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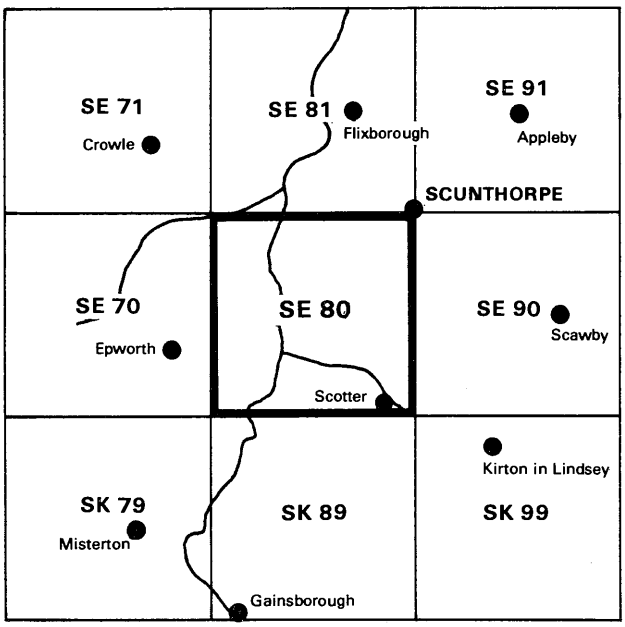

The sand and gravel resources of the country south-west of Scunthorpe, Humberside

Description of 1:25 000 resource sheet SE 80

J. H. Lovell

London Her Majesty's Stationery Office 1977

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

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PREFACE

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

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

The survey was conducted by Mr J.H. Lovell, under the supervision of Mr D. Price. Messrs J.R. Gozzard, I. Jackson, J.W.C. James and A. Smith assisted with the drilling programme and data preparation. The work, which was controlled from the sub-unit based in Leeds (J.H. Hull, Officer-in-charge), is based on six-inch scale geological surveys by G.H. Rhys and E.G. Smith in 1964-1965 and by R.J. Bull and T.P. Fletcher in 1972-1975.

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

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SUMMARY

The geological maps of the Institute of Geological Sciences, pre-existing borehole information, and 82 boreholes drilled for the Mineral Assessment Unit form the basis of the assessment of sand and gravel resources in the area south-west of Scunthorpe, Humberside.

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

The 1:25 000 map is divided into six resource blocks containing between 8.0 and 16.5 km^2 of sand and gravel. For each block the geology of the deposit is described and the mineral-bearing area, the mean thickness of overburden and mineral and the mean grading are stated. Detailed borehole data are also given. The geology, the positions of the boreholes and the outlines of the resource blocks are shown on the accompanying map.

SOMMAIRE

Les sources des renseignements qui constituent la base de l'évaluation des ressources en sable et en gravier dans la région de Scunthorpe, Humberside, comprennent les cartes géologiques de l'Institute of Geological Sciences, des données obtenues de trous de sonde déjà en existence et 82 trous de sonde forés pour le Mineral Assessment Unit.

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

La carte 1:25 000 est divisée en six blocs de ressources avec d'entre 8.0 et 16.5 km^2 de sable et de gravier. Pour chaque bloc on décrit la géologie des dépôts et on donne l'étendue du terrain minéralisé, l'épaisseur moyenne de recouvrement et de minéral et les triages moyens. Des données detaillées des trous de sonde aussi présentées. La géologie, la situation des trous de sonde et les profils des blocs de ressources sont montrées sur la carte.

ZUSAMMENFASSUNG

Die geologischen Karten vom Institute of Geological Sciences, vorher-existierende Information, und 82 für die Mineral Assessment Unit gebohrten Bohrlöcher, bilden den Grund der Einschätzung von Sand- und Schottermittel in Scunthorpe Gebiet, Humberside.

Alle Ablagerungen im Gebiet, die möglich bearbeitbar für Sand und Schotter sind, wurden untersucht, und eine einfache statistische Methode wurde benutzt, um den Volumen zu schätzen. Man gibt die Zuverlässigkeit der Volumen schatzungen mit symmetrischen 95 Prozent Ventrauenswerten.

Man teilt die 1:25 000 Karte in sechs Mittelsblöcke, die zwischen 8.0 und 16.5 km^2 von Sand und Schotter umfassen. Für jeden Block beschreibt man die Geologie der Ablageringen, und das mineralhaltige Gebiet, die mittleren Dicken von Uberlastung und Mineral und die mittleren Klassifizierungen werden erklärt. Ausfuhrliche Bohrlöcherdaten werden auch gegeben. Die Geologie die Lage der Böhrlocher und die Skizzen der Mittelsblöcke werden auf der Begleitkarte gezeigt.

The sand and gravel resources of the country south-west of Scunthorpe, Humberside

Description of 1:25 000 resource sheet SE 80

J. H. Lovell

Introduction

The survey is concerned with the estimation of resources, which include deposits that are not currently exploitable but have a foreseeable use, rather than reserves, which can only be assessed in the light of current, locally prevailing, economic considerations. Clearly, both the economic and the social factors used to decide whether a deposit may be workable in the future cannot be predicted; they are likely to change with time. Deposits not currently economically workable may be exploited as demand increases, as higher grade or alternative materials become scarce, or as improved processing techniques are applied to them. The improved knowledge of the main physical properties of the resource and their variability which this survey seeks to provide, will add significantly to the factual background against which planning policies can be decided (Archer, 1969; Thurrell, 1971; Harris and others, 1974).

The survey provides information at the 'indicated' level "for which tonnage and grade are computed partly from specific measurements, samples or production data and partly from projection for a reasonable distance on geological evidence. The sites available for inspection, measurement, and sampling are too widely spaced to permit the mineral bodies to be outlined completely or the grade established throughout" (Bureau of Mines and Geological Sciences, 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 one metre 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 1/16 mm) should not exceed 40 per cent.
d. The deposit must lie within 25 m of the surface, this being taken as the likely maximum working depth under most circumstances. It follows from the second criterion that boreholes are drilled no deeper than 18 m if no sand and gravel has been proved.

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

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

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

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

Description of sheet SE 80

The area (Fig. 1) lies in the lower Trent valley astride the Humberside-Lincolnshire border. The River Trent, which is tidal and navigable, flows northwards between high flood-banks across a floodplain which widens to about 7 km near Althorpe and West Butterwick. To the west, the floodplain is bordered by low hills of Keuper Marl, while to the east and south-east drift-covered scarps of Rhaetic and Lower Lias rocks rise to about 150 ft (46 m)[1] OD. The major tributaries of the River Trent in the area are the River Torne, Bottesford Beck and the River Eau.

The south-western suburbs of Scunthorpe are built on the Jurassic scarps in the north-east. Elsewhere, habitations and lines of communication tend to be aligned with the scarps or with the River Trent. The area is largely agricultural apart from some light industry near Scunthorpe.

[1] Metric measurements are used throughout this publication except for altitudes. A conversion table appears in Appendix H.

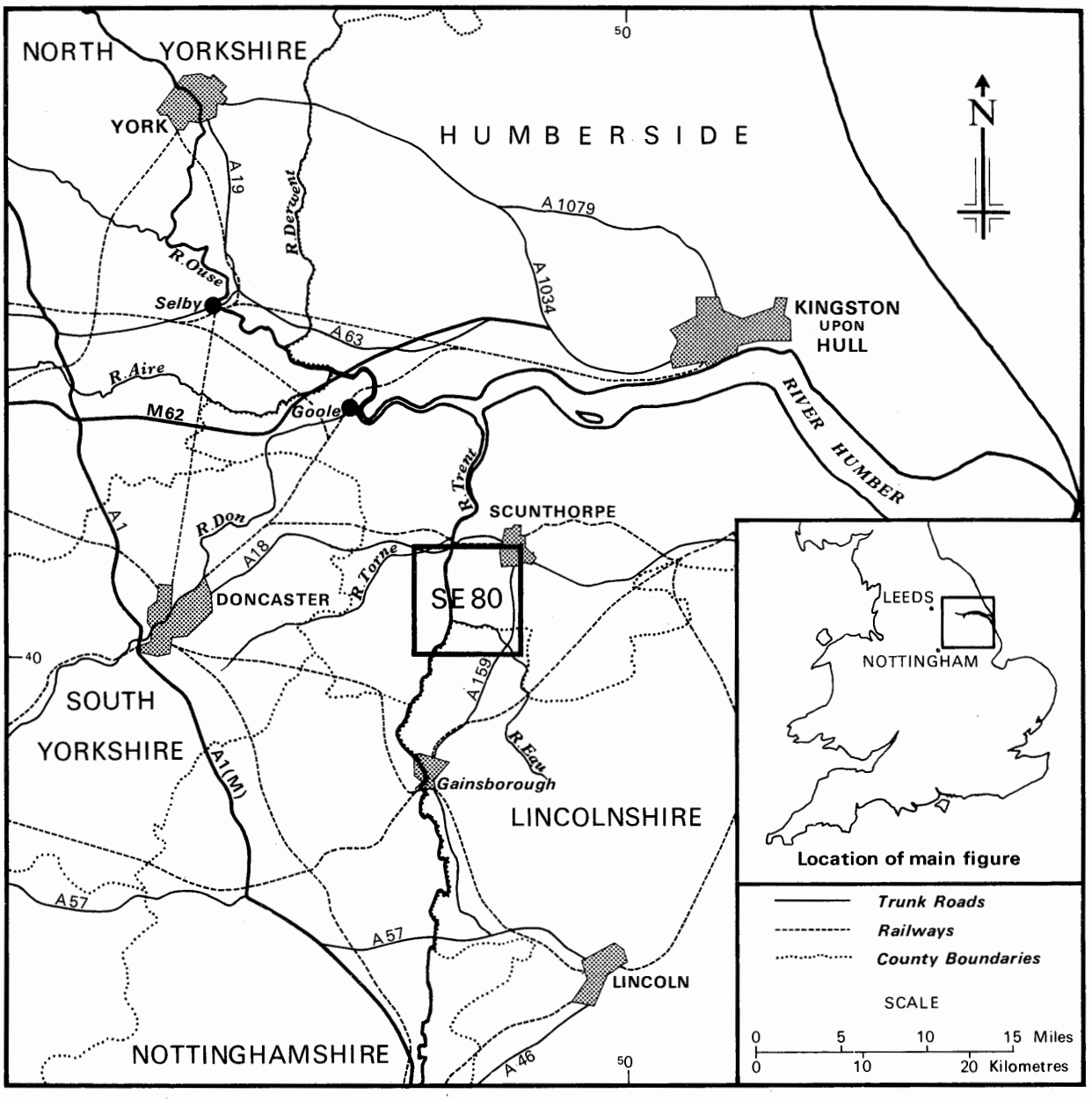


Fig. 1. Sketch map showing the location of sheet SE 80

GEOLOGY

The geological sequence is summarised in Table 1, which also includes a classification of the drift deposits. The relationships of the latter are shown in Fig. 2, and their geological history is discussed more fully in the report on sheet SE 81 to the north (James, 1976).

Keuper Marl

The uppermost 120 m of the Keuper Marl occur in the area, but are concealed by drift deposits except near Beltoft and Owston Ferry in the west and at Scotter [873 030; 878 028]. The beds, which dip gently eastwards, consist of red and subordinate greenish grey, unfossiliferous mudstones with bands of gypsum. Near Owston Ferry, bands of hard, white and pale green, dolomitic sandstones and siltstones called 'skerries' form small topographic features. A persistent bed of hard, green and grey mudstone, the Tea Green Marl, has been recognised at the top of the Keuper Marl. It is not identified on the resource map.

Rhaetic

Rhaetic rocks are intermittently exposed in the south-east, near Scotter, but in general their outcrop is drift-covered. The lower beds consist of dark, papery shales but the upper beds are grey, brown and reddish clays and mudstones. The total thickness of the Rhaetic is about 15 m.

Lower Lias

About 55 m of fossiliferous Lower Lias rocks, which dip gently eastwards, form the high ground in the east of the area. They consist of grey calcareous mudstones and shales interbedded with thin, grey and buff, argillaceous and ferruginous limestones which form distinct topographic features.

Table 1. Geological sequence and classification

System	Stage	Drift deposit/solid formation
Quaternary (Recent and Pleistocene)	Flandrian	Calcareous tufa
		Alluvium
		Peat
	Devensian	Blown Sand
		First Terrace
		Head
		Older Littoral Sand and Gravel
		Silt and Clay of 25-Foot Drift of Vale of York
	pre-Devensian	Older River Sand and Gravel
		Glacial Sand and Gravel
		Boulder Clay
Jurassic		Lower Lias
Triassic		Rhaetic
		Keuper Marl (including Tea Green Marl)

Boulder Clay

Pebbly clay occurs throughout the area, and is reddish brown and sandy west of the Trent near Beltoft, but darker east of the river, near Scotter, where it overlies Rhaetic and Lower Lias rocks. Although the deposit is generally thin, in borehole SE 72 [8554 0014] 2 m of locally-derived, dark brown clay with limestone and black mudstone pebbles is overlain by 2 m of predominantly fine sand and 8.3 m of reddish brown clay with flint and chalk pebbles.

Glacial Sand and Gravel

One small patch [853 002] occurs just above 23 m (75 ft) OD and consists of sand with pebbles of limestone, flint and brown and grey quartzites and an admixture of brown clay. Elsewhere, thin lenses of Glacial Sand and Gravel occur within the Boulder Clay.

Older River Sand and Gravel

These deposits consist of sand and gravel in varying proportions and are entirely concealed by younger sediments. The upper surface lies between 3 and 8 m (10 and 26 ft) below OD and the base falls to about 14 m (46 ft) below OD. They are certainly pre-Devensian in age and were probably laid down along the Trent valley after the Wolstonian glaciation.

Silt and Clay of 25-Foot Drift of Vale of York[1]

These deposits consist of up to 4 m of red and reddish grey, laminated, micaceous clays and silts with local sand partings up to 2 m thick. Beneath the floodplain their top lies generally between 1 and 4 m (3.5 and 13 ft) below OD and their base falls to about 8 m (26 ft) below OD, but similar deposits occur at higher elevations to the east. They are nowhere exposed at the surface but form a persistent marker horizon in boreholes; they are thought (Gaunt and others, 1971, pp. 4-5) to be lacustrine deposits laid down during the low-level phase (10 to 14 m above OD) of Lake Humber, an ice-dammed lake which existed in this area during Devensian times.

[1] Hereinafter abbreviated to Silt and Clay of 25-Foot Drift.

Older Littoral Sand and Gravel

Sands with locally derived pebbles of Jurassic limestone straddle the 50 ft contour east of the Trent floodplain. They are thought to be the lateral equivalents of similar deposits to the north, and probably represent shore lines of Lake Humber.

Head

Head occurs in patches in the east of the area and consists of locally derived clay, pebbles, sand and silt.

First Terrace

Sands with a small percentage of gravel which crop out around Cote Houses [844 017] in the south of the area have been mapped as First Terrace. Their top has been greatly affected by wind action and the distinction between terrace and blown sand deposits is not everywhere clear. Elsewhere this Terrace occurs beneath cover. The deposits range up to 8.9 m in thickness and in places are interbedded with clay and peat. They overlie the Silt and Clay of 25-Foot Drift (Fig. 2) and are thought to be the lateral equivalent of the Sand of the 25-Foot Drift of the Vale of York.

Blown Sand

Blown Sand has accumulated against the Rhaetic and Lower Liassic scarps in the east and south-east of the area in a strip up to 2 km wide. It crops out extensively on the Trent floodplain and small patches occur on the higher ground in the extreme east and west of the area. Most of the sand has apparently been derived from the First Terrace deposits by the prevailing westerly winds. Up to 9.0 m of sand have been proved in boreholes, but it is difficult to distinguish between the various sands of the district and the deeper parts of the deposit may well be undisturbed First Terrace.

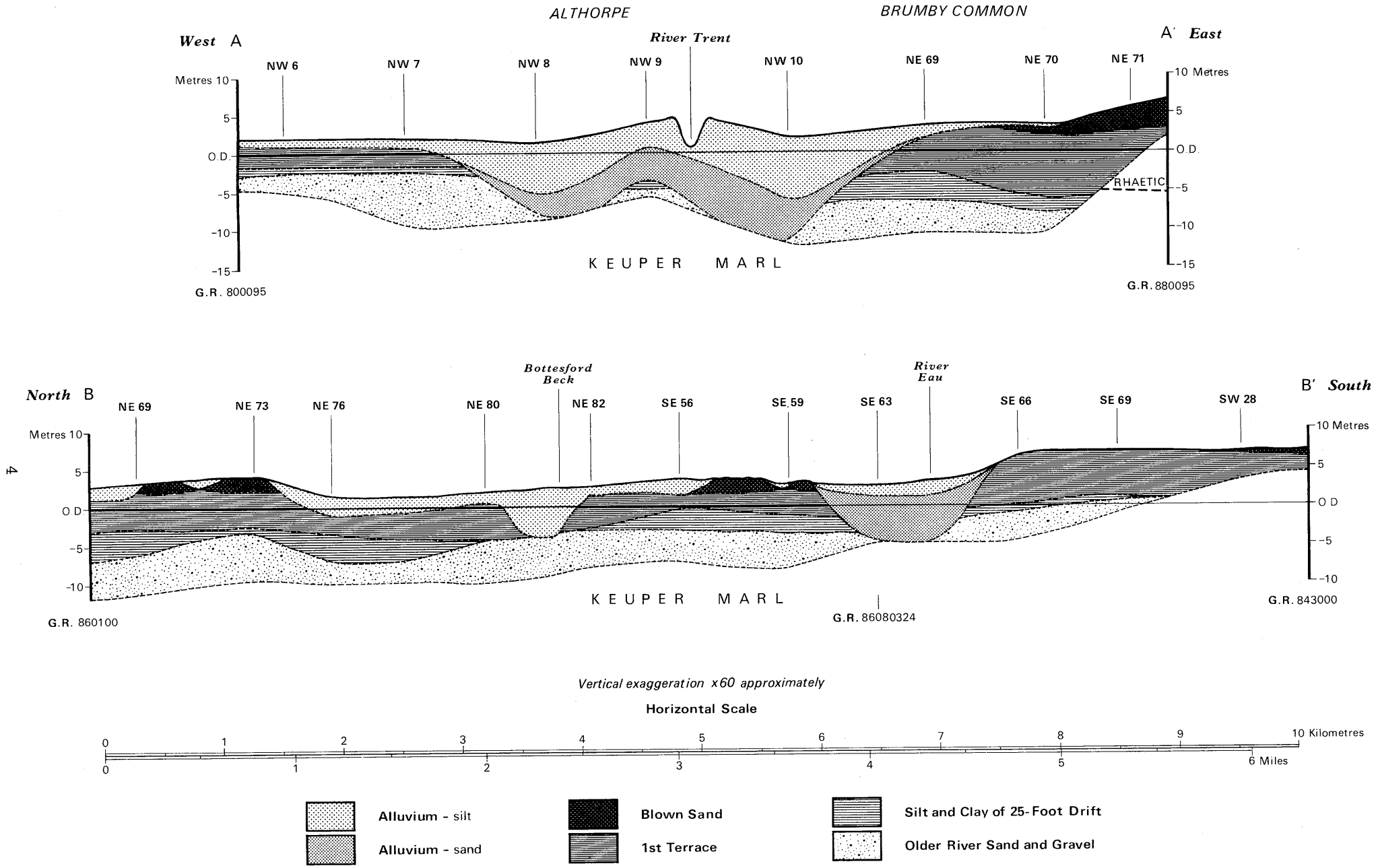


Fig. 2. Schematic sections showing the relationships between the drift deposits (the lines of sections are marked on the resource sheet)

Peat

Throughout the area patches of peat overlie the First Terrace, Blown Sand and Alluvium, but thick beds of peat are also concealed beneath Alluvium near the present channel of the River Trent.

Alluvium

The Alluvium which forms the floodplain of the River Trent represents the latest stages of the geological evolution of the lower Trent valley. Two distinct phases can be recognised. The early Flandrian incision removed all pre-existing drift deposits from a deep, narrow channel which follows approximately the present course of the River Trent. Downcutting by the River Eau and Bottesford Beck was initiated at this time. During the first stages of aggradation following this incision, basal gravels and thick sands were laid down in the channel, but as the Trent became more mature, thick peat, dark silt and clay were deposited to form the present floodplain which covers most of the First Terrace. The floodplain is up to 7 km wide, and lies between 0.6 and 2.4 m (2 and 8 ft) above OD, except near the river and drains, where natural and induced flood deposits are somewhat higher.

Alluvium consisting of thin, locally derived material occurs in the east of the area along the valleys of Bottesford Beck and the River Eau.

Calcareous Tufa

White or grey, calcareous tufa is found at the surface along a valley bottom [898 066] near Bottesford, and is also associated with peat in the Alluvium.

COMPOSITION OF THE SAND AND GRAVEL

The potentially workable sand and gravel deposits in the district are the Older River Sand and Gravel, First Terrace, Blown Sand and the sands and gravels of the Alluvium, together with lenses of sand which occur locally within the Silt and Clay of 25-Foot Drift.

Older River Sand and Gravel

This deposit has a mean grading of fines 6 per cent, sand 89 per cent and gravel 5 per cent. The gravel does not exceed 24 per cent, except where basal gravel layers exist, for example, in borehole NE 82, where 59 per cent was recorded for a sample in the lower part of the deposit. The gravel is mainly fine (Appendix C) and consists of pebbles of subrounded to well rounded flint, vein-quartz, quartzite and sandstone, with small percentages of locally derived limestone and rolled fossils. The sand comprises fine to medium grained, subrounded to well rounded quartz with some rock fragments, including coal. The fines fraction ranges up to a maximum of 22 per cent (at the base of the deposit in borehole SE 69) and consists predominantly of red-brown and grey micaceous silt.

Silt and Clay of 25-Foot Drift

Lenses of sand in these deposits have a mean grading of fines 16 per cent and sand 84 per cent. The sands consist of fine grained, subrounded to well rounded quartz grains with some rock fragments; the fines comprise reddish brown silt and clay.

First Terrace

The mean grading for First Terrace deposits is fines 6 per cent, sand 94 per cent with a trace of gravel. The gravel consists of fine grained, subrounded to well rounded quartz, flint and sandstone pebbles with sporadic subangular limestone fragments. The sands consist of fine and medium grained, subangular to well rounded quartz, with subangular rock fragments, including coal. The fines fraction, which reaches a maximum of 37 per cent in the top of borehole NW 7, contains red and grey silt.

Blown Sand

The Blown Sand has a mean grading of fines 5 per cent and sand 95 per cent. Fine and medium grained, subangular to well rounded quartz predominates in the sand fraction, with a small proportion of subangular to subrounded chert and quartzite fragments. The proportion of fines is generally very low, except in the thinner deposits on the higher ground in the east and south-east, where it reaches 27 per cent in borehole SE 76. The fines are reddish brown on the low ground but become darker in the south-east.

Alluvium

The sand and gravel at the base of this deposit has a mean grading of fines 5 per cent, sand 87 per cent and gravel 8 per cent. The deposit is generally clean, but samples from the top of borehole NW 9 and the base of NW 18 have fines percentages of 26 and 25 per cent respectively, possibly due to contamination by silt from adjacent deposits. The sand fraction is mainly fine and medium grained and contains subrounded to well rounded quartz and quartzite with a small percentage of more angular, darker-coloured rock fragments. The gravel percentage is generally low, but reaches high values in the basal parts of several boreholes (for example, 70 per cent in borehole SW 18). These basal gravels, which probably represent relics of channel deposits associated with the early Flandrian incision, consist of fine and coarse, subrounded to well rounded quartz and quartzite with subangular to subrounded flint, chert, sandstone and a small proportion of limestone and locally derived mudstone pebbles and rolled fossils.

THE MAP

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

Geological Data

The geological boundary lines are taken from the sources shown at the foot of the map.

Table 2. Statistical assessment of the sand and gravel resources of sheet SE 80

Resource block	Area		Mean thickness			Volume of mineral			Mean grading percentage		
							Limits at the 95 per cent confidence level		Fines	Sand	Gravel
	Block km^2	Mineral km^2	Overburden m	Mineral m	Waste m	Million m^3	± %	± Vol. million m^3	-1/16 mm	+1/16-4 mm	+4 mm
A	13.0	10.7	3.8	4.7	0.4	50	44	22	9	88	3
B	14.7	14.7	3.9	7.5	1.0	110	21	23	5	92	3
C	11.7	11.6	0.6	6.5	0.6	75	29	21	4	93	3
D	13.6	13.4	6.5	4.5	nil	60	43	26	4	83	13
E	17.1	16.5	3.5	7.3	0.9	120	22	26	4	93	3
F	10.2	8.0	0.8	2.5	1.2	21	40	8	10	89	1
	13.0	Scunthorpe area not assessed									
	2.7	Beltoft									
	4.0	Owston Ferry									
		Generally barren areas									
Sheet total	100.0	74.9	3.6	5.8	0.7	434	13	56	5	90	5

The boundaries are the best interpretation of the information available at the time of survey. However it is inevitable, particularly with glacial deposits (such as those included in this area) which change rapidly vertically and laterally, that local irregularities or discrepancies will be revealed by some boreholes (as, for example, at boreholes SE 72 and SE 74). These are taken into account in the assessment of resources.

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

Mineral Resource Information

For assessment purposes the map is divided into areas of mineral and areas where sand and gravel is either not potentially workable or absent (for definition of 'mineral' and 'potentially workable' see p. 1).

On sheet SE 80 the mineral is subdivided into areas where it crops out and areas where it is present in continuous spreads beneath overburden. However, within these areas there may be small patches where sand and gravel is absent or not potentially workable, for example, around boreholes NW 27, SW 14 and SE 74. Areas where bedrock crops out, where superficial deposits are classified as non-mineral and where sand and gravel is deemed to be not potentially workable are shown uncoloured. Areas of unassessed sand and gravel are indicated by a red stipple.

For the most part, the distribution of categories of deposits is based on the mapped geological boundaries. Where there is a transition from one category to another which cannot be related to the geological lines and which could not be delineated accurately during the survey, inferred boundaries, shown by a distinctive symbol, have been inserted. The symbol is intended to signify an approximate location within a likely zone of occurrence rather than to represent the breadth of the zone, its size being limited only by cartographic considerations. For the purpose of measuring areas the centre-line of the symbol is used.

RESULTS

The statistical results are summarised in Table 2 and Fig. 3. Fuller grading particulars are shown in Tables 3 to 8 and Figs. 5 to 10. Up to 11 data points have been used in plotting each grading curve.

Accuracy of Results

For the six resource blocks on sheet SE 80 the accuracy of the results at the 95 per cent probability level varies between 21 and 44 per cent (that is, it is probable that nineteen times out of twenty the true volumes present will be within the stated limits). However, the true values are more likely to be nearer the figure estimated than the limits. Moreover, it is probable that in each block, approximately the same percentage limits would apply for the estimate of volume of a very much smaller parcel of ground (say 1 km^2) containing similar sand and gravel deposits if the results from the same number of sample points (as provided by, say, ten boreholes) were used in the calculation. Thus, if closer limits are needed for the quotation of reserves of part of a block, it can be expected that data from more than ten sample points will be required, even if the area is quite small. This point can be illustrated by considering the whole of the potentially workable sand and gravel in resource blocks A to F on this sheet. The volume (434 million m^3) can be estimated to limits of $\pm$ 13 per cent at the 95 per cent confidence level by a calculation based on data from 78 sample points spread across the six resource blocks. However, it must again be emphasised that the quoted volume of sand and gravel has no simple relationship with the amount which could be extracted in practice, as no allowance has been made in the calculations for any restraints (such as existing buildings and roads) on the use of the land for mineral working.

NOTES ON RESOURCE BLOCKS

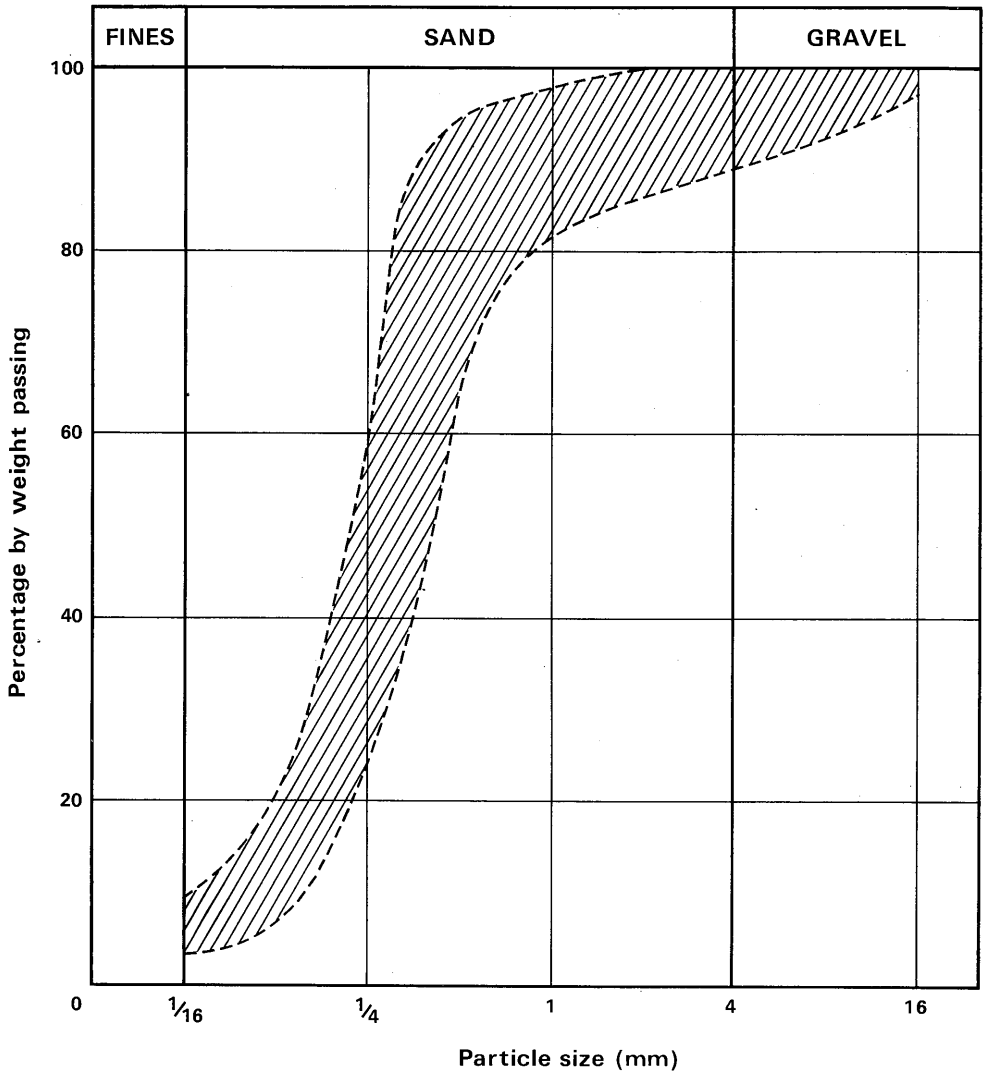
All the sand and gravel deposits have been assessed except those patches of Blown Sand and Older Littoral Sand and Gravel which occur on higher ground around Beltoft and Owston Ferry in the west, and south-west of Scunthorpe, in the east. These deposits are either too small or too thin to be potentially workable or have been sterilised beneath the suburbs of Scunthorpe.

Because of the geological similarity of resource blocks A, B, D and E their boundaries are arbitrary, except that the eastern margins of blocks B and E approximate to the Alluvium-Blown Sand boundary. Block C encloses much of the main Blown Sand outcrop, while block F comprises most of the thin sand and gravel deposits on higher ground. Within resource blocks, there are outcrops of bedrock and areas where mineral is absent or not potentially workable, for example, around boreholes NW 12, 13 and 16 in block A and around borehole SW 26 in block E; these areas have been subtracted from the resource block areas to give mineral-bearing areas.

Block A

In this block mineral-bearing deposits have an area of 10.7 km^2, and consist of the Older River Sand and Gravel, First Terrace and the Alluvium. The Older River Sand and Gravel and First Terrace occur in the north-west of the block, where they range up to maximum proved thicknesses of 6.3 and 3.6 m respectively, and consist of sands, 'clayey' sands and pebbly sands. They are separated by the Silt and Clay of 25-Foot Drift, which is largely waste except for a 1-m thick lens of 'very clayey' sand in borehole NW 11. The sands and pebbly sands of the basal Alluvium, with a mean thickness of 3.4 m and a proved maximum thickness of 10.9 m in borehole NW 24, occur in the south and east of the block. Borehole NW 21 failed to prove mineral, and a nil thickness value was used in the calculations.

Combined mineral thicknesses reach a maximum of 10.9 m in borehole NW 24, but have a mean of 4.7 m; the mean grading is fines 9 per



Envelope within which the mean grading curves for each block fall

Resource block	Percentage by weight passing				
	1/16 mm	$\frac{1}{4}$ mm	1 mm	4 mm	16 mm
A	9	57	94	97	100
B	5	51	94	97	99
C	4	60	95	97	99
D	4	27	81	87	96
E	4	42	94	97	99
F	10	55	97	99	100

Fig. 3. Mean particle size distribution for the assessed thickness of sand and gravel in resource blocks A to F

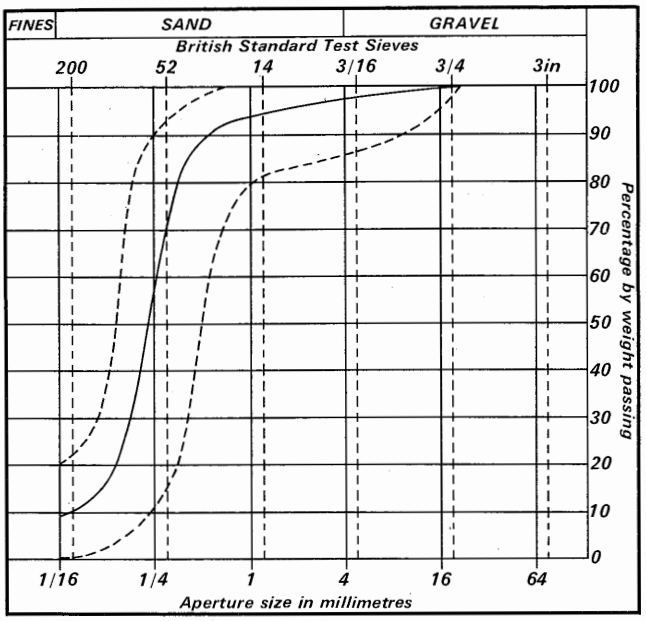


Fig. 4. Grading characteristics of the mineral in block A; the continuous line represents the weighted mean grading of the block; the broken lines denote the envelope within which the mean grading curves for individual boreholes fall

cent, sand 88 per cent and gravel 3 per cent. The estimated total volume of mineral is 50 million $m^3 \pm 22$ million m^3.

Overburden which consists of alluvial silt, clay and peat, is thickest in the eastern part of the block where it reaches a recorded maximum of 9.4 m in borehole NW 23, and has a mean thickness of 3.8 m. Data from MAU boreholes are summarised in Fig. 4 and Table 3.

Block B

This block has an area of 14.7 km^2, all of which is mineral bearing. The sand and gravel deposits represented are the Older River Sand and Gravel, First Terrace, basal Alluvium and, locally, Blown Sand and Silt and Clay of 25-Foot Drift.

In the west of the block, near the River Trent, the mineral consists of sands, pebbly sands and 'clayey' sands of the basal Alluvium, and reaches a maximum proved thickness of 7.1 m beneath thick overburden. In the central and eastern parts of the block pebbly sands, sands and 'clayey' sands of the Older River Sand and Gravel range from 2.4 m to 6.2 m in thickness. They are overlain by the Silt and Clay of 25-Foot Drift, which is waste except for a sand lens 2 m thick occurring in borehole NE 76. Sands and 'clayey' sands of the First Terrace overlie the 25-Foot Drift, and boreholes show that they vary in thickness from 2 to 8.9 m. Locally, Blown Sand (reworked First Terrace) reaches at least 4.0 m in thickness.

For the whole block (see Table 4) proved mineral thickness ranges from 3.6 to 12.0 m, with a mean of 7.5 m. The mean grading is fines 5 per cent, sand 92 per cent, gravel 3 per cent (Fig. 5) and the estimated volume of mineral present is 110 million $m^3 \pm 23$ million m^3.

Overburden consists of alluvial silt, clay and peat, ranges up to a maximum proved thickness of 8.5 m in the west and thins rapidly eastwards; its mean thickness is 3.9 m.

Block C

Mineral in this block occupies 11.6 km^2, and consists of Blown Sand and Older River Sand and Gravel. As it is difficult to distinguish between Blown Sand and First Terrace, from which it was derived, in boreholes sands described here as Blown Sand may include First Terrace deposits in the lower parts of some boreholes, for example, NE 71 and NE 74. Recognition of Older River Sand and Gravel is also difficult where it lies at a higher level than usual (for example, in boreholes SE 61 and SE 65) and is overlain by laminated silts resembling the Silt and Clay of 25-Foot Drift which also lie at an anomalously

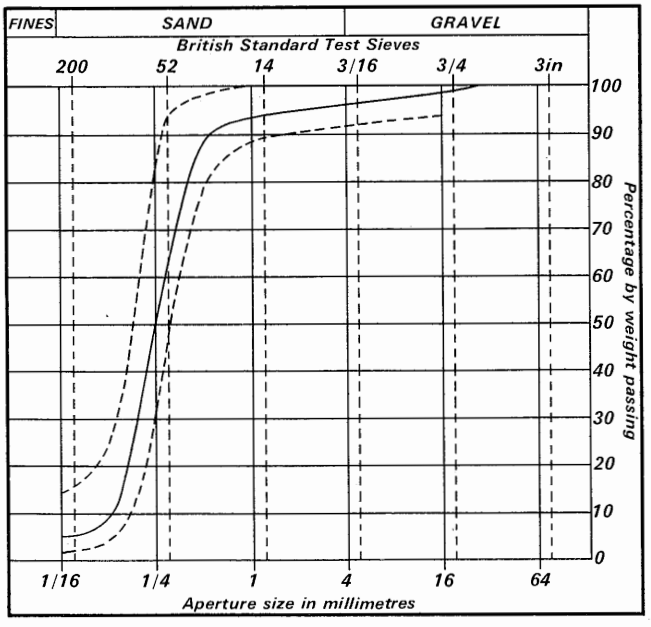


Fig. 5. Grading characteristics of the mineral in block B (For explanation see Fig. 4)

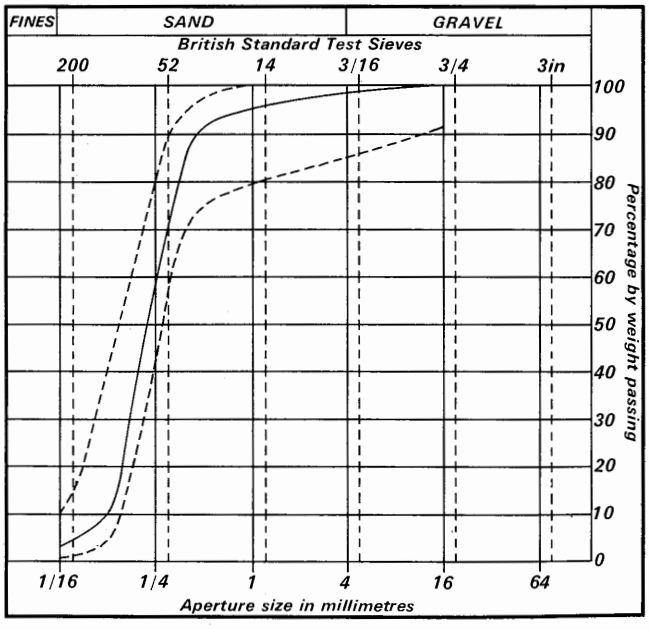


Fig. 6. Grading characteristics of the mineral in block C (For explanation see Fig. 4)

Table 3. Data used in the assessment of the resources of block A

Recorded thickness			Mean grading percentage					
MAU Borehole Number	Mineral (m)	Overburden (m)	Fines -1/16 mm	Fine sand $-\frac{1}{4}+1/16$ mm	Medium sand $-1+\frac{1}{4}$ mm	Coarse sand -4+1 mm	Fine gravel -16+4 mm	Coarse gravel +16 mm
NW 6	4.7	1.1	10	78	9	1	2	0
NW 7	9.9	0.6	8	42	44	3	3	0
NW 8	2.8	6.4	9	43	41	6	1	0
NW 9	4.9	2.9	13	79	7	1	0	0
NW 11	3.5	1.5	21	71	7	1	0	0
NW 15	1.4	1.7	12	61	26	1	0	0
NW 18	3.3	1.3	12	44	42	2	0	0
NW 19	5.0	9.2	2	33	50	7	7	1
NW 21	nil	5.9						
NW 22	4.9	0.6	8	67	24	1	0	0
NW 23	5.1	9.4	1	9	68	7	13	2
NW 24	10.9	4.5	10	57	31	2	0	0

Table 4. Data used in the assessment of the resources of block B

Recorded thickness			Mean grading percentage					
MAU Borehole Number	Mineral (m)	Overburden (m)	Fines -1/16 mm	Fine sand $-\frac{1}{4}+1/16$ mm	Medium sand $-1+\frac{1}{4}$ mm	Coarse sand -4+1 mm	Fine gravel -16+4 mm	Coarse gravel +16 mm
NW 10	6.2	8.0	4	34	51	4	4	3
NW 14	3.6	7.9	5	42	49	3	1	0
NW 17	7.1	8.0	5	32	51	5	6	1
NW 20	6.7	8.5	4	26	63	5	1	1
NW 25	5.1	4.9	10	68	21	1	0	0
NE 69	4.6+*	1.2	4	45	50	1	0	0
NE 70	12.0	0.2	2	55	42	1	0	0
NE 72	8.9	2.5	5	36	50	4	3	2
NE 75	5.3	6.8	5	45	42	4	4	0
NE 76	6.5	2.3	15	56	26	1	2	0
NE 77	11.4	0.7	6	53	33	5	3	0
NE 79	9.4	0.3	3	38	56	2	1	0
NE 80	10.3	1.6	4	55	38	2	1	0
NE 82	8.1	1.1	6	45	36	4	2	7

*The + sign indicates that the full thickness of mineral was not proved in the borehole.

Table 5. Data used in the assessment of the resources of block C

Recorded thickness			Mean grading percentage					
MAU Borehole Number	Mineral (m)	Overburden (m)	Fines -1/16 mm	Fine sand $-\frac{1}{4}+1/16$ mm	Medium sand $-1+\frac{1}{4}$ mm	Coarse sand -4+1 mm	Fine gravel -16+4 mm	Coarse gravel +16 mm
NE 71	6.1	0.2	2	60	36	2	0	0
NE 73	11.3	0.6	8	55	36	1	0	0
NE 74	10.9	0.1	4	68	26	1	1	0
NE 78	3.0	0.4	3	55	41	1	0	0
NE 81	6.6	3.5	3	48	28	7	5	9
NE 83	9.9	0.0	4	50	41	3	2	0
NE 84	3.0	0.2	3	47	50	0	0	0
SE 57	6.6	0.3	3	64	31	2	0	0
SE 58	1.7	0.3	12	68	18	2	0	0
SE 60	9.5	0.5	3	48	42	2	3	2
SE 61	6.3	0.4	3	52	36	5	3	1
SE 64	6.9	1.0	3	61	32	1	2	1
SE 65	5.1	0.4	5	49	44	1	1	0
SE 68	3.6	0.4	8	53	35	2	2	0

Table 6. Data used in the assessment of the resources of block D

Recorded thickness			Mean grading percentage					
MAU Borehole Number	Mineral (m)	Overburden (m)	Fines -1/16 mm	Fine sand $-\frac{1}{4}+1/16$ mm	Medium sand $-1+\frac{1}{4}$ mm	Coarse sand -4+1 mm	Fine gravel -16+4 mm	Coarse gravel +16 mm
NW 26	2.0	0.5	9	56	35	0	0	0
NW 27	nil	14.6						
SW 7	6.9	5.8	1	17	51	6	14	11
SW 9	1.0	1.2	24	59	15	2	0	0
SW 10	8.0	0.7	5	34	56	3	2	0
SW 11	2.3+*	7.1	2	21	64	7	6	0
SW 12	9.4	7.7	5	38	54	2	1	0
SW 14	nil	1.0						
SW 15	6.1	6.9	2	21	56	7	11	3
SW 16	7.5	7.9	2	16	54	7	15	6
SW 18	3.0	8.0	1	6	34	11	30	18
SW 19	5.2	10.0	3	20	63	6	6	2
SW 22	7.6	8.0	3	16	65	5	8	3
SW 25	4.0	11.0	2	13	54	7	19	5

* The + sign indicates that the full thickness of mineral was not proved in the borehole.

high level.

The Blown Sand consists of sands and 'clayey' sands which range in the boreholes from 1.7 to 9.0 m in thickness, with a mean of about 4.6 m. Older River Sand and Gravel was not proved in boreholes NE 71, 78 and 84 and SE 58, but elsewhere it consists of sands, pebbly sands and 'clayey' sands, with a sandy gravel in the basal part of borehole NE 81; it ranges in thickness from 1.0 to 6.6 m with a mean of about 2.0 m.

For the whole block, the combined mineral ranges from 1.7 to 11.3 m in thickness, with a mean of 6.5 m, and the mean grading is fines 4 per cent, sand 93 per cent, gravel 3 per cent (see Fig. 6 and Table 5). Estimated total volume of mineral present is 75 million m^3 $\pm$ 21 million m^3.

Overburden is generally thin, with a mean thickness of 0.6 m, but it reaches 3.5 m in thickness in borehole NE 81. It consists mainly of topsoil and patches of peat.

Block D

This block has a mineral-bearing area of 13.4 km^2, the mineral occurring in the basal Alluvium except for a small contribution by Blown Sand in the north-west. Borehole SW 14 proved no mineral, and in borehole NW 27 the overburden to sand and gravel ratio exceeds 3 to 1, but additional borehole information round these points is inadequate to permit mineral-free areas to be defined; accordingly nil thicknesses have been used in the calculations.

There is considerable lateral and vertical variation in composition of the mineral in the Alluvium (Table 6 and Fig. 7): sands, 'clayey' sands, pebbly sands and sandy gravels were proved, with gravels occurring in the basal parts of some boreholes, for example, SW 7. The maximum recorded mineral thickness of 9.4 m occurs in borehole SW 12. The Blown Sand reaches a maximum proved thickness of 2.0 m.

For the whole block, the mineral has a mean thickness of 4.5 m, a mean grading of fines 4 per cent, sand 83 per cent, gravel 13 per cent and an estimated total volume of 60 million m^3 $\pm$ 26 million m^3.

Overburden, which consists of alluvial clay, silt and peat, reaches a maximum recorded thickness of 11.0 m in the south of the block; it has a mean thickness of 6.5 m.

Block E

Block E is geologically similar to block B in that the mineral in the west and centre of the block consists of the basal Alluvium deposited following the incision by the rivers Trent and Eau into pre-existing deposits. In the east and south, however, the mineral comprises the First Terrace and Blown Sand, with local contributions from the Silt and Clay of 25-Foot Drift. The total mineral-bearing area is 16.5 km^2.

The sands, 'clayey' sands and pebbly sands of the basal Alluvium reach a maximum proved thickness of 7.0 m in borehole SE 63. The sands and 'clayey' sands of the Blown Sand and First Terrace reach maximum recorded thicknesses of 6.8 and 7.0 m respectively. Sand lenses in the Silt and Clay of 25-Foot Drift occur in boreholes SW 24, SE 55 and 59, reaching a maximum recorded thickness of 1.6 m.

Within the block, the combined mineral thickness ranges from 2.0 to 11.7 m with a mean thickness of 7.3 m. The mean grading is fines 4 per cent, sand 93 per cent, gravel 3 per cent (Table 7, Fig. 8), and the estimated total volume of mineral present is 120 million m^3 $\pm$ 26 million m^3.

Overburden consists of alluvial clay, silt and peat, with a mean thickness of 3.5 m. It is thin in the east of the block but thickens westwards to the maximum recorded thickness of 13.0 m.

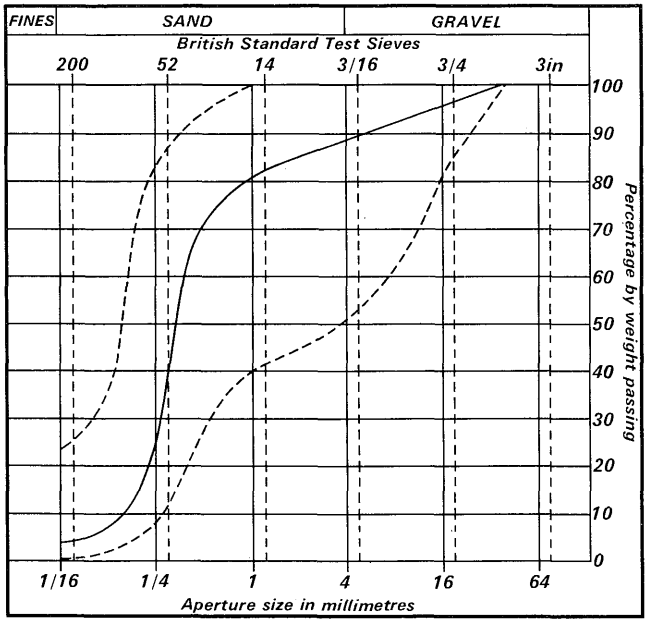


Fig. 7. Grading characteristics of the mineral in block D (For explanation see Fig. 4)

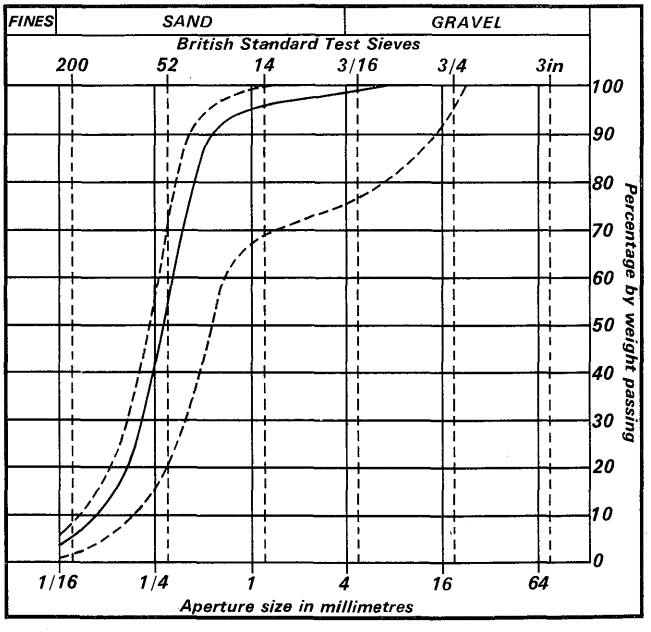


Fig. 8. Grading characteristics of the mineral in block E (For explanation see Fig. 4)

Table 7. Data used in the assessment of the resources of block E

Recorded thickness			Mean grading percentage					
MAU Borehole Number	Mineral (m)	Overburden (m)	Fines -1/16 mm	Fine sand $-\frac{1}{4}+1/16$ mm	Medium sand $-1+\frac{1}{4}$ mm	Coarse sand -4+1 mm	Fine gravel -16+4 mm	Coarse gravel +16 mm
SW 8	5.7	7.3	3	33	57	3	2	2
SW 13	9.0	1.7	6	51	35	2	3	3
SW 17	5.2	7.8	4	47	47	1	1	0
SW 20	5.5	11.0	2	24	66	2	3	3
SW 21	11.6	0.4	4	38	55	2	1	0
SW 23	4.8	13.0	4	10	54	6	20	6
SW 24	11.2	0.3	5	41	51	2	1	0
SW 27	2.0	0.4	3	31	65	1	0	0
SE 55	11.7	0.2	5	51	43	1	0	0
SE 56	5.4	2.6	3	51	29	6	10	1
SE 59	9.0	1.0	2	50	47	1	0	0
SE 62	6.2	4.6	2	38	54	4	2	0
SE 63	7.0	1.8	3	35	60	2	0	0
SE 66	8.6	0.4	8	50	40	1	1	0
SE 69	6.6	0.4	5	38	55	2	0	0

Table 8. Data used in the assessment of the resources of block F

Recorded thickness			Mean grading percentage					
MAU Borehole Number	Mineral (m)	Overburden (m)	Fines -1/16 mm	Fine sand $-\frac{1}{4}+1/16$ mm	Medium sand $-1+\frac{1}{4}$ mm	Coarse sand -4+1 mm	Fine gravel -16+4 mm	Coarse gravel +16 mm
SW 28	3.1	0.2	5	30	64	1	0	0
SE 67	2.6	0.4	9	46	42	2	1	0
SE 70	2.0	0.3	7	38	54	1	0	0
SE 71	3.0	4.0	19	63	14	2	2	0
SE 72	4.9	0.2	5	53	38	2	1	1
SE 73	2.5	0.3	6	36	55	2	1	0
SE 74	nil	1.0						
SE 75	2.6	0.4	12	45	42	1	0	0
SE 76	2.6	0.4	19	34	44	2	1	0

Block F

The mineral consists mainly of Blown Sand, which covers the Rhaetic and Lower Lias scarps, with local contributions from the First Terrace, Older Littoral Sand and Gravel and Glacial Sand and Gravel which, in borehole SE 72, is interbedded with boulder clay. The mineral-bearing area is 8.0 km^2. Borehole SE 74 proved no mineral, but as additional borehole evidence suggests the presence of mineral around it, only a single nil thickness value was used in the calculations.

Mineral ranges up to a maximum recorded thickness of 4.9 m, with a mean thickness of 2.6 m and a mean grading of fines 10 per cent, sand 89 per cent and gravel 1 per cent (Fig. 9, Table 8). The estimated mineral volume is 21 million m^3 ± 8 million m^3.

Overburden has a mean thickness of 0.8 m and consists of topsoil.

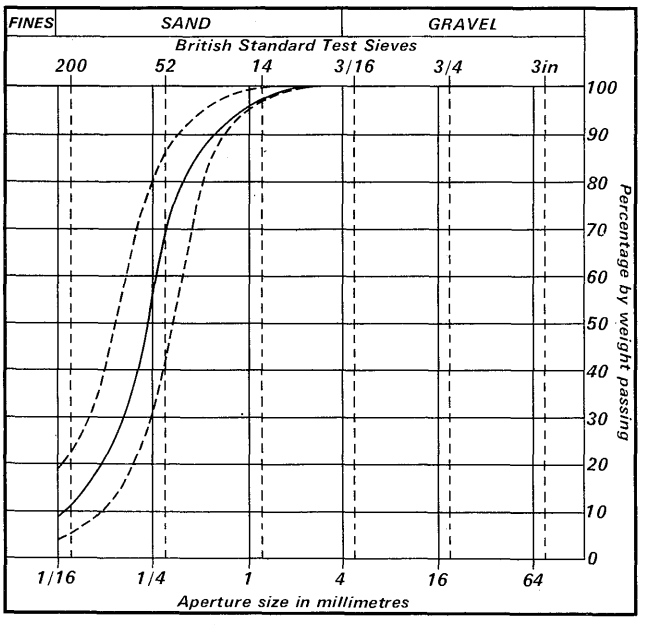


Fig. 9. Grading characteristics of the mineral in block F (For explanation see Fig. 4)

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. The blocks are drawn provisionally before drilling begins.

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

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

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

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

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

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

Appendix B: Statistical Procedure

Statistical Assessment

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

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

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

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

4. The above relationship may be transposed such that

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

From this it can be seen that as $S_A^2/S_{\bar{l}_m}^2$ tends to 0, S_V tends to $S_{\bar{l}_m}$.
If, therefore, the standard deviation for area is small with respect to that for mean thickness, the standard deviation for volume approximates to that for mean thickness.

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

$$\frac{\sum (l_{m_1} + l_{m_2} \ldots l_{m_n})}{n}$$

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

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

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

6. The sampled area in each resource block is coloured pink on the map. Wherever possible, calculations relate to the mineral within mapped geological boundaries (which may not necessarily correspond to the limits of deposit). Where the area is not defined by a mapped boundary, that is, where the boundary is inferred, a distinctive symbol is used. Experience suggests that the errors in determining area are small relative to those in thickness. The relationship $S_A/S_{\bar{l}_m} \leqslant 1/3$ is assumed in all cases. It follows from equation [2] that

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

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

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

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

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

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

per cent.

11. The application of this procedure to a fictitious area is illustrated in Figs. 10 and 11.

Inferrred Assesssment

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 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 1/16 mm. Thus it has no mineralogical significance and includes particles falling within the size range of silt. The normal meaning applies to the term clay where it does not appear in single quotation marks.

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

Thus it is possible to classify the mineral into one of twelve descriptive categories (see Fig. 12). The procedure is as follows:

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

For example, a deposit grading 11 per cent gravel, 70 per cent sand and 19 per cent fines is classified as 'clayey' pebbly sand. This short description is included in the borehole log (see Note 11, p. 21).

Many differing proposals exist for the classification of the grain size of sediments (Atterberg, 1905; Udden, 1914; Wentworth, 1922; Wentworth, 1935; Allen, 1936; Twenhofel, 1937; Lane and others, 1947). As Archer (1970a, b) has emphasised, there is a pressing need for a simple metric scale acceptable to both scientific and engineering interests, for which the class limit sizes correspond closely with certain marked changes in the natural properties of mineral particles. For example, there is an important change in the degree of cohesion between particles at about the 1/16-mm size, which approximates to the generally accepted boundary between silt and sand. These and other requirements are met by a system based on Udden's geometric scale and a simplified form of Wentworth's terminology (Table 9), which is used in this Report.

The fairly wide intervals in the scale are consistent with the general level of accuracy of the qualitative assessments of the resource blocks. Three sizes of sand are recognised, fine (−¼ +1/16 mm), medium (−1 +¼ mm) and coarse (−4 +1 mm). The boundary at 16 mm distinguishes a range of finer gravel (−16 +4 mm), often characterised by abundance of worn tough pebbles of vein quartz, from larger pebbles often of notably different materials. The boundary at 64 mm distinguishes pebbles from cobbles. The term 'gravel' is used loosely to denote both pebble-sized and cobble-sized material.

The size distribution of borehole samples is determined by sieve analysis, which is presented by the laboratory as logarithmic cumulative curves (see, for example, British Standard 1377: 1967). In this report the grading is tabulated on the borehole record sheets (Appendix F), the intercepts corresponding with the simple geometric scale 1/16 mm, ¼ mm, 1 mm, 4 mm, 16 mm and so on as required. Original sample grading curves are available for reference at the appropriate office of the Institute.

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

The relative proportions of the rock types present in the gravel fraction are indicated by the use of the words 'and' or 'with'. For example, 'flint and quartz' indicates very approximately 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 types, comprises 5 to 25 per cent of the whole. Where the accessory material accounts for less than 5 per cent of the whole, but is still readily apparent, the phrase 'with some' has been used. Rare constituents are referred to as 'trace'.

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

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

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

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

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

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

Table 9. Classification of gravel, sand and fines

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

Block Calculation — 1:25 000 Block — Fictitious (See map in Fig. 11)

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

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

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

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

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

Sample point	Weighting w	Overburden l_o	Overburden wl_o	Mineral l_m	Mineral wl_m	Remarks
SE 14	1	1.5	1.5	9.4	9.4	MAU boreholes
SE 18	1	3.3	3.3	5.8	5.8	
SE 20	1	nil	-	6.9	6.9	
SE 22	1	0.7	0.7	6.4	6.4	
SE 23	1	6.2	6.2	4.1	4.1	
SE 24	1	4.3	4.3	6.4	6.4	
SE 17	½	1.2	1.6	9.8	7.2	Hydrogeological Dept record
123/45	½	2.0		4.6		
1	¼	2.7	2.6	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	Σw = 8	Σwl_o = 20.2		Σwl_m = 52.0		
Means		$\bar{l}_o$ = 2.5		$\bar{l}_m$ = 6.5		

Calculation of confidence limits

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

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

$n = 8$

$t = 2.365$

L_V is calculated as

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

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

$$= 20.3$$

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

Fig. 10. Example of resource block assessment: calculation and results

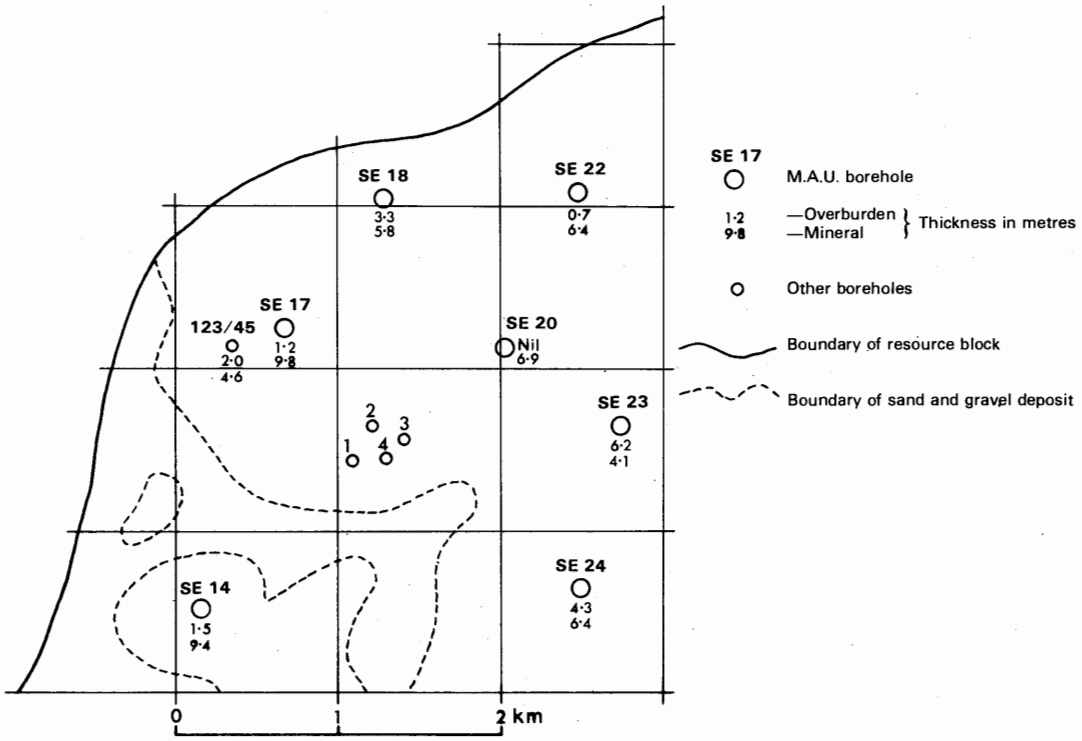
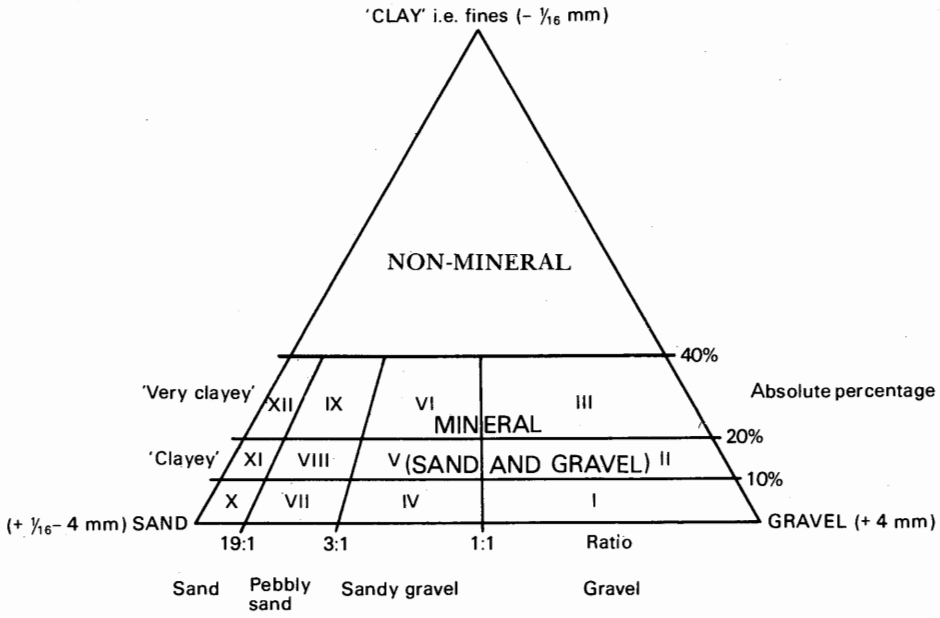


Fig. 11. Example of resource block assessment: map of fictitious block



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

Fig. 12. Diagram to show the descriptive categories used in the classification of sand and gravel

Appendix D: Explanation of the Borehole Records

ANNOTATED EXAMPLE

SE 80 SW 13[1] 8487 0414[2] East Butterwick[3] Block E

Surface level (+2.4 m) +8 ft[4]
Water level -0.6 m (-2 ft)[5]
February 1973[6]

Overburden[7] 1.7 m (5.5 ft)
Mineral 3.7 m (12.0 ft)
Waste 0.8 m (2.5 ft)
Mineral 5.3 m (17.5 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

			Thickness[8] m	(ft)	Depth m	(ft)
		Topsoil, sandy, peaty at base	1.7	(5.5)	1.7	(5.5)
Blown Sand[10]	(a)	Sand,[11] fine and medium, subangular to well rounded quartz and rock fragments	3.7	(12.0)	5.4	(17.5)
Alluvium		Peaty silt, dark brown and black	0.8	(2.5)	6.2	(20.5)
Older River Sand and Gravel	(b)	Sand, 'clayey' at top, fine, subangular to rounded quartz and rock fragments. Some brown silt	3.0	(10.0)	9.2	(30.0)
	(c)	Pebbly sand Gravel: fine and coarse, subangular to rounded quartz, quartzite and chert. Sand: fine and medium, well rounded quartz and rock fragments	2.3	(7.5)	11.5	(37.5)
Keuper Marl		Mudstone, red	1.5+	(5.0+)	13.0	(42.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand[15]	93	-4 + 1	0
		-1 + ¼	44
		-¼ + 1/16	49
Fines	7	-1/16	7
(b)			
Sand	90	-4 + 1	1
		-1 + ¼	20
		-¼ + 1/16	69
Fines	10	-1/16	10
(c)			
Gravel	24	+16	11
		-16 + 4	13
Sand	74	-4 + 1	6
		-1 + ¼	37
		-¼ + 1/16	31
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)[12]	Percentage[13] Fines	Sand	Gravel
1.7 - 2.7	4	96	0
2.7 - 3.7	[2	98	0][14]
3.7 - 4.7	1	99	0
4.7 - 5.7	26	74	0
6.2 - 7.2	19	81	0
7.2 - 8.2	5	95	0
8.2 - 9.2	4	95	1
9.2 - 10.2	1	78	21
10.2 - 11.2	2	68	30
11.2 - 11.5	1	80	19

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

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

1) The number of the 1:25 000 sheet on which the borehole lies, for example, SE 80.
2) The quarter of the 1:25 000 sheet on which the borehole lies and its number in a series for that quarter, for example, SW 13.

Thus the full Registration Number is SE 80 SW 13.

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

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

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

5. Groundwater Conditions.
Three kinds of entry are made: the record indicates the level at which groundwater stood on completion of drilling (in m and ft above or below OD) or that water was not struck, or that no record of groundwater conditions was made.

6. Type of Drill and Date of Drilling.
Unless otherwise stated a conventional Dando shell and auger rig, in conjunction with 6-inch diameter casing, was used in the survey. 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 it classified as overburden.

8. Thickness and Depth.
Measurements were made in metres. Conversions from metres to feet are shown in brackets and have been rounded off to the nearest 0.5 ft. Where figures have been rounded in this way there may be a discrepancy between the sum of the thicknesses and the recorded depths. A conversion table is given in Appendix H.

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

10. Geological Classification.
The geological classification (p. 2) is given whenever possible.

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

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

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

14. If, exceptionally, grading results are not available, an attempt is made to give grading information by comparing the grading and field descriptions of adjacent samples with the sample in question. Such estimates are shown in square brackets.

15. Mean Grading.
The grading of the full thickness of the mineral horizons identified in the log is the mean of the grading of individual samples weighted by the thicknesses represented, if these vary. The classification used is shown in Table 9.

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

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

MINERAL ASSESSMENT UNIT BOREHOLES

Borehole Number by sheet quadrant	Grid ref: (all fall in 100 km square SE)	Page
SE 80 NW		
6	8040 0946	23
7	8143 0944	24
8	8254 0963	25
9	8341 0977	26
10	8463 0961	27
11	8077 0848	28
12	8215 0880	29
13	8285 0868	29
14	8416 0880	30
15	8169 0771	31
16	8241 0762	32
17	8363 0762	33
18	8192 0678	34
19	8296 0680	35
20	8406 0686	36
21	8060 0600	37
22	8133 0599	37
23	8257 0589	38
24	8343 0601	39
25	8474 0575	40
26	8105 0503	41
27	8332 0510	42
SE 80 NE		
69	8578 0958	43
70	8681 0950	44
71	8744 0948	45
72	8532 0886	46
73	8652 0859	47
74	8733 0875	48
75	8512 0803	49
76	8583 0795	50
77	8695 0774	51
78	8771 0754	52
79	8504 0698	53
80	8635 0660	54
81	8745 0687	55
82	8636 0571	56
83	8691 0559	57
84	8812 0592	58
SE 80 SW		
7	8204 0483	59
8	8399 0496	60
9	8024 0393	61
10	8155 0424	62
11	8286 0418	63
12	8359 0418	64
13	8487 0414	65
14	8119 0329	66
15	8204 0334	66
16	8313 0305	67
17	8410 0295	68
18	8189 0221	69
19	8248 0195	70
20	8367 0209	71
21	8462 0222	72
22	8204 0122	73
23	8300 0117	74
24	8421 0140	75
25	8171 0052	76
26	8303 0042	77
27	8366 0022	77
28	8462 0050	78
SE 80 SE		
55	8527 0497	79
56	8626 0498	80
57	8756 0495	81
58	8814 0464	82
59	8573 0398	83
60	8697 0403	84
61	8781 0427	85
62	8519 0339	86
63	8608 0324	87
64	8719 0333	88
65	8838 0320	89
66	8550 0221	90
67	8685 0226	91
68	8821 0217	92
69	8518 0144	93
70	8611 0140	94
71	8741 0132	95
72	8554 0014	96
73	8702 0023	97
74	8790 0030	97
75	8848 0074	98
76	8896 0027	99

OTHER BOREHOLES

SE 80 SW, 2/418, 8276 0076.

Appendix F: Mineral Assessment Unit Borehole Records

SE 80 NW 6 | 8040 0946 | North Moor | Block A

Surface level (+1.8 m) +6 ft
Water level -0.7 m (-2 ft)
February 1973

Overburden 1.1 m (3.5 ft)
Mineral 2.9 m (9.5 ft)
Waste 1.2 m (4.0 ft)
Mineral 1.8 m (6.0 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	1.1	(3.5)	1.1	(3.5)
First Terrace	(a)	Sand, pebbly at top Gravel: fine, well rounded quartz and subrounded quartzites pebbles Sand: fine, well rounded quartz grains with some coal	2.9	(9.5)	4.0	(13.0)
Silt and Clay of 25-Foot Drift		Clayey silt, red, laminated, micaceous	1.2	(4.0)	5.2	(17.0)
Older River Sand and Gravel	(b)	'Clayey' sand, fine, well rounded quartz	1.8	(6.0)	7.0	(23.0)
Keuper Marl		Mudstone, red and greyish green, gypsiferous	1.5+	(5.0+)	8.5	(28.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Gravel	3	+16	0
		-16 + 4	3
Sand	90	-4 + 1	1
		-1 + ¼	10
		-¼ + 1/16	79
Fines	7	-1/16	7
(b)			
Sand	86	-4 + 1	1
		-1 + ¼	7
		-¼ + 1/16	78
Fines	14	-1/16	14

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.1 - 2.1	10	81	9
2.1 - 3.1	8	92	0
3.1 - 4.0	4	96	0
5.2 - 6.2	17	83	0
6.2 - 7.0	10	90	0

SE 80 NW 7 8143 0944 Low Farm Block A

Surface level (+1.8 m) +6 ft
Water level -1.2 m (-4 ft)
February 1973

Overburden 0.6 m (2.0 ft)
Mineral 3.6 m (12.0 ft)
Waste 1.6 m (5.0 ft)
Mineral 6.3 m (20.5 ft)
Bedrock 0.9 m+ (3.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Fill	0.6	(2.0)	0.6	(2.0)
First Terrace	(a)	'Clayey' sand, 'very clayey' at top Sand: fine, rounded quartz with some subrounded rock fragments	3.6	(12.0)	4.2	(14.0)
Silt and Clay of 25-Foot Drift		Clay, red, silty	1.6	(5.0)	5.8	(19.0)
Older River Sand and Gravel	(b)	Sand, pebbly at base Gravel: fine, well rounded quartz and sandstone pebbles with mudstone, subangular flint and chert Sand: medium, well rounded quartz and subrounded lithic fragments	6.3	(20.5)	12.1	(39.5)
Keuper Marl		Mudstone, red and green	0.9+	(3.0+)	13.0	(42.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	83	-4 + 1	0
		-1 + ¼	22
		-¼ + 1/16	61
Fines	17	-1/16	17
(b)			
Gravel	4	+16	1
		-16 + 4	3
Sand	93	-4 + 1	5
		-1 + ¼	57
		-¼ + 1/16	31
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.6 - 1.6	37	63	0
1.6 - 2.6	16	84	0
2.6 - 3.6	5	95	0
3.6 - 4.2	4	96	0
5.8 - 6.8	5	95	0
6.8 - 7.8	3	95	2
7.8 - 8.8	2	93	5
8.8 - 9.8	4	95	1
9.8 - 10.8	2	97	1
10.8 - 12.1	2	85	13

SE 80 NW 8 8254 0963 Althorpe Block A

Surface level (+0.6 m) +2 ft
Water level -0.8 m (-3 ft)
February 1973

Overburden 6.4 m (21.0 ft)
Mineral 2.8 m (9.0 ft)
Bedrock 0.8 m+ (2.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	1.4	(4.5)	1.4	(4.5)
Alluvium	Peaty silt, brown and grey, micaceous	5.0	(16.5)	6.4	(21.0)
	Sand: medium, well rounded quartz with subrounded rock fragments; occasional fine gravel	2.8	(9.0)	9.2	(30.0)
Keuper Marl	Mudstone, hard, red and green	0.8+	(2.5+)	10.0	(33.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	1	+ 16	0
		-16 + 4	1
Sand	90	-4 + 1	5
		-1 + $\frac{1}{4}$	42
		-$\frac{1}{4}$ + 1/16	43
Fines	9	-1/16	9

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
6.4 - 8.4	9	90	1
8.4 - 9.2	8	90	2

SE 80 NW 9 | 8341 0977 | Althorpe | Block A

Surface level (+4.0 m) +13 ft
Water level +1.2 m (+4 ft)
September 1973

Overburden 2.9 m (9.5 ft)
Mineral 4.9 m (16.0 ft)
Waste 2.2 m (7.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil, brown, silty	0.7	(2.5)	0.7	(2.5)
Alluvium	Clayey silt, pale brown, micaceous, laminated, some carbonaceous matter. Becomes sandy towards base	2.2	(7.0)	2.9	(9.5)
	'Clayey' sand, 'very clayey' at top, fine, well rounded or rounded quartz with some lithic grains. Some carbonaceous particles and dark, laminated silt bands	4.9	(16.0)	7.8	(25.5)
	Silt, brown, laminated, micaceous, with some sand and occasional quartz pebbles. Much wood and seed debris	2.2	(7.0)	10.0	(33.0)
Keuper Marl	Mudstone, hard, red, weathered to green at top	1.0+	(3.5+)	11.0	(36.0)

GRADING

Mean for Deposit

%	mm	%
Sand 87	-4 + 1	1
	-1 + $\frac{1}{4}$	7
	-$\frac{1}{4}$ + 1/16	79
Fines 13	-1/16	13

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
2.9 - 3.9	26	74	0
3.9 - 4.9	13	87	0
4.9 - 5.9	7	93	0
5.9 - 6.9	4	96	0
6.9 - 7.8	17	83	0

SE 80 NW 10 8463 0961 Brumby Common West Block B

Surface level (+1.5 m) +5 ft
Water level -1.5 m (-5 ft)
February 1973

Overburden 8.0 m (26.0 ft)
Mineral 6.2 m (20.5 ft)
Bedrock 0.8 m+ (2.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.7	(2.5)	0.7	(2.5)
Alluvium	Sandy silt, yellowish, clayey, micaceous	0.8	(2.5)	1.5	(5.0)
	Peaty silt, grey and brown	6.5	(21.5)	8.0	(26.0)
	Sand, with sandy gravel at base Gravel: fine, subrounded, quartz and sandstone with limestone, red marl and flint Sand: medium, well rounded quartz	6.2	(20.5)	14.2	(46.5)
Keuper Marl	Mudstone, red and green	0.8+	(2.5+)	15.0	(49.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	7	+16	3
		-16 + 4	4
Sand	89	-4 + 1	4
		-1 + $\frac{1}{4}$	51
		-$\frac{1}{4}$ + 1/16	34
Fines	4	-1/16	4

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
8.0 - 9.0	2	98	0
9.0 - 10.0	3	97	0
10.0 - 11.0	4	96	0
11.0 - 12.0	3	97	0
12.0 - 13.0	3	97	0
13.0 - 14.2	9	56	35

Surface level (+1.5 m) +5 ft
Water level -0.7 m (-2 ft)
February 1973

Overburden 1.5 m (5.0 ft)
Mineral 1.4 m (4.5 ft)
Waste 1.1 m (3.5 ft)
Mineral 1.0 m (3.5 ft)
Waste 0.9 m (3.0 ft)
Mineral 1.1 m (3.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

			Thickness m	Thickness (ft)	Depth m	Depth (ft)
		Topsoil and fill	1.5	(5.0)	1.5	(5.0)
First Terrace	(a)	'Clayey' sand: fine, well rounded quartz with some coal specks Brown silt	1.4	(4.5)	2.9	(9.5)
Silt and Clay of 25-Foot Drift		Clayey silt, reddish brown, micaceous, laminated	1.1	(3.5)	4.0	(13.0)
	(b)	'Very clayey' sand: fine, well rounded quartz sand with brown silt	1.0	(3.5)	5.0	(16.5)
		Clayey silt: brown, laminated	0.9	(3.0)	5.9	(19.5)
Older River Sand and Gravel	(c)	'Very clayey' sand: fine, well rounded quartz sand with clay and silt	1.1	(3.5)	7.0	(23.0)
Keuper Marl		Mudstone, red and green, gypsiferous	1.0+	(3.5+)	8.0	(26.0)

GRADING

Mean for Deposit				Bulk Samples			
	%	mm	%	Depth below surface (m)	Percentage Fines	Sand	Gravel
(a)							
Sand	90	-4 + 1	0	1.5 - 2.9	10	90	0
		-1 + $\frac{1}{4}$	5				
		-$\frac{1}{4}$ + 1/16	85				
Fines	10	-1/16	10				
(b)							
Sand	73	-4 + 1	1	4.0 - 5.0	27	73	0
		-1 + $\frac{1}{4}$	4				
		-$\frac{1}{4}$ + 1/16	68				
Fines	27	-1/16	27				
(c)							
Sand	71	-4 + 1	1	5.9 - 7.0	29	71	0
		-1 + $\frac{1}{4}$	12				
		-$\frac{1}{4}$ + 1/16	58				
Fines	29	-1/16	29				

SE 80 NW 12 8215 0880 Derrythorpe Common Block A

Surface level (+0.3 m) +1 ft
Water level -2.2 m (-7.0 ft)
February 1973

Waste 7.5 m (24.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	1.4	(4.5)	1.4	(4.5)
Alluvium	Peaty silt, grey and brown, laminated micaceous, very peaty in parts. Layer of fine, well rounded quartz and sandstone pebbles at base	6.1	(20.0)	7.5	(24.5)
Keuper Marl	Mudstone, red and green, weathered at top	1.0+	(3.5+)	8.5	(28.0)

SE 80 NW 13 8285 0868 Derrythorpe Block A

Surface level (+2.7 m) +9.0 ft
Water level -0.3 m (-1 ft)
February 1973

Waste 14.9 m (49.0 ft)
Bedrock 1.1 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil and warp	0.9	(3.0)	0.9	(3.0)
Alluvium	Clayey silt, brown, micaceous with ochreous sandy patches	1.0	(3.5)	1.9	(6.5)
	Peaty silt, laminated, soft, grey, clayey in parts. Gravelly and shelly at base	9.8	(32.0)	11.7	(38.5)
	Pebbly sand Gravel: fine, rounded quartz and sandstone with some siltstone Sand: medium, rounded quartz	3.2	(10.5)	14.9	(49.0)
Keuper Marl	Mudstone, hard, red	1.1+	(3.5+)	16.0	(52.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	9	+16	2
		-16 + 4	7
Sand	90	-4 + 1	8
		-1 + $\frac{1}{4}$	71
		-$\frac{1}{4}$ + 1/16	11
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
11.7 - 12.7	1	85	14
12.7 - 13.7	1	89	10
13.7 - 14.9	2	93	5

SE 80 NW 14 8416 0880 Burringham Block B

Surface level (+1.2 m) +4 ft
Water level +0.2 m (+1 ft)
February 1973

Overburden 7.9 m (26.0 ft)
Mineral 3.6 m (12.0 ft)
Bedrock 0.5 m+ (1.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.5	(1.5)	0.5	(1.5)
Alluvium	Peaty silt, ochreous at top, grey and brown becoming dark in lower part	7.4	(24.5)	7.9	(26.0)
	Sand, medium, sub to well rounded quartz with some lithic grains. Some flint and mudstone pebbles	3.6	(12.0)	11.5	(37.5)
Keuper Marl	Mudstone, red and green	0.5+	(1.5+)	12.0	(39.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	1	+16	0
		-16 + 4	1
Sand	94	-4 + 1	3
		-1 + $\frac{1}{4}$	49
		-$\frac{1}{4}$ + 1/16	42
Fines	5	-1/16	5

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
7.9 - 8.9	2	98	0
8.9 - 9.9	2	98	0
9.9 - 11.5	9	89	2

SE 80 NW 15 | 8169 0771 | Beltoft Grange | Block A

Surface level (+1.8 m) +6 ft
Water not struck
March 1973

Overburden 1.7 m (5.5 ft)
Mineral 1.4 m (4.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil and warp	1.0	(3.5)	1.0	(3.5)
	Silty peat, dark brown	0.7	(2.5)	1.7	(5.5)
First Terrace	'Clayey' sand: fine, subrounded quartz and some lithic grains. Some fine quartz pebbles and grey silt	1.4	(4.5)	3.1.	(10.0)
Keuper Marl	Mudstone, hard red marl with green 'fisheyes'	1.0+	(3.5+)	4.1	(13.5)

GRADING

Mean for Deposit

	%	mm	%
Sand	87	-4 + 1	0
		-1 + ¼	26
		-¼ + 1/16	61
Fines	13	-1/16	13

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.7 - 3.1	13	87	0

SE 80 NW 16 8241 0762 Derrythorpe Grange Block A

Surface level (+0.9 m) +3 ft
Water level not recorded
September 1973

Waste 8.3 m (27.0 ft)
Bedrock 0.7 m+ (2.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil, dark brown, micaceous	0.6	(2.0)	0.6	(2.0)
Alluvium	Silt and Peat, dark grey and brown, laminated, micaceous silt with dark brown, fibrous peat	5.9	(19.5)	6.5	(21.5)
	Pebbly sand Gravel: fine, subrounded, quartz and quartzite with chert Sand: medium, rounded quartz with some mudstone, coal and chert fragments	1.8	(6.0)	8.3	(27.0)
Keuper Marl	Mudstone, reddish brown with green 'fish eyes'	0.7+	(2.5+)	9.0	(29.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	6	+16	1
		-16 + 4	5
Sand	89	-4 + 1	3
		-1 + ¼	73
		-¼ + 1/16	13
Fines	5	-1/16	5

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
6.5 - 7.5	2	91	7
7.5 - 8.3	9	86	5

Surface level (+2.1 m) +7 ft
Water level -0.9 m (-3 ft)
February 1973

Overburden 8.0 m (26.0 ft)
Mineral 7.1 m (23.5 ft)
Bedrock 0.5 m+ (1.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	1.2	(4.0)	1.2	(4.0)
Alluvium	Peaty silt, yellow, grey and black, laminated, micaceous	6.8	(22.5)	8.0	(26.0)
	Pebbly sand Gravel: fine, well rounded quartz and sandstones, subrounded flint and sandstone Sand: medium with fine, coarsening downwards, well rounded quartz grains	7.1	(23.5)	15.1	(49.5)
Keuper Marl	Mudstone, red and green	0.5+	(1.5+)	15.6	(51.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	6	+16	0
		-16 + 4	6
Sand	88	-4 + 1	5
		-1 + $\frac{1}{4}$	51
		-$\frac{1}{4}$ + 1/16	32
Fines	6	-1/16	6

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
8.0 - 9.0	8	89	3
9.0 - 10.0	7	91	2
10.0 - 11.0	8	92	0
11.0 - 12.0	4	96	0
12.0 - 13.0	5	80	15
13.0 - 14.0	3	73	24
14.0 - 15.1	4	94	2

SE 80 NW 18 8192 0678 Beltoft Block A

Surface level (+1.2 m) +4 ft
Water level -0.8 m (-3 ft)
March 1973

Overburden 1.3 m (4.5 ft)
Mineral 3.3 m (11.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.9	(3.0)	0.9	(3.0)
Alluvium	Silty peat, dark, with much wood debris	0.4	(1.5)	1.3	(4.5)
	'Clayey' sand: fine, subrounded, quartz with some lithic grains, some greyish brown silt	3.3	(11.0)	4.6	(15.0)
Keuper Marl	Mudstone, red and green, gypsiferous	1.0+	(3.5+)	5.6	(18.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	1	+16	0
		-16 + 4	1
Sand	87	-4 + 1	1
		-1 + $\frac{1}{4}$	42
		-$\frac{1}{4}$ + 1/16	44
Fines	12	-1/16	12

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.3 - 2.3	3	96	1
2.3 - 3.3	4	96	0
3.3 - 4.6	25	74	1

SE 80 NW 19 8296 0680 West Butterwick Block A

Surface level (+2.7 m) +9 ft
Water level +0.2 m (+1 ft)
March 1973

Overburden 9.2 m (30.0 ft)
Mineral 5.0 m (16.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.4	(1.5)	0.4	(1.5)
Alluvium	Silty clay, brown, ochreous in parts	1.9	(6.0)	2.3	(7.5)
	Peaty silt, dark grey and brown, clayey in parts	6.9	(22.5)	9.2	(30.0)
	Pebbly sand Gravel: fine, well rounded quartz and grey sandstone with green, tabular, subangular sandstone and some flint Sand: medium, subrounded quartz, with some coal	5.0	(16.5)	14.2	(46.5)
Keuper Marl	Mudstone, hard, red and green	1.0+	(3.5+)	15.2	(50.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	8	+16	1
		-16 + 4	7
Sand	90	-4 + 1	7
		-1 + ¼	50
		-¼ + 1/16	33
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
9.2 - 10.2	2	95	3
10.2 - 11.2	2	96	2
11.2 - 12.2	3	90	7
12.2 - 13.2	1	92	7
13.2 - 14.2	2	78	20

SE 80 NW 20 8406 0686 East Butterwick Block B

Surface level (+1.8 m) +6 ft
Water level +1.3 m (+4 ft)
January 1973

Overburden 8.5 m (28.0 ft)
Mineral 6.7 m (22.0 ft)
Bedrock 0.8 m+ (2.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.5	(1.5)	0.5	(1.5)
Alluvium	Peaty silt, grey, brown and black	8.0	(26.0)	8.5	(28.0)
	Sand, pebbly at base Gravel: fine, subrounded sandstone and siltstone Sand: medium with fine, well rounded quartz with some rock fragments	6.7	(22.0)	15.2	(50.0)
Keuper Marl	Mudstone, red and green	0.8+	(2.5+)	16.0	(52.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	2	+16	1
		-16 + 4	1
Sand	94	-4 + 1	5
		-1 + $\frac{1}{4}$	63
		-$\frac{1}{4}$ + 1/16	26
Fines	4	-1/16	4

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
8.5 - 9.5	11	89	0
9.5 - 10.5	4	95	1
10.5 - 11.5	5	95	0
11.5 - 12.5	2	98	0
12.5 - 13.5	1	97	2
13.5 - 14.5	3	92	5
14.5 - 15.2	1	88	11

SE 80 NW 21 | 8060 0600 | Woods Farm | Block A

Surface level (+2.4 m) +8 ft
Water level +0.4 m (+1 ft)
March 1973

Waste 5.9 m (19.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.5	(1.5)	0.5	(1.5)
Alluvium	Clayey silt: red and greyish brown, soft, micaceous, laminated silt, sandy in parts, with patches of bluish clay	5.4	(18.0)	5.9	(19.5)
Keuper Marl	Mudstone, red and green, gypsiferous	1.0+	(3.5+)	6.9	(22.5)

SE 80 NW 22 | 8133 0599 | Gravel Hill Wood | Block A

Surface level (+2.7 m) +9 ft
Water level +0.7 m (+2 ft)
January 1973

Overburden 0.6 m (2.0 ft)
Mineral 4.9 m (16.0 ft)
Bedrock 1.0 m (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.6	(2.0)	0.6	(2.0)
Alluvium	Sand: fine, subrounded quartz, coarser at base. Some coal 'Very clayey' at top	4.9	(16.0)	5.5	(18.0)
Keuper Marl	Mudstone, red and green	1.0+	(3.5+)	6.5	(21.5)

GRADING

Mean for Deposit

	%	mm	%
Sand	92	-4 + 1	0
		-1 + $\frac{1}{4}$	25
		-$\frac{1}{4}$ + 1/16	67
Fines	8	-1/16	8

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.6 - 1.6	24	76	0
1.6 - 2.6	6	94	0
2.6 - 3.6	4	96	0
3.6 - 4.6	5	95	0
4.6 - 5.5	1	99	0

Surface level (+2.1 m) +7 ft
Water level -0.9 m (-3 ft)
March 1973

Overburden 9.4 m (30.5 ft)
Mineral 5.1 m (16.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Fill and topsoil	2.4	(8.0)	2.4	(8.0)
Alluvium	Peat, brown, on soft, grey, peaty silt	7.0	(23.0)	9.4	(31.0)
	(a) Sand: medium, well rounded quartz with subrounded lithic grains and some coal. Some rounded flint and sandstone pebbles	2.0	(6.5)	11.4	(37.5)
	(b) Pebbly sand Gravel: fine, well rounded quartz and quartzite with subrounded flint and sandstone Sand: as above	3.1	(10.0)	14.5	(47.5)
Keuper Marl	Mudstone, red and green	1.0+	(3.5+)	15.5	(51.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Gravel	4	+16	0
		-16 + 4	4
Sand	95	-4 + 1	5
		-1 + $\frac{1}{4}$	82
		-$\frac{1}{4}$ + 1/16	8
Fines	1	-1/16	1
(b)			
Gravel	22	+16	3
		-16 + 4	19
Sand	77	-4 + 1	7
		-1 + $\frac{1}{4}$	60
		-$\frac{1}{4}$ + 1/16	10
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
9.4 - 10.4	1	95	4
10.4 - 11.4	2	94	4
11.4 - 12.4	1	75	24
12.4 - 13.4	1	67	32
13.4 - 14.5	1	89	10

Surface level (+4.0 m) +13 ft
Water level +1.1 m (+4 ft)
March 1973

Overburden 4.5 m (15.0 ft)
Mineral 10.9 m (36.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.5	(1.5)	0.5	(1.5)
Alluvium	Silty clay, greyish brown	4.0	(13.0)	4.5	(15.0)
	Sand, 'clayey' to 'very clayey' in lower part, scattered pebbles at base Gravel: fine, well rounded quartz, sandstone, flint and subangular green sandstone Sand: fine, well rounded to subrounded quartz, some rounded rock fragments and coal specks	10.9	(36.0)	15.4	(50.5)
Keuper Marl	Mudstone, hard, red and green	1.0+	(3.5+)	16.4	(54.0)

GRADING

Mean for Deposit

	%	mm	%
Sand	90	-4 + 1	2
		-1 + $\frac{1}{4}$	31
		-$\frac{1}{4}$ + 1/16	57
Fines	10	-1/16	10

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
4.5 - 5.5	8	92	0
5.5 - 6.5	8	92	0
6.5 - 7.5	6	94	0
7.5 - 8.5	4	96	0
8.5 - 9.5	3	97	0
9.5 - 10.5	2	98	0
10.5 - 11.5	21	79	0
11.5 - 12.5	35	65	0
12.5 - 13.5	6	94	0
13.5 - 14.5	11	89	0
14.5 - 15.4	9	90	1

SE 80 NW 25 8474 0575 East Butterwick Block B

Surface level +1.8 m (+6 ft)
Water level -0.2 m (-1 ft)
February 1973

Overburden 4.9 m (16.0 ft)
Mineral 5.1 m (16.5 ft)
Bedrock 0.9 m+ (3.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	1.2	(4.0)	1.2	(4.0)
Alluvium	Silt and clay: black and peaty, becoming paler and sandy below 3.9 m	3.7	(12.0)	4.9	(16.0)
Older River Sand and Gravel	Sand: "clayey" at top and base Sand: fine with medium, well rounded quartz grains with rock fragments Fines: reddish brown to grey clay and silt	5.1	(16.5)	10.0	(33.0)
Keuper Marl	Mudstone, red and green	0.9+	(3.0+)	10.9	(36.0)

GRADING

Mean for Deposit

	%	mm	%
Sand	90	-4 + 1	1
		-1 + $\frac{1}{4}$	21
		-$\frac{1}{4}$ + 1/16	68
Fines	10	-1/16	10

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
4.9 - 5.9	12	88	0
5.9 - 6.9	8	92	0
6.9 - 7.9	9	91	0
7.9 - 8.9	8	92	0
8.9 - 10.0	14	86	0

Surface level (+2.1 m) +7 ft
Water level -0.9 m (-3 ft)
September 1973

Overburden 0.5 m (1.5 ft)
Mineral 2.0 m (6.5 ft)
Waste 2.3 m (7.5 ft)
Bedrock 0.8 m+ (2.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil, brown, sandy	0.5	(1.5)	0.5	(1.5)
Blown Sand	Sand: fine, rounded quartz with some lithic grains. Red and grey silt towards base	2.0	(6.5)	2.5	(8.0)
Weathered Keuper Marl	Clay: reddish brown with thin peat and silt lenses. Hard mudstone granules, greenish grey staining and skerry pebbles towards base	2.3	(7.5)	4.8	(15.5)
Keuper Marl	Mudstone, greenish grey, hard	0.8+	(2.5+)	5.6	(18.5)

GRADING

Mean for Deposit

	%	mm	%
Sand	91	-4 + 1	0
		-1 + $\frac{1}{4}$	35
		-$\frac{1}{4}$ + 1/16	56
Fines	9	-1/16	9

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.5 - 1.5	5	95	0
1.5 - 2.5	13	87	0

SE 80 NW 27 8332 0510 West Butterwick Block D

Surface level (+3.4 m) +11.0 ft
Water level -0.6 m (-2.0 ft)
March 1973

Waste 14.6 m (42.5 ft)
Bedrock 1.4 m+ (4.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.3	(1.0)	0.3	(1.0)
Alluvium	Clayey silt, light brown	2.7	(9.0)	3.0	(10.0)
	Silty clay, light grey, laminated, peaty towards base	8.4	(27.5)	11.4	(37.5)
	Silty peat	1.6	(5.0)	13.0	(42.5)
	Pebbly sand and sandy gravel Gravel: fine, subangular to rounded quartz and quartzite with chert and sandstone Sand: medium, rounded quartz	1.6	(5.0)	14.6	(48.0)
Keuper Marl	Mudstone, red	1.4+	(4.5+)	16.0	(52.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	24	+16	3
		-16 + 4	21
Sand	74	-4 + 1	11
		-1 + $\frac{1}{4}$	48
		-$\frac{1}{4}$ + 1/16	15
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
13.0 - 14.0	2	84	14
14.0 - 14.6	1	59	40

Surface level (+3.0 m) +10 ft
Water level +1.0 m (+3 ft)
February 1973

Overburden 1.2 m (4.0 ft)
Mineral 4.6 m (15.0 ft)
Waste 4.0 m (13.0 ft)
Mineral 2.4 m+ (8.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil, dark silty	1.2	(4.0)	1.2	(4.0)
First Terrace	(a)	Sand, fine, well rounded quartz	4.6	(15.0)	5.8	(19.0)
Silt and Clay of 25-Foot Drift		Silty clay, grey and brown, laminated, becoming sandy	4.0	(13.0)	9.8	(32.0)
Older River Sand and Gravel	(b)	Sand, medium, rounded quartz with lithic grains Borehole abandoned owing to rising sand	2.4+	(8.0+)	12.2	(40.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	95	-4 + 1	1
		-1 + $\frac{1}{4}$	41
		-$\frac{1}{4}$ + 1/16	53
Fines	5	-1/16	5
(b)			
Sand	98	-4 + 1	1
		-1 + $\frac{1}{4}$	66
		-$\frac{1}{4}$ + 1/16	31
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.2 - 2.2	9	91	0
2.2 - 3.2	8	92	0
3.2 - 4.2	3	97	0
4.2 - 5.8	1	99	0
9.8 - 10.8	2	98	0
10.8 - 12.2	2	98	0

Surface level (+2.7 m) +9 ft
Water level +0.7 m (+2 ft)
February 1973

Overburden 0.2 m (0.5 ft)
Mineral 8.9 m (29.0 ft)
Waste 1.8 m (6.0 ft)
Mineral 3.1 m (10.0 ft)
Bedrock 0.8 m+ (2.5 ft+)

LOG

			Thickness m	Thickness (ft)	Depth m	Depth (ft)
		Topsoil, black, silty	0.2	(0.5)	0.2	(0.5)
First Terrace and Blown Sand	(a)	Sand: fine, well rounded quartz	8.9	(29.0)	9.1	(30.0)
Silt and Clay of 25-Foot Drift		Silty clay, grey and reddish brown, micaceous, laminated in parts	1.8	(6.0)	10.9	(36.0)
Older River Sand and Gravel	(b)	Sand: medium and fine, well rounded quartz. Some limestone and flint pebbles	3.1	(10.0)	14.0	(46.0)
Keuper Marl		Mudstone, red and green	0.8+	(2.5+)	14.8	(48.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	98	-4 + 1	1
		-1 + $\frac{1}{4}$	39
		-$\frac{1}{4}$ + 1/16	58
Fines	2	-1/16	2
(b)			
Gravel		+16	0
trace		-16 + 4	trace
Sand	98	-4 + 1	1
		-1 + $\frac{1}{4}$	51
		-$\frac{1}{4}$ + 1/16	46
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.2 - 1.2	6	94	0
1.2 - 2.2	2	98	0
2.2 - 3.2	1	99	0
3.2 - 4.2	3	97	0
4.2 - 5.2	1	99	0
5.2 - 6.2	2	98	0
6.2 - 7.2	1	99	0
7.2 - 8.2	2	98	0
8.2 - 9.1	2	98	0
10.9 - 11.9	2	98	0
11.9 - 12.9	2	98	0
12.9 - 14.0	1	97	2

SE 80 NE 71 8744 0948 Brumby Grove Block C

Surface level (+5.5 m) +18 ft
Water level +4.5 m (+15 ft)
February 1973

Overburden 0.2 m (0.5 ft)
Mineral 6.1 m (20.0 ft)
Bedrock 0.7 m+ (2.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Fill	0.2	(0.5)	0.2	(0.5)
Blown Sand and First Terrace	Sand: fine, subrounded quartz with some lithic grains. Some grey silt and limestone pebbles	6.1	(20.0)	6.3	(20.5)
Rhaetic	Mudstone, grey	0.7+	(2.5+)	7.0	(23.0)

GRADING

Mean for Deposit

%	mm	%
Gravel trace	+16	0
	-16 + 4	trace
Sand 98	-4 + 1	1
	-1 + $\frac{1}{4}$	37
	-$\frac{1}{4}$ + 1/16	60
Fines 2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.2 - 1.2	2	98	0
1.2 - 2.2	1	99	0
2.2 - 3.2	1	99	0
3.2 - 4.2	1	99	0
4.2 - 5.2	1	99	0
5.2 - 6.3	8	90	2

Surface level +1.8 m (+6.0 ft)
Water level -0.2 m (-1.0 ft)
February 1973

Overburden 2.5 m (8.0 ft)
Mineral 2.7 m (9.0 ft)
Waste 3.7 m (12.0 ft)
Mineral 6.2 m (20.5 ft)
Bedrock 0.4 m+ (1.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.4	(1.5)	0.4	(1.5)
Alluvium		Silt, dark brown, sandy and peaty	2.1	(7.0)	2.5	(8.0)
First Terrace	(a)	'Clayey' sand: medium, well rounded quartz grains with brown silt	2.7	(9.0)	5.2	(17.0)
Silt and Clay of 25-Foot Drift		Silty clay, red, brown and grey, laminated	3.7	(12.0)	8.9	(29.0)
Older River Sand and Gravel	(b)	Sand with sandy gravel at base Gravel: fine, well rounded quartz and sandstone with flint, limestone and rolled gryphaea shells Sand: medium, well rounded quartz with some subrounded flints and rock fragments	6.2	(20.5)	15.1	(49.5)
Keuper Marl		Mudstone, red and green, gypsiferous	0.4+	(1.5+)	15.5	(51.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	86	-4 + 1	1
		-1 + $\frac{1}{4}$	55
		-$\frac{1}{4}$ + 1/16	30
Fines	14	-1/16	14
(b)			
Gravel	8	+16	3
		-16 + 4	5
Sand	90	-4 + 1	5
		-1 + $\frac{1}{4}$	48
		-$\frac{1}{4}$ + 1/16	37
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
2.5 - 3.5	15	85	0
3.5 - 4.5	7	93	0
4.5 - 5.2	21	79	0
8.9 - 10.0	2	98	0
10.0 - 11.0	5	95	0
11.0 - 12.0	2	97	1
12.0 - 13.0	1	98	1
13.0 - 14.0	1	92	7
14.0 - 15.1	1	65	34

Surface level (+3.7 m) +12.0 ft
Water level +1.7 m (+6.0 ft)
February 1973

Overburden 0.6 m (2.0 ft)
Mineral 6.2 m (20.5 ft)
Waste 1.2 m (4.0 ft)
Mineral 5.1 m (16.5 ft)
Bedrock 0.7 m+ (2.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil and made ground	0.6	(2.0)	0.6	(2.0)
Blown Sand	(a)	Sand: medium and fine, subangular to well rounded quartz	6.2	(20.5)	6.8	(22.5)
Silt and Clay of 25-Foot Drift		Silty clay, grey and brown, laminated	1.2	(4.0)	8.0	(26.0)
Older River Sand and Gravel	(b)	'Clayey' sand: fine and medium quartz grains with much silt and clay near top	5.1	(16.5)	13.1	(43.0)
Keuper Marl		Mudstone, red and green	0.7+	(2.5+)	13.8	(45.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	98	-4 + 1	2
		-1 + $\frac{1}{4}$	52
		-$\frac{1}{4}$ + 1/16	44
Fines	2	-1/16	2
(b)			
Sand	84	-4 + 1	1
		-1 + $\frac{1}{4}$	28
		-$\frac{1}{4}$ + 1/16	55
Fines	16	-1/16	16

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.6 - 1.6	2	98	0
1.6 - 2.6	2	98	0
2.6 - 3.6	1	99	0
3.6 - 4.6	2	98	0
4.6 - 5.6	1	98	1
5.6 - 6.8	2	98	0
8.0 - 9.0	36	64	0
9.0 - 10.0	35	64	1
10.0 - 11.0	3	97	0
11.0 - 12.0	2	98	0
12.0 - 13.1	3	97	0

SE 80 NE 74 | 8733 0875 | Scotter Road | Block C

Surface level (+4.0 m) +13 ft
Water level not recorded
February 1973

Overburden 0.1 m (0.5 ft)
Mineral 9.0 m (29.5 ft)
Waste 0.5 m (1.5 ft)
Mineral 1.9 m (6.0 ft)
Bedrock 0.9 m+ (3.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.1	(0.5)	0.1	(0.5)
Blown Sand and First Terrace	Sand: fine with medium, subrounded to well rounded quartz grains	9.0	(29.5)	9.1	(30.0)
Silt and Clay of 25-Foot Drift	Clay, reddish brown and grey, laminated	0.5	(1.5)	9.6	(31.5)
Older River Sand and Gravel	Sand: fine, rounded quartz grains with some reddish silt	1.9	(6.0)	11.5	(37.5)
Keuper Marl	Mudstone, red, hard	0.9+	(3.0+)	12.4	(40.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	97	-4 + 1	1
		-1 + ¼	30
		-¼ + 1/16	66
Fines	3	-1/16	3
(b)			
Gravel	2	+16	0
		-16 + 4	2
Sand	89	-4 + 1	5
		-1 + ¼	5
		-¼ + 1/16	79
Fines	9	-1/16	9

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.1 - 1.1	3	96	1
1.1 - 2.1	4	96	0
2.1 - 3.1	2	98	0
3.1 - 4.1	3	97	0
4.1 - 5.1	4	96	0
5.1 - 6.1	4	96	0
6.1 - 7.1	3	97	0
7.1 - 8.1	3	97	0
8.1 - 9.1	3	97	0
9.6 - 10.6	10	90	0
10.6 - 11.5	8	88	4

Surface level (+1.5 m) +5 ft
Water level +0.5 m (+2 ft)
February 1973

Overburden 6.8 m (22.5 ft)
Mineral 5.3 m (17.5 ft)
Bedrock 0.5 m+ (1.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	1.2	(4.0)	1.2	(4.0)
Alluvium	Peaty silt, dark grey and brown; some sandy lenses	5.6	(18.5)	6.8	(22.5)
	Sand, pebbly at base Gravel: fine, subrounded flint, well rounded quartz and sandstone Sand: fine and medium, well rounded quartz grains	5.3	(17.5)	12.1	(39.5)
Keuper Marl	Mudstone, red and green	0.5+	(1.5+)	12.6	(41.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	4	+16	0
		-16 + 4	4
Sand	91	-4 + 1	3
		-1 + $\frac{1}{4}$	43
		-$\frac{1}{4}$ + 1/16	45
Fines	5	-1/16	5

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
6.8 - 7.8	10	90	0
7.8 - 8.8	8	92	0
8.8 - 9.8	2	97	1
9.8 - 10.8	3	97	0
10.8 - 12.1	2	83	15

SE 80 NE 76 8583 0795 Warp Farm Block B

Surface level (+0.9 m) +3 ft
Water level -1.1 m (-4 ft)
September 1973

Overburden 2.3 m (7.5 ft)
Mineral 2.0 m (6.5 ft)
Waste 1.0 m (3.5 ft)
Mineral 2.0 m (6.5 ft)
Waste 1.0 m (3.5 ft)
Mineral 2.5 m (8.0 ft)
Bedrock 0.8 m+ (2.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.9	(3.0)	0.9	(3.0)
Alluvium		Peat, dark, silty with twigs, roots and reeds	1.4	(4.5)	2.3	(7.5)
First Terrace	(a)	'Clayey' sand Sand: fine and medium, rounded to well rounded quartz and rock fragments Fines: yellowish brown silt and clay	2.0	(6.5)	4.3	(14.0)
Silt and Clay of 25-Foot Drift	(b)	Clay, reddish brown and grey	1.0	(3.5)	5.3	(17.5)
		'Very clayey' sand: fine, rounded to well rounded quartz grains with reddish brown silt and clay	2.0	(6.5)	7.3	(24.0)
		Clay: reddish brown	1.0	(3.5)	8.3	(27.0)
Older River Sand and Gravel	(c)	Sand, pebbly at base, 'clayey' near top Gravel: fine, well rounded to subangular quartz and quartzite with subangular flint Sand: fine, subangular to well rounded quartz and rock fragments	2.5	(8.0)	10.8	(35.5)
Keuper Marl		Mudstone, green, gypsiferous	0.8+	(2.5+)	11.6	(38.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	88	-4 + 1	1
		-1 + ¼	37
		-¼ + 1/16	50
Fines	12	-1/16	12
(b)			
Sand	73	-4 + 1	0
		-1 + ¼	11
		-¼ + 1/16	62
Fines	27	-1/16	27

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
2.3 - 3.3	17	83	0
3.3 - 4.3	7	93	0
5.3 - 6.3	20	80	0
6.3 - 7.3	34	66	0

SE 80 NE 76 cont'd

	%	mm	%
(c)			
Gravel	3	+16	0
		-16 + 4	3
Sand	89	-4 + 1	4
		-1 + ¼	28
		-¼ + 1/16	57
Fines	8	-1/16	8

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
8.3 - 9.3	12	88	0
9.3 - 10.3	9	91	0
10.3 - 10.8	2	82	16

SE 80 NE 77 8695 0774 Golf Course Block **B**

Surface level (+4.0 m) +13 ft
Water level +3.0 m (+10 ft)
February 1973

Overburden 0.7 m (2.5 ft)
Mineral 5.3 m (17.5 ft)
Waste 1.4 m (4.5 ft)
Mineral 6.1 m (20.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.7	(2.5)	0.7	(2.5)
First Terrace	(a)	Sand: fine with medium, well rounded quartz grains and subrounded rock fragments	5.3	(17.5)	6.0	(19.5)
Silt and Clay of 25-Foot Drift		Silty clay, laminated, reddish brown	1.4	(4.5)	7.4	(24.5)
Older River Sand and Gravel	(b)	Pebbly sand, clayey near top Gravel: fine, subrounded limestone, sandstone and flint Sand: fine and medium, well rounded quartz	6.1	(20.0)	13.5	(44.5)
Keuper Marl		Mudstone, red and green	1.0+	(3.5+)	14.5	(47.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	96	-4 + 1	1
		-1 + ¼	32
		-¼ + 1/16	63
Fines	4	-1/16	4
(b)			
Gravel	5	+16	1
		-16 + 4	4
Sand	87	-4 + 1	9
		-1 + ¼	34
		-¼ + 1/16	44
Fines	8	-1/16	8

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.7 - 1.7	8	92	0
1.7 - 2.7	4	96	0
2.7 - 3.7	4	96	0
3.7 - 4.7	2	98	0
4.7 - 6.0	3	97	0
7.4 - 8.4	19	81	0
8.4 - 9.4	21	77	2
9.4 - 10.4	3	85	12
10.4 - 11.4	2	94	4
11.4 - 12.4	2	97	1
12.4 - 13.5	4	82	14

SE 80 NE 78 8771 0754 North Farm Block C

Surface level (+7.6 m) +25 ft
Water level +5.6 m (+18 ft)
February 1973

Overburden 0.4 m (1.5 ft)
Mineral 3.0 m (10.0 ft)
Waste 3.6 m (12.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.4	(1.5)	0.4	(1.5)
Blown Sand	Sand: fine and medium, subrounded to well rounded quartz with rock fragments	3.0	(10.0)	3.4	(11.0)
Silt and Clay of 25-Foot Drift	Clayey silt, red, grey and brown, laminated in parts, becoming darker and pebbly towards base	3.6	(12.0)	7.0	(23.0)
Rhaetic	Mudstone, black, shaly and laminated	1.0+	(3.5+)	8.0	(26.0)

GRADING

Mean for Deposit

	%	mm	%
Sand	97	-4 + 1	1
		-1 + $\frac{1}{4}$	42
		-$\frac{1}{4}$ + 1/16	54
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 1.4	6	94	0
1.4 - 2.4	2	98	0
2.4 - 3.4	2	98	0

SE 80 NE 79 8504 0698 Sand Hill Block B

Surface level (+1.8 m) +6 ft
Water level +0.3 m (+1 ft)
January 1973

Overburden 0.3 m (1.0 ft)
Mineral 4.0 m (13.0 ft)
Waste 4.0 m (13.0 ft)
Mineral 5.4 m (17.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.3	(1.0)	0.3	(1.0)
Blown Sand	(a)	Sand: fine and medium, sub to well rounded quartz	4.0	(13.0)	4.3	(14.0)
Silt and Clay of 25-Foot Drift		Silt, grey and brown, laminated	4.0	(13.0)	8.3	(27.0)
Older River Sand and Gravel	(b)	Sand, pebbly at base Gravel: fine, subrounded to well rounded flint, sandstone and rolled shells Sand: medium with fine, subrounded rock fragments	5.4	(17.5)	13.7	(45.0)
Keuper Marl		Mudstone, red and green	1.0+	(3.5+)	14.7	(48.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	96	-4 + 1	0
		-1 + ¼	45
		-¼ + 1/16	51
Fines	4	-1/16	4
(b)			
Gravel	2	+16	0
		-16 + 4	2
Sand	95	-4 + 1	3
		-1 + ¼	63
		-¼ + 1/16	29
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.3 - 1.3	5	95	0
1.3 - 2.3	4	96	0
2.3 - 3.3	3	97	0
3.3 - 4.3	2	98	0
8.3 - 9.3	4	96	0
9.3 - 10.3	2	96	2
10.3 - 11.3	3	97	0
11.3 - 12.3	4	96	0
12.3 - 13.3	3	92	5
13.3 - 13.7	1	85	14

Surface level (+1.5 m) +5 ft
Water level +1.0 m (+3 ft)
February 1973

Overburden 1.6 m (5.0 ft)
Mineral 10.3 m (34.0 ft)
Bedrock 0.6 m+ (2.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.5	(1.5)	0.5	(1.5)
Alluvium	Silt, dark, with peat and sand pockets	1.1	(3.5)	1.6	(5.0)
First Terrace and Older River Sand and Gravel	Sand: fine and medium, well rounded quartz with subrounded rock fragments. Some pebbles of quartz and limestone below 9.6 m	10.3	(34.0)	11.9	(39.0)
Keuper Marl	Mudstone, red and green	0.6+	(2.0+)	12.5	(41.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	1	+16	0
		-16 + 4	1
Sand	95	-4 + 1	2
		-1 + $\frac{1}{4}$	38
		-$\frac{1}{4}$ + 1/16	55
Fines	4	-1/16	4

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.6 - 2.6	14	86	0
2.6 - 3.6	1	98	1
3.6 - 4.6	2	97	1
4.6 - 5.6	3	97	0
5.6 - 6.6	3	97	0
6.6 - 7.6	2	98	0
7.6 - 8.6	2	98	0
8.6 - 9.6	4	95	1
9.6 - 10.6	5	91	4
10.6 - 11.9	2	97	1

Surface level (+3.4 m) +11 ft
Water level +1.4 m (+5 ft)
February 1973

Overburden 3.5 m (11.5 ft)
Mineral 6.6 m (21.5 ft)
Bedrock 0.9 m+ (3.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.6	(2.0)	0.6	(2.0)
? Silt and Clay of 25-Foot Drift	Silt, dark, with some sand pockets	1.1	(3.5)	1.7	(5.5)
	Clay, reddish brown and grey	1.8	(6.0)	3.5	(11.5)
Older River Sand and Gravel	Pebbly sand with sandy gravel at base Gravel: fine and coarse, subangular to well rounded flint, quartz and limestone Sand: fine and medium, rounded quartz	6.6	(21.5)	10.1	(33.0)
Rhaetic	Mudstone, dark grey, laminated	0.9+	(3.0+)	11.0	(36.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	14	+16	9
		-16 + 4	5
Sand	83	-4 + 1	6
		-1 + $\frac{1}{4}$	29
		-$\frac{1}{4}$ + 1/16	48
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
3.5 - 4.5	3	95	2
4.5 - 6.5	5	94	1
6.5 - 7.5	2	88	10
7.5 - 8.5	3	86	11
8.5 - 10.1	2	58	40

Surface level (+2.1 m) +7 ft
Water level +1.1 m (+4 ft)
February 1973

Overburden 1.1 m (3.5 ft)
Mineral 3.9 m (13.0 ft)
Waste 1.0 m (3.5 ft)
Mineral 4.2 m (14.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.6	(2.0)	0.6	(2.0)
Alluvium		Peaty silt	0.5	(1.5)	1.1	(3.5)
First Terrace	(a)	Sand: medium and fine, well rounded quartz and subrounded rock fragments. Some fine flint and limestone pebbles below 3.1 m	3.9	(13.0)	5.0	(16.5)
Silt and Clay of 25-Foot Drift		Silty clay, reddish brown and grey	1.0	(3.5)	6.0	(19.5)
Older River Sand and Gravel	(b)	Sand, 'very clayey' at top and with gravel at base Gravel: fine and coarse, well rounded flint, limestone and fossils Sand: fine with medium, well rounded quartz with coal specks Fines: reddish brown silt	4.2	(14.0)	10.2	(33.5)
Keuper Marl		Mudstone, red and green	1.0+	(3.5+)	11.2	(36.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Gravel		+16	0
trace		-16 + 4	trace
Sand	96	-4 + 1	2
		-1 + ¼	51
		-¼ + 1/16	43
Fines	4	-1/16	4
(b)			
Gravel	17	+16	12
		-16 + 4	5
Sand	75	-4 + 1	6
		-1 + ¼	22
		-¼ + 1/16	47
Fines	8	-1/16	8

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.1 - 2.1	4	96	0
2.1 - 3.1	2	98	0
3.1 - 4.1	1	98	1
4.1 - 5.0	10	89	1
6.0 - 7.0	22	78	0
7.0 - 8.0	7	93	0
8.0 - 9.0	3	97	0
9.0 - 10.2	1	40	59

Surface level (+4.3 m) +14 ft
Water level +1.3 m (+4 ft)
January 1973

Mineral 7.3 m (24.0 ft)
Waste 1.2 m (4.0 ft)
Mineral 2.6 m (8.5 ft)
Bedrock 0.7 m+ (2.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
Blown Sand	(a)	Sand: fine and medium, subrounded quartz with some subangular lithic grains. Rootlets at top	7.3	(24.0)	7.3	(24.0)
Silt and Clay of 25-Foot Drift		Clayey silt, reddish brown, laminated	1.2	(4.0)	8.5	(28.0)
Older River Sand and Gravel	(b)	Pebbly sand Gravel: fine, well rounded quartz and flint with subangular limestone and rolled Gryphaea Sand: fine, well rounded to subrounded quartz	2.6	(8.5)	11.1	(36.5)
Keuper Marl		Mudstone, red and green	0.7+	(2.5+)	11.8	(38.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Gravel		+16	0
trace		-16 + 4	trace
Sand	97	-4 + 1	1
		-1 + ¼	48
		-¼ + 1/16	48
Fines	3	-1/16	3
(b)			
Gravel	8	+16	1
		-16 + 4	7
Sand	86	-4 + 1	7
		-1 + ¼	22
		-¼ + 1/16	57
Fines	6	-1/16	6

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.0 - 1.0	5	95	0
1.0 - 2.0	3	97	0
2.0 - 3.0	3	97	0
3.0 - 4.0	5	95	0
4.0 - 5.0	3	97	0
5.0 - 6.0	3	97	0
6.0 - 7.3	2	96	2
8.5 - 9.5	10	90	0
9.5 - 11.1	4	84	12

SE 80 NE 84 8812 0592 Water Mill Farm Block C

Surface level (+7.6 m) +25 ft
Water not struck
February 1973

Overburden 0.2 m (0.5 ft)
Mineral 3.0 m (10.0 ft)
Bedrock 2.8 m+ (9.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil, sandy	0.2	(0.5)	0.2	(0.5)
Blown Sand	Sand: medium and fine, subangular to subrounded quartz with some lithic grains, leached and ochreous in parts	3.0	(10.0)	3.2	(10.5)
Rhaetic	Clay and mudstone: sandy clay with subangular, shelly limestone fragments passing downwards into dark brown fossiliferous mudstone	2.8+	(9.0+)	6.0	(19.5)

GRADING

Mean for Deposit

	%	mm	%
Sand	97	-4 + 1	0
		-1 + $\frac{1}{4}$	50
		-$\frac{1}{4}$ + 1/16	47
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.2 - 1.2	3	97	0
1.2 - 2.2	3	97	0
2.2 - 3.2	2	98	0

Surface level (+0.6 m) +2 ft
Water level -1.4 m (-5 ft)
March 1973

Overburden 5.8 m (19.0 ft)
Mineral 6.9 m (22.5 ft)
Bedrock 1.3 m+ (4.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.4	(1.5)	0.4	(1.5)
Alluvium	Peaty silt, dark grey with rootlets	5.4	(17.5)	5.8	(19.0)
	(a) Pebbly sand Gravel: mainly fine, but coarse at base, subangular to rounded quartz and quartzite with chert and some sandstone Sand: medium, rounded quartz and quartzite with subangular chert and other lithic grains	5.0	(16.5)	10.8	(35.5)
	(b) Gravel Gravel: coarse, as above Sand: as above	1.9	(6.0)	12.7	(41.5)
Keuper Marl	Mudstone, red and grey	1.3+	(4.5+)	14.0	(46.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Gravel	16	+16	4
		-16 + 4	12
Sand	82	-4 + 1	5
		-1 + $\frac{1}{4}$	58
		-$\frac{1}{4}$ + 1/16	19
Fines	2	-1/16	2
(b)			
Gravel	49	+16	29
		-16 + 4	20
Sand	50	-4 + 1	6
		-1 + $\frac{1}{4}$	32
		-$\frac{1}{4}$ + 1/16	12
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
5.8 - 6.8	2	61	37
6.8 - 7.8	2	82	16
7.8 - 8.8	2	94	4
8.8 - 9.8	2	94	4
9.8 - 10.8	2	80	18
10.8 - 11.8	1	50	49
11.8 - 12.7	0	50	50

Surface level (+2.4 m) +8 ft
Water level -0.6 m (-2 ft)
February 1973

Overburden 7.3 m (24.0 ft)
Mineral 5.7 m (18.5 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.4	(1.5)	0.4	(1.5)
Alluvium	Peaty silt, brown with black fibrous peat	6.9	(22.5)	7.3	(24.0)
	Sand and pebbly sand Gravel: fine, subangular to rounded quartzite and chert Sand: medium, subangular to rounded quartz and quartzite with chert and other rock fragments	5.7	(18.5)	13.0	(42.5)
Keuper Marl	Mudstone, greyish green	1.5+	(5.0+)	14.5	(47.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	4	+16	1
		-16 + 4	3
Sand	93	-4 + 1	3
		-1 + $\frac{1}{4}$	57
		-$\frac{1}{4}$ + 1/16	33
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
7.3 - 8.3	4	96	0
8.3 - 9.3	3	91	6
9.3 - 10.3	5	93	2
10.3 - 11.3	3	93	4
11.3 - 12.3	2	93	5
12.3 - 13.0	2	91	7

SE 80 SW 9 | 8024 0393 | The Paddocks | Block D

Surface level (+2.4 m) +8 ft
Water level +2.1 m (+7 ft)
September 1973

Overburden 1.2 m (4.0 ft)
Mineral 1.0 m (3.5 ft)
Waste 1.0 m (3.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil, dark brown, silty	0.4	(1.5)	0.4	(1.5)
Alluvium	Sandy silt, light grey, with fine sand and mudstone fragments, becoming bluish grey and peaty towards base	0.8	(2.5)	1.2	(4.0)
? Silt and Clay of 25-Foot Drift	'Very clayey' sand: fine, subrounded quartz sand with thin, reddish brown, laminated silt bands	1.0	(3.5)	2.2	(7.0)
	Clay, reddish brown, with peat lenses, laminated and sandy towards base	1.0	(3.5)	3.2	(10.5)
Keuper Marl	Mudstone, greyish green, gypsiferous	1.0+	(3.5+)	4.2	(14.0)

GRADING

Mean for Deposit

	%	mm	%
Sand	76	-4 + 1	2
		-1 + $\frac{1}{4}$	15
		-$\frac{1}{4}$ + 1/16	59
Fines	24	-1/16	24

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.2 - 2.2	24	76	0

Surface level (+1.8 m) +6 ft
Water level -0.2 m (-0.5 ft)
September 1974

Overburden 0.7 m (2.5 ft)
Mineral 8.0 m (26.0 ft)
Bedrock 0.7 m+ (2.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil, peaty towards base	0.7	(2.5)	0.7	(2.5)
Alluvium	Sand, pebbly and 'very clayey' in parts Gravel: fine and coarse, subangular to rounded chert and quartzite Sand: medium and fine, subangular to well rounded quartz with some coal and mudstone specks	8.0	(26.0)	8.7	(28.5)
Keuper Marl	Mudstone, reddish brown, with green 'fish eyes'	0.7+	(2.5+)	9.4	(31.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	2	+16	1
		-16 + 4	1
Sand	93	-4 + 1	3
		-1 + $\frac{1}{4}$	57
		-$\frac{1}{4}$ + 1/16	33
Fines	5	-1/16	5

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.7 - 1.7	4	96	0
1.7 - 2.7	7	93	0
2.7 - 3.7	21	67	12
3.7 - 4.7	2	98	0
4.7 - 5.7	2	97	1
5.7 - 6.7	2	96	2
6.7 - 7.7	1	96	3
7.7 - 8.7	3	97	0

SE 80 SW 11 8286 0418 Spectacle Drain Block D

Surface level (+1.8 m) +6 ft
Water level +0.8 m (+3 ft)
September 1973

Overburden 7.1 m (23.5 ft)
Mineral 2.3 m+ (7.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil, brown silty	0.7	(2.5)	0.7	(2.5)
Alluvium	Peat and silt, brownish grey, micaceous	6.4	(21.0)	7.1	(23.5)
	Sand, with thin sandy gravel at base Gravel: fine, subrounded to rounded quartz and quartzite with some sandstone and mudstone, occasional silicified limestone and chert Sand: medium, subangular to rounded quartz with some mudstone, chert and coal	2.3+	(7.5+)	9.4	(31.0)
	Borehole abandoned due to rising sand				

GRADING

Mean for Deposit

	%	mm	%
Gravel	6	+16	1
		-16 + 4	5
Sand	92	-4 + 1	6
		-1 + $\frac{1}{4}$	65
		-$\frac{1}{4}$ + 1/16	21
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
7.1 - 8.1	1	95	4
8.1 - 9.1	2	96	2
9.1 - 9.4	2	67	31

SE 80 SW 12 8359 0418 Spectacle House Block D

Surface level (+4.6 m) +15 ft
Water level +0.1 m (OD)
March 1973

Overburden 7.7 m (25.5 ft)
Mineral 4.0 m (13.0 ft)
Waste 0.5 m (1.5 ft)
Mineral 5.4 m (17.5 ft)
Bedrock 1.9 m+ (6.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Fill	1.2	(4.0)	1.2	(4.0)
Alluvium		Clayey silt, pale brown and pale grey, laminated	6.5	(21.5)	7.7	(25.5)
	(a)	Sand: fine, subangular to rounded quartz and quartzite with chert and other lithic fragments	4.0	(13.0)	11.7	(38.5)
		Silt, pale and dark grey	0.5	(1.5)	12.2	(40.0)
	(b)	Sand, 'clayey' towards top and pebbly at base: As above but medium grained	5.4	(17.5)	17.6	(57.5)
Keuper Marl		Mudstone, red	1.9+	(6.0+)	19.5	(64.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	94	-4 + 1	2
		-1 + ¼	29
		-¼ + 1/16	63
Fines	6	-1/16	6
(b)			
Gravel	1	+16	0
		-16 + 4	1
Sand	94	-4 + 1	3
		-1 + ¼	72
		-¼ + 1/16	19
Fines	5	-1/16	5

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
7.7 - 8.7	5	95	0
8.7 - 9.7	9	90	1
9.7 - 10.7	5	95	0
10.7 - 11.7	5	95	0
12.2 - 13.2	6	94	0
13.2 - 14.2	10	90	0
14.2 - 15.2	2	97	1
15.2 - 16.2	2	98	0
16.2 - 17.2	5	95	0
17.2 - 17.6	3	88	9

Surface level (+2.4 m) +8 ft
Water level -0.6 m (-2 ft)
February 1973

Overburden 1.7 m (5.5 ft)
Mineral 3.7 m (12.0 ft)
Waste 0.8 m (2.5 ft)
Mineral 5.3 m (17.5 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil, sandy, peaty at base	1.7	(5.5)	1.7	(5.5)
Blown Sand	(a)	Sand: fine and medium, subangular to well rounded quartz and rock fragments	3.7	(12.0)	5.4	(17.5)
Alluvium		Peaty silt, dark brown and black	0.8	(2.5)	6.2	(20.5)
Older River Sand and Gravel	(b)	Sand, 'clayey' at top: fine, subangular to rounded quartz and rock fragments with brown silt	3.0	(10.0)	9.2	(30.0)
	(c)	Pebbly sand Gravel: fine and coarse, subangular to rounded quartz, quartzite and chert Sand: fine and medium, well rounded quartz and rock fragments	2.3	(7.5)	11.5	(37.5)
Keuper Marl		Mudstone, red	1.5+	(5.0+)	13.0	(42.5)

GRADING

	%	mm	%
(a)			
Sand	93	-4 + 1	0
		-1 + ¼	44
		-¼ + 1/16	49
Fines	7	-1/16	7
(b)			
Gravel		+16	0
trace		-16 + 4	trace
Sand	90	-4 + 1	1
		-1 + ¼	20
		-¼ + 1/16	69
Fines	10	-1/16	10
(c)			
Gravel	24	+16	11
		-16 + 4	13
Sand	74	-4 + 1	6
		-1 + ¼	37
		-¼ + 1/16	31
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.7 - 2.7	4	96	0
2.7 - 3.7	2	98	0
3.7 - 4.7	1	99	0
4.7 - 5.7	26	74	0
6.2 - 7.2	19	81	0
7.2 - 8.2	5	95	0
8.2 - 9.2	4	95	1
9.2 - 10.2	1	78	21
10.2 - 11.2	2	68	30
11.2 - 11.5	1	80	19

SE 80 SW 14 | 8119 0329 | The Paddocks | Block D

Surface level (+1.2 m) +4 ft
Water not struck
March 1973

Waste 1.0 m (3.5 ft)
Bedrock 2.0 m+ (6.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.1	(0.5)	0.1	(0.5)
Alluvium	Clayey silt, mottled grey and brown, with rootlets	0.9	(3.0)	1.0	(3.5)
Keuper Marl	Mudstone, red and grey	2.0+	(6.5+)	3.0	(10.0)

SE 80 SW 15 | 8204 0334 | Black Drain | Block D

Surface level (+0.9 m) +3 ft
Water level -1.1 m (-4 ft)
March 1973

Overburden 6.9 m (22.5 ft)
Mineral 6.1 m (20.0 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.3	(1.0)	0.3	(1.0)
Alluvium	Silt, pale brown and grey with dark peat, roots and leaves towards base	6.6	(21.5)	6.9	(22.5)
	Gravel on pebbly sand Gravel: fine, subangular to well rounded quartz, quartzite and sandstone, with angular to rounded chert Sand: medium, subangular to rounded quartz and quartzite	6.1	(20.0)	13.0	(42.5)
Keuper Marl	Mudstone, red	1.5+	(5.0+)	14.5	(47.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	14	+16	3
		-16 + 4	11
Sand	83	-4 + 1	7
		-1 + ¼	56
		-¼ + 1/16	20
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
6.9 - 7.9	6	47	47
7.9 - 8.9	2	82	16
8.9 - 9.9	3	95	2
9.9 - 10.9	1	93	6
10.9 - 11.9	2	93	5
11.9 - 13.0	2	89	9

SE 80 SW 16 8313 0305 North Ewster Block D

Surface level (+2.1 m) +7 ft
Water level +0.1 m (+0.5 ft OD)
February 1973

Overburden 7.9 m (26.0 ft)
Mineral 7.5 m (24.5 ft)
Bedrock 2.6 m+ (8.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.3	(1.0)	0.3	(1.0)
Alluvium		Peaty silt	7.6	(25.0)	7.9	(26.0)
	(a)	Pebbly sand Gravel: fine, subangular to rounded, tabular quartz, quartzite and chert with sandstone Sand: medium, subangular to rounded quartz and quartzite with chert and other lithic fragments	4.0	(13.0)	11.9	(39.0)
	(b)	Sandy gravel on pebbly sand Gravel and sand: As above	3.5	(11.5)	15.4	(50.5)
Keuper Marl		Mudstone, grey, weathered	2.6+	(8.5+)	18.0	(59.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Gravel	12	+16	3
		-16 + 4	9
Sand	87	-4 + 1	4
		-1 + $\frac{1}{4}$	61
		-$\frac{1}{4}$ + 1/16	22
Fines	1	-1/16	1
(b)			
Gravel	32	+16	9
		-16 + 4	23
Sand	66	-4 + 1	9
		-1 + $\frac{1}{4}$	46
		-$\frac{1}{4}$ + 1/16	11
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
7.9 - 8.9	1	78	21
8.9 - 9.9	2	97	1
9.9 - 10.9	2	94	4
10.9 - 11.9	1	78	21
11.9 - 12.9	1	53	46
12.9 - 13.9	1	63	36
13.9 - 14.9	3	79	18
14.9 - 15.4	2	74	24

SE 80 SW 17 8410 0295 Susworth Block E

Surface level (+2.4 m) +8 ft
Water level -0.6 m (-2 ft)
February 1973

Overburden 7.8 m (25.5 ft)
Mineral 5.2 m (17.0 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.4	(1.5)	0.4	(1.5)
Alluvium	Silt, brown and grey, laminated peaty in parts	7.4	(24.5)	7.8	(25.5)
	Sand: fine and medium, angular to rounded quartz, quartzite and lithic grains. Some pebbles of chert and quartzite	5.2	(17.0)	13.0	(42.5)
Keuper Marl	Mudstone, red	1.5+	(5.0+)	14.5	(47.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	1	+16	0
		-16 + 4	1
Sand	95	-4 + 1	1
		-1 + $\frac{1}{4}$	47
		-$\frac{1}{4}$ + 1/16	47
Fines	4	-1/16	4

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
7.8 - 8.8	6	94	0
8.8 - 9.8	5	95	0
9.8 - 10.8	3	96	1
10.8 - 11.8	3	97	0
11.8 - 12.8	4	95	1
12.8 - 13.0	4	93	3

SE 80 SW 18 | 8189 0221 | Kelfield Grange | Block D

Surface level (+1.2 m) +4 ft
Water level +1.2 m (+ 4 ft)
February 1973

Overburden 8.0 m (26.0 ft)
Mineral 3.0 m (10.0 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.2	(0.5)	0.2	(0.5)
Alluvium	Silt, pale brown, laminated	0.8	(2.5)	1.0	(3.5)
	Peat, black and fibrous at top becoming brown and silty below	7.0	(23.0)	8.0	(26.0)
	Gravel and sandy gravel Gravel: fine with coarse, subangular to rounded quartz, quartzite, sandstone and siltstone, with some angular to subrounded chert Sand: medium, subangular to rounded quartz and quartzite with chert	3.0	(10.0)	11.0	(36.0)
Keuper Marl	Siltstone, hard, pale grey	1.5+	(5.0+)	12.5	(41.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	48	+16	18
		-16 + 4	30
Sand	51	-4 + 1	11
		-1 + $\frac{1}{4}$	34
		-$\frac{1}{4}$ + 1/16	6
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
8.0 - 9.0	1	47	52
9.0 - 10.0	2	76	22
10.0 - 11.0	1	29	70

SE 80 SW 19 | 8248 0195 | Kelfield | Block D

Surface level (+1.5 m) +5.0 ft
Water level -0.5 m (-2 ft)
February 1973

Overburden 10.0 m (33.0 ft)
Mineral 5.2 m (17.0 ft)
Bedrock 1.3 m+ (4.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.4	(1.5)	0.4	(1.5)
Alluvium	Silt, light brown and grey, occasionally peaty and laminated	9.6	(31.5)	10.0	(33.0)
	Pebbly sand Gravel: fine, subangular to rounded quartz and quartzite with chert and sandstone Sand: medium, subangular to rounded quartz and quartzite with sandstone and chert	5.2	(17.0)	15.2	(50.0)
Keuper Marl	Mudstone, hard, red	1.3+	(4.5+)	16.5	(54.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	8	+16	2
		-16 + 4	6
Sand	89	-4 + 1	6
		-1 + $\frac{1}{4}$	63
		-$\frac{1}{4}$ + 1/16	20
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
10.0 - 11.0	4	90	6
11.0 - 12.0	3	82	15
12.0 - 13.0	2	82	16
13.0 - 14.0	2	96	2
14.0 - 15.2	3	96	1

Surface level (+3.7 m) +12 ft
Water level +0.7 m (+ 2 ft)
March 1973

Overburden 11.0 m (36.0 ft)
Mineral 5.5 m (18.0 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.2	(0.5)	0.2	(0.5)
Alluvium	Clay and silt, laminated, bluish grey to brown, with fibrous, woody peat	10.8	(35.5)	11.0	(36.0)
	Pebbly sand Gravel: fine and coarse, angular to rounded quartz and quartzite with sandstone and chert Sand: medium, angular to rounded quartz and quartzite with chert and flint	5.5	(18.0)	16.5	(54.0)
Keuper Marl	Mudstone, grey, gypsiferous	1.5+	(5.0+)	18.0	(59.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	6	+16	3
		-16 + 4	3
Sand	92	-4 + 1	2
		-1 + $\frac{1}{4}$	66
		-$\frac{1}{4}$ + 1/16	24
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
11.0 - 12.0	3	97	0
12.0 - 13.0	1	88	11
13.0 - 14.0	2	97	1
14.0 - 15.0	2	93	5
15.0 - 16.0	1	94	5
16.0 - 16.5	1	77	22

SE 80 SW 21 8462 0222 North Ings Drain Block F

Surface level (+3.0 m) +10 ft
Water level not recorded
January 1973

Overburden 0.4 m (1.5 ft)
Mineral 11.6 m (38.0 ft)
Bedrock 2.0 m+ (6.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Silt, dark grey	0.4	(1.5)	0.4	(1.5)
First Terrace and Older River Sand and Gravel	Sand, thin clay band at 6.0 m: medium, subangular to well rounded quartz and quartzite with chert and lithic grains. Well rounded pebbles of quartz, quartzite and chert towards base	11.6	(38.0)	12.0	(39.5)
Keuper Marl	Mudstone, grey	2.0+	(6.5+)	14.0	(46.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	1	+16	0
		-16 + 4	1
Sand	95	-4 + 1	2
		-1 + $\frac{1}{4}$	55
		-$\frac{1}{4}$ + 1/16	38
Fines	4	-1/16	4

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 1.4	14	86	0
1.4 - 2.4	1	99	0
2.4 - 3.4	1	99	0
3.4 - 4.4	0	100	0
4.4 - 5.4	1	99	0
5.4 - 6.4	7	93	0
6.4 - 7.4	10	90	0
7.4 - 8.4	7	93	0
8.4 - 9.4	3	97	0
9.4 - 10.4	3	95	2
10.4 - 11.4	1	92	7
11.4 - 12.0	5	92	3

Surface level (+3.4 m) +11 ft
Water level not recorded
February 1973

Overburden 8.0 m (26.0 ft)
Mineral 7.6 m (25.0 ft)
Bedrock 1.4 m+ (4.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.3	(1.0)	0.3	(1.0)
Alluvium	Silt, light brown, mottled, grey and green, darker and peaty below 2.8 m	7.7	(25.5)	8.0	(26.0)
	Pebbly sand Gravel: fine, subangular to rounded quartz, quartzite and sandstone with angular to rounded flint and chert Sand: medium, subangular to rounded quartz and quartzite with chert and other lithic grains	7.6	(25.0)	15.6	(51.0)
Keuper Marl	Mudstone, red	1.4+	(4.5+)	17.0	(56.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	11	+16	3
		-16 + 4	8
Sand	86	-4 + 1	5
		-1 + $\frac{1}{4}$	65
		-$\frac{1}{4}$ + 1/16	16
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
8.0 - 9.0	9	70	21
9.0 - 10.0	3	89	8
10.0 - 11.0	2	91	7
11.0 - 12.0	2	90	8
12.0 - 13.0	2	79	19
13.0 - 14.0	2	94	4
14.0 - 15.0	2	94	4
15.0 - 15.6	2	84	14

SE 80 SW 23 8300 0117 Groves House Block E

Surface level (+3.4 m) +11 ft
Water level +0.4 m (+1 ft)
January 1973

Overburden 13.0 m (42.5 ft)
Mineral 4.8 m (15.5 ft)
Bedrock 2.2 m+ (7.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
Alluvium	Silt, light brown and grey, peaty, with 0.9 m of pebbly sand at base	12.0	(39.5)	12.0	(39.5)
	Clay, light brown	1.0	(3.5)	13.0	(42.5)
	Sandy gravel, 'clayey' at top Gravel: fine, subangular to rounded quartz and quartzite with angular to subrounded flint and chert Sand: medium, subangular to rounded quartz and quartzite with other lithic grains	4.8	(15.5)	17.8	(58.5)
Keuper Marl	Mudstone, grey	2.2+	(7.0+)	20.0	(65.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	26	+16	6
		-16 + 4	20
Sand	70	-4 + 1	6
		-1 + $\frac{1}{4}$	54
		-$\frac{1}{4}$ + 1/16	10
Fines	4	-1/16	4

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
13.0 - 14.0	16	80	4
14.0 - 15.0	2	98	0
15.0 - 16.0	1	59	40
16.0 - 17.0	2	62	36
17.0 - 17.8	1	45	54

Surface level (+3.7 m) +12 ft
Water level +0.7 m (+2 ft)
January 1973

Overburden 0.3 m (1.0 ft)
Mineral 7.0 m (23.0 ft)
Waste 1.3 m (4.5 ft)
Mineral 1.6 m (5.0 ft)
Waste 1.0 m (3.5 ft)
Mineral 2.6 m (8.5 ft)
Bedrock 3.2 m+ (10.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.3	(1.0)	0.3	(1.0)
First Terrace	(a)	Sand: medium, subangular to rounded quartz and quartzite with chert and other lithic grains	7.0	(23.0)	7.3	(24.0)
Silt and Clay of 25-Foot Drift		Clay, brown, laminated	1.3	(4.5)	8.6	(28.0)
	(b)	'Clayey' sand Sand: as above but fine grained	1.6	(5.0)	10.2	(33.5)
		Clay, light brown, laminated	1.0	(3.5)	11.2	(36.5)
Older River Sand and Gravel	(c)	Sand, pebbly towards base Gravel: fine, subangular to rounded quartz with quartzite and chert Sand: as above	2.6	(8.5)	13.8	(45.5)
Keuper Marl		Mudstone, grey	3.2+	(10.5+)	17.0	(56.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	97	-4 + 1	0
		-1 + ¼	57
		-¼ + 1/16	40
Fines	3	-1/16	3
(b)			
Sand	81	-4 + 1	0
		-1 + ¼	22
		-¼ + 1/16	59
Fines	19	-1/16	19
(c)			
Gravel	4	+16	1
		-16 + 4	3
Sand	95	-4 + 1	6
		-1 + ¼	55
		-¼ + 1/16	34
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.3 - 1.3	6	94	0
1.3 - 3.3	1	99	0
3.3 - 4.3	2	98	0
4.3 - 5.3	5	95	0
5.3 - 7.3	2	98	0
8.6 - 9.6	21	79	0
9.6 - 10.2	16	84	0
11.2 - 12.2	1	99	0
12.2 - 13.2	1	94	5
13.2 - 13.8	2	90	8

Surface level (+4.6 m) +15 ft
Water level +1.6 m (+5 ft)
March 1973

Overburden 11.0 m (36.0 ft)
Mineral 4.0 m (13.0 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.4	(1.5)	0.4	(1.5)
Alluvium	Silt, light brown and light grey	4.1	(13.5)	4.5	(15.0)
	Silt, brown, with fibrous peat	6.5	(21.5)	11.0	(36.0)
	Pebbly sand and sandy gravel Gravel: fine, subangular to well rounded quartz, quartzite and sandstone with angular to subrounded chert Sand: medium, subangular to rounded quartz, quartzite and other lithic grains	4.0	(13.0)	15.0	(49.0)
Keuper Marl	Mudstone, red	1.5+	(5.0+)	16.5	(54.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	24	+16	5
		-16 + 4	19
Sand	74	-4 + 1	8
		-1 + $\frac{1}{4}$	53
		-$\frac{1}{4}$ + 1/16	13
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
11.0 - 12.0	2	62	36
12.0 - 13.0	2	77	22
13.0 - 14.0	2	87	11
14.0 - 15.0	1	72	27

SE 80 SW 26 8303 0042 Kelfield Grange Block E

Surface level (+3.4 m) +11 ft
Water level +0.4 m (+1 ft)
September 1973

Waste 17.2 m (56.5 ft)
Bedrock 0.8 m+ (2.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil, silty, brown	0.5	(1.5)	0.5	(1.5)
Alluvium	Silt, grey and brown, laminated and micaceous, with rootlets and sand lenses. Basal layer of fine and coarse quartz and quartzite gravel with many bivalve shells	16.7	(55.0)	17.2	(56.5)
Keuper Marl	Mudstone, hard, red and green	0.8+	(2.5+)	18.0	(59.0)

SE 80 SW 27 8366 0022 Hardwick Grange Farm Block F

Surface level (+4.0 m) +13 ft
Water not struck
January 1973

Overburden 0.4 m (1.5 ft)
Mineral 1.0 m (3.5 ft)
Waste 1.6 m (5.0 ft)
Mineral 1.0 m (3.5 ft)
Bedrock 3.0 m+ (10.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.4	(1.5)	0.4	(1.5)
First Terrace	(a) Sand: medium, subangular to rounded quartz and quartzite with chert and other lithic grains	1.0	(3.5)	1.4	(4.5)
	Peat, brown, fibrous	1.6	(5.0)	3.0	(10.0)
	(b) Sand: as above	1.0	(3.5)	4.0	(13.0)
Keuper Marl	Mudstone, weathered, grey, becoming red at base	3.0+	(10.0+)	7.0	(23.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	96	-4 + 1	0
		-1 + $\frac{1}{4}$	71
		-$\frac{1}{4}$ + 1/16	25
Fines	4	-1/16	4
(b)			
Sand	97	-4 + 1	0
		-1 + $\frac{1}{4}$	60
		-$\frac{1}{4}$ + 1/16	37
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 1.4	4	96	0
3.0 - 4.0	3	97	0

SE 80 SW 28 | 8462 0050 | South Carr | Block F

Surface level (+4.9 m) +16 ft
Water level +3.4 m (+11 ft)
March 1973

Overburden 0.2 m (0.5 ft)
Mineral 3.1 m (10.0 ft)
Bedrock 1.7 m+ (5.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.2	(0.5)	0.2	(0.5)
Blown Sand	Sand: medium, subangular to well rounded quartz and quartzite with chert and other lithic grains	3.1	(10.0)	3.3	(11.0)
Keuper Marl	Mudstone, red	1.7+	(5.5+)	5.0	(16.5)

GRADING

Mean for Deposit

	%	mm	%
Sand	94	-4 + 1	0
		-1 + $\frac{1}{4}$	64
		-$\frac{1}{4}$ + 1/16	30
Fines	6	-1/16	6

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.2 - 1.2	5	95	0
1.2 - 2.2	4	96	0
2.2 - 3.3	8	92	0

Surface level (+3.7 m) +12 ft
Water level not recorded
February 1973

Overburden 0.2 m (0.5 ft)
Mineral 6.8 m (22.5 ft)
Waste 1.1 m (3.5 ft)
Mineral 1.4 m (4.5 ft)
Waste 1.0 m (3.5 ft)
Mineral 3.5 m (11.5 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.2	(0.5)	0.2	(0.5)
Blown Sand	(a)	Sand: fine, subangular to well rounded quartz and quartzite with chert and rock fragments	6.8	(22.5)	7.0	(23.0)
Silt and Clay of 25-Foot Drift		Clay, brown, plastic	1.1	(3.5)	8.1	(26.5)
	(b)	Sand: as above but subangular to rounded	1.4	(4.5)	9.5	(31.0)
		Clay, brown, silty	1.0	(3.5)	10.5	(34.5)
Older River Sand and Gravel	(c)	Sand: as above, with quartz and quartzite pebbles towards base	3.5	(11.5)	14.0	(46.0)
Keuper Marl		Mudstone, red and greyish green	1.5+	(5.0+)	15.5	(51.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	94	-4 + 1	1
		-1 + ¼	45
		-¼ + 1/16	48
Fines	6	-1/16	6
(b)			
Sand	94	-4 + 1	2
		-1 + ¼	31
		-¼ + 1/16	61
Fines	6	-1/16	6
(c)			
Gravel	1	+16	0
		-16 + 4	1
Sand	97	-4 + 1	1
		-1 + ¼	42
		-¼ + 1/16	54
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.2 - 1.2	25	75	0
1.2 - 3.2	2	98	0
3.2 - 4.2	1	99	0
4.2 - 5.2	3	97	0
5.2 - 6.2	2	98	0
6.2 - 7.0	2	98	0
8.1 - 9.1	6	94	0
9.1 - 9.5	7	93	0
10.5 - 12.5	3	97	0
12.5 - 13.5	2	98	0
13.5 - 14.0	2	94	4

Surface level (+3.0 m) +10 ft
Water level -0.6 m (-2 ft)
February 1973

Overburden 2.6 m (8.5 ft)
Mineral 2.0 m (6.5 ft)
Waste 2.9 m (9.5 ft)
Mineral 3.4 m (11.0 ft)
Bedrock 1.6 m+ (5.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.2	(0.5)	0.2	(0.5)
Alluvium		Silt and peat, light brown, laminated	2.4	(8.0)	2.6	(8.5)
First Terrace	(a)	Sand: fine, subangular to rounded quartz and quartzite with chert and other lithic grains	2.0	(6.5)	4.6	(15.0)
Silt and Clay of 25-Foot Drift		Clay, brown with a 0.6 m sand parting	2.9	(9.5)	7.5	(24.5)
Older River Sand and Gravel	(b)	Pebbly sand Gravel: fine, subangular to rounded quartz, quartzite and sandstone with flint and chert Sand: fine, subangular to rounded quartzite, chert and sandstone	3.4	(11.0)	10.9	(36.0)
Keuper Marl		Mudstone, red	1.6+	(5.0+)	12.5	(41.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	97	-4 + 1	1
		-1 + ¼	47
		-¼ + 1/16	49
Fines	3	-1/16	3
(b)			
Gravel	17	+16	2
		-16 + 4	15
Sand	80	-4 + 1	9
		-1 + ¼	18
		-¼ + 1/16	53
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
2.6 - 3.6	3	97	0
3.6 - 4.6	3	97	0
7.5 - 8.5	3	97	0
8.5 - 9.5	3	80	17
9.5 - 10.5	2	72	26
10.5 - 10.9	3	60	37

Surface level (+3.4 m) +11 ft
Water level +1.4 m (+5 ft)
February 1973

Overburden 0.3 m (1.0 ft)
Mineral 4.6 m (15.0 ft)
Waste 0.5 m (1.5 ft)
Mineral 2.0 m (6.5 ft)
Bedrock 1.6 m+ (5.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.3	(1.0)	0.3	(1.0)
Blown Sand	(a)	Sand: fine, subangular to well rounded quartz and quartzite with chert and other lithic grains	4.6	(15.0)	4.9	(16.0)
Silt and Clay of 25-Foot Drift		Clayey silt, light brown, laminated	0.5	(1.5)	5.4	(17.5)
Older River Sand and Gravel	(b)	Sand: as above, but with a little gravel in lower part	2.0	(6.5)	7.4	(24.5)
Keuper Marl		Mudstone, red	1.6+	(5.0+)	9.0	(29.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	97	-4 + 1	1
		-1 + ¼	29
		-¼ + 1/16	67
Fines	3	-1/16	3
(b)			
Gravel	1	+16	0
		-16 + 4	1
Sand	97	-4 + 1	3
		-1 + ¼	37
		-¼ + 1/16	57
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.3 - 1.3	2	98	0
1.3 - 2.3	4	96	0
2.3 - 3.3	3	97	0
3.3 - 4.3	2	98	0
4.3 - 4.9	3	97	0
5.4 - 6.4	3	97	0
6.4 - 7.4	2	97	1

SE 80 SE 58 | 8814 0464 | Willow Farm | Block C

Surface level (+5.8 m) +19 ft
Water not struck
September 1973

Overburden 0.3 m (1.0 ft)
Mineral 1.7 m (5.5 ft)
Waste 2.0 m (6.5 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil, light brown, sandy	0.3	(1.0)	0.3	(1.0)
Blown Sand	'Clayey' sand, peaty and ochreous Sand: fine, subangular to well rounded quartz and quartzite with other lithic grains	1.7	(5.5)	2.0	(6.5)
?Silt and Clay of 25-Foot Drift	Clay, light brown, silty, laminated, soft	2.0	(6.5)	4.0	(13.0)
Lower Lias	Mudstone, red, brown and grey, laminated	1.5+	(5.0+)	5.5	(18.0)

GRADING

Mean for Deposit

	%	mm	%
Sand	88	-4 + 1	2
		-1 + $\frac{1}{4}$	18
		-$\frac{1}{4}$ + 1/16	68
Fines	12	-1/16	12

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.3 - 1.3	12	88	0
1.3 - 2.0	12	88	0

Surface level (+1.8 m) +6 ft
Water level -0.2 m (-1 ft)
February 1973

Overburden 1.0 m (3.5 ft)
Mineral 3.5 m (11.5 ft)
Waste 0.5 m (1.5 ft)
Mineral 1.0 m (3.5 ft)
Waste 1.0 m (3.5 ft)
Mineral 4.5 m (15.0 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
Alluvium		Thin topsoil on dark brown silt and peat	1.0	(3.5)	1.0	(3.5)
First Terrace	(a)	Sand: fine, subangular to well rounded quartz and quartzite with chert and some other lithic grains	3.5	(11.5)	4.5	(15.0)
		Silt, grey, soft	0.5	(1.5)	5.0	(16.5)
Silt and Clay of 25-Foot Drift	(b)	Sand: as above	1.0	(3.5)	6.0	(19.5)
		Clay, brown, laminated	1.0	(3.5)	7.0	(23.0)
Older River Sand and Gravel	(c)	Sand: as above but medium, some quartzite pebbles at base	4.5	(15.0)	11.5	(37.5)
Keuper Marl		Mudstone, greyish green	1.5+	(5.0+)	13.0	(42.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Gravel		+16	0
trace		-16 + 4	trace
Sand	98	-4 + 1	1
		-1 + $\frac{1}{4}$	45
		-$\frac{1}{4}$ + 1/16	52
Fines	2	-1/16	2
(b)			
Sand	96	-4 + 1	0
		-1 + $\frac{1}{4}$	26
		-$\frac{1}{4}$ + 1/16	70
Fines	4	-1/16	4
(c)			
Gravel	1	+16	0
		-16 + 4	1
Sand	97	-4 + 1	2
		-1 + $\frac{1}{4}$	53
		-$\frac{1}{4}$ + 1/16	42
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.0 - 2.0	3	97	1
2.0 - 3.0	2	98	0
3.0 - 4.0	2	98	0
4.0 - 4.5	3	97	0
5.0 - 6.0	4	96	0
7.0 - 8.0	2	96	1
8.0 - 9.0	3	97	0
9.0 - 10.0	2	97	1
10.0 - 11.0	3	97	0
11.0 - 11.5	2	95	3

Surface level (+3.7 m) +12 ft
Water level +0.7 m (+2 ft)
February 1973

Overburden 0.5 m (1.5 ft)
Mineral 6.5 m (21.5 ft)
Waste 0.5 m (1.5 ft)
Mineral 3.0 m (10.0 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.5	(1.5)	0.5	(1.5)
Blown Sand	(a)	Sand: fine and medium, subangular to rounded quartz and quartzite with chert and other lithic grains	6.5	(21.5)	7.0	(23.0)
Silt and Clay of 25-Foot Drift		Clay, light brown	0.5	(1.5)	7.5	(24.5)
Older River Sand and Gravel	(b)	Pebbly sand Gravel: fine, subangular to rounded quartz and quartzite with chert Sand: as above but medium	3.0	(10.0)	10.5	(34.5)
Keuper Marl		Mudstone, red	1.5+	(5.0+)	12.0	(39.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	97	-4 + 1	1
		-1 + ¼	41
		-¼ + 1/16	55
Fines	3	-1/16	3
(b)			
Gravel	14	+16	5
		-16 + 4	9
Sand	83	-4 + 1	8
		-1 + ¼	42
		-¼ + 1/16	33
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.5 - 1.5	2	98	0
1.5 - 2.5	2	98	0
2.5 - 3.5	5	95	0
3.5 - 4.5	4	96	0
4.5 - 5.5	2	98	0
5.5 - 6.5	3	97	0
6.5 - 7.0	4	96	0
7.5 - 8.5	2	97	1
8.5 - 9.5	1	86	13
9.5 - 10.5	8	65	27

Surface level (+4.6 m) +15 ft
Water level +2.6 m (+9 ft)
February 1973

Overburden 0.4 m (1.5 ft)
Mineral 2.9 m (9.5 ft)
Waste 1.0 m (3.5 ft)
Mineral 1.0 m (3.5 ft)
Waste 1.2 m (4.0 ft)
Mineral 2.4 m (8.0 ft)
Bedrock 1.6 m+ (5.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.4	(1.5)	0.4	(1.5)
Blown Sand	(a)	Sand: fine, subangular to well rounded quartz and quartzite with chert and other lithic grains	2.9	(9.5)	3.3	(11.0)
Silt and Clay of 25-Foot Drift		Silty clay, grey, laminated	1.0	(3.5)	4.3	(14.0)
	(b)	Sand: as above	1.0	(3.5)	5.3	(17.5)
		Silty clay, grey and brown, laminated	1.2	(4.0)	6.5	(21.5)
Older River Sand and Gravel	(c)	Pebbly sand Gravel: fine, subangular to rounded quartz and quartzite with chert Sand: medium, subangular to well rounded quartz and quartzite with chert and other lithic grains	2.4	(8.0)	8.9	(29.0)
Rhaetic		Mudstone, green and grey	1.6+	(5.0+)	10.5	(34.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Gravel		+16	0
trace		-16 + 4	trace
Sand	94	-4 + 1	3
		-1 + $\frac{1}{4}$	39
		-$\frac{1}{4}$ + 1/16	52
Fines	6	-1/16	6
(b)			
Sand	98	-4 + 1	1
		-1 + $\frac{1}{4}$	5
		-$\frac{1}{4}$ + 1/16	92
Fines	2	-1/16	2
(c)			
Gravel	11	+16	3
		-16 + 4	8
Sand	87	-4 + 1	7
		-1 + $\frac{1}{4}$	46
		-$\frac{1}{4}$ + 1/16	34
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 1.4	6	94	0
1.4 - 2.4	3	96	1
2.4 - 3.3	8	92	0
4.3 - 5.3	2	98	0
6.5 - 7.5	3	93	4
7.5 - 8.5	1	84	15
8.5 - 8.9	1	83	16

SE 80 SE 62 | 8519 0339 | Warp Farm | Block E

Surface level (+1.5 m) +5 ft
Water level -0.5 m (-2 ft)
February 1973

Overburden 4.6 m (15.0 ft)
Mineral 6.2 m (20.5 ft)
Bedrock 1.2 m+ (4.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.5	(1.5)	0.5	(1.5)
Alluvium	Silt and peat, brown	4.1	(13.5)	4.6	(15.0)
	Sand, pebbly towards base Gravel: fine, subangular to rounded quartzite and chert Sand: medium, subangular to rounded, quartz and quartzite with other lithic grains	6.2	(20.5)	10.8	(35.5)
Keuper Marl	Mudstone, red and grey	1.2+	(4.0+)	12.0	(39.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	2	+16	0
		-16 + 4	2
Sand	96	-4 + 1	4
		-1 + $\frac{1}{4}$	54
		-$\frac{1}{4}$ + 1/16	38
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
4.6 - 5.6	3	97	0
5.6 - 6.6	2	98	0
6.6 - 7.6	2	98	0
7.6 - 8.6	3	97	0
8.6 - 9.6	1	96	3
9.6 - 10.6	2	89	9
10.6 - 10.8	2	94	4

SE 80 SE 63 | 8608 0324 | Black Bank Farm | Block E

Surface level (+1.5 m) +5 ft
Water level -0.5 m (-2 ft)
February 1973

Overburden 1.8 m (6.0 ft)
Mineral 7.0 m (23.0 ft)
Bedrock 1.7 m+ (5.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.4	(1.5)	0.4	(1.5)
Alluvium	Peat, dark brown and black, fibrous	1.4	(4.5)	1.8	(6.0)
	Sand: medium, subangular to rounded, quartz and quartzite with chert	7.0	(23.0)	8.8	(29.0)
Keuper Marl	Mudstone, red and green	1.7+	(5.5+)	10.5	(34.5)

GRADING

Mean for Deposit

%	mm	%
Gravel	+16	0
trace	-16 + 4	trace
Sand 97	-4 + 1	1
	-1 + $\frac{1}{4}$	60
	-$\frac{1}{4}$ + 1/16	36
Fines 3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.8 - 2.8	4	96	0
2.8 - 3.8	4	96	0
3.8 - 4.8	2	98	0
4.8 - 5.8	2	98	0
5.8 - 6.8	4	95	1
6.8 - 7.8	2	98	0
7.8 - 8.8	3	97	0

SE 80 SE 64 8719 0333 Newstead Block C

Surface level (+4.0 m) +13 ft
Water level not recorded
February 1973

Overburden 1.0 m (3.5 ft)
Mineral 5.0 m (16.5 ft)
Waste 1.0 m (3.5 ft)
Mineral 1.9 m (6.0 ft)
Bedrock 1.6 m+ (5.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil, very sandy	1.0	(3.5)	1.0	(3.5)
Blown Sand	(a)	Sand: fine, subrounded to well rounded, quartz and quartzite with other lithic grains	5.0	(16.5)	6.0	(19.5)
Silt and Clay of 25-Foot Drift		Clay, light grey	1.0	(3.5)	7.0	(23.0)
Older River Sand and Gravel	(b)	Pebbly sand Gravel: fine, subangular to rounded, quartzite, chert and siltstone Sand: as above	1.9	(6.0)	8.9	(29.0)
Keuper Marl		Mudstone, red and green	1.6+	(5.0+)	10.5	(34.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Gravel		+16	0
trace		-16 + 4	trace
Sand	97	-4 + 1	0
		-1 + $\frac{1}{4}$	33
		-$\frac{1}{4}$ + 1/16	64
Fines	3	-1/16	3
(b)			
Gravel	10	+16	4
		-16 + 4	6
Sand	86	-4 + 1	4
		-1 + $\frac{1}{4}$	28
		-$\frac{1}{4}$ + 1/16	54
Fines	4	-1/16	4

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
1.0 - 2.0	2	98	0
2.0 - 3.0	3	97	0
3.0 - 4.0	4	96	0
4.0 - 5.0	2	98	0
5.0 - 6.0	2	97	1
7.0 - 8.0	3	96	1
8.0 - 8.9	4	75	21

Surface level (+7.0 m) +23 ft
Water level +6.0 m (+20 ft)
February 1973

Overburden 0.4 m (1.5 ft)
Mineral 4.1 m (13.5 ft)
Waste 0.5 m (1.5 ft)
Mineral 1.0 m (3.5 ft)
Waste 2.0 m (6.5 ft)
Bedrock 2.8 m+ (9.0 ft+)

LOG

			Thickness m	Thickness (ft)	Depth m	Depth (ft)
		Topsoil	0.4	(1.5)	0.4	(1.5)
Blown Sand	(a)	Sand: fine and medium, subangular to well rounded, quartz and quartzite with chert and some other lithic grains. Sporadic quartz pebbles	4.1	(13.5)	4.5	(15.0)
? Silt and Clay of 25-Foot Drift		Silty clay, grey	0.5	(1.5)	5.0	(16.5)
Older River Sand and Gravel	(b)	Sand: as above but fine and with occasional quartz and quartzite pebbles	1.0	(3.5)	6.0	(19.5)
		Clayey silt, grey and brown	1.5	(5.0)	7.5	(24.5)
Older River Sand and Gravel		Sand: as above	0.5	(1.5)	8.0	(26.0)
Lower Lias		Mudstone, hard, grey	2.8+	(9.0+)	10.8	(35.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Gravel	1	+16	0
		-16 + 4	1
Sand	95	-4 + 1	1
		-1 + ¼	47
		-¼ + 1/16	47
Fines	4	-1/16	4
(b)			
Gravel	2	+16	0
		-16 + 4	2
Sand	90	-4 + 1	3
		-1 + ¼	30
		-¼ + 1/16	57
Fines	8	-1/16	8

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 1.4	7	92	1
1.4 - 2.4	6	93	1
2.4 - 3.4	1	99	0
3.4 - 4.5	2	97	1
5.0 - 6.0	8	90	2

Surface (+5.5 m) +18 ft
Water level not recorded
January 1973

Overburden 0.4 m (1.5 ft)
Mineral 6.6 m (21.5 ft)
Waste 2.0 m (6.5 ft)
Mineral 2.0 m (6.5 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.4	(1.5)	0.4	(1.5)
First Terrace	(a)	Sand: 'clayey' in parts Sand: fine and medium, angular to rounded, quartz and quartzite with other lithic grains	6.6	(21.5)	7.0	(23.0)
Silt and Clay of 25-Foot Drift		Silty clay, brown, laminated, with thin sand parting	2.0	(6.5)	9.0	(29.5)
Older River Sand and Gravel	(b)	'Clayey' sand: as above, with quartzite pebbles at base	2.0	(6.5)	11.0	(36.0)
Keuper Marl		Mudstone, dark green	1.5+	(5.0+)	12.5	(41.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	94	-4 + 1	0
		-1 + ¼	44
		-¼ + 1/16	50
Fines	6	-1/16	6
(b)			
Gravel	1	+16	0
		-16 + 4	1
Sand	83	-4 + 1	5
		-1 + ¼	30
		-¼ + 1/16	48
Fines	16	-1/16	16

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 1.4	14	86	0
1.4 - 2.4	6	94	0
2.4 - 3.4	12	88	0
3.4 - 4.4	1	99	0
4.4 - 5.4	2	98	0
5.4 - 6.4	1	99	0
6.4 - 7.0	2	98	0
9.0 - 10.0	16	84	0
10.0 - 11.0	16	81	3

SE 80 SE 67 8685 0226 Scotterthorpe Block F

Surface level (+4.0 m) +13 ft
Water level not recorded
January 1973

Overburden 0.4 m (1.5 ft)
Mineral 2.6 m (8.5 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.4	(1.5)	0.4	(1.5)
Blown Sand	Sand, 'clayey' at base and with 0.3 m silt band at 2.2 m Sand: fine and medium, subangular to rounded, quartz and quartzite with chert and some other lithic grains	2.6	(8.5)	3.0	(10.0)
Rhaetic	Mudstone, light grey	1.5+	(5.0+)	4.5	(15.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	1	+16	0
		-16 + 4	1
Sand	80	-4 + 1	2
		-1 + $\frac{1}{4}$	37
		-$\frac{1}{4}$ + 1/16	41
Fines	19	-1/16	19

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 1.4	6	94	0
1.4 - 2.5	34	66	0
2.5 - 3.0	14	84	2

SE 80 SE 68 8821 0217 Scotterthorpe Block C

Surface level (+6.1 m) +20 ft
Water level +4.1 m (+13 ft)
February 1973

Overburden 0.4 m (1.5 ft)
Mineral 2.0 m (6.5 ft)
Waste 1.0 m (3.5 ft)
Mineral 1.6 m (5.0 ft)
Waste 0.6 m (2.0 ft)
Bedrock 0.9 m+ (3.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.4	(1.5)	0.4	(1.5)
Blown Sand	(a)	Sand: fine and medium, subangular to rounded, quartz and quartzite with chert and some other rock fragments	2.0	(6.5)	2.4	(8.0)
Silt and Clay of 25-Foot Drift		Silt, soft grey	1.0	(3.5)	3.4	(11.0)
Older River Sand and Gravel	(b)	'Clayey' sand with a little gravel Gravel: fine, well rounded quartz and quartzite Sand: fine, well rounded quartz and rock fragments	1.6	(5.0)	5.0	(16.5)
		Pebbly clay: brown clay, with quartz and quartzite pebbles	0.6	(2.0)	5.6	(18.5)
Rhaetic		Limestone, hard, grey, fossiliferous	0.9+	(3.0+)	6.5	(21.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	95	-4 + 1	1
		-1 + ¼	48
		-¼ + 1/16	46
Fines	5	-1/16	5
(b)			
Gravel	4	+16	0
		-16 + 4	4
Sand	84	-4 + 1	5
		-1 + ¼	17
		-¼ + 1/16	62
Fines	12	-1/16	12

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 1.4	9	91	0
1.4 - 2.4	2	98	0
3.4 - 4.4	13	84	3
4.4 - 5.0	12	84	4

SE 80 SE 69 8518 0144 Warren Farm Block E

Surface level (+5.8 m) +19 ft
Water level +2.8 m (+9 ft)
February 1973

Overburden 0.4 m (1.5 ft)
Mineral 5.6 m (18.5 ft)
Waste 1.0 m (3.5 ft)
Mineral 1.0 m (3.5 ft)
Bedrock 2.0 m+ (6.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.4	(1.5)	0.4	(1.5)
First Terrace	(a)	Sand: medium, subangular to well rounded quartz and quartzite with other lithic grains	5.6	(18.5)	6.0	(19.5)
Silt and Clay of 25-Foot Drift		Clay, brown, laminated	1.0	(3.5)	7.0	(23.0)
Older River Sand and Gravel	(b)	'Very clayey' sand, as above but fine-grained	1.0	(3.5)	8.0	(26.0)
Keuper Marl		Mudstone, red	2.0+	(6.5+)	10.0	(33.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	98	-4 + 1	1
		-1 + ¼	60
		-¼ + 1/16	37
Fines	2	-1/16	2
(b)			
Gravel	3	+16	1
		-16 + 4	2
Sand	75	-4 + 1	7
		-1 + ¼	27
		-¼ + 1/16	41
Fines	22	-1/16	22

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 1.4	2	98	0
1.4 - 2.4	2	98	0
2.4 - 3.4	2	98	0
3.4 - 4.4	1	99	0
4.4 - 5.4	2	98	0
5.4 - 6.0	7	93	0
7.0 - 8.0	22	75	3

SE 80 SE 70 | 8611 0140 | Scotter Wood | Block F

Surface level (+8.5 m) +28 ft
Water not struck
January 1973

Overburden 0.3 m (1.0 ft)
Mineral 2.0 m (6.5 ft)
Bedrock 1.7 m+ (5.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.3	(1.0)	0.3	(1.0)
Blown Sand	Sand: fine, subangular to rounded quartz and quartzite with chert	2.0	(6.5)	2.3	(7.5)
Rhaetic	Mudstone, light grey	1.7+	(5.5+)	4.0	(13.0)

GRADING

Mean for Deposit

	%	mm	%
Sand	93	-4 + 1	1
		-1 + $\frac{1}{4}$	54
		-$\frac{1}{4}$ + 1/16	38
Fines	7	-1/16	7

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.3 - 1.3	8	92	0
1.3 - 2.3	6	94	0

SE 80 SE 71 8741 0132 Scotter Block F

Surface level (+9.1 m) +30 ft
Water level +5.1 m (+16.5 ft)
January 1973

Overburden 4.0 m (13.0 ft)
Mineral 1.0 m (3.5 ft)
Waste 1.0 m (3.5 ft)
Mineral 2.0 m (6.5 ft)
Bedrock 2.5 m+ (8.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.3	(1.0)	0.3	(1.0)
Older Littoral Sand and Gravel		'Clayey' sand: medium, subrounded to rounded quartz and quartzite with chert and other lithic grains	0.5	(1.5)	0.8	(2.5)
? Boulder Clay		Clay, brown, with light grey limestone pebbles	2.2	(7.0)	3.0	(10.0)
		Silt, dark grey and brown, laminated	1.0	(3.5)	4.0	(13.0)
? Glacial Sand and Gravel	(a)	'Very clayey' sand: fine, subangular to rounded quartz and quartzite with other lithic grains	1.0	(3.5)	5.0	(16.5)
		Silt, dark grey, laminated	1.0	(3.5)	6.0	(19.5)
	(b)	'Clayey' sand: as above	2.0	(6.5)	8.0	(26.0)
Lower Lias		Mudstone, grey	2.5	(8.0)	10.5	(34.5)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	71	-4 + 1	0
		-1 + $\frac{1}{4}$	4
		-$\frac{1}{4}$ + 1/16	67
Fines	29	-1/16	29
(b)			
Gravel	3	+16	1
		-16 + 4	2
Sand	83	-4 + 1	3
		-1 + $\frac{1}{4}$	19
		-$\frac{1}{4}$ + 1/16	61
Fines	14	-1/16	14

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
4.0 - 5.0	29	71	0
6.0 - 7.0	14	83	3
7.0 - 8.0	15	83	2

Surface level (+25.9 m) +85 ft
Water level +24.9 m (+82 ft)
February 1973

Overburden 0.2 m (0.5 ft)
Mineral 1.5 (5.0 ft)
Waste 8.3 m (6.5 ft)
Mineral 2.0 m (6.5 ft)
Waste 2.0 m (6.5 ft)
Mineral 1.4 m (4.5 ft)
Bedrock 1.6 m+ (5.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Topsoil	0.2	(0.5)	0.2	(0.5)
Blown Sand	(a)	Sand, 'clayey' at base Sand: medium, subangular to well rounded quartz and quartzite with chert and other lithic grains	1.5	(5.0)	1.7	(5.5)
Boulder Clay		Clay, hard, brown, with pebbles of chalk, quartzite and sandstone	8.3	(27.0)	10.0	(33.0)
Glacial Sand and Gravel	(b)	Sand: fine, subangular to well rounded quartz and quartzite with other lithic grains	2.0	(6.5)	12.0	(39.5)
Boulder Clay		Clay, hard, brownish grey with limestone pebbles	2.0	(6.5)	14.0	(46.0)
Glacial Sand and Gravel	(c)	Sand: as above, pebbly at top	1.4	(4.5)	15.4	(50.5)
Rhaetic		Mudstone, hard grey	1.6+	(5.0+)	17.0	(56.0)

GRADING

Mean for Deposit

	%	mm	%
(a)			
Sand	93	-4 + 1	0
		-1 + ¼	60
		-¼ + 1/16	33
Fines	7	-1/16	7
(b)			
Gravel	2	+16	0
		-16 + 4	2
Sand	92	-4 + 1	3
		-1 + ¼	28
		-¼ + 1/16	61
Fines	6	-1/16	6
(c)			
Gravel	3	+16	3
		-16 + 4	0
Sand	93	-4 + 1	1
		-1 + ¼	30
		-¼ + 1/16	62
Fines	4	-1/16	4

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.2 - 1.2	2	98	0
1.2 - 1.7	17	83	0
10.0 - 11.0	2	94	4
11.0 - 12.0	9	90	1
14.0 - 15.0	4	91	5
15.0 - 15.4	3	97	0

SE 80 SE 73 8702 0023 Poplar Grove Block F

Surface level (+13.1 m) +43 ft
Water not struck
January 1973

Overburden 0.3 m (1.0 ft)
Mineral 2.5 m (8.0 ft)
Bedrock 2.2 m+ (7.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.3	(1.0)	0.3	(1.0)
Blown Sand	Sand: medium, subangular to rounded quartz and quartzite with chert	2.5	(8.0)	5.0	(16.5)
Lower Lias	Mudstone, grey	2.2+	(7.0+)	5.0	(16.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	1	+16	0
		-16 + 4	1
Sand	93	-4 + 1	1
		-1 + $\frac{1}{4}$	56
		-$\frac{1}{4}$ + 1/16	36
Fines	6	-1/16	6

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.3 - 1.3	5	94	1
1.3 - 2.3	5	95	0
2.3 - 2.8	14	84	2

SE 80 SE 74 8790 0030 Mill Hill Block F

Surface level (+21.6 m) +71 ft
Water level not recorded
January 1973

Waste 1.0 m (3.5 ft)
Bedrock 3.5 m+ (11.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil, sandy	0.3	(1.0)	0.3	(1.0)
Blown Sand	Clay, light brown	0.7	(2.5)	1.0	(3.5)
Lower Lias	Mudstone, grey	3.5+	(11.5+)	4.5	(15.0)

SE 80 SE 75 | 8848 0074 | Scotter | Block F

Surface level (+11.0 m) +36 ft
Water not struck
January 1973

Overburden 0.4 m (1.5 ft)
Mineral 2.6 m (8.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.4	(1.5)	0.4	(1.5)
Blown Sand	Clayey sand: fine, and medium, subangular to well rounded, quartz, quartzite and chert	2.6	(8.5)	3.0	(10.0)
Lower Lias	Limestone, hard, grey, fossiliferous	1.0+	(3.5+)	4.0	(13.0)

GRADING

Mean for Deposit

%	mm	%
Gravel trace	-16 + 4	trace
Sand 88	-4 + 1	1
	-1 + $\frac{1}{4}$	42
	-$\frac{1}{4}$ + 1/16	45
Fines 12	-1/16	12

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 1.4	8	91	1
1.4 - 2.4	16	84	0
2.4 - 3.0	11	89	0

SE 80 SE 76 8896 0027 Field House Block F

Surface level (+8.5 m) +28 ft
Water level not recorded
January 1973

Overburden 0.4 m (1.5 ft)
Mineral 2.6 m (8.5 ft)
Bedrock 2.5 m+ (8.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Topsoil	0.4	(1.5)	0.4	(1.5)
Blown Sand	'Clayey' sand: medium and fine, subangular to rounded quartz and quartzite with chert and some other lithic grains. Dark silt	2.6	(8.5)	3.0	(10.0)
Lower Lias	Limestone and mudstone, grey, fossiliferous limestone, and laminated mudstone	2.5+	(8.0+)	5.5	(18.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	1	+16	0
		-16 + 4	1
Sand	80	-4 + 1	2
		-1 + $\frac{1}{4}$	44
		-$\frac{1}{4}$ + 1/16	34
Fines	19	-1/16	19

Bulk Samples

Depth below surface (m)	Percentage Fines	Sand	Gravel
0.4 - 1.4	8	92	0
1.4 - 2.4	25	73	2
2.4 - 3.0	27	73	0

Appendix G: List of Workings

The Messingham Sand Company at present operates three sandpits at [851 047] near Hollywood Farm, and at localities [862 040; 877 038] on Messingham Common.

There are no known defunct workings for sand and gravel apart from those shown as worked out areas.

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

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

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INSTITUTE OF GEOLOGICAL SCIENCES

MINERAL ASSESSMENT UNIT

THE SAND & GRAVEL RESOURCES OF SHEET SE 80

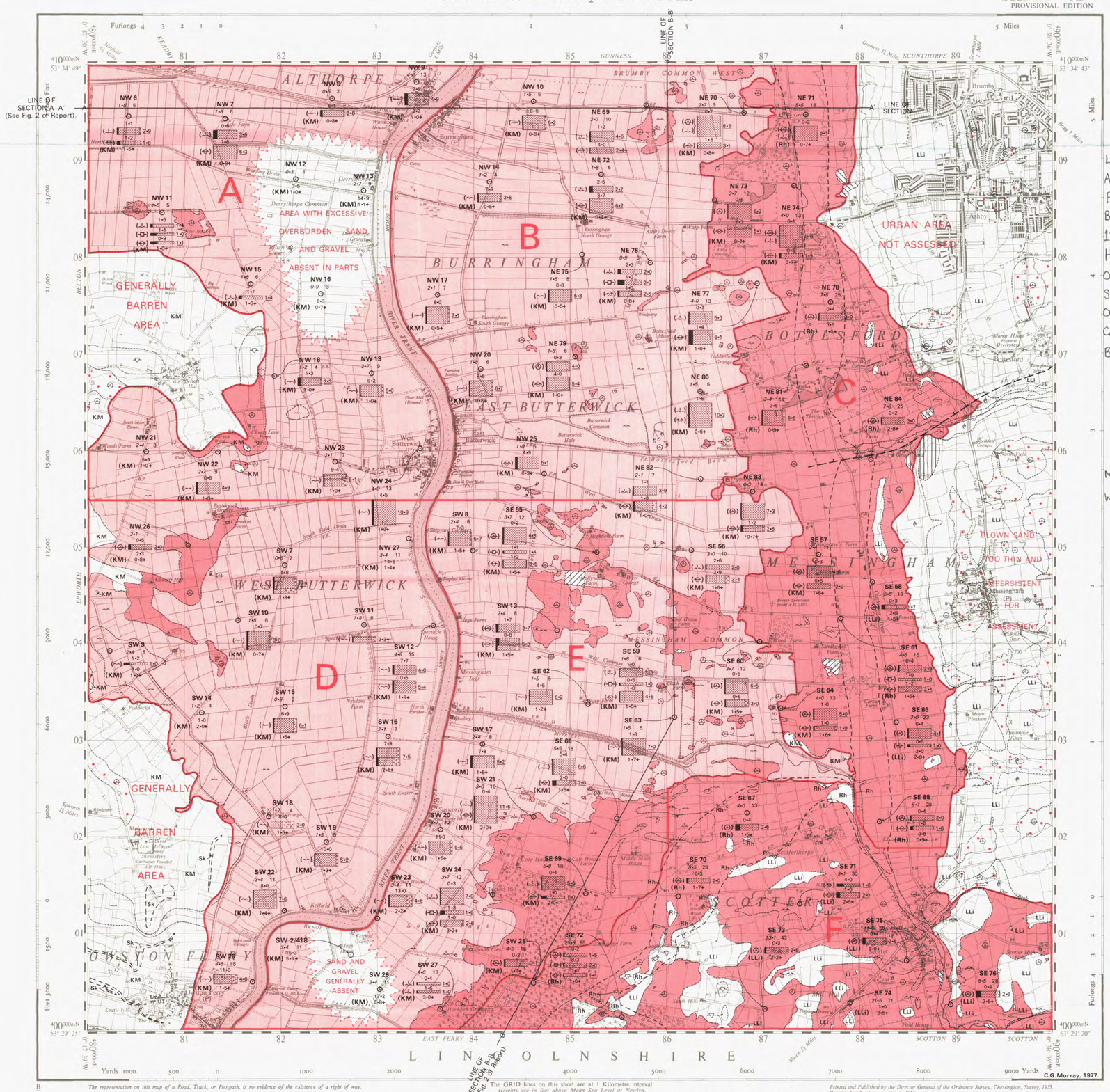
(SOUTH-WEST OF SCUNTHORPE, HUMBERSIDE)

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

ORDNANCE SURVEY
SHEET SE80
PROVISIONAL EDITION

29

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



EXPLANATION OF SYMBOLS AND ABBREVIATIONS

Landslip

DRIFT

L-1	**Calcareous Tufa**
A-20	**Alluvium** — silts, clays and peats with basal sand and gravel.
P-1	**Peat**
BS-3	**Blown Sand** — well rounded sands.
1T-10	**1st Terrace** — sands with sporadic pebbles.
H-14	**Head** — soliflucted deposits of clay, silt, sand and pebbles.
OL-1	**Older Littoral Sand and Gravel** — locally derived sands with pebbles.
SI-1	**Silt and Clay of 25-Foot Drift of Vale of York (not present at surface)** — laminated clays with sand beds.
OR-8	**Older River Sand and Gravel (not present at surface)** — sands and gravels in varying proportions.
GS-19	**Glacial Sand and Gravel** — mainly sand with sporadic pebbles.
BC-10	**Boulder Clay** — stony clay.

RECENT AND PLEISTOCENE

SOLID

LLi	**Lower Lias, undivided** — grey, calcareous mudstones and thin limestones.
Rh	**Rhaetic** — dark pyritic shales and brown mudstones.
KM	**Keuper Marl including Tea Green Marl at top** — red and green mudstones.
Sk	**Skerry band in Keuper Marl** — hard, green, dolomitic sandstone.

JURASSIC TRIASSIC

MG-2 **Made Ground**

WO-9 **Worked-out areas of sand and gravel**

BOUNDARY LINES

Geological boundary, Drift.

Geological boundary, Solid.

Fault, crossmark indicates downthrow side.

Inferred boundary between categories of deposits recognised.

Resource Block boundary.

Broken lines denote uncertainty.

BOREHOLE DATA

SITE LOCATIONS

Mineral Assessment Unit (M.A.U.) boreholes.

Other boreholes.

M.A.U. BOREHOLES

Borehole Registration Number → SW 13
Borehole Site → 2·4 8 ← Surface level in metres and feet above O.D. (Newlyn).
1·0 — Overburden.
(⊖) 3·7+ — Mineral (sand and gravel).
0·8+ — Waste
(⊖) 5·3+ — Mineral (sand and gravel).
Grading Diagram → (KM) 1·5+ ← Bedrock.
Geological Classification →

Thicknesses in metres.

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

Borehole Registration Number

Each M.A.U. borehole is identified by a Registration Number, e.g. SW 13. The letters refer to the quarter sheet and the figures to the I.G.S. serial number for that quarter, The unique designation for borehole SW13 is SE80 SW13.

Grading Diagrams

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

Sand (+1/16-4mm)
Fines (-1/16mm) Gravel (+4mm)

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

OTHER BOREHOLES

The layout of information is the same as for M.A.U boreholes, although data available may not be as comprehensive. They are registered in the same series.

CATEGORIES OF DEPOSITS

Exposed mineral, assessed. CAT - E2

Continuous or almost continuous spreads of mineral beneath overburden. CAT - C1

Sand and gravel either not potentially workable (see Report) or absent. CAT - A2

Sand and gravel not assessed. CAT - N1

Where appropriate on other sheets a fifth category 'Discontinuous spreads of sand and gravel beneath overburden is recognised.

RESOURCE BLOCKS

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

Horizontal sections showing the general relationships between drift and solid deposits along lines AA' and BB' constitute Fig. 2 of the Report.

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

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 1905-06. Other partial systematic revision 1938-51 has been incorporated.

Printed and Published by the Director General of the Ordnance Survey, Chessington, Surrey, 1933. Reprinted with minor corrections 1956.

Geological lines from six inch surveys by G.D.Gaunt and G.H.Rhys in 1964-65 and by R.J. Bull and T.P. Fletcher in 1972-75, D.R.A.Ponsford and E.G.Smith, District Geologists.

Sand and Gravel Survey by J.H. Lovell, J.R.Gozzard, I.Jackson and J.W.C. James in 1972-73. under the supervision of D. Price. R.G.Thurrell, Head, Mineral Assessment Unit.

1:25 000 Sand and Gravel Resource Sheet published 1977
Austin W.Woodland, C.B.E., Director, Institute of Geological Sciences, incorporating the Geological Survey of Great Britain, the Museum of Practical Geology and Overseas Geological Survey

1550/77

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

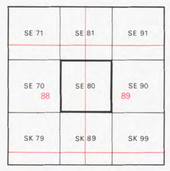


Diagram showing the relation of the National Grid 1:25 000 Sheets with the One-Inch New Series Geological Sheets 88 (Doncaster) and 89 (Brigg).

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