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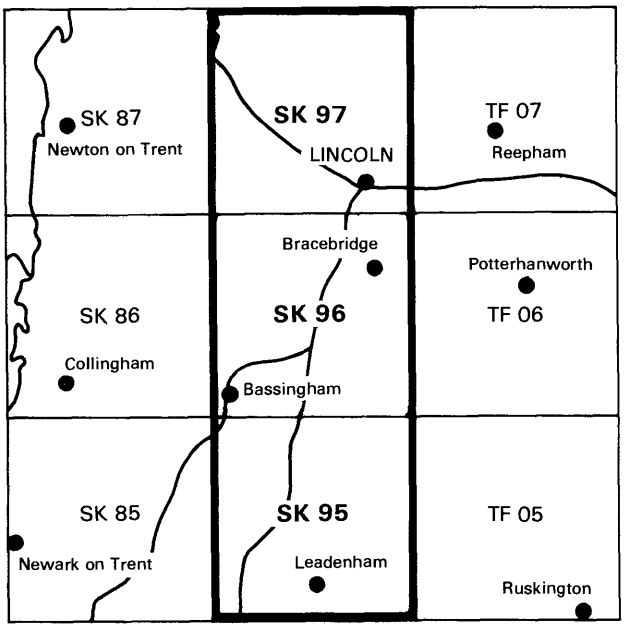

The sand and gravel resources of the country west and south of Lincoln, Lincolnshire

Description of 1:25 000 resource sheets SK 95, SK 96 and SK 97

I. Jackson

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 resources of these minerals should be undertaken. The publication of information about the quantity and quality of deposits over large areas is intended to provide a comprehensive factual background against which planning decisions can be made.

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

This report describes the resources of sand and gravel of 300 km^2 of country west and south of Lincoln shown on the accompanying resource maps. The survey was conducted by Mr. I. Jackson, under the supervision of Mr D. Price, assisted in the drilling and sampling programme by Mr J.W.C. James, Mr J.H. Lovell and Mr A. Smith. The work, which was controlled from the sub-unit in Leeds, (J.H. Hull, Officer-in-Charge) is based on one-inch geological surveys published in 1886 on Old Series Sheets 70 and 83 and republished in part, with the inclusion of the results of a partial six-inch survey, on the 1:50 000 scale in 1973. The geological lines, now presented at the 1:25 000 scale, incorporate minor amendments resulting from the present work.

Mr J.W. Gardner, C.B.E. (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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The geological maps of the Institute of Geological Sciences, pre-existing borehole information, and 73 boreholes drilled for the Mineral Assessment Unit form the basis of the assessment of sand and gravel resources in the area west and south of Lincoln, Lincolnshire.

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 five resource blocks containing between 8.5 and 14.6 km^2 of potentially workable sand and gravel. For the blocks assessed statistically the geology of the deposits is described and the mineral-bearing area, the mean thickness of overburden and mineral, and the mean grading of the mineral are stated. Detailed borehole data are given. The geology, the position of the boreholes and the outlines of the resource blocks are shown on the accompanying maps.

Sommaire

Les sources des renseignements qui constituent les bases de l'évaluation des ressources en sable et en gravier dans la région a l'ouest et au sud de Lincoln, Lincolnshire, comprennent les cartes géologiques de l'Institute of Geological Sciences, des données obtenues des trous de sonde déjà en existence, et de 73 trous de sonde forés pour le Mineral Assessment Unit.

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

La carte 1:25 000 est divisée en cinq blocs de ressource avec d'entre 8.5 a 14.6 km^2 de sable et de gravier. Pour les blocs évalués statistiquement on décrit la géologie des dépôts et on donne l'étendue du terrain minéralisé, l'épaisseur moyenne de recouvrement et de minéral, et le triage moyen de minéral. On présente des données détaillées des trous de sonde. La situation des trous de sonde, la géologie et les profils des blocs de ressource sont montrés sur les cartes.

Zusammenfassung

Die geologischen Karten vom Institute of Geological Sciences, vorherexistierende Information über Bohrlöcher, und 73 für die Mineral Assessment Unit gebohrten Bohrlöcher, bilden den Grund für die Einschätzung der Sand- und Schottermittel westlich und südlich von Lincoln Gebiet, Lincolnshire.

Alle Ablagerungen im Gebiet, die möglich bearbeitbar fur Sand und Schotter sind, wurden untersucht, und eine einfache statistische Methode wurde benutzt, um das Volumen zu schätzen. Man gibt die Zuverlässigkeit der Volumenschatzungen mit symmetrishen 95 Prozent Vertrauensgrenzen.

Man teilt die 1:25 000 Karte in 5 Mittelsblöcke, die zwischen 8.5 und 14.6 km^2 von Sand und Schotter umfassen. Man beschreibt die Geologie der Ablagerungen für die statistisch bewerteten Blöcke. Das mineralhaltige Gebiet, die mittlere Dicke von Überlastung und Mineral, und die mittlere Klassifizierung von Mineral werden bestimmt Ausführliche Bohrlöcherdaten werden auch gegeben. Die Geologie, die Lage der Bohrlöcher und die Skizzen der Blöcke werden auf der Begleitkarten gezeigt.

The sand and gravel resources of the country west and south of Lincoln, Lincolnshire

Description of 1:25 000 sheets SK 95, 96 and 97

I. Jackson

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 Survey, 1948, p. 15).

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

The following arbitrary physical criteria have been adopted:

a. The deposit should average at least 1 m in thickness.
b. The ratio of overburden to sand and gravel should be no more than 3:1.
c. The proportion of fines (particles passing the No. 240 mesh BS sieve, about 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 Resource Sheets SK 95 and Part of SK 96 (Southern Sheet - Bassingham) and SK 97 and Part of SK 96 (Northern Sheet Lincoln)

The prominent escarpment, Lincoln Edge, dominates the area. It is breached by the River Witham at Lincoln but otherwise maintains a height of over 200 ft (61 m) throughout its length rising to 325 ft (99 m) above OD near Leadenham. To the west, the scarp overlooks the flat, low-lying alluvial tracts of the rivers Brant, Till and Witham and the gently undulating ground beyond, which rises to 97 ft OD (c. 30 m) near Whisby [903 673]; these areas contain the assessed resources of sand and gravel. Eastwards from the crest of the scarp there is a gradual decrease in elevation.

The city of Lincoln is the commercial and industrial focus of a region which, apart from the extraction of sand and gravel around North Hykeham, is predominantly agricultural.

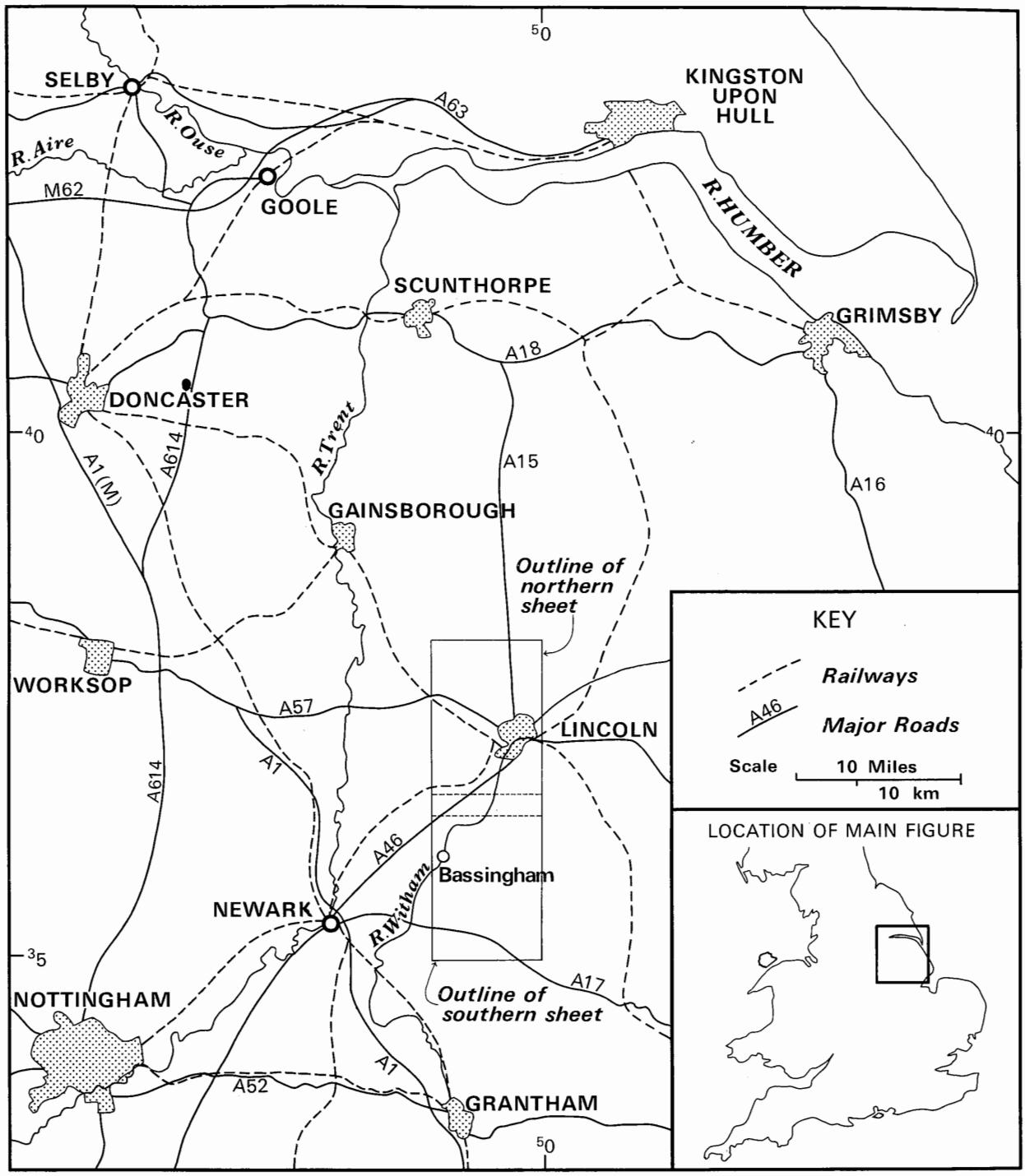


Fig. 1. Map showing the location of the northern and southern sheets (SK 97 and part of SK 96–Lincoln and SK 95 and part of SK 96–Bassingham)

GEOLOGY

The geological sequence is summarised in Table 1 where deposits are listed as far as possible in order of increasing age. The relationship between deposits is illustrated in Fig. 2 and the lines of section are shown on the accompanying maps.

Table 1. Geological sequence.

DRIFT		
Recent and Pleistocene	Alluvium	
	River Terrace - Floodplain Deposits	Terrace
	Older River Sand and Gravel	Beeston Terrace / Hilton Terrace
	Glacial Sand and Gravel	
	Boulder Clay	
	Sand of unknown age	
SOLID		
Jurassic	Great Oolite Limestone	
	Upper Estuarine Beds	
	Lincolnshire Limestone	
	Lower Estuarine Beds with Northampton Sand and Ironstone	
	Upper Lias	
	Middle Lias with Marlstone Rock Bed	
	Lower Lias, including Upper Ferruginous Limestone	

Lower Lias

The Lower Lias occupies a considerable area in the west where the uppermost 130 m (430 ft) of the easterly dipping sequence crops out. The rocks consist of soft blue-grey clays with subordinate limestones and calcareous mudstones which are commonly very fossiliferous. The Upper Ferruginous Limestone is responsible for a prominent feature as for example at Thorpe on the Hill.

Middle Lias

The Middle Lias, which is about 15 m (50 ft) thick, crops out along Lincoln Edge and to the south of the city follows the line of the 100-ft (31-m) contour. Locally a division has been made into a lower series of shales and clays and an upper series of ferruginous limestones variously termed the 'Marlstone', the spinatum Zone (Wilson, 1948, p. 22) or the 'Marlstone Rock-bed' (Ussher and others, 1888, p. 31). The clays have been worked in places for brick production.

Upper Lias

The Upper Lias is 30 m (100 ft) thick at Lincoln and consists of clays and black fossiliferous shales. These beds are thought to thin northwards (Ussher and others, 1888, p. 33).

Lower Estuarine Beds with Northampton Sand and Ironstone

These beds (up to 5.5 m (18 ft) in total thickness) are of deltaic origin and include ferruginous, arenaceous and argillaceous rocks. Historically, the ironstones were commercially important.

Lincolnshire Limestone

The Lincolnshire Limestone caps the escarpment and has an extensive dip slope to the east. The rocks have a thickness of about 30 m (98.5 ft) and consist of oolitic limestones with clays.

Upper Estuarine Beds

The Upper Estuarine Beds have a restricted outcrop in a faulted area north-east of Lincoln. They consist locally of about 10 m (35 ft) of fluviatile sandy clays.

The Great Oolite Limestone

This has a similarly restricted outcrop north-east of Lincoln. Here the sequence consists of limestones and intercalated marls and clays which amount to a thickness of about 4.6 m (15.0 ft).

Sand

Sand of unknown age occurs in small patches on the escarpment south of Lincoln between 50 ft (15 m) and 200 ft (61 m) OD.

Boulder Clay

Boulder clay covers the Lias in the north-west of the area near Scampton, where it is partially overlain by alluvium. Its lithology is influenced by the local bedrock, which gives rise to a blue-grey, stony clay.

Glacial Sand and Gravel

Glacial Sand and Gravel crops out in small isolated patches west of Scampton and on the escarpment in the south-east of the area near Leadenham. Topographic position appears to be the most important criterion for their recognition (Ussher and others, 1888, p. 126) and there is some doubt as to their glacial origin.

Older River Sand and Gravel

Older River Sand and Gravel found between Doddington and Skellingthorpe (designated as resource block C on the map) has been correlated with the Hilton Terrace of the upper and middle Trent (Clayton, 1957, p. 38). It consists of 0.4 (1.5) to 6.2 m (20.5 ft) of 'clayey' sand and gravel, the surface of which descends from over 90 ft (27.5 m) at Whisby [903 673] to 28 ft (8.5 m) OD at Skellingthorpe. Almost everywhere there is a laminated, red-brown clayey silt, probably deposited in a lacustrine environment, below the sand and gravel.

The trend and form of these relatively high-level sands and gravels is consistent with the theory that they were deposited by the Trent when it flowed eastwards through the Lincoln Gap, its course being influenced by the presence of ice. The Hilton Terrace is considered to be fluvio-glacial by Stevenson and Mitchell (1955, p. 93) and fluvial by other authors (Clayton, 1953, p. 198; Pocock, 1929, p. 312).

To the south of the Hilton Terrace, in the Hykeham and Bassingham areas, the Older River Sand and Gravel (block D and part of block E on the map) is thought be be equivalent to the

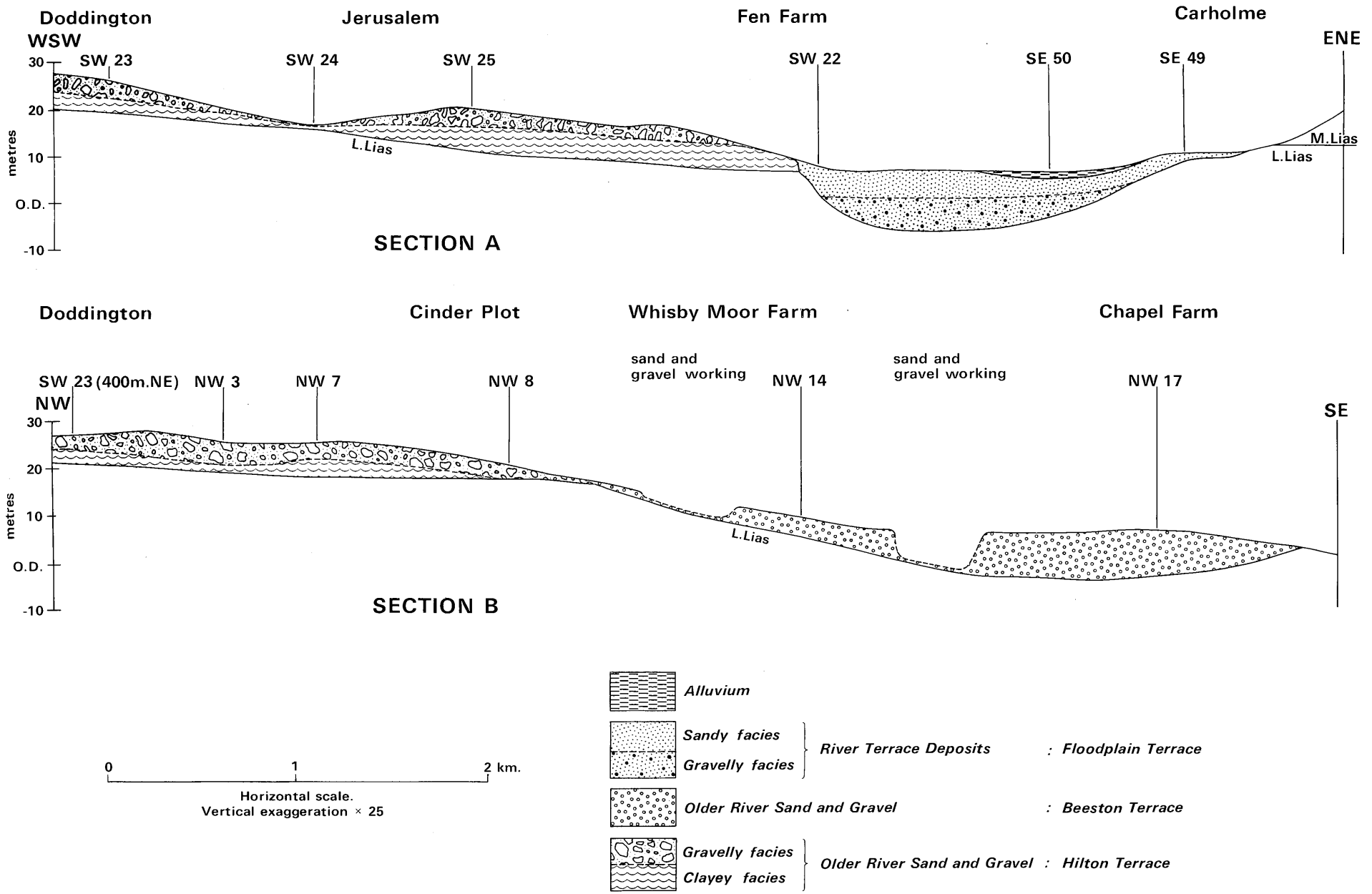


Fig. 2. Schematic sections across the district

Beeston Terrace of the upper and middle Trent (Swinnerton, 1937, p. 151). It is best developed around North Hykeham, where it lies at a height of about 37 ft (11.3 m), and consists of up to 9.1 m (30 ft) of sand and gravel in varying proportions. The material fills a channel (Fig. 3) which is thought to have been cut when ice caused the diversion of the Trent through the Lincoln Gap. The deposits at Bassingham are less extensive, discontinuous and much thinner.

River Terrace Deposits

These deposits are found to the west of Lincoln in a broad valley which runs south-eastwards towards the Lincoln Gap, and in the narrower valleys of the rivers Brant and Witham. Boreholes show that in the broad valley these deposits also fill a channel cut into the Lias to a maximum depth of about 6 m (19.5 ft) below OD (Fig. 3), where they are divisible into a basal sandy gravel, present in the deeper parts of the channel, and an upper sand and clay sequence. It has been suggested (Pocock, 1929, p. 313; Clayton, 1957, p. 38) that this channel marks a former course of the River Trent and that these deposits are equivalent to the Floodplain Terrace of the middle Trent Valley. A tributary was probably responsible for the deposition of the sand and gravel in the valleys of the Brant and Witham.

Alluvium

This deposit is present in the valleys of the Brant, Witham and Till and other smaller streams and drains. It consists of clay, silts and fine sands, up to 1.7 m (5.5 ft) thick near Till Bridge [908 798], where it rests on 0.3 m (1 ft) of gravel overlying the Lower Lias. At Lincoln, where it has been deposited on the undulating surface of the River Terrace sands and gravels, the Alluvium is from 0.6 (2) to 4.3 m (14 ft) thick and has an average elevation of 12 ft (3.6 m) (Ussher and others, 1888, p. 164). To the west of the River Brant in an area known as the Malborough and Aubourn Fen [940 615] the Alluvium has a maximum proved thickness of 1.0 m (3.5 ft) in borehole SK 96 SW 10 and overlies 'clayey' sands and gravels of the Floodplain Terrace.

COMPOSITION OF THE SAND AND GRAVEL

The potentially workable sand and gravel deposits are the Older River Sand and Gravel (Hilton and Beeston terraces) and River Terrace Deposits (Floodplain Terrace). The patches of sand of unknown age occupy too small an area to justify assessment; detailed information regarding composition is not available.

The Hilton Terrace consists predominantly of 'clayey' pebbly sands and gravels with a mean grading of fines 12 per cent, sand 58 per cent, gravel 30 per cent. The deposits constitute the whole of the mineral of resource block C and their composition is more fully discussed below.

The Beeston Terrace is generally less 'clayey' and more gravelly, with a mean grading of fines 4 per cent, sand 55 per cent, and gravel 41 per cent. The majority of boreholes in this deposit proved gravel or sandy gravel but locally sand, pebbly sand and 'clayey' gravel is recorded. On average 58 per cent of the pebbles fall in the fine gravel fraction; cobbles are absent. The sand fraction is predominantly medium grained.

The composition of the Floodplain Terrace is more varied. In places, notably north-west of Skellingthorpe, only sand or 'clayey' sand is present but elsewhere the mineral generally comprises an upper layer of sand or 'clayey' sand, sometimes pebbly, overlying sandy gravel or gravel. The upper sandy layer is up to 3.4 m (11 ft) thick and proved thicknesses of the lower layer range from 0.9 to 7.1 m (3 to 23.5 ft). The gravels tend to coarsen with depth but on average 55 per cent of the pebbles are in the fine gravel fraction. The sand is fine to medium grained.

Despite differences in age and grading the nature of the constituents is fairly uniform for all deposits (Table 2). The gravel fraction is dominated by rounded quartzite pebbles but vein quartz is also common; flint, chert and sandstone are generally present in subordinate amounts, whereas mudstone, siltstone, limestone and igneous rocks together usually account for less than 5 per cent of the total. However some of the gravels just north of Aubourn and south of Blackmoor Farm are exceptional in containing unusually high proportions of calcareous material and mudstone (for example, borehole SK 96 SW 12). The calcareous material (included under limestone in Table 2) commonly consists of worn fragments of ammonites, belemnites, bivalves and crinoids. These deposits are probably locally derived.

The sand is predominantly of quartz but lithic fragments comparable to the rocks found in the gravels may be recognised, especially in the coarse fraction.

THE MAPS

The sand and gravel resource maps (which for convenience are produced as northern and southern sheets) are folded into the pocket at the end of this report. The base maps are Ordnance Survey 1:25 000 Outline Editions 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 boundaries shown are based on a one-inch scale geological survey of Old Series sheets 70 and 83 published in 1886. The maps were redrawn in part on the 1:50 000 scale as New Series sheets 114 (Lincoln) and 127 (Grantham) and published in 1972 and 1973, incorporating the results of partial six-inch surveys made in 1940-1941 and 1954. The assessment maps also incorporate minor amendments resulting from the sand and gravel survey. The Plateau Gravels and Ancient Gravels of Older Rivers of the original survey were renamed 'Older river sand and gravel' on the New Series maps and River Gravels were renamed 'Undifferentiated river terrace sand and gravel'. On the assessment maps the latter are now termed River Terrace Deposits.

The geological boundaries are the best interpretation of the information available at the time

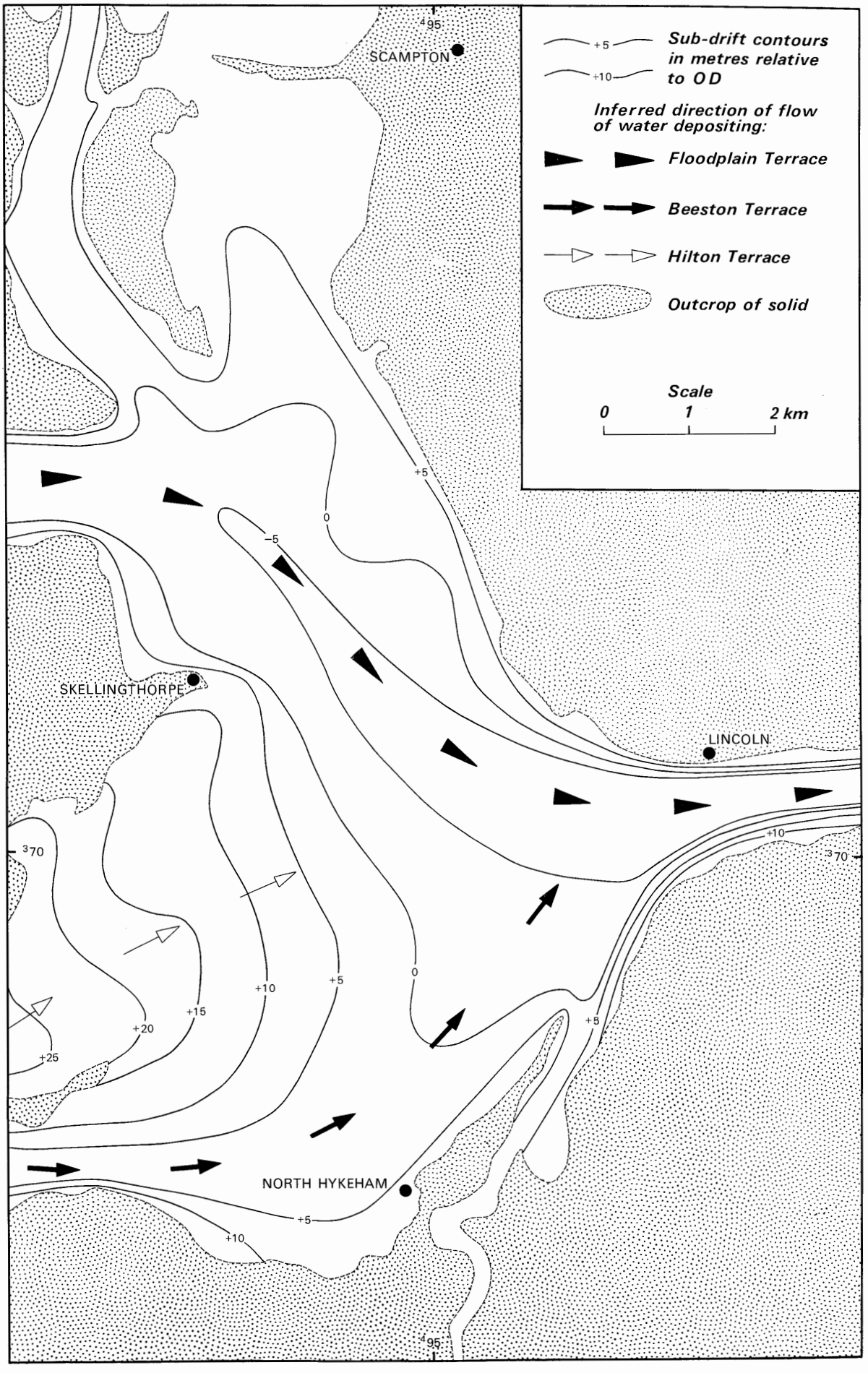


Fig. 3. Contours on the sub-drift surface of SK 97 and part of SK 96 (northern sheet)

of survey. However it is inevitable, particularly with variable superficial deposits, that local irregularities and discrepancies will be revealed as new evidence from boreholes and excavations becomes available.

Borehole data which include the stratigraphical relations and mean particle-size analysis of the sand and gravel samples collected during the assessment are also shown on the map.

Mineral Resource Information

For assessment purposes the maps are divided into areas of mineral and areas where sand and gravel are not assessed, not potentially workable or absent (for definitions of 'mineral' and 'potentially workable' see page 1). The mineral is further subdivided into areas where it crops out (except for thin soil) 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, as for example, around borehole SK 96 NW 16. Areas where bedrock crops out, where superficial deposits do not contain mineral and where sand and gravel is deemed to be not potentially workable are shown uncoloured. Areas of unassessed sand and gravel, for example built-up areas, 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 maps and which could not be accurately delineated during this survey, inferred boundaries have been inserted. Such boundaries are shown by a distinctive symbol which is intended to convey an approximate location within a likely zone of occurrence rather than to represent the breadth of the zone; its width is dictated by cartographic considerations. For the purpose of measuring areas the centre-line of the symbol is used.

RESULTS

The results are summarised in Table 3. Further grading particulars are shown in Fig. 4 and the mean gradings and grading 'envelope' for each resource block are given in Figs. 6 to 10.

Accuracy of Results

For the five resource blocks the accuracy of the results at the symmetrical 95 per cent probability level ranges from 17 to 47 per cent. However, the true values are more likely to be nearer the figure estimated than the limits. Moreover it is probable that in each block roughly the same percentage limits would apply for the estimate of volume of a very much smaller parcel of ground (say, 200 acres) containing similar sand and gravel deposits if results from the same number of sample points (as provided by, say, 10 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 10 sample points will be required, even if the area is quite small.

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

NOTES ON RESOURCE BLOCKS

In general the resource block boundaries reflect the distribution of different mineral-bearing deposits within the area (Fig. 5). Blocks A and B consist of Floodplain Terrace deposits north-west of Lincoln which are arbitrarily divided for assessment purposes. Blocks C and D contain deposits of the Hilton and Beeston terraces respectively and block E encompasses scattered deposits of the Beeston and Floodplain terraces.

Boreholes and hand auger holes sited on the alluvium of the River Till north of grid reference [908 764], and upon Floodplain Terrace around Fox Covert House [923 763], Brant Broughton and west of Boothby Graffoe proved the deposits to be too thin to be potentially workable. The built-up area around Lincoln sterilises parts of the Hilton, Beeston and Floodplain terraces and these, together with several small patches of sand of unknown age and Glacial Sand and Gravel have not been assessed.

Block A

Block A comprises the north-eastern part of a broad open valley northwest of Lincoln which is floored by Alluvium and Floodplain Terrace. Borehole SK 97 NW 15 proved no sand or gravel and, although the extent of the barren area cannot be delineated, the absence of mineral at this point has been taken into account in calculating the volume of the resources. Elsewhere proved thicknesses (Table 4) range from 1.2 to 7.0 m (4 to 23 ft) giving a mean of 3.4 m (11 ft). In the thicker sequences the mineral consists of 2.4 to 5.5 m (8 to 18 ft) of gravel and sandy gravel overlain by 'clayey' sands 1 to 2.3 m (3.5 to 7.5 ft) thick. The 'gravelly' facies has a grading of fines 3 per cent, sand 46 per cent, gravel 51 per cent while the 'clayey' sands have a mean grading of fines 16 per cent, sand 79 per cent, gravel 5 per cent.

The mean grading of the block as a whole is fines 9 per cent, sand 60 per cent, gravel 31 per cent and the estimated volume of mineral is 31 million $m^3 \pm 47$ per cent. The deposits have been worked in the past near both Burton [945 740] and Odder [925 748].

Boreholes SK 97 NW 16 and SK 97 SW 15 proved silt and clay to depths of 2.5 and 2.8 m (8 and 9 ft) from the surface respectively, but elsewhere overburden was found to be thin.

Block B

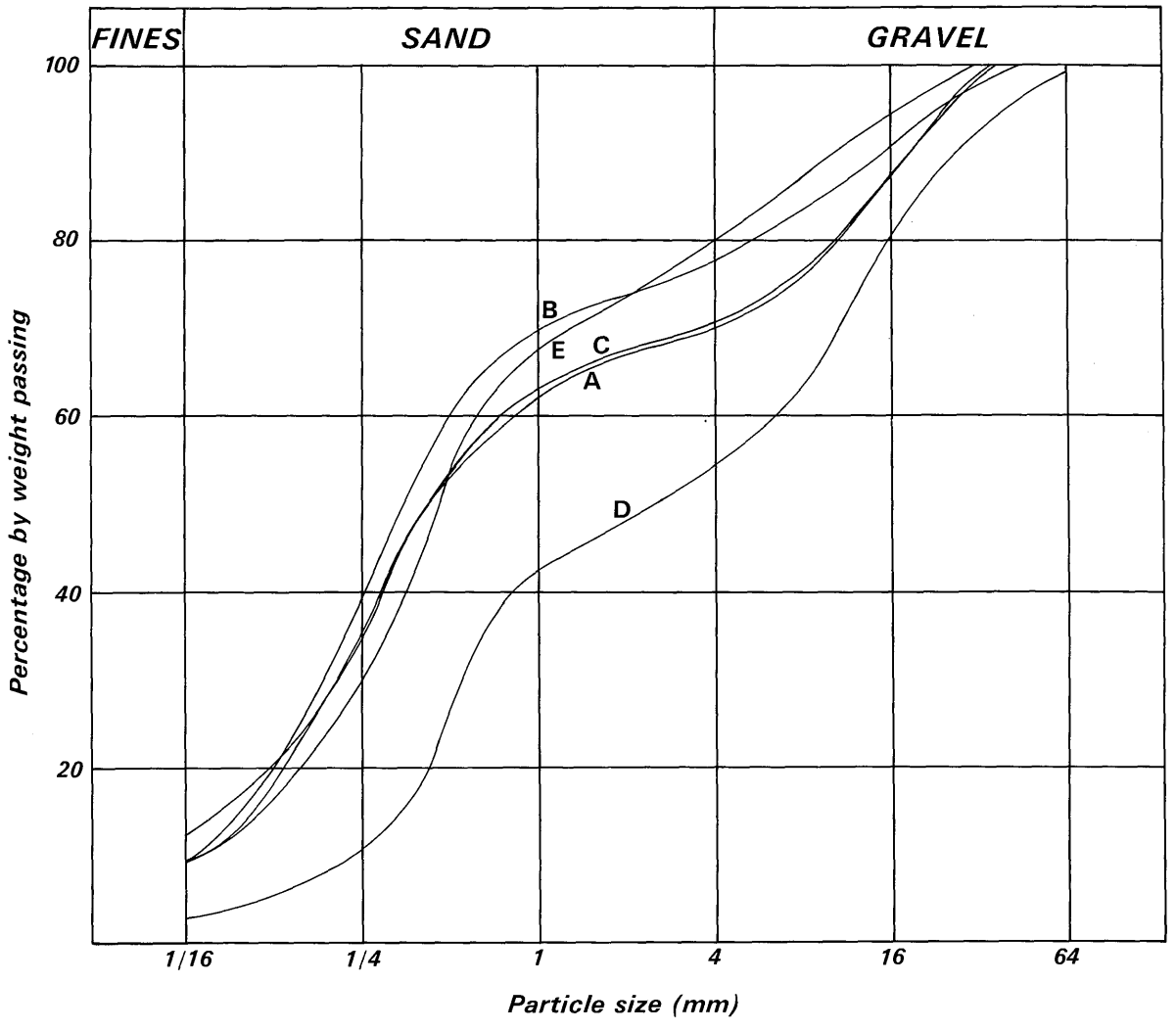
The major part of this block lies immediately to the south-west of block A but a detached area east of Lincoln is also included. The drift comprises Floodplain Terrace deposits and Alluvium. Locally, the former contains more clays and silts than in block A. Around Skellingthorpe and in a narrow tongue extending south-eastwards close to the margin of the block

Table 2. Pebble count analyses given as a per cent by number (and weight).

		Quartz	Quartzite	Flint and chert	Sandstone	Mudstone & siltstone	Limestone	Igneous
FLOODPLAIN TERRACE								
Borehole	Depth m							
SK 96 SW 6	2.4 - 3.6	14(14)	46(58)	15(10)	2(4)	Trace	23(14)	-
SK 96 SW 12	1.5 - 3.2	2(6)	4(11)	8(7)	13(14)	28(18)	43(42)	2(2)
SK 97 SW 12	6.3 - 7.3	36(29)	26(48)	21(12)	15(10)	1(trace)	1(trace)	-
SK 97 SW 13	5.3 - 6.3	16(17)	64(70)	11(8)	-	5(2)	3(2)	Trace(1)
SK 97 SW 16	4.8 - 5.6	23(17)	59(71)	18(11)	Trace	-	Trace	-
SK 97 SW 18	5.3 - 6.4	22(13)	50(75)	15(7)	7(4)	6(1)	-	-
SK 97 SE 50	6.5 - 7.5	22(27)	53(54)	14(11)	6(5)	2(trace)	3(2)	Trace
SK 97 SE 51	4.3 - 5.3	35(31)	25(37)	23(19)	14(12)	2(trace)	Trace	Trace
BEESTON TERRACE								
Borehole	Depth m							
SK 96 NW 11	4.4 - 5.4	22(16)	56(64)	18(15)	1(3)	2(1)	Trace	1(1)
SK 96 NW 12	1.0 - 2.0	33(31)	30(46)	21(13)	16(10)	Trace	-	-
SK 96 NW 13	8.4 - 9.2	31(23)	35(42)	20(14)	13(21)	1(trace)	Trace	-
SK 96 NW 15	5.4 - 6.4	32(31)	31(43)	19(10)	17(13)	1(3)	-	-
SK 96 NW 17	4.4 - 5.4	16(20)	60(67)	19(12)	-	5(1)	-	-
SK 96 NW 17	6.4 - 7.4	18(21)	54(54)	14(7)	11(17)	1(trace)	1(trace)	Trace
HILTON TERRACE								
Borehole	Depth m							
SK 96 NW 8	0.3 - 1.3	19(17)	62(61)	15(17)	Trace	2(1)	1(1)	Trace
SK 96 NW 8	1.3 - 2.3	23(20)	53(66)	17(9)	1(1)	3(2)	1(1)	2(1)
SK 96 NW 8	2.3 - 3.1	22(15)	47(70)	19(10)	8(3)	3(trace)	Trace	Trace
SK 97 SW 26	1.2 - 2.2	17(16)	53(71)	26(12)	2(trace)	-	2(trace)	-
SK 97 SW 26	4.2 - 5.2	32(23)	31(60)	19(8)	16(9)	-	2(trace)	-
SK 97 SW 26	5.2 - 6.0	20(25)	56(56)	18(11)	Trace(2)	4(2)	1(1)	1(3)

Table 3. Sand and gravel resources of the area.

Resource block	Area		Mean thickness				Volume of mineral				Mean grading percentage		
	Block km^2	Mineral km^2	Overburden		Mineral		Million		Limits at 95% probability level		Fines	Sand	Gravel
			m	ft	m	ft	m^3	yd^3	± %	± million m^3	-1/16 mm	-4+1/16 mm	+4 mm
A	9.4	9.2	0.7	2.5	3.4	11.0	31	41	47	15	9	60	31
B	14.8	14.6	1.4	4.5	6.0	19.5	88	115	23	20	9	68	23
C	13.1	12.7	0.4	1.5	3.5	11.5	44	58	29	13	12	58	30
D	11.3	8.5	0.4	1.5	5.8	19.0	49	64	36	18	3	52	45
E	29.9	11.5	0.6	2.0	2.4	8.0	28	37	17	5	9	71	20
Built-up area of Lincoln 22.7 km^2 Barren areas 198.8 km^2													
TOTAL	300	56.5	0.8	2.5	4.3	14.0	240	314	16	38			



Resource Block	Percentage by weight passing				
	1/16 mm	$\frac{1}{4}$ mm	1 mm	4 mm	16 mm
A	9	36	62	69	87
B	9	39	70	77	91
C	12	35	63	70	87
D	3	11	43	55	81
E	9	30	68	80	96

Fig. 4. Mean particle-size distribution for the assessed thickness of sand and gravel in resource blocks A to E

the terrace deposits at the surface consist of silt and clay (formerly thought to be outcropping Lower Lias bedrock) and in these areas overburden may be up to at least 2.5 m (8 ft) thick (Table 5). In the same areas boreholes generally proved one or two waste partings, accounting for up to about 20 per cent of the thickness of the deposit. Although overburden is thin elsewhere, the mean thickness for the block is 1.4 m (4.5 ft).

Total thicknesses of mineral proved range from 1.5 to 10.1 m (5 to 33 ft) with a mean of 6.0 m (19.5 ft). The mineral generally comprises gravels and sandy gravels overlain by mainly 'clayey' sands. The sandy gravels were not found in boreholes SK 97 SW 28, 29, 30 and 31 but elsewhere proved to be from 1.5 to 7.1 m (5 to 23.5 ft) thick; their mean grading is fines 1 per cent, sand 55 per cent, gravel 44 per cent. The 'clayey' sands were found to range from 0.3 to at least 4.7 m (3 to 15.5 ft) in thickness. They have a mean grading of fines 16 per cent, sand 81 per cent, gravel 3 per cent.

The mean grading of the mineral of the block as a whole is fines 9 per cent, sand 68 per cent, gravel 23 per cent and the estimate of volume is 88 million $m^3 \pm 23$ per cent.

Block C

The mineral of this block consists entirely of Hilton Terrace deposits. With only one exception, it rests in boreholes on a clayey or sandy silt deposit up to 6.5 m (21.5 ft) thick which is often laminated.

Proved sand and gravel thicknesses range from 0.4 m (1.5 ft), found in a site investigation borehole SK 96 NW 27, to 6.2 m (20.5 ft) in Mineral Assessment Unit borehole SK 96 NW 6 (Table 6). Sand and gravel was not proved in borehole SK 97 SW 24 and the absence of mineral at this point has been taken into account in calculating the volume of resources, although the extent of the barren ground cannot be delineated. The mean thickness based on 13 data points is 3.5 m (11.5 ft). The mineral varies irregularly both laterally and vertically, and ranges in composition from very 'clayey' sand to gravel. The mean gravel content of individual boreholes lies between 14 and 61 per cent but is commonly greater than 20 and less than 40 per cent; fines account for between 4 and 21 per cent of the deposit (Table 6 and Fig. 8). The mean grading of the mineral of the block is fines 12 per cent, sand 58 per cent, gravel 30 per cent, and the estimate of volume is 44 million $m^3 \pm 29$ per cent. The overburden, consisting of sandy soil and subsoil has not been found to be more than 0.5 m (1.5 ft) thick. Borehole SK 96 NW 3 proved a 1 m waste parting.

Block D

The mineral of this block consists of Beeston Terrace possibly with some Hilton Terrace deposits at depth in its north-eastern part. The deposits have been extensively exploited, and at the time of the survey aggregate was being extracted from pits at Whisby and North Hykeham.

Borehole SK 96 NW 16 proved no mineral; the extent of the barren ground cannot be delimited on the resource map but the results of this hole have been taken into account in calculating the volume of mineral in this block. Elsewhere proved thicknesses range from 2.5 to 9.1 m (8 to 30 ft) but generally exceed 7 m (23 ft); the mean for the block is 5.8 m (19 ft). Overburden is everywhere less than 1 m thick.

The mineral is generally gravel or sandy gravel overlain in places by thin pebbly sand. Borehole SK 96 NW 17, exceptionally, proved a sand parting between two gravel horizons. The mean gravel content of individual boreholes ranges from 34 to 58 per cent; fines are generally present in only small amounts (Table 7; Fig. 9) although 15 per cent is recorded in SK 96 NW 14. The mean grading for the block as a whole is fines 3 per cent, sand 52 per cent, gravel 45 per cent. The estimated volume of mineral in the block is 49 million $m^3 \pm 36$ per cent.

Block E

The potentially workable sand and gravel of this block consists of deposits of the Beeston and Floodplain terraces. A narrow strip of Beeston Terrace between Aubourn and Carleton le Moorland [907 580] covers about 5 km^2 of ground above 33 ft (10 m) OD. Within this area borehole SK 95 NW 6 found no sand or gravel and borehole SK 95 NW 10 proved only 0.3 m (1 ft) of 'clayey' gravel on bedrock. Accordingly, small areas of the terrace around Carleton le Moorland and east of Bassingham have been classified as non-mineral. Four other boreholes in this narrow area proved from 2.3 to 3.0 m (7.5 to 10 ft) of mineral, giving a mean of 2.6 m (8.5 ft): borehole SK 95 NW 8, at the southern end, contained only 2 per cent gravel but the three other holes yielded 24, 29 and 32 per cent; fines content ranged from 5 to 9 per cent. The remainder of the Beeston Terrace deposits are in small isolated patches; these have not been separately investigated but their areas have been taken into account in assessing mineral volume.

Floodplain Terrace deposits occupy present-day river valleys and are in part overlain by alluvium which has a maximum proved thickness of only 1.4 m (4.5 ft). Boreholes SK 96 SW 8 and SK 95 NW 9 failed to prove sand and gravel and as a result small areas east of Aubourn and on Bassingham Fen are shown as mineral-free on the resource map. The six other boreholes found from 1.4 to 3.2 m (4.5 to 10.5 ft) of potentially workable deposits, giving a mean of 2.3 m (7.5 ft). Boreholes SK 96 SW 7 and SK 96 SE 13 proved only 2 per cent and 10 per cent of gravel respectively but the other holes yielded between 19 and 30 per cent (Table 8; Fig. 10). Except in one borehole (SK 96 SW 12), the fines content is relatively high ranging from 9 to 18 per cent.

Considering the block as a whole, the mineral has a mean grading of fines 9 per cent, sand 71 per cent, gravel 20 per cent. Its mean thickness is 2.4 m (8.0 ft) leading to an estimate of volume of 28 million $m^3 \pm 17$ per cent.

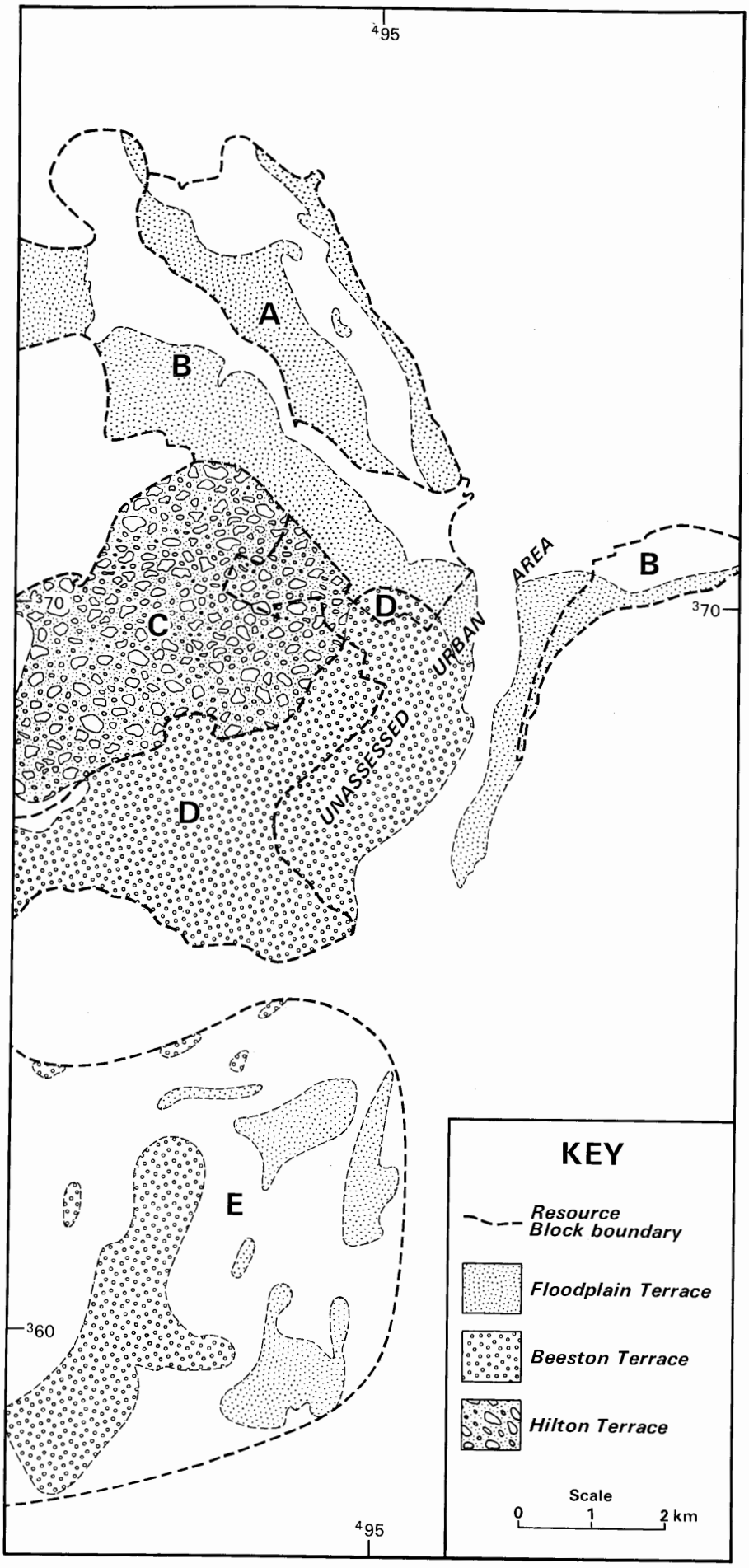


Fig. 5. Relationship between outcrops of mineral-bearing terraces and resource block boundaries

Table 4. Data from MAU boreholes used in the assessment of block A.

Borehole No.	Recorded thickness		Mean grading percentage					
	Mineral (m)	Overburden (m)	Fines -1/16 mm	Fine sand +1/16 -$\frac{1}{4}$mm	Medium sand +$\frac{1}{4}$-1 mm	Coarse sand +1-4 mm	Fine gravel +4-16 mm	Coarse gravel +16 mm
97 NW 15	Absent	-	-	-	-	-	-	-
97 NW 16	1.3	2.5	23	25	36	7	8	1
97 NW 17	2.0	0.3	19	36	18	11	15	1
97 SW 15	4.1	2.8	9	16	25	11	26	13
97 SW 16	5.3	0.3	2	28	36	6	14	14
97 SW 17	4.2	0.3	8	22	19	9	19	23
97 SW 20	7.0	0.5	2	17	22	10	26	23
97 SW 27	1.6	0.2	20	54	23	3	0	0
97 SE 48	2.3	0.2	22	52	23	1	2	0
97 SE 49	1.2	0.3	1	45	45	3	3	3

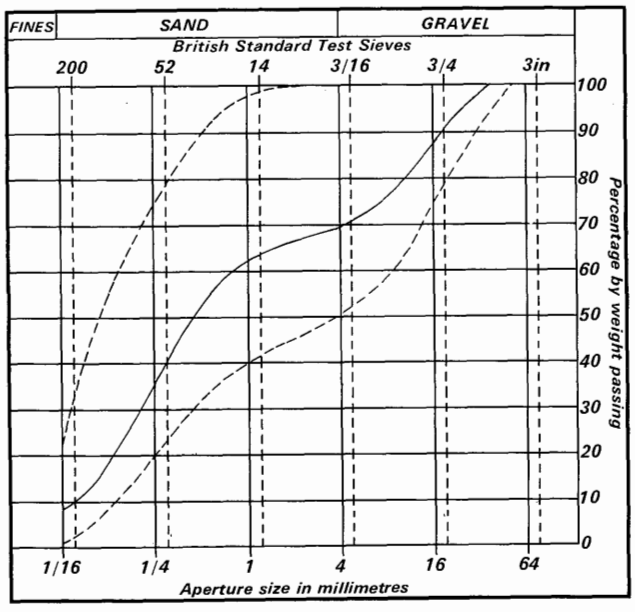


Fig. 6. Grading characteristics of the mineral in block A; the continuous line represents the weighted mean grading of the block; the broken lines denote the envelope within which the mean grading curves for individual boreholes fall

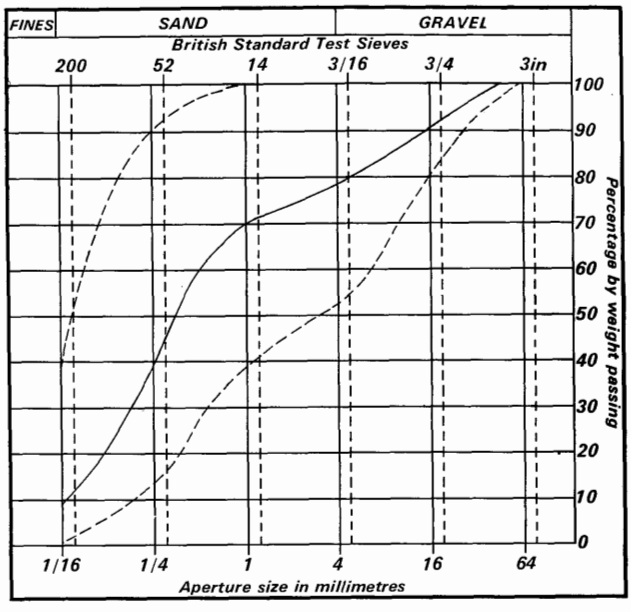


Fig. 7. Grading characteristics of the mineral in block B (For explanation see Fig. 6)

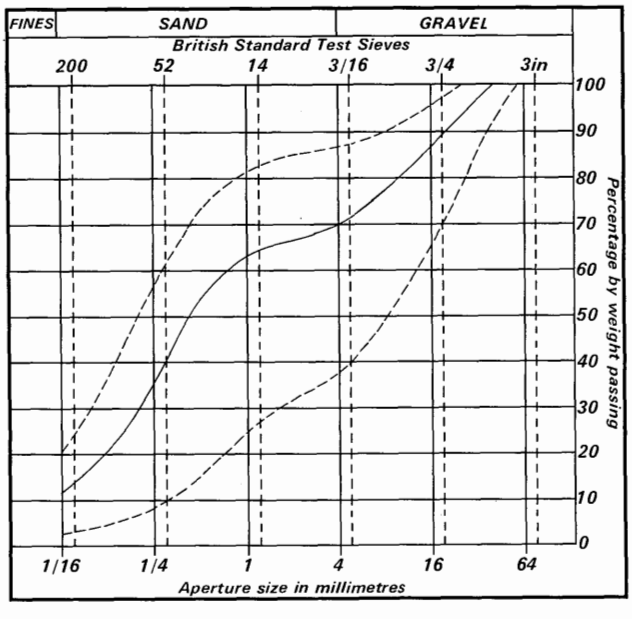


Fig. 8. Grading characteristics of the mineral in block C (For explanation see Fig. 6)

Table 5. Data from MAU boreholes used in the assessment of block B.

Borehole No.	Recorded thickness		Mean grading percentage					
	Mineral (m)	Overburden (m)	Fines -1/16 mm	Fine sand +1/16 -¼mm	Medium sand +¼-1 mm	Coarse sand +1-4 mm	Fine gravel +4-16 mm	Coarse gravel +16 mm
97 NW 14	1.5	2.6	1	13	26	11	35	14
97 SW 12	6.5	0.6	5	26	30	9	17	13
97 SW 13	5.8	2.3	4	14	30	11	24	17
97 SW 14	9.5	0.7	3	23	37	7	18	12
97 SW 18	3.5	1.6	13	26	21	10	15	15
97 SW 19	8.8	0.5	6	34	28	9	17	6
97 SW 22	8.8	0.3	8	25	35	8	14	10
97 SW 28	2.5	1.4	16	51	33	0	0	0
97 SW 29	3.9	1.5	17	67	13	2	1	0
97 SW 30	2.0	1.7	35	49	11	3	2	0
97 SW 31	4.7	0.8	24	67	7	1	1	0
97 SW 32	6.2	0.6	15	39	34	5	7	0
97 SE 50	7.6	1.5	3	18	41	11	16	11
97 SE 51	10.1	0.3	5	28	31	6	20	10
97 SE 52	6.6	2.5	6	23	40	6	13	12

Table 6. Data from MAU boreholes used in the assessment of block C.

Recorded thickness			Mean grading percentage					
Borehole No.	Mineral (m)	Overburden (m)	Fines -1/16 mm	Fine sand +1/16 -¼mm	Medium sand +¼-1 mm	Coarse sand +1-4 mm	Fine gravel +4-16 mm	Coarse gravel +16 mm
96 NW 3	4.4	0.4	12	46	17	4	9	12
96 NW 4	2.6	0.4	17	14	41	7	15	6
96 NW 5	3.1	0.4	16	26	22	4	15	17
96 NW 6	6.2	0.3	8	24	33	8	15	12
96 NW 7	3.4	0.3	17	35	29	5	7	7
96 NW 8	2.8	0.3	4	4	18	13	29	32
96 NW 9	3.8	0.4	14	18	20	6	23	19
97 SW 21	2.7	0.5	17	19	27	9	23	5
97 SW 23	3.6	0.4	6	7	33	13	31	10
97 SW 24	Absent	-	-	-	-	-	-	-
97 SW 25	2.6	0.4	21	30	30	2	9	8
97 SW 26	5.8	0.2	6	24	33	7	16	14

Table 7. Data from MAU boreholes used in the assessment of block D.

Recorded thickness			Mean grading percentage					
Borehole No.	Mineral (m)	Overburden (m)	Fines -1/16 mm	Fine sand +1/16 -¼mm	Medium sand +¼-1 mm	Coarse sand +1-4 mm	Fine gravel +4-16 mm	Coarse gravel +16 mm
96 NW 10	2.6	0.3	7	11	37	9	25	11
96 NW 11	7.2	0.4	1	4	24	13	32	26
96 NW 12	8.5	0	2	11	34	11	24	18
96 NW 13	8.8	0.4	4	8	28	9	26	25
96 NW 14	2.5	0.6	15	6	26	18	23	12
96 NW 15	7.0	0.4	1	5	31	11	28	24
96 NW 16	Absent	-	-	-	-	-	-	-
96 NW 17	9.1	0.4	1	9	43	13	22	12

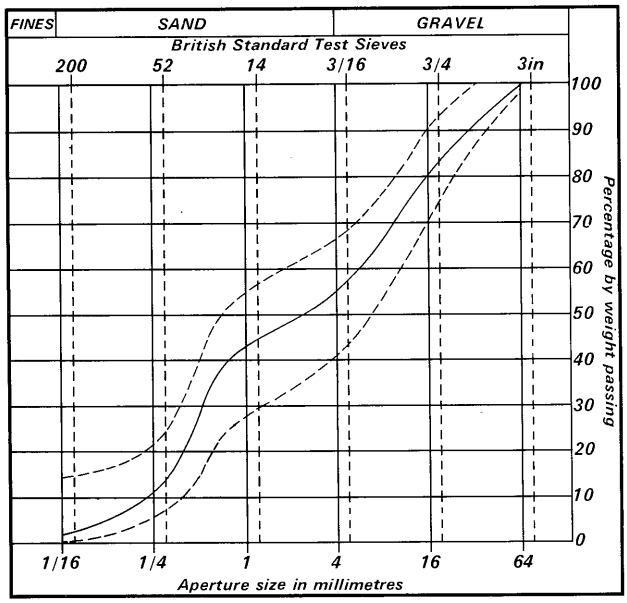


Fig. 9. Grading characteristics of the mineral in block D (For explanation see Fig. 6)

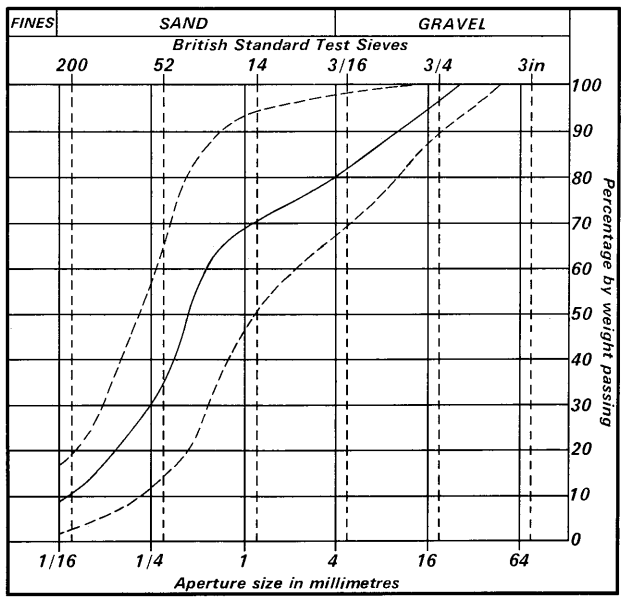


Fig. 10. Grading characteristics of the mineral in block E (For explanation see Fig. 6)

Table 8. Data from MAU boreholes used in the assessment of block E.

Recorded thickness			Mean grading percentage					
Borehole No.	Mineral (m)	Overburden (m)	Fines -1/16 mm	Fine sand +1/16 -$\frac{1}{4}$mm	Medium sand +$\frac{1}{4}$-1 mm	Coarse sand +1-4 mm	Fine gravel +4-16 mm	Coarse gravel +16 mm
FLOODPLAIN TERRACE								
95 NW 7	2.0	0.6	9	13	35	24	19	0
96 SW 6	3.2	0.4	9	24	27	10	22	8
96 SW 7	2.4	0.8	9	53	32	4	2	0
96 SW 10	1.4	1.4	13	8	26	28	24	1
96 SW 12	2.7	0.5	3	16	36	20	21	4
96 SE 13	1.9	0.6	18	39	23	10	9	1
BEESTON TERRACE								
95 NW 5	2.4	0.4	5	8	42	16	25	4
95 NW 8	3.0	0.5	9	30	54	5	2	0
96 SW 9	2.4	0.5	9	10	42	8	21	11
96 SW 11	2.3	0.5	6	13	49	8	13	11

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. 11 and 12.

Inferred Assessment

12. If the sampled area of mineral in a resource block is between 0.25 km² and 2 km² an assessment is inferred, based on geological and topographical information usually supported by the data from one or two boreholes. The volume of mineral is calculated as the product of the area, measured from field data, and the estimated thickness. Confidence limits are not calculated.

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

14. No assessment is attempted for an isolated area of mineral less than 0.25 km².

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

Appendix C: Classification and Description of Sand and Gravel

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

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

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

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

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

Thus it is possible to classify the mineral into one of twelve descriptive categories (see Fig. 13). 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. 24).

Many differing proposals exist for the classification of the grain size of sediments (Atterberg, 1905; Udden, 1914; Wentworth, 1922; Wentworth, 1935; Allen, 1936; Twenhofel, 1937; Lane and others, 1947). As Archer (1970a, b) has emphasised, there is a pressing need for a simple metric scale acceptable to both scientific and engineering interests, for which the class limit sizes correspond closely with certain marked changes in the natural properties of mineral particles. For example, there is an important change in the degree of cohesion between particles at about the $\frac{1}{16}$-mm size, which approximates to the generally accepted boundary between silt and sand. These and other requirements are met by a system based on Udden's geometric scale and a simplified form of Wentworth's terminology (Table 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 ($-\frac{1}{4}$ $+\frac{1}{16}$ mm), medium (-1 $+\frac{1}{4}$ mm) and coarse (-4 $+1$ mm). The boundary at 16 mm distinguishes a range of finer gravel (-16 $+4$ mm), often characterised by abundance of worn tough pebbles of vein quartz, from larger pebbles often of notably different materials. The boundary at 64 mm distinguishes pebbles from cobbles. The term 'gravel' is used loosely to denote both pebble-sized and cobble-sized material.

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

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

The relative proportions of the rock types present in the gravel fraction are indicated by the use of the words 'and' or 'with'. For example, 'flint and quartz' indicates very approximate equal proportions with neither constituent accounting for less than about 25 per cent of the whole; 'flint with quartz' indicates that flint is dominant and quartz, the principal accessory rock 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	
$\frac{1}{16}$mm	Fines (silt and clay)		Fines

Block Calculation — 1:25 000 Block — Fictitious

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

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

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

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

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

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

Fig. 11. Example of resource block assessment: calculations and results

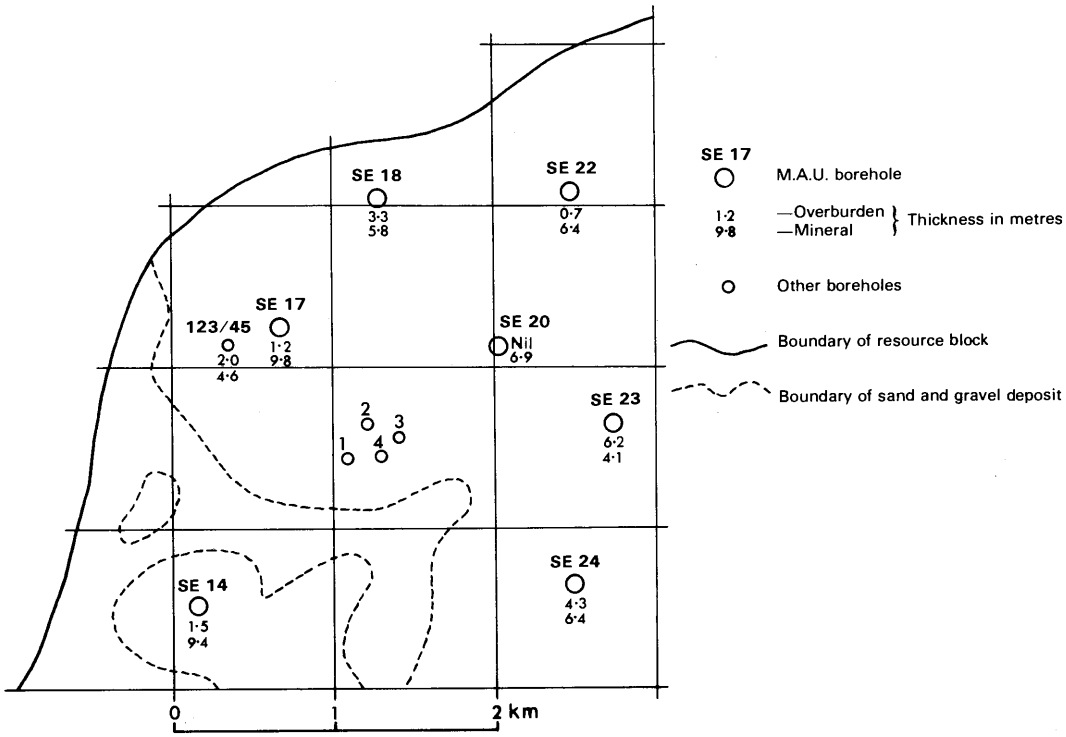


Fig. 12. Example of resource block assessment: map of fictitious block

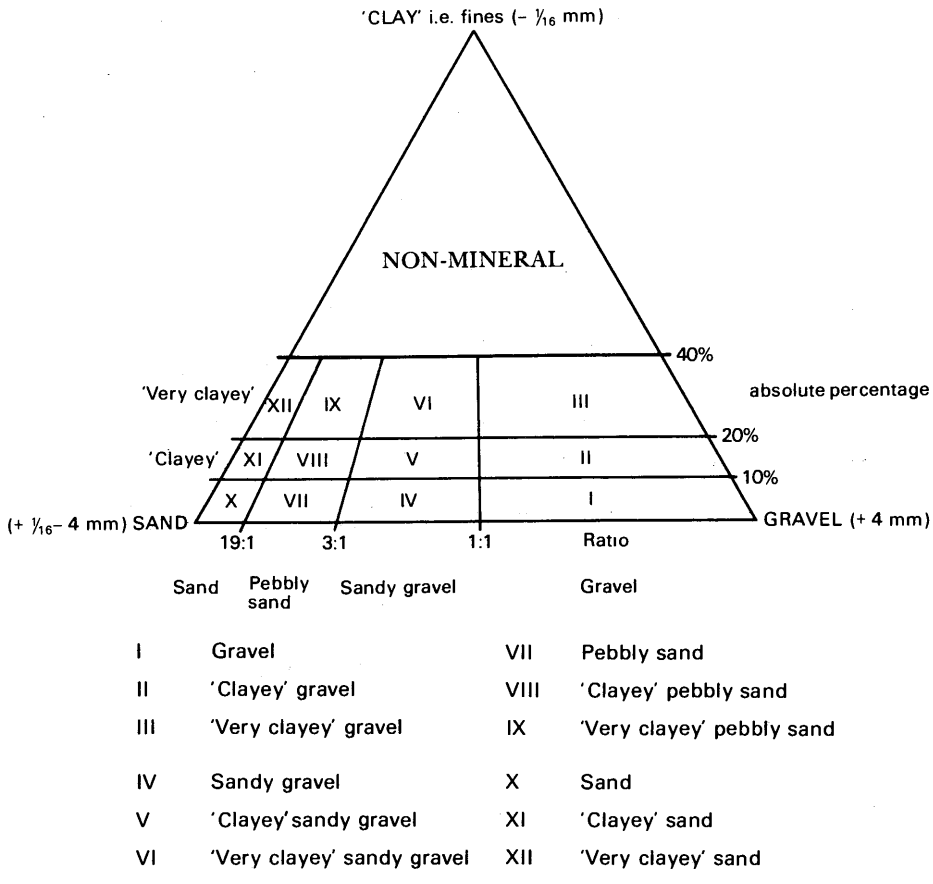


Fig. 13. Diagram showing the descriptive categories used in the classification of sand and gravel

Appendix D: Explanation of the Borehole Records

ANNOTATED EXAMPLE

SK 97 SE 51[1] 9544 7086[2] Swan Pool[3] Block B

Surface level (+3.7 m) +12 ft[4]
Water level +2.9 m (+9.5 ft)[5]
January 1974[6]

Overburden[7] 0.3 m (1.0 ft)
Mineral 10.1 m (33.0 ft)
Bedrock 0.6 m+ (2.0 ft+)[9]

		LOG	Thickness m	(ft)	Depth[8] m	(ft)
		Soil	0.3	(1.0)	0.3	(1.0)
River Terrace[10] Deposits (Floodplain Terrace)	(a)	'Clayey sand[11] Sand: fine quartz Fines: brown, red and blue-grey silt	3.0	(10.0)	3.3	(11.0)
	(b)	Sandy gravel Gravel: fine, rounded quartz and quartzite with angular flint Sand: medium, subangular quartz with coarse angular flint	7.1	(23.5)	10.4	(34.0)
Lower Lias		Mudstone, blue-grey	0.6+	(2.0+)	11.0	(36.0)

GRADING

	%	mm	%
[14]Gravel	30	+16	10
		-16+4	20
Sand	65	-4+1	6
		-1+¼	31
		-¼+1/16	28
Fines	5	-1/16	5

	Depth below[12] surface (m)	Percentage[13] Fines	Sand	Gravel
(a)	0.3 - 1.3	17	83	0
	1.3 - 2.3	14	85	1
	2.3 - 3.3	20	80	0
(b)	3.3 - 4.3	2	86	12
	4.3 - 5.3	0	58	42
	5.3 - 6.3	0	62	38
	6.3 - 7.3	0	37	63
	7.3 - 8.3	1	57	42
	8.3 - 9.3	1	48	51
	9.3 -10.4	0	53	47

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 SK 97.
   2) The quarter of the 1:25 000 sheet on which the borehole lies and the number of the borehole in a series for that quarter, for example SE 51.

Thus the full Registration Number is SK 97 SE 51.

2. The National Grid Reference
All National Grid References in this publication lie within the 100 km square SK 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 1, the level at which groundwater stood on completion of drilling (in metres and feet above OD); or 2, that water was encountered but its level not recorded; or 3, that water was not encountered.

6. Type of Drill and Date of Drilling
Unless otherwise stated, all boreholes were drilled by a Dando 150 shell and auger rig using 6-inch casing. The month and year of completion of the hole 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. Where waste occurs between the surface and mineral it is classified as overburden.

8. Thickness and Depth
All measurements were made in metres. Conversions from metres to feet (shown in brackets) have been rounded off to the nearest 0.5 ft. Where figures have been rounded in this way there may be a discrepancy between the sum of the thicknesses and the recorded depths.

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

10. Geological Classification
The geological classification (page 3) 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; fine, -1/16 mm.

14. Mean Grading
The grading of the full thickness of the mineral horizon identified in the log is the mean of the individual sample gradings weighted by the thicknesses represented, if those 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 No. by sheet quadrant	Grid reference (all fall in 100 km square SK)	Page No.
SK 95 NW		
5	9132 5976	26
6	9210 5971	26
7	9404 5985	27
8	9127 5897	28
9	9347 5902	28
10	9054 5839	29
11	9156 5748	29
12	9229 5701	30
13	9141 5647	30
14	9245 5581	31
15	9144 5547	32
SK 95 NE		
13	9632 5874	32
SK 95 SW		
4	9200 5460	33
5	9072 5333	34
6	9102 5078	35
SK 96 NW		
3	9058 6944	36
4	9123 6976	37
5	9235 6942	38
6	9333 6925	39
7	9056 6882	40
8	9192 6865	41
9	9060 6794	42
10	9275 6800	43
11	9381 6806	44
12	9426 6871	45
13	9112 6613	46
14	9223 6689	47
15	9320 6678	48
16	9265 6545	48
17	9380 6574	49
SK 96 SW		
6	9235 6325	50
7	9461 6325	51
8	9342 6271	52
9	9220 6174	52
10	9402 6194	53
11	9157 6076	54
12	9404 6093	55
SK 96 SE		
13	9303 6198	56
14	9615 6072	56
SK 97 NW		
10	9069 7949	57
11	9058 7858	57
12	9008 7745	57
13	9065 7648	58
14	9141 7581	59
15	9220 7520	59
16	9283 7563	60
17	9372 7561	61
SK 97 SW		
12	9074 7462	62
13	9166 7445	63
14	9263 7403	64
15	9344 7467	65
16	9365 7362	66
17	9499 7364	67
18	9274 7273	68
19	9341 7249	69
20	9457 7265	70
21	9195 7122	71
22	9404 7109	72
23	9036 7031	73
24	9143 7059	74
25	9228 7069	74
26	9353 7040	75
27	9451 7495	76
28	9108 7392	77
29	9211 7345	78
30	9199 7257	79
31	9316 7232	80
32	9461 7077	81
SK 97 SE		
48	9535 7284	82
49	9574 7207	83
50	9518 7150	84
51	9544 7086	85
52	9925 7087	86

OTHER BOREHOLES

SK 96 NW 27; SK 97 SW 1, 3 to 5, 9 and 10, SK 97 SE 1, 29 and 30; and 3 confidential records.

Appendix F: Mineral Assessment Unit Borehole Records

SK 95 NW 5 — 9132 5976 — Bassingham — Block E

Surface level (+14.3 m) +47 ft
Water level +11.8 m (+38.5 ft)
December 1973

Overburden 0.4 m (1.5 ft)
Mineral 2.4 m (8.0 ft)
Bedrock 1.2 m+ (4.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Older River Sand and Gravel (Beeston Terrace)	Sandy gravel Gravel: fine, subangular chert and rounded quartz, with some quartzite and mudstone Sand: medium, subangular to rounded quartz with angular chert	2.4	(8.0)	2.8	(9.0)
Lower Lias	Mudstone, with thin shelled bivalves	1.2+	(4.0+)	4.0	(13.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	29	+16	4
		-16 + 4	25
Sand	66	-4 + 1	16
		-1 + ¼	42
		-¼ + 1/16	8
Fines	5	-1/16	5

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.4 - 1.4	10	54	36
1.4 - 2.8	2	74	24

SK 95 NW 6 — 9210 5971 — Torgate Lane, Bassingham — Block E

Surface level (+13.1 m) +43 ft
Water not encountered
December 1973

Waste 2.3 m (7.5 ft)
Bedrock 1.7 m+ (5.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.3	(1.0)	0.3	(1.0)
Older River Sand and Gravel (Beeston Terrace)	Clayey silt, slightly sandy at top, ochreous-brown to light grey, laminated	2.0	(6.5)	2.3	(7.5)
Lower Lias	Mudstone, blue-grey, laminated, with thin shelled bivalves	1.7+	(5.5+)	4.0	(13.0)

SK 95 NW 7 9404 5985 Wirelock Block E

Surface level (+6.1 m) +20 ft
Water not encountered
November 1973

Overburden 0.6 m (2.0 ft)
Mineral 2.0 m (6.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.6	(2.0)	0.6	(2.0)
River Terrace Deposits (Flood-plain Terrace)	Pebbly sand, 'clayey' in lower part Gravel: fine, chert with mudstone and quartzite Sand: medium, subrounded quartz with mudstone and chert	2.0	(6.5)	2.6	(8.5)
Lower Lias	Mudstone, blue-grey, slightly micaceous	1.0+	(3.5+)	3.6	(12.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	19	+16	0
		-16 + 4	19
Sand	72	-4 + 1	24
		-1 + $\frac{1}{4}$	35
		-$\frac{1}{4}$ + 1/16	13
Fines	9	-1/16	9

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.6 - 1.6	3	75	22
1.6 - 2.6	15	69	16

SK 95 NW 8 9127 5897 Sands Lane, Bassingham Block E

Surface level (+14.3 m) +47 ft
Water level +12.3 m (+40.5 ft)
December 1973

Overburden 0.5 m (1.5 ft)
Mineral 3.0 m (10.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.5	(1.5)	0.5	(1.5)
Older River Sand and Gravel (Beeston Terrace)	Sand: silty and pebbly at top, medium and fine, rounded to well rounded quartz	3.0	(10.0)	3.5	(11.5)
Lower Lias	Mudstone, dark blue-grey, with thin shelled bivalves	1.0+	(3.5+)	4.5	(15.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	2	+16	0
		-16 + 4	2
Sand	89	-4 + 1	5
		-1 + $\frac{1}{4}$	54
		-$\frac{1}{4}$ + 1/16	30
Fines	9	-1/16	9

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.5 - 1.5	20	76	4
1.5 - 3.5	3	96	1

SK 95 NW 9 9347 5902 Bassingham Fen Block E

Surface level (+6.7 m) +22 ft
Water not encountered
November 1973

Waste 1.9 m (6.0 ft)
Bedrock 1.1 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.7	(2.5)	0.7	(2.5)
River Terrace Deposits (Flood-plain Terrace)	Pebbly sandy silt	1.2	(4.0)	1.9	(6.5)
Lower Lias	Mudstone, blue-grey, slightly micaceous	1.1+	(3.5+)	3.0	(10.0)

SK 95 NW 10 9054 5839 Back Lane, Carlton le Moorland Block E

Surface level (+14.6 m) +48 ft
Water not encountered
November 1973

Waste 1.1 m (3.5 ft)
Bedrock 1.4 m+ (4.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.8	(2.5)	0.8	(2.5)
Older River Sand and Gravel (Beeston Terrace)	'Clayey' gravel Gravel: subrounded quartzite with some quartz and mudstone Sand: medium, subrounded quartz with subangular chert and some mudstone	0.3	(1.0)	1.1	(3.5)
Lower Lias	Mudstone, blue-grey, slightly micaceous	1.4+	(4.5+)	2.5	(8.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	46	+16	17
		-16 + 4	29
Sand	44	-4 + 1	7
		-1 + $\frac{1}{4}$	30
		-$\frac{1}{4}$ + 1/16	7
Fines	10	-1/16	10

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.8 - 1.1	10	44	46

SK 95 NW 11 9156 5748 Pinfold Lane, Carlton le Moorland

Surface level (+8.8 m) +29 ft
Water not encountered
November 1973

Waste 1.2 m (4.0 ft)
Bedrock 1.3 m+ (4.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
River Terrace Deposits (Flood-plain Terrace)	Silty clay, sandy at top	0.8	(2.5)	1.2	(4.0)
Lower Lias	Mudstone, blue-grey	1.3+	(4.5+)	2.5	(8.0)

SK 95 NW 12 9229 5701 Pinfold Lane, Carlton le Moorland

Surface level (+9.2 m) +30 ft
Water not encountered
November 1973

Waste 1.2 m (4.0 ft)
Bedrock 0.8 m+ (2.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.6	(2.0)	0.6	(2.0)
River Terrace Deposits (Flood-plain Terrace)	'Clayey' pebbly sand Gravel: fine, subangular chert with subrounded quartzite and some mudstone Sand: medium, subrounded quartz with some subangular chert and sandstone	0.6	(2.0)	1.2	(4.0)
Lower Lias	Mudstone, blue-grey	0.8+	(2.5+)	2.0	(6.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	22	+16	0
		-16 + 4	22
Sand	67	-4 + 1	16
		-1 + $\frac{1}{4}$	37
		-$\frac{1}{4}$ + 1/16	14
Fines	11	-1/16	11

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.6 - 1.2	11	67	22

SK 95 NW 13 9141 5647 Brigg Lane, Carlton le Moorland

Surface level (+9.5 m) +31 ft
Water not encountered
November 1973

Waste 2.5 m (8.0 ft)
Bedrock 0.7 m+ (2.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.7	(2.5)	0.7	(2.5)
River Terrace Deposits (Flood-plain Terrace)	Clay, light blue-grey with yellow-brown silt laminations	1.8	(6.0)	2.5	(8.5)
Lower Lias	Mudstone, dark blue-grey, massive	0.7+	(2.5+)	3.2	(10.5)

SK 95 NW 14 9245 5581 Carlton Lowfield Farm

Surface level (+8.8 m) +29 ft
Water level +7.6 m (+25 ft)
November 1973

Waste 0.7 m (2.5 ft)
Bedrock 0.9 m+ (3.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
River Terrace Deposits (Flood-plain Terrace)	'Clayey' pebbly sand Gravel: subangular chert with subrounded quartzite and some quartz Sand: medium, subrounded to rounded quartz with subangular chert and tabular mudstone	0.3	(1.0)	0.7	(2.5)
Lower Lias	Mudstone, blue-grey, massive	0.9+	(3.0+)	1.6	(5.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	19	+16	0
		-16 + 4	19
Sand	71	-4 + 1	18
		-1 + $\frac{1}{4}$	40
		-$\frac{1}{4}$ + 1/16	13
Fines	10	-1/16	10

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.4 - 0.7	10	71	19

SK 95 NW 15 9144 5547 The Cottage, Brant Broughton

Surface level (+10.7 m) +35 ft
Water not encountered
November 1973

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

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.6	(2.0)	0.6	(2.0)
River Terrace Deposits (Flood-plain Terrace)	Sandy gravel Gravel: quartzite and chert Sand: medium and coarse, subrounded quartz with some subangular chert	0.4	(1.5)	1.0	(3.5)
Lower Lias	Mudstone, grey-green, weathered and massive	1.0+	(3.5+)	2.0	(6.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	28	+16	0
		-16 + 4	28
Sand	72	-4 + 1	28
		-1 + $\frac{1}{4}$	37
		-$\frac{1}{4}$ + 1/16	7
Fines	0	-1/16	0

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.6 - 1.0	0	72	28

SK 95 NE 13 9632 5874 Somerton Castle

Surface level (+14.3 m) +47 ft
Water not encountered
December 1973

Waste 2.2 m (7.0 ft)
Bedrock 1.2 m+ (4.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.7	(2.5)	0.7	(2.5)
River Terrace Deposits (Flood-plain Terrace)	Silt, clayey near base, slightly sandy at top with some pebbles	1.5	(5.0)	2.2	(7.0)
Lower Lias	Mudstone, blue-grey	1.2+	(4.0+)	3.4	(11.0)

SK 95 SW 4 9200 5460 Manor House, Brant Broughton

Surface level (+10.4 m) +34 ft
Water not encountered
November 1973

Waste 1.1 m (3.5 ft)
Bedrock 0.9 m+ (3.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.7	(2.5)	0.7	(2.5)
River Terrace Deposits (Flood-plain Terrace)	'Clayey' sandy gravel Gravel: fine, quartzite Sand: medium, subrounded quartz with angular chert and tabular mudstone Fines: brown silt	0.4	(1.5)	1.1	(3.5)
Lower Lias	Mudstone, blue-grey, massive	0.9+	(3.0+)	2.0	(6.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	26	+16	1
		-16 + 4	25
Sand	64	-4 + 1	16
		-1 + $\frac{1}{4}$	32
		-$\frac{1}{4}$ + 1/16	16
Fines	10	-1/16	10

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.7 - 1.1	10	64	26

SK 95 SW 5 9072 5333 The Holmes, Brant Broughton

Surface level (+12.5 m) +41 ft
Water not encountered
November 1973

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

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.5	(1.5)	0.5	(1.5)
River Terrace Deposits (Flood-plain Terrace)	'Clayey' pebbly sand Gravel: fine, subrounded quartzite with some angular chert Sand: medium, quartz with some subangular chert and tabular mudstone Fines: grey-brown silt	0.5	(1.5)	1.0	(3.5)
Lower Lias	Mudstone, blue-grey, massive	1.0+	(3.5+)	2.0	(6.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	19	+16	1
		-16 + 4	18
Sand	66	-4 + 1	13
		-1 + $\frac{1}{4}$	37
		-$\frac{1}{4}$ + 1/16	16
Fines	15	-1/16	15

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.5 - 1.0	15	66	19

SK 95 SW 6 9102 5078 Fulbeck Grange

Surface level (+16.8 m) +55 ft
Water not encountered
November 1973

Waste 1.1 m (3.5 ft)
Bedrock 1.4 m+ (4.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.6	(2.0)	0.6	(2.0)
River Terrace Deposits (Flood-plain Terrace)	'Clayey' pebbly sand Gravel: quartz and chert Sand: fine and medium, subrounded quartz with some chert and mudstone Fines: brown silt	0.5	(1.5)	1.1	(3.5)
Lower Lias	Mudstone, blue-grey, massive	1.4+	(4.5+)	2.5	(8.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	8	+16	2
		-16 + 4	6
Sand	75	-4 + 1	6
		-1 + $\frac{1}{4}$	31
		-$\frac{1}{4}$ + 1/16	38
Fines	17	-1/16	17

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.6 - 1.1	17	75	8

Surface level (+26.5 m) +87 ft
Water level +23.5 m (+77 ft)
November 1973

Overburden 0.4 m (1.5 ft)
Mineral 2.0 m (6.5 ft)
Waste 1.0 m (3.5 ft)
Mineral 2.4 m (8.0 ft)
Waste 0.7 m (2.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.4	(1.5)	0.4	(1.5)
Older River Sand and Gravel (Hilton Terrace)	a)	Sandy gravel Gravel: fine and coarse, subrounded quartzite with subangular chert and rounded quartz Sand: medium, subrounded to rounded quartz with some coarse chert and lithic grains	2.0	(6.5)	2.4	(8.0)
		Sandy silt	1.0	(3.5)	3.4	(11.0)
	b)	'Very clayey' sand Sand: fine, rounded quartz with few lithic grains	2.4	(8.0)	5.8	(19.0)
		Clayey silt, red-brown, laminated	0.7	(2.5)	6.5	(21.5)
Lower Lias		Mudstone, dark grey, laminated, with thin shelled bivalves	1.0+	(3.5+)	7.5	(24.5)

GRADING

Mean for Deposit

	%	mm	%
a)			
Gravel	48	+16	27
		-16 + 4	21
Sand	50	-4 + 1	7
		-1 + ¼	35
		-¼ + 1/16	8
Fines	2	-1/16	2
b)			
Gravel	0	+16	0
		-16 + 4	0
Sand	79	-4 + 1	0
		-1 + ¼	2
		-¼ + 1/16	77
Fines	21	-1/16	21

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.4 - 1.4	3	66	31
1.4 - 2.4	1	35	64
3.4 - 4.4	17	83	0
4.4 - 5.8	24	76	0

SK 96 NW 4 9123 6976 Gilberts Plot Block C

Surface level (+23.5 m) +77 ft
Water level not recorded
December 1973

Overburden 0.4 m (1.5 ft)
Mineral 2.6 m (8.5 ft)
Waste 6.6 m (21.5 ft)
Bedrock 0.7 m+ (2.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Older River Sand and Gravel (Hilton Terrace)	'Clayey' pebbly sand Gravel: well rounded quartzite and quartz with subrounded chert and some sandstone Sand: medium, well rounded quartz with some lithic grains	2.6	(8.5)	3.0	(10.0)
	Clayey silt, red-brown, laminated, with a grey colour after 7.0 m	6.6	(21.5)	9.6	(31.5)
Lower Lias	Mudstone, dark grey, with cephalopods and bivalves	0.7+	(2.5+)	10.3	(34.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	21	+16	6
		-16 + 4	15
Sand	62	-4 + 1	7
		-1 + $\frac{1}{4}$	41
		-$\frac{1}{4}$ + 1/16	14
Fines	17	-1/16	17

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.4 - 1.4	19	61	20
1.4 - 3.0	16	62	22

SK 96 NW 5 9235 6942 Farm Belt Block C

Surface level (+20.7 m) +68 ft
Water level +16.7 m (+55 ft)
November 1973

Overburden 0.4 m (1.5 ft)
Mineral 3.1 m (10.0 ft)
Waste 2.8 m (9.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Older River Sand and Gravel (Hilton Terrace)	'Clayey' sandy gravel Gravel: fine and coarse, well rounded quartzite and quartz with subangular chert, rounded sandstone and mudstone Sand: medium and fine, rounded to well rounded quartz with few lithic grains	3.1	(10.0)	3.5	(11.5)
	Silty clay, red-brown, laminated, sandy towards base	2.8	(9.0)	6.3	(20.5)
Lower Lias	Mudstone, grey, with bivalves	1.0+	(3.5+)	7.3	(24.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	32	+16	17
		-16 + 4	15
Sand	52	-4 + 4	4
		-1 + $\frac{1}{4}$	22
		-$\frac{1}{4}$ + 1/16	26
Fines	16	-1/16	16

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.4 - 1.4	17	47	36
1.4 - 2.4	16	67	17
2.4 - 3.5	16	42	42

SK 96 NW 6 9333 6925 Disused Airfield, Lincoln Block C

Surface level (+17.4 m) +57 ft
Water level +14.4 m (+47 ft)
January 1974

Overburden 0.3 m (1.0 ft)
Mineral 6.2 m (20.5 ft)
Waste 5.5 m (18.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.3	(1.0)	0.3	(1.0)
Older River Sand and Gravel (Hilton Terrace)	a)	Sandy gravel Gravel: fine, rounded quartz and quartzite with rounded sandstone and some angular flint Sand: medium, subangular quartz with quartzite and angular flint	2.9	(9.5)	3.2	(10.5)
	b)	'Clayey' sand, with some pebbles Sand: fine to medium, quartz with coarse flint Fines: clay bands, red-brown with black organic remains	2.1	(7.0)	5.3	(17.5)
	c)	Gravel, 'clayey' towards base Gravel: coarse, rounded quartz and quartzite with subangular flint Sand: medium, quartz	1.2	(4.0)	6.5	(21.5)
		Clay, red-brown, laminated with mudstone pebbles and sandy layers	5.5	(18.0)	12.0	(39.5)
Lower Lias		Clay, blue-grey, with mudstone fragments	1.0+	(3.5+)	13.0	(42.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	27	+16	12
		-16 + 4	15
Sand	65	-4 + 1	8
		-1 + $\frac{1}{4}$	33
		-$\frac{1}{4}$ + 1/16	24
Fines	8	-1/16	8

Bulk Samples

	Depth below surface (m)	Percentages Fines	Sand	Gravel
a)	0.3 - 1.3	2	58	40
	1.3 - 2.3	2	68	30
	2.3 - 3.2	13	64	23
b)	3.2 - 4.3	7	92	1
	4.3 - 5.3	20	77	3
c)	5.3 - 6.3	1	36	63
	6.3 - 6.5	11	30	59

SK 96 NW 7 9056 6882 Old Orchard, Doddington Block C

Surface level (+28.7 m) +94 ft
Water level +25.7 m (+84.5 ft)
November 1973

Overburden 0.3 m (1.0 ft)
Mineral 3.4 m (11.0 ft)
Waste 3.8 m (12.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.3	(1.0)	0.3	(1.0)
Older River Sand and Gravel (Hilton Terrace)	'Clayey' pebbly sand, with 'very clayey' sand between 1.3 and 2.3 m Gravel: fine and coarse, subrounded to well rounded quartzite and quartz with chert and some mudstone Sand: fine and medium, rounded to well rounded quartz Fines: ochreous silt bands	3.4	(11.0)	3.7	(12.0)
	Silty clay, laminated, red-brown with some light grey bands	3.8	(12.5)	7.5	(24.5)
Lower Lias	Mudstone, dark grey, with bivalve impressions	1.0+	(3.5+)	8.5	(28.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	14	+16	7
		-16 + 4	7
Sand	69	-4 + 1	5
		-1 + $\frac{1}{4}$	29
		-$\frac{1}{4}$ + 1/16	35
Fines	17	-1/16	17

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.3 - 1.3	16	68	16
1.3 - 2.3	22	78	0
2.3 - 3.7	14	63	23

SK 96 NW 8 9192 6865 Cinder Plot Block C

Surface level (+20.7 m) +68 ft
Water level +19.3 m (+63.5 ft)
December 1973

Overburden 0.3 m (1.0 ft)
Mineral 2.8 m (9.0 ft)
Bedrock 1.6 m+ (5.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.3	(1.0)	0.3	(1.0)
Older River Sand and Gravel (Hilton Terrace)	Gravel, with ochreous silt Gravel: fine and coarse, well rounded quartzite with quartz and some sandstone, mudstone and subrounded chert. Average size increases with depth Sand: medium, subrounded to well rounded quartz with subangular chert and some rounded sandstone	2.8	(9.0)	3.1	(10.0)
Lower Lias	Mudstone, blue-grey	1.6+	(5.0+)	4.7	(15.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	61	+16	32
		-16 + 4	29
Sand	35	-4 + 1	13
		-1 + $\frac{1}{4}$	18
		-$\frac{1}{4}$ + 1/16	4
Fines	4	-1/16	4

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.3 - 1.3	1	38	61
1.3 - 2.3	10	38	52
2.3 - 3.1	1	26	73

Surface level (+29.3 m) +96.0 ft
Water level +28.3 m (+93.0 ft)
November 1973

Overburden 0.4 m (1.5 ft)
Mineral 3.8 m (12.5 ft)
Waste 0.2 m (0.5 ft)
Bedrock 1.1 m+ (3.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.4	(1.5)	0.4	(1.5)
Older River Sand and Gravel (Hilton Terrace)	a)	'Very clayey' sandy gravel Gravel: coarse, well rounded quartzite and quartz with subrounded chert Sand: fine, subrounded to well rounded quartz with some coarse lithic grains Fines: ochreous-brown silt with light grey-green and black laminations	2.0	(6.5)	2.4	(8.0)
	b)	Gravel Gravel: fine, well rounded quartzite, with some quartz and subangular, subrounded chert Sand: medium, subrounded to well rounded quartz with mudstone and other lithic grains	1.8	(6.0)	4.2	(14.0)
		Clayey silt, red-brown	0.2	(0.5)	4.4	(14.5)
Lower Lias		Mudstone, dark grey, with bivalves	1.1+	(3.5+)	5.5	(18.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	42	+16	19
		-16 + 4	23
Sand	44	-4 + 1	6
		-1 + $\frac{1}{4}$	20
		-$\frac{1}{4}$ + 1/16	18
Fines	14	-1/16	14

Bulk Samples

	Depth below surface (m)	Percentages Fines	Sand	Gravel
a)	0.4 - 1.4	20	48	32
	1.4 - 2.4	22	52	26
b)	2.4 - 3.4	2	39	59
	3.4 - 4.2	10	32	58

SK 96 NW 10 9275 6800 Whisby Farm Block D

Surface level (+15.2 m) +50 ft
Water level +13.2 m (+43.5 ft)
November 1973

Overburden 0.3 m (1.0 ft)
Mineral 2.6 m (8.5 ft)
Waste 1.1 m (3.5 ft)
Bedrock 1.4 m+ (4.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.3	(1.0)	0.3	(1.0)
Older River Sand and Gravel (Beeston Terrace)	Sandy gravel Gravel: fine, rounded to well rounded quartzite and some subangular chert and rounded mudstone Sand: medium, subangular to rounded quartz with some subangular chert and rounded mudstone	2.6	(8.5)	2.9	(9.5)
	Clayey silt, dark blue-grey, with pebbles of siltstone and white limestone in a plastic matrix	1.1	(3.5)	4.0	(13.0)
Lower Lias	Mudstone, light grey, with bivalves	1.4+	(4.5+)	5.4	(17.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	36	+16	11
		-16 + 4	25
Sand	57	-4 + 1	9
		-1 + $\frac{1}{4}$	37
		-$\frac{1}{4}$ + 1/16	11
Fines	7	-1/16	7

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.3 - 1.3	2	79	19
1.3 - 2.9	11	43	46

SK 96 NW 11 9381 6806 Hykeham Station Block D

Surface level (+10.7 m) +35 ft
Water level +8.7 m (+28.5 ft)
January 1974

Overburden 0.4 m (1.5 ft)
Mineral 7.2 m (23.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Older River Sand and Gravel (Beeston Terrace)	Gravel Gravel: fine, well rounded quartzite with some well rounded quartz, subangular to rounded chert and occasional rounded fragments of fossiliferous limestone and mudstone Sand: medium, quartz with some coarse angular to subrounded rock fragments	7.2	(23.5)	7.6	(25.0)
Lower Lias	Mudstone, dark blue-grey, compact, clayey	1.0+	(3.5+)	8.6	(28.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	58	+16	26
		-16 + 4	32
Sand	41	-4 + 1	13
		-1 + $\frac{1}{4}$	24
		-$\frac{1}{4}$ + 1/16	4
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.4 - 1.4	1	50	49
1.4 - 2.4	1	40	59
2.4 - 3.4	1	61	38
3.4 - 4.4	0	36	64
4.4 - 5.4	1	32	67
5.4 - 6.4	0	34	66
6.4 - 7.6	0	35	65

SK 96 NW 12 9426 6871 Hartsholme Wood Block D

Surface level (+11.6 m) +38 ft
Water level +9.0 m (+29.5 ft)
January 1974

Mineral 6.3 m (20.5 ft)
Waste 1.5 m (5.0 ft)
Mineral 2.2 m (7.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
Older River Sand and Gravel (Beeston Terrace)	a)	Sandy gravel Gravel: fine, subrounded quartzite and subangular chert, with quartz and some sandstone Sand: medium, subrounded quartz, with chert and lithic grains	6.3	(20.5)	6.3	(20.5)
		Silt, grey-brown, massive to poorly laminated, slightly micaceous with thin carbonaceous lenses	1.5	(5.0)	7.8	(25.5)
	b)	Gravel, with thin clay band at 8.2 m Gravel: coarse, subrounded quartzite, with subangular chert, and some quartz and sandstone Sand: medium, quartz with coarse lithic grains	2.2	(7.0)	10.0	(33.0)
Lower Lias		Mudstone, blue-grey, massive	1.0+	(3.5+)	11.0	(36.0)

GRADING

Mean for Deposit

a)	%	mm	%
Gravel	38	+16	16
		-16 + 4	22
Sand	60	-4 + 1	10
		-1 + ¼	36
		-¼ + 1/16	14
Fines	2	-1/16	2
b)			
Gravel	55	+16	31
		-16 + 4	24
Sand	44	-4 + 1	16
		-1 + ¼	26
		-¼ + 1/16	2
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.0 - 1.0	3	79	18
1.0 - 2.0	6	47	47
2.0 - 3.0	2	57	41
3.0 - 4.0	1	71	28
4.0 - 5.0	1	51	48
5.0 - 6.0	2	55	43
6.0 - 6.3	1	68	31
7.8 - 8.8	1	39	60
8.8 - 10.0	1	48	51

SK 96 NW 13 9112 6613 Moor Lane Block D

Surface level (+12.8 m) + 42 ft
Water level +9.8 m (+32 ft)
December 1973

Overburden 0.4 m (1.5 ft)
Mineral 8.8 m (29.0 ft)
Bedrock 0.8 m+ (2.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Older River Sand and Gravel (Beeston Terrace)	Gravel, sandy in upper part and with ochreous-brown silt at top Gravel: fine and coarse, well rounded to rounded quartzite and quartz, with subangular chert and some rounded mudstone, limestone and sandstone Sand: medium, rounded to well rounded quartz and subangular to well rounded rock fragments	8.8	(29.0)	9.2	(30.0)
Lower Lias	Mudstone, soft, blue-grey, with thin shelled bivalves	0.8+	(2.5+)	10.0	(33.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	51	+16	25
		-16 + 4	26
Sand	45	-4 + 1	9
		-1 + $\frac{1}{4}$	28
		-$\frac{1}{4}$ + 1/16	8
Fines	4	-1/16	4

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.4 - 1.4	14	60	26
1.4 - 2.4	11	45	44
2.4 - 3.4	8	51	41
3.4 - 4.4	1	61	38
4.4 - 5.4	1	36	63
5.4 - 6.4	0	34	66
6.4 - 7.4	0	34	66
7.4 - 8.4	1	48	51
8.4 - 9.2	1	38	61

SK 96 NW 14 9223 6689 Low Moor Plantation Block D

Surface level (+12.2 m) +40 ft
Water level +10.7 m (+35 ft)
November 1973

Overburden 0.6 m (2.0 ft)
Mineral 2.5 m (8.0 ft)
Bedrock 1.2 m+ (4.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.6	(2.0)	0.6	(2.0)
Older River Sand and Gravel (Beeston Terrace)	'Clayey' sandy gravel Gravel: fine, subrounded to well rounded quartzite and quartz with chert and sandstone Sand: medium, rounded quartz with some coarse lithic grains Fines: grey-brown silt	2.5	(8.0)	3.1	(10.0)
Lower Lias	Mudstone, blue-grey, with thin shelled bivalves	1.2+	(4.0+)	4.3	(14.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	35	+16	12
		-16 + 4	23
Sand	50	-4 + 1	18
		-1 + $\frac{1}{4}$	26
		-$\frac{1}{4}$ + 1/16	6
Fines	15	-1/16	15

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.6 - 1.6	21	46	33
1.6 - 3.1	11	53	36

SK 96 NW 15 9320 6678 Hykeham Moor Block D

Surface level (+10.4 m) +34 ft
Water level +9.4 m (+31 ft)
November 1973

Overburden 0.4 m (1.5 ft)
Mineral 7.0 m (23.0 ft)
Bedrock 1.2 m+ (4.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Older River Sand and Gravel (Beeston Terrace)	Gravel, sandy in upper part Gravel: fine and coarse, subrounded to well rounded quartzite with quartz and chert and some limestone, sandstone and mudstone Sand: medium, rounded to well rounded quartz with some coarse lithic grains	7.0	(23.0)	7.4	(24.5)
Lower Lias	Mudstone, dark grey, micaceous, with cephalopods and thin shelled bivalves	1.2+	(4.0+)	8.6	(28.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	52	+16	24
		-16 + 4	28
Sand	47	-4 + 1	11
		-1 + $\frac{1}{4}$	31
		-$\frac{1}{4}$ + 1/16	5
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.4 - 1.4	2	79	19
1.4 - 2.4	3	55	42
2.4 - 3.4	1	57	42
3.4 - 4.4	0	31	69
4.4 - 5.4	0	31	69
5.4 - 6.4	0	30	70
6.4 - 7.4	2	43	55

SK 96 NW 16 9265 6545 Broom House Block D

Surface level (+10.7 m) +35 ft
Water not encountered
November 1973

Waste 2.8 m (9.0 ft)
Bedrock 1.8 m+ (6.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.3	(1.0)	0.3	(1.0)
Older River Sand and Gravel (Beeston Terrace)	Sandy silt: fine sand with a yellow silt to 1.5 m; clayey silt with sand and pebbles, becoming blue-grey in colour, below	2.5	(8.0)	2.8	(9.0)
Lower Lias	Mudstone, light grey becoming dark grey, laminated, with thin shelled bivalves	1.8+	(6.0+)	4.6	(15.0)

SK 96 NW 17 9380 6574 Chapel Farm Block D

Surface level (+12.2 m) +40 ft
Water level +9.7 m (+32 ft)
November 1973

Overburden 0.4 m (1.5 ft)
Mineral 9.1 m (30.0 ft)
Bedrock 0.9 m+ (3.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.4	(1.5)	0.4	(1.5)
Older River Sand and Gravel (Beeston Terrace)	a)	Sandy gravel, with a little orange-brown silt Gravel: fine, well rounded quartzite and quartz with subrounded to well rounded chert Sand: medium, rounded to well rounded quartz	4.0	(13.0)	4.4	(14.5)
	b)	Sand: medium, rounded to well rounded quartz, with some fine gravel in first metre	2.0	(6.5)	6.4	(21.0)
	c)	Gravel Gravel: fine, well rounded quartzite and quartz with subrounded chert and some sandstone and siltstone Sand: medium, well rounded quartz with some coarse rounded lithic grains	3.1	(10.0)	9.5	(31.0)
Lower Lias		Mudstone, blue-grey	0.9+	(3.0+)	10.4	(34.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	34	+16	12
		-16 + 4	22
Sand	65	-4 + 1	13
		-1 + $\frac{1}{4}$	43
		-$\frac{1}{4}$ + 1/16	9
Fines	1	-1/16	1

Bulk Samples

	Depth below surface (m)	Percentages Fines	Sand	Gravel
a)	0.4 - 1.4	2	78	20
	1.4 - 2.4	2	73	25
	2.4 - 3.4	1	59	40
	3.4 - 4.4	1	61	38
b)	4.4 - 5.4	1	93	6
	5.4 - 6.4	1	98	1
c)	6.4 - 7.4	2	54	44
	7.4 - 8.4	1	34	65
	8.4 - 9.5	1	39	60

SK 96 SW 6 9235 6325 Haddington Block E

Surface level (+7.3 m) +24 ft
Water level +5.8 m (+19 ft)
November 1973

Overburden 0.4 m (1.5 ft)
Mineral 3.2 m (10.5 ft)
Bedrock 1.2 m+ (4.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.4	(1.5)	0.4	(1.5)
River Terrace Deposits (Flood-plain Terrace)	a)	Sand: medium and fine, rounded to well rounded quartz	1.0	(3.5)	1.4	(4.5)
	b)	'Clayey' sandy gravel Gravel: fine, rounded to well rounded quartzite with quartz, chert and shell fragments Sand: medium, quartz	2.2	(7.0)	3.6	(12.0)
Lower Lias		Mudstone, grey, laminated	1.2+	(4.0+)	4.8	(15.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	30	+16	8
		-16 + 4	22
Sand	61	-4 + 1	10
		-1 + $\frac{1}{4}$	27
		-$\frac{1}{4}$ + 1/16	24
Fines	9	-1/16	9

Bulk Samples

	Depth below surface (m)	Percentages Fines	Sand	Gravel
a)	0.4 - 1.4	4	95	1
b)	1.4 - 2.4	23	50	27
	2.4 - 3.6	0	41	59

SK 96 SW 7 9461 6325 Blackmoor Farm Block E

Surface level (+6.4 m) +21 ft
Water level +3.9 m (+13 ft)
December 1973

Overburden 0.8 m (2.5 ft)
Mineral 0.9 m (3.0 ft)
Waste 0.8 m (2.5 ft)
Mineral 1.5 m (5.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.8	(2.5)	0.8	(2.5)
River Terrace Deposits (Flood-plain Terrace)	a)	'Clayey' sand Sand: fine, subrounded to well rounded quartz Fines: grey-green silt	0.9	(3.0)	1.7	(5.5)
		Clayey silt, grey	0.8	(2.5)	2.5	(8.0)
	b)	Sand, with grey silt and some fine gravel: fine rounded quartz with some coarse rock fragments	1.5	(5.0)	4.0	(13.0)
Lower Lias		Mudstone: blue-grey clay with hard angular fragments	1.0+	(3.5+)	5.0	(16.5)

GRADING

Mean for Deposit

	%	mm	%
a)			
Gravel	0	+16	0
		-16 + 4	0
Sand	82	-4 + 1	1
		-1 + ¼	29
		-¼ + 1/16	52
Fines	18	-1/16	18
b)			
Gravel	3	+16	0
		-16 + 4	3
Sand	93	-4 + 1	6
		-1 + ¼	34
		-¼ + 1/16	53
Fines	4	-1/16	4

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.8 - 1.7	18	82	0
2.5 - 4.0	4	93	3

SK 96 SW 8 | 9342 6271 | Aubourn | Block E

Surface level (+10.4 m) +34 ft
Water not encountered
November 1973

Waste 2.4 m (8.0 ft)
Bedrock 1.1 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
River Terrace Deposits (Flood-plain Terrace)	Clayey silt with some sand and pebbles, mainly light green-grey but becoming blue-grey towards base	2.0	(6.5)	2.4	(8.0)
Lower Lias	Mudstone, grey, laminated, with thin shelled bivalves	1.1+	(3.5+)	3.5	(11.5)

SK 96 SW 9 | 9220 6174 | Aubourn Moor | Block E

Surface level (+12.8 m) +42 ft
Water level +10.8 m (+35.5 ft)
November 1973

Overburden 0.5 m (1.5 ft)
Mineral 2.5 m (8.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.5	(1.5)	0.5	(1.5)
Older River Sand and Gravel (Beeston Terrace)	Sandy gravel, with ochreous silt Gravel: fine, rounded to well rounded quartzite and quartz with chert and some limestone Sand: medium, subangular to rounded quartz with some coarse lithic grains	2.5	(8.0)	3.0	(10.0)
Lower Lias	Mudstone, dark blue-grey, laminated	1.0+	(3.5+)	4.0	(13.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	32	+16	11
		-16 + 4	21
Sand	60	-4 + 1	8
		-1 + $\frac{1}{4}$	42
		-$\frac{1}{4}$ + 1/16	10
Fines	8	-1/16	8

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.5 - 1.5	10	62	28
1.5 - 3.0	8	58	34

SK 96 SW 10 9402 6194 Aubourn Fen Block E

Surface level (+5.5 m) +18 ft
Water level +3.5 m (+11.5 ft)
November 1973

Overburden 1.4 m (4.5 ft)
Mineral 1.4 m+ (4.5 ft+)
Bedrock 1.2 m+ (4.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Alluvium	Sandy silt, light grey-brown, with ochreous sand bands and some pebbles	1.0	(3.5)	1.4	(4.5)
River Terrace Deposits (Flood-plain Terrace)	'Clayey' sandy gravel Gravel: fine, subrounded to well rounded quartzite, quartz and chert with sandstone and limestone Sand: medium and coarse, rounded quartz with some subangular lithic grains Fines: grey silt bands	1.4	(4.5)	2.8	(9.0)
Lower Lias	Mudstone, dark grey, laminated, becoming light grey and very fossiliferous towards base	1.2+	(4.0+)	4.0	(13.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	25	+16	1
		-16 + 4	24
Sand	62	-4 + 1	28
		-1 + $\frac{1}{4}$	26
		-$\frac{1}{4}$ + 1/16	8
Fines	13	-1/16	13

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
1.4 - 2.4	19	58	23
2.4 - 2.8	1	71	28

SK 96 SW 11 9157 6076 Witham House Block E

Surface level (+13.4 m) +44 ft
Water level +10.9 m (+36 ft)
December 1973

Overburden 0.5 m (1.5 ft)
Mineral 2.3 m (7.5 ft)
Bedrock 1.2 m+ (4.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.5	(1.5)	0.5	(1.5)
Older River Sand and Gravel (Beeston Terrace)	Sandy gravel, 'clayey' at top Gravel: fine, well rounded quartz, rounded quartzite and subrounded chert Sand: medium, subrounded to well rounded quartz with some coarse angular rock fragments	2.3	(7.5)	2.8	(9.0)
Lower Lias	Mudstone, soft blue-grey, becoming hard and light grey	1.2+	(4.0+)	4.0	(13.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	24	+16	11
		-16 + 4	13
Sand	70	-4 + 1	8
		-1 + $\frac{1}{4}$	49
		-$\frac{1}{4}$ + 1/16	13
Fines	6	-1/16	6

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.5 - 1.5	13	71	16
1.5 - 2.8	2	69	29

SK 96 SW 12 9404 6093 Malborough Fen Block E

Surface level (+6.1 m) +20 ft
Water level +4.1 m (+13.5 ft)
November 1973

Overburden 0.5 m (1.5 ft)
Mineral 2.7 m (9.0 ft)
Bedrock 1.3 m+ (4.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.5	(1.5)	0.5	(1.5)
River Terrace Deposits (Flood-plain Terrace)	Sandy gravel Gravel: fine, subrounded to well rounded limestone with mudstone and sandstone and some quartz, quartzite and chert Sand: medium, rounded to well rounded quartz with some coarse lithic grains	2.7	(9.0)	3.2	(10.5)
Lower Lias	Mudstone, blue-grey	1.3+	(4.5+)	4.5	(15.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	25	+16	4
		-16 + 4	21
Sand	72	-4 + 1	20
		-1 + $\frac{1}{4}$	36
		-$\frac{1}{4}$ + 1/16	16
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.5 - 1.5	3	82	15
1.5 - 3.2	3	66	31

SK 96 SE 13 9503 6198 Broughton Lane Block E

Surface level (+8.2 m) +27 ft
Water level +6.2 m (+20.5 ft)
November 1973

Overburden 0.6 m (2.0 ft)
Mineral 1.9 m (6.0 ft)
Bedrock 1.8 m+ (6.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.6	(2.0)	0.6	(2.0)
River Terrace Deposits (Flood-plain Terrace)	'Clayey' pebbly sand Gravel: fine, well rounded quartzite, quartz and sandstone with subrounded chert Sand: fine, rounded to well rounded quartz	1.9	(6.0)	2.5	(8.0)
Lower Lias	Mudstone, blue-grey, laminated, with thin shelled bivalves	1.8+	(6.0+)	4.3	(14.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	10	+16	1
		-16 + 4	9
Sand	72	-4 + 1	10
		-1 + $\frac{1}{4}$	23
		-$\frac{1}{4}$ + 1/16	39
Fines	18	-1/16	18

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.6 - 1.6	16	83	1
1.6 - 2.5	20	60	20

SK 96 SE 14 9615 6072 Hall Farm, Coleby

Surface level (+16.2 m) +53 ft
Water not encountered
November 1973

Waste 2.3 m (7.5 ft)
Bedrock 1.3 m+ (4.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil, light, sandy	0.3	(1.0)	0.3	(1.0)
River Terrace Deposits (Flood-plain Terrace)	Clayey silt, light blue-grey with ochreous patches and rootlets	2.0	(6.5)	2.3	(7.5)
Lower Lias	Mudstone, blue-grey, laminated, with bivalve impressions	1.3+	(4.5+)	3.6	(12.0)

SK 97 NW 10 9069 7949 Till Bridge Farm

Surface level (+5.8 m) +19 ft
Water level +3.8 m (+12.5 ft)
December 1973

Waste 2.6 m (8.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.6	(2.0)	0.6	(2.0)
Alluvium	Clayey silt, blue-grey and brown, with thin sand layers and some gravel at base	2.0	(6.5)	2.6	(8.5)
Lower Lias	Mudstone, blue-grey, laminated	1.0+	(3.5+)	3.6	(12.0)

SK 97 NW 11 9053 7858 Broxholme

Surface level (+5.5 m) +18 ft
Water not encountered
December 1973

Waste 2.5 m (8.0 ft)
Bedrock 1.3 m+ (4.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.3	(1.0)	0.3	(1.0)
Alluvium	Clayey silt, light blue-grey, with ochreous patches and some fine sand at top	2.2	(7.0)	2.5	(8.0)
Lower Lias	Mudstone, blue-grey, fossiliferous	1.3+	(4.5+)	3.8	(12.5)

SK 97 NW 12 9008 7745 Broxholme

Surface level (+5.2 m) +17 ft
Water not encountered
December 1973

Waste 2.1 m (7.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Alluvium	Clayey silt, light blue-grey	1.7	(5.5)	2.1	(7.0)
Lower Lias	Mudstone, blue-grey	1.0+	(3.5+)	3.1	(10.0)

SK 97 NW 13 9065 7648 Broxholme

Surface level (+4.9 m) +16 ft
Water level +2.9 m (+9.5 ft)
December 1973

Waste 3.6 m (12.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Alluvium	Clayey silt, light blue and brown, laminated, with pockets of fine sand at top	2.4	(8.0)	2.8	(9.0)
River Terrace Deposits (Flood-plain Terrace)	Pebbly sand Gravel: fine, well rounded white limestone and quartz and subangular flint Sand: medium and fine, subrounded to well rounded quartz with some lithic grains	0.8	(2.5)	3.6	(12.0)
Lower Lias	Mudstone, blue-grey, laminated	1.0+	(3.5+)	4.6	(15.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	14	+16	2
		-16 + 4	12
Sand	84	-4 + 1	12
		-1 + $\frac{1}{4}$	38
		-$\frac{1}{4}$ + 1/16	34
Fines	2	-1/16	2

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
2.8 - 3.6	2	84	14

SK 97 NW 14 9141 7581 Odder Block B

Surface level (+4.9 m) +16 ft
Water level +2.4 m (+8 ft)
December 1973

Overburden 2.6 m (8.5 ft)
Mineral 1.5 m (5.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.2	(0.5)	0.2	(0.5)
Alluvium	Clayey silt, brown and blue, laminated, with layers and pockets of fine sand	2.4	(8.0)	2.6	(8.5)
River Terrace Deposits (Flood-plain Terrace)	Sandy gravel Gravel: fine, rounded quartz and white limestone and subangular flint Sand: medium, subangular to rounded quartz with coarse limestone, mudstone and chert grains	1.5	(5.0)	4.1	(13.5)
Lower Lias	Mudstone, blue-grey, laminated	1.0+	(3.5+)	5.1	(16.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	49	+16	14
		-16 + 4	35
Sand	50	-4 + 1	11
		-1 + $\frac{1}{4}$	26
		-$\frac{1}{4}$ + 1/16	13
Fines	1	-1/16	1

Bulk Samples

Depth below Surface (m)	Percentages Fines	Sand	Gravel
2.6 - 4.1	1	50	49

SK 97 NW 15 9220 7520 Odder Farm Block A

Surface level (+6.1 m) +20 ft
Water not encountered
December 1973

Waste 2.4 m (8.0 ft)
Bedrock 1.4 m+ (4.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
River Terrace Deposits (Flood-plain Terrace)	Clayey and sandy silt, ochreous, pale grey to dark grey and brown	2.0	(6.5)	2.4	(8.0)
Lower Lias	Mudstone, dark grey to 2.8 m, light grey below	1.4+	(4.5+)	3.8	(12.5)

SK 97 NW 16 9283 7563 Odder Block A

Surface level (+5.5 m) +18 ft
Water not encountered
December 1973

Overburden 2.5 m (8.0 ft)
Mineral 1.3 m (4.5 ft)
Bedrock 1.2 m+ (4.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.5	(1.5)	0.5	(1.5)
Alluvium	Sandy and clayey silt, red brown and grey with thin layer of fine sand at 1.6 m	2.0	(6.5)	2.5	(8.0)
River Terrace Deposits (Flood-plain Terrace)	'Very clayey' pebbly sand Gravel: fine, well rounded white limestone with subrounded to rounded flint Sand: medium, rounded quartz with rock fragments	1.3	(4.5)	3.8	(12.5)
Lower Lias	Mudstone, blue-grey with thin shelled bivalves	1.2+	(4.0+)	5.0	(16.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	9	+16	1
		-16 + 4	8
Sand	68	-4 + 1	7
		-1 + $\frac{1}{4}$	36
		-$\frac{1}{4}$ + 1/16	25
Fines	23	-1/16	23

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
2.5 - 3.8	23	68	9

SK 97 NW 17 9372 7561 Catchwater Drain Block A

Surface level (+5.2 m) +17 ft
Water not encountered
December 1973

Overburden 0.3 m (1.0 ft)
Mineral 2.0 m (6.5 ft)
Waste 1.2 m (4.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.3	(1.0)	0.3	(1.0)
River Terrace Deposits (Flood-plain Terrace)	'Clayey' pebbly sand Gravel: fine, subangular quartzite with some subrounded mudstone and limestone and angular flint Sand: fine, subangular quartz with flint and coarse rounded mudstone and limestone	2.0	(6.5)	2.3	(7.5)
	Clayey silt, red-brown and grey	1.2	(4.0)	3.5	(11.5)
Lower Lias	Mudstone, blue-grey, with belemnite guards	1.0+	(3.5+)	4.5	(15.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	16	+16	1
		-16 + 4	15
Sand	65	-4 + 1	11
		-1 + $\frac{1}{4}$	18
		-$\frac{1}{4}$ + 1/16	36
Fines	19	-1/16	19

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.3 - 1.3	19	74	7
1.3 - 2.3	19	56	25

Surface level (+4.3 m) +14 ft
Water level +3.0 m (+10 ft)
December 1973

Overburden 0.6 m (2.0 ft)
Mineral 0.9 m (3.0 ft)
Waste 0.9 m (3.0 ft)
Mineral 1.4 m (4.5 ft)
Waste 0.5 m (1.5 ft)
Mineral 4.2 m (14.0 ft)
Bedrock 0.5 m+ (1.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.6	(2.0)	0.6	(2.0)
River Terrace Deposits (Flood-plain Terrace)	a) 'Very clayey' pebbly sand Gravel: fine Sand: fine and medium, rounded quartz	0.9	(3.0)	1.5	(5.0)
	Clayey silt, red-brown and grey	0.9	(3.0)	2.4	(8.0)
	b) Sand: fine, rounded to well rounded quartz with medium coal particles and some clay	1.4	(4.5)	3.8	(12.5)
	Clayey silt, red-brown, laminated	0.5	(1.5)	4.3	(14.0)
	c) Sandy gravel Gravel: fine and coarse, well rounded quartzite with quartz and subrounded chert and mudstone Sand: medium, well rounded quartz with mudstone and subangular chert	4.2	(14.0)	8.5	(28.0)
Lower Lias	Mudstone, blue-grey, fossiliferous	0.5+	(1.5+)	9.0	(29.5)

GRADING

Mean for Deposit

	%	mm	%
a)			
Gravel	9	+16	0
		-16 + 4	9
Sand	66	-4 + 1	3
		-1 + ¼	27
		-¼ + 1/16	36
Fines	25	-1/16	25
b)			
Gravel	0	+16	0
		-16 + 4	0
Sand	95	-4 + 1	1
		-1 + ¼	17
		-¼ + 1/16	77
Fines	5	-1/16	5

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.6 - 1.5	25	66	9
2.4 - 3.4	3	97	0
3.4 - 3.8	9	91	0

SK 97 SW 12 cont'd

Mean for Deposit

	%	mm	%
c)			
Gravel	45	+16	20
		-16 + 4	25
Sand	54	-4 + 1	13
		-1 + ¼	35
		-¼ + 1/16	6
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
4.3 - 5.3	1	63	36
5.3 - 6.3	1	70	29
6.3 - 7.3	0	49	51
7.3 - 8.5	0	39	61

SK 97 SW 13 9166 7445 Odder Farm Block B

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

Overburden 2.3 m (7.5 ft)
Mineral 5.8 m (19.0 ft)
Bedrock 0.5 m+ (1.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.3	(1.0)	0.3	(1.0)
Alluvium		Sandy silt, light grey-brown with fine quartz sand	2.0	(6.5)	2.3	(7.5)
River Terrace Deposits (Flood-plain Terrace)	a)	'Very clayey' pebbly sand Gravel: fine, well rounded white limestone, with some rounded mudstone, quartz and quartzite Sand: fine, rounded quartz with some coarse chert, limestone, mudstone and quartz	1.0	(3.5)	3.3	(11.0)
	b)	Sandy gravel Gravel: fine and coarse, rounded to well rounded quartzite and white limestone, with subrounded chert, well rounded quartz, mudstone and sandstone Sand: medium, subangular to rounded quartz, with rounded limestone, subangular chert and some rounded mudstone	4.8	(15.5)	8.1	(26.5)
Lower Lias		Mudstone, dark grey, laminated	0.5+	(1.5+)	8.6	(28.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	41	+16	17
		-16 + 4	24
Sand	55	-4 + 1	11
		-1 + ¼	30
		-¼ + 1/16	14
Fines	4	-1/16	4

Bulk Samples

	Depth below surface (m)	Percentages Fines	Sand	Gravel
a)	2.3 - 3.3	23	70	7
b)	3.3 - 4.3	1	48	51
	4.3 - 5.3	1	57	42
	5.3 - 6.3	1	53	46
	6.3 - 7.3	1	53	46
	7.3 - 8.1	0	46	54

SK 97 SW 14 9263 7403 Lound Farm Block B

Surface level (+4.9 m) +16 ft
Water level +2.6 m (+8.5 ft)
January 1974

Overburden 0.7 m (2.5 ft)
Mineral 9.5 m (31.0 ft)
Bedrock 0.8 m+ (2.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.7	(2.5)	0.7	(2.5)
River Terrace Deposits (Flood-plain Terrace)	a)	Sand, 'clayey' at top and with pebbles at base: fine and medium, subangular quartz and lithic fragments	3.0	(10.0)	3.7	(12.0)
	b)	Sandy gravel, with 0.5 m of sand at base Gravel: fine, rounded quartz and quartzite with some subangular flint and grey and green sandstone and siltstone Sand: medium, subangular quartz and lithic grains	6.5	(21.5)	10.2	(33.5)
Lower Lias		Mudstone, grey, silty	0.8+	(2.5+)	11.0	(36.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	30	+16	12
		-16 + 4	18
Sand	67	-4 + 1	7
		-1 + $\frac{1}{4}$	37
		-$\frac{1}{4}$ + 1/16	23
Fines	3	-1/16	3

Bulk Samples

	Depth below surface (m)	Percentages Fines	Sand	Gravel
a)	0.7 - 1.7	16	84	0
	1.7 - 2.7	3	97	0
	2.7 - 3.7	1	95	4
b)	3.7 - 4.7	1	53	46
	4.7 - 5.7	1	58	41
	5.7 - 6.7	1	48	51
	6.7 - 7.7	1	50	49
	7.7 - 8.7	1	47	52
	8.7 - 9.7	1	56	43
	9.7 - 10.2	3	95	2

SK 97 SW 15 9344 7467 Burton Block A

Surface level (+3.1 m) +10 ft
Water level +0.6 m (+2 ft)
December 1973

Overburden 2.8 m (9.0 ft)
Mineral 4.1 m (13.5 ft)
Bedrock 1.1 m+ (3.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Fill: limestone and clay	0.9	(3.0)	0.9	(3.0)
Alluvium		Clay, dark red and grey, laminated in parts, with sandy lenses	1.9	(6.0)	2.8	(9.0)
River Terrace Deposits (Flood-plain Terrace)	a)	'Very clayey' pebbly sand Gravel: fine, limestone Sand: fine and medium, rounded quartz and rock fragments Fines: red-brown silt	1.7	(5.5)	4.5	(15.0)
	b)	Gravel Gravel: fine, well rounded quartzite and quartz with subangular to rounded flint, chert and limestone Sand: medium, well rounded quartz and rock fragments and some limestone and sandstone	2.4	(8.0)	6.9	(22.5)
Lower Lias		Clay, soft, pale to dark grey	1.1+	(3.5+)	8.0	(26.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	39	+16	13
		-16 + 4	26
Sand	52	-4 + 1	11
		-1 + $\frac{1}{4}$	25
		-$\frac{1}{4}$ + 1/16	16
Fines	9	-1/16	9

Bulk Samples

	Depth below surface (m)	Percentages Fines	Sand	Gravel
a)	2.8 - 3.5	23	68	9
	3.5 - 4.5	20	67	13
b)	4.5 - 5.5	2	46	52
	5.5 - 6.9	0	37	63

SK 97 SW 16 9365 7362 Fen Cottages Block A

Surface level (+5.5 m) +18 ft
Water level +4.0 m (+13 ft)
January 1974

Overburden 0.3 m (1.0 ft)
Mineral 5.3 m (17.5 ft)
Bedrock 1.2 m+ (4.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.3	(1.0)	0.3	(1.0)
River Terrace Deposits (Flood-plain Terrace)	a)	Sand: fine, subrounded quartz with some rock fragments	1.5	(5.0)	1.8	(6.0)
	b)	Sandy gravel Gravel: fine, well rounded quartzite, quartz and sandstone with some angular flint and limestone Sand: medium, subrounded to well rounded quartz and rock fragments	3.8	(12.5)	5.6	(18.5)
Lower Lias		Mudstone, soft, grey, becoming hard and dark	1.2+	(4.0+)	6.8	(22.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	28	+16	14
		-16 + 4	14
Sand	70	-4 + 1	6
		-1 + $\frac{1}{4}$	36
		-$\frac{1}{4}$ + 1/16	28
Fines	2	-1/16	2

Bulk Samples

	Depth below surface (m)	Percentages Fines	Sand	Gravel
a)	0.3 - 1.8	3	96	1
b)	1.8 - 2.8	3	74	23
	2.8 - 3.8	3	87	10
	3.8 - 4.8	1	38	61
	4.8 - 5.6	1	33	66

SK 97 SW 17 9499 7364 Bishop's Bridge Block A

Surface level (+4.3 m) +14 ft
Water level +2.8 m (+9 ft)
December 1973

Overburden 0.3 m (1.0 ft)
Mineral 4.2 m (14.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.3	(1.0)	0.3	(1.0)
River Terrace Deposits (Flood-plain Terrace)	a)	'Clayey' sand Sand: fine, rounded to well rounded quartz	1.0	(3.5)	1.3	(4.5)
	b)	Gravel, 'clayey' and sandy at top Gravel: fine and coarse, well rounded quartzite and quartz with some mudstone and flint Sand: medium, well rounded quartz and angular rock fragments	3.2	(10.5)	4.5	(15.0)
Lower Lias		Mudstone, soft blue-grey becomes hard, light grey; fossiliferous	1.0+	(3.5+)	5.5	(18.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	42	+16	23
		-16 + 4	19
Sand	50	-4 + 1	9
		-1 + ¼	19
		-¼ + 1/16	22
Fines	8	-1/16	8

Bulk Samples

	Depth below surface (m)	Percentages Fines	Sand	Gravel
a)	0.3 - 1.3	18	82	0
b)	1.3 - 2.3	15	52	33
	2.3 - 3.3	1	41	58
	3.3 - 4.5	1	28	71

Surface level (+5.2 m) +17 ft
Water level +2.4 m (+8 ft)
November 1973

Overburden 1.6 m (5.5 ft)
Mineral 1.4 m (4.5 ft)
Waste 1.3 m (4.5 ft)
Mineral 2.1 m (7.0 ft)
Bedrock 0.8 m+ (2.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.6	(2.0)	0.6	(2.0)
River Terrace Deposits (Flood-plain Terrace)		Sandy silt, grey-brown	1.0	(3.5)	1.6	(5.0)
	a)	'Very clayey' sand Sand: fine, subrounded quartz with some coal fragments and chert	1.4	(4.5)	3.0	(10.0)
		Silt, red-brown, laminated, with fine sand and some pebbles towards base	1.3	(4.5)	4.3	(14.0)
	b)	Gravel Gravel: fine and coarse, subrounded quartzite with some rounded quartz and subangular chert Sand: medium, subrounded quartz with subangular chert, tabular mudstone and some rounded quartzite	2.1	(7.0)	6.4	(21.0)
Lower Lias		Mudstone, grey-green, micaceous	0.8+	(2.5+)	7.2	(23.5)

GRADING

Mean for Deposit

	%	mm	%
a)			
Gravel	1	+16	0
		-16 + 4	1
Sand	69	-4 + 1	1
		-1 + ¼	12
		-¼ + 1/16	56
Fines	30	-1/16	30
b)			
Gravel	50	+16	26
		-16 + 4	24
Sand	49	-4 + 1	16
		-1 + ¼	27
		-¼ + 1/16	6
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
1.6 - 2.6	38	61	1
2.6 - 3.0	11	89	0
4.3 - 5.3	1	47	52
5.3 - 6.4	1	50	49

SK 97 SW 19 9341 7249 Fen Lane, Skellingthorpe Block B

Surface level (+4.6 m) +15 ft
Water level not recorded
November 1973

Overburden 0.5 m (1.5 ft)
Mineral 8.8 m (29.0 ft)
Bedrock 0.8 m+ (2.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.5	(1.5)	0.5	(1.5)
River Terrace Deposits (Flood-plain Terrace)	a)	'Clayey' sand Sand: fine, well rounded quartz	3.3	(11.0)	3.8	(12.5)
	b)	Sandy gravel Gravel: fine, rounded to well rounded quartzite with rounded quartz, sub-angular chert and some mudstone and sandstone Sand: medium, subangular to well rounded quartz with some chert and lithic grains	5.5	(18.0)	9.3	(30.5)
Lower Lias		Mudstone, dark grey	0.8+	(2.5+)	10.1	(33.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	23	+16	6
		-16 + 4	17
Sand	71	-4 + 1	9
		-1 + $\frac{1}{4}$	28
		-$\frac{1}{4}$ + 1/16	34
Fines	6	-1/16	6

Bulk Samples

	Depth below surface (m)	Percentages Fines	Sand	Gravel
a)	0.5 - 1.5	27	72	1
	1.5 - 2.5	7	93	0
	2.5 - 3.8	6	94	0
b)	3.8 - 4.8	2	66	32
	4.8 - 5.8	1	42	57
	5.8 - 6.8	2	73	25
	6.8 - 7.8	0	59	41
	7.8 - 9.3	1	61	38

Surface level (+5.5 m) +18 ft
Water level +4.0 m (+13 ft)
December 1973

Overburden 0.5 m (1.5 ft)
Mineral 1.5 m (5.0 ft)
Waste 0.8 m (2.5 ft)
Mineral 1.7 m (5.5 ft)
Waste 0.8 m (2.5 ft)
Mineral 3.8 m (12.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.5	(1.5)	0.5	(1.5)
River Terrace Deposits (Flood-plain Terrace)	a)	Sand: fine, subrounded to rounded quartz	1.5	(5.0)	2.0	(6.5)
		Clayey silt, compact, red-brown and grey	0.8	(2.5)	2.8	(9.0)
	b)	Sandy gravel, with aggregates of grey-brown silt Gravel: fine, well rounded quartzite, quartz and subangular chert with some mudstone and sandstone Sand: medium, well rounded quartz with some angular lithic fragments	1.7	(5.5)	4.5	(15.0)
		Silt, grey-brown, slightly sandy	0.8	(2.5)	5.3	(17.5)
	c)	Gravel Gravel: fine and coarse, rounded to well rounded quartzite and quartz and subangular to subrounded chert with some rounded mudstone and sandstone Sand: medium and coarse, quartz with some angular rock fragments	3.8	(12.5)	9.1	(30.0)
Lower Lias		Mudstone, dark blue-grey, with thin shelled bivalves	1.0+	(3.5+)	10.1	(33.0)

GRADING

Mean for Deposit

	%	mm	%
a)			
Gravel	0	+16	0
		-16 + 4	0
Sand	93	-4 + 1	3
		-1 + $\frac{1}{4}$	26
		-$\frac{1}{4}$ + 1/16	64
Fines	7	-1/16	7
b)			
Gravel	48	+16	19
		-16 + 4	29
Sand	51	-4 + 1	15
		-1 + $\frac{1}{4}$	27
		-$\frac{1}{4}$ + 1/16	9
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.5 - 1.5	7	92	1
1.5 - 2.0	5	95	0
2.8 - 3.8	1	60	39
3.8 - 4.5	1	39	60

SK 97 SW 20 cont'd

Mean for Deposit

	%	mm	%
c)			
Gravel	69	+16	34
		-16 + 4	35
Sand	30	-4 + 1	11
		-1 + ¼	17
		-¼ + 1/16	2
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
5.3 - 6.3	1	27	72
6.3 - 7.3	1	20	79
7.3 - 8.3	0	35	65
8.3 - 9.1	0	41	59

SK 97 SW 21 9195 7122 Skellingthorpe Block C

Surface level (+17.1 m) +56 ft
Water not encountered
December 1973

Overburden 0.5 m (1.5 ft)
Mineral 2.7 m (9.0 ft)
Waste 0.2 m (0.5 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.5	(1.5)	0.5	(1.5)
Older River Sand and Gravel (Hilton Terrace)	'Clayey' sandy gravel Gravel: fine, well rounded quartzite and quartz with subangular chert Sand: medium, rounded to well rounded quartz with coarser rock fragments	2.7	(9.0)	3.2	(10.5)
	Sandy silt, mustard and grey, with some fine sand	0.2	(0.5)	3.4	(11.0)
Lower Lias	Mudstone, light grey, fossiliferous	1.0+	(3.5+)	4.4	(14.5)

GRADING

Mean for Deposit

	%	mm	%
Gravel	28	+16	5
		-16 + 4	23
Sand	55	-4 + 1	9
		-1 + ¼	27
		-¼ + 1/16	19
Fines	17	-1/16	17

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.5 - 1.5	23	61	16
1.5 - 3.2	13	51	36

Surface level (+5.8 m) +19 ft
Water level +3.8 m (+12.5 ft)
December 1973

Overburden 0.3 m (1.0 ft)
Mineral 1.5 m (5.0 ft)
Waste 0.2 m (0.5 ft)
Mineral 3.5 m (11.5 ft)
Waste 1.0 m (3.5 ft)
Mineral 3.8 m (12.5 ft)
Bedrock 0.7 m+ (2.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.3	(1.0)	0.3	(1.0)
River Terrace Deposits (Flood-plain Terrace)	a) Sand: fine and medium, rounded to well rounded quartz with some pebbles	1.5	(5.0)	1.8	(6.0)
	Clayey silt, red-brown	0.2	(0.5)	2.0	(6.5)
	b) 'Clayey' pebbly sand Gravel: subrounded to well rounded quartzite, with quartz and some limestone and sandstone and sub-angular chert Sand: fine and medium, subangular to subrounded quartz with coarse lithic grains Fines: red-brown silt	3.5	(11.5)	5.5	(18.0)
	Sandy silt, brown-grey	1.0	(3.5)	6.5	(21.5)
	c) Sandy gravel Gravel: fine and coarse, well rounded quartzite and quartz with subangular chert and some rounded limestone, mudstone and sandstone Sand: medium, rounded to well rounded quartz, with some coarse subangular quartz, chert and lithic grains	3.8	(12.5)	10.3	(34.0)
Lower Lias	Mudstone, blue-grey, laminated	0.7+	(2.5+)	11.0	(36.0)

GRADING

Mean for Deposit

a)

	%	mm	%
Gravel	0	+16	0
		-16 + 4	0
Sand	97	-4 + 1	8
		-1 + $\frac{1}{4}$	40
		-$\frac{1}{4}$ + 1/16	49
Fines	3	-1/16	3

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.3 - 1.8	3	97	0

SK 97 SW 22 cont'd

Mean for Deposit

	%	mm	%
b)			
Gravel	14	+16	4
		-16 + 4	10
Sand	69	-4 + 1	9
		-1 + ¼	28
		-¼ + 1/16	32
Fines	17	-1/16	17
c)			
Gravel	43	+16	20
		-16 + 4	23
Sand	56	-4 + 1	9
		-1 + ¼	38
		-¼ + 1/16	9
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
2.0 - 3.0	38	61	1
3.0 - 4.0	6	81	13
4.0 - 5.5	11	66	23
6.5 - 7.5	1	51	48
7.5 - 8.5	2	84	14
8.5 - 9.5	0	37	63
9.5 - 10.3	1	53	46

SK 97 SW 23 9036 7031 Church Farm Block C

Surface level (+26.8 m) +88 ft
Water not encountered
December 1973

Overburden 0.4 m (1.5 ft)
Mineral 3.6 m (12.0 ft)
Waste 2.9 m (9.5 ft)
Bedrock 0.4 m+ (1.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Older River Sand and Gravel (Hilton Terrace)	Sandy gravel, with some ochreous silt Gravel: fine, rounded to well rounded quartzite and quartz with subangular chert and some sandstone Sand: medium, subangular to well rounded quartz, with some coarse grains of rounded mudstone, sandstone and quartzite and subangular chert	3.6	(12.0)	4.0	(13.0)
	'Clayey' silt, grey, micaceous	2.9	(9.5)	6.9	(22.5)
Lower Lias	Mudstone, grey, with bivalves	0.4+	(1.5+)	7.3	(24.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	41	+16	10
		-16 + 4	31
Sand	53	-4 + 1	13
		-1 + ¼	33
		-¼ + 1/16	7
Fines	6	-1/16	6

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.4 - 1.4	2	42	56
1.4 - 2.4	5	89	6
2.4 - 4.0	9	39	52

SK 97 SW 24 9143 7059 Top House Farm Block C

Surface level (+15.6 m) +51 ft
Water not encountered
December 1973

Waste 3.4 m (11.0 ft)
Bedrock 1.3 m+ (4.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.3	(1.0)	0.3	(1.0)
Older River Sand and Gravel (Hilton Terrace)	Clayey silt, light blue-grey with rounded quartzite and subrounded chert pebbles and patches of sand at top	3.1	(10.0)	3.4	(11.0)
Lower Lias	Mudstone, blue-grey, laminated	1.3+	(4.5+)	4.7	(15.5)

SK 97 SW 25 9228 7069 Monsons Farm Block C

Surface level (+19.2 m) +63 ft
Water not encountered
December 1973

Overburden 0.4 m (1.5 ft)
Mineral 2.6 m (8.5 ft)
Waste 6.5 m (21.5 ft)
Bedrock 0.9 m+ (3.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.4	(1.5)	0.4	(1.5)
Older River Sand and Gravel (Hilton Terrace)	'Clayey' pebbly sand Gravel: rounded to well rounded quartzite and quartz with sub-angular chert Sand: fine and medium, well rounded quartz with some coarse lithic grains Fines: mustard and light blue-grey	2.6	(8.5)	3.0	(10.0)
	Clayey silt, red-brown, laminated	6.5	(21.5)	9.5	(31.0)
Lower Lias	Mudstone, grey, with belemnites and bivalves	0.9+	(3.0+)	10.4	(34.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	17	+16	8
		-16 + 4	9
Sand	62	-4 + 1	2
		-1 + $\frac{1}{4}$	30
		-$\frac{1}{4}$ + 1/16	30
Fines	21	-1/16	21

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.4 - 1.4	24	66	10
1.4 - 3.0	20	59	21

SK 97 SW 26 9353 7040 Disused Airfield, Lincoln Block C

Surface level (+14.3 m) +47 ft
Water level +11.3 m (+37 ft)
January 1974

Overburden 0.2 m (0.5 ft)
Mineral 5.8 m (19.0 ft)
Waste 4.3 m (14.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.2	(0.5)	0.2	(0.5)
Older River Sand and Gravel (Hilton Terrace)	a) Sandy gravel Gravel: fine, well rounded quartzite with some well rounded quartz and subangular flints Sand: medium, subangular quartz with some quartzite and other lithic grains	1.0	(3.5)	1.2	(4.0)
	b) 'Clayey' pebbly sand Gravel: fine, well rounded quartzite and quartz with subangular flint Sand: fine and medium, subangular quartz Fines: thin blue-grey clay bands	2.0	(6.5)	3.2	(10.5)
	c) Sandy gravel, with some clay bands Gravel: fine and coarse, well rounded quartz and quartzite with subangular flint Sand: medium, subangular quartz with angular flint	2.8	(9.0)	6.0	(19.5)
	Clay, with some sand and gravel, laminated, red-brown becoming blue-grey towards base	4.3	(14.0)	10.3	(34.0)
Lower Lias	Clay, blue-grey, with limestone and mudstone fragments	1.0+	(3.5+)	11.3	(37.0)

GRADING

Mean for Deposit

		mm	%
Gravel	30	+16	14
		-16 + 4	16
Sand	64	-4 + 1	7
		-1 + $\frac{1}{4}$	33
		-$\frac{1}{4}$ + 1/16	24
Fines	6	-1/16	6

Bulk Samples

	Depth below surface (m)	Percentages Fines	Sand	Gravel
a)	0.2 - 1.2	3	68	29
b)	1.2 - 2.2	21	70	9
	2.2 - 3.2	6	93	1
c)	3.2 - 4.2	4	56	40
	4.2 - 5.2	1	45	54
	5.2 - 6.0	1	50	49

SK 97 SW 27 9451 7495 Birch Holt Block A

Surface level (+6.1 m) +20 ft
Water not encountered
December 1973

Overburden 0.2 m (0.5 ft)
Mineral 1.6 m (5.0 ft)
Bedrock 1.5 m+ (5.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.2	(0.5)	0.2	(0.5)
River Terrace Deposits (Flood-plain Terrace)	'Very clayey' sand Sand: fine, rounded to well rounded quartz Fines: ochreous-brown silt	1.6	(5.0)	1.8	(6.0)
Lower Lias	Mudstone, blue-grey, laminated, with belemnite guards	1.5+	(5.0+)	3.3	(11.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	0	+16	0
		-16 + 4	0
Sand	80	-4 + 1	3
		-1 + $\frac{1}{4}$	23
		-$\frac{1}{4}$ + 1/16	54
Fines	20	-1/16	20

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.2 - 1.2	19	81	0
1.2 - 1.8	20	80	0

SK 97 SW 28 9108 7392 Ox Pasture Bridge Block B

Surface level (+4.8 m) +16 ft
Water level not recorded
Minuteman power auger, 4.5 inch (115 mm) diam.
July 1974

Overburden 1.4 m (4.5 ft)
Mineral 1.0 m (3.5 ft)
Waste 0.3 m (1.0 ft)
Mineral 1.5 m (5.0 ft)
Bedrock 1.2 m+ (4.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
Alluvium		Soil, sandy, with clay at base	1.4	(4.5)	1.4	(4.5)
River Terrace Deposits (Flood-plain Terrace)	a)	'Clayey' sand: fine quartz	1.0	(3.5)	2.4	(8.0)
		Clay, red-brown, laminated	0.3	(1.0)	2.7	(9.0)
	b)	'Clayey' sand: fine and medium quartz	1.5	(5.0)	4.2	(14.0)
Lower Lias		Mudstone, blue-grey	1.2+	(4.0+)	5.4	(17.5)

GRADING

Mean for Deposit

	%	mm	%
a)			
Gravel	0	+16	0
		-16 + 4	0
Sand	84	-4 + 1	1
		-1 + $\frac{1}{4}$	18
		-$\frac{1}{4}$ + 1/16	65
Fines	16	-1/16	16
b)			
Gravel	0	+16	0
		-16 + 4	0
Sand	84	-4 + 1	1
		-1 + $\frac{1}{4}$	41
		-$\frac{1}{4}$ + 1/16	42
Fines	16	-1/16	16

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
1.4 - 1.8	23	77	0
1.8 - 2.4	13	87	0
2.7 - 3.6	16	84	0
3.6 - 4.3	15	85	0

SK 97 SW 29 9211 7345 Lound Farm Block B

Surface level (+5.5 m) +18 ft
Water level not recorded
Minuteman power auger, 4.5 inch (115 mm) diam.
July 1974

Overburden 1.5 m (5.0 ft)
Mineral 1.2 m (4.0 ft)
Waste 0.9 m (3.0 ft)
Mineral 2.7 m (9.0 ft)
Bedrock 0.9 m+ (3.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.3	(1.0)	0.3	(1.0)
River Terrace Deposits (Flood-plain Terrace)		Sandy silt and clay	1.2	(4.0)	1.5	(5.0)
	a)	'Very clayey' sand Sand: fine quartz Fines: brown silt	1.2	(4.0)	2.7	(9.0)
		Sandy silt	0.9	(3.0)	3.6	(12.0)
	b)	'Clayey' sand, with fine gravel at base Sand: fine quartz	2.7	(9.0)	6.3	(20.5)
Lower Lias		Mudstone, blue-grey clay	0.9+	(3.0+)	7.2	(23.5)

GRADING

Mean for Deposit

	%	mm	%
a)			
Gravel	0	+16	0
		-16 + 4	0
Sand	74	-4 + 1	1
		-1 + ¼	9
		-¼ + 1/16	64
Fines	26	-1/16	26
b)			
Gravel	2	+16	0
		-16 + 4	2
Sand	86	-4 + 1	3
		-1 + ¼	15
		-¼ + 1/16	68
Fines	12	-1/16	12

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
1.5 - 1.8	37	63	0
1.8 - 2.7	22	78	0
3.6 - 4.5	14	86	0
4.5 - 5.4	10	89	1
5.4 - 6.3	13	82	5

SK 97 SW 30 9199 7257 Western Lane Block B

Surface level (+5.5 m) +18 ft
Water level not recorded
Minuteman power auger, 4.5 inch (115 mm) diam.
July 1974

Overburden 1.7 m (5.5 ft)
Mineral 1.0 m (3.5 ft)
Waste 0.9 m (3.0 ft)
Mineral 1.0 m (3.5 ft)
Bedrock 1.8 m+ (6.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.9	(3.0)	0.9	(3.0)
River Terrace Deposits (Flood-plain Terrace)	Clay	0.8	(2.5)	1.7	(5.5)
	a) 'Very clayey' sand, with fine gravel Sand: fine quartz	1.0	(3.5)	2.7	(9.0)
	Clay, with grey sand	0.9	(3.0)	3.6	(12.0)
	b) 'Very clayey' sand Sand: fine quartz	1.0	(3.5)	4.6	(15.0)
Lower Lias	Mudstone, blue-grey	1.8+	(6.0+)	6.4	(21.0)

GRADING

Mean for Deposit

	%	mm	%
a)			
Gravel	3	+16	0
		-16 + 4	3
Sand	58	-4 + 1	4
		-1 + ¼	5
		-¼ + 1/16	49
Fines	39	-1/16	39
b)			
Gravel	0	+16	0
		-16 + 4	0
Sand	68	-4 + 1	2
		-1 + ¼	17
		-¼ + 1/16	49
Fines	32	-1/16	32

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
1.7 - 2.7	39	58	3
3.6 - 4.6	32	68	0

SK 97 SW 31 9316 7232 Skellingthorpe Block B

Surface level (+4.8 m) +16 ft
Water level not recorded
Minuteman power auger, 4.5 inch (115 mm) diam.
July 1974

Overburden 0.8 m (2.5 ft)
Mineral 1.0 m (3.5 ft)
Waste 0.9 m (3.0 ft)
Mineral 1.0 m (3.5 ft)
Waste 0.9 m (3.0 ft)
Mineral 2.7 m+ (9.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.8	(2.5)	0.8	(2.5)
River Terrace Deposits (Flood-plain Terrace)	a) 'Clayey' sand Sand: fine quartz Fines: brown silt	1.0	(3.5)	1.8	(6.0)
	Clay, brown and blue	0.9	(3.0)	2.7	(9.0)
	b) 'Very clayey' sand: as above	1.0	(3.5)	3.7	(12.0)
	Sandy silt	0.9	(3.0)	4.6	(15.0)
	c) 'Very clayey' sand: as above, with some pebbles	2.7+	(9.0+)	7.3	(24.0)

GRADING

Mean for Deposit

	%	mm	%
a)			
Gravel	0	+16	0
		-16 + 4	0
Sand	83	-4 + 1	0
		-1 + ¼	2
		-¼ + 1/16	81
Fines	17	-1/16	17
b)			
Gravel	0	+16	0
		-16 + 4	0
Sand	79	-4 + 1	0
		-1 + ¼	6
		-¼ + 1/16	73
Fines	21	-1/16	21
c)			
Gravel	1	+16	0
		-16 + 4	1
Sand	71	-4 + 1	1
		-1 + ¼	11
		-¼ + 1/16	59
Fines	28	-1/16	28

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.8 - 1.8	17	83	0
2.7 - 3.7	21	79	0
4.6 - 5.5	28	72	0
5.5 - 6.4	29	68	3
6.4 - 7.3	28	71	1

Surface level (+4.5 m) +15 ft
Water level not recorded
Minuteman power auger, 4.5 m inch (115 mm) diam.
July 1974

Overburden 0.6 m (2.0 ft)
Mineral 1.2 m (4.0 ft)
Waste 0.5 m (1.5 ft)
Mineral 5.0 m+ (16.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.6	(2.0)	0.6	(2.0)
River Terrace Deposits (Flood-plain Terrace)	a)	'Very clayey' sand	1.2	(4.0)	1.8	(6.0)
		Clay	0.5	(1.5)	2.3	(7.5)
	b)	'Clayey' pebbly sand, gravelly at base Gravel: fine Sand: fine and medium quartz	5.0+	(16.5+)	7.3	(24.0)

GRADING

Mean for Deposit

	%	mm	%
a)			
Gravel	1	+16	0
		-16 + 4	1
Sand	73	-4 + 1	0
		-1 + ¼	9
		-¼ + 1/16	64
Fines	26	-1/16	26
b)			
Gravel	9	+16	0
		-16 + 4	9
Sand	79	-4 + 1	6
		-1 + ¼	41
		-¼ + 1/16	32
Fines	12	-1/16	12

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.6 - 0.9	18	81	1
0.9 - 1.8	29	70	1
2.3 - 2.7	10	90	0
2.7 - 3.6	11	84	5
3.6 - 4.6	12	85	3
4.6 - 5.5	12	84	4
5.5 - 6.4	12	81	7
6.4 - 7.3	12	57	31

SK 97 SE 48 9535 7284 Race Course Block A

Surface level (+5.2 m) +17 ft
Water not encountered
January 1974

Overburden 0.2 m (0.5 ft)
Mineral 2.3 m (7.5 ft)
Waste 1.0 m (3.5 ft)
Bedrock 2.0 m+ (6.5 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.2	(0.5)	0.2	(0.5)
River Terrace Deposits (Flood-plain Terrace)	'Very clayey' sand, with some gravel Sand: fine, subrounded to rounded quartz with rare chert Fines: brown silt with bands of grey-green clay	2.3	(7.5)	2.5	(8.0)
	Clay, green-grey and red-brown, slightly micaceous, with silt and sand laminations near base	0.5	(1.5)	3.0	(10.0)
	'Clayey' sand, with some quartz, quartzite and chert pebbles	0.5	(1.5)	3.5	(11.5)
Lower Lias	Mudstone, blue-grey, with shell fragments	2.0+	(6.5+)	5.5	(18.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	2	+16	0
		-16 + 4	2
Sand	76	-4 + 1	1
		-1 + $\frac{1}{4}$	23
		-$\frac{1}{4}$ + 1/16	52
Fines	22	-1/16	22

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.2 - 1.2	22	77	1
1.2 - 2.5	22	76	2

SK 97 SE 49 9574 7207 Golf Course Block A

Surface level (+7.6 m) +25 ft
Water level +3.3 m (+11 ft)
January 1974

Overburden 0.3 m (1.0 ft)
Mineral 1.2 m (4.0 ft)
Bedrock 3.0 m+ (10.0 ft+)

LOG

		Thickness m	(ft)	Depth m	(ft)
	Soil	0.3	(1.0)	0.3	(1.0)
River Terrace Deposits (Flood-plain Terrace)	Pebbly sand Gravel: fine and coarse, rounded quartz and quartzite Sand: fine and medium, quartz	1.2	(4.0)	1.5	(5.0)
Lower Lias	Mudstone, grey, micaceous	3.0+	(1.0+)	4.5	(15.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	6	+16	3
		-16 + 4	3
Sand	93	-4 + 1	3
		-1 + $\frac{1}{4}$	45
		-$\frac{1}{4}$ + 1/16	45
Fines	1	-1/16	1

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
0.3 - 1.5	1	93	6

SK 97 SE 50 9518 7150 Carholme Block B

Surface level (+4.0 m) +13 ft
Water level +1.5 m (+5 ft)
December 1973

Overburden 1.5 m (5.0 ft)
Mineral 7.6 m (25.0 ft)
Bedrock 0.7 m+ (2.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.5	(1.6)	0.5	(1.6)
Alluvium		Silt, grey	1.0	(3.5)	1.5	(5.0)
River Terrace Deposits (Flood-plain Terrace)	a)	Sand, with grey silt at top: medium to fine, rounded to well rounded quartz with some coal specks and coarse limestone fragments	3.0	(10.0)	4.5	(15.0)
	b)	Sandy gravel Gravel: fine, rounded to well rounded quartzite with quartz and some subangular to rounded chert, well rounded sandstone, mudstone and limestone Sand: medium, rounded quartz with subangular chert and lithic grains including coal	4.6	(15.0)	9.1	(30.0)
Lower Lias		Mudstone, light grey and dark blue-grey, laminated	0.7+	(2.5+)	9.8	(32.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	27	+16	11
		-16 + 4	16
Sand	70	-4 + 1	11
		-1 + $\frac{1}{4}$	41
		-$\frac{1}{4}$ + 1/16	18
Fines	3	-1/16	3

Bulk Samples

	Depth below surface (m)	Percentages Fines	Sand	Gravel
a)	1.5 - 2.5	17	83	0
	2.5 - 3.5	1	99	0
	3.5 - 4.5	0	99	1
b)	4.5 - 5.5	1	57	42
	5.5 - 6.5	0	59	41
	6.5 - 7.5	1	44	55
	7.5 - 8.5	1	49	50
	8.5 - 9.0	1	66	53

SK 97 SE 51 9544 7086 Swan Pool Block B

Surface level (+3.7 m) +12 ft
Water level +2.9 m (+9.5 ft)
January 1974

Overburden 0.3 m (1.0 ft)
Mineral 10.1 m (33.0 ft)
Bedrock 0.6 m+ (2.0 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
		Soil	0.3	(1.0)	0.3	(1.0)
River Terrace Deposits (Flood-plain Terrace)	a)	'Clayey' sand Sand: fine quartz Fines: brown, red and blue-grey silt	3.0	(10.0)	3.3	(11.0)
	b)	Sandy gravel Gravel: fine, rounded quartz and quartzite with angular flint Sand: medium, subangular quartz with coarse angular flint	7.1	(23.5)	10.4	(34.0)
Lower Lias		Mudstone, blue-grey	0.6+	(2.0+)	11.0	(36.0)

GRADING

Mean for Deposit

	%	mm	%
Gravel	30	+16	10
		-16 + 4	20
Sand	65	-4 + 1	6
		-1 + $\frac{1}{4}$	31
		-$\frac{1}{4}$ + 1/16	28
Fines	5	-1/16	5

Bulk Samples

	Depth below surface (m)	Percentages Fines	Sand	Gravel
a)	0.3 - 1.3	17	83	0
	1.3 - 2.3	14	85	1
	2.3 - 3.3	20	80	0
b)	3.3 - 4.3	2	86	12
	4.3 - 5.3	0	58	42
	5.3 - 6.3	0	62	38
	6.3 - 7.3	0	37	63
	7.3 - 8.3	1	57	42
	8.3 - 9.3	1	48	51
	9.3 - 10.4	0	53	47

SK 97 SE 52 9925 7087 Lincoln Block B

Surface level (+5.2 m) +17 ft
Water level +4.1 m (+13.5 ft)
January 1974

Overburden 2.5 m (8.0 ft)
Mineral 3.4 m (11.0 ft)
Waste 0.5 m (1.5 ft)
Mineral 3.2 m (10.5 ft)
Bedrock 1.4 m+ (4.5 ft+)

LOG

			Thickness m	(ft)	Depth m	(ft)
Alluvium		Soil and subsoil	2.5	(8.0)	2.5	(8.0)
River Terrace Deposits (Flood-plain Terrace)	a)	'Clayey' sand Sand: medium and fine quartz Fines: red and grey clay bands	3.4	(11.0)	5.9	(19.5)
		Clay, grey, laminated	0.5	(1.5)	6.4	(21.0)
	b)	Gravel Gravel: fine and coarse, well rounded quartzite with quartz and some sub-angular flint Sand: medium, subangular quartz with some quartzite and traces of coal	3.2	(10.5)	9.6	(31.5)
Middle Lias		Mudstone and blue-grey clay	1.4+	(4.5+)	11.0	(36.0)

GRADING

Mean for Deposit

	%	mm	%
a)			
Gravel	0	+16	0
		-16 + 4	0
Sand	88	-4 + 1	3
		-1 + ¼	47
		-¼ + 1/16	38
Fines	12	-1/16	12
b)			
Gravel	51	+16	24
		-16 + 4	27
Sand	49	-4 + 1	10
		-1 + ¼	33
		-¼ + 1/16	6
Fines	0	-1/16	0

Bulk Samples

Depth below surface (m)	Percentages Fines	Sand	Gravel
2.5 - 3.5	20	80	0
3.5 - 4.5	14	85	1
4.5 - 5.9	4	96	0
6.4 - 7.4	0	42	58
7.4 - 8.4	0	49	51
8.4 - 9.6	1	53	46

Appendix G: List of Workings

ACTIVE

	Site	Grid Reference	Operator	Deposit worked
SK 96				
	Whisby	915 675	R Teale Ltd	Beeston Terrace
	Whisby	910 670	Steetley Denniff Ltd	Beeston Terrace
	Low Moor Plantation (North Hykeham)	925 660	Butterley Aggregates Ltd	Beeston Terrace

ABANDONED

SK 96				
	Hartsholme Wood	945 685	---	Beeston Terrace
	Hykeham Farm	930 673	---	Beeston Terrace
	Bathurst	945 675	---	Beeston Terrace
SK 97				
	Odder	925 748	---	Floodplain Terrace
	Burton	945 740	---	Floodplain Terrace
	New Boultham	957 715	---	Floodplain Terrace
	Jerusalem	915 712	---	Hilton Terrace
	Gravel Pit Plantation	935 707	---	Hilton Terrace
	Canwick	991 703	---	Floodplain Terrace

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

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

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

REPORTS OF THE INSTITUTE OF GEOLOGICAL SCIENCES

Assessment of British Sand and Gravel Resources

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

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

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

No. 4 The sand and gravel resources of the country around Maldon, Essex: Description of 1 : 25 000 resource sheet TL 80. By J. D. Ambrose. Price £1.20. Report No. 73/1

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No. 12 The sand and gravel resources of the country around Gerrards Cross, Buckinghamshire: Description of 1 : 25 000 resource sheets SU 98, SU 99, TQ 08 and TQ 09. By H. C. Squirrell. Price £2.20. Report No. 74/14

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No. 18 The sand and gravel resources of the Thames Valley, the country around Cricklade, Wiltshire. Description of 1:25 000 resource sheets SU 09/19 and parts of SP 00/10. By P. Robson. Price £3.00.

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No. 26 The limestone and dolomite resources of the country around Monyash, Derbyshire. Description of the 1 : 25 000 resource sheet SK 16. By F. C. Cox and D. McC. Bridge. Price not yet fixed

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Other Reports

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INSTITUTE OF GEOLOGICAL SCIENCES

MINERAL ASSESSMENT UNIT

THE SAND & GRAVEL RESOURCES WEST & SOUTH OF LINCOLN. SOUTHERN SHEET (SK 95 & PART OF SK 96) BASSINGHAM, LINCOLNSHIRE

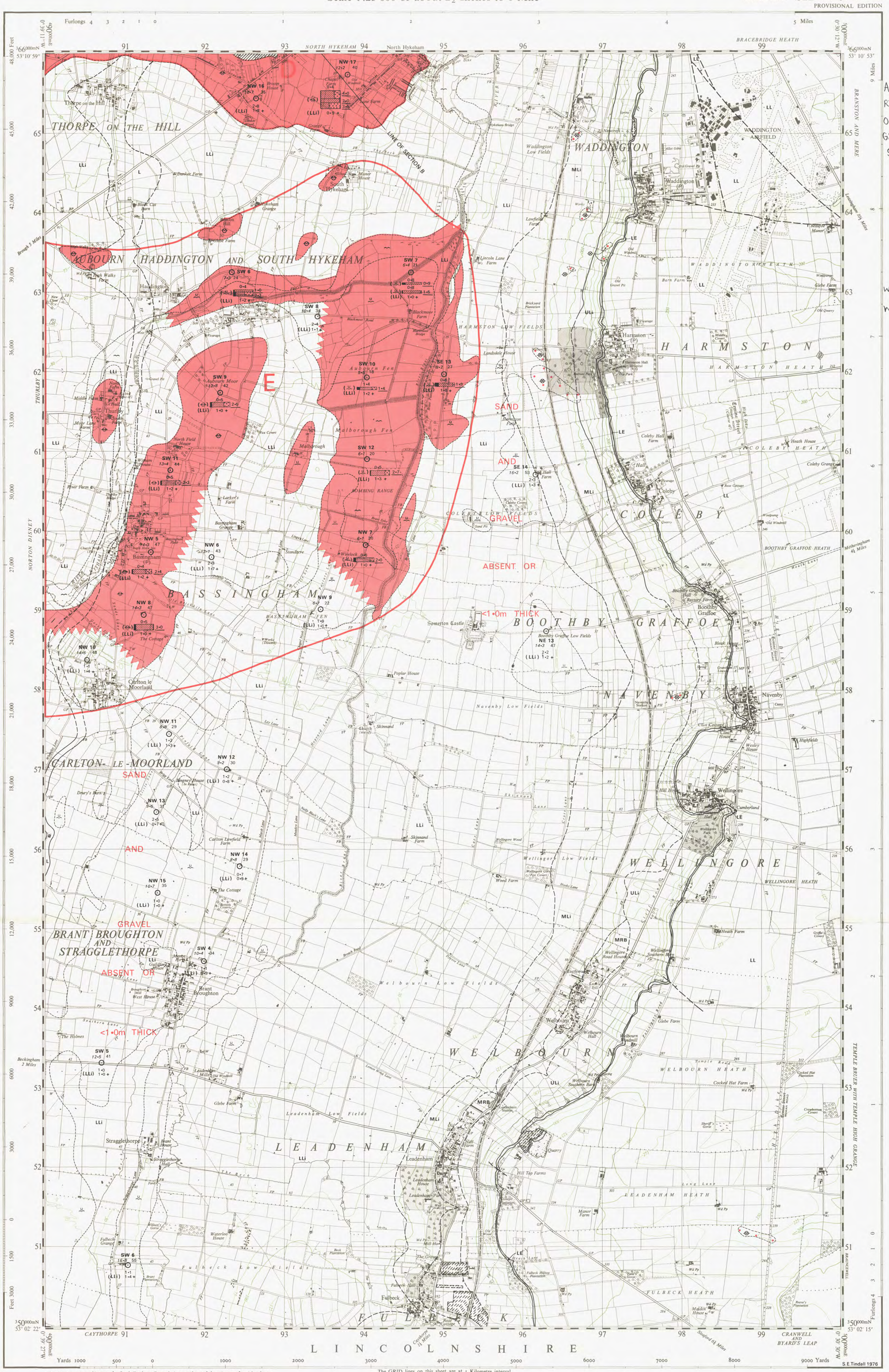
Scale 1:25 000 or about 2½ Inches to 1 Mile

ORDNANCE SURVEY
SHEET SK 95 & Pt.96
PROVISIONAL EDITION

THE SAND & GRAVEL RESOURCES WEST & SOUTH OF LINCOLN
SOUTHERN SHEET (SK 95 & PART OF SK 96) BASSINGHAM, LINCOLNSHIRE

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

27a



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

Geological lines from an original geological survey on the one-inch scale published in 1886 on Old Series sheets 83 and 70.
Part re-surveyed in 1941 by W.D.Evans, T.H.Whitehead, District Geologist.
Part redrawn and published on the 1:50,000 scale in 1972-73 on New Series Sheets 114 and 127.

Sand and Gravel Survey by I.Jackson and J.W.C. James in 1973 under the supervision of D.Price. R.G.Thurrell, Head, Mineral Assessment Unit.

1:25,000 Sand and Gravel Resource Sheet published 1976.
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 Surveys.

1550/76

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

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

Compiled from 6" sheets last fully revised 1903-38.
Other partial systematic revision 1938-53 has been incorporated.
Some major roads revised 1965.

EXPLANATION OF SYMBOLS AND ABBREVIATIONS

DRIFT

RECENT AND PLEISTOCENE

- A-18 — **Alluvium** – clays, silts and fine sands.
- RT-7 — **River Terrace Deposits** – Floodplain Terrace: sand and gravel with clay.
- OR-7 — **Older River Sand and Gravel** – Beeston Terrace: mainly sand and gravel.
- GS-18 — **Glacial Sand and Gravel** – mainly sand and gravel.
- S-1 — **Sand of unknown age.**

SOLID

JURASSIC

- LL — **Lincolnshire Limestone, undivided** – limestone with clays.
- LE — **Lower Estuarine Beds and Northampton Sand and Ironstone** – clays, sands and ironstones.
- ULi — **Upper Lias** – clays and shales.
- MRB — **Marlstone Rock Bed** – limestones, ironstones and sandstones.
- MLi — **Middle Lias, undivided** – clays and shales.
- LLi — **Lower Lias, undivided** – clays, mudstones and thin limestones, including Upper Ferruginous Limestone (L)

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

WO-10 — **Worked-out opencast ironstone area.**

BOUNDARY LINES

- Geological boundary, Drift.
- Geological boundary, Solid.
- Fault, crossmark indicates downthrow side.
- Inferred boundary between recognised categories of deposits.
- Resource Block boundary.

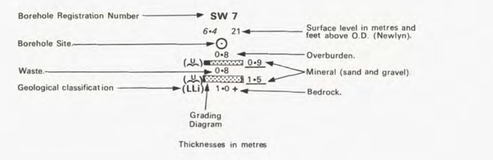
Broken lines denote uncertainty

BOREHOLE DATA

SITE LOCATIONS

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

M.A.U. BOREHOLES



Thicknesses in metres

Note:

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

Borehole Registration Number

Each M.A.U. borehole is identified by a Registration Number e.g. SW 7. The letters refer to the quarter sheet and the figures to the I.G.S. serial number for that quarter. The unique designation for borehole SW 7 is SK96 SW 7.

Grading Diagrams

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

The height of the diagram is proportional to the mineral thickness

The widths of the divisions show the proportions of **Fines, Sand** and **Gravel** but small amounts of gravel may be omitted or exaggerated.

CATEGORIES OF DEPOSITS

- **Exposed mineral, assessed.** CAT-E2
- **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 other categories, viz 'Continuous or almost continuous spreads of mineral beneath overburden' and 'Discontinuous spreads of mineral beneath overburden' are recognised

RESOURCE BLOCKS

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

A horizontal section showing the general relations of the drift deposits along line of Section B is included in Fig. 2 of the Report.

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

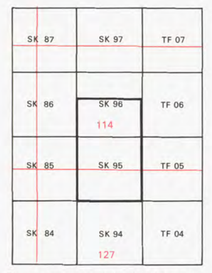


Diagram showing the relation of the National Grid 1:25 000 sheets with the 1:50 000 New Series Geological sheets 114 and 127

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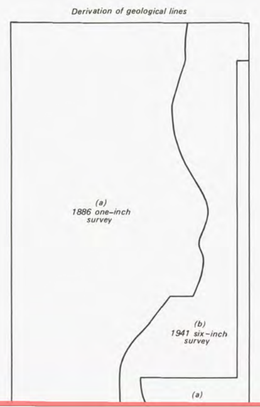
Derivation of geological lines



INSTITUTE OF GEOLOGICAL SCIENCES

MINERAL ASSESSMENT UNIT

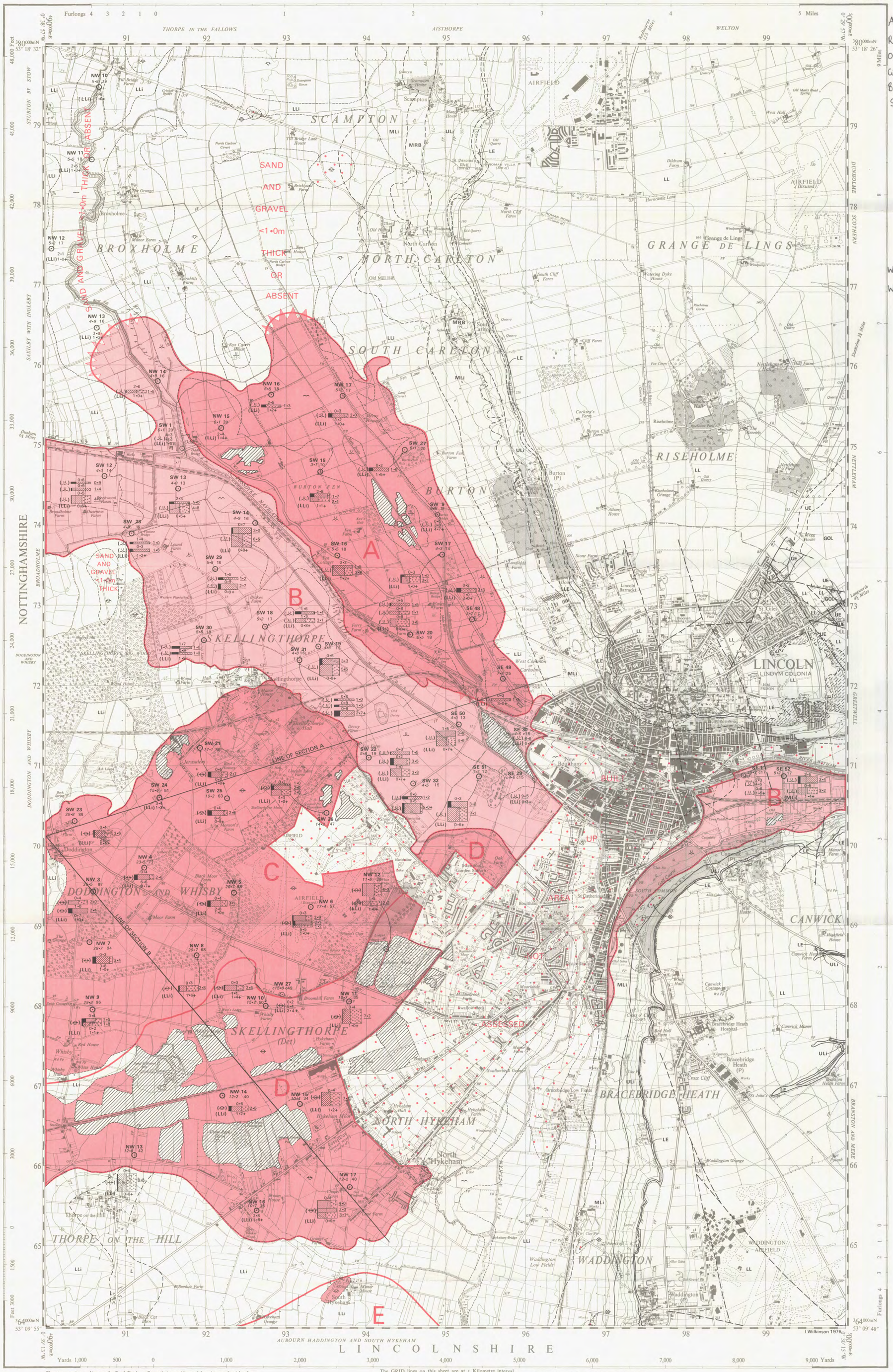
THE SAND & GRAVEL RESOURCES WEST & SOUTH OF LINCOLN. NORTHERN SHEET (SK 97 & PART OF SK 96) LINCOLN, LINCOLNSHIRE

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

ORDNANCE SURVEY

SHEET SK 97 & Pt.96

PROVISIONAL EDITION



THE SAND & GRAVEL RESOURCES WEST & SOUTH OF LINCOLN NORTHERN SHEET (SK 97 & PART OF SK 96) LINCOLN, LINCOLNSHIRE

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

EXPLANATION OF SYMBOLS AND ABBREVIATIONS

27b

DRIFT — RECENT AND PLEISTOCENE

- A-18 — **Alluvium** - clays, silts and fine sands.
- RT-7 — **River Terrace Deposits** - Floodplain Terrace: sand with clay and basal gravel.
- OR-7 — **Older River Sand and Gravel** - Beeston and Hilton terraces: mainly sand and gravel.
- GS-18 — **Glacial Sand and Gravel** - mainly sand and gravel.
- BC-10 — **Boulder Clay** - stony clay.
- S-1 — **Sand of unknown age.**

SOLID — JURASSIC

- GOL — **Great Oolite Limestone** - limestone with clays.
- UE — **Upper Estuarine Beds** - sandy clays.
- LL — **Lincolnshire Limestone, undivided** - limestone with clays.
- LE — **Lower Estuarine Beds and Northampton Sand and Ironstone** - clays, sands and ironstones.
- ULi — **Upper Lias** - clays and shales.
- MRB — **Marlstone Rock Bed** - limestones, ironstones and sandstones.
- MLi — **Middle Lias, undivided** - clays and shales.
- LLi — **Lower Lias, undivided** - clays, mudstones and thin limestones; including Upper Ferruginous Limestone (**L**).

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

WO-10 — **Worked-out opencast ironstone area.**

BOUNDARY LINES

- Geological boundary, Drift.
- Geological boundary, Solid.
- Fault, crossmark indicates downthrow side.
- Inferred boundary between recognised categories of deposits.
- 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 → SE 52 (5·2 17) ← Surface level in metres and feet above O.D. (Newlyn).
Borehole Site →
Waste → 2·5 (U) 3·4 ← Overburden.
0·5 (U) 3·2 ← Mineral (sand and gravel).
Geological classification → (MLi) 1·4+ ← Bedrock.
Grading Diagram. Thicknesses in metres

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

Borehole Registration Number

Each M.A.U. borehole is identified by a Registration Number e.g. SE 52. The letters refer to the quarter sheet and the figure to the I.G.S. serial number for that quarter. The unique designation for borehole SE 52 is SK 97 SE 52.

Grading diagrams

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

Sand (+1/16-4mm)
Fines : Gravel
(-1/16mm) (+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** but small amounts of gravel may be omitted or exaggerated.

OTHER BOREHOLES

The layout of information is the same as for M.A.U. boreholes though the 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 category: 'Discontinuous spreads of mineral beneath overburden' is recognised.

RESOURCE BLOCKS

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

Horizontal sections showing the general relations of the drift deposits along the lines of section A and B constitute Fig.2 of the Report.

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

SK 88	SK 98 (102)	TF 08
SK 87	SK 97	TF 07
SK 86	SK 96 (114)	TF 06
SK 85	SK 95	TF 05

Diagram showing the relation of the National Grid 1:25 000 sheets with One-Inch Geological Sheet 102 and the 1:50 000 Geological Sheet 114.

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

Geological lines from original geological survey on the one-inch scale published in 1886 on Old Series sheet 83. Part resurveyed in 1941 by W.D.Evans. T.H.Whitehead, District Geologist. Part redrawn and published on the 1:50,000 scale in 1973 on New Series sheet 114. Amended on the 1:25,000 scale by I.Jackson, J.R.Gozzard and D.Price in 1974. D.R.A.Ponsford, District Geologist.

Sand and Gravel Survey by I.Jackson, J.W.C.James, J.H.Lovell and A.Smith in 1973–74, under the supervision of D.Price. R.G.Thurrell, Head, Mineral Assessment Unit.

1:25,000 Sand and Gravel Resources Sheet published 1976. 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 Surveys.

1550/76

The GRID lines on this sheet are at 1 Kilometre interval.
Heights are in feet above Mean Sea Level at Newlyn.

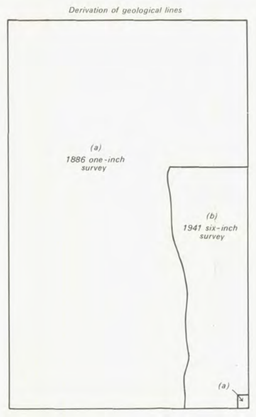
Contour values are in feet

1 square inch on this map represents 99·639 acres on the ground.

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

Compiled from 6" sheets last fully revised 1904-38. Other partial systematic revision 1938-53 has been incorporated. Major roads revised 1963-65.

Derivation of geological lines



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