.0 m (in boreholes SW 4 and SW 19, respectively) and the mean thickness is 6.4 m. Mineral (of which, 18 per cent is considered to be 'exposed') has a thickness range of 0.5 to 11.4 m, these values being recorded in boreholes SW 13 and SW 6, respectively, and a mean thickness of 6.6 m (Table 9).

Table 8 Sub-block B_2: data from IMAU boreholes

Borehole No.	Recorded thickness		Mean grading percentage						Grading Classification
	Mineral m	Overburden m	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}-1$ mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm	
NE 7	3.3	0.3	5	7	23	10	29	26	Gravel
NE 11	4.4	1.2	4	9	36	12	18	21	Sandy gravel
NE 12	6.4	12.2	17	12	53	12	4	2	'Clayey' pebbly sand
NE 13	Non-mineral								
NE 16	7.2	11.5	6	7	36	13	22	16	Sandy gravel
NE 17	8.0†	7.3	9	15	44	11	15	6	Sandy gravel
NE 18	3.5	4.5	8	20	35	16	13	8	Pebbly sand
SE 7	8.0	9.1	4	4	21	10	32	29	Gravel
SE 11	6.8	14.1	3	2	17	10	33	35	Gravel
SE 12	7.3†	3.1	6	15	33	9	22	15	Sandy gravel
SE 14	12.3‡	1.2	4	7	37	14	21	17	Sandy gravel
SE 15	Non-Mineral								
SE 16	5.8	9.4	4	20	44	7	14	11	Sandy gravel
SE 17	5.2	11.3	17	21	18	6	17	21	'Clayey' sandy gravel
SE 18	Non-mineral								
SE 19	7.6	4.6	10	12	22	10	25	21	'Clayey' gravel
SE 20	Non-mineral								
SE 23	3.0§	14.8	8	5	21	13	33	20	Gravel
SE 24	7.7	14.0	3	5	25	12	31	24	Gravel
SE 25	4.1‖	6.2	5	4	20	12	34	25	Gravel
SE 26	5.7	8.8	2	7	25	11	29	26	Gravel
Mean	6.4*	7.4*	6	10	31	11	23	19	Sandy gravel

* Data based on 21 boreholes.
† Mineral divided by 0.9 m waste
‡ Mineral divided by 1.8 m waste.
§ Data not used in sub-block calculations.
‖ Mineral divided by 1.3 m waste.

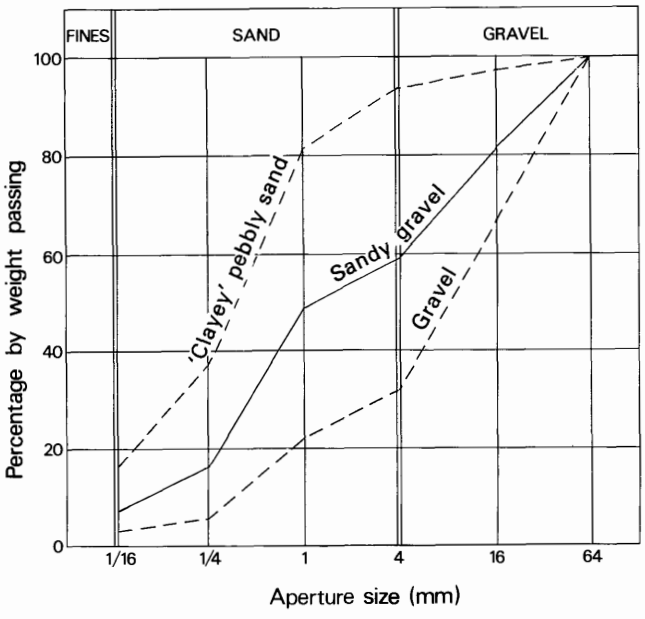


Figure 12 Grading characteristics of the resources within sub-block B_2: the continuous line represents the weighted mean grading of the resource; the broken lines denote the envelope containing the mean grading curves for individual boreholes proving mineral.

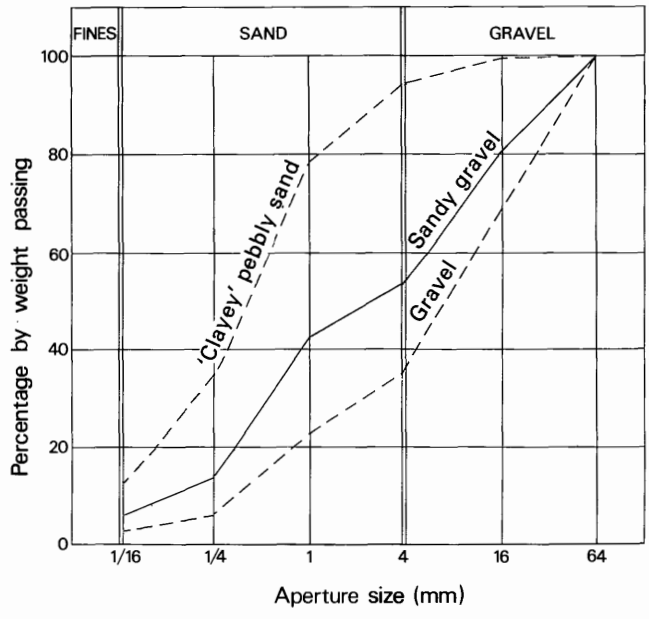


Figure 13 Grading characteristics of the resources within block C (for explanation, see Figure 12).

Six of the IMAU boreholes proved mineral classified as sandy gravel, five proved gravel and the remaining three boreholes proved a range from 'clayey' sandy gravel to 'clayey' pebbly sand to pebbly sand, respectively (Table 9 and Figure 13).

The mean grading of the mineral is gravel 46 per cent, sand 49 per cent and fines 5 per cent, an overall classification for the block of sandy gravel. The volume is estimated as 88 million m^3 ± 28 per cent (± 25 million m^3) at the 95 per cent probability level.

Block D

This block includes the fluvial deposits of the two main river valleys (i.e. of the Rivers Colne and Blackwater) together with their respective tributary valleys. The

Table 9 Block C: data from IMAU boreholes

Borehole No.	Recorded thickness		Mean grading percentage						Grading Classification
	Mineral m	Overburden m	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}-1$ mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm	
SW 2	4.3	2.1	10	25	41	18	5	1	'Clayey' pebbly sand
SW 3	3.4	1.2	7	15	56	8	6	8	Pebbly sand
SW 4	7.0	0.9	12	7	36	18	18	9	'Clayey' sandy gravel
SW 6	11.4†	8.2	3	5	15	14	35	28	Gravel
SW 7	4.6	8.8	6	8	20	11	28	27	Gravel
SW 10	6.5	9.1	3	10	29	10	23	25	Sandy gravel
SW 11	8.2	9.8	7	11	29	10	25	18	Sandy gravel
SW 13	(0.5)‡	6.9	2	4	19	19	36	20	Gravel
SW 14	6.2	9.4	6	5	18	11	28	32	Gravel
SW 19	5.9	12.0	3	6	29	14	33	15	Sandy gravel
SW 20	11.2	6.0	2	6	34	13	28	17	Sandy gravel
SW 21	11.3§	3.0	5	6	24	8	27	30	Gravel
SW 22	6.1	10.3	8	7	27	13	34	11	Sandy gravel
SE 9	6.4	8.5	5	13	30	9	21	22	Sandy gravel
Mean	6.6*	6.4*	5	9	28	12	26	20	Sandy gravel

* Data based on 15 boreholes.
† Mineral divided by 0.4 m waste.
‡ Brackets show that the sand and gravel in the individual borehole does not meet certain of the limiting physical criteria of the definition of mineral set out in the Introduction of this report.
§ Mineral divided by 4.4 m waste.

total area of this resource block is 5.8 km² of which, 4.6 km² or 79 per cent is considered to be mineral-bearing.

Potentially workable sand and gravel forms river terraces one to three and 'discontinuous spreads' are concealed beneath the Alluvium as 'sub-alluvial' gravels (see Geology section). Inferred boundaries at [848 227, 843 296 and 845 295] delineating mineral-bearing ground from barren areas are drawn on the basis of non-IMAU borehole data.

Sand and gravel extraction has taken place in the Colne Valley, principally around [875 285] where the mineral has been worked from both the River Terrace Deposits and the 'sub-alluvial' gravels. No workings are known in the valley of the River Blackwater.

An *inferred* assessment is offered for this block (combining the River Terrace Deposits and 'sub-alluvial' gravels) as the data points (particularly the non-IMAU information) are concentrated in a small area (for example around Coggeshall), so that an unbiased statistical assessment is not feasible. The individual and combined details for each valley are given below:

The Colne Valley This part of the resource block covers an area of 3.4 km² of which 2.4 km² or 71 per cent is considered to be mineral-bearing. The assessment of mineral is based on three IMAU boreholes and ten others. Overburden, comprising thin clayey soil overlying alluvial silts and clays, ranges in thickness from 0.1 to 2.6 m (values recorded in non-IMAU boreholes) and has a mean thickness of 1.2 m. Potentially workable sand and gravel ranges in thickness from 1.2 to 18.5 m (in a non-IMAU borehole and borehole NE 4, respectively) and has a calculated mean thickness of 5.5 m. The 'lower' 13.5 m of sand and gravel recorded in borehole NE 4 is interpreted (Ellison, in press) as the infill of a localised glacial scour (see also Geology section).

The mineral in the valley grades as gravel. The *inferred* volume is 13 million m³.

The valley of the River Blackwater The part of the resource block for this valley (see Topography section) occupies 2.4 km² of which 2.2 km² or 92 per cent is considered to be mineral-bearing. The assessment is based on four IMAU boreholes and 14 others. Sand and gravel proved in borehole SW 24 does not meet the criteria **a** or **b** of the definition of mineral but nevertheless, the data have been used in the assessment of resources.

Overburden, comprising mainly alluvial silts and clays, ranges from 0.5 to 9.5 m thick (in boreholes SE 28 and SW 24, respectively) and has a mean thickness of 3.5 m. Proved mineral ranges from 0.3 to 3.8 m thick (values recorded in non-IMAU boreholes) and has a mean thickness of 1.9 m.

The mineral classification (based on limited grading data) ranges from gravel to 'clayey' gravel. The *inferred* volume of mineral is 4 million m³.

Combined results The assessment for the block as a whole is based on seven IMAU boreholes and 24 others. The recorded thickness of overburden ranges from 0.1 to 9.5 m (in a non-IMAU borehole and borehole SW 24, respectively); it has a mean thickness of 2.3 m. The thickness of mineral ranges from 0.3 to 18.5 m, these values being recorded in a non-IMAU borehole and borehole NE 4, respectively, the mean thickness, based on 29 data points, being 3.7 m (Table 10).

The mean grading data for individual boreholes indicate a classification range from 'clayey' gravel to gravel (Figure 14). The mean grading for the block is gravel 54 per cent, sand 43 per cent and fines 3 per cent, an overall classification of gravel. The *inferred* volume of mineral in the block is 17 million m³.

CONCLUSION

The resource sheet area centred on Coggeshall is rural and forms part of the gently undulating north Essex and West Suffolk plateau. Fieldwork for the sand and gravel survey was conducted from 1970 to 1973 when 90 bore-

Table 10 Block D: data from IMAU boreholes

Borehole No.	Recorded thickness		Mean grading percentage						Grading Classification
	Mineral m	Overburden m	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}-1$ mm	Coarse sand +1–4 mm	Fine gravel +4–16 mm	Coarse gravel +16 mm	
NE 4	18.5†	1.6	1	3	23	20	29	24	Gravel
NE 20	8.5	0.8	4	4	28	13	31	20	Gravel
NE 21	3.9	1.3	6	5	21	10	29	29	Gravel
SW 23	1.5	1.9	7	3	16	13	37	24	Gravel
SW 24	(0.5)‡	9.5	3	1	12	12	39	33	Gravel
SE 27	3.5	4.0	5	2	21	12	37	23	Gravel
SE 28	1.5	0.5	10	8	21	10	29	22	'Clayey' gravel
Mean	3.7*	2.3*	3	4	23	16	31	23	Gravel

* Data based on 29 boreholes.
† Mineral divided by 0.8 m waste.
‡ Brackets show that the sand and gravel in the individual borehole does not meet certain of the limiting physical criteria for the definition of mineral set out in the Introduction of this report.

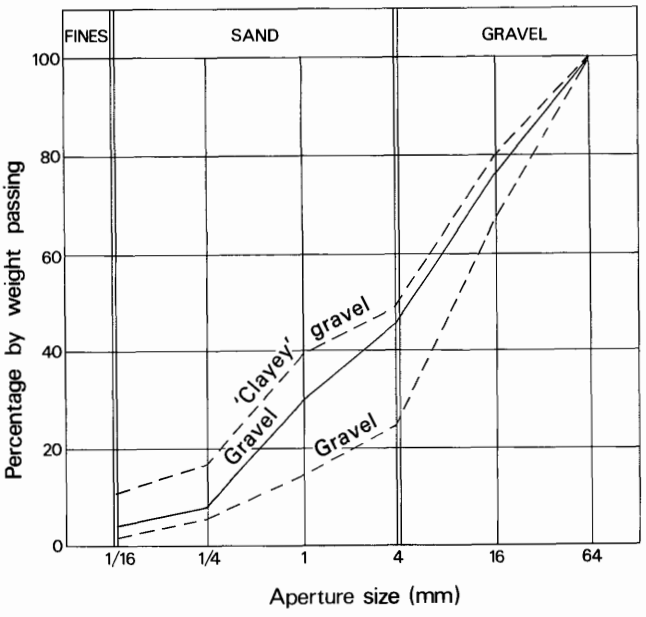


Figure 14 Grading characteristics of the resources within block D: the continuous line represents the weighted mean grading of the resource; the broken lines denote the envelope containing the mean grading curves for individual boreholes proving mineral.

holes were drilled into the Drift deposits which blanket much of the area.

The assessment of resources has shown that the most widespread (approximately 73 km²) aggregate-bearing deposits are the Pleistocene Kesgrave Sands and Gravels; these occur beneath the Boulder Clay of the plateau and are exposed only along the flanks of the river valleys. The deposit is thickest (generally greater than 6 m with a maximum of 11.8 m) in the western, central and south-western parts of the resource sheet area and thinnest in the east. Gravel extraction has centred around Bradwell in the south.

The deposit comprises well-sorted, cross-bedded sandy gravels commonly yellowish brown in colour but occasionally yellowish white where patinated flint, vein-quartz and quartzites are in abundance—the 'Essex White Ballast'. Locally, the lower part of the deposit comprises finely laminated, cross-bedded, well-sorted medium-grained sands with thin interbeds of silty clay. The highest beds are frequently relatively poorly sorted and clayey.

Because the survey preceded the work of Rose, Allen and Hey (1976) who proposed a refined stratigraphy for the Middle Pleistocene no attempt has been made to adopt the scheme systematically.

Less extensive, but potentially workable sand and gravel is present in the River Terrace Deposits and 'sub-alluvial' gravels of the Rivers Blackwater and Colne. The former deposits (2.3 km² in area) occur at three altimetric levels. In the valley of the River Blackwater, the Third Terrace occupies the greatest area and has a mean proven thickness of 3.8 m of pebbly sand. Other terrace deposits in the same valley are not sufficiently extensive to be considered a resource in the context of a regional survey. In the Colne Valley, First Terrace deposits, mainly of gravel and up to 18.5 m thick are likely to provide the most attractive prospects of the valley gravels. Gravel extraction has occurred in this valley, principally south-east of White Colne Station [871 291].

The 'sub-alluvial' gravels in these valleys comprise a discontinuous sequence composed mainly of angular to rounded flint with some vein-quartz, quartzite and sandstone gravel.

The resources of greatest potential in this area are likely to be found in the glacial and fluvial deposits on the flanks and bottoms of the river valleys where the mineral is exposed and the overburden is thinnest and where sand and gravel extraction has concentrated in the past.

LIST OF DISUSED WORKINGS (UP TO 1973)

Locality	*Grid reference*	*Approximate area (km²)*	*Geological deposit*
Colne Valley	875 285	0.3	River Terrace Deposits plus 'sub-alluvial' gravel
White Colne	878 291	0.1	Glacial Sand and Gravel
Bradwell (village)	804 230	0.1	Kesgrave Sands and Gravels
Bradwell Pit	817 216	0.2	Kesgrave Sands and Gravels
Coggeshall (Fabian's Farm)	855 233	0.1	Kesgrave Sands and Gravels

REFERENCES

ALLEN, V. T. 1936. Terminology of medium-grained sediments. *Rep. Natl. Res. Counc. Washington, 1935–1936, App. 1, Rep. Comm. Sedimentat.*, 18–47.

AMBROSE, J. D. 1973. The sand and gravel resources of the country around Layer Breton and Tolleshunt D'Arcy, Essex. Description of 1:25 000 resource sheet TL 91 and part of TL 90. *Rep. Inst. Geol. Sci.*, No. 73/8. 34 pp.

— 1974. The sand and gravel resources of the country west of Colchester, Essex. Description of 1:25 000 resource sheet TL 92. *Rep. Inst. Geol. Sci.*, No. 74/6. 68 pp.

ARCHER, A. A. 1969. Background and problems of an assessment of sand and gravel resources in the United Kingdom. In *Proc. 9th Commonw. Min. Metall. Congr., 1969*, Vol. 2, Mining and petroleum geology, 495–508. (London: Institution of Mining and Metallurgy.)

— 1970a. Standardisation of the size classification of naturally occurring particles. *Géotechnique*, Vol. 20, 103–107.

— 1970b. Making the most of metrication. *Quarry Managers' J.*, Vol. 54, No. 6, 223–227.

ATTERBERG, A. 1905. Die rationelle Klassifikation der Sande und Kiese. *Chem. Ztg.*, Vol. 29, 195–198.

BIOMETRIKA 1962. *Tables for statisticians*, Vol. 1, 2nd edition. (Cambridge University Press.)

BRISTOW, C. R. and COX, F. C. 1973. The Gipping Till: a reappraisal of East Anglian glacial stratigraphy. *Q. J. Geol. Soc. London*, Vol. 129, 1–37.

BRITISH STANDARD 1377 1967. *Methods of testing soils for civil engineering purposes.* (London: British Standard Institution.) 233 pp.

BUREAU OF MINES AND GEOLOGICAL SURVEY 1948. *Mineral Resources of the United States.* (Washington DC: Public Affairs Press.) 14–17.

CLAYTON, K. M. 1957. Some aspects of the glacial deposits of Essex. *Proc. Geol. Assoc.*, Vol. 68, 1–21.

CLARKE, M. R. and AMBROSE, J. D. 1975. The sand and gravel resources of the country around Braintree, Essex. Description of 1:25 000 resource sheet TL 72. *Miner. Assess. Rep. Inst. Geol. Sci.*, No. 16. 111 pp.

DALTON, W. H. 1880. The geology of the neighbourhood of Colchester. *Mem. Geol. Surv. G. B.*, (Old Series Memoir 48).

EATON, C. H. 1973. The sand and gravel resources of the country around Terling, Essex. Description of 1:25 000 resource sheet TL 71. *Rep. Inst. Geol. Sci.*, No. 73/5. 120 pp.

ELLISON, R. A. *In press.* The geology of the country around Braintree. *Mem. Geol. Surv. G. B.*

FIGG, J. 1977. Flint: quality decrease brings need for more caution. *New Civil Eng.*, Issue 269, 58–60.

HARRIS, P. M., THURRELL, R. G., HEALING, R. A. and ARCHER, A. A. 1974. Aggregates in Britain. *Proc. R. Soc. London*, Ser. A, Vol. 339, 329–353.

HAGGARD, H. J. E. 1972. The sand and gravel resources of the country around Witham, Essex. Description of 1:25 000 resource sheet TL 81. *Rep. Inst. Geol. Sci.*, No. 72/6, 90 pp.

HOPSON, P. M. 1981. The sand and gravel resources of the country around Nayland, Suffolk. Description of 1:25 000 resource sheet TL 93. *Miner. Assess. Rep. Inst. Geol. Sci.*, No. 85.

LANE, E. W., and others. 1947. Report of the sub-committee on sediment terminology. *Trans. Am. Geophys. Union*, Vol. 28, pp. 936–938.

MARKS, R. J. and MERRITT, J. W. 1981. The sand and gravel resources of the country north-east of Halstead, Essex. Description of 1:25 000 resource sheet TL 83. *Miner. Assess. Rep. Inst. Geol. Sci.*, No. 68. 118 pp.

— and MURRAY, D. W. 1981. The sand and gravel resources of the country around Sible Hedingham, Essex. Description of 1:25 000 resource sheet TL 73. *Miner. Assess. Rep. Inst. Geol. Sci.*, No. 82. 99 pp.

MITCHELL, G. F., PENNY, L. F., SHOTTON, F. W. and WEST, R. G. 1973. A correlation of Quarternary Deposits in the British Isles. *Proc. Geol. Soc. London*, Special Report No. 4.

PETTIJOHN, F. J. 1957. *Sedimentary rocks*, 2nd edition. (London: Harper and Row.)

PRESTWICH, J. 1890. On the relation of the Westleton Beds, or Pebbly Sands of Suffolk, to those of Norfolk, and on their extension inland. *Q. J. Geol. Soc. London*, Vol. 46, Pts. 1–3, 84–181.

ROEDER, A. R. 1977. Some properties of flint particles and their behaviour in concrete. *Mag. Concr. Res., Slough*, Vol. 29, 92–99.

ROSE, J., ALLEN, P. and HEY, R. W. 1976. Middle Pleistocene stratigraphy in southern East Anglia. *Nature, London*, Vol. 263, 492–494.

— — 1977. Middle Pleistocene stratigraphy in south-east Suffolk. *Q. J. Geol. Soc. London*, Vol. 133, 83–102.

SOLOMON, J. D. 1935. The Westleton Series of East Anglia: its age, distribution, and relations. *Q. J. Geol. Soc. London*, Vol. 91, 216–233.

THURRELL, R. G. 1971. The assessment of mineral resources with particular reference to sand and gravel. *Quarry Managers' J.*, Vol. 55, 19–25.

— 1981. Quarry resources and reserves: the identification of bulk mineral resources: the contribution of the Institute of Geological Sciences. *Quarry Management*, Vol. 8, No. 3, 181–193.

TWENHOFEL, W. H. 1937. Terminology of the fine-grained mechanical sediments. *Rep. Natl. Res. Counc. Washington, 1936–1937, App. 1, Rep. Comm. Sediment*, 81–104.

UDDEN, J. A. 1914. Mechanical composition of clastic sediments. *Bull. Geol. Soc. Am.*, Vol. 25, 655–744.

WENTWORTH, C. K. 1922. A scale of grade and class terms for clastic sediments. *J. Geol.*, Vol. 30, No. 5, 377–392.

— 1935. The terminology of coarse sediments. *Bull. Natl. Res. Counc. Washington*, No. 98, 225–246.

WHITAKER, W., PENNING, W. H., DALTON, W. H. and BENNETT, F. J. 1878. The geology of part of NW Essex, with parts of Cambridgeshire and Suffolk and the NE part of Hertfordshire. *Mem. Geol. Surv. G. B.*, (Old Series Memoir 47).

— 1885. The geology of the country around Ipswich, Hadleigh and Felixstowe. *Mem. Geol. Surv. G. B.*, (Old Series).

WOOD, S. V. 1867. On the structure of the post-glacial deposits of the south-east of England. *Q. J. Geol. Soc. London*, Vol. 23, 394–417.

WOODLAND, A. W. 1970. The buried tunnel-valleys of East Anglia. *Proc. Yorks. Geol. Soc.*, Vol. 37, Part 4, No. 22, 521–578.

WOOLDRIDGE, S. W. and LINTON, D. L. 1955. Structure, surface and drainage in south-east England. (London: George Phillip.)

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. Exceptionally, other schemes for subdividing the resource sheet area (for example, the use of 'resource sub-blocks') may be used where these are considered to be more appropriate.

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

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

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

A continuous series of bulk samples is taken throughout the sand and gravel. Ideally samples are composed exclusively of the whole of the material encountered in the borehole between stated depths. However, care is taken to discard, as far as possible, material which has caved or has been pumped from the bottom of the hole. A new sample is commenced whenever there is an appreciable lithological change within the deposit, or, ideally, at every 1 m (3.3 ft) depth. The samples, each weighing between 25 and 45 kg (55 and 100 lb), are despatched in heavy duty polythene bags to a laboratory for grading. The grading procedure is based on British Standard 1377 (1975). Random checks on the accuracy of the grading are made in the Institute's laboratories.

Other methods of drilling and sampling are occasionally employed, for example the Minuteman power auger rig, and downhole tests such as U4 and SPT may be carried out. The Minuteman, which is small and portable, is normally used when access to land with shell rigs would be difficult to arrange and when information is requested quickly.

The auger tool comprises a continuous-'flight' 76-mm (3-inch) spiral auger; the use of this equipment, as with all 'open-hole' drilling methods, inevitably leads to the mixing and contamination of the sampled material. Thus, data relating to depth and composition cannot always be accurately determined.

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 E.

Detailed records may be consulted at the appropriate office of the Institute: the address is shown on page ii of this report, next to the preface.

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 (Hull, pp. 192–193 *in* Thurrell, 1981). Conventional symmetrical confidence limits are calculated for the 95 per cent probability level, that is, there is a 5 per cent or one in twenty chance of a result falling outside the stated limits.

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

$$S_v = \sqrt{(S_A^2 + S_{\bar{l}_m}^2)}. \quad [1]$$

4 The above relationship may be transposed such that

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

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

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

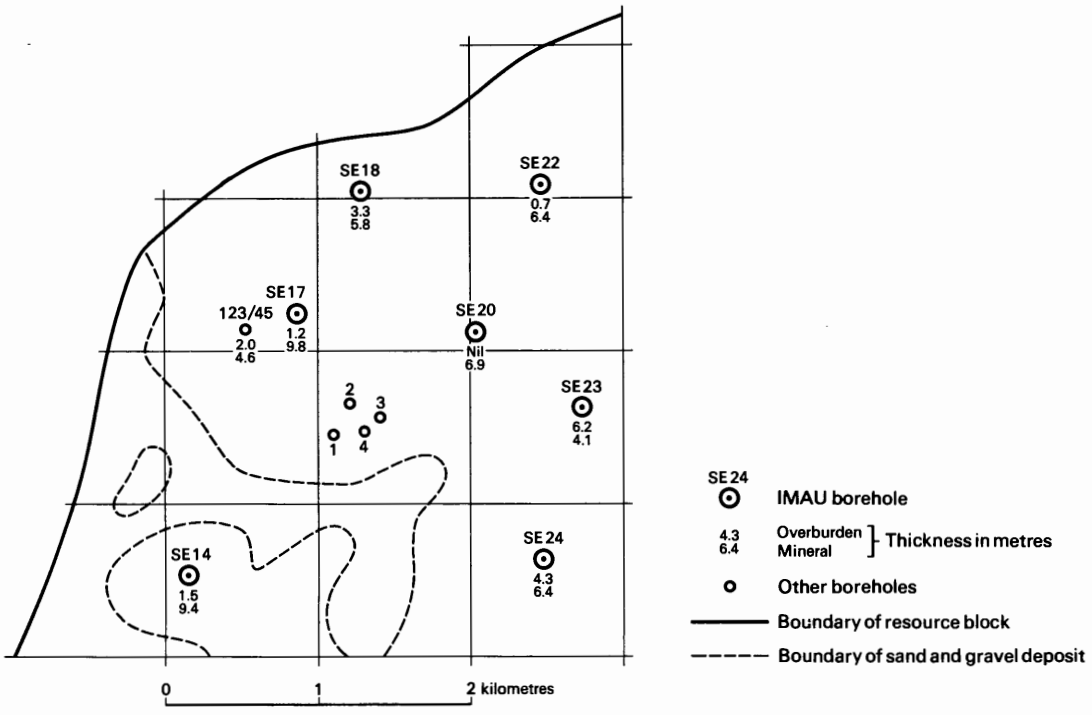
For groups of closely spaced boreholes a discretionary weighting factor may be applied to avoid bias (see note on weighting below). The standard deviation for mean thickness $S_{\bar{l}_m}$, expressed as a proportion of the mean thickness, is given by

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

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

Example of resource block assessment: map of fictitious block, calculation and results.



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 point	Weighting w	Overburden l_o	Overburden wl_o	Mineral l_m	Mineral wl_m	Remarks
SE 14	1	1.5	1.5	9.4	9.4	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_r is calculated as

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

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 usually small relative to those in thickness. The relationship $S_A/S_{\bar{l}_m} \leqslant \frac{1}{3}$ is assumed in all cases. It follows from equation [2] that

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

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_l, the following inequality corresponding to equation [3] is applied: $L_{\bar{l}_m} \leqslant L_l \leqslant 1.05\, L_{\bar{l}_m}$.

10 In summary, for values of n between 5 and 20, L_l 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 the diagram which accompanies this Appendix.

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 (illustrated at the end of this appendix). 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 the note on lithological description in 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, which is used in this report, and which appears in the table at the end of this appendix.

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 at 64 mm distinguishes pebbles from cobbles. The term 'gravel' is used loosely to denote both pebble-sized and cobble-sized material.

The size distribution of borehole samples is determined by sieve analysis, which is presented by the laboratory as logarithmic cumulative curves (see, for example, British Standard 1377: 1975). In this report the grading is tabulated on the borehole record sheets (Appendix E), 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. Subsequently, the descriptive categories of the mineral for each borehole are modified according to the results obtained from the mean particle size analysis of the samples.

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.

Classification of gravel, sand and fines

Size limits	Grain size description	Qualification	Primary classification
	Cobble		
64 mm –			
		Coarse	Gravel
16 mm –	Pebble		
		Fine	
4 mm –			
		Coarse	
1 mm –			
	Sand	Medium	Sand
$\frac{1}{4}$ 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

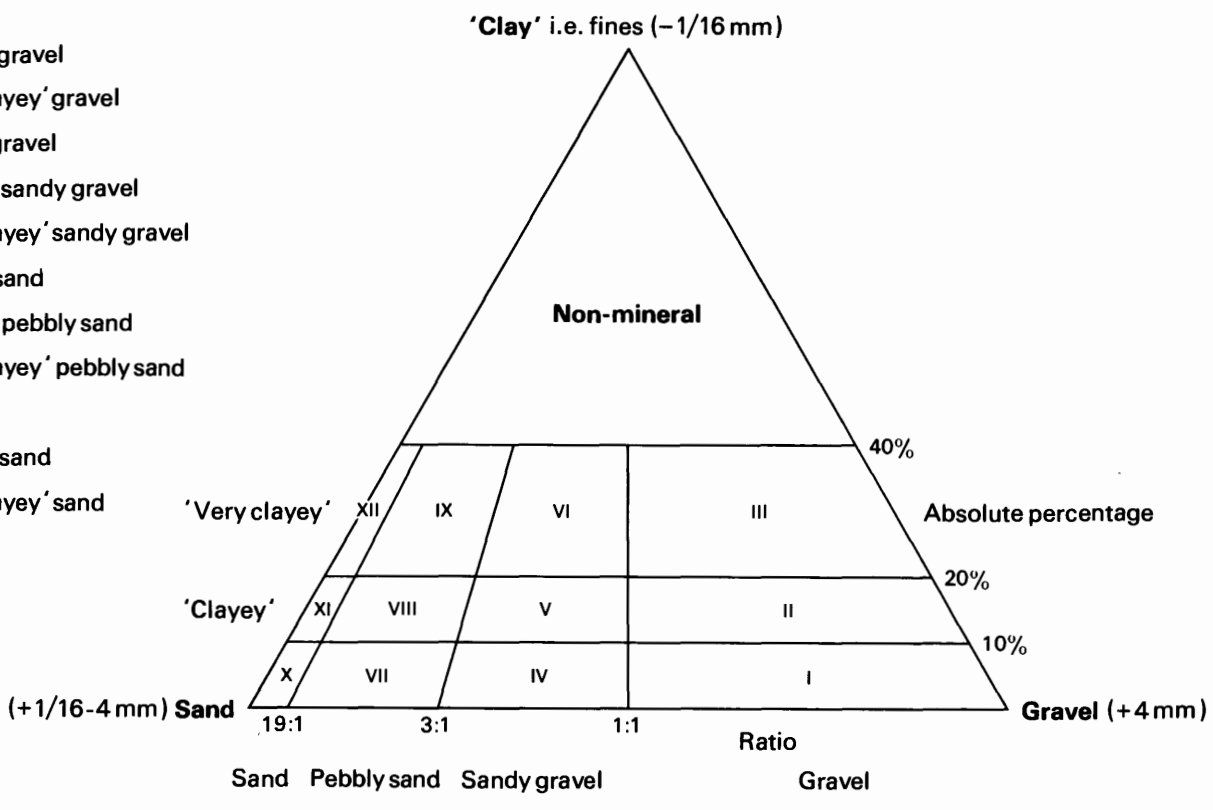


Diagram showing the descriptive categories used in the classification of sand and gravel

APPENDIX D

EXPLANATION OF THE BOREHOLE RECORDS

Annotated example

TL 82 SE 14[1]	8746 2043[2]	Near railway bridge, Feering[3]	SUB-BLOCK B_2
Surface level + 35.4 m (+ 116 ft)[4]			Overburden 1.2 m[7]
Water struck at + 25.9 m (+ 85 ft)[5]			Mineral 3.7 m
203 mm auger[6]			Waste 1.8 m
September 1970			Mineral 8.6 m
			Bedrock 1.1 m +[8]

LOG

Geological classification[9]	Lithology[10]	Thickness m	Depth m
	Soil	1.2	1.2
River Terrace Deposits (Third Terrace)	a Pebbly sand, 'clayey' in upper 0.9 m Gravel: fine with coarse, rounded to subangular flint Sand: medium with fine and coarse, subangular, orange-brown	3.7	4.9
Boulder Clay	Clay, brown with some small chalk pebbles	1.8	6.7
?Glacial Sand and Gravel	b Sandy gravel Gravel: fine and coarse, angular to rounded, flint with quartzite and quartz Sand: medium with coarse and traces of fine, subangular, pale brown to orange	8.6	15.3
London Clay	Clay, dark bluish grey	1.1+	16.4

GRADING[11]

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
a	7	77	16	1.2−2.1	14	17	59	4	2	4	0
				2.1−3.0	7	12	49	15	12	5	0
				3.0−4.0	4	9	56	17	12	2	0
				4.0−4.9	4	5	42	22	17	10	0
				Mean	7	11	51	15	11	5	0
b	3	49	48	6.7−7.6	7	10	16	10	24	33	0
				7.6−8.5	8	4	21	14	24	29	0
				8.5−9.5	2	3	20	12	35	28	0
				9.5−10.4	2	2	20	12	34	30	0
				10.4−11.3	1	4	27	15	28	25	0
				11.3−12.2	0	11	54	16	14	5	0
				12.2−13.1	2	5	53	8	18	14	0
				13.1−14.0	1	3	22	25	35	14	0
				14.0−15.3	No grading data available						
				Mean	3	5	30	14	26	22	0
a & b	4	58	38	Mean	4	7	37	14	21	17	0

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

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 1:25 000 sheet on which the boreholes lies, for example TL 82.

2 The quarter of the 1:25 000 sheet on which the borehole lies and the number of the borehole in a series for that quarter, for example SE 14.

Thus the full Registration Number is TL 82 SE 14. Usually this is abbreviated to 82 SE 14 in the text.

2 The National Grid reference
All National Grid references in this publication lie within the 100-km square TL unless otherwise stated. Grid references are given to eight figures, accurate to within 10 m for borehole locations. (In the text, six-figure grid references are used for more approximate locations, for example, for farms.)

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

4 Surface level
The surface level at the borehole site is given in metres and feet above Ordnance Datum.

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

6 Type of drill and date of drilling
The diameter of the casing, the type of machine 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. The description of the other rocks is based on visual examination, in the field. Where more than one mineral deposit is recognised, each is designated by a letter, e.g. a, b, etc.

11 Grading data
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 or at every 1 m of depth.

For each bulk sample the percentages of fines ($-\frac{1}{16}$ mm), fine sand ($+\frac{1}{16}-\frac{1}{4}$ mm), medium sand ($+\frac{1}{4}-1$ mm), coarse sand ($+1-4$ mm), fine gravel ($+4-16$ mm) and coarse gravel ($+16$ mm) are stated. The mean grading of groups of samples making up an identified mineral horizon are also given in detail and, to the left, in summary. Where more than one horizon is recognised the mean grading for the whole of the mineral in the borehole is also given. Where necessary in calculating the mean grading, data for individual samples are weighted by the thickness represented.

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 proportion of fines and coarse gravel may be lower.

APPENDIX E

INDUSTRIAL MINERALS ASSESSMENT UNIT BOREHOLE RECORDS

TL 82 NW 1	8030 2964	Near Attwoods, Halstead	BLOCK A

Surface level + 77.7 m (+ 255 ft)
Water struck at + 60.7 m (+ 199 ft)
152 mm percussion
November 1970

Overburden 11.6 m
Mineral 5.9 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder clay	Soil on brown clay with pellets of chalk, becoming grey below 3.0 m	11.6	11.6
Kesgrave Sands and Gravels	Gravel Gravel: fine and coarse with occasional cobbles, subangular to subrounded black flint, with vein-quartz and quartzite Sand: medium with fine and coarse, mainly quartz, pale greyish yellow	5.9	17.5
London Clay	Clay, brown becoming bluish grey, micaceous	0.3+	17.8

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
2	49	49	11.2–12.6	4	15	42	11	16	12	0
			12.6–13.6	4	17	25	6	22	26	0
			13.6–14.6	1	6	28	10	28	27	0
			14.6–15.6	1	13	25	8	22	26	5
			15.6–16.6	1	4	14	9	31	41	0
			16.6–17.5	2	9	34	15	24	16	0
			Mean	2	11	28	10	23	25	1

TL 82 NW 2 | 8070 2703 | Near Moat Wood, Stisted | SUB-BLOCK B_1

Surface level + 71.9 m (+ 236 ft)
Water struck at + 59.9 m (+ 196.5 ft)
152 mm percussion
November 1970

Overburden 8.2 m
Mineral 6.8 m
Bedrock 0.1 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Soil on dark brown clay becoming pale grey with rounded chalk pebbles	8.2	8.2
Kesgrave Sands and Gravels	Sandy gravel, pebbly sand below 13.2 m Gravel: fine and coarse, angular to subangular brown flint with vein-quartz and grey quartzite Sand: medium with fine and coarse, mainly quartz	6.8	15.0
London Clay	Clay, dark grey with carbonaceous patches	0.1+	15.1

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
1	64	35	8.2–9.2	2	2	12	8	29	47	0
			9.2–10.2	No grading data available						
			10.2–11.2	0	4	31	12	20	33	0
			11.2–12.2	1	7	54	17	14	6	1
			12.2–13.2	1	8	48	16	17	10	0
			13.2–14.2	0	25	40	21	9	5	0
			14.2–15.0	3	30	39	17	7	3	1
			Mean	1	12	37	15	17	18	0

TL 82 NW 3 | 8042 2579 | Baines Farm, Stisted | SUB-BLOCK B_1

Surface level + 67.4 m (+ 221 ft)
Water not struck
152 mm percussion
November 1970

Overburden 5.4 m
Mineral 9.4 m
Bedrock 0.2 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Soil, on pebbly clay with fragments of chalk: becoming sandy towards base	5.4	5.4
Kesgrave Sands and Gravels	Pebbly sand, gravelly in upper 1.7 m with clay layer between 14.5 and 14.7 m Gravel: fine with coarse, subangular to rounded flint with vein-quartz, quartzite and ironstone Sand: medium with fine and coarse, mainly quartz with some flint	9.4	14.8
London Clay	Clay, bluish grey, sandy in part	0.2+	15.0

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
4	83	13	5.4–6.1	5	12	49	17	12	5	0
			6.1–7.1	3	3	39	11	26	18	0
			7.1–8.1	2	16	59	11	5	3	4
			8.1–9.1	3	16	59	11	6	5	0
			9.1–10.1	8	36	46	7	2	1	0
			10.1–11.1	0	24	43	14	16	3	0
			11.1–12.0	6	14	60	13	4	3	0
			12.0–13.1	2	18	62	16	2	0	0
			13.1–14.1	4	13	48	31	3	1	0
			14.1–14.5	4	20	41	28	6	1	0
			14.5–14.7	Clay						
			14.7–14.8	4	20	41	28	6	1	0
			Mean	4	17	51	15	9	4	0

TL 82 NW 4 | 8117 2792 | Ward's Farm, Halstead | SUB-BLOCK B_1

Surface level + 64.0 m (+ 210 ft)
Water struck at + 60.0 m (+ 198 ft)
152 mm percussion
November 1970

Overburden 2.1 m
Mineral 2.4 m
Bedrock 0.5 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Soil on brown sandy clay with flints	2.1	2.1
Kesgrave Sands and Gravels	Gravel Gravel: fine and coarse, angular to subangular flint with rounded quartzite Sand: medium and coarse with some fine	2.4	4.5
London Clay	Clay, brown becoming dark bluish grey, silty at base	0.5+	5.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
1	27	72	2.1–3.1	0	2	9	12	36	41	0
			3.1–4.1	2	4	15	11	28	40	0
			4.1–4.5	2	1	12	13	44	28	0
			Mean	1	3	12	12	34	38	0

TL 82 NW 5 | 8180 2515 | West of Woodhouse Farm, Pattiswick | SUB-BLOCK B_1

Surface level + 68.3 m (+ 224 ft)
Water struck at + 60.0 m (+ 197 ft)
152 mm percussion
November 1970

Overburden 5.4 m
Mineral 5.0 m
Bedrock 0.7 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Soil on brown pebbly clay with chalk, becoming grey below 4.0 m	5.4	5.4
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine and coarse, subrounded quartz, flint and quartzite Sand: medium with fine and coarse, mainly quartz	5.0	10.4
London Clay	Clay, reddish-brown, becoming dark bluish grey and silty below 10.7 m	0.7+	11.1

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
5	57	38	5.4–6.4	3	2	10	11	37	37	0
			6.4–7.4	2	4	38	24	25	7	0
			7.4–8.4	3	19	38	17	17	6	0
			8.4–9.4	13	14	30	11	18	14	0
			9.4–10.4	2	22	31	17	16	12	0
			Mean	5	12	29	16	23	15	0

TL 82 NW 6 | 8228 2931 | Greenstead Hall, Greenstead Green | BLOCK A

Surface level + 65.2 m (+ 214 ft)
Water struck at + 62.2 m (+ 204 ft)
152 mm percussion
October 1970

Waste 6.1 m
Bedrock 0.5 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
Glacial Sand and Gravel	Clay, silty, grey-brown with some sand and gravel and plant material; partly cryoturbated	4.9	4.9
	Gravel Gravel: fine to coarse with some cobbles, mainly subrounded to subangular flint Sand: fine to medium, pale brown	0.6	5.5
Boulder Clay	Clay, dark bluish grey with chalk pebbles	0.6	6.1
London Clay	Clay, dark bluish grey, silty	0.5+	6.6

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
4	30	66	4.9−5.5	4	2	15	13	30	36	0

TL 82 NW 7 | 8255 2833 | Greenstead Green | BLOCK A

Surface level + 63.7 m (+ 209 ft)
Water struck at + 59.0 m (+ 194 ft)
152 mm percussion
November 1970

Overburden 3.5 m
Mineral 1.0 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil on pebbly clay	3.5	3.5
Kesgrave Sands and Gravels	Gravel Gravel: fine with coarse, angular to subangular flint with rounded to sub-rounded vein-quartz and quartzite Sand: medium and coarse with some fine	1.0	4.5
London Clay	Clay, weathered in upper 0.2 m	0.3+	4.8

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
1	28	71	3.5−4.5	1	2	11	15	44	27	0

TL 82 NW 8 | 8276 2696 | Burton's Green | SUB-BLOCK B_1

Surface level + 65.8 m (+ 216 ft)
Water struck at + 57.9 m (+ 190 ft)
152 mm percussion
November 1970

Overburden 3.6 m
Mineral 4.5 m
Bedrock 0.4 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, with chalk pebbles, brown becoming grey towards base	3.3	3.6
Kesgrave Sands and Gravels	Sandy gravel, gravelly in upper 2.0 m Gravel: fine and coarse, subrounded to subangular flint with quartz and quartzite Sand: medium with coarse and fine, mainly quartz	4.5	8.1
London Clay	Clay, brown and weathered, becoming dark bluish grey below 8.3 m	0.4+	8.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
2	72	26	3.6–4.6	3	9	33	10	25	20	0
			4.6–5.6	2	7	30	13	24	24	0
			5.6–6.6	0	20	65	13	1	1	0
			6.6–7.6	2	25	37	20	12	4	0
			7.6–8.1	2	31	39	14	11	3	0
			Mean	2	17	41	14	15	11	0

TL 82 NW 9 | 8285 2532 | Little Nunty's Farm, Coggeshall | SUB-BLOCK B_1

Surface level + 67.7 m (+ 222 ft)
Water struck at + 58.7 m (+ 192.5 ft)
152 mm percussion
November 1970

Overburden 6.2 m
Mineral 8.9 m
Bedrock 0.1 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil on brown pebbly clay	1.5	1.5
Boulder Clay	Clay, brown with pebbles of chalk and flint	4.7	6.2
Kesgrave Sands and Gravels	Pebbly sand, with clay layer between 12.2 and 12.4 m Gravel: fine and coarse, subangular flint with subrounded quartzite Sand: medium with fine and some coarse	8.9	15.1
London Clay	Clay, dark grey becoming buff towards base	0.1+	15.2

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
9	73	18	6.2–7.2	6	21	29	8	13	23	0
			7.2–8.2	3	7	34	13	27	16	0
			8.2–9.2	2	8	62	10	6	12	0
			9.2–10.2	7	9	56	9	8	11	0
			10.2–11.2	7	23	58	7	4	1	0
			11.2–12.2	25	28	38	5	3	1	0
			12.2–12.4	Clay						
			12.4–13.4	13	60	22	4	1	0	0
			13.4–15.1	No grading data available						
			Mean	9	22	43	8	9	9	0

TL 82 NW 10 | 8373 2917 | Near Parley Beams Farm, Halstead Rural | BLOCK A

Surface level + 55.2 m (+ 181 ft)
Water struck at + 54.1 m (+ 177.5 ft
152 mm percussion
October 1970

Overburden 0.5 m
Mineral 1.8 m
Bedrock 1.4 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Kesgrave Sands and Gravels	Gravel Gravel: fine and coarse, subangular flint with subrounded to rounded vein-quartz and quartzite Sand: medium with coarse and some fine	1.8	2.3
London Clay	Clay, dark brown becoming dark bluish grey below 3.2 m	1.4+	3.7

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
3	37	60	0.5–1.5	4	3	22	15	24	32	0
			1.5–2.3	1	2	18	14	24	41	0
			Mean	3	2	21	14	24	36	0

TL 82 NW 11 | 8398 2649 | Park Estate, Markshall | SUB-BLOCK B_1

Surface level + 68.6 m (+ 225 ft)
Water struck at + 64.0 m (+ 210 ft)
203 mm auger
September 1970

Overburden 6.1 m
Mineral 10.6 m
Bedrock 0.9 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown with chalk and flint pebbles	5.8	6.1
Kesgrave Sands and Gravels	Sandy gravel, with iron concretions near the base Gravel: fine and coarse, subangular to subrounded flint with some subrounded quartzite and vein-quartz Sand: medium with coarse and fine	10.1	16.2
London Clay	Clay, dark bluish grey	0.9+	17.1

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
7	58	35	6.1−7.0	10	15	20	8	22	25	0
			7.0−7.9	9	9	25	12	19	26	0
			7.9−8.8	7	9	25	14	25	20	0
			8.8−9.7	No grading data available						
			9.7−10.6	4	28	56	8	4	0	0
			10.6−16.2	No grading data available						
			Mean	7	15	33	10	17	18	0

TL 82 NW 12 | 8485 2879 | Morley's Farm, Earls Colne | SUB-BLOCK B_1

Surface level + 53.0 m (+ 174 ft)
Water struck at + 46.0 m (+ 151 ft)
152 mm percussion
November 1970

Overburden 1.6 m
Mineral 5.6 m
Bedrock 0.5 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil with some flint gravel	1.6	1.6
Kesgrave Sands and Gravels	Sandy gravel, with clay seams between 3.1 and 3.2 m and 6.7 to 6.9 m Gravel: fine and coarse with some cobbles, angular to subrounded flint with subrounded vein-quartz and quartzite Sand: medium with coarse and fine, mainly quartz	5.6	7.2
London Clay	Clay, brown, becoming dark bluish grey with depth	0.5+	7.7

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
5	55	40	1.6–2.6	9	11	46	13	13	7	1
			2.6–3.1	3	13	41	11	20	12	0
			3.1–3.2	Clay						
			3.2–4.2	2	5	23	11	23	29	7
			4.2–5.2	0	6	17	13	24	40	0
			5.2–6.1	3	9	30	16	23	5	14
			6.1–6.7	15	29	44	6	3	3	0
			6.7–6.9	Clay						
			6.9–7.2	4	14	38	7	21	12	4
			Mean	5	11	32	12	19	17	4

TL 82 NW 13 | 8418 2734 | Lodge Farm, Earls Colne | SUB-BLOCK B_1

Surface level + 70.7 m (+ 232 ft)
Water struck at + 61.3 m (+ 201 ft)
203 mm percussion
November 1970

Overburden 8.4 m
Mineral 8.3 m
Bedrock 0.6 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown with chalk and flint pebbles, becomes sandy below 6.6 m	8.1	8.4
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine with coarse, subangular to subrounded flint and chert with subrounded vein-quartz and quartzite Sand: medium with fine and coarse	8.3	16.7
London Clay	Clay, reddish brown becoming dark bluish grey below 17.0 m	0.6+	17.3

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
4	53	43	8.4–9.4	16	9	43	8	13	11	0
			9.4–10.4	5	3	19	8	22	42	1
			10.4–11.4	1	1	22	19	32	23	2
			11.4–12.4	0	4	18	20	47	10	1
			12.4–13.4	2	5	40	19	23	9	2
			13.4–14.4	1	2	18	16	32	31	0
			14.4–15.4	2	3	32	19	26	18	0
			15.4–16.4	3	23	53	9	10	2	0
			16.4–16.7	4	35	46	12	2	1	0
			Mean	4	7	31	15	25	17	1

TL 82 NW 14 | 8417 2518 | Markshall | SUB-BLOCK B_1

Surface level + 60.4 m (+ 198 ft)
Water struck at + 54.3 m (+ 178 ft)
203 mm percussion
November 1970

Overburden 2.3 m
Mineral 5.5 m
Bedrock 0.6 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Soil on brown sandy clay, becoming chalky below 0.8 m	2.3	2.3
Kesgrave Sands and Gravels	Sandy gravel, clayey in upper 2.0 m Gravel: fine and coarse with rare cobbles, subangular to subrounded flint with subrounded to rounded vein-quartz and quartzite Sand: medium with fine and coarse	5.5	7.8
London Clay	Clay, brown, becoming dark bluish grey below 8.1 m	0.6+	8.4

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−¼	+¼−1	+1−4	+4−16	+16−64	+64
7	67	26	2.3−3.3	16	4	24	11	23	22	0
			3.3−4.3	10	2	53	8	14	11	2
			4.3−5.3	6	16	69	5	2	2	0
			5.3−6.3	3	19	60	12	5	1	0
			6.3−7.3	3	9	34	17	23	12	2
			7.3−7.8	2	9	20	23	28	18	0
			Mean	7	10	45	12	15	10	1

TL 82 NW 15 | 8129 2936 | Stone's Farm, Halstead | BLOCK A

Surface level + 73.5 m (+ 241 ft)
Water struck at + 59.4 m (+ 195 ft)
152 mm percussion
September 1973

Overburden 8.6 m
Mineral 6.4 m
Bedrock 0.2 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Soil on orange-brown and grey mottled clay, becoming yellowish brown, soft and sandy with depth	3.0	3.0
	Clay, yellowish brown with chalk and some flint pebbles	5.6	8.6
Kesgrave Sands and Gravels	Pebbly sand, gravelly in upper 2.0 m Gravel: fine with coarse, subangular to subrounded flint with vein-quartz quartzite and traces of chert Sand: fine and medium with some coarse, mainly subangular quartz and flint	6.4	15.0
London Clay	Clay, brown becoming grey	0.2+	15.2

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−¼	+¼−1	+1−4	+4−16	+16−64	+64
6	80	14	8.6–9.6	9	4	19	9	47	12	0
			9.6–10.6	4	12	48	5	15	16	0
			10.6–11.6	4	26	69	1	0	0	0
			11.6–12.6	3	9	82	4	2	0	0
			12.6–12.9	7	54	36	3	0	0	0
			12.9–13.9	12	83	4	0	0	1	0
			13.9–15.0	4	51	43	2	0	0	0
			Mean	6	33	44	3	10	4	0

TL 82 NW 16 | 8176 2860 | North-west of Greenstead Green | BLOCK A

Surface level + 69.2 m (+ 227 ft)
Water struck at + 54.9 m (+ 180 ft)
152 mm percussion
September 1973

Overburden 8.5 m
Mineral 7.3 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Soil on orange-brown pebbly clay, becoming yellow to buff with pebbles and cobbles of chalk with traces of flint	8.5	8.5
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine with coarse, subangular to rounded flint with vein-quartz and quartzite Sand: medium with some fine and coarse, chiefly quartz with rounded flint	7.3	15.8
London Clay	Clay, dark grey and silty	0.3+	16.1

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−¼	+¼−1	+1−4	+4−16	+16−64	+64
3	72	25	8.5–9.5	5	5	55	8	15	7	5
			9.5–10.5	5	4	51	13	20	7	0
			10.5–11.5	4	4	58	15	15	4	0
			11.5–12.5	2	4	74	10	9	1	0
			12.5–13.5	3	2	47	14	27	5	2
			13.5–14.5	3	3	55	12	20	7	0
			14.5–15.5	2	4	47	13	27	7	0
			15.5–15.8	4	8	61	11	12	4	0
			Mean	3	4	56	12	19	5	1

TL 82 NW 17 | 8299 2870 | Stanstead Hall, Greenstead Green | BLOCK A

Surface level + 61.3 m (+ 201 ft)
Water struck at + 57.0 m (+ 187 ft)
152 mm percussion
September 1973

Overburden 1.4 m
Mineral 3.3 m
Bedrock 0.3 m +

LOG

Geological Classification	Lithology	Thickness m	Depth m
Boulder Clay	Soil on brown and grey mottled clay with rounded flint and vein-quartz	1.4	1.4
Kesgrave Sands and Gravels	Gravel Gravel: fine and coarse with some cobbles, subrounded to rounded flint, vein-quartz and quartzite, commonly iron stained Sand: medium with coarse and some fine, mainly flint	3.3	4.7
London Clay	Clay, mottled orange-brown to dark grey	0.3+	5.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
7	46	47	1.4–2.4	11	5	34	9	22	13	6
			2.4–3.4	7	6	30	13	23	18	3
			3.4–4.4	6	5	22	13	29	21	4
			4.4–4.7	2	5	33	12	25	23	0
			Mean	7	5	29	12	25	18	4

TL 82 NW 18 | 8468 2819 | Site of Harvey's Farm, Earls Colne | SUB-BLOCK B_1

Surface level + 56.4 m (+ 185 ft)
Water struck at + 50.6 m (+ 166 ft)
152 mm percussion
June 1973

Overburden 1.0 m
Mineral 6.6 m
Bedrock 0.4 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	1.0	1.0
Kesgrave Sands and Gravels	'Clayey' sandy gravel Gravel: fine with coarse, subangular to subrounded flint with subrounded quartz and quartzite Sand: medium with coarse and fine	6.6	7.6
London Clay	Clay, firm, bluish black to dark grey	0.4+	8.0

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
13	54	33	1.0−2.0		No grading data available					
			2.0−3.0		"					
			3.0−4.0	12	22	53	8	5	0	0
			4.0−6.0	10	9	34	13	23	11	0
			6.0−7.0	16	4	18	14	28	20	0
			7.0−7.6	19	2	13	17	29	20	0
			Mean	13	10	32	12	21	12	0

TL 82 NW 19 | 8023 2826 | North of Highbarn Hall, Halstead | SUB-BLOCK B_1

Surface level + 67.1 m (+ 220 ft)
Water struck at + 64.0 m (+ 210 ft)
152 mm percussion
June 1973

Overburden 1.0 m
Mineral 1.2 m
Waste 0.3 m
Mineral 2.0 m
Bedrock 0.8 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made-ground: mixture of clay, sand and some flint gravel	0.4	0.4
Boulder Clay	Clay, mottled grey, brown and orange, sandy and pebbly	0.6	1.0
Kesgrave Sands and Gravels	a 'Clayey' sandy gravel Gravel: fine and coarse with rare cobbles, subangular to subrounded flint, quartz and jaspar Sand: medium with fine and some coarse	1.2	2.2
	Clay, mottled grey and orange-brown, sandy with subangular flint pebbles	0.3	2.5
	b Sand Gravel: trace, subangular flint Sand: fine to medium with a trace of coarse, orange-brown, slightly clay-bound	2.0	4.5
London Clay	Clay, firm, streaky brown passing into olive-black	0.8+	5.3

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
a	13	60	27	1.0−2.0	13	11	48	5	13	10	0
				2.0−2.2	12	9	25	6	16	32	0
				Mean	13	11	44	5	13	14	0
				2.2−2.5	Clay						

b No grading data available

TL 82 NW 20 | 8137 2643 | Brook's Farm, Tumbler's Green | SUB-BLOCK B_1

Surface level + 65.8 m (+ 216 ft)
Water struck at + 59.4 m (+ 195 ft)
152 mm percussion
June 1973

Overburden 2.7 m
Mineral 6.4 m
Waste 0.3 m
Mineral 0.9 m
Bedrock 0.4 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Soil on orange, mottled brown and grey, stiff clay with a trace of flint gravel	2.7	2.7
Kesgrave Sands and Gravels	a Sandy gravel Gravel: fine with coarse, subangular to subrounded flint with subrounded quartz and quartzite Sand: medium and fine with coarse	6.4	9.1
	Clay, pale to dark grey, streaky, sandy in parts	0.3	9.4
	b 'Clayey' pebbly sand Gravel: fine with coarse, mainly flint Sand: mainly coarse, subangular quartz with grey clay matrix	0.9	10.3
London Clay	Clay, dark brown to olive-black, soft and silty becoming firm	0.4+	10.7

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					–1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
a	8	68	24	2.7–3.7	13	7	38	9	23	10	0
				3.7–4.7	6	5	26	15	30	18	0
				4.7–5.3	No grading data available						
				5.3–6.3			"				
				6.3–7.3	4	22	39	14	9	12	0
				7.3–8.3	6	35	46	10	3	0	0
				8.3–9.1	14	31	32	12	4	7	0
				Mean	8	21	35	12	15	9	0
				9.1–9.4	Clay						

b No grading data available

TL 82 NW 21 | 8239 2641 | Great Nunty's Farm, Greenstead Green | SUB-BLOCK B_1

Surface level + 68.0 m (+ 223 ft)
Water struck at + 58.8 m (+ 193 ft)
152 mm percussion
June 1973

Overburden 9.2 m
Mineral 2.9 m
Bedrock 0.4 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	2.0	2.0
Boulder Clay	Clay, firm, brown slightly mottled with pebbles of chalk and rare flint	7.2	9.2
Kesgrave Sands and Gravels	Sandy gravel, becoming more sandy towards base Gravel: fine with coarse, subrounded to subangular flint with quartz and quartzite Sand: medium with fine and coarse	2.9	12.1
London Clay	Clay, brown to grey, sandy, passing into firm olive-black clay	0.4+	12.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$
1	71	28	9.2–10.2	1	15	34	22	19	9	0
			10.2–11.2	No grading data available						
			11.2–12.1	No grading data available						
			Mean	1	15	34	22	19	9	0

TL 82 NW 22 | 8337 2723 | Lodge Farm, Burton's Green | SUB-BLOCK B_1

Surface level + 68.3 m (+ 224 ft)
Water struck at + 59.7 m (+ 196 ft)
152 mm percussion
September 1973

Overburden 5.1 m
Mineral 5.8 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, silty, yellow-brown with pebbles of chalk, flint, vein-quartz, quartzite and chert	4.9	5.1
Kesgrave Sands and Gravels	Pebbly sand Gravel: fine with coarse, flint with vein-quartz and some quartzite Sand: medium with fine and some coarse, subangular to subrounded quartz with subrounded flint and rounded vein-quartz	5.8	10.9
London Clay	Clay, silty, dark grey	0.3+	11.2

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
4	73	23	5.1–5.6	8	11	48	4	15	11	3
			5.6–6.6	7	7	25	11	34	16	0
			6.6–7.6	1	13	35	8	28	15	0
			7.6–8.6	4	19	65	5	5	2	0
			8.6–9.6	3	24	56	7	8	2	0
			9.6–10.6	3	23	61	5	5	3	0
			10.6–10.9	8	24	57	5	4	2	0
			Mean	4	17	49	7	15	8	0

TL 82 NW 23 | 8475 2606 | Disused airfield, Coggeshall | SUB-BLOCK B_1

Surface level + 68.6 m (+ 225 ft)
Water struck at + 60.0 m (+ 197 ft)
152 mm percussion
June 1973

Overburden 7.6 m
Mineral 6.2 m
Waste 0.5 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.6	0.6
Boulder Clay	Clay, pale orange-brown with abundant sand to cobble sized chalk clasts and rare flint; some orange sandy seams	7.0	7.6
Kesgrave Sands and Gravels	Pebbly sand Gravel: fine and coarse, subangular to subrounded flint with vein-quartz and quartzite Sand: medium with fine and coarse	6.2	13.8
	Clay, grey, silty and plastic	0.5	14.3
London Clay	Clay, weathered, brown and silty	0.3+	14.6

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
3	82	15	7.6–8.6	9	6	42	6	21	11	5
			8.6–9.6	1	3	63	10	17	6	0
			9.6–10.6	2	6	76	6	4	6	0
			10.6–11.6	3	17	60	13	5	2	0
			11.6–13.8	3	20	57	14	4	2	0
			Mean	3	12	59	10	9	6	1

TL 82 NE 1 | 8556 2771 | Highfields Farm, Earl's Colne | SUB-BLOCK B_1

Surface level + 65.5 m (+ 215 ft)
Water struck at + 54.9 m (+ 180 ft)
203 mm auger
June 1970

Overburden 5.5 m
Mineral 9.1 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown with chalk and flint clasts	5.2	5.5
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine and coarse, angular to subangular flint with rare quartzite Sand: medium with coarse and some fine	9.1	14.6
London Clay	Clay, silty, orange-brown	0.3+	14.9

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
7	57	36	5.5−6.4		No grading data available					
			6.4−7.3		"					
			7.3−8.3	10	3	45	8	13	21	0
			8.3−9.2	8	4	35	10	18	24	1
			9.2−10.1	6	4	42	13	18	17	0
			10.1−11.0	7	3	49	14	16	11	0
			11.0−11.9	6	6	39	13	16	20	0
			11.9−12.2	5	6	33	12	17	21	6
			12.2−14.6		No grading data available					
			Mean	7	4	42	11	17	18	1

TL 82 NE 2 | 8557 2616 | Gatehouse Farm, Earl's Colne | SUB-BLOCK B_1

Surface Level + 66.4 m (+ 218 ft)
Water struck at + 54.6 m (+ 179 ft)
152 mm percussion
November 1970

Overburden 9.1 m
Mineral 4.9 m
Waste 0.3 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, pale greyish brown, mottled, with chalk and flint pebbles	8.8	9.1
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine and coarse, angular to subangular flint with subrounded vein-quartz and quartzite Sand: medium with fine and coarse, mainly quartz	4.9	14.0
	Clay, with pebbles of rounded flint, vein-quartz and quartzite	0.3	14.3
London Clay	Clay, dark bluish grey, stiff, silty	0.3+	14.6

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
2	63	35	9.1–10.2	6	12	45	9	19	9	0
			10.2–11.2	1	24	64	7	3	1	0
			11.2–12.2	0	24	48	9	14	5	0
			12.2–13.2	1	2	7	14	33	43	0
			13.2–14.0	1	3	26	21	20	29	0
			Mean	2	13	38	12	18	17	0

TL 82 NE 3 | 8662 2967 | Near Colne Park, Earl's Colne | BLOCK A

Surface level + 50.3 m (+ 165 ft)
Water struck at + 47.5 m (+ 156 ft)
203 mm percussion
November 1970

Overburden 0.4 m
Mineral 4.6 m
Bedrock 0.4 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil, overlying brown sandy clay	0.4	0.4
Glacial Sand and Gravel	Gravel Gravel: coarse with fine and rare cobbles, angular to subangular flint with subrounded quartzite and vein-quartz Sand: medium and coarse with fine, flint and quartz	4.6	5.0
London Clay	Clay, reddish brown becoming dark bluish grey below 5.2 m	0.4+	5.4

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
2	32	66	0.4–1.4	1	1	12	9	31	44	2
			1.4–2.4	1	2	6	9	30	45	7
			2.4–3.4	3	3	18	8	31	32	5
			3.4–4.4	4	3	15	7	25	46	0
			4.4–5.0	3	14	49	21	10	3	0
			Mean	2	4	18	10	26	37	3

TL 82 NE 4 | 8658 2856 | Tey Road, Earl's Colne | BLOCK D

Surface level + 28.0 m (+ 92 ft)
Water struck at + 22.6 m (+ 74 ft)
152 mm percussion
November 1970

Overburden 1.6 m
Mineral 5.0 m
Waste 0.8 m
Mineral 13.5 m
Bedrock 0.1 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
River Terrace Deposit (First/Second Terrace)	Clay, orange-brown, silty becoming sandy towards base	1.3	1.6
	a Gravel Gravel: fine with coarse and rare cobbles, subangular brown flint with rounded to subrounded quartzite and vein-quartz Sand: medium and coarse with some fine, rounded to subrounded quartz	5.0	6.6
	Clay, medium brown	0.8	7.4
'Sub-alluvial' gravels	b Gravel Gravel: fine and coarse with rare cobbles, angular to subangular flint with rounded to subrounded quartzite Sand: medium with coarse and some fine, mainly quartz, with 'seams' of chalk grains	13.5	20.9
London Clay	Clay, dark bluish grey	0.1+	21.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					–1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
a	2	40	58	1.6–2.6	2	3	20	21	34	20	0
				2.6–3.6	1	2	20	14	28	24	11
				3.6–4.6	1	4	21	21	32	21	0
				4.6–5.6	1	2	16	17	39	25	0
				5.6–6.6	3	3	19	19	36	20	0
				Mean	2	2	20	18	34	22	2
				6.6–7.4	Clay						
b	1	46	53	7.4–8.4	1	2	10	16	40	31	0
				8.4–9.4	0	1	13	17	31	31	7
				9.4–10.4	2	2	18	17	30	31	0
				10.4–11.4	1	3	30	16	21	29	0
				11.4–12.4	1	2	16	16	33	32	0
				12.4–13.4	1	2	23	18	33	23	0
				13.4–14.4	2	7	36	10	25	20	0
				14.4–15.4	1	4	26	18	28	23	0
				15.4–16.4	1	4	33	18	33	11	0
				16.4–17.4	1	5	48	17	20	9	0
				17.4–18.4	1	3	29	14	21	32	0
				18.4–19.4	1	2	25	23	32	17	0
				19.4–20.4	3	4	28	21	28	16	0
				20.4–20.9	6	5	18	18	30	23	0
				Mean	1	4	25	17	29	23	1
a & b	1	46	53	Mean	1	3	23	20	29	23	1

TL 82 NE 5 | 8703 2736 | Holmwood Farm, Earl's Colne | SUB-BLOCK B_1

Surface level + 60.4 m (+ 198 ft)
Water struck at + 53.3 m (+ 175 ft)
203 mm percussion
November 1970

Overburden 4.3 m
Mineral 5.3 m
Bedrock 1.0 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, pale brown, sandy with chalk and flint pebbles	4.1	4.3
Kesgrave Sands and Gravels	Gravel, very clayey in upper 1.0 m Gravel: fine with coarse, subangular flint with rounded to subrounded quartzite and vein-quartz Sand: medium with coarse and fine	5.3	9.6
London Clay	Clay, reddish brown becoming dark bluish grey below 10.4 m	1.0+	10.6

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				–1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
5	33	62	4.3–5.3	21	9	23	9	21	17	0
			5.3–6.3	1	2	8	8	36	43	2
			6.3–7.3	1	1	13	16	36	33	0
			7.3–8.3	1	4	27	7	22	39	0
			8.3–9.3	1	4	21	8	31	35	0
			9.3–9.6	2	9	29	18	29	13	0
			Mean	5	4	19	10	29	33	0

TL 82 NE 6 | 8755 2927 | Hill Farm, White Colne | BLOCK A

Surface level + 46.6 m (+ 153 ft)
Water not struck
203 mm percussion
November 1970

Overburden 0.8 m
Mineral 3.1 m
Waste 1.5 m
Bedrock 2.8 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Glacial Sand and Gravel	Clay, brown, sandy	0.4	0.8
	Sandy gravel Gravel: fine with coarse, angular to subangular flint with rounded to subrounded quartzite and vein-quartz Sand: medium with coarse and some fine, mainly quartz	3.1	3.9
Boulder Clay	Clay, brown with chalk and rare flint and quartzite, becoming bluish grey towards base	1.5	5.4
London Clay	Clay, dark bluish grey	2.8+	8.2

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
3	51	46	0.8–1.8	6	3	28	21	34	8	0
			1.8–2.8	2	4	27	14	29	24	0
			2.8–3.9	2	3	32	21	21	21	0
			Mean	3	4	29	18	28	18	0

TL 82 NE 7 | 8795 2793 | Chalkney Wood, Earl's Colne | SUB-BLOCK B_2

Surface level + 44.5 m (+ 146 ft)
Water struck at + 41.5 m (+ 136 ft)
203 mm percussion
November 1970

Overburden 0.3 m
Mineral 3.3 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Kesgrave Sands and Gravels	Gravel, 'clayey' in upper 1.0 m Gravel: fine and coarse, angular to subangular flint with some subrounded quartzite and vein-quartz Sand: medium with coarse and some fine, mainly quartz and flint	3.3	3.6
London Clay	Clay, reddish brown becoming dark bluish grey below 3.8 m	0.3+	3.9

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
5	40	55	0.3–1.3	13	15	41	10	13	8	0
			1.3–2.3	2	3	11	8	36	40	0
			2.3–3.7	2	4	17	13	32	32	0
			Mean	5	7	23	10	29	26	0

TL 82 NE 8 | 8716 2613 | Flories' Farm, Great Tey | SUB-BLOCK B_1

Surface level + 66.1 m (+ 217 ft)
Water struck at + 55.2 m (+ 181 ft)
203 mm auger
July 1970

Overburden 9.8 m
Mineral 7.9 m
Bedrock 0.6 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown with chalk, becoming grey below 7.9 m	9.5	9.8
Kesgrave Sands and Gravels	'Clayey' pebbly sand, with very fine sand between 11.6 and 16.8 m Gravel: fine with coarse, angular to subangular flint and subrounded quartzite Sand: fine with coarse, angular to subangular flint and subrounded quartzite	7.9	17.7
London Clay	Clay, dark bluish grey with rare black to dark purple mudstone pellets	0.6+	18.3

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
19	65	16	9.7−10.7	20	11	52	8	6	3	0
			10.7−11.6	19	5	31	11	20	14	0
			11.6−16.8	No grading data available						
			16.8−17.7	19	28	33	14	4	2	0
			Mean	19	15	39	11	10	6	0

TL 82 NE 9 | 8925 2973 | Lane Farm, Wakes Colne | BLOCK A

Surface level + 59.1 m (+ 194 ft)
Water struck at + 53.0 m (+ 174 ft)
203 mm percussion
November 1970

Overburden 2.1 m
Mineral 7.2 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Head	Clay, brown, sandy with trace of flint gravel	1.7	2.1
Kesgrave Sands and Gravels	'Clayey' sand, with clay layer between 6.1 and 6.2 m Gravel: trace only, mainly flint Sand: medium with fine and some coarse, mainly quartz	7.2	9.3
London Clay	Clay, reddish brown becoming bluish grey below 9.4 m	0.3+	9.6

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4-1	+1–4	+4–16	+16–64	+64
15	83	2	2.1–3.1	22	13	46	8	3	6	2
			3.1–4.1	16	18	63	2	1	0	0
			4.1–5.1	16	19	64	1	0	0	0
			5.1–6.1	18	16	62	2	0	2	0
			6.1–6.2	Clay						
			6.2–7.2	20	20	56	4	0	0	0
			7.2–8.2	6	23	64	6	1	0	0
			8.2–9.3	5	23	58	13	1	0	0
			Mean	15	18	59	6	1	1	0

TL 82 NE 10 | 8845 2895 | Wakes Hall, Wakes Colne | BLOCK A

Surface level + 43.9 m (+ 144 ft)
Water not struck
203 mm percussion
November 1970

Overburden 0.6 m
Mineral 3.6 m
Bedrock 0.4 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil on dark brown sandy clay	0.6	0.6
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine and coarse with rare cobbles, angular to subangular flint and rounded to subrounded quartzite Sand: medium with fine and coarse, mainly quartz	3.6	4.2
London Clay	Clay, brown becoming predominantly dark bluish grey	0.4+	4.6

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
5	50	45	0.6–1.6	12	5	20	16	30	13	4
			1.6–2.6	1	7	24	10	20	20	18
			2.6–3.6	1	15	31	12	28	13	0
			3.6–4.2	4	17	45	9	18	7	0
			Mean	5	10	28	12	25	14	6

TL 82 NE 11 | 8926 2752 | Swan Street Hamlet, Chappel | SUB-BLOCK B_2

Surface level + 48.5 m (+ 159 ft)
Water struck at + 45.1 m (+ 148 ft)
203 mm percussion
November 1970

Overburden 1.2 m
Mineral 4.4 m
Bedrock 0.6 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil on dark brown sandy clay	1.2	1.2
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine and coarse with occasional cobbles, angular flint with rounded to subrounded quartzite and vein-quartz Sand: medium with coarse and fine, mainly quartz and flint	4.4	5.6
London Clay	Clay, reddish brown becoming dark greyish blue below 5.8 m	0.6+	6.2

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
4	57	39	1.2–2.2	9	7	31	16	14	23	0
			2.2–3.0	0	2	28	22	25	16	7
			3.0–4.0	2	6	29	6	22	14	21
			4.0–5.0	3	18	43	5	18	13	0
			5.0–5.6	5	17	57	17	3	1	0
			Mean	4	9	36	12	18	15	6

TL 82 NE 12 | 8902 2647 | Chappel Road, Great Tey | SUB-BLOCK B_2

Surface level + 67.7 m (+ 222 ft)
Water struck at + 49.7 m (+ 163 ft)
203 mm auger
July 1970

Overburden 12.2 m
Mineral 6.4 m
Bedrock 0.9 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, brown becoming grey, chalky	12.0	12.2
Kesgrave Sands and Gravels	'Clayey' pebbly sand Gravel: fine and coarse, subangular to subrounded flint and quartzite Sand: medium with fine and coarse, quartz with rare chalk	6.4	18.6
London Clay	Clay, brown becoming dark bluish grey	0.9+	19.5

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
17	77	6	12.2–13.1	22	11	57	9	1	0	0
			13.1–14.0	20	7	55	7	8	3	0
			14.0–15.0	11	8	68	8	2	3	0
			15.0–15.9	8	10	60	13	8	1	0
			15.9–16.8	26	6	46	16	5	1	0
			16.8–17.7	10	23	57	11	4	1	0
			17.7–18.6	20	23	34	17	4	2	0
			Mean	17	12	53	12	4	2	0

TL 82 NE 13 | 8819 2540 | Walcott's Hall, Great Tey | SUB-BLOCK B_2

Surface level + 52.7 m (+ 173 ft)
Water struck at + 47.5 m (+ 156 ft)
203 mm percussion
November 1970

Waste 6.3 m
Bedrock 0.4 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, dark brown becoming greyish brown to buff, rare subangular flint	5.8	6.0
Kesgrave Sands and Gravels	'Clayey' sandy gravel Gravel: fine and coarse with some cobbles Sand: medium with some fine and coarse	0.3	6.3
London Clay	Clay, dark orange-brown becoming dark bluish grey	0.4+	6.7

TL 82 NE 14 | 8979 2913 | Oldhouse Farm, Chappel | BLOCK A

Surface level + 49.1 m (+ 161 ft)
Water not struck
152 mm percussion
June 1973

Overburden 1.9 m
Mineral 2.1 m
Waste 6.6 m
Bedrock 0.6 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Glacial Sand and Gravel	Clay, grey mottled brown and orange, firm with flint gravel	0.7	0.8
	Clay, with abundant pebbles and cobbles of flint and vein-quartz	1.1	1.9
	'Clayey' sandy gravel Gravel: coarse and fine, subangular to subrounded flint with quartz and quartzite Sand: medium with fine and coarse	2.1	4.0
Boulder Clay	Clay, brown, stiff with pebbles of flint and vein-quartz with rare chalk, becoming grey and less pebbly towards base	6.6	10.6
London Clay	Clay, dark olive-black clay with some pyritised nodules	0.6+	11.2

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				–1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
15	44	41	1.9–2.9	13	10	32	8	23	14	0
			2.9–4.0	17	13	16	9	16	22	7
			Mean	15	12	24	8	18	19	4

TL 82 NE 15 | 8539 2671 | Disused airfield, Earl's Colne | SUB-BLOCK B_1

Surface level (+ 68.3 m (+ 224 ft)
Water struck at + 57.3 m (+ 188 ft)
152 mm percussion
September 1973

Overburden 10.0 m
Mineral 6.2 m
Bedrock 0.2 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, mottled brown and grey with chalk pebbles and some flint, the latter becoming more abundant with depth	9.7	10.0
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine and coarse, subrounded to subangular flint, vein-quartz and quartzite with rare limestone Sand: medium with some fine and coarse, mainly quartz	6.2	16.2
London Clay	Clay, firm, dark bluish grey	0.2+	16.4

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
2	69	29	10.0–11.0	4	4	31	11	32	18	0
			11.0–12.0	3	16	41	8	20	12	0
			12.0–13.0	2	14	78	3	2	1	0
			13.0–14.0	1	4	42	9	20	24	0
			14.0–15.0	1	6	55	10	11	12	5
			15.0–16.2	2	10	59	8	14	7	0
			Mean	2	9	52	8	16	12	1

TL 82 NE 16 | 8844 2710 | Near Pattock's Farm, Great Tey | SUB-BLOCK B_2

Surface level + 71.0 m (+ 233 ft)
Water struck at + 54.3 m (+ 178 ft)
152 mm percussion
September 1973

Overburden 11.5 m
Mineral 7.2 m
Bedrock 0.5 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, yellowish brown, silty with chalk pebbles and rare flint, the latter becoming more abundant with depth along with vein-quartz, shale, ironstone and limestone	9.7	10.0
	Clay, mottled orange-brown and grey, sandy becoming pebbly towards base	1.5	11.5
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine and coarse, subangular to rounded flint with subrounded to rounded vein-quartz and rare quartzite Sand: medium with coarse and some fine, angular to subangular quartz with flint	7.2	18.7
London Clay	Clay, brown passing into firm, bluish grey silty clay	0.5+	19.2

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
6	56	38	11.5–12.5	5	5	39	9	26	13	3
			12.5–13.5	9	4	22	15	25	12	13
			13.5–14.5	10	7	20	18	23	20	2
			14.5–15.5	8	7	53	12	13	7	0
			15.5–16.5	6	6	51	9	15	13	0
			16.5–17.5	3	3	29	14	33	18	0
			17.5–18.7	4	16	34	16	19	11	0
			Mean	6	7	36	13	22	13	3

TL 82 NE 17 | 8822 2649 | Teycross Farm, Great Tey | SUB-BLOCK B_2

Surface level + 63.7 m (+ 209 ft)
Water struck at + 52.1 m (+ 171 ft)
152 mm percussion
June 1973

Overburden 7.3 m
Mineral 1.5 m
Waste 0.9 m
Mineral 6.5 m
Bedrock 0.2 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown with abundant pebbles of flint, chalk, vein-quartz and quartzite	7.0	7.3
Kesgrave Sands and Gravels	a Gravel Gravel: mainly fine with coarse, subangular to subrounded flint with vein-quartz Sand: medium and coarse with fine, mainly subangular quartz	1.5	8.8
	Clay, grey mottled brown containing many flint and vein-quartz pebbles	0.9	9.7
	b Pebbly sand Gravel: fine with coarse, subrounded to subangular flint with vein-quartz and quartzite Sand: medium with fine and coarse, quartz with some flint	6.5	16.2
London Clay	Clay, stiff, dark bluish grey	0.2+	16.4

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
a	7	37	56	7.3−8.3	4	5	16	17	46	12	0
				8.3−8.8	12	7	22	7	36	16	0
				Mean	7	6	18	13	43	13	0
				8.8−9.7	Clay						
b	9	81	10	9.7−10.7	13	14	43	5	13	12	0
				10.7−11.7	13	8	68	4	6	1	0
				11.7−12.7	6	17	52	16	8	1	0
				12.7−13.7	10	12	51	13	10	4	0
				13.7−14.7		No grading data available					
				14.7−15.7	5	24	55	14	2	0	0
				15.7−16.2	7	35	42	15	1	0	0
				Mean	9	17	53	11	7	3	0
a & b	9	70	21	Mean	9	15	44	11	15	6	0

TL 82 NE 18 | 8961 2537 | Near the Rectory, Great Tey | SUB-BLOCK B_2

Surface level + 46.3 m (+ 152 ft)
Water struck at + 43.0 m (+ 141 ft)
152 mm percussion
September 1973

Overburden 4.5 m
Mineral 3.5 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, yellowish brown, stiff with chalk pebbles and rare flint	4.3	4.5
Kesgrave Sands and Gravels	Pebbly sand Gravel: fine with coarse, subrounded to rounded flint Sand: medium with fine and coarse, mainly quartz and flint	3.5	8.0
London Clay	Clay, brown becoming grey, firm and silty	0.3+	8.3

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
8	71	21	4.5−5.5	9	11	28	12	20	20	0
			5.5−8.0	8	23	38	18	10	3	0
			Mean	8	20	35	16	13	8	0

TL 82 NE 19 | 8580 2564 | Witch Wood, Coggeshall | SUB-BLOCK B_1

Surface level + 65.2 m (+ 214 ft)
Water struck at + 57.6 m (+ 189 ft)
152 mm percussion
June 1973

Overburden 5.6 m
Mineral 7.9 m
Bedrock 0.1 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay, grey mottled orange brown, firm and sandy; abundant chalk and flint pebbles below 1.2 m	5.5	5.6
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine with coarse, subrounded to subangular flint with vein-quartz Sand: medium with coarse and some fine, flint and vein-quartz	7.9	13.5
London Clay	Clay, brown, firm and silty	0.1+	13.6

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				–1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
4	60	36	5.6–6.6	10	7	62	10	8	3	0
			6.6–7.6	8	6	49	10	19	8	0
			7.6–8.6	3	6	39	17	25	10	0
			8.6–9.6	0	4	29	21	29	17	0
			9.6–10.6	4	1	36	18	28	13	0
			10.6–11.6	0	0	24	29	30	17	0
			11.6–12.6	1	0	20	20	41	18	0
			12.6–13.5	3	17	43	20	12	5	0
			Mean	4	5	36	19	25	11	0

TL 82 NE 20 | 8541 2970 | Near disused Station, Earls Colne | BLOCK D

Surface level + 29.0 m (+ 95 ft)
Water struck at + 27.2 m (+ 89 ft)
152 mm percussion
June 1973

Overburden 0.8 m
Mineral 8.5 m
Bedrock 0.9 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
River Terrace Deposit (Second Terrace)	Gravel, becoming sandy towards base Gravel: fine with coarse, subangular to subrounded flint with some quartz and sandstone Sand: medium with coarse and some fine, mainly quartz and flint	8.5	9.3
London Clay	Clay, soft becoming firm, silty, grey	0.9+	10.2

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				–1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
4	45	51	0.8–1.8		No grading data available					
			1.8–2.8		"					
			2.8–3.8	1	1	18	11	31	38	0
			3.8–4.8		No grading data available					
			4.8–5.8	1	3	19	15	34	28	0
			5.8–6.8		No grading data available					
			6.8–7.8	7	2	28	14	41	8	0
			7.8–8.8	8	8	46	11	19	8	0
			8.8–9.3		No grading data available					
			Mean	4	4	28	13	31	20	0

TL 82 NE 21 | 8806 2882 | Fox and Pheasant Farm, Wakes Colne | BLOCK D

Surface level + 23.2 m (+ 76 ft)
Water struck at + 20.7 m (+ 68 ft)
152 mm percussion
July 1973

Overburden 1.3 m
Mineral 3.9 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
River Terrace Deposits (First Terrace)	Clay, brown, firm, with abundant flint gravel	1.2	1.3
	Gravel Gravel: fine and coarse with some cobbles, subangular to rounded flint, vein-quartz, and quartzite with some sandstone and limestone Sand: medium with coarse and some fine	3.9	5.2
London Clay	Clay, fresh, dark bluish grey clay	0.3+	5.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
6	36	58	1.3−2.3	8	8	22	12	28	22	0
			2.3−3.3	5	6	31	15	36	7	0
			3.3−4.3	2	3	22	8	31	30	4
			4.3−5.2	8	2	10	5	20	36	19
			Mean	6	5	21	10	29	24	5

TL 82 SW 1 | 8092 2418 | Pattiswick Hall, Pattiswick Green | SUB-BLOCK B_1

Surface level + 61.9 m (+ 203 ft)
Water struck at + 52.4 m (+ 172 ft)
203 mm auger
August 1970

Overburden 5.8 m
Mineral 7.9 m
Bedrock 0.6 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Clay, brown with chalk fragments becoming sandy towards base	5.2	5.8
Kesgrave Sands and Gravels	'Clayey' pebbly sand Gravel: fine and coarse with occasional cobbles, mainly subangular to subrounded flint Sand: medium with fine and some coarse, mainly quartz	7.9	13.7
London Clay	Clay, brown	0.6+	14.3

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
11	73	16	5.8–6.7	20	29	32	2	7	7	3
			6.7–7.6	15	14	45	9	8	9	0
			7.6–8.6	11	6	38	10	14	21	0
			8.6–9.5	10	21	45	9	4	3	8
			9.5–10.4	7	35	37	10	5	6	0
			10.4–12.8	No grading data available						
			12.8–13.7	4	26	49	20	1	0	0
			Mean	11	22	41	10	7	8	1

TL 82 SW 2 | 8006 2310 | Near Hollies Road, Bradwell | BLOCK C

Surface level + 53.0 m (+ 174 ft)
Water struck at + 50.9 m (+ 167 ft)
203 mm auger
August 1970

Overburden 2.1 m
Mineral 4.3 m
Bedrock 0.9 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Clay, brown and silty	1.5	2.1
Kesgrave Sands and Gravels	'Clayey' pebbly sand Gravel: fine with coarse, mainly subangular flint Sand: medium with coarse and fine	4.3	6.4
London Clay	Clay, brown	0.9+	7.3

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
10	84	6	2.1–3.1	26	18	49	5	1	1	0
			3.1–4.0	7	41	32	13	6	1	0
			4.0–4.9	6	21	41	24	6	2	0
			4.9–5.8	6	22	42	24	5	1	0
			5.8–6.4	4	21	38	27	8	2	0
			Mean	10	25	41	18	5	1	0

TL 82 SW 3 | 8084 2241 | Park Farm, Bradwell | BLOCK C

Surface level + 49.7 m (+ 163 ft)
Water struck at + 48.5 m (+ 159 ft)
203 mm auger
August 1970

Overburden 1.2 m
Mineral 3.4 m
Bedrock 0.9 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Kesgrave Sands and Gravels	Clay, orange brown, silty	0.9	1.2
	Pebbly sand Gravel: fine and coarse, subangular patinated flint and subrounded quartzite Sand: medium with fine and some coarse, mainly quartz	3.4	4.6
London Clay	Clay, dark bluish grey	0.9+	5.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				–1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
7	79	14	1.2–2.2	No grading data available						
			2.2–3.1	8	18	62	6	3	3	0
			3.1–4.0	5	16	61	9	5	4	0
			4.0–4.6	8	8	41	11	11	21	0
			Mean	7	15	56	8	6	8	0

TL 82 SW 4 | 8050 2151 | Clapdog Green, Cressing | BLOCK C

Surface level + 59.1 m (+ 194 ft)
Water struck at + 55.2 m (+ 181 ft)
203 mm auger
August 1970

Overburden 0.9 m
Mineral 7.0 m
Bedrock 0.6 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Clay, sandy and brown	0.3	0.9
Kesgrave Sands and Gravels	'Clayey' sandy gravel Gravel: fine with coarse, subangular to subrounded flint with rare quartzite Sand: medium with coarse and some fine, mainly quartz and flint	7.0	7.9
London Clay	Clay, brown	0.6+	8.5

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
12	61	27	0.9–3.1	16	9	37	18	15	5	0
			3.1–4.0	10	4	38	19	19	10	0
			4.0–4.9	7	2	31	18	25	17	0
			4.9–8.0	No grading data available						
			Mean	12	7	36	18	18	9	0

TL 82 SW 6 | 8156 2146 | Near Goslings Farm, Bradwell | BLOCK C

Surface level + 51.8 m (+ 170 ft)
Water struck at + 32.9 m (+ 108 ft)
152 mm percussion
November 1970

Overburden 8.2 m
Mineral 2.6 m
Waste 0.4 m
Mineral 8.8 m
Bedrock 0.4 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, dark brown, chalky, some gravel towards base	4.8	5.1
	Clay, orange and brown, silty, crudely stratified with sand lenses	3.1	8.2
Kesgrave Sands and Gravels	a Sandy gravel Gravel: fine and coarse, subangular to rounded flint with some subrounded quartz and quartzite Sand: medium with coarse and fine, mainly quartz	2.6	10.8
	Clay, dark brown, silty with sandy seams	0.4	11.2
	b Gravel Gravel: fine and coarse, subangular to subrounded brown flint with quartz and quartzite and rare sandstone Sand: medium and coarse with some fine, subangular to rounded flint and quartz	8.8	20.0
London Clay	Clay, pale brown with traces of gypsum	0.4+	20.4

(... continued)

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
a	3	51	46	8.2–9.2	5	13	19	11	29	23	0
				9.2–10.2	2	19	26	10	21	22	0
				10.2–10.8	3	15	31	14	25	12	0
				Mean	3	16	24	11	26	20	0
				10.8–11.2	Clay						
b	2	29	69	11.2–12.2	2	1	12	15	35	35	0
				12.2–13.2	1	2	20	15	40	22	0
				13.2–14.2	12	1	15	17	23	32	0
				14.2–15.2	0	4	15	11	41	29	0
				15.2–16.2	1	4	11	16	43	25	0
				16.2–17.2	2	3	13	15	40	27	0
				17.2–18.2	0	3	13	21	36	27	0
				18.2–19.2	0	2	6	10	42	40	0
				19.2–20.0	3	0	4	15	39	39	0
				Mean	2	2	12	15	39	30	0
a & b	3	34	63	Mean	3	5	15	14	35	28	0

TL 82 SW 7 | 8147 2046 | Sheepcote Farm, Silver End | BLOCK C

Surface level + 50.9 m (+ 167 ft)
Water not struck
203 mm auger
August 1970

Overburden 8.8 m
Mineral 4.6 m
Bedrock 1.2 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, grey to brown, chalky becoming sandy with depth	7.6	7.9
	Clay, sandy, orange brown	0.9	8.8
Kesgrave Sands and Gravels	Gravel Gravel: fine and coarse with rare cobbles, subangular to subrounded flint and quartzite Sand: medium with coarse and fine	4.6	13.4
London Clay	Clay, brown becoming dark bluish grey	1.2+	14.6

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
	6	39	55	8.8–9.8	10	17	11	6	23	33	0
				9.8–10.7	10	6	18	11	25	30	0
				10.7–11.6	4	5	20	11	35	25	0
				11.6–12.5	2	7	21	11	31	24	4
				12.5–13.4	2	6	31	15	31	15	0
				Mean	6	8	20	11	28	26	1

TL 82 SW 8 | 8270 2406 | North of Hovel's Farm, Coggeshall | SUB-BLOCK B_1

Surface level + 59.4 m (+ 195 ft)
Water struck at + 55.2 m (+ 181 ft)
152 mm percussion
November 1970

Overburden 0.6 m
Mineral 8.1 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Kesgrave Sands and Gravels	Pebbly sand Gravel: fine with coarse, rounded to subrounded flint with vein-quartz and quartzite Sand: medium with coarse and fine, mainly subrounded quartz	8.1	8.7
London Clay	Clay, dark bluish grey, silty with traces of gypsum	0.3+	9.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				-1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
8	82	10	0.6–1.6	11	11	46	7	11	14	0
			1.6–2.6	12	18	58	7	3	2	0
			2.6–3.6	7	25	44	15	5	4	0
			3.6–4.6	2	17	45	22	10	4	0
			4.6–5.6	2	20	45	30	3	0	0
			5.6–6.6	23	21	28	19	7	2	0
			6.6–7.6	4	34	36	22	4	0	0
			7.6–8.6	6	15	37	26	14	2	0
			8.6–8.7	3	13	43	31	9	1	0
			Mean	8	20	43	19	7	3	0

TL 82 SW 9 | 8290 2258 | Stock Street Farm, Coggeshall | SUB-BLOCK B_1

Surface level + 41.8 m (+ 137 ft)
Water struck at + 38.4 m (+ 126 ft)
203 mm auger
August 1970

Overburden 2.4 m
Mineral 1.6 m
Bedrock 0.9 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
Head	Clay, pale brown, becoming silty below 1.8 m	1.5	2.4
Glacial Sand and Gravel	'Clayey' gravel Gravel: coarse and fine, subangular to subrounded flint Sand: medium with coarse and some fine, mainly quartz and flint	1.6	4.0
London Clay	Clay, brown, sandy in part	0.9+	4.9

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–¼	+¼–1	+1–4	+4–16	+16–64	+64
11	32	57	2.4–3.4	14	3	16	10	26	31	0
			3.4–4.0	7	4	20	12	24	33	0
			Mean	11	4	17	11	25	32	0

TL 82 SW 10 | 8321 2163 | Curd Hall, Coggeshall | BLOCK C

Surface level + 45.7 m (+ 150 ft)
Water struck at + 32.9 m (+ 108 ft)
203 mm auger
July 1970

Overburden 9.1 m
Mineral 6.5 m
Bedrock 0.9 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown and chalky	8.8	9.1
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine and coarse, angular to subrounded flint and quartzite Sand: medium with fine and coarse	6.5	15.6
London Clay	Clay, brown becoming dark bluish grey with depth	0.9+	16.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–¼	+¼–1	+1–4	+4–16	+16–64	+64
3	49	48	9.1–10.1	10	11	36	13	19	11	0
			10.1–11.0	2	23	48	12	12	3	0
			11.0–11.9	0	22	45	8	12	13	0
			11.9–12.8	1	3	15	10	25	46	0
			12.8–13.7	4	4	24	13	29	26	0
			13.7–14.7	2	2	15	9	34	38	0
			14.7–15.6	4	1	18	12	30	35	0
			Mean	3	10	29	10	23	25	0

TL 82 SW 11 | 8296 2050 | Allshot's Farm, Coggeshall | BLOCK C

Surface level + 49.1 m (+ 161 ft)
Water not struck
203 mm auger
August 1970

Overburden 9.8 m
Mineral 8.2 m
Bedrock 0.6 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.3	0.3
Boulder Clay	Clay, brown and chalky, becoming grey towards base	9.1	9.4
Kesgrave Sands and Gravels	Clay, very pebbly	0.4	9.8
	Sandy gravel Gravel: fine and coarse, subangular to subrounded flint with rare quartzite Sand: medium with fine and coarse	8.2	18.0
London Clay	Clay, brown becoming dark bluish grey with depth	0.6+	18.6

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
7	49	44	9.8–10.7	6	10	31	12	25	16	0
			10.7–11.6	11	18	30	10	17	14	0
			11.6–12.5	12	16	36	8	14	14	0
			12.5–13.4	5	13	20	9	27	26	0
			13.4–14.4	7	8	28	12	28	17	0
			14.4–15.3	No grading data available						
			15.3–16.2	1	6	24	11	36	22	0
			16.2–16.5	1	4	19	9	43	24	0
			16.5–18.0	No grading data available						
			Mean	7	11	29	10	25	18	0

TL 82 SW 12 | 8423 2273 | Highfields, Coggeshall | SUB-BLOCK B_1

Surface level + 45.1 m (+ 148 ft)
Water struck at + 36.9 m (+ 121 ft)
203 mm auger
July 1970

Overburden 0.3 m
Mineral 5.5 m
Waste 2.4 m
Mineral 1.9 m
Waste 2.1 m
Mineral 1.8 m
Bedrock 0.6 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Kesgrave Sands and Gravels	a 'Clayey' sandy gravel Gravel: coarse with fine and rare cobbles, angular to subrounded flint with quartzite Sand: medium with fine and coarse, mainly flint	5.5	5.8
	Silt, grey with orange laminae	2.4	8.2
	b Sand Gravel: trace Sand: fine and medium with coarse	1.9	10.1
	Silt, dark grey with iron-stained laminae	2.1	12.2
	c 'Clayey' sandy gravel Gravel: fine with coarse, subangular flint with subrounded quartzite Sand: medium and fine with some coarse	1.8	14.0
London Clay	Clay, brown and pebbly in part	0.6+	14.6

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
a	14	50	36	0.3–1.2	11	11	51	8	12	7	0
				1.2–2.2	20	9	29	7	15	20	0
				2.2–3.1	9	12	29	10	17	23	0
				3.1–4.0	10	4	26	12	17	26	5
				4.0–4.9	15	6	19	15	19	17	9
				4.9–5.8	17	23	21	6	10	16	7
				Mean	14	11	29	10	15	18	3
				5.8–8.2	Silt						
b	9	90	1	8.2–9.1	6	47	40	4	2	1	0
				9.1–10.1	12	47	39	2	0	0	0
				Mean	9	47	40	3	1	0	0
				10.1–12.2	Silt						
c	13	62	25	12.2–13.1	16	32	31	3	11	4	3
				13.1–14.0	9	20	31	7	24	9	0
				Mean	13	26	31	5	17	6	2
a to c	13	60	27	Mean	13	21	32	7	13	12	2

TL 82 SW 13 | 8486 2212 | Grange Farm, Coggeshall | BLOCK C

Surface level + 36.3 m (+ 119 ft)
Water not struck
152 mm percussion
November 1970

Waste 7.4 m
Bedrock 1.1 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil, dark brown, clayey, with much organic matter	0.2	0.2
Kesgrave Sands and Gravels	Clay, sandy and pebbly in parts, with subrounded to rounded flint and some quartzite and vein-quartz gravel	5.6	5.8
	Silt, pale greenish grey, sandy in part	0.2	6.0
	Gravel, with much sandy clay Gravel: subangular to subrounded, mainly flint Sand: very fine to silt grade, interbedded with much fawnish brown, locally mottled orange brown clay	0.9	6.9
	Gravel Gravel: mainly fine, rounded and subrounded with occasional subangular, mainly brown flint with some quartzite Sand: rounded and subrounded, mainly quartz	0.5	7.4
London Clay	Clay, dark grey, silty, weathered in upper layers	1.1+	8.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
3	42	56	6.9–7.4	2	4	19	19	36	14	6

TL 82 SW 14 | 8432 2111 | Cuthedge Lane, Coggeshall | BLOCK C

Surface level + 46.6 m (+ 153 ft)
Water struck at + 32.9 m (+ 108 ft)
203 mm auger
July 1970

Overburden 9.4 m
Mineral 6.2 m
Bedrock 0.9 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Clay, brown and chalky	8.8	9.4
Kesgrave Sands and Gravels	Gravel Gravel: coarse and fine, subangular to subrounded flint with some subrounded quartzite Sand: medium with coarse and some fine	6.2	15.6
London Clay	Clay, brown, pebbly in part, becoming dark bluish grey with depth	0.9+	16.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
6	34	60	9.4−10.1	8	9	22	13	27	21	0
			10.1−11.0	11	6	22	10	23	26	2
			11.0−11.9	5	6	26	11	33	19	0
			11.9−12.8	8	5	20	10	26	31	0
			12.8−13.7	6	5	18	10	32	29	0
			13.7−14.7	1	5	10	9	20	55	0
			14.7−15.6	4	3	9	14	35	35	0
			Mean	6	5	18	11	28	32	0

TL 82 SW 15 | 8197 2459 | Compasses Road, Pattiswick Green | SUB-BLOCK B_1

Surface level + 68.9 m (+ 226 ft)
Water struck at + 57.9 m (+ 190 ft)
152 mm percussion
September 1973

Overburden 3.7 m
Mineral 10.7 m
Bedrock 0.1 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, mottled grey and brown, sandy, becoming chalky with depth	3.5	3.7
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine with coarse, mainly subangular to rounded flint with subrounded to rounded vein-quartz and quartzite Sand: medium with coarse and fine, angular flint and chalk becoming more rounded with depth	10.7	14.4
London Clay	Clay, dark grey, firm and silty	0.1+	14.5

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
9	65	26	3.7–4.7	23	30	36	3	6	2	0
			4.7–5.7	14	16	25	7	27	11	0
			5.7–6.7	24	5	20	9	28	14	0
			6.7–7.7	7	7	29	15	30	12	0
			7.7–8.7	7	5	27	13	34	14	0
			8.7–9.7	4	9	52	6	19	10	0
			9.7–10.7	2	4	85	3	4	2	0
			10.7–11.7	3	11	58	16	10	2	0
			11.7–12.7	3	31	55	7	4	0	0
			12.7–13.7	4	23	40	8	14	11	0
			13.7–14.4	3	17	32	14	19	15	0
			Mean	9	14	42	9	18	8	0

TL 82 SW 16 | 8170 2381 | Doghouse Road, Pattiswick | SUB-BLOCK B_1

Surface level + 67.4 m (+ 221 ft)
Water struck at + 55.2 m (+ 181 ft)
152 mm percussion
September 1973

Overburden 5.0 m
Mineral 11.8 m
Bedrock 0.4 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Clay, orange-brown, silty with chalk pebbles, some flint and rare chert, vein-quartz and quartzite	4.4	5.0
Kesgrave Sands and Gravels	Pebbly sand Gravel: fine with coarse, subrounded to rounded flint and vein-quartz Sand: medium with fine and some coarse, mainly quartz	11.8	16.8
London Clay	Clay, silty, brown becoming dark grey with depth	0.4+	17.2

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
8	83	9	5.0–6.0	11	5	63	5	6	10	0
			6.0–7.0	9	3	64	5	11	6	2
			7.0–8.0	14	69	14	1	1	1	0
			8.0–9.0	11	33	55	1	0	0	0
			9.0–10.0	11	38	42	7	2	0	0
			10.0–11.0	5	21	61	10	3	0	0
			11.0–12.0	No grading data available						
			12.0–13.0	3	29	38	16	13	1	0
			13.0–14.0	13	18	53	11	4	1	0
			14.0–15.0	5	12	45	24	14	0	0
			15.0–16.0	2	19	47	20	10	2	0
			16.0–16.8	3	18	46	17	13	3	0
			Mean	8	24	48	11	7	2	0

TL 82 SW 17 | 8344 2463 | Bungate Wood, Coggeshall | SUB-BLOCK B_1

Surface level + 67.7 m (+ 222 ft)
Water struck at + 56.1 m (+ 184 ft)
152 mm percussion
September 1973

Overburden 6.5 m
Mineral 11.7 m
Bedrock 0.2 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, silty, orange-brown with chalk pebbles and rare flint, vein-quartz, chert and quartzite	6.3	6.5
Kesgrave Sands and Gravels	a Sandy gravel Gravel: fine with coarse, subangular to rounded flint, vein-quartz and quartzite Sand: medium with some fine and coarse, quartz with some chalk fragments	5.0	11.5
	b Pebbly sand Gravel: fine with coarse Sand: fine and medium with some coarse, subrounded to rounded quartz and flint	6.7	18.2
London Clay	Clay, silty, brown becoming dark grey with depth	0.2+	18.4

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					−1/16	+1/16–¼	+¼–1	+1–4	+4–16	+16–64	+64
a	7	63	30	6.5–7.5	2	5	50	8	24	11	0
				7.5–8.5	7	5	48	16	20	4	0
				8.5–9.5	8	15	52	7	14	4	0
				9.5–10.5	7	4	44	9	26	10	0
				10.5–11.5	10	6	40	7	21	14	2
				Mean	7	7	47	9	21	9	0
b	7	86	7	11.5–12.5	10	20	45	7	12	6	0
				12.5–13.5	10	21	49	14	5	1	0
				13.5–14.5	7	35	38	15	5	0	0
				14.5–15.5	3	60	18	7	11	1	0
				15.5–16.5	4	57	30	8	1	0	0
				16.5–17.5	8	41	38	10	3	0	0
				17.5–18.2	6	45	35	11	3	0	0
				Mean	7	40	36	10	6	1	0
a & b	7	77	16	Mean	7	26	41	10	11	5	0

TL 82 SW 18 | 8346 2353 | Park Lodge, Coggeshall | SUB-BLOCK B_1

Surface level + 65.8 m (+ 216 ft)
Water struck at + 57.0 m (+ 187 ft)
152 mm percussion
September 1973

Overburden 3.8 m
Mineral 4.0 m
Waste 1.0 m
Mineral 1.9 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, orange-brown, sandy in part, with much rounded to subrounded chalk clasts together with angular to subrounded flint and traces of vein-quartz, chert and quartzite gravel, clay becoming grey towards base	3.4	3.8
Kesgrave Sands and Gravels	a 'Clayey' sandy gravel Gravel: fine with some coarse, rare cobbles, mainly angular to subrounded flint with rounded to subrounded vein-quartz and quartzite Sand: mainly medium with some coarse and fine; flint with rare chalk, much quartz, pebbly	4.0	7.8
	Sandy clay, pale grey to brown with interbedded lenses of reddish brown; many alternations of pebbly clay with pebbly sand; pebbles mainly of flint and quartzite	1.0	8.8
	b 'Clayey' pebbly sand Gravel: mainly fine with some coarse, mainly subrounded to rounded flint and vein-quartz Sand: mainly fine with some medium and coarse, mainly flint with quartz and traces of mica	1.9	10.7
London Clay	Clay, dark grey, silty	0.3+	11.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
a	18	59	23	3.8–4.8	20	7	32	6	23	9	3
				4.8–5.8	9	5	63	7	11	5	0
				5.8–6.8	7	4	53	11	17	8	0
				6.8–7.8	35	45	4	2	2	12	0
				Mean	18	15	38	6	13	9	1
				7.8–8.8	45	27	14	4	8	2	0
b	10	73	17	8.8–9.8	5	92	2	1	0	0	0
				9.8–10.7	15	17	20	11	24	13	0
				Mean	10	56	11	6	11	6	0
a & b	15	64	21	Mean	15	28	29	7	12	8	1

TL 82 SW 19 | 8055 2052 | Rolph's Farm, Silver End | BLOCK C

Surface level + 54.3 m (+ 178 ft)
Water struck at + 37.2 m (+ 122 ft)
152 mm percussion
June 1973

Overburden 12.0 m
Mineral 5.9 m
Bedrock 0.6 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay, mottled brown, orange and grey with chalk, flint and vein-quartz pebbles, becomes sandy towards base	11.9	12.0
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine with coarse and some cobbles, subangular to subrounded, flint with some vein-quartz and rare quartzite Sand: medium with coarse and fine	5.9	17.9
London Clay	Clay, brown becoming bluish grey with depth	0.6+	18.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
3	49	48	12.0–13.0	2	3	55	7	27	6	0
			13.0–14.0	5	11	30	12	28	14	0
			14.0–15.0	3	5	21	15	37	19	0
			15.0–16.0	6	8	29	16	30	4	7
			16.0–17.0	1	2	23	16	31	22	5
			17.0–17.9	3	4	13	24	40	16	0
			Mean	3	6	29	14	33	13	2

TL 82 SW 20 | 8245 2137 | Heron's Farm, Coggeshall | BLOCK C

Surface level + 45.4 m (+ 149 ft)
Water struck at + 30.9 m (+ 101.5 ft)
152 mm percussion
June 1973

Overburden 6.0 m
Mineral 11.2 m
Bedrock 0.4 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay, stiff, brown with abundant chalk fragments and some flint; sandy in part	5.9	6.0
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine with coarse, subangular to subrounded flint with vein-quartz Sand: medium with coarse and fine	11.2	17.2
London Clay	Clay, brown	0.4+	17.6

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
2	53	45	6.0–7.0	3	6	45	10	18	18	0
			7.0–8.0	2	13	45	10	15	15	0
			8.0–9.0	No grading data available						
			9.0–10.0	3	4	39	14	27	13	0
			10.0–11.0	3	5	26	17	35	14	0
			11.0–12.0	3	5	25	18	30	19	0
			12.0–13.0	3	4	23	18	29	23	0
			13.0–14.0	4	7	28	12	40	9	0
			14.0–15.0	1	4	37	10	34	14	0
			15.0–16.0	0	3	43	10	26	18	0
			16.0–17.2	2	3	27	9	33	26	0
			Mean	2	6	34	13	28	17	0

TL 82 SW 21 | 8428 2026 | Pantlings Lane, Kelvedon | BLOCK C

Surface level + 45.1 m (+ 148 ft)
Water struck at + 32.0 m (+ 105 ft)
152 mm percussion
September 1973

Overburden 3.0 m
Mineral 1.8 m
Waste 4.4 m
Mineral 9.5 m
Bedrock 0.5 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Clay, firm, orange-brown, silty with chalk and flint pebbles and rare vein-quartz, chert and quartzite	3.0	3.0
Glacial Sand and Gravel	a Clayey sandy gravel Gravel: fine and coarse, with rare cobbles, subangular to subrounded flint and vein-quartz with some chalk Sand: medium with fine and coarse with chalk and angular flint	1.8	4.8
Boulder Clay	Clay, firm, dark orange-brown becoming dark grey with depth, some chalk gravel	4.4	9.2
Kesgrave Sands and Gravels	Gravel Gravel: fine and coarse, subangular to rounded flint with subrounded to rounded vein-quartz and grey quartzite Sand: medium with fine and coarse, mainly quartz and flint	9.5	18.7
London Clay	Clay, stiff, silty, orange-brown becoming dark grey with depth	0.5+	19.2

(... continued)

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
a	17	49	34	3.0−4.0	16	18	31	6	15	14	0
				4.0−4.8	17	11	23	8	22	19	0
				Mean	17	14	28	7	18	16	0
				4.8−9.2	Clay						
b	4	37	59	9.2−10.2	21	7	24	8	23	17	0
				10.2−11.2	3	6	27	11	38	15	0
				11.2−12.2	5	6	35	10	28	16	0
				12.2−13.2	5	7	53	7	14	11	3
				13.2−14.2	2	4	26	8	32	25	3
				14.2−15.2	0	3	14	6	30	25	22
				15.2−16.2	1	4	27	7	19	27	15
				16.2−17.2	1	2	8	7	34	39	9
				17.2−18.2	0	3	7	8	34	29	19
				18.2−18.7	0	5	12	11	32	34	6
				Mean	4	5	24	8	28	23	8
a & b	5	38	57	Mean	5	6	24	8	27	23	7

TL 82 SW 22 | 8495 2096 | Scrip's Farm, Coggeshall | BLOCK C

Surface level + 45.7 m (+ 150 ft)
Water struck at + 30.5 m (+ 100 ft)
152 mm percussion
June 1973

Overburden 10.3 m
Mineral 6.1 m
Bedrock 0.6 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay, pale brown, stiff with abundant chalk pebbles and some flint and vein-quartz, sandy in part	10.2	10.3
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine with coarse, subangular to subrounded flint with subrounded vein-quartz and quartzite Sand: medium with coarse and some fine, mainly quartz	6.1	16.4
London Clay	Clay, brown, becoming grey-blue with depth	0.6+	17.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
	8	47	45	10.3−11.3	10	17	51	7	13	2	0
				11.3−12.3	6	6	32	15	31	10	0
				12.3−13.3	4	4	15	17	46	14	0
				13.3−14.3	8	5	34	9	28	16	0
				14.3−15.3	19	5	15	14	33	14	0
				15.3−16.4	1	8	13	15	51	12	0
				Mean	8	7	27	13	34	11	0

TL 82 SW 23 | 8181 2260 | Bradwell Hall, Bradwell | BLOCK D

Surface level + 29.9 m (+ 98 ft)
Water struck at + 27.9 m (+ 91.5 ft)
152 mm percussion
October 1975

Overburden 1.9 m
Mineral 1.5 m
Bedrock 0.6 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Alluvium	Silt, soft, sandy, clayey, mottled yellowish grey with orange, becoming pale bluish grey with depth	1.8	1.9
'Sub-alluvial' gravels	Gravel Gravel: fine and coarse with rare cobbles, angular to subrounded flint with some rounded vein-quartz and brown quartzite Sand: medium and coarse with fine, angular to subrounded flint, with subangular quartz	1.5	3.4
London Clay	Clay, stiff, silty, dark olive-grey	0.6+	4.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
7	32	61	1.9–3.4	7	3	16	13	37	24	0

TL 82 SW 24 | 8360 2189 | Curd Hall, Coggeshall | BLOCK D

Surface level + 28.0 m (+ 92 ft)
Water struck at + 18.4 m (+ 60.5 ft)
152 mm percussion
October 1975

Waste 10.0 m
Bedrock 1.0 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
Alluvium	Silt, soft, clayey, orange-brown mottled dark bluish grey	4.0	4.0
	Silt, very soft, sandy, clayey, olive-grey with flint and shell fragments	5.5	9.5
'Sub-alluvial' gravels	Gravel Gravel: fine and coarse with rare cobbles, subangular to angular flint with some vein-quartz and quartzite Sand: medium and coarse with some fine, flint, quartz and shell fragments	0.5	10.0
London Clay	Clay, stiff, silty, olive-grey with selenite crystals	1.0+	11.0

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
3	25	72	9.5−10.0	3	1	12	12	39	32	1

TL 82 SE 5 | 8513 2456 | Bullock's Cross, Coggeshall | SUB-BLOCK B_1

Surface level + 66.1 m (+ 217 ft)
Water struck at + 52.1 m (+ 171 ft)
152 mm percussion
November 1970

Overburden 6.1 m
Mineral 9.9 m
Waste 0.2 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	1.0	1.0
Boulder Clay	Clay, brown, mottled orange and brown in some parts, chalky with some flint pebbles	5.1	6.1
Kesgrave Sands and Gravels	Sandy gravel, gravel mainly in the upper 3.0 m and lower 1.9 m. Clay seams between 6.8 and 7.1 m Gravel: fine to coarse, subangular to rounded flint with some rounded quartzite and vein-quartz Sand: medium with coarse and fine, subrounded, iron-stained in parts, brown to grey	9.9	16.0
	Clay, bluish grey, silty	0.1	16.1
	'Clayey' gravel, grey, sandy	0.1	16.2
London Clay	Clay, dark grey with traces of gypsum	0.3+	16.5

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
2	71	27	6.1−6.8	3	9	28	15	20	25	0
			6.8−7.1	Clay						
			7.1−8.1	2	3	24	9	29	33	0
			8.1−9.1	0	20	35	12	17	13	3
			9.1−10.1	2	37	42	12	5	2	0
			10.1−11.1	2	39	36	15	5	3	0
			11.1−12.1	7	42	30	12	6	3	0
			12.1−13.1	1	21	45	25	7	1	0
			13.1−14.1	2	30	27	25	13	3	0
			14.1−15.1	1	10	9	12	46	22	0
			15.1−16.0	2	28	23	28	15	4	0
			Mean	2	25	30	16	16	11	0

TL 82 SE 6 | 8533 2372 | Coggeshall | SUB-BLOCK B_1

Surface level + 53.0 , (+ 174 ft)
Water not struck
203 mm auger
July 1970

Waste 4.9 m
Bedrock 5.5 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Head	Clay, pale blue to green with traces of organic matter and interbedded pale brown clay	4.6	4.9
London Clay	Clay, pale brown with minute crystals of gypsum, becoming dark brown at 9.1 m	5.5+	10.4

TL 82 SE 7 | 8595 2221 | Coggeshall | SUB-BLOCK B_2

Surface level + 40.5 m (+ 133 ft)
Water struck at + 29.6 m (+ 97 ft)
203 mm auger
July 1970

Overburden 9.1 m
Mineral 8.0 m
Bedrock 0.9 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, chalky with flints and other erratics	8.8	9.1
Kesgrave Sands and Gravels	Gravel Gravel: fine with coarse and rare cobbles between 10.1 and 11.0 m and 16.2 and 17.1 m, angular and subrounded, flint and quartzite Sand: medium with coarse and traces of fine, subangular, yellowish-brown	8.0	17.1
London Clay	Clay, brown, becoming dark bluish grey with depth	0.9+	18.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
4	35	61	9.1–10.1	8	12	39	8	22	11	0
			10.1–11.0	4	4	22	7	30	17	16
			11.0–11.9	4	4	18	11	31	32	0
			11.9–12.8	2	2	16	12	34	34	0
			12.8–15.2	No grading data available						
			15.2–16.1	2	2	24	19	33	20	0
			16.1–17.1	2	1	6	6	42	36	7
			Mean	4	4	21	10	32	25	4

TL 82 SE 9 | 8576 2021 | Farm Hill, Kelvedon | BLOCK C

Surface level + 39.6 m (+ 130 ft)
Water struck at + 29.3 m (+ 96 ft)
203 mm auger
July 1970

Overburden 8.5 m
Mineral 6.4 m
Bedrock 1.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Clay, bluish grey, chalky with flints and other erratics	7.9	8.5
Kesgrave Sands and Gravels	Sandy gravel, 'clayey' in upper 0.9 m Gravel: fine to coarse with rare cobbles, subrounded flint and quartzite with some subangular flint Sand: medium with some fine and coarse, subangular, orange to yellow-brown	6.4	14.9
London Clay	Clay, brown, with some gravel, becoming dark bluish grey with depth	1.3+	16.2

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
5	52	43	8.5−9.4	14	39	31	3	4	1	8
			9.4−10.4	9	18	38	10	19	6	0
			10.4−11.3	2	13	38	10	21	16	0
			11.3−12.2	4	7	30	14	30	15	0
			12.2−13.1	0	10	8	8	26	47	1
			13.1−14.0	3	4	41	17	16	19	0
			14.0−14.9	2	2	11	6	31	48	0
			Mean	5	13	30	9	21	21	1

TL 82 SE 10 | 8616 2490 | Palmer's Farm, Coggeshall | SUB-BLOCK B_1

Surface level + 63.7 m (+ 209 ft)
Water struck at + 56.7 m (+ 186 ft)
203 mm auger
August 1970

Overburden 6.7 m
Mineral 8.2 m
Waste 0.6 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.3	0.3
Boulder Clay	Clay, brown, chalky with flints and other erratics	3.7	4.0
	Clay, grey to brown, silty becoming sandy towards the base	2.7	6.7
Kesgrave Sands and Gravels	Sand Gravel: fine and coarse, mainly subangular flint with subrounded quartzite Sand: fine and medium with rare coarse, subangular, yellow	8.2	14.9
? London Clay	Sand, dark bluish grey	0.6+	15.5

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
8	90	2	6.7−7.6	9	48	39	1	2	1	0
			7.6−8.5	20	40	34	1	1	4	0
			8.5−9.5	8	51	40	1	0	0	0
			9.5−10.4	5	54	38	2	1	0	0
			10.4−11.3	8	33	46	12	1	0	0
			11.3−12.2	1	38	48	12	1	0	0
			12.2−12.8	7	41	44	7	1	0	0
			12.8−14.9		No grading data available					
			Mean	8	44	41	5	1	1	0

TL 82 SE 11 | 8692 2290 | Surrex, near Coggeshall | SUB-BLOCK B_2

Surface level + 46.6 m (+ 153 ft)
Water struck at + 37.3 m (+ 122.5 ft)
203 mm percussion
November 1970

Overburden 14.1 m
Mineral 6.8 m
Bedrock 0.7 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground on dark brown, sandy clay	0.6	0.6
Boulder Clay	Clay, brown with red and grey layers, chalky, occasional pebbles	13.5	14.1
Kesgrave Sands and Gravels	Gravel, 'clayey' in upper 1.0 m Gravel: fine and coarse with rare cobbles, subangular to subrounded flint and subrounded to rounded quartz Sand: medium and coarse with some fine, subangular, brown to grey	6.8	20.9
London Clay	Clay, reddish brown becoming dark bluish grey and silty	0.7+	21.6

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
3	29	68	14.1−15.1	16	3	14	8	25	31	3
			15.1−16.1	0	3	19	15	43	20	0
			16.1−17.1	1	1	25	9	31	33	0
			17.1−18.1	0	2	23	14	31	28	2
			18.1−19.1	2	1	11	5	24	57	0
			19.1−20.1	0	1	8	8	39	44	0
			20.1−20.9	1	2	17	14	36	30	0
			Mean	3	2	17	10	33	34	1

TL 82 SE 12 | 8673 2131 | Opposite Old Mill Lane, Feering | SUB-BLOCK B_2

Surface level + 33.8 m (+ 111 ft)
Water struck at + 25.6 m (+ 84 ft)
203 mm auger
July 1970

Overburden 3.1 m
Mineral 1.8 m
Waste 0.9 m
Mineral 5.5 m
Bedrock 0.9 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, chalky with flints	2.8	3.1
Kesgrave Sands and Gravels	a 'Clayey' pebbly sand Gravel: fine to coarse, subangular to rounded, flint Sand: fine and medium with rare coarse, grey to yellow	1.8	4.9
	Silt, pale grey to green, traces of mica	0.9	5.8
	b Sandy gravel Gravel: fine with coarse, subrounded to angular flint with subrounded quartzite Sand: medium with some coarse and fine, brown to yellowish brown	5.5	11.3
London Clay	Clay, brown, becoming dark bluish grey	0.9+	12.2

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
a	19	71	10	3.0–4.0	19	43	35	1	1	1	0
				4.0–4.9	19	28	32	4	11	6	0
				Mean	19	35	33	3	6	4	0
				4.9–5.8	Silt						
b	2	53	45	5.8–6.7	4	11	26	8	34	17	0
				6.7–7.6	0	10	28	11	34	17	0
				7.6–8.5	4	6	26	8	23	33	0
				8.5–9.5	1	4	35	14	29	17	0
				9.5–10.4	1	2	33	19	29	16	0
				10.4–11.3	3	17	47	10	14	9	0
				Mean	2	8	33	12	27	18	0
a & b	6	57	37	Mean	6	15	33	9	22	15	0

TL 82 SE 13 | 8751 2415 | Cuckoo's Farm, Great Tey | SUB-BLOCK B_1

Surface level + 45.5 m (+ 149 ft)
Water struck at + 39.3 m (+ 129 ft)
203 mm auger
June 1970

Overburden 5.5 m
Mineral 7.0 m
Bedrock 0.6 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, chalky with flints, sandy near the base	5.2	5.5
Kesgrave Sands and Gravels	'Clayey' sandy gravel Gravel: fine to coarse, subrounded to subangular, flint and quartzite Sand: medium with fine and coarse, orange to brown, silty	7.0	12.5
London Clay	Clay, dark bluish grey	0.6+	13.1

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
11	47	42	5.5−6.4	10	14	17	11	33	15	0
			6.4−7.3	No grading data available						
			7.3−8.2	11	16	24	12	22	15	0
			8.2−12.5	No grading data available						
			Mean	11	15	20	12	27	15	0

TL 82 SE 14 | 8746 2043 | Near railway bridge, Feering | SUB-BLOCK B_2

Surface level + 35.4 m (+ 116 ft)
Water struck at + 25.9 m (+ 85 ft)
203 mm auger
September 1970

Overburden 1.2 m
Mineral 3.7 m
Waste 1.8 m
Mineral 8.6 m
Bedrock 1.1 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.2	1.2
River Terrace Deposits (Third Terrace)	a Pebbly sand, 'clayey' in upper 0.9 m Gravel: fine with coarse, rounded to subangular flint Sand: medium with fine and coarse, subangular, orange-brown	3.7	4.9
Boulder Clay	Clay, brown with some small chalk pebbles	1.8	6.7
?Glacial Sand and Gravel	b Sandy gravel Gravel: fine and coarse, angular to rounded, flint with quartzite and quartz Sand: medium with coarse and traces of fine, subangular, pale brown to orange	8.6	15.3
London Clay	Clay, dark bluish grey	1.1+	16.4

(... continued)

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
a	7	77	16	1.2–2.1	14	17	59	4	2	4	0
				2.1–3.0	7	12	49	15	12	5	0
				3.0–4.0	4	9	56	17	12	2	0
				4.0–4.9	4	5	42	22	17	10	0
				Mean	7	11	51	15	11	5	0
b	3	49	48	6.7–7.6	7	10	16	10	24	33	0
				7.6–8.5	8	4	21	14	24	29	0
				8.5–9.5	2	3	20	12	35	28	0
				9.5–10.4	2	2	20	12	34	30	0
				10.4–11.3	1	4	27	15	28	25	0
				11.3–12.2	0	11	54	16	14	5	0
				12.2–13.1	2	5	53	8	18	14	0
				13.1–14.0	1	3	22	25	35	14	0
				14.0–15.3	No grading data available						
				Mean	3	5	30	14	26	22	0
a & b	4	58	38	Mean	4	7	37	14	21	17	0

TL 82 SE 15 | 8889 2330 | Honeylands Farm, Little Tey | SUB-BLOCK B_2

Surface level + 43.5 m (+ 143 ft)
Water struck at + 32.3 m (+ 106 ft)
203 mm auger
June 1970

Waste 18.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Clay, brown, chalky with flints and other erratics	11.9	12.5
Kesgrave Sands and Gravels	'Clayey' sandy gravel Gravel: fine to coarse, subrounded, flint Sand: medium and coarse, brown, clayey and silty	0.9	13.4
Boulder Clay	Clay, grey, chalky with flints and other erratics	4.9+	18.3

TL 82 SE 16 | 8844 2199 | Diddles near Feering | SUB-BLOCK B_2

Surface level + 43.3 m (+ 142 ft)
Water struck at + 32.6 m (+ 107 ft)
203 mm auger
July 1970

Overburden 9.4 m
Mineral 5.8 m
Bedrock 0.9 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil and made ground	0.6	0.6
Boulder Clay	Clay, brown becoming bluish grey, chalky with flints and other erratics	8.8	9.4
Kesgrave Sands and Gravels	Sandy gravel Gravel: fine and coarse, angular to subrounded, flint and quartzite with some vein-quartz Sand: medium with fine and some coarse, grey, silty in parts	5.8	15.2
London Clay	Clay, dark bluish grey	0.9+	16.1

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
4	71	25	9.4−10.4	1	41	50	4	3	1	0
			10.4−11.3	5	19	61	6	6	3	0
			11.3−12.2	5	15	45	8	14	12	1
			12.2−13.1	5	17	44	8	16	10	0
			13.1−14.0	4	11	40	10	18	17	0
			14.0−14.9	2	16	35	8	22	17	0
			14.9−15.2	5	10	24	10	25	26	0
			Mean	4	20	44	7	14	11	0

TL 82 SE 17 | 8935 2440 | Little Tey House, Little Tey | SUB-BLOCK B_2

Surface level + 45.1 m (+ 148 ft)
Water struck at + 31.1 m (+ 102 ft)
203 mm auger
June 1970

Overburden 11.3 m
Mineral 5.2 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil and made-ground	0.9	0.9
Boulder Clay	Clay, brown to bluish grey, chalky, increasing gravel content towards the base	6.7	7.6
	Clay, pale brown to orange, laminated, silty with flint and quartzite gravel	3.7	11.3
Kesgrave Sands and Gravels	'Clayey' sandy gravel, 'very clayey' in upper 0.9 m, occasional cobbles in upper 1.8 m Gravel: fine and coarse, mainly subangular flint with some subrounded quartzite and vein-quartz Sand: fine and medium with some coarse, subangular, grey to brown	5.2	16.5
London Clay	Clay, dark bluish grey	0.3+	16.8

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
17	45	38	11.3–12.2	30	28	14	4	9	11	4
			12.2–13.1	18	28	21	4	10	17	2
			13.1–13.4	5	12	19	10	30	24	0
			13.4–14.3	7	11	17	9	27	29	0
			14.3–16.5	No grading data available						
			Mean	17	21	18	6	17	19	2

TL 82 SE 18 | 8994 2210 | A12 road verge, near Marks Tey | SUB-BLOCK B_2

Surface level + 38.7 m (+ 127 ft)
Water not struck
203 mm auger
July 1970

Waste 9.1 m
Bedrock 1.8 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown becoming blue with depth, chalky with flints and other erratics	8.8	9.1
London Clay	Clay, dark bluish grey	1.8+	10.9

TL 82 SE 19 | 8969 2070 | Scottie's Farm, near Marks Tey | SUB-BLOCK B_2

Surface level + 39.0 m (+ 128 ft)
Water struck at + 37.8 m (+ 124 ft)
203 mm auger
July 1970

Overburden 4.6 m
Mineral 7.6 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, chalky with flints and other erratics	4.3	4.6
Kesgrave Sands and Gravels	'Clayey' gravel Gravel: fine with coarse, angular to subrounded, flint and quartzite Sand: medium with fine and coarse, mainly subangular, yellow to brown, silty and clayey in parts	7.6	12.2
London Clay	Clay, dark bluish grey	0.3+	12.5

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
10	44	46	4.6–5.5	No grading data available						
			5.5–6.4	14	21	31	9	16	9	0
			6.4–7.3	18	15	22	8	23	14	0
			7.3–8.2	7	13	18	11	29	22	0
			8.2–9.1	9	10	20	10	27	24	0
			9.1–10.1	8	8	26	13	26	19	0
			10.1–11.0	5	17	24	11	27	16	0
			11.0–11.9	6	3	12	6	30	43	0
			11.9–12.2	No grading data available						
			Mean	10	12	22	10	25	21	0

TL 82 SE 20 | 8652 2375 | ENE of Monks Down Farm, Coggeshall | SUB-BLOCK B_2

Surface level + 53.9 m (+ 17.7 ft)
Water struck at + 44.2 m (+ 145 ft)
152 mm percussion
September 1973

Waste 10.3 m
Bedrock 0.5 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, orange-brown becoming dark grey with depth containing chalk, some flint and other erratics	8.3	8.5
Kesgrave Sands and Gravels	'Clayey' sand, orange-brown and grey	0.9	9.4
	Clay, orange-brown and pale grey, sandy	0.6	10.0
	Sandy gravel, fine and coarse, medium to coarse sand	0.3	10.3
London Clay	Clay, dark grey, firm, silty	0.5+	10.8

TL 82 SE 21 | 8727 2483 | Buckler's Farm, Great Tey | SUB-BLOCK B_1

Surface level + 61.3 m (+ 201 ft)
Water struck at + 53.0 m (+ 174 ft)
152 percussion
May 1973

Overburden 7.0 m
Mineral 8.0 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, brown, mottled with grey and orange, with chalk clasts	6.8	7.0
Kesgrave Sands and Gravels	'Clayey' pebbly sand Gravel: coarse with fine, subrounded to subangular, flint with some quartz and quartzite Sand: mainly medium with some fine and coarse, brown	8.0	15.0
London Clay	Clay, grey, silty	0.3+	15.3

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–¼	+¼–1	+1–4	+4–16	+16–64	+64
11	81	8	7.0–8.0		No grading data available					
			8.0–9.0	11	23	58	3	4	1	0
			9.0–10.0	13	13	70	3	1	0	0
			10.0–11.0	8	15	52	6	5	14	0
			11.0–12.0		No grading data available					
			12.0–13.0			"				
			13.0–14.0			"				
			14.0–15.0			"				
			Mean	11	17	60	4	3	5	0

TL 82 SE 22 | 8825 2473 | North-east of Trumpingtons, Little Tey | SUB-BLOCK B_1

Surface level + 47.2 m (+ 155 ft)
Water struck at + 43.3 m (+ 142 ft)
152 mm percussion
October 1973

Waste 5.3 m
Bedrock 0.8 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Boulder Clay	Clay, orange-brown, becoming darker with depth, silty, with chalk and rare flints	3.5	4.0
Kesgrave Sands and Gravels	Gravel Gravel: fine to coarse, subrounded to rounded, mainly flint Sand: mainly medium, with fine and coarse, orange-brown	1.3	5.3
London Clay	Clay, firm, brown becoming dark grey with depth, silty	0.8+	6.1

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
8	36	56	4.0–5.3	8	6	21	9	23	21	12

TL 82 SE 23 | 8796 2284 | Near Broadgreen Farm, Little Tey | SUB-BLOCK B_2

Surface level + 42.7 m (+ 140 ft)
Water struck at + 27.9 m (+ 91.5 ft)
152 mm percussion
June 1973

Waste 24.0 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil and made-ground	0.2	0.2
Boulder Clay	Clay, mottled brown, orange and grey, with rare flint pebbles in upper 2.1 m. Becoming predominantly grey to greenish grey with abundant chalk, flint and quartzite pebbles below 2.3 m. Below 10.2 m includes much sandy to silty brown clay	14.6	14.8
Glacial Sand and Gravel	Gravel Gravel: fine and coarse, subangular to subrounded flint with some quartz and quartzite Sand: medium with coarse and some fine	3.0	17.8
Boulder Clay	Clay, stiff, grey to dark grey, with abundant subrounded chalk and flint gravel (occasionally up to cobble size clasts) in upper 1.8 m. Below 19.6 m gravel scarce; occasional 'flecks' of chalk	6.2+	24.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
8	39	53	14.8–15.8	11	5	15	10	32	27	0
			15.8–16.8	8	4	14	12	40	22	0
			16.8–17.8	5	6	34	18	26	11	0
			Mean	8	5	21	13	33	20	0

TL 82 SE 24 | 8716 2217 | Cockerell's Farm, Feering | SUB-BLOCK B_2

Surface level + 48.5 m (+ 159 ft)
Water struck at + 29.6 m (+ 97 ft)
152 mm percussion
October 1973

Overburden 14.0 m
Mineral 7.7 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, buff brown becoming dark orange-brown below 6.8 m and dark grey below 11.3 m, containing fragments of chalk and other erratics as well as seams of 'clayey' sandy gravel below 8.7 m	13.6	14.0
Kesgrave Sands and Gravels	Gravel Gravel: fine to coarse with rare cobbles, subangular to rounded flint and subrounded to rounded vein-quartz and quartzite Sand: medium to coarse with some fine, subangular to rounded, quartz and flint, pale brown	7.7	21.7
London Clay	Clay, orange-brown becoming dark grey with depth, firm, silty	0.3+	22.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
3	42	55	14.0–15.0	7	13	28	13	23	16	0
			15.0–16.0	4	8	48	14	20	6	0
			16.0–17.0	6	6	38	13	30	7	0
			17.0–18.0	3	5	13	13	37	22	7
			18.0–19.0	4	5	17	19	41	14	0
			19.0–20.0	0	2	13	9	34	34	8
			20.0–21.0	1	1	16	9	37	29	7
			21.0–21.7	2	1	27	7	20	35	8
			Mean	3	5	25	12	31	20	4

TL 82 SE 25 | 8795 2114 | Old Will's Farm, Feering | SUB-BLOCK B_2

Surface level + 40.5 m (+ 133 ft)
Water struck at + 30.8 m (+ 101 ft)
152 mm percussion
October 1973

Overburden 6.2 m
Mineral 2.0 m
Waste 1.3 m
Mineral 2.1 m
Bedrock 0.3 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, yellowish brown, firm, silty containing fragments of chalk and other erratics and thin seams of clayey gravel	5.9	6.2
Glacial Sand and Gravel	a Gravel Gravel: fine to coarse, angular to rounded flint with rounded vein-quartz Sand: medium to coarse with some fine, subangular to subrounded, orange-brown	2.0	8.2
Boulder Clay	Clay, orange-brown, containing fragments of chalk and other erratics	1.3	9.5
?Kesgrave Sands and Gravels	b Gravel Gravel: fine to coarse with rare cobble, angular to rounded flint with rounded vein-quartz Sand: medium with coarse and some fine, angular to rounded quartz and flint, pale brown	2.1	11.6
London Clay	Clay, firm, brown becoming dark grey, silty	0.3+	11.9

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					−1/16	+1/16−1/4	+1/4−1	+1−4	+4−16	+16−64	+64
a	9	35	56	6.2–7.2	9	3	19	13	34	19	3
				7.2–8.2	8	7	15	12	32	20	6
				Mean	9	5	17	13	31	20	5
b	2	37	61	9.5–9.8	7	5	25	12	30	18	3
				9.8–10.8	1	2	23	13	39	22	0
				10.8–11.6	1	4	21	8	33	33	0
				Mean	2	4	22	11	35	26	0
a & b	5	36	59	Mean	5	4	20	12	34	23	2

TL 82 SE 26 | 8882 2108 | A12 road verge, Feering | SUB-BLOCK B_2

Surface level + 41.5 m (+ 136 ft)
Water struck at + 32.6 m (+ 107 ft)
152 mm percussion
October 1973

Overburden 8.8 m
Mineral 5.7 m
Bedrock 0.1 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, pale brown becoming dark grey at 6.3 m and dark brown at 8.5 m, silty, containing fragments of chalk and other erratics	8.6	8.8
Kesgrave Sands and Gravels	Gravel Gravel: fine and coarse, angular to subrounded flint and subrounded to rounded vein-quartz and quartzite Sand: medium with coarse and some fine, angular to subrounded, pale brown	5.7	14.5
London Clay	Clay, firm, brown, silty	0.1+	14.6

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+16	+16–64	+64
2	43	55	8.8–9.8	5	8	25	13	28	21	0
			9.8–10.8	3	14	28	9	28	18	0
			10.8–11.8	3	7	27	8	27	17	11
			11.8–12.8	1	4	25	11	31	25	3
			12.8–13.8	0	2	21	13	29	26	9
			13.8–14.5	1	2	24	14	30	29	0
			Mean	2	7	25	11	29	22	4

TL 82 SE 27 | 8555 2198 | South of Abbey Mill, Coggeshall | BLOCK D

Surface level + 26.2 m (+ 86 ft)
Water struck at + 22.3 m (+ 73 ft)
152 mm percussion
October 1975

Overburden 4.0 m
Mineral 3.5 m
Bedrock 0.5 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Silt, dark greyish brown becoming dark bluish grey to greenish grey with scattered flints, wood, peat and shell debris	3.7	4.0
'Sub-alluvial' gravels	Gravel Gravel: fine to coarse with rare cobbles, angular to well rounded flint, well rounded vein-quartz, quartzite and rare greenish grey sandstone Sand: medium to coarse, angular to subrounded, quartz and flint	3.5	7.5
London Clay	Clay, stiff, dark greenish grey, slightly silty	0.5+	8.0

(... continued)

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
5	35	60	4.0–5.0	1	2	13	11	44	28	1
			5.0–6.0	1	3	26	14	33	23	0
			6.0–7.5	10	2	24	11	33	20	0
			Mean	5	2	21	12	37	23	0

TL 82 SE 28 | 8663 2049 | South-west of Frame Farm, Feering | BLOCK D

Surface level + 23.8 m (+ 78 ft)
Water struck at + 22.3 m (+ 73 ft)
152 mm percussion
October 1975

Overburden 0.5 m
Mineral 1.5 m
Bedrock 3.0 m +

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
River Terrace Deposits (First/Second Terrace)	Clay, with gravel	0.4	0.5
	'Clayey' gravel Gravel: fine to coarse, subangular to well rounded flint with well rounded vein-quartz, quartzite and sandstone Sand: medium with fine and coarse, flint and quartz, orange-brown	1.5	2.0
London Clay	Clay, orange-brown becoming dark grey, silty, with concretionary fragments and selenite crystals	3.0+	5.0

GRADING

Mean for deposit percentages			Depth below surface (m)	percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				−1/16	+1/16–1/4	+1/4–1	+1–4	+4–16	+16–64	+64
10	39	51	0.5–2.0	10	8	21	10	29	22	0

The following IGS registered boreholes were used in the assessment of resources

Borehole*	Grid reference	Block/sub-block
TL 82 NW 26	8449 2915	D
28	8481 2988	D
34	8195 2922	A
36	8098 2821	B_1
38	8418 2587	B_1
TL 82 NE 22	8618 2985	D
23	8605 2991	D
25	8674 2846	D
26	8557 2710	B_1
27	8738 2686	B_1
28a	8772 2706	B_2
28d	8776 2718	B_2
29	8799 2766	B_2
30	8965 2819	D
31	8510 2980	D
TL 82 SW 27	8353 2266	B_1
28	8385 2299	B_1
29	8412 2328	B_1
30	8456 2365	D
32	8484 2372	B_1
42	8459 2239	D
48	8497 2240	D
51	8175 2237	C
TL 82 SE 1	8774 2002	B_2
2	8778 2003	B_2
3	8775 2014	B_2
29	8602 2344	B_2
44	8560 2292	B_2

* By sheet quadrant.

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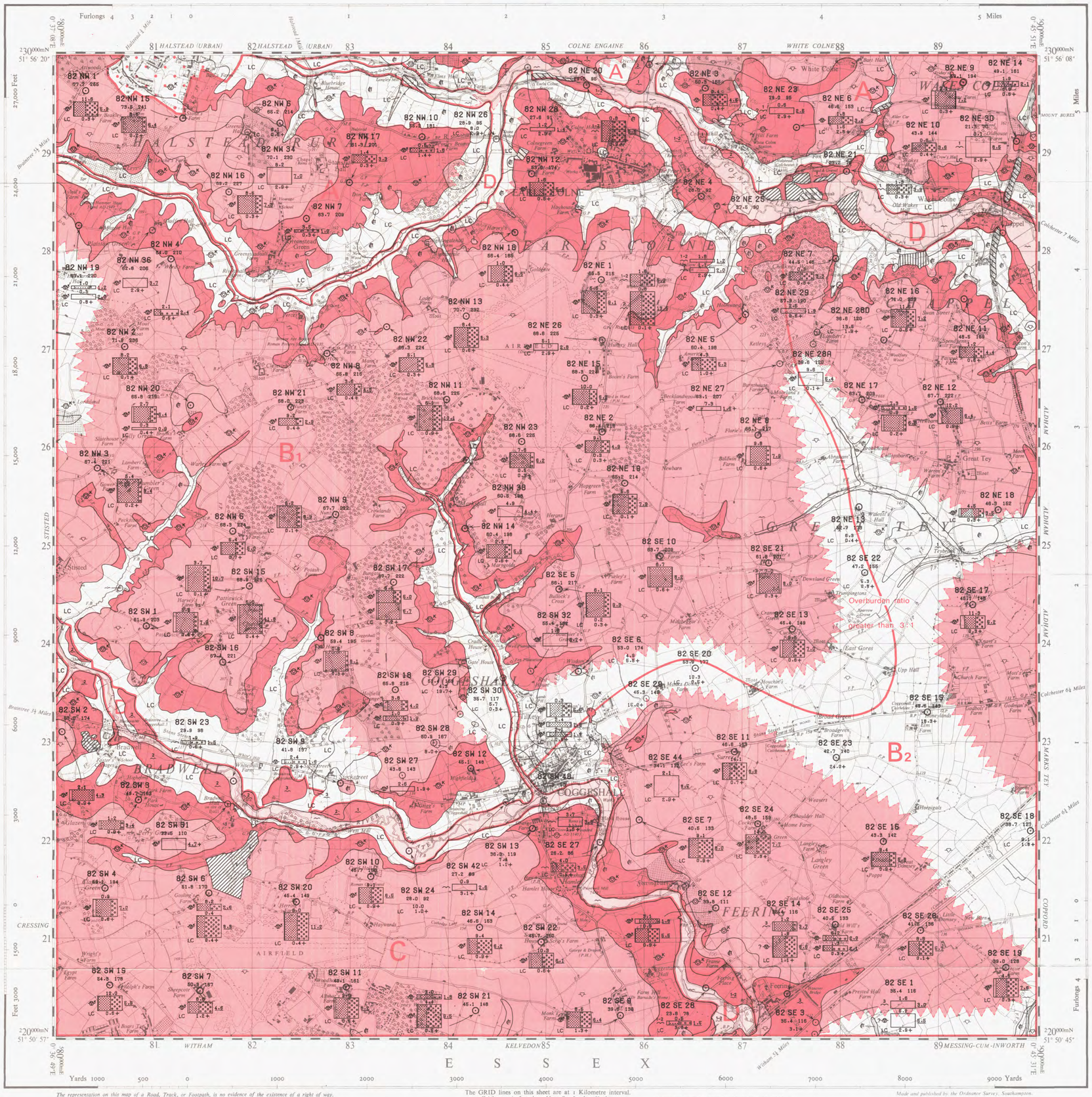
SHEET TL 82
PROVISIONAL EDITION



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

The GRID lines on this sheet are at 1 Kilometre interval.
Heights are in feet above Mean Sea Level at Newlyn.
Contour values are in feet.
1 square inch on this map represents 99.639 acres on the ground.

Compiled from 6" sheets last fully revised 1920.
Other partial systematic revision 1938-54 has been incorporated.

Made and published by the Ordnance Survey, Southampton.

Original survey on the One-Inch scale by W. Whitaker, W. H. Penning, W. H. Dalton and F. J. Bennett; published as parts of the Old Series sheets 47 and 48 between 1881 and 1883

Surveyed on the Six-Inch scale by M. J. Heath and S. R. Mills between 1973 and 1974. W. A. Read, District Geologist. New Series 1:50 000 Geological Sheet 223 (Braintree) in press. R. A. Bazley, District Geologist

Limit of worked ground (sand and gravel) shown to 1974

Sand and Gravel Survey by J. D. Ambrose, S. J. Booth, J. W. Merritt, P. Robson, G. M. Bladon and J. A. Gray between 1970 and 1973. R. C. Thurrell, Head, Industrial Minerals Assessment Unit

1:25 000 Sand and Gravel Resource Sheet published 1982

G. M. Brown, D.Sc, FRS; *Director, Institute of Geological Sciences*

Borehole graphics drawn by computer using programs written by J. L. McInnes, NERC Computing Service, IGS, Edinburgh

Data quoted for an individual sample point 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 volume and mean grading of the mineral as a whole in each Resource Block are given in the Report

Produced for the Institute of Geological Sciences by Carto-Graphics (Edinburgh) Limited
Printed by John Bartholomew & Son Ltd. Edinburgh 1982

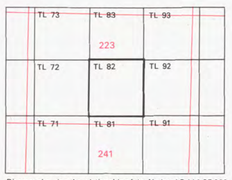


Diagram showing the relationship of the National Grid 1:25 000 sheets with the One-Inch Geological Sheets

THE SAND AND GRAVEL RESOURCES OF THE COUNTRY AROUND COGGESHALL, ESSEX

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

EXPLANATION OF SYMBOLS AND ABBREVIATIONS

DRIFT

- **Peat** – black, partially decomposed organic matter P-2
- **Alluvium** – clayey silt and silty clay with some peaty layers, including 'sub-alluvial' gravels A-63
- **First Terrace** 1T-35
- **Second Terrace** 2T-26
- **Third Terrace** 3T-21

  (**River Terrace Deposits** of the Rivers Colne and Blackwater, comprising sands and gravels; the gravels are mainly of flint and quartzite)
- **Head** – heterogeneous pebbly clay and silt H-41
- **Lacustrine Deposits** – shelly, silty clay LA-8
- **Glacial Sand and Gravel** – deposits above and interbedded with Boulder Clay; mainly clayey sandy gravel GS-69
- **Boulder Clay** – stiff sandy clay with erratics, principally clasts of chalk BC-37
- **Kesgrave Sands and Gravels** – poor to well sorted sand and gravel; locally termed the 'Essex White Ballast' K-6

(RECENT AND PLEISTOCENE – QUATERNARY)

SOLID

- **London Clay** – stiff silty clay with scattered calcareous nodules

(LOWER EOCENE – TERTIARY)

- **Worked-out ground** – some pits have been backfilled and landscaped WO-21
- **Made ground** MG-2
- **Landslip** L-1

BOUNDARY LINES

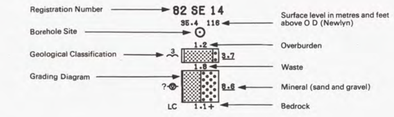
- Geological boundary, Drift
- Resource block boundary
- Inferred boundary between categories of deposit

BOREHOLE DATA

SITE LOCATIONS

- Industrial Minerals Assessment Unit (IMAU) borehole
- Other borehole

IMAU BOREHOLES



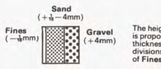
Note:
1 Measurements of thickness are all quoted in metres
2 The surface levels in metres are conversions of measurements recorded in feet
3 Figures underlined denote thicknesses used in the assessment of resources
4 The + sign indicates that the base of the deposit was not reached
5 The Geological Classification is given only for mineral and bedrock
6 When grading data are not sufficiently detailed or are absent the grading diagram is shown without ornament

Borehole Registration Number

Each IMAU borehole is identified by a Registration Number e.g. **82 SE 14**. The first numbers and letters refer to the quarter sheet, and the final figures to the IGS serial number for that quarter. The unique designation for borehole **82 SE 14** is **TL 82 SE 14**

Grading Diagrams

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



The height of the diagram is proportional to the mineral thickness. The widths of the divisions show the proportion of **Fines**, **Sand** and **Gravel**

OTHER BOREHOLES

The layout of information is the same as for IMAU boreholes, although data available may not be as comprehensive. They are registered in the same series. Owing to the limitations of the computer-drawn graphics, the true thicknesses of bedrock proved are shown only where they are 2.8 m or less: where the thicknesses proved are greater, they are always shown as 2.9 m+

CATEGORIES OF DEPOSITS

- **Exposed mineral** CAT-E6
- **Continuous or almost continuous spreads of mineral beneath overburden** CAT-C1
- **Discontinuous spreads of mineral beneath overburden** CAT-D1
- **Sand and gravel either absent or not potentially workable (see Report)** CAT-A2
- **Sand and gravel not assessed** CAT-N1

RESOURCE BLOCKS

For the purpose of the assessment the mineral is divided into Resource blocks and sub-blocks (see Report). Each block is designated by a letter; sub-blocks by a letter and subscript number

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