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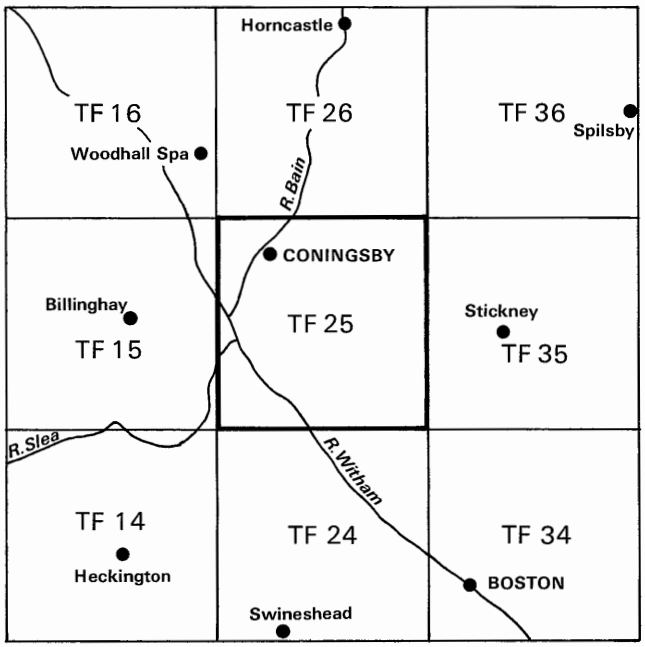

The sand and gravel resources of the country around Coningsby, Lincolnshire

Description of 1:25 000 sheet TF 25

I. Jackson and M. D. Issaias

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The first twelve reports on the assessment of British sand and gravel resources appeared in the Report Series of the Institute of Geological Sciences as a subseries. Report No. 13 and subsequent reports appear as Mineral Assessment Reports of the Institute.

Details of published reports appear at the end of this Report.

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PREFACE

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

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

This report describes the sand and gravel resources of 100 km^2 of country around Coningsby, Lincolnshire, shown on the accompanying 1:25 000 resource map. The survey which was supervised by B. J. Taylor, was conducted by M. D. Issaias and J. B. L. Wild. The work is based on one-inch geological surveys published in 1886 and 1893 on Old Series sheets 69, 70, 83 and 84. The geological lines, now presented at the 1:25 000 scale, incorporate amendments by T. P. Fletcher (Yorkshire and East Midlands Unit).

J. W. Gardner, C.B.E., (Land Agent) was responsible for negotiating access to land for drilling. The ready cooperation of landowners and tenants in this work and the assistance of officials of the Anglian Water Authority, British Gas Corporation, Central Electricity Generating Board, East Midlands Electricity Board, Post Office Telecommunications and Lincolnshire County Council are gratefully acknowledged.

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The sand and gravel resources of the country around Coningsby, Lincolnshire

Description of 1:25 000 sheet TF 25

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SUMMARY

The geological maps of the Institute of Geological Sciences, pre-existing borehole information, and 85 boreholes drilled for the Industrial Minerals Assessment Unit form the basis of the assessment of the sand and gravel resources of the country around Coningsby, Lincolnshire.

The survey identified potentially workable sand and gravel within the exposed fluvial sediments north-east of the River Witham. South-west of the river, boreholes encountered a buried valley in bedrock and till infilled with alluvial sediments overlying sands and gravels. Over most of the south and east, barren marine or estuarine sediments rest directly on till. No mineral was recorded within the till.

The deposits of the district are divided into four resource blocks, containing between 8.6 and 20.8 km^2 of mineral. For each block the geology of the deposits is described, and the mineral-bearing area, the mean thickness of overburden and mineral and the mean gradings are stated. Detailed borehole data are also given. The geology, the position of the boreholes and the outlines of the resource blocks are shown on the accompanying map.

Notes

Each borehole registered with the Institute is identified by a four-element code (e.g. TF 25 NW 35). The first two elements define the 10-km square (of the National Grid) in which the borehole is situated; the third element defines a quadrant of that square, and the fourth is the accession number of the borehole. In the text of the report the borehole is normally referred to by the last two elements alone (e.g. NW 35).

All National Grid references in this publication lie within the 100-km square TF unless otherwise stated. Grid references may be given to eight figures, accurate to within 10 m, or to six figures for more extensive locations such as farms.

Bibliographical reference

JACKSON, I. and ISSAIAS, M. D. 1982. The sand and gravel resources of the country around Coningsby, Lincolnshire: description of 1:25 000 sheet TF 25. **Miner. Assess. Rep. Inst. Geol. Sci.,** No.128.

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INTRODUCTION

The survey is concerned with the estimation of resources, which include deposits that are not currently exploitable but have a foreseeable use, rather than reserves, which can only be assessed in the light of current, locally prevailing, economic considerations. Clearly, neither the economic nor the social factors used to decide whether a deposit may be workable in the future can be predicted; they are likely to change with time. Deposits not currently economically workable may be exploited as demand increases, as higher-grade or alternative materials become scarce, or as improved processing techniques are applied to them. The improved knowledge of the main physical properties of the resource and their variability, which this survey seeks to provide, will add significantly to the factual background against which planning policies can be decided (Archer, 1969; Thurrell, 1971, 1981; Harris and others, 1974).

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 geologic evidence. The sites available for inspection, measurement, and sampling are too widely or otherwise inappropriately spaced to permit the mineral bodies to be outlined completely or the grade established throughout" (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 B.S. sieve, about 1/16 mm) should not exceed 40 per cent.
d The deposit should lie within 25 m of the surface, this being taken as the likely maximum working depth under most circumstances. It follows from the second criterion that boreholes are drilled no deeper than 18 m if no sand and gravel has been proved. (Because assessment surveys in adjacent areas (for example, Horncastle, TF 26) found no mineral within till, several boreholes in TF 25 were terminated in that deposit before reaching the prescribed depth.)

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

Pre-Pleistocene rocks, which are usually consolidated and devoid of potentially workable sand and gravel, are referred to as 'bedrock'; 'waste' is any material other than bedrock or mineral; 'overburden' is waste that occurs between the surface and an underlying body of mineral.

For the particular needs of assessing sand and gravel resources, a grain-size classification based on the geometric scale 1/16 mm, ¼ mm, 1 mm, 4 mm, 16 mm,

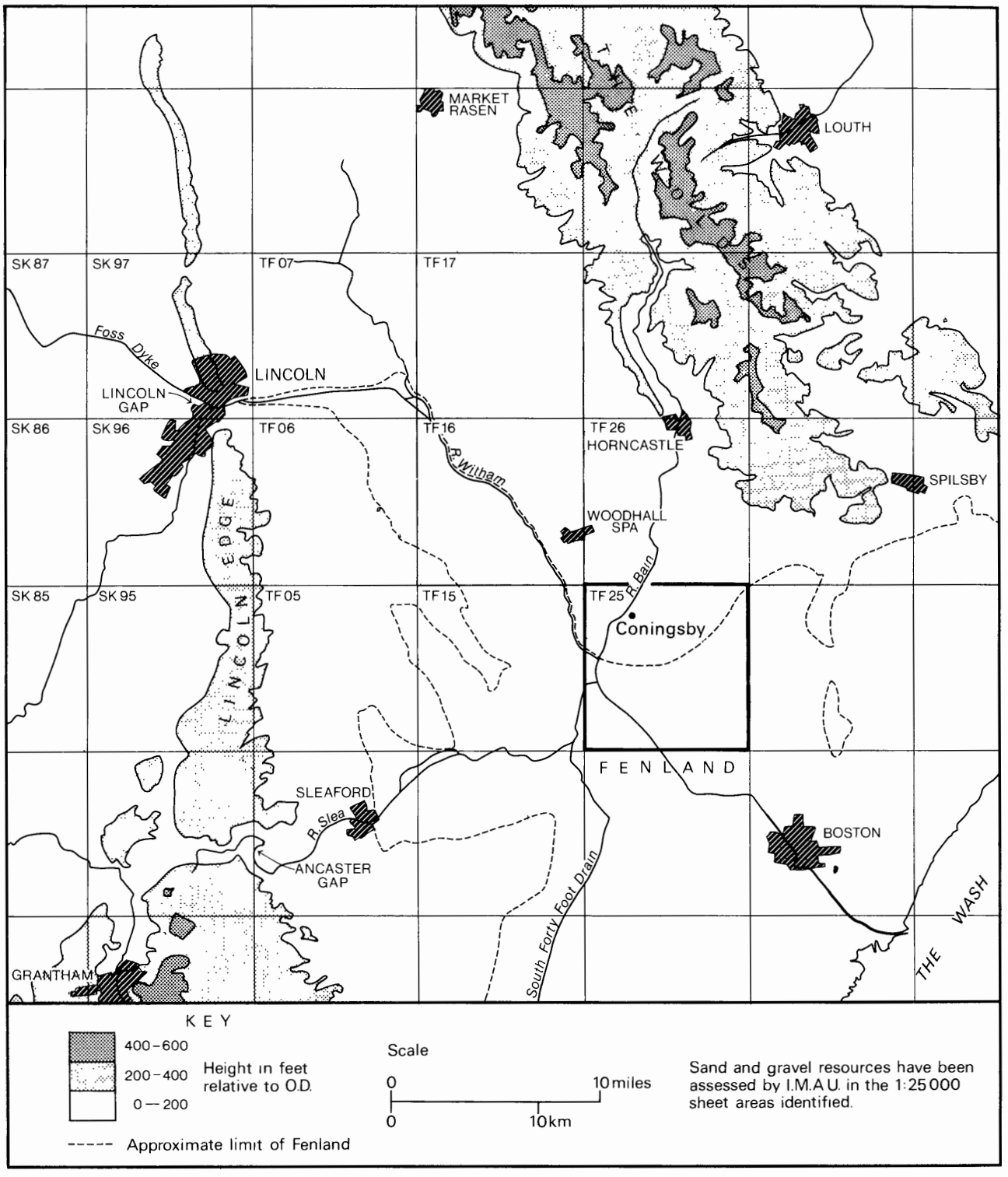


Figure 1 Sketch map showing the location of sheet TF 25.

64 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 or land of high agricultural or landscape value, which might stand in the way of sand and gravel being exploited, although towns are excluded. The estimated total volume 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 mineral in parts of a block, except in the immediate vicinity of the actual sample points.

DESCRIPTION OF THE DISTRICT

The district is situated approximately eight miles north-west of Boston (Figure 1). It is chiefly agricultural, the adjoining villages of Tattershall [212 578] and Coningsby [224 580] in the north-west being the only sizable settlements. However, there is an active military airbase

to the south of these villages. Sand and gravel is currently being worked [207 570] near the western margin of the district.

Topography

The district, which lies at the southern end of the Lincoln Clay Vale, is virtually flat and featureless. The land surface falls gently from a maximum height of only 36ft (11 m) OD in the extreme north to altitudes a few feet above sea level in the south and east. The River Bain flows southwards to meet the River Witham at Dogdyke [209 556], 1500 m north of the outfall of the Kyme Eau (the canalised River Slea). The Witham maintains a south-easterly course and meets The Wash to the south of Boston. Extensive drainage schemes in the Fenland over several centuries (Darby, 1940, p.148) have had a profound effect on the landscape, making the region one of the most fertile arable areas in the country.

Geology

The geological sequence is summarised in Table 1 where deposits are listed as far as possible in order of increasing age.

Table 1 Geological sequence

DRIFT	
Quaternary	
(Recent and Pleistocene)	Alluvium
	Marine or Estuarine Alluvium
	River Gravels, undifferentiated
	Fluvio-glacial and Older River Sand and Gravel
	Till
SOLID	
Jurassic	Ancholme Clay Group

SOLID

Ancholme Clay Group In this district the Ancholme Clay Group comprises approximately 200 m of strata previously referred to as the Ampthill and Kimmeridge clays. The rocks, which dip gently eastwards, are concealed by drift throughout the district except for a small outcrop in the north-east. In IMAU boreholes the Group is represented by fossiliferous silty clays which are predominantly olive black in colour.

DRIFT

Till Till probably once mantled bedrock throughout the district, but in the area south-east of the present course of the River Witham it has been removed by fluvial erosion (see Figure 2 and Section 2 at foot of the resource map). The deposit, concealed by younger sediments over much of the district, reaches a maximum proved thickness of 17.2 m in borehole NW 25, but thins to less than 5 m in the north-west and north-east. It consists chiefly of grey, olive grey and black silty clays with abundant chalk fragments and some flint, siltstone and sandstone pebbles.

Straw (1966, p.146; 1969, p.89; 1979, p.542) subdivided the till sheet north of the district into two, essentially contemporaneous, lithological units, the Wragby and Calcethorpe tills. He considered them to be of Wolstonian age and the product of ice flowing southwards. More recently, Perrin and others, (1979, p.547) equated these tills with the pre-Devensian Chalky Boulder Clay of East Anglia and interpreted them as deposits of a fan-like ice sheet centred on The Wash.

Fluvio-glacial and Older River Sand and Gravel These deposits, which overlie the till, crop out extensively in the north and west of the district and also occur in the south around Wildmore [255 530], where they are partially concealed by recent alluvium. They consist predominantly of flint-rich sands and gravels that are thickest in the north (maximum proved thickness of

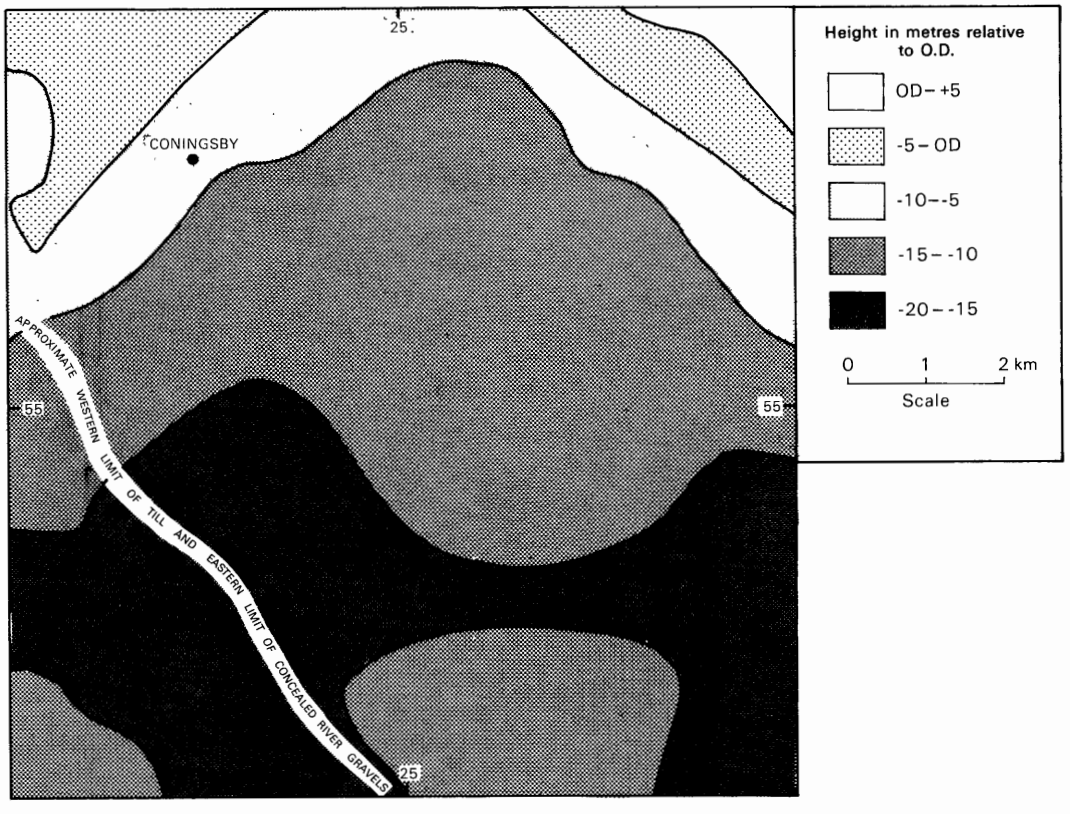


Figure 2 Contours on the bedrock surface.

7.8 m in borehole NW 16) and thin to an irregular veneer in the south and east (see Figure 4 and Section 1 at foot of the resource map).

Old Series Sheet 70 shows these sands and gravels as Fen Beds (Gravel) and the authors of the accompanying memoir (Jukes-Browne and others, 1885, p.101) agree with Skertchly's earlier interpretation (1877, p.183) of their marine origin. Old Series Sheet 83, however, classifies the deposits as Ancient Gravels of old Rivers, and the memoir (Ussher and others, 1888) describes them as estuarine sediments of the ancient River Trent and its tributaries. Straw (1958, p.37) ascribed the deposits to his Southrey Terrace and considered them to be fluviatile fans.

River Gravels These sands and gravels, mapped between the River Bain and the north-western outcrop of the Fluvio-glacial and Older River Sand and Gravel, have also been identified in IMAU boreholes in the south-west, where they occupy a rockhead channel beneath Marine and Estuarine Alluvium (see Figures 2 and 5 and sections at foot of the resource map). The exposed River Gravels north-west of the River Bain are between 2.1 and 7.5 m thick and are similar lithologically to the adjacent Fluvio-glacial and Older River Sand and Gravel, i.e., with flint as the dominant rock-type in the gravel fraction. Old Series Sheet 70 makes no distinction between these deposits, which are collectively referred to as Fen Beds (Gravel), whereas to the north on Old Series Sheet 83 the deposits were separated. Later workers (for example, Straw, 1958, p.38) have accepted the first interpretation. Subsequently sections through the deposits at gravel workings [207 570] south-west of Tattershall have been the subject of detailed research. The sequence exposed contains organic silts and a vertebrate and invertebrate fauna that indicate a mid-Devensian age for these sediments (Girling, 1974, p.270; Rackham, 1978, p.2). These organic sediments were not recorded in IMAU boreholes near the quarry; however it is possible that the action of the drilling tool in sand and gravel beneath the water table could result in the loss of such thin deposits.

In the south-west the concealed River Gravels have a different lithological composition and contain abundant quartzite pebbles with flint as a common but subordinate component. These sandy gravels, with a base as much as 18.8 m below OD, reach a maximum thickness of 13.1 m in borehole SW 1. They are contiguous with similar gravels west of the Lincoln Gap and are thought to mark a former phase of Trent drainage to the Wash (Jackson, 1977, p.5; 1982, p.4). The higher proportion of flint in the gravels probably reflects the influx of tributaries like the River Bain.

Marine or Estuarine Alluvium These deposits occur extensively on the low-lying ground in the south of the district. They are best developed south-west of the River Witham where thicknesses of up to 12.5 m (borehole SW 15) have been encountered. They consist chiefly of soft grey clays and silts with disseminated plant remains, but discrete peat bands were recorded and silty sands up to 6.5 m in thickness (borehole SW 15) have been proved. The variable sequence is probably an attenuated continuation of recent sediments to the south, and results both directly and indirectly from oscillations of sea level (see Godwin, 1978).

Alluvium Alluvium occurs as a thin ribbon-like deposit alongside the River Bain. The only IMAU borehole sited on these sediments (NW 19) proved 0.4 m of sandy, pebbly silt.

Composition of the Sand and Gravel Deposits

Within the district, Fluvio-glacial and Older River Sand and Gravel, River Gravels and Marine or Estuarine Alluvium contain potentially workable sand and gravel.

Fluvio-glacial and Older River Sand and Gravel This deposit, which has a mean grading of fines 6 per cent, sand 71 per cent and gravel 23 per cent, consists of pebbly sands and sandy gravels which are sporadically 'clayey' (as in boreholes NE 5, NE 10, SW 10 and SE 9). The gravel is predominantly of fine grade with 70 per cent of pebbles in that fraction. Except for one borehole (SE 8) the gravels are lithologically uniform (Figure 3): flint is the major constituent with chalk the principal subsidiary component; quartzite, quartz, sandstone, limestone and igneous rocks are usually only present in subordinate amounts. However, in borehole SE 8 quartzite is more common than flint.

The sand fraction is mainly medium-grained and composed of quartz with lithic grains similar in composition to those of the gravel.

River Gravels All five boreholes in the exposed deposits north-west of the River Bain proved sandy gravel with a mean grading of fines 5 per cent, sand 62 per cent, gravel 33 per cent. The gravel fraction is predominantly fine-grained and comprises flint with chalk and small amounts of quartz, quartzite, limestone, sandstone, igneous rocks and shell debris. The mean grading of the concealed deposit is fines 3 per cent, sand 68 per cent, gravel 29 per cent. The majority of boreholes proved sandy gravel but locally pebbly sand was recorded. On average, 69 per cent of the pebbles fall into the fine-gravel fraction; cobbles are rare. Quartzite is the dominant rock-type but flint and quartz are also common. In contrast chalk, sandstone, igneous rocks and shell fragments together usually account for less than 20 per cent of the total. The sand fraction of both deposits is medium-grained and consists of quartz with lithic clasts.

Marine or Estuarine Alluvium The potentially workable deposits within these sediments are irregular both in distribution and thickness and comprise sands and 'clayey' sands with a mean grading of fines 8 per cent, sand 91 per cent, gravel 1 per cent. They consist predominantly of fine-grained quartz but disseminated organic matter, including shell debris, may be present.

The Map

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

Geological data The geological boundaries shown are based on one-inch geological surveys of Old-Series sheets 69, 70, 83 and 84 published in 1886 and 1893. The resource map incorporates some amendments to both the stratigraphical nomenclature and the geological boundaries.

The geological boundaries are the best interpretation of the information available at the time of survey. However, it is inevitable that local irregularities and discrepancies will be revealed as new evidence from boreholes and excavations becomes available.

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

Mineral resource information The mineral-bearing ground is divided into resource blocks (see Appendix A). Within a resource block the mineral is subdivided into areas where it is exposed, that is where the overburden averages less than 1 m in thickness, and areas where it is present in continuous, or 'almost continuous', spreads beneath overburden. The discontinuous mineral category has not been recognised in this area.

Areas where bedrock crops out, where boreholes indicate absence of sand and gravel beneath cover and where sand and gravel beneath cover is interpreted to be

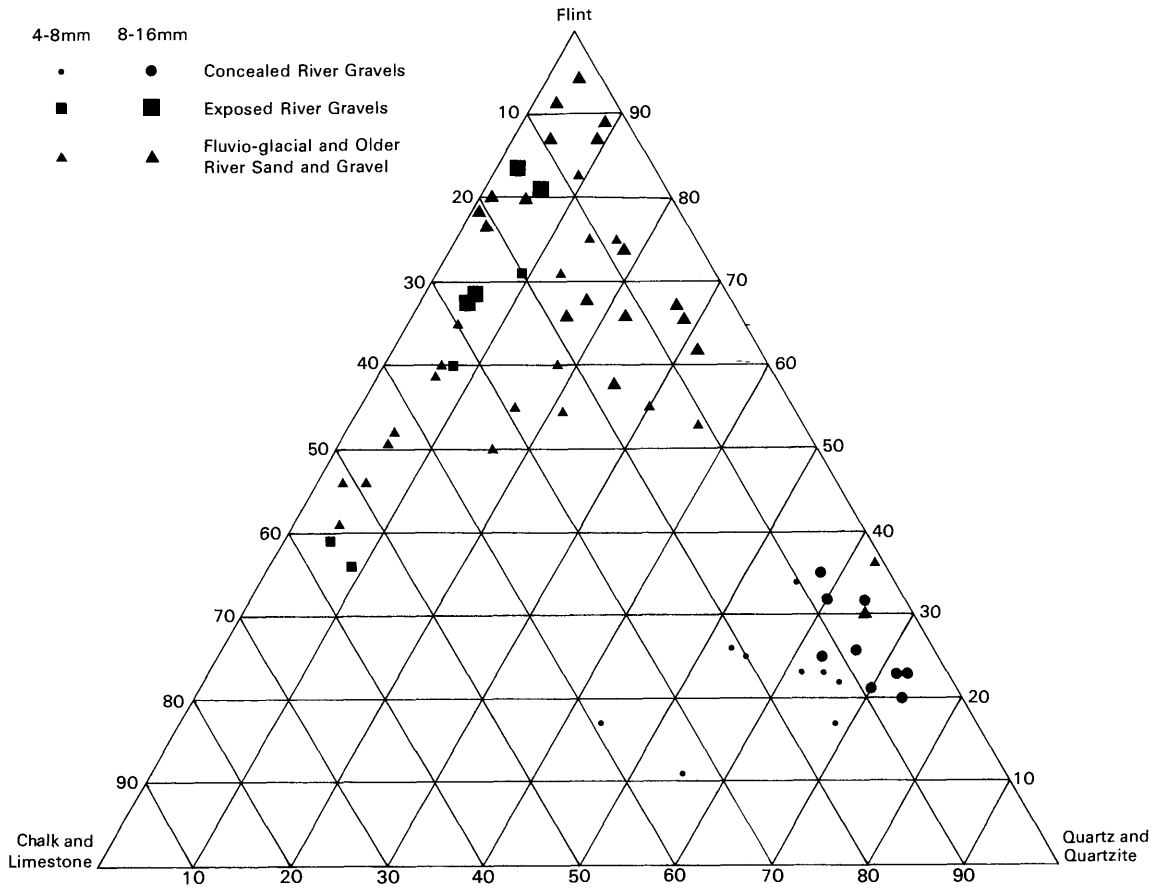


Figure 3 Lithological composition of the sand and gravel deposits from IMAU boreholes.

Table 2 Sand and gravel resources of the district.

Block	Area		Mean thickness		Volume of sand and gravel			Mean grading percentage		
	Block	Mineral	Over-burden	Mineral		Limits at the 95% probability level		Fines $-\frac{1}{16}$ mm	Sand $+\frac{1}{16}-4$ mm	Gravel +4 mm
	km^2	km^2	m	m	$m^3 \times 10^6$	± %	± $m^3 \times 10^6$			
A	9.4	8.6	1.1	3.7	32	43	14	4	63	33
B	30.0	20.8	1.1	4.1	85	21	18	6	72	22
C	14.9	14.9	7.6	10.9	162	21	34	4	72	24
D	9.2	9.2	1.4	2.5	23	48	11	8	69	23
A–D	**63.5**	**53.5**	**3.0**	**5.7**	**302**					

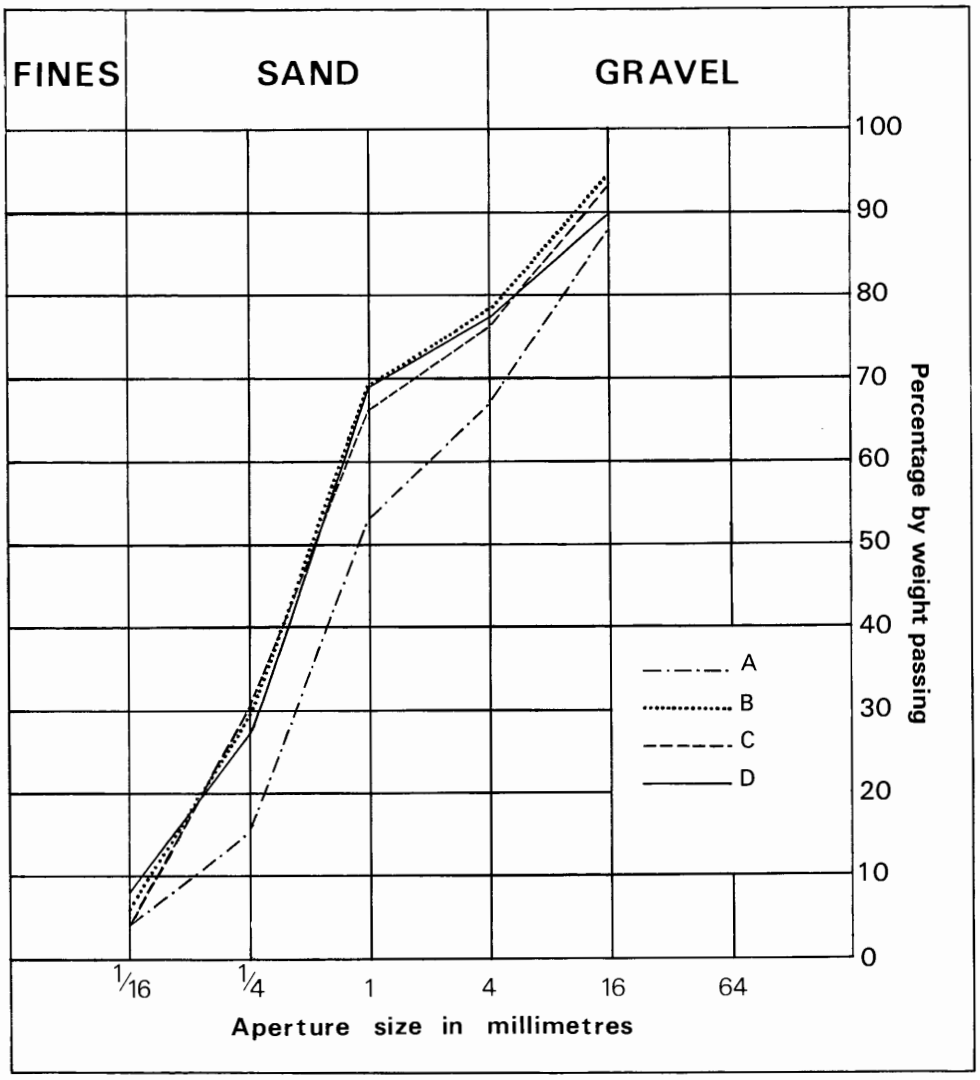
not potentially workable, are uncoloured on the map; where appropriate, the relevant criterion is noted. In such cases it has been assumed that mineral is absent except in infrequent and relatively minor patches that can neither be outlined nor assessed quantitatively in the context of this survey.

For the most part the depicted distribution of the various 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 map and which cannot be delineated accurately, inferred boundaries have been inserted. The symbol is intended to indicate an approximate location within a likely zone of occurrence rather than to represent the breadth of the zone, its size being determined only by cartographic considerations. For the purpose of measuring areas the centre line of the symbol is used.

Results

The statistical results are summarised in Table 2. Fuller grading particulars are shown in Figure 4 and the mean gradings and 'grading envelopes' for each resource block are given in Figures 6 to 9.

Accuracy of results For the four resource blocks, the accuracy of the results at the 95 per cent probability level (that is, on average nineteen out of every twenty



Resource block	Cumulative percentage by weight passing				
	1/16mm	1/4mm	1mm	4mm	16mm
A	4	15	53	67	88
B	6	29	69	78	94
C	4	30	66	76	93
D	8	27	69	77	90

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

sets of limits constructed in this way contain the true value for the volume of mineral) varies between 21 per cent and 48 per cent (Appendix B). However, the true volumes are more likely to be nearer the figure estimated than either of the limits. Moreover, it is probable that roughly the same percentage limits would apply for the statistical estimate of mineral volume within a very much smaller parcel of ground (say 100 hectares) containing similar sand and gravel deposits, if the results from the same number of sample points (as provided by, say, ten boreholes) were used in the calculation. Thus, if closer limits are needed for quotation of reserves, data from more sample points would be required, even if the area were quite small. It must be emphasised that the quoted volume of mineral has no simple relationship with the amount that could be extracted in practice, as no allowance has been made in the calculations for any restraints (such as existing buildings and roads) on the use of the land for mineral working.

Notes on the Resource Blocks

The potentially workable sand and gravel of the district has been divided into four resource blocks (see Figure 5). Block A contains Fluvio-glacial and Older River Sand and Gravel and River Gravels north-west of the River Bain, whereas Block B contains that part of the Fluvio-glacial and Older River Sand and Gravel to the south-east, extending towards the parishes of Revesby and Wildmore. Block C encompasses the concealed mineral

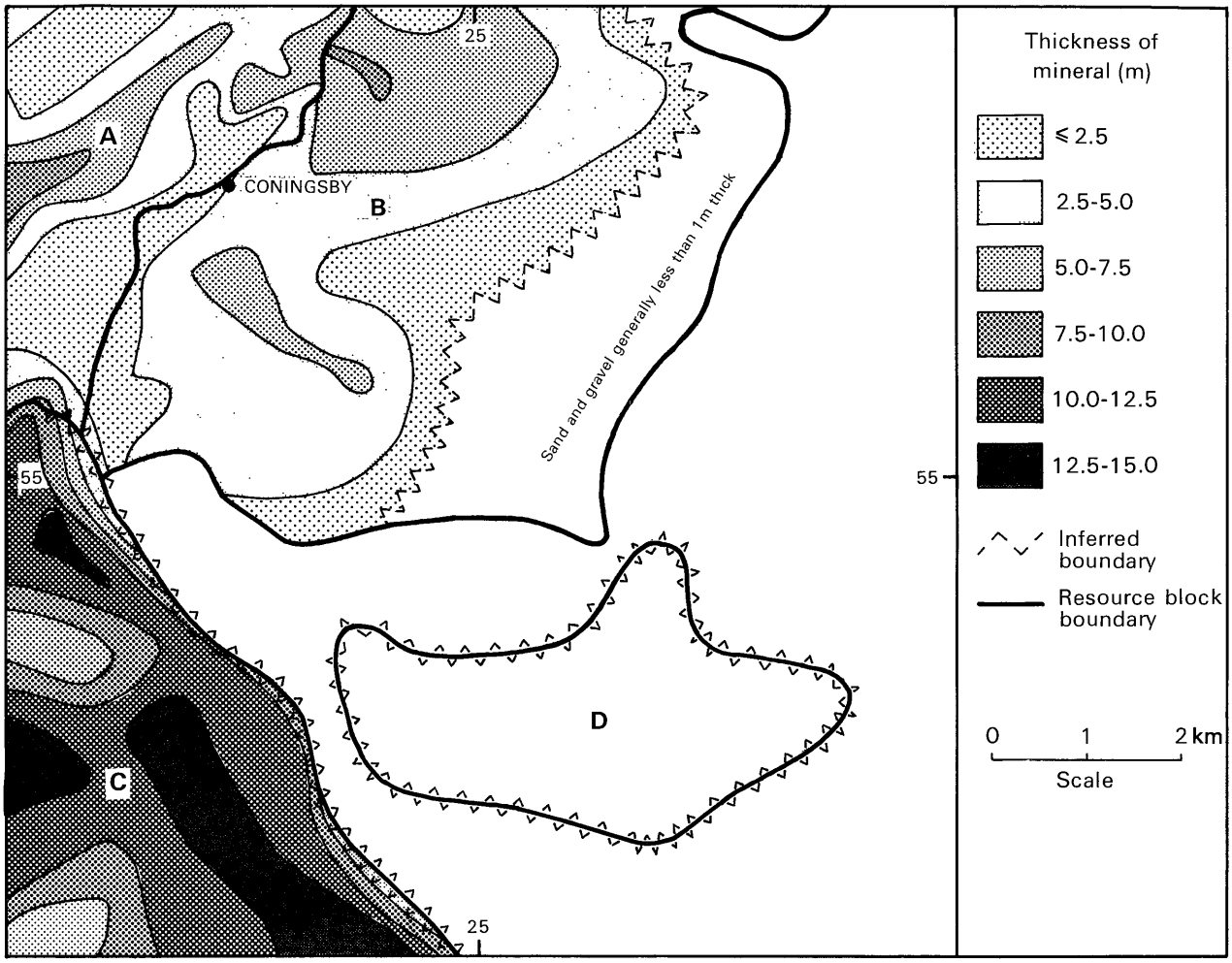


Figure 5 Isopachytes of the mineral in blocks A, B and C (there is insufficient data to allow contouring of block D).

Table 3 Block A: data from IMAU boreholes.

Borehole	Recorded thickness (m)		Mean grading percentage					
	Over-burden	Mineral	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}-1$ mm	Coarse sand +1 -4 mm	Fine gravel +4 -16 mm	Coarse gravel +16 mm
NW 13	1.6	1.3	No grading data available					
NW 14	1.5	3.2	1	11	45	8	18	17
NW 15	1.1	7.5	4	10	38	15	21	12
NW 18	1.8	4.8	3	12	46	14	18	7
NW 19	1.2	2.3	4	7	32	18	24	15
NW 22	0.6	2.1	6	12	34	13	23	12
NW 27	0.9	2.1	9	10	23	17	27	14
NW 99	0.9	5.4	No grading data available					
NW 100	0.4	6.9	No grading data available					
NW 103	0.8	3.8	No grading data available					
Block mean grading			**4**	**11**	**38**	**14**	**21**	**12**

deposits of the River Gravels and Marine or Estuarine Allvuium in the south-west. A large number of boreholes in the south and east of the district failed to prove mineral; however, a relatively thin and variable spread of Fluvio-glacial and Older River Sand and Gravel south of Wildmore comprises Block D.

Block A (Table 3; Figure 6)
This block, in the north-west of the district (Figure 4), encompasses approximately 8.6 km^2 of mineral-bearing Fluvio-glacial and Older River Sand and Gravel and River Gravels. In the ten IMAU boreholes, thicknesses between 1.3 and 7.5 m have been proved but data from confidential boreholes show that the range may marginally exceed this. The mean thickness, based on 25 boreholes, is 3.7 m, producing an estimated volume of mineral of 32 million m^3 $\pm$ 43 per cent. Samples from six IMAU boreholes show the mineral to grade

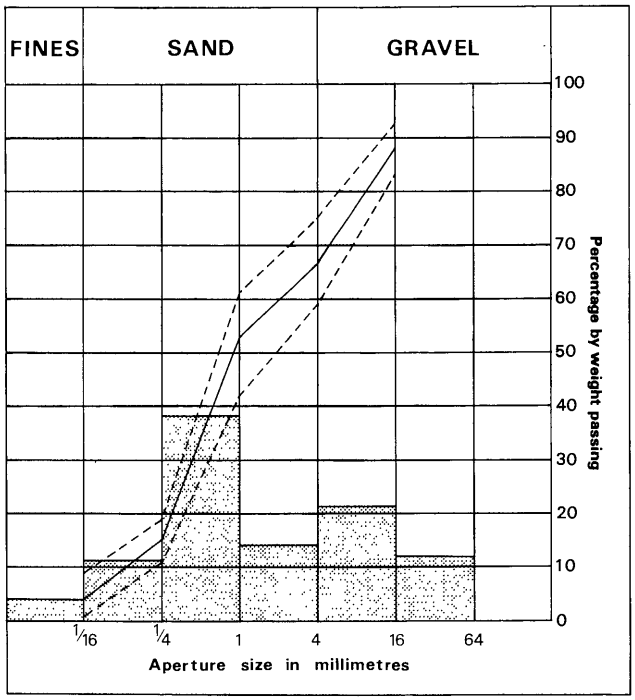


Figure 6 Grading characteristics of the mineral in Block A. The continuous line is the cumulative frequency curve of the mean grading of the block as a whole; the broken lines denote the envelope within which the mean grading curves for individual boreholes fall. The mean grading of the block is also shown as a bar graph.

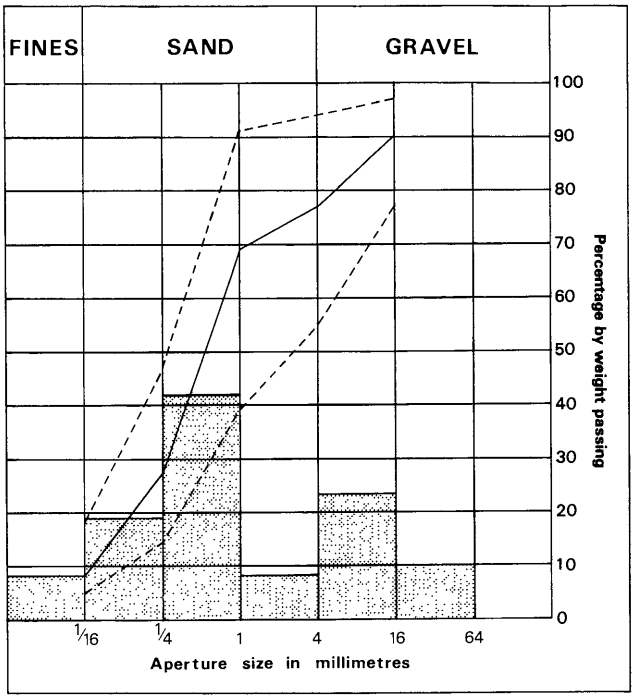


Figure 7 Grading characteristics of the mineral in Block B (for explanation, see Figure 6).

consistently as a sandy gravel; fines do not exceed 9 per cent of the total. The mean grading for the block is fines 4 per cent, sand 63 per cent, gravel 33 per cent.

Overburden averages just less than 1 metre within the exposed Fluvio-glacial and Older River Sand and Gravel and River Gravels, but figures from IMAU boreholes may be misleadingly high as Made Ground was encountered at several sites (NW 13, 14 and 18). Within the alluvium thicknesses of up to 3.0 m may be present.

Waste partings were not encountered. Up to 1981, approximately 0.7 km^2 of River Gravels south-west of Tattershall had been worked for sand and gravel.

Block B (Table 4; Figure 7)

Block B occupies 30 km^2 of which 20.8 km^2 is mineral-bearing. Except for borehole NE 25, boreholes in the eastern part of the Fluvio-glacial and Older River Sand and Gravel failed to prove sand and gravel more than 1 m in thickness, and an inferred boundary has been inserted accordingly. West of this boundary 21 IMAU boreholes prove mineral between 1.5 m (NW 25) and 7.8 m (NW 16) in thickness which, with data from 67 irregularly spaced confidential boreholes, gives a mean thickness of 4.1 m. The estimated volume of mineral is 85 million m^3 $\pm$ 21 per cent. The grade of the mineral is uniform and the mean for the block is fines 6 per cent, sand 72 per cent, gravel 22 per cent. Although most boreholes contained pebbly sand or sandy gravel, three boreholes (NW 28, 30 and 102) proved beds of sand. In only two boreholes (NE 5 and 10) does the fines content exceed 10 per cent. Over-burden within the Fluvio-glacial and Older River Sand and Gravel usually comprises only soil and subsoil and averages 0.9 m in thickness; waste partings were not encountered.

Block C (Table 5; Figure 8)

This block, which is 14.9 km^2 in area, contains the concealed sand and gravel of the River Gravels and

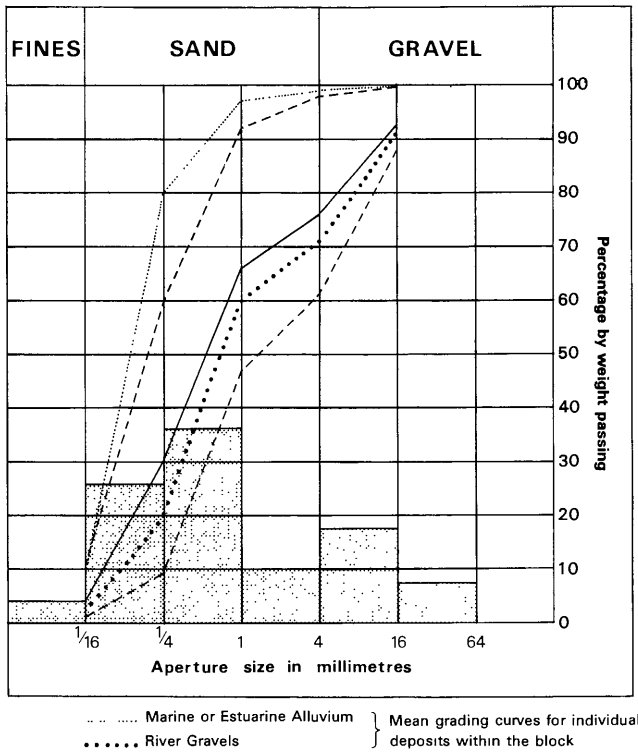


Figure 8 Grading characteristics of the mineral in Block C (for explanation, see key and Figure 6).

Table 4 Block B: data from IMAU boreholes.

Borehole	Recorded thickness (m)		Mean grading percentage					
	Over-burden	Mineral	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}$ -1 mm	Coarse sand +1 -4 mm	Fine gravel +4 -16 mm	Coarse gravel +16 mm
NW 16	0.9	7.8	6	27	42	8	13	4
NW 17	0.7	6.9	4	20	44	8	16	8
NW 20	0.8	4.9	7	28	40	7	15	3
NW 21	0.6	6.1	7	18	34	12	21	8
NW 23	1.4	4.7	2	8	47	17	16	10
NW 24	1.2	4.4	3	30	39	7	11	10
NW 25	1.3	1.5	7	18	37	11	19	8
NW 26	1.4	2.2	9	15	38	10	21	7
NW 28	1.4	3.8	4	39	37	6	9	5
NW 29	1.4	4.6	2	13	36	15	25	9
NW 30	1.3	6.0	8	18	51	7	12	4
NW 31		absent						
NW 34	0.6	3.9	6	18	51	8	13	4
NW 35		absent						
NW 101	0.9	6.7	No grading data available					
NW 102	0.5	7.0	No grading data available					
NW 104	0.4	3.5	No grading data available					
NW 105		absent						
NW 106	0.3	3.6	No grading data available					
NE 5	1.1	4.8	10	38	38	6	7	1
NE 6		absent						
NE 7		absent						
NE 9	0.4	4.1	7	16	29	13	26	9
NE 10	1.2	2.7	16	24	29	7	16	8
NE 11		absent						
NE 13		absent						
NE 14		absent						
NE 16		absent						
NE 19		absent						
NE 24	0.8	2.6	No grading data available					
NE 25	0.6	4.2	No grading data available					
Block mean grading			**6**	**23**	**40**	**9**	**16**	**6**

Table 5 Block C: data from IMAU boreholes.

Borehole	Recorded thickness (m)		Mean grading percentage					
	Over-burden	Mineral	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}$ -1 mm	Coarse sand +1 -4 mm	Fine gravel +4 -16 mm	Coarse gravel +16 mm
NW 32	2.0	11.5*	3	24	33	11	21	8
SW 1	5.4	13.1	5	25	44	7	12	7
SW 5	12.0	5.4	3	21	44	9	16	7
SW 6	10.2	11.6	3	22	41	12	17	5
SW 8	7.2	12.8	2	9	41	13	24	11
SW 9	9.1	11.2	2	7	38	14	27	12
SW 11	6.5	11.7	4	30	35	8	17	6
SW 12	11.6	1.4+	1	9	43	15	26	6
SW 14	8.0	7.0†	6	28	36	10	15	5
SW 15	3.7	13.4‡	5	53	19	4	11	8
SW 16	7.3	4.2+	10	50	32	6	2	0
Block mean grading			**4**	**26**	**36**	**10**	**17**	**7**

\+ Base of deposit not reached. † Excludes a 1.5 m waste parting.

* Excludes a 1.9 m waste parting. ‡ Excludes a 1.0 m waste parting.

Table 6 Block D: data from IMAU boreholes.

Borehole	Recorded thickness (m)		Mean grading percentage					
	Over-burden	Mineral	Fines $-\frac{1}{16}$ mm	Fine sand $+\frac{1}{16}-\frac{1}{4}$ mm	Medium sand $+\frac{1}{4}$ -1 mm	Coarse sand +1 -4 mm	Fine gravel +4 -16 mm	Coarse gravel +16 mm
SW 10	1.6	1.9	11	14	41	13	16	5
SW 17	1.3	1.2	No grading data available					
SE 3	0.9	2.9	5	31	41	6	10	7
SE 8	0.6	3.3	8	6	25	15	27	19
SE 9	0.7	1.5	17	29	18	4	9	23
SE 10	3.4	3.9	5	19	67	3	3	3
Block mean grading			**8**	**19**	**42**	**8**	**13**	**10**

Marine or Estuarine Alluvium. The north-eastern margin of the mineral deposits is, of necessity, inferred from borehole information. Boreholes SW 12 and SW 16 had to be abandoned in mineral without proving the base. However all nine IMAU boreholes which reached bedrock proved River Gravels; these deposits range in thickness from 5.4 m in SW 5 to 13.1 m in SW 1, with a mean thickness of 9.5 m. Sandy gravels predominate and the fines fraction never accounts for more than 5 per cent of the total. Mineral within Marine or Estuarine Alluvium occurs in only four boreholes in the south of the block (SW 11, 14, 15 and 16); borehole SW 15 recorded the maximum thickness, 7.8 m of sand, but at SW 14 only 1.5 m of 'clayey' sand was encountered. The probable discontinuous nature of these deposits is shown in Section 2 at the foot of the map. The combined mineral deposits of the block have a mean grading of fines 4 per cent, sand 72 per cent, gravel 24 per cent. The mean thickness is calculated at 10.9 m and the estimated total volume is 162 million m^3 $\pm$ 21 per cent.

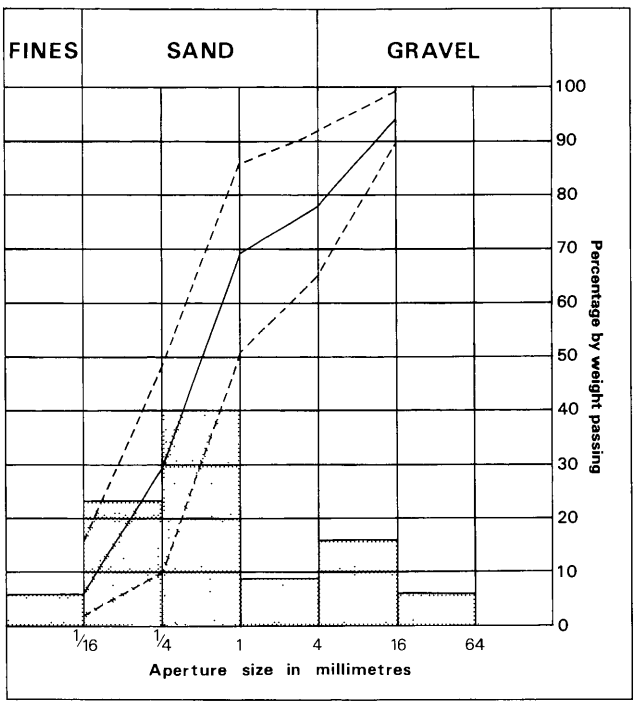


Figure 9 Grading characteristics of the mineral in Block D (for explanation, see Figure 6).

Overburden, generally clays and silts of Marine or Estuarine Alluvium, has a mean thickness of 7.6 m but it is notably thinner in borehole SW 15, where mineral within that deposit is present at shallow depths, and in borehole NW 32 where River Gravels are nearer the surface. Waste partings between 1.0 and 1.9 m thick were noted in boreholes NW 32, SW 14 and 15.

Block D (Table 6; Figure 9)
A group of six IMAU boreholes sited on and surrounding part of the outcrop of Fluvio-glacial and Older River Sand and Gravel in the south of the district proved mineral of variable thickness and composition. Inferred boundaries enclosing these boreholes indicate an area of mineral of approximately 9.2 km^2. The deposit ranges from 1.2 m of sand in borehole SW 17 to 3.3 m of quartzite-rich sandy gravel in borehole SE 8 and 3.9 m of flint-rich pebbly sand in borehole SE 10. The mean grading is fines 8 per cent, sand 69 per cent, gravel 23 per cent and a calculated mean thickness of 2.5 m produces an estimate of volume of 23 million m^3 $\pm$ 48 per cent. Within the outcrop of Fluvio-glacial and Older River Sand and Gravel, overburden comprises only thin soil and subsoil 0.6 to 0.7 m in thickness, whereas in the surrounding Marine or Estuarine Alluvium, up to 3.4 m of overburden was recorded.

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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 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.

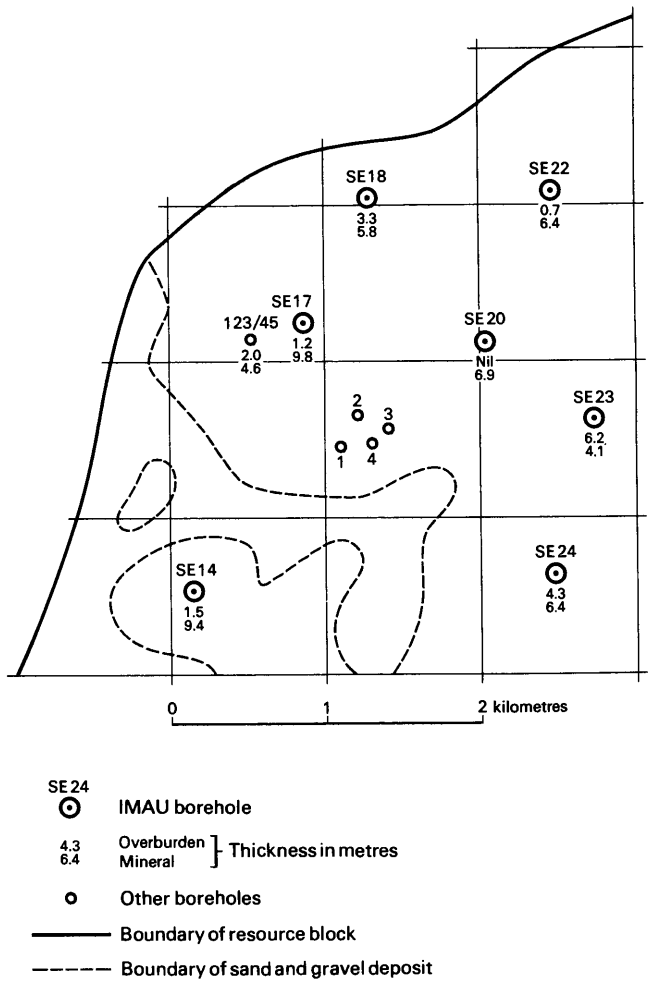
The drilling machine employed should be capable of providing a continuous sample representative of all unconsolidated deposits, so that the in-situ grading can be determined, if necessary, to a depth of 30 m (100 ft) at a diameter of about 200 mm (8 in), beneath different types of overburden. It should 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 B.S. 1337 (British Standards Institution, 1967). Random checks of the accuracy of the grading are made in the Institute's laboratories.

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

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



Example of resource block assessment: map of a fictitious block

APPENDIX B

STATISTICAL PROCEDURE

Statistical assessment

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

2 The simple methods used in the calculations are consistent with the amount of data provided by the survey (Hull, 1981). Conventional symmetrical confidence limits are calculated for the 95 per cent probability level, that is, on average nineteen out of every twenty sets of limits constructed in this way contain the true value for the volume of mineral.

3 The volume estimate (V) for the mineral in a given block is the product of 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 thickness, the standard deviation for volume approximates to that for mean thickness.

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

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

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

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

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

6 The sampled area in each resource block is coloured pink on the map. Wherever possible, calculations relate to the mineral within mapped geological boundaries (which may not necessarily correspond to the limits of a deposit). Where the area is not defined by a mapped boundary, that is, where the boundary is inferred, a distinctive symbol is used. Experience suggests that the errors in determining area are small relative to those in thickness. The relationship $S_A / S_{\bar{l}_m} \leqq 0.\dot{3}$ is assumed in all cases. It follows from Equation [2] that

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

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 in *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:

$$L_{\bar{l}_m} \leqq L_V \leqq 1.05\, L_{\bar{l}_m}.$$

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 the accompanying Figure and example of a block calculation.

Inferred assessment

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

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

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

15 Note on weighting The thickness of a deposit at any point may be governed solely by the position of the point in relation to a broad trend. However, most sand and gravel deposits also exhibit a random pattern of local, and sometimes considerable, variation in thickness. Thus the distribution of sample points needs to 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 with the zone as the weighting factor.

Block calculation

Scale: 1:25 000
Block: Fictitious

Area
Block: 11.08 km²
Mineral: 8.32 km²

Mean thickness
Overburden: 2.5 m
Mineral: 6.5 m

Volume
Overburden: 21 million m³
Mineral: 54 million m³

Confidence limits of the estimate of mineral volume at the 95 per cent probability level: ± 20 per cent
That is, the volume of mineral (with 95 per cent probability): 54 ± 11 million m³

Thickness estimate (measurements in metres)
l_o= overburden thickness l_m = mineral thickness

Sample point	Weighting w	Overburden l_o	Overburden wl_o	Mineral l_m	Mineral wl_m	Remarks
SE 14	1	1.5	1.5	9.4	9.4	IMAU boreholes
SE 18	1	3.3	3.3	5.8	5.8	
SE 20	1	nil	-	6.9	6.9	
SE 22	1	0.7	0.7	6.4	6.4	
SE 23	1	6.2	6.2	4.1	4.1	
SE 24	1	4.3	4.3	6.4	6.4	
SE 17	½	1.2	1.6	9.8	7.2	Hydrogeology Unit record
123/45	½	2.0		4.6		
1	¼	2.7	2.6	7.3	5.8	Close group of four boreholes (commercial)
2	¼	4.5		3.2		
3	¼	0.4		6.8		
4	¼	2.8		5.9		
Totals	$\Sigma w = 8$	$\Sigma wl_o = 20.2$		$\Sigma wl_m = 52.0$		
Means		$\overline{wl}_o = 2.5$		$\overline{wl}_m = 6.5$		

Calculation of confidence limits

wl_m	$\lvert(wl_m - \overline{wl}_m)\rvert$	$(wl_m - \overline{wl}_m)^2$
9.4	2.9	8.41
5.8	0.7	0.49
6.9	0.4	0.16
6.4	0.1	0.01
4.1	2.4	5.76
6.4	0.1	0.01
7.2	0.7	0.49
5.8	0.7	0.49

$\Sigma(wl_m - \overline{wl}_m)^2 = 15.82$

$n = 8$

$t = 2.365$

L_Y is calculated as

$1.05\ (t/\overline{wl}_m)\ \sqrt{[\Sigma(wl_m - \overline{wl}_m)^2/\ n(n-1)]} \times 100$

$= 1.05 \times (2.365/6.5)\ \sqrt{[15.82/(8 \times 7)]} \times 100$

$= 20.3$

$\simeq 20$ per cent.

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 (< $\frac{1}{16}$ mm) and coarser than pebbles (> 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 considered to be not 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 the accompanying Figure). The procedure is as follows:

1 Classify according to the ratio of sand to gravel.
2 Describe the 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 Appendix D)

Many differing proposals have been made 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 (see the accompanying table), which is used in the Report.

The fairly wide intervals in the scale are consistent with the general level of accuracy of the qualitative assessments of the resource blocks. Three sizes of sand are recognised, fine (+$\frac{1}{16}$ -$\frac{1}{4}$ mm), medium (+$\frac{1}{4}$ -1 mm) and coarse (+1 -4 mm). The boundary at 16 mm distinguishes a range of finer gravel (+4 -16 mm), often characterised by abundance of worn tough pebbles of vein quartz, from larger pebbles, often of notably different materials. The boundary 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 Standards Institution, 1967). In this report the grading is tabulated on the borehole record sheets (Appendix E), the intercepts corresponding with the simple geometric scale $\frac{1}{16}$ mm, $\frac{1}{4}$ mm, 1 mm, 4 mm, 16 mm and so on as required. Original sample grading curves are available for reference at the appropriate office of the Institute.

Each bulk sample is described, subjectively, by a geologist at the borehole site. 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 roughly equal proportions with neither constituent accounting for less than about 25 per cent of the whole; 'flint with quartz' indicates that flint is dominant and quartz, the principal accessory rock type, comprises 5 to 25 per cent of the whole. Where the accessory material accounts for less than 5 per cent of the whole, but is still readily apparent, the phrase 'with some' has been used. Rare constitutents are referred to as 'trace'.

The terms used in the field to describe the degree of rounding of particles, which is concerned with the sharpness of the edges and corners of a clastic fragment and not the shape (after Pettijohn, 1975), are as follows.

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

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

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

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

Well rounded: not original faces, edges or corners left. The entire surface consists of broad curves; flat areas are absent. The original shape is suggested by the present form of the grain.

Classification of gravel, sand and fines

Size limits	Grain-size description	Qualification	Primary classification
	Cobble		
64 mm			
		Coarse	Gravel
16 mm	Pebble		
		Fine	
4 mm			
		Coarse	
1 mm			
	Sand	Medium	Sand
$\frac{1}{4}$ mm			
		Fine	
$\frac{1}{16}$ mm			
	Fines (silt and clay)		Fines

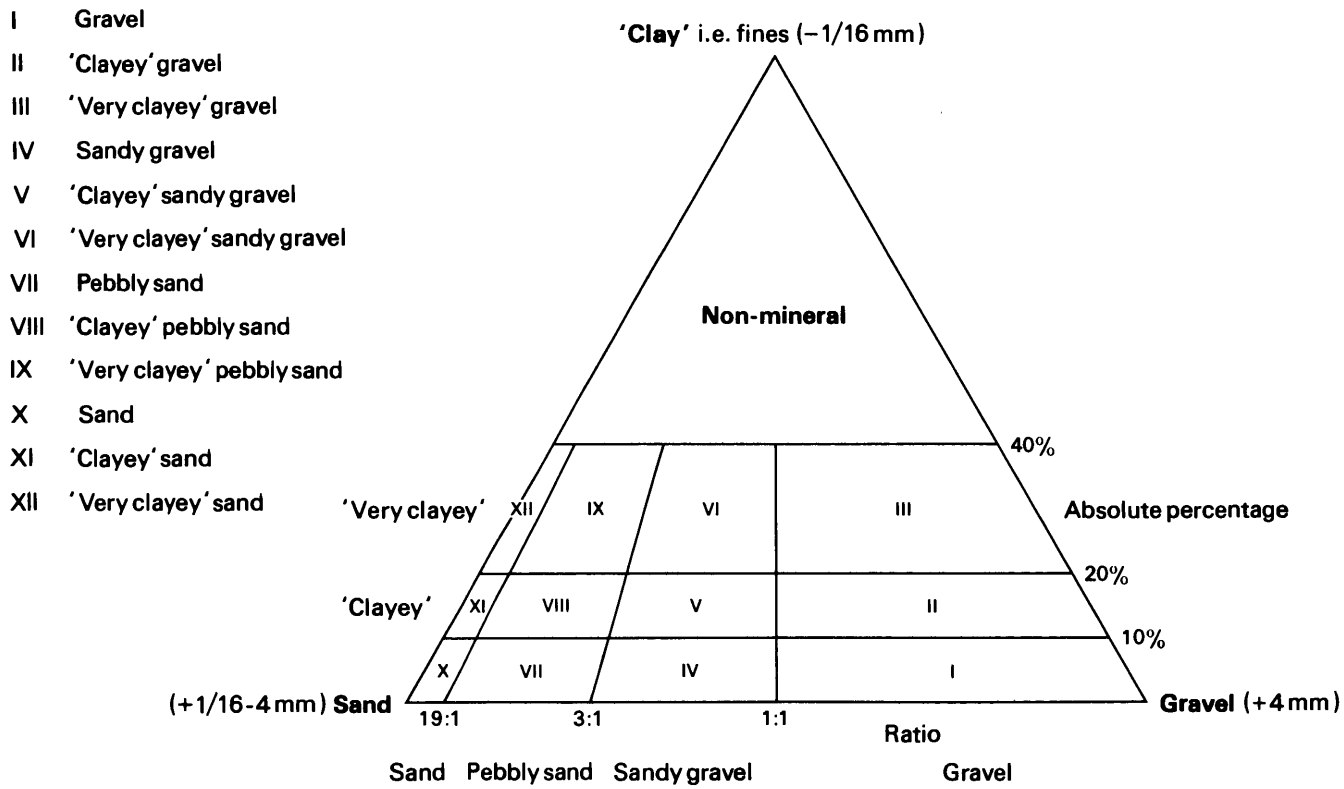


Diagram showing the descriptive categories used in the classification of sand and gravel

APPENDIX D

EXPLANATION OF THE BOREHOLE RECORDS

Annotated fictitious example

CK 66 NW 5[1] **6191 6962**[2] **Northfields**[3] **Block B**

Surface level (+49.7 m) +163 ft[4]
Water struck at +45.9 m[5]
October 1972[6]

Overburden[7] 2.8 m
Mineral 5.4 m
Waste 1.1 m
Mineral 1.4 m
Bedrock 0.7 m+[8]

LOG

Geological classification	Lithology[9]	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Clay, silty, dark brown	2.6	2.8
River Terrace Deposits	**a** Gravel Gravel: fine to coarse, with cobbles towards base, angular to rounded flint and limestone with ironstone and some quartz and chalk Sand: medium with coarse and some fine, quartz and limestone	5.4	8.2
Boulder Clay	Clay, sandy and pebbly, red-brown	1.1	9.3
Glacial Sand and Gravel	**b** Sand, 'clayey' in part: fine, subangular to rounded, quartz with some coal	1.4	10.7
Lias	Mudstone, blue-grey, fossiliferous	0.7+	11.4

GRADING[10]

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}$ -1	+1 -4	+4 -16	+16 -64	+64 mm
a	5	46	49	2.8-3.9	20	14	62	2	2	0	0
				3.8-4.8	2	2	12	18	42	24	0
				4.8-5.8	1	3	24	13	35	24	0
				5.8-6.8	0	4	21	20	26	29	0
				6.8-8.2	4	3	23	10	23	30	7
				Mean	**5**	**5**	**28**	**13**	**25**	**22**	**2**
b	5	95	0	9.3-10.3	3	73	23	1	0	0	0
				10.3-10.7	9	85	5	1	0	0	0
				Mean	**5**	**77**	**17**	**1**	**0**	**0**	**0**
a+b	**5**	**56**	**39**	**Mean**	**5**	**20**	**26**	**10**	**20**	**17**	**2**

COMPOSITION[11]

Fraction (mm)	percentages by weight				
	Flint	Quartz	Limestone	Chalk	Ironstone
8-16	32	6	47	4	11
4-8	35	4	51	3	7

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

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

a The number of the 1:25 000 sheet on which the borehole lies, here CK 66.
b 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, here NW 5.

Thus the full Registration Number is CK 66 NW 5.

2 National Grid Reference
All National Grid References fall in the 100 km square identified by the first two letters of the Registration Number. Grid references are given to eight figures, accurate to within 10 m.

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 the borehole lies is stated.

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

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

6 Type of drill and date of drilling
Unless otherwise stated the borehole was drilled by a shell and auger rig using 152 mm diameter casing. The month and year of completion of drilling are stated.

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

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

9 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 of the gravel and/or sand fraction. Where more than one bed of mineral is recognised each is designated by a letter, e.g. **a, b,** etc. The description of other deposits is based on visual examination in the field.

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

For each bulk sample the percentages of fines ($-\frac{1}{16}$ mm), fine sand ($+\frac{1}{16}$-$\frac{1}{4}$ mm), medium sand ($+\frac{1}{4}$-1 mm), coarse sand (+1-4 mm), fine gravel (+4-16 mm) and coarse and cobble gravel (+16 mm) are stated.

The mean grading of groups of samples making up an identified bed of mineral are also given in detail and in summary. Where more than one bed is recognised the mean grading for the whole of the mineral in the borehole may be given. Where necessary, in calculating mean gradings, data for individual samples are weighted by the thickness represented.

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

11 Composition
Details of the composition of selected samples may be given.

APPENDIX E

INDUSTRIAL MINERALS ASSESSMENT UNIT BOREHOLE RECORDS

TF 25 NW 13 **2034 5908** **Tattershall** **Block A**

Surface level +3.7 m (+1.2 ft)
Water struck at +2.1 m
October 1978

Overburden	1.6 m
Mineral	1.3 m
Waste	5.9 m
Bedrock	1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.3	0.3
?	Clay and silt, sandy in part, firm, dark grey	1.3	1.6
Fluvio-glacial and Older River Sand and Gravel	Sandy gravel Gravel: coarse and fine, flint with some quartz Sand: medium and coarse, quartz and lithic grains	1.3	2.9
Till	Clay, silty, olive black, stiff, with sporadic chalk and flint pebbles	5.9	8.8
Ancholme Clay Group	Clay, silty, olive black, stiff to hard, with shell fragments	1.2+	10.0
	No grading data available		

TF 25 NW 14 **2149 5967** **Tattershall Thorpe Carr** **Block A**

Surface level +10.0 m (+33 ft)
Water struck at +8.4 m
October 1978

Overburden	1.5 m
Mineral	3.2 m
Waste	7.1 m
Bedrock	0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	1.5	1.5
Fluvio-glacial and Older River Sand and Gravel	Sandy gravel Gravel: fine and coarse, subangular to subrounded flint with some chalk and quartz Sand: medium, quartz with lithic grains	3.2	4.7
Till	Clay, silty, olive black, stiff, with sporadic chalk granules	7.1	11.8
Ancholme Clay Group	Clay, silty, olive black, stiff to hard, with shell fragments	0.7+	12.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
1	64	35	1.5-2.5	2	14	55	8	12	9
			2.5-3.5	1	14	50	6	11	18
			3.5-4.7	1	6	30	11	28	24
			Mean	**1**	**11**	**45**	**8**	**18**	**17**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	94	2	-	1	1	1	trace	trace
4-8 mm	81	8	-	2	7	1	1	-

TF 25 NW 15 **2268 5929** **Gibbet Nook** **Block A**

Surface level +7.1 m (+23 ft)
Water struck at +4.8 m
October 1978

Overburden	1.1 m
Mineral	7.5 m
Waste	4.8 m
Bedrock	1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.1	1.1
River Gravels	Sandy gravel,'clayey' between 7.3 and 8.3m Gravel: fine with coarse, subangular flint and subrounded to rounded chalk with some limestone, quartz, quartzite, sandstone and igneous rocks Sand: medium, quartz with lithic grains	7.5	8.6
Till	Clay, light olive grey, stiff, with chalk granules	0.5	9.1
	Clay, dark olive grey, stiff to hard, with chalk pebbles and granules	4.3	13.4
Ancholme Clay Group	Clay, silty, olive black, hard, with shell fragments	1.1+	14.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
4	63	33	1.1-2.3	7	38	41	5	4	5
			2.3-3.3	1	6	28	19	30	16
			3.3-4.3	1	8	41	10	23	17
			4.3-5.3	1	3	34	23	28	11
			5.3-6.3	1	5	42	16	17	19
			6.3-7.3	1	4	39	20	27	9
			7.3-8.3	18	4	36	14	21	7
			8.3-8.6	1	5	30	18	23	23
			Mean	**4**	**10**	**38**	**15**	**21**	**12**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	67	21	4	3	2	trace	2	trace
4-8 mm	34	46	6	2	6	2	2	2

TF 25 NW 16 **2373 5947** **Tumby** **Block B**

Surface level +10.6 m (+35 ft)
Water struck at +7.2 m
November 1978

Overburden	0.9 m
Mineral	7.8 m
Waste	2.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
Fluvio-glacial and Older River Sand and Gravel	Pebbly sand, 'clayey' from 6.0-6.9m Gravel: fine angular flint with subrounded chalk and some quartz, quartzite, limestone, sandstone and igneous rocks Sand: medium with fine, quartz and lithic grains	7.8	8.7
Till	Clay, grey, firm, with chalk and flint pebbles	2.3+	11.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
6	77	17	0.9-1.9	8	25	50	7	8	2
			1.9-2.9	5	19	46	7	14	9
			2.9-4.0	9	21	42	11	13	4
			4.0-5.0	3	23	46	11	13	4
			5.0-6.0	3	31	37	7	17	5
			6.0-6.9	12	45	33	5	5	0
			6.9-8.0	5	25	33	7	23	7
			8.0-8.7	5	28	42	12	11	2
			Mean	**6**	**27**	**42**	**8**	**13**	**4**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	79	15	-	2	3	1	trace	-
4-8 mm	58	32	1	2	4	2	1	-

TF 25 NW 17 **2467 5966** **Keepers Cottage** **Block B**

Surface level +11.0 m (+36 ft)
Water struck at +8.9 m
November 1978

Overburden	0.7 m
Mineral	6.9 m
Waste	1.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
Fluvio-glacial and Older River Sand and Gravel	Pebbly sand, 'clayey' in first metre Gravel: fine, angular flint and subrounded chalk with some quartz, quartzite, sandstone and igneous rocks Sand: medium with fine quartz and lithic grains	6.9	7.6
Till	Clay, silty, olive brown, firm to stiff, with chalk and some flint pebbles	1.4+	9.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
4	72	24	0.7-1.7	10	20	47	8	9	6
			1.7-3.5	6	21	47	6	12	8
			3.5-4.5	1	16	42	7	15	19
			4.5-5.5	2	23	49	8	16	2
			5.5-6.5	2	21	42	11	18	6
			6.5-7.6	3	21	30	11	29	6
			Mean	**4**	**20**	**44**	**8**	**16**	**8**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	76	20	-	trace	trace	1	1	-
4-8 mm	40	51	-	1	4	2	2	-

TF 25 NW 18 **2158 5867** **Tattershall** **Block A**

Surface level +6.7 m (+22 ft)
Water struck at +4.4 m
October 1978

Overburden	1.8 m
Mineral	4.8 m
Waste	4.0 m
Bedrock	0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	1.4	1.4
	Soil	0.4	1.8
River Gravels	Sandy gravel, 'clayey' in first 0.5 m Gravel: fine, subangular to subrounded flint and subrounded to well rounded chalk with some limestone, quartzite and quartz Sand: medium, quartz with lithic grains	4.8	6.6
Till	Clay, silty, olive black, stiff, with sporadic chalk granules	4.0	10.6
Ancholme Clay Group	Clay, silty, olive black, stiff, with shell fragments	0.9+	11.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines				Sand					
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
3	72	25	1.8-2.3	12	16	39	12	19	2
			2.3-3.3	2	7	37	19	27	8
			3.3-3.8	1	7	30	14	26	22
			3.9-4.6	1	26	61	7	5	0
			4.6-5.6	3	12	54	11	14	6
			5.6-6.6	1	7	46	17	20	9
			Mean	**3**	**12**	**46**	**14**	**18**	**7**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	67	20	6	3	2	trace	1	trace
4-8 mm	39	50	5	3	2	trace	trace	trace

TF 25 NW 19 **2250 5852** **Corbet Hill** **Block A**

Surface level +5.8 m (+19 ft)
Water struck at +4.6 m
October 1978

Overburden	1.2 m
Mineral	2.3 m
Waste	11.7 m
Bedrock	0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
Alluvium	Silt, sandy and pebbly, dark grey and black	0.4	1.2
River Gravels	Sandy gravel Gravel: fine with coarse, subangular to subrounded flint with subrounded to rounded chalk and some quartz, quartzite and igneous rocks Sand: medium, quartz with lithic grains	2.3	3.5
Till	Clay, silty, dark greenish grey, stiff, with some sand and chalk and flint pebbles	10.6	14.1
	Clay, silty, olive black, stiff, with chalk granules	1.1	15.2
Ancholme Clay Group	Clay, silty, olive black, hard, with shell fragments	0.8+	16.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
4	57	39	1.2-2.2	3	7	32	17	26	15
			2.2-3.5	6	8	31	18	22	15
			Mean	**4**	**7**	**32**	**18**	**24**	**15**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	82	14	-	trace	2	trace	trace	-
4-8 mm	58	32	-	2	5	1	2	-

TF 25 NW 20 **2383 5831** **Lea Gate Farm** **Block B**

Surface level +9.2 m (+30 ft)
Water struck at +7.6 m
October 1978

Overburden	0.8 m
Mineral	4.9 m
Waste	13.5 m
Bedrock	0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
Fluvio-glacial and Older River Sand and Gravel	**a** Sandy gravel, 'clayey' to 1.7 m Gravel: fine, subangular to subrounded flint with subrounded to rounded chalk and some limestone, quartz, quartzite, sandstone and igneous rocks Sand: medium with fine, quartz and lithic grains	3.1	3.9
	b Pebbly sand Gravel: fine, flint and chalk Sand: medium and fine, quartz with lithic grains	1.8	5.7
Till	Clay, silty, olive grey, with chalk pebbles	13.5	19.2
Ancholme Clay Group	Clay, silty, olive black, stiff to hard, with shell fragments	0.8+	20.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
a	6	69	25	0.8-1.7	10	25	37	7	14	7
				1.7-2.7	8	15	39	8	25	5
				2.7-3.9	3	22	40	10	23	2
				Mean	**6**	**21**	**39**	**9**	**21**	**4**
b	7	88	5	3.9-5.0	7	41	43	6	3	0
				5.0-5.7	8	42	39	5	4	2
				Mean	**7**	**41**	**41**	**6**	**4**	**1**
a+b	7	75	18	0.8-5.7	7	28	40	7	15	3

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	79	15	4	1	trace	trace	-	trace
4-8 mm	44	42	3	2	3	4	1	-

TF 25 NW 21 **2457 5877** **St. Helen's Wood** **Block B**

Surface level +9.6 m (+32 ft)
Water struck at +6.2 m
November 1978

Overburden	0.6 m
Mineral	6.1 m
Waste	1.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Fluvio-glacial and Older River Sand and Gravel	Sandy gravel, 'clayey' in parts Gravel: fine, angular to subrounded flint with subrounded chalk and some limestone, quartzite, quartz and igneous rocks Sand: medium, quartz with lithic grains	6.1	6.7
Till	Clay, silty, dark greyish brown, stiff, with much chalk	1.3+	8.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
7	64	29	0.6-1.6	15	33	32	7	10	3
			1.6-2.6	8	21	40	8	16	7
			2.6-4.0	7	18	42	11	14	8
			4.0-5.0	1	9	31	10	29	20
			5.0-5.5	10	8	25	10	37	10
			5.5-6.7	2	15	30	21	27	5
			Mean	**7**	**18**	**34**	**12**	**21**	**8**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	75	17	3	trace	2	trace	trace	trace
4-8 mm	50	36	5	2	3	trace	2	trace

TF 25 NW 22 **2058 5772** **Horncastle Canal** **Block A**

Surface level +4.6 m (+15 ft)
Water struck at +3.3 m
October 1978

Overburden	0.6 m
Mineral	2.1 m
Waste	6.1 m
Bedrock	0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
River Gravels	Sandy gravel, 'clayey' to 1.3 m Gravel: fine with coarse, subangular to subrounded flint with subrounded to rounded chalk and some quartzite, quartz, sandstone and igneous rocks Sand: medium, quartz with lithic grains	2.1	2.7
Till	Clay, silty, dark brown mottled with medium brown	0.5	3.2
	Clay, silty, olive black, stiff, with sporadic chalk and flint pebbles	5.6	8.8
Ancholme Clay Group	Clay, silty, olive black, stiff to hard, with sporadic shell fragments	0.7+	9.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
6	59	35	0.6-1.3	11	23	27	10	17	12
			1.3-2.3	2	6	36	16	28	12
			2.3-2.7	9	6	37	13	23	12
			Mean	**6**	**12**	**34**	**13**	**23**	**12**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	79	13	-	3	3	1	1	-
4-8 mm	65	18	trace	2	6	5	4	-

TF 25 NW 23 **2180 5721** **Coningsby** **Block B**

Surface level +5.5 m (+18 ft)
Water struck at +4.1 m
December 1978

Overburden	1.4 m
Mineral	4.7 m
Waste	0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
	Made ground	1.2	1.4
Fluvio-glacial and Older River Sand and Gravel	Sandy gravel Gravel: fine with coarse, subangular to subrounded flint with some chalk, quartz, quartzite, sandstone, limestone and igneous rocks Sand: medium, quartz with lithic grains	4.7	6.1
Till	Clay, silty, dark yellowish brown, stiff	0.2	6.3
	Clay, silty, olive black, stiff, with chalk pebbles	0.2+	6.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				-$\frac{1}{16}$	+$\frac{1}{16}$ -$\frac{1}{4}$	+$\frac{1}{4}$ -1	+1 -4	+4 -16	+16 mm
2	72	26	1.4-2.4	3	10	48	10	12	17
			2.4-3.4	3	11	57	14	8	7
			3.4-4.4	2	10	50	14	13	11
			4.4-5.4	3	4	38	25	22	8
			5.4-6.1	2	6	28	28	30	6
			Mean	**2**	**8**	**47**	**17**	**16**	**10**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	89	2	3	2	1	trace	2	trace
4-8 mm	70	3	4	7	9	3	3	1

TF 25 NW 24 **2276 5783** **Coningsby** **Block B**

Surface level +8.0 m (+26 ft)
Water struck at +6.7 m
November 1978

Overburden	1.2 m
Mineral	4.4 m
Waste	12.7 m
Bedrock	1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.2	1.2
Fluvio-glacial and Older River Sand and Gravel	Pebbly sand Gravel: fine and coarse, subangular to subrounded flint with some chalk, quartz, quartzite, sandstone, limestone and igneous rocks Sand: medium with fine, quartz with lithic grains	4.4	5.6
Till	Clay, silty, olive grey, stiff, with chalk and flint pebbles; bands of chalky sand between 9.7 and 10.1 m and 15.0 and 15.6 m	10.0	15.6
	Clay, silty, olive grey, hard, with sporadic chalk granules	2.7	18.3
Ancholme Clay Group	Clay, silty, olive black, stiff to hard, with shell fragements	1.0+	19.3

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}$ -1	+1 -4	+4 -16	+16 mm
3	76	21	1.2-2.2	1	8	31	11	23	26
			2.2-2.8	2	11	37	13	23	14
			2.8-3.8	4	30	56	6	3	1
			3.8-4.8	4	40	34	5	9	8
			4.8-5.6	6	55	33	3	2	1
			Mean	**3**	**30**	**39**	**7**	**11**	**10**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	81	4	trace	5	3	4	2	-
4-8 mm	72	9	2	4	9	2	2	-

TF 25 NW 25 **2364 5720** **Baptist Farm** **Block B**

Surface level +7.5 m (+25 ft)
Water struck at +5.5 m
October 1978

Overburden	1.3 m
Mineral	1.5 m
Waste	17.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.3	1.3
Fluvio-glacial and Older River Sand and Gravel	Sandy gravel, 'clayey' to 2.0 m Gravel: fine, subangular to subrounded flint with some chalk, limestone, quartzite, quartz, sandstone and igneous rocks Sand: medium, quartz with lithic grains	1.5	2.8
Till	Clay, silty, olive grey, stiff, with chalk and flint pebbles; a band of very 'clayey' pebbly sand occurs between 3.3 and 3.7 m.	17.2+	20.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
7	66	27	1.3-2.0	10	25	41	9	10	5
			2.0-2.8	4	11	34	13	27	11
			Mean	**7**	**18**	**37**	**11**	**19**	**8**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	65	12	6	7	9	1	trace	-
4-8 mm	47	26	6	5	10	3	3	trace

TF 25 NW 26 **2479 5775** **Moorside** **Block B**

Surface level +7.8 m (+26 ft)
Water struck at+5.3 m
October 1978

Overburden	1.4 m
Mineral	2.2 m
Waste	15.2 m
Bedrock	0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Fluvio-glacial and Older River Sand and Gravel	Clay, sandy, dark yellowish orange	0.9	1.4

	Sandy gravel, 'clayey' to 2.4 m Gravel: fine, subangular to subrounded flint with subrounded to rounded chalk and some quartzite, quartz and sandstone Sand: medium, quartz with lithic grains	2.2	3.6
Till	Clay, silty, dark olive brown to dark olive grey with depth, stiff, with chalk pebbles	15.2	18.8
Ancholme Clay Group	Clay, silty, olive black, stiff, with shell fragments	0.7+	19.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
9	63	28	1.4-2.4	17	10	34	10	21	8
			2.4-3.6	3	20	41	10	20	6
			Mean	**9**	**15**	**38**	**10**	**21**	**7**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	80	15	-	2	3	trace	-	-
4-8 mm	50	43	-	1	4	2	trace	-

TF 25 NW 27 **2028 5657** **Tattershall Station** **Block A**

Surface level +3.5 m (+12 ft)
Water struck at +1.5 m
October 1978

Overburden	0.9 m
Mineral	2.1 m
Waste	6.1 m
Bedrock	0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
River Gravels	Sandy gravel, 'clayey' from 2.0 to 3.0 m Gravel: fine, subangular to subrounded flint and subrounded to well rounded chalk with some quartzite, sandstone and quartz Sand: medium, quartz with lithic grains	2.1	3.0
Till	Clay, silty, dark olive grey, stiff, with chalk pebbles and rare siltstone boulders	6.1	9.1
Ancholme Clay Group	Clay, silty, olive black, hard, with shell fragments	0.9+	10.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
9	50	41	0.9-2.0	6	13	28	15	25	13
			2.0-3.0	12	6	18	20	28	16
			Mean	**9**	**10**	**23**	**17**	**27**	**14**

TF 25 NW 28 **2192 5610** **Coningsby Airfield** **Block B**

Surface level +3.6 m (+12 ft)
Water struck at +2.3 m
November 1978

Overburden	1.4 m
Mineral	3.1 m
Waste	10.1 m
Bedrock	0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	1.4	1.4
Fluvio-glacial and Older River Sand and Gravel	**a** Sandy gravel Gravel: fine, subrounded flint with some chalk, quartz, quartzite, sandstone and igneous rocks Sand: medium	1.4	2.8
	b Sand, pebbly in part, medium and fine, quartz with lithic grains	2.4	5.2
Till	Clay, silty, olive grey, stiff, with chalk and sporadic flint pebbles	10.1	15.3
Ancholme Clay Group	Clay, silty, olive black, stiff to hard, with shell fragments	0.7+	16.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
a	3	63	34	1.4-2.8	3	7	45	11	21	13
b	5	93	2	2.8-4.2	6	60	27	4	2	1
				4.2-5.0	4	54	39	1	2	0
				5.0-5.2	4	56	34	4	2	0
				Mean	**5**	**59**	**31**	**3**	**2**	**trace**
a+b	4	82	14	1.4-5.2	4	39	37	6	9	5

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	62	6	-	11	14	6	trace	-
4-8 mm	51	14	trace	9	19	4	3	-

TF 25 NW 29 **2314 5653** **Coningsby Airfield** **Block B**

Surface level +6.1 m (+20 ft)
Water struck at +4.4 m
November 1978

Overburden	1.4 m
Mineral	4.6 m
Waste	14.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.4	1.4
Fluvio-glacial and Older River Sand and Gravel	Sandy gravel Gravel: fine, subangular to subrounded flint with some quartzite, quartz, sandstone, chalk,limestone and igneous rocks Sand: medium, quartz with lithic grains	4.6	6.0
Till	Clay, olive black to olive grey with depth, stiff to hard, with chalk and sandstone pebbles	4.4	10.4
	Silt, clayey, olive grey, firm, with scattered chalk granules	9.1	19.5
	Clay, silty, olive black, hard, with shell fragments and sporadic chalk pebbles	1.0+	20.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}$ -1	+1 -4	+4 -16	+16 mm
2	64	34	1.4-2.5	2	17	44	18	15	5
			2.5-3.5	2	13	45	15	21	4
			3.5-4.6	1	10	23	13	38	15
			4.6-5.4	1	14	33	13	25	14
			5.4-6.0	2	8	31	20	28	11
			Mean	**2**	**13**	**36**	**15**	**25**	**9**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	55	6	-	19	9	8	3	-
4-8 mm	49	6	4	18	16	5	2	trace

TF 25 NW 30 **2373 5610** **Ivy House** **Block B**

Surface level +5.2 m (+17 ft)
Water struck at +3.5 m
November 1978

Overburden	1.3 m
Mineral	6.0 m
Waste	11.0 m
Bedrock	0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.3	1.3
Fluvio-glacial and Older River Sand and Gravel	**a** Sandy gravel Gravel: fine, subangular to subrounded flint with subrounded chalk and quartz Sand: medium, quartz with lithic grains	1.0	2.3
	b Sand, pebbly in parts, medium, quartz with lithic grains	2.8	5.1
	c 'Clayey' sandy gravel Gravel: fine, subrounded to well rounded flint with subrounded to rounded chalk, sandstone, quartz, quartzite and limestone Sand: medium, quartz with lithic grains	2.2	7.3
Till	Clay, silty and sandy, greyish olive, with chalk pebbles; sand band from 8.0 to 8.5 m; silt from 11.0 to 11.8 m	11.0	18.3
Ancholme Clay Group	Clay, silty, olive black, hard, with shell fragments	0.6+	18.9

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
a	7	62	31	1.3-2.3	7	14	38	10	20	11
b	3	94	3	2.3-3.3	4	23	68	3	2	0
				3.3-4.3	4	29	65	1	1	0
				4.3-5.1	0	14	73	6	6	1
				Mean	**3**	**23**	**68**	**3**	**3**	**tace**
c	16	56	28	5.1-6.2	26	16	26	8	21	3
				6.2-7.3	4	9	35	18	24	10
				Mean	**16**	**12**	**32**	**12**	**22**	**6**
a+b+c	8	76	16	1.3-7.3	8	18	51	7	12	4

TF 25 NW 31 **2488 5670** **Coningsby Moor** **Block B**

Surface level +5.5 m (+18 ft)
Water struck at +4.0 m
October 1978

Waste	16.7 m
Bedrock	0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Fluvio-glacial and Older River Sand and Gravel	Clay, very sandy, dark yellowish orange, stiff, with flint pebbles	1.0	1.3
	Pebbly sand Gravel: fine, flint, chalk and some sandstone Sand: fine and medium, quartz with lithic grains	0.8	2.1
Till	Clay, silty, partly sandy, dark yellowish brown to olive grey with depth, stiff, with chalk and some flint pebbles	14.6	16.7
Ancholme Clay Group	Clay, silty, olive black, hard, with shell fragments	0.8+	17.5

TF 25 NW 32 **2023 5565** **Stennett's Farm** **Block C**

Surface level +1.8 m (+6 ft)
Water struck at -0.7 m
November 1978

Overburden	2.0 m
Mineral	5.6 m
Waste	1.9 m
Mineral	5.9 m
Bedrock	0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.4	1.4
Marine or Estuarine Alluvium	Silt, sandy, moderate yellowish brown, soft	0.6	2.0
River Gravels	**a** Pebbly sand Gravel: fine, subangular to subrounded flint with subrounded quartzite and quartz and some limestone, sandstone and chalk Sand: fine with medium, quartz with lithic grains	5.6	7.6
	Silt, dark greyish olive, soft, with fine quartz sand	1.9	9.5
	b Sandy gravel Gravel: fine, subrounded to well rounded quartzite with well rounded quartz and subangular to subrounded flint and some sandstone and limestone Sand: medium, quartz with lithic grains	5.9	15.4
Ancholme Clay Group	Clay, silty, olive black, hard, with shell fragments	0.6+	16.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
a	4	84	12	2.0-3.2	4	30	38	6	11	11
				3.2-4.2	1	31	49	6	9	4
				4.2-5.3	2	64	31	1	1	1
				5.3-6.0	3	63	25	5	4	0
				6.0-7.3	6	38	29	10	13	4
				7.3-7.6	9	32	37	11	8	3
				Mean	**4**	**43**	**35**	**6**	**8**	**4**
b	2	54	44	9.5-10.5	4	9	31	16	28	12
				10.5-11.5	1	7	33	10	34	15
				11.5-12.4	3	5	45	15	25	7
				12.4-13.5	1	3	35	16	34	11
				13.5-14.5	3	4	33	23	31	6
				14.5-15.4	2	10	9	16	42	21
				Mean	**2**	**6**	**32**	**16**	**32**	**12**
a+b	**3**	**68**	**29**	**Mean**	**3**	**24**	**33**	**11**	**21**	**8**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	30	trace	4	45	16	3	trace	trace
4-8 mm	33	2	8	35	19	3	trace	trace

TF 25 NW 33 **2144 5514** **Hawthorn Hill**

Surface level +1.2 m (+4 ft)
Water not struck
September 1978

Waste 5.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
Till	Clay, sandy, yellowish brown with grey streaks of silty clay	1.4	3.1
	Clay, dark grey with chalk and siltsone pebbles	3.3+	6.4

TF 25 NW 34 **2322 5514** **Scrub Hill** **Block B**

Surface level +3.2 m (+11 ft)
Water struck at +1.3 m
October 1978

Overburden	0.6 m
Mineral	3.9 m
Waste	14.4 m
Bedrock	1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.6	0.6
Fluvio-glacial and Older River Sand and Gravel	Pebbly sand Gravel: fine, subrounded flint with some quartzite, chalk, quartz, limestone, sandstone and igneous rocks Sand: medium, quartz with lithic grains	3.9	4.5
Till	Clay, olive grey, stiff, with chalk pebbles; silt band between 15.1 and 15.4 m	14.4	18.9
Ancholme Clay Group	Clay, silty, olive black, hard, with shell fragments	1.1+	20.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
6	77	17	0.6-1.9	9	20	53	8	9	1
			1.9-2.9	3	25	48	7	14	3
			2.9-3.9	5	9	50	8	20	8
			3.9-4.5	3	14	62	8	8	5
			Mean	**6**	**18**	**51**	**8**	**13**	**4**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	61	8	3	13	7	5	2	trace
4-8 mm	51	15	7	14	6	4	2	trace

TF 25 NW 35 **2466 5537** **New York** **Block B**

Surface level +3.7 m (+12 ft)
Water struck at -0.9 m
October 1978

Waste 18.5 +m

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
Till	Clay, silty, dark yellowish orange to dark olive grey with depth, stiff to hard, with pebbles of chalk and sporadic flint and mudstone	17.8+	18.5

TF 25 NW 99 **2216 5977** **Tattershall Thorpe** **Block A**

Surface level c +10.5 m (+35 ft)
Water not struck
3 inch Minuteman power auger
October 1977

Overburden 0.9 m
Mineral 5.4 m
Waste 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
Fluvio-glacial and Older River Sand and Gravel	Pebbly sand Gravel: fine, chalk and flint Sand: medium, quartz with lithic grains	5.4	6.3
Till	Clay	0.1+	6.4
	No grading data available		

TF 25 NW 100 **2256 5901** **Corbet Hill** **Block A**

Surface level c +6.0 m (+20 ft)
Water not struck
3 inch Minuteman power auger
October 1977

Overburden 0.4 m
Mineral 6.9 m
Waste 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
River Gravels	Pebbly sand Gravel: fine, flint and chalk Sand: medium, quartz with lithic grains	6.9	7.3
Till	Clay, silty, dark blue	0.3+	7.6
	No grading data		

TF 25 NW 101 **2382 5983** **Tumby** **Block B**

Surface level c +10.5 m (+35 ft)
Water struck at c +6.9 m
3 inch Minuteman power auger
October 1977

Overburden	0.9 m
Mineral	6.7 m
Waste	0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
Fluvio-glacial and Older River Sand and Gravel	Pebbly sand Gravel: fine, flint Sand: medium, quartz with lithic grains	6.7	7.6
Till	Clay	0.1+	7.7
	No grading data available		

TF 25 NW 102 **2405 5858** **Leeds Gate Farm** **Block B**

Surface level c +9.2 m (+30 ft)
Water struck at c +6.5 m
3 inch Minuteman power auger
October 1977

Overburden	0.5 m
Mineral	7.0 m
Waste	0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Fluvio-glacial and Older River Sand and Gravel	Sand, pebbly in part Gravel: fine, chalk and flint Sand: medium, quartz with lithic grains	7.0	7.5
Till	Clay	0.1+	7.6
	No grading data available		

TF 25 NW 103 **2050 5878** **Tattershall** **Block A**

Surface level c +3.7 m(12 ft)
Water struck at c +1.6 m
3 inch Minuteman power auger
October 1977

Overburden	0.8 m
Mineral	3.8 m
Waste	2.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
Fluvio-glacial and Older River Sand and Gravel	Pebbly sand Gravel: fine, flint Sand: medium, quartz with lithic grains	3.8	4.6
Till	Clay, silty, dark blue-grey with chalk fragments	2.4+	7.0
	No grading data available		

TF 25 NW 104 **2370 5661** **Langworth Grange** **Block B**

Surface level c +6.5 m (+21 ft)
Water struck at c +5.3 m
3 inch Minuteman power auger
October 1977

Overburden	0.4 m
Mineral	3.5 m
Waste	0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Fluvio-glacial and Older River Sand and Gravel	Pebbly sand Gravel: fine, flint Sand: medium, quartz with lithic grains	3.5	3.9
Till	Clay	0.1+	4.0
	No grading data available		

TF 25 NW 105 **2490 5520** **New York** **Block B**

Surface level c +3.7 m(12 ft)
Water not struck
3 inch Minuteman power auger
October 1977

Waste	2.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
Fluvio-glacial and Older River Sand and Gravel	Pebbly sand Gravel: fine, flint Sand: fine with medium, quartz with lithic grains	0.7	1.5
Till	Clay, pale grey mottled with orange and yellow, with chalk, flint and sandstone pebbles	0.5+	2.0

TF 25 NW 106 **2220 5516** **Toot Hill Farm** **Block B**

Surface level c +2.0 m (+7 ft)
Water not struck
3 inch Minuteman power auger
October 1977

Overburden	0.3 m
Mineral	3.6 m
Waste	0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Fluvio-glacial and Older River Sand and Gravel	Pebbly sand Gravel: fine, flint with some chalk Sand: medium, quartz with lithic grains	3.6	3.9
Till	Clay	0.3+	4.2
	No grading data available		

TF 25 NE 5 **2601 5929** **St. Helen's Wood** **Block B**

Surface level +8.2 m (+27 ft)
Water struck at +5.2 m
November 1978

Overburden	1.1 m
Mineral	4.8 m
Waste	1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.1	1.1
Fluvio-glacial and Older River Sand and Gravel	Pebbly sand, 'clayey' in parts Gravel: fine, angular to subangular flint and subrounded to rounded chalk with some quartz, sandstone and igneous rocks Sand: fine and medium, quartz with lithic grains	4.8	5.9
Till	Clay, dark grey, firm to stiff, with chalk and some flint pebbles	1.1+	7.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
10	82	8	1.1-2.4	13	42	38	3	4	0
			2.4-3.4	8	30	42	8	10	2
			3.4-4.0	2	23	45	11	17	2
			4.0-5.0	19	41	31	5	4	0
			5.0-5.9	6	45	35	7	7	0
			Mean	**10**	**38**	**38**	**6**	**7**	**1**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
4-8 mm	45	50	trace	trace	2	1	1	-

TF 25 NE 6 **2678 5997** **Birkwood** **Block B**

Surface level +5.8 m (+19 ft)
Water not struck
November 1978

Waste	4.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.3	1.3
Fluvio-glacial and Older River Sand and Gravel	Pebbly sand Gravel: flint Sand: quartz with lithic grains	0.3	1.6
Till	Clay, silty, olive grey, firm to stiff, with pebbles of chalk and some flint	2.7+	4.3

TF 25 NE 7 **2766 5925** **Mareham Gate** **Block B**

Surface level +4.0 m (+13 ft)
Water not struck
October 1978

Waste	8.9 m
Bedrock	1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Fluvio-glacial and Older River Sand and Gravel	Clay, very sandy, pale orange-brown,with flint pebbles	1.4	1.7
	Very 'clayey' pebbly sand Gravel: fine, flint and chalk Sand: medium with fine, quartz	0.6	2.3
Till	Clay, silty, dark grey, stiff to hard, with chalk and rare flint pebbles	6.6	8.9
Ancholme Clay Group	Clay, silty, olive black, stiff to hard, with shell fragments	1.1+	10.0

TF 25 NE 8 **2938 5971** **Middle Yard**

Surface level +3.2 m (+11 ft)
Water not struck
October 1978

Waste	2.4 m
Bedrock	1.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	1.7	1.7
Till	Clay, sandy, dark yellowish orange, soft	0.7	2.4
Ancholme Clay Group	Clay, silty, olive black, stiff to hard, with shell fragments	1.6+	4.0

TF 25 NE 9 **2552 5838** **St. Helen's Wood** **Block B**

Surface level +6.5 m (+22 ft)
Water struck at +3.9 m
September 1978

Overburden	0.4 m
Mineral	4.1 m
Waste	12.9 m
Bedrock	1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Fluvio-glacial and Older River Sand and Gravel	Sandy gravel, 'clayey' to 2.4 m Gravel: fine, subangular to subrounded flint with subrounded to rounded chalk and some quartz, quartzite, sandstone and igneous rocks Sand: medium, quartz with lithic grains	4.1	4.5
Till	Clay, silty, light grey, firm to stiff, with chalk and rare flint pebbles, and a sand band at 5.0-5.7 m	12.9	17.4
Ancholme Clay Group	Clay, silty, dark olive grey, hard, with shell fragments	1.1+	18.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
7	58	35	0.4-1.4	10	21	27	8	23	11
			1.4-2.4	11	8	32	10	25	14
			2.4-3.4	2	11	31	15	31	10
			3.4-4.5	4	24	30	17	24	1
			Mean	**7**	**16**	**29**	**13**	**26**	**9**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	86	9	-	2	2	trace	trace	-
4-8 mm	53	33	trace	1	5	2	5	-

TF 25 NE 10 **2667 5887** **Little Birkwood Wood** **Block B**

Surface level +6.0 m (+20 ft)
Water struck at +4.6 m

Overburden	1.2 m
Mineral	2.7 m
Waste	13.2 m
Bedrock	0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.2	1.2
Fluvio-glacial and Older River Sand and Gravel	'Clayey' sandy gravel Gravel: fine, subangular to subrounded flint with subrounded chalk and some quartz, quartzite, sandstone and igneous rocks Sand: medium and fine, quartz with lithic grains	2.7	3.9
Till	Clay, silty and sandy, olive grey to dark olive grey, stiff, with chalk pebbles	13.2	17.1
Ancholme Clay Group	Clay, silty, olive black with shell fragments	0.9+	18.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
16	60	24	1.2-2.2	10	19	30	6	19	16
			2.2-2.9	9	16	33	12	23	7
			2.9-3.9	26	35	24	5	8	2
			Mean	**16**	**24**	**29**	**7**	**16**	**8**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	88	9	-	2	trace	trace	-	-
4-8	63	29	-	1	4	2	1	-

TF 25 NE 11 **2743 5843** **Tumby House** **Block B**

Surface level +3.5 m (+12 ft)
Water not struck
October 1978

Waste	13.0 m
Bedrock	1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
Fluvio-glacial and Older River Sand and Gravel	Very 'clayey' sand with sporadic chalk pebbles	0.4	1.1
Till	Clay, silty and sandy, light olive grey to dark olive grey with depth, stiff to hard, with chalk and flint pebbles	11.9	13.0
Ancholme Clay Group	Clay, silty, olive black, hard, with shell fragments	1.0+	14.0

TF 25 NE 12 **2960 5801** **Sheriff's Farm**

Surface level +2.2 m (+7 ft)
Water struck at -1.0 m
October 1978

Waste	7.0 m
Bedrock	2.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Marine or Estuarine Alluvium	Silt, greyish brown, soft, sandy to base	6.0	6.5
Till	Clay, silty, dark olive grey, stiff to hard, with chalk and flint pebbles	0.5	7.0
Ancholme Clay Group	Clay, silty, olive black, stiff to hard, with abundant shells below 8.0 m	2.0+	9.0

TF 25 NE 13 **2571 5707** **Tumby Woodside** **Block B**

Surface level +5.1 m (+17 ft)
Water struck at +3.1 m
September 1978

Waste 11.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.3	1.3
Fluvio-glacial and Older River Sand and Gravel	'Clayey' sand, fine quartz	0.9	2.2
	Clay, very sandy, yellowish brown with grey-brown partings; flint pebbles	0.4	2.6
	Gravel Gravel: coarse with fine, chalk and flint Sand: medium and fine, quartz	0.3	2.9
Till	Clay, silty, olive grey; light brownish grey to base, stiff, with chalk and flint pebbles	6.5	9.4
	Clay, light grey, hard; consists almost entirely of chalk with rare flint	1.6+	11.0

TF 25 NE 14 **2664 5783** **Tumby Woodside** **Block B**

Surface level +5.1 m (+17 ft)
Water struck at +4.5 m
November 1978

Waste 4.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.5	1.5
Fluvio-glacial and Older River Sand and Gravel	Sandy gravel Gravel: fine, angular flint with subangular chalk Sand: fine to coarse, quartz with lithic grains	0.3	1.8
Till	Clay, silty, firm to stiff, with chalk and some flint pebbles	2.2+	4.0

TF 25 NE 15 **2826 5781** **Moorhouses**

Surface level +1.9 m (+6 ft)
Water not struck
October 1978

Waste 13.2 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Till	Clay, silty, sandy at top, light olive brown to dark olive grey with depth, stiff, with chalk pebbles	12.9	13.2
Ancholme Clay Group	Clay, silty, olive black, stiff to hard, with shell fragments	0.8+	14.0

TF 25 NE16 **2669 5699** **Tumby Woodside** **Block B**

Surface level +3.2 m (+11 ft)
Water not struck
September 1978

Waste 14.4 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
Fluvio-glacial and Older River Sand and Gravel	Clay, very sandy, yellowish brown, with gravel between 0.9 and 1.0 m	0.9	1.8
	Very 'clayey' sand with rare gravel	0.7	2.5
Till	Clay, sandy, greyish brown with yellow streaks, some chalk and flint pebbles	1.0	3.5
	Clay, grey to very dark grey with depth, stiff to hard, with chalk and flint pebbles	10.9	14.4
Ancholme Clay Group	Clay, silty, black, stiff, with shell fragments	1.1+	15.5

TF 25 NE 17 **2883 5628** **Fen Farm**

Surface level +1.8 m (+6 ft)
Water struck at -1.8 m
October 1978

Waste 13.9 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
Marine or Estuarine	Silt, moderate brown, soft to firm, with rare chalk pebbles	0.8	1.6
Till	Clay, light olive grey to olive grey with depth, stiff to hard, with chalk pebbles	12.3	13.9
Ancholme Clay Group	Clay, silty, olive black, hard, with shell fragments	1.1+	15.0

TF 25 NE 18 **2981 5697** **Glebe Farm**

Surface level +1.7 m (+6 ft)
Water not struck
October 1978

Waste 7.8 m
Bedrock 1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Marine or Estuarine Alluvium	Clay, silty, dark yellowish brown, stiff	1.2	1.5
Till	Clay, sandy, dark yellowish orange with light grey streaks, stiff becoming firm, with chalk and rare flint pebbles	2.8	4.3
	Clay, dark olive grey, stiff to hard, with chalk pebbles	3.5	7.8
Ancholme Clay Group	Clay, silty, olive black, stiff to hard, with shell fragments	1.2+	9.0

TF 25 NE 19 **2592 5559** **Sandy Bank** **Block B**

Surface level +2.5 m (+8 ft)
Water not struck
November 1978

Waste 12.6 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Till	Clay, mottled yellow and light grey to grey with depth, firm to stiff, with chalk and some flint pebbles	12.0	12.6
Ancholme Clay Group	Clay, silty, olive black, hard, with shell fragments	0.4+	13.0

TF 25 NE 20 **2691 5516** **Sandy Bank**

Surface level +1.5 m (+5 ft)
Water not struck
November 1978

Waste 11.5 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Marine or Estuarine Alluvium	Clay, silty and sandy, pale brown and grey with a sand layer at base	0.8	1.2
Till	Clay, reddish yellow mottled with grey to olive grey with depth, firm to base, with chalk and some flint pebbles	10.3	11.5
Ancholme Clay Group	Clay, silty, olive black, hard, with numerous shell fragments	0.5+	12.0

TF 25 NE 21 **2771 5547** **Mill's Bridge**

Surface level +1.5 m (+5 ft)
Water not struck
November 1978

Waste 13.7 m
Bedrock 0.3+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
Marine or Estuarine Alluvium	Peat, pebbly	0.2	0.9
	Sand	0.4	1.3
Till	Clay, light grey, soft to firm, with chalk pebbles, which decrease in number to base, and some flint	12.4	13.7
Ancholme Clay Group	Clay, silty, olive black, hard, with shell fragments	0.3+	14.0

TF 25 NE 22 **2898 5528** **The Royalty**

Surface level +1.2 m (+4 ft)
Water not struck
November 1978

Waste	14.6 m
Bedrock	0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Marine or Estuarine	Clay, silty, yellowish red mottled with grey, grey to base firm to soft,with peaty patches and shell debris below 2.4 m	2.4	2.8
Till	Clay, light yellowish brown to olive grey with depth, firm, with chalk pebbles which increase in amount to base	11.8	14.6
Ancholme Clay Group	Clay, silty, olive grey, hard, with shell fragments	0.9+	15.5

TF 25 NE 23 **2982 5506** **Westville**

Surface level +1.2 m (+4 ft)
Water not struck
November 1978

Waste	14.5 m
Bedrock	1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Marine or Estuarine Alluvium	Silt, greyish brown mottled with brown to dark grey with depth, soft, sandy, with layers of carbonaceous material	5.0	5.6
Till	Clay, pale grey to dark grey with depth, firm to hard, with chalk and some flint and sandstone pebbles	8.9	14.5
Ancholme Clay Group	Clay, silty, olive black, hard, with shell fragments	1.0+	15.5

TF 25 NE 24 **2689 5940** **Birkwood Hall** **Block B**

Surface level c +4.0 m (+13 ft)
Water struck at c +2.4 m
3 inch Minuteman power auger
October1977

Overburden	0.8 m
Mineral	2.6 m
Waste	0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
Fluvio-glacial and Older River Sand and Gravel	Pebbly sand Gravel: fine, flint and chalk Sand: fine and medium, quartz with lithic grains	2.6	3.4
Till	Clay, silty, dark blue, with chalk fragments	0.2+	3.6
	No grading data available		

TF 25 NE 25 **2558 5666** **Tumby Woodside** **Block B**

Surface level c +4.2 m (+14 ft)
Water struck at c +2.4 m
3 inch Minuteman power auger
November 1977

Overburden	0.6 m
Mineral	4.2 m
Waste	0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Fluvio-glacial and Older River Sand	Pebbly sand Gravel: fine, angular flint with some subangular to subrounded quartzite Sand: medium with fine, quartz with lithic grains	4.2	4.8
Till	Clay, dark grey, with fine chalk fragments	0.2+	5.0
	No grading data available		

TF 25 SW 1 **2075 5423** **Chapel Hill** **Block C**

Surface level +4.4 m (+15 ft)
Water struck at -1.1 m
October 1978

Overburden	5.4 m
Mineral	13.1 m
Bedrock	1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	2.3	2.3
Marine or Estuarine Alluvium	Silt, black, soft, with much organic debris	0.2	2.5
	Silt, dark olive grey, soft, laminated	2.9	5.4
River Gravels	Pebbly sand, 'clayey' to 'very clayey' in parts Gravel: fine with coarse, subrounded to rounded, flint with quartz, quartzite and some chalk and sandstone Sand: medium, quartz with lithic grains	13.1	18.5
Ancholme Clay Group	Clay, silty, greenish black, hard, with some shell fragments	1.0+	19.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
5	76	19	5.4-6.5	1	12	46	10	19	12
			6.5-7.5	11	23	49	6	6	5
			7.5-8.5	2	29	46	5	10	8
			8.5-9.5	2	48	40	2	5	3
			9.5-10.5	4	72	22	1	1	0
			10.5-11.5	2	46	28	7	16	1
			11.5-12.5	3	19	39	14	21	4
			12.5-13.5	7	23	52	7	8	3
			13.5-14.5	20	18	56	5	1	0
			14.5-15.0	1	13	64	9	12	1
			15.0-16.0	11	4	25	9	28	23
			16.0-17.0	1	3	26	13	28	29
			17.0-18.0	4	10	64	7	11	4
			18.0-18.5	3	13	79	3	2	0
			Mean	**5**	**25**	**44**	**7**	**12**	**7**

TF 25 SW 2 **2326 5398** **Bettinson's Farm**

Surface level c +2.5 m (+8 ft)
Water not struck
3 inch Minuteman power auger
November 1977

Waste 8.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.2	1.2
Marine or Estuarine Alluvium	Clay, silty, dark brown to dark grey with depth	5.5	6.7
Till	Clay	1.3+	8.0

TF 25 SW 3 **2265 5406** **Bettinson's Farm**

Surface level +4.5 m (+15 ft)
Water not struck
November 1978

Waste 2.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
Till	Clay, silty, dark yellowish brown mottled grey	0.4	1.1
	Clay, silty, olive black, stiff to hard, with rare chalk pebbles	1.4+	2.5

TF 25 SW 4 **2360 5416** **Packet House**

Surface level +1.7 m (+6 ft)
Water not struck
December 1978

Waste 6.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.3	1.3
Marine or Estuarine Alluvium	Silt, 'clayey' and sandy, yellowish brown with grey and orange brown layers	1.1	2.4
	Silt, dark olive grey, with sporadic sand grains	1.8	4.2
	Peat	0.2	4.6
	Silt, dark olive grey, with sporadic sand grains and flint pebbles	0.3	4.9
Till	Very 'clayey' gravel Gravel: fine flint Sand: medium quartz Fines: dark olive grey	0.3	5.2
	Clay, dark greenish grey streaked with moderate olive brown, firm, slightly sandy with chalk and flint pebbles	1.3+	6.5

TF 25 SW 5 **2076 5315** **Hart's Grounds** **Block C**

Surface level +2.3 m (+8 ft)
Water struck at -3.7 m
December 1978

Overburden 12.0 m
Mineral 5.4 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.0	1.0
Marine or Estuarine Alluvium	Silt, dark yellowish brown, plastic, firm	1.5	2.5
	Silt, sandy to base, dark olive grey, soft	5.4	7.9
	Clay, moderate yellowish brown, stiff, with chalk fragments	0.9	8.8
	Silt, sandy to base, dark olive, grey, soft	3.2	12.0
River Gravels	**a** Pebbly sand Gravel: fine, subangular to subrounded flint with subrounded to well rounded quartzite and quartz and some sandstone, limestone and chalk Sand: medium with fine, quartz with lithic grains	3.0	15.0
	b Sandy gravel Gravel: fine, subrounded to rounded quartzite, flint and quartz, with some chalk, limestone and sandstone Sand: medium, quartz with lithic grains	2.4	17.4
Ancholme Clay Group	Clay, silty, olive black, stiff to hard, with shell fragments	0.6+	17.6

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
a	4	84	12	12.0-13.0	7	49	36	5	3	0
				13.0-14.0	4	22	43	13	16	2
				14.0-15.0	3	20	58	4	10	5
				Mean	**4**	**30**	**46**	**8**	**10**	**2**
b	1	62	37	15.0-16.0	1	12	44	7	21	15
				16.0-17.0	1	8	48	14	21	8
				17.0-17.4	1	7	24	8	38	22
				Mean	**1**	**9**	**43**	**10**	**24**	**13**
a+b	3	74	23	12.0-17.4	3	21	44	9	16	7

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	22	1	3	49	21	3	trace	trace
4-8 mm	21	3	8	46	17	4	1	trace

TF 25 SW 6 **2195 5323** **Great Beats Farm** **Block C**

Surface level +3.4 m (+11 ft)
Water struck at -4.1 m
December 1978

Overburden	10.2 m
Mineral	11.6 m
Bedrock	0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.1	1.1
Marine or Estuarine Alluvium	Silt, light olive brown to dark olive grey with depth, sandy and 'clayey' in parts, plastic, firm	5.0	6.1
	Peat	0.2	6.3
	Silt, dark olive grey, sandy and 'clayey' in parts	1.2	7.5
	Very 'clayey' sand; fine quartz	0.8	8.3
	Clay, sandy and silty, dark yellowish brown, with some chalk fragments	1.9	10.2
River Gravels	Pebbly sand Gravel: fine, subrounded to rounded quartzite and quartz, subangular to subrounded flint with some limestone, sandstone and chalk Sand: medium, quartz with lithic grains	11.6	21.8
Ancholme Clay Group	Clay, silty, dark olive grey, stiff to hard, with shell fragments	0.7+	22.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
3	75	22	10.2-11.2	4	36	30	12	17	1
			11.2-12.2	5	37	49	6	3	0
			12.2-13.2	1	22	54	8	12	3
			13.2-14.2	2	10	53	14	17	4
			14.2-15.2	1	9	47	20	19	4
			15.2-16.2	6	9	68	7	8	2
			16.2-17.2	1	4	55	13	23	4
			17.2-18.2	1	3	37	18	31	10
			18.2-19.0	2	8	29	17	29	15
			19.0-20.2	4	86	8	1	1	0
			20.2-21.8	3	12	35	14	28	8
			Mean	**3**	**22**	**41**	**12**	**17**	**5**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	31	1	7	38	20	3	-	-
4-8 mm	25	5	15	33	17	5	-	trace

TF 25 SW 7 **2453 5336** **Hundle Houses**

Surface level +1.9 m (+16 ft)
Water not struck
October 1978

Waste 15.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
?Fluvio-glacial and Older River Sand and Gravel	Sand, some flint pebbles	0.2	0.7
Till	Clay, grey streaked with brown, firm to hard, with pebbles of chalk, flint and sandstone and a boulder of siltstone at 14.0 m	14.3+	15.0

TF 25 SW 8 **2142 5237** **Light House** **Block C**

Surface level +1.2 m (+4 ft)
Water struck at -6.7 m
November 1978

Overburden	7.2 m
Mineral	12.8 m
Bedrock	0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.0	1.0
Marine or Estuarine Alluvium	Silt, yellowish brown to olive grey	5.0	6.0
	Peat	0.1	6.1
	Silt, sandy, olive grey	1.1	7.2
River Gravels	Sandy gravel Gravel: fine, subrounded to well rounded quartzite and quartz, angular to subangular flint with some limestone, chalk and sandstone Sand: medium, quartz with lithic grains	12.8	20.0
Ancholme Clay Group	Clay, dark yellowish brown, stiff to hard, with shell fragments	0.5+	20.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
2	63	35	7.2-8.2	4	21	46	14	14	1
			8.2-9.5	2	15	69	8	5	1
			9.5-10.5	2	13	47	15	18	5
			10.5-11.8	1	12	45	10	19	13
			11.8-13.0	3	13	47	13	16	8
			13.0-14.0	0	6	33	17	32	12
			14.0-15.0	2	7	53	16	18	4
			15.0-16.0	2	4	40	15	32	7
			16.0-17-0	1	2	20	8	34	35
			17.0-17.9	1	5	33	15	32	14
			17.9-18.5	2	7	24	18	30	19
			18.5-19.5	0	4	16	14	44	22
			19.5-20.0	4	7	28	17	27	17
			Mean	**2**	**9**	**41**	**13**	**24**	**11**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	24	1	10	39	21	3	1	1
4-8 mm	21	7	7	38	20	4	1	2

TF 25 SW 9 **2287 5248** **Round House Farm** **Block C**

Surface level +3.2 m (+11 ft)
Water struck but level not recorded
November 1978

Overburden	9.1 m
Mineral	11.2 m
Bedrock	0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Marine or Estuarine Alluvium	Silt, clayey and sandy, dark yellowish brown to moderate olive brown	5.8	6.1
	Peat	0.2	6.3
	Silt, sandy and 'clayey', moderate olive brown	1.9	8.2
?	Clay, dark yellowish brown streaked with grey, stiff to hard, with chalk and flint pebbles	0.9	9.1
River Gravels	Sandy gravel Gravel: fine, subrounded to well rounded quartzite with rounded to well rounded quartz, subrounded flint and limestone and some chalk and sandstone Sand: medium, quartz with lithic grains	11.2	20.3
Ancholme Clay Group	Clay, silty, dark olive grey, stiff to hard, with shell fragments	0.7 +	21.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
2	59	39	9.1-10.1	6	11	29	9	37	8
			10.1-11.0	2	14	51	8	19	6
			11.0-12.0	1	6	42	19	20	12
			12.0-13.0	1	6	38	21	25	9
			13.0-14.0	1	7	37	13	28	14
			14.0-15.0	3	8	46	9	20	14
			15.0-16.0	1	8	54	12	22	3
			16.0-17.0	1	3	49	16	28	3
			17.5-18.0	2	5	28	19	29	17
			18.0-19.0	1	6	19	16	38	20
			19.0-20.3	3	5	23	16	29	24
			Mean	**2**	**7**	**38**	**14**	**27**	**12**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	26	3	5	43	19	3	1	trace
4-8 mm	23	4	15	33	19	5	trace	trace

TF 25 SW 10 **2420 5199** **Wildmore** **Block D**

Surface level +3.1 m (+10 ft)
Water struck at O.D.
December 1978

Overburden	1.6 m
Mineral	1.9 m
Waste	0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
Marine or Estuarine Alluvium	Clay, olive grey mottled with reddish brown	0.5	1.3
	Silt, dark yellowish brown	0.3	1.6
Fluvio-glacial and Older River Sand and Gravel	'Clayey' pebbly sand Gravel: fine, subangular to subrounded flint with some chalk, limestone, quartz, quartzite, sandstone and igneous rocks Sand: medium, quartz with lithic grains	1.9	3.5
Till	Clay, silty, olive black, stiff, with chalk fragments	0.5+	4.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
11	68	21	1.6-2.6	11	14	36	11	19	9
			2.6-3.5	10	14	48	16	12	1
			Mean	**11**	**14**	**41**	**13**	**16**	**5**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	65	12	3	5	11	3	1	-
4-8 mm	55	18	2	5	12	5	3	-

TF 25 SW 11 **2097 5178** **Reed Point Farm** **Block C**

Surface level +2.0 m (+7 ft)
Water struck at -0.5 m
December 1978

Overburden	6.5 m
Mineral	11.7 m
Bedrock	0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Marine or Estuarine Alluvium	Silt, sandy, moderate yellowish brown to dark yellowish brown, soft	6.2	6.5
	a Sand, fine, quartz with lithic grains and rare chalk and shell fragments	2.8	9.3
River Gravels	**b** Sandy gravel Gravel: fine, subrounded to well rounded quartzite with rounded to well rounded quartz, subangular to subrounded flint and some limestone, sandstone, chalk and igneous rocks Sand: medium, quartz with lithic grains	8.9	18.2
Ancholme Clay Group	Clay, silty, dark greyish olive, stiff to hard, with shell fragments	0.3+	18.5

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}$ -1	+1 -4	+4 -16	+16 mm
a	7	93	0	6.5-7.5	6	93	1	0	0	0
				7.5-8.5	7	90	3	0	0	0
				8.5-9.3	8	71	21	0	0	0
				Mean	**7**	**86**	**7**	**trace**	**0**	**0**
b	3	67	30	9.3-10.3	3	30	58	5	4	0
				10.3-11.2	3	36	40	8	10	3
				11.2-12.4	1	9	40	16	27	7
				12.4-13.4	3	7	42	9	22	17
				13.4-14.4	1	5	37	13	31	13
				14.4-15.4	5	15	49	7	17	7
				15.4-16.4	6	8	40	12	26	8
				16.4-17.4	0	4	45	14	31	6
				17.4-18.2	2	6	36	10	31	15
				Mean	**3**	**13**	**43**	**11**	**22**	**8**
a+b	4	73	73	6.5-18.2	4	30	35	8	17	6

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	23	1	4	45	25	-	2	trace
4-8 mm	21	1	11	35	23	5	4	trace

TF 25 SW12 **2207 5145** **Brewery** **Block C**

Surface level +2.5 m (+8 ft)
Water struck at +0.3 m
October 1978

Overburden 11.6 m
Mineral 1.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil + subsoil	2.0	2.0
Marine or Estuarine Alluvium	Silt, 'clayey' and sandy, greyish brown, soft, with a thin gravel band at base	9.1	11.1
	Clay, peaty, dark olive grey	0.5	11.6
River Gravels	Sandy gravel Gravel: fine, subrounded to well rounded quartzite and quartz and some subangular to subrounded flint with some limestone, chalk, sandstone and igneous rocks Sand: medium, quartz with lithic grains	1.4+	13.0
	Borehole abandoned because of slow progress		

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
1	67	32	11.6-13.0	1	9	43	15	26	6

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	20	2	7	40	26	4	1	-
4-8 mm	16	14	21	20	20	6	3	trace

TF 25 SW 13 **2344 5166** **Round House Farm**

Surface level +3.6 m (+12 ft)
Water struck at -3.4 m
November 1978

Waste	12.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Marine or Estuarine Alluvium	Silt, orange-brown, sandy in parts	1.3	1.6
	Silt, sandy at 9.3 m, olive grey, with rare shells	8.2	9.8
?River Gravels	Pebbly sand Gravel: fine, limestone, flint and quartz Sand: fine and medium, quartz with lithic grains	0.3	10.1
Till	Clay, silty, light olive grey darkening with depth, stiff, with chalk and sporadic flint pebbles	1.9+	12.0

TF 25 SW 14 **2101 5059** **Reed Point** **Block C**

Surface level +1.6 m (+5 ft)
Water struck at -6.4 m
December 1978

Overburden	8.0 m
Mineral	1.5 m
Waste	1.5 m
Mineral	5.5 m
Bedrock	0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Marine or Estuarine Alluvium	Silt, dark yellowish brown to moderate olive grey, peaty between 3.3 and 3.6 m	7.1	7.5
	Peat, silty in parts	0.5	8.0
	a 'Clayey' sand, medium and fine quartz; greyish olive silt	1.5	9.5
	Silt, very sandy, greyish olive	1.5	11.0
River Gravels	**b** Sandy gravel, (gravel absent between 13.2 and 14.4 m) Gravel:fine, subrounded to well rounded quartzite and subangular to subrounded flint with rounded to well rounded quartz and some limestone, sandstone and chalk Sand: medium with fine quartz with lithic grains	5.5	16.5
Ancholme Clay Group	Clay, silty, dark olive grey, stiff to hard, with shell fragments	0.5+	17.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}$ -1	+1 -4	+4 -16	+16 mm
a	15	84	1	8.0-9.5	15	37	45	2	1	0
b	3	71	26	11.0-12.0	6	15	46	15	17	1
				12.0-12.4	6	10	38	21	23	2
				12.4-13.2	2	9	37	12	24	16
				13.2-14.4	5	80	10	4	1	0
				14.4-15.4	1	13	40	12	27	7
				15.4-16.5	2	7	32	15	28	16
				Mean	**3**	**26**	**33**	**12**	**19**	**7**
a+b	**6**	**24**	**20**	**Mean**	**6**	**28**	**36**	**10**	**15**	**5**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	33	1	6	37	18	5	trace	trace
4-8 mm	32	3	8	36	16	4	1	-

TF 25 SW 15 **2280 5078** **Brewery** **Block C**

Surface level +2.7 m (+9 ft)
Water struck at -1.0 m
November 1978

Overburden	3.7 m
Mineral	1.3 m
Waste	1.0 m
Mineral	12.1 m
Bedrock	0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
Marine or Estuarine Alluvium	Silt,dark yellowish brown, soft	3.0	3.7
	a 'Clayey' sand, fine quartz; olive grey silt	1.3	5.0
	Silt, very sandy, olive grey	1.0	6.0
	b Sand, fine quartz	6.5	12.5
River Gravels	**c** Sandy gravel Gravel: fine with coarse, subrounded to well rounded quartzite and quartz with subrounded flint and some sandstone, limestone, chalk and igneous rocks Sand: medium, quartz with lithic grains	5.6	18.1
Ancholme Clay Group	Clay, silty, brownish black, stiff to hard, with some shell fragments	0.9+	19.0

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages					
	Fines	Sand	Gravel		Fines	Sand			Gravel	
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
a	15	25	0	3.7-5.0	15	84	1	0	0	0
b	5	95	0	6.0-7.1	6	92	2	0	0	0
				7.1-8.1	5	92	2	1	0	0
				8.1-9.1	6	93	1	0	0	0
				9.1-10.0	5	90	5	0	0	0
				10.0-10.8	no sample data					
				10.8-11.2	5	63	32	0	0	0
				11.2-12.5	4	72	24	0	0	0
				Mean	**5**	**85**	**10**			
c	2	52	46	12.5-13.5	1	12	30	8	26	23
				13.5-14.5	2	14	43	9	23	9
				14.5-15.5	2	6	42	8	24	18
				15.5-16.5	3	4	36	8	22	27
				16.5-17.5	2	4	31	11	31	21
				17.5-18.1	2	4	34	9	32	19
				Mean	**2**	**8**	**35**	**9**	**26**	**20**
a+b+c	**5**	**76**	**19**	**Mean**	**5**	**53**	**19**	**4**	**11**	**8**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	18	1	4	40	26	7	3	1
4-8 mm	14	3	10	32	25	9	6	1

TF 25 SW 16 **2386 5049** **Pelham's Lands** **Block C**

Surface level +3.8 m (+13 ft)
Water struck at +2.2 m
October 1978

Overburden	7.3 m
Mineral	4.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
Marine or Estuarine Alluvium	Silt, dark orange-brown, soft	3.1	3.8
	Sand, fragmented shells only	0.3	4.1
	Silt, peaty in parts, greyish brown, soft	3.2	7.3
	Sand, very 'clayey' in first metre, pebbly in last Gravel: fine, flint and quartz Sand: fine with medium	4.2+	11.5
	Borehole abandoned due to slow progress		

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
10	88	2	7.3-8.3	35	65	0	0	0	0
			8.3-9.3	4	86	9	1	0	0
			9.3-10.5	2	28	62	6	2	0
			10.5-11.5	2	19	52	18	8	1
			Mean	**10**	**50**	**32**	**6**	**2**	**trace**

TF 25 SW 17 **2390 5304** **Wildmore** **Block D**

Surface level c+2.5 (+8 ft)
Water not struck
3 inch Minuteman power auger
November 1977

Overburden	1.3 m
Mineral	1.2 m
Waste	0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
Marine or Estuarine Alluvium	Clay, brown and grey, sporadic chalk fragments	0.5	1.3
Fluvio-glacial and Older River Sand and Gravel	Sand, medium with fine, quartz and lithic grains	1.2	2.5
Till	Clay, weathered and brown to dark grey and fresh	0.5+	3.0
	No grading data available		

TF 25 SE 2 **2557 5399** **Bunker's Hill**

Surface level +2.0 m (+7 ft)
Water not struck
November 1978

Waste	4.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
Till	Clay, sandy in upper part, orange brown to dark yellowish brown with depth, firm to stiff, with chalk pebbles	2.5	3.2
	Silt, olive grey, soft	0.3	3.5
	Clay, very silty, olive grey, with chalk pebbles	0.5+	4.0

TF 25 SE 3 **2698 5404** **Bunker's Hill** **Block D**

Surface level +2.2 m (+7 ft)
Water struck at +0.5 m
November 1978

Overburden	0.9 m
Mineral	2.9 m
Waste	1.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Marine or Estuarine Alluvium	Clay, grey mottled with strong brown; peat band at 0.7 m	0.4	0.9
Fluvio-glacial and Older River Sand and Gravel	Pebbly sand Gravel: fine with coarse, subangular to subrounded flint with chalk, quartzite, quartz, limestone and sandstone Sand: medium with fine, quartz with lithic grains	2.9	3.8
Till	Clay, silty, grey, firm to stiff, with some chalk and flint	1.7+	5.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
5	78	17	0.9-1.9	9	29	40	11	10	1
			1.9-2.9	3	39	47	4	4	3
			2.9-3.8	4	23	34	4	16	19
			Mean	**5**	**31**	**41**	**6**	**10**	**7**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	72	4	4	13	5	1	trace	trace
4-8 mm	54	11	17	9	7	trace	trace	trace

TF 25 SE 4 **2784 5456** **Grange Farm**

Surface level +1.2 m (+4 ft)
Water not struck
November 1978

Waste 11.9 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Marine or Estuarine Alluvium	Clay, sandy and silty, very dark greyish brown mottled with red to brownish yellow with depth; some sandstone pebbles	1.6	2.1
Till	Clay, pale grey with pale brown mottling; some chalk pebbles	9.8	11.9
Ancholme Clay Group	Clay, silty, dark olive grey, hard, with shell fragments	0.6+	12.5

TF 25 SE 5 **2906 5419** **Westville**

Surface level +1.9 m(6 ft)
Water not struck
December 1978

Waste 4.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Marine or Estuarine Alluvium	Silt, greyish brown with orange brown streaks, plastic to soft	1.7	2.1
	Peat	0.4	2.5
	Silt, clayey, very dark greenish grey	0.1	2.6
Till	Clay, silty, dark olive, firm to stiff, with chalk pebbles	1.4+	4.0

TF 25 SE 6 **2765 5345** **Dovecote Hall**

Surface level +0.7 m (+2 ft)
Water not struck
December 1978

Waste 5.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.6	0.6
Marine or Estuarine Alluvium	Silt, sandy, moderate yellowish brown to moderate olive grey, plastic	1.9	2.5
	Peat	0.5	3.0
	Silt, moderate olive grey, plastic	0.5	3.5
Till	Clay, silty, moderate olive brown to olive grey with depth, firm to stiff, with chalk granules	2.0+	5.5

TF 25 SE 7 **2914 5338** **Westville**

Surface level +2.3 m (+8 ft)
Water not struck
December 1978

Waste 3.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
Marine or Estuarine Alluvium	Silt, olive grey, plastic	1.2	2.0
	Peat	0.7	2.7
	Silt, olive black, plastic	0.3	3.0
Till	Clay, silty, greyish olive to dark olive grey with depth, firm, with chalk pebbles	0.5+	3.5

TF 25 SE 8 **2526 5270** **Frog Hall** **Block D**

Surface level +2.4 m (+8 ft)
Water struck at +0.7 m
October 1978

Overburden	0.6 m
Mineral	3.3 m
Waste	14.0 m
Bedrock	0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Fluvio-glacial and Older River Sand and Gravel	Sandy gravel, 'clayey' to 1.9 m Gravel: fine with coarse, subrounded to well rounded quartzite with subangular flint, well rounded quartz and some limestone and sandstone Sand: medium, quartz with lithic grains	3.3	3.9
Till	Clay, silty, very dark grey, stiff to hard, with chalk and flint pebbles	14.0	17.9
Ancholme Clay Group	Clay, silty, dark grey, firm to stiff, with shell fragments	0.2+	18.1

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
8	46	46	0.6-1.9	11	9	33	14	26	7
			1.9-3.2	5	5	23	16	24	27
			3.2-3.9	6	2	13	14	40	25
			Mean	**8**	**6**	**25**	**15**	**27**	**19**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	28	trace	4	44	16	7	trace	-
4-8 mm	33	trace	1	42	15	7	-	-

TF 25 SE 9 **2642 5259** **Waite Farm** **Block D**

Surface level +3.9 m (+13 ft)
Water struck at +1.9 m
October 1978

Overburden	0.7 m
Mineral	1.5 m
Waste	16.9 m
Bedrock	0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
Fluvio-glacial and Older River Sand and Gravel	'Clayey' sandy gravel Gravel: coarse with fine, subrounded to rounded quartzite with angular flint Sand: fine to medium, quartz with lithic grains	1.5	2.2
Till	Clay, silty, olive grey, firm to stiff, with chalk and flint pebbles, and Jurassic clay fragments from 2.4 to 2.6 m	16.9	19.1
Ancholme Clay Group	Clay, greyish black, stiff to hard, with shell fragments	0.4+	19.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
17	51	32	0.7-2.2	17	29	18	4	9	23

TF 25 SE 10 **2886 5267** **Thornton le Fen** **Block D**

Surface level +1.2 m (+4 ft)
Water struck at -2.0 m
October 1978

Overburden	3.4 m
Mineral	3.9 m
Waste	11.9 m
Bedrock	0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.0	1.0
Marine or Estuarine Alluvium	Silt, greyish brown to dark brownish grey at 3.0 m, firm	2.4	3.4
Fluvio-glacial and Older River Sand and Gravel	Pebbly sand Gravel: fine and coarse, subangular to subrounded flint with subrounded to well rounded chalk and quartzite and some quartz, sandstone and limestone Sand: medium, quartz with lithic grains	3.9	7.3
Till	Clay, silty, olive grey, stiff to hard, with chalk and mudstone fragments	11.9	19.2
Ancholme Clay Group	Clay, silty, olive black, stiff, with shell fragments	0.8+	20.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
5	89	6	3.4-4.4	8	26	64	2	0	0
			4.4-5.4	5	19	69	2	2	3
			5.4-6.4	4	19	70	3	3	1
			6.4-7.3	2	14	59	6	9	10
			Mean	**5**	**19**	**67**	**3**	**3**	**3**

COMPOSITION

Fraction	Percentages by weight							
	Flint	Chalk	Limestone	Quartzite	Quartz	Sandstone	Igneous	Shell debris
8-16 mm	57	14	3	19	5	2	-	-
4-8 mm	66	13	2	5	7	6	-	-

TF 25 SE 11 **2520 5095** **Hermitage Farm**

Surface level +1.6 m (+5 ft)
Water not struck
November 1978

Waste 8.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Marine or Estuarine Alluvium	Silt, orange brown, slightly sandy	1.3	1.9
	Silt, moderate olive grey	3.8	5.7
	Peat	0.2	5.9
	Silt, dark olive grey, sandy	0.5	6.4
Till	Clay, silty and slightly sandy, olive grey, stiff, with chalk and flint pebbles	1.6+	8.0

TF 25 SE 12 **2809 5145** **Primrose Hill Farm**

Surface level +2.4 m (+8 ft)
Water not struck
October 1978

Waste 16.2 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Marine or Estuarine Alluvium	Clay, silty, dark greyish brown, soft to firm	2.0	2.5
Till	Clay, silty but sandy to 2.9 m, olive yellow to 3.4 m, dark grey below, soft becoming firm with depth, with chalk and flint pebbles	13.7	16.2
Ancholme Clay Group	Clay, olive black, hard, with shell fragments	0.8+	17.0

TF 25 SE 13 **2981 5144** **Westville Farm**

Surface level +1.3 m (+4 ft)
Water struck at -3.6 m
October 1978

Waste 18.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
Marine or Estuarine Alluvium	Silt, light brown becoming dark grey with depth	2.7	3.5
	Peat	0.5	4.0
	Silt, dark grey	0.9	4.9
?	Sandy gravel Gravel: fine, sandstone, flint, quartzite and chalk Sand: medium, quartz with lithic grains	0.6	5.5
Till	Clay, dark grey, firm to stiff, with chalk, flint and mudstone pebbles	12.5+	18.0

TF 25 SE 14 **2644 5031** **Thornton le Fen**

Surface level +3.1 m (+10 ft)
Water not struck
November 1978

Waste 16.9 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Marine or Estuarine Alluvium	Clay, dark greyish brown to dark bluish grey, peaty in parts	3.5	3.8
	Peat	1.0	4.8
Till	Clay, silty, grey mottled with olive grey, soft to firm, with chalk and flint pebbles	12.1	16.9
Ancholme Clay Group	Clay, very dark grey, hard, with shell fragments	1.1+	18.0

TF SE 15 **2807 5051** **Thonton le Fen**

Surface level +2.4 m (+8 ft)
Water struck at -4.6 m
October 1978

Waste 16.8 m
Bedrock 1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Marine or Estuarine Alluvium	Silt, dark grey mottled with dark orange brown, firm	1.1	1.7
	Peat	0.1	1.8
Till	Clay, very dark grey mottled with olive yellow to light grey with depth; some chalk pebbles; a band of 'very clayey' sandy gravel occurs between 3.5 and 4.0 m	15.0	16.8
Ancholme Clay Group	Clay, greyish black, hard, with shell fragments	1.2+	18.0

TF 25 SE 16 **2951 5069** **Bay Cottage**

Surface level +2.4 m (+8 ft)
Water struck at -4.6 m
October 1978

Waste 19.2 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	1.0	1.0
Marine or Estuarine Alluvium	Silt, moderate brown streaked with orange brown and black	3.1	4.1
	'Very clayey' sand, fine, quartz	1.1	5.2
	Silt, slightly sandy, dark olive grey, soft	1.0	6.2
	Clay, light brown streaked with orange brown	0.9	7.1
Till	Clay, silty, olive grey, firm, with chalk and rare flint pebbles	12.1	19.2
Ancholme Clay Group	Clay, silty, dark olive grey, with shell fragments	0.8+	20.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages					
Fines	Sand	Gravel		Fines	Sand			Gravel	
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 mm
24	76	0	4.1-5.2	24	75	1	0	0	0

TF 25 SE 18 **2912 5274** **Westville**

Surface level c+1.8 m (+6 ft)
Water struck at c-0.2 m
3 inch Minuteman power auger
November 1977

Waste 6.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
Marine or Estuarine Alluvium	Sand, fine, quartz with lithic grains; sporadic flint pebble	0.6	1.3
	Silt, light brown to grey with depth	4.0	5.3
Till	Clay, brownish yellow and weathered, with some chalk fragments and flint pebbles	0.7+	6.0

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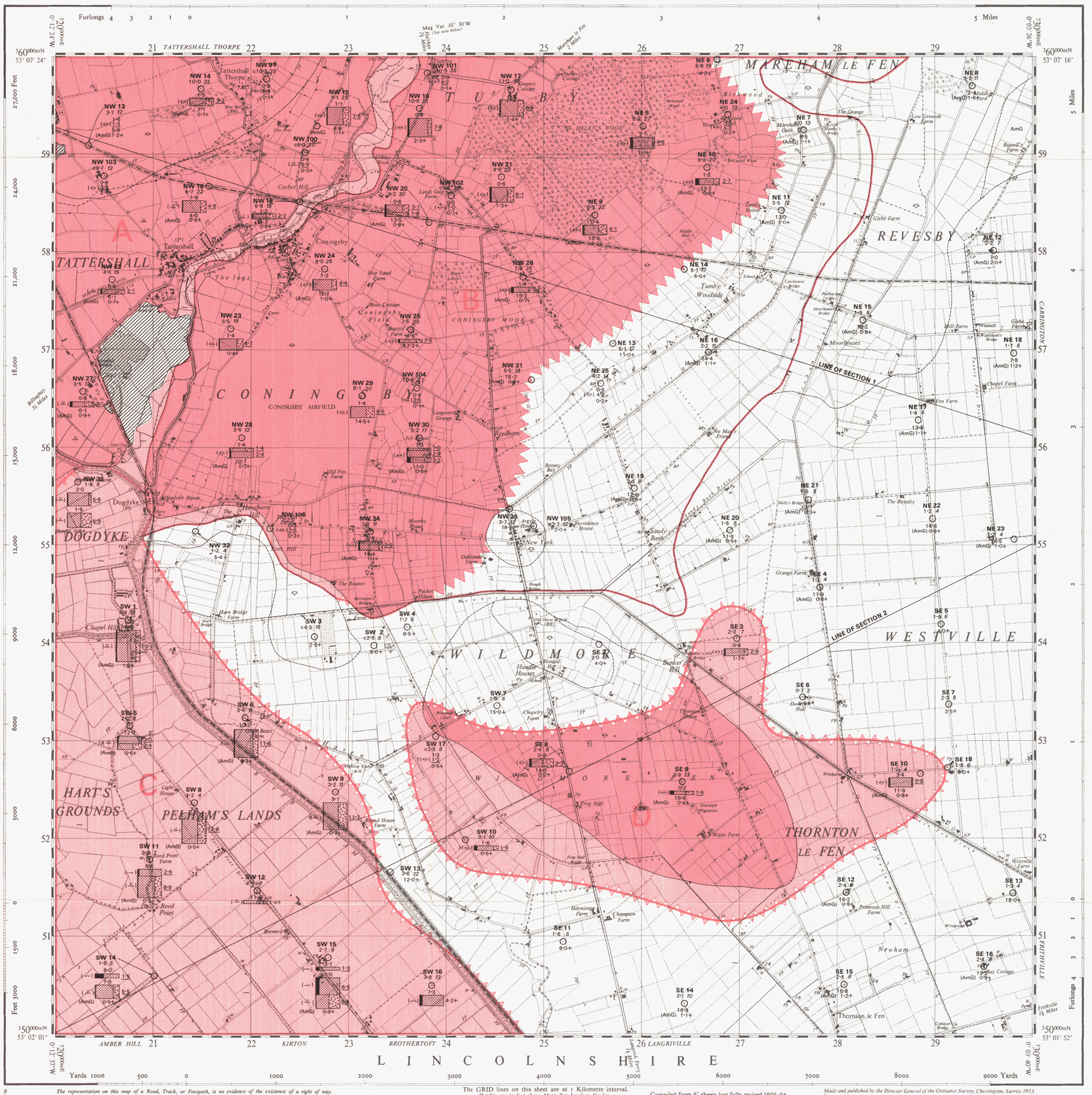
INSTITUTE OF GEOLOGICAL SCIENCES

INDUSTRIAL MINERALS ASSESSMENT UNIT

THE SAND & GRAVEL RESOURCES OF THE COUNTRY AROUND CONINGSBY, LINCOLNSHIRE

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

ORDNANCE SURVEY
SHEET TF 25
PROVISIONAL EDITION



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 surveys on the one-inch scale published in 1886 and 1893 on Old Series sheets 69, 70, 83 and 84.
Part resurveyed in 1979 by T.P. Fletcher;
E.G. Smith, District Geologist.
Sand and Gravel Survey by M.D. Isaias and J.B.L. Wild in 1978–9;
R.G. Thurrell, Head, Industrial Minerals Assessment Unit.
1:25000 Sand and Gravel Resource Sheet published 1982.
G.M. Brown, DSc, FRS., *Director, Institute of Geological Sciences.*

The GRID lines on this sheet are at 1 Kilometre interval.
Heights are in feet above Mean Sea Level at Newlyn.
Heights of Bench Marks and Trigonometrical Stations may be obtained on application to the Director General, Ordnance Survey.

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

Compiled from 6' sheets last fully revised 1903–04. Other partial systematic revision 1946–53 has been incorporated.

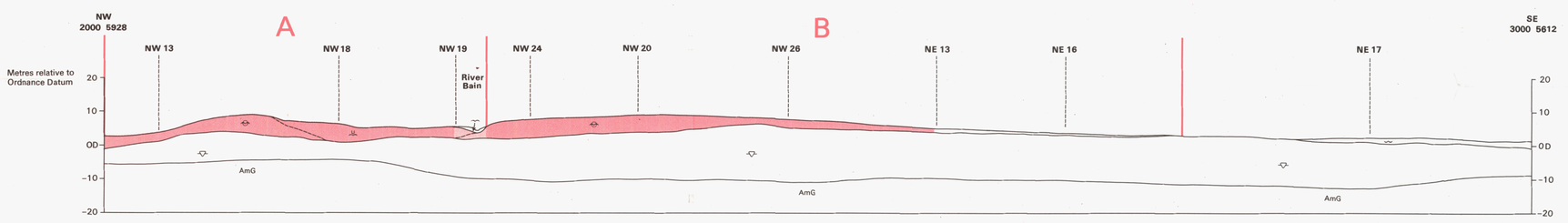
Made and published by the Director General of the Ordnance Survey, Chessington, Surrey 1953. Reprinted with minor corrections 1960.

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.

GENERALIZED HORIZONTAL SECTIONS

Horizontal scale: 1:25,000
Vertical exaggeration: x25

SECTION 1



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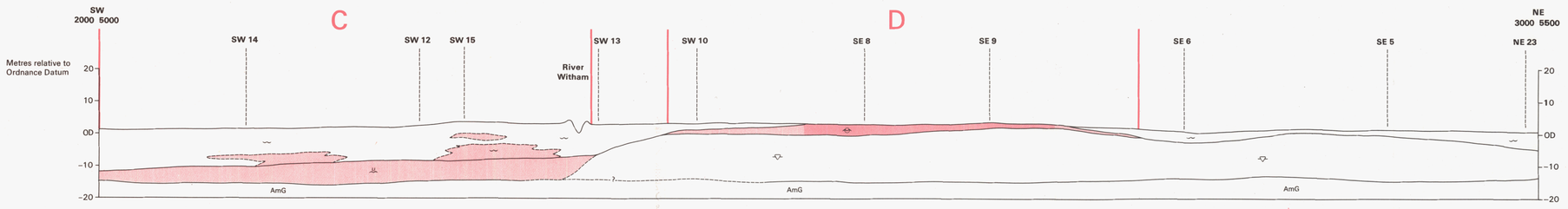


THE SAND & GRAVEL RESOURCES OF THE COUNTRY AROUND CONINGSBY, LINCOLNSHIRE

128

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

EXPLANATION OF SYMBOLS AND ABBREVIATIONS

DRIFT

- **Alluvium** – clays and silts with some sand and gravel. A-47
- **Marine or Estuarine Alluvium** – silts and clays with some sand and peat. ME-9
- **River Gravels, undifferentiated** – mainly sandy gravels. RG-3
- **Fluvio-glacial and Older River Sand and Gravel** – pebbly sands and sandy gravels. FL-27
- **Till** – stony clays. TL-9

QUATERNARY — RECENT AND PLEISTOCENE

SOLID

- AmG **Ancholme Clay Group** — JURASSIC
- **Worked areas of sand and gravel** WO-25

BOUNDARY LINES

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

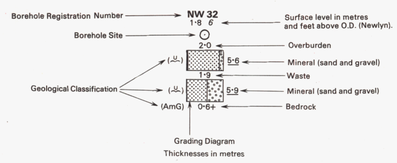
Broken lines denote uncertainty.

BOREHOLE DATA

SITE LOCATIONS

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

I.M.A.U. BOREHOLES



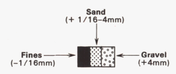
Note:
1. The figures in *italics* are the imperial conversions of measurements recorded in metres.
2. Figures underlined denote thicknesses used in the assessment of resources.
3. The + sign indicates that the base of the deposit was not reached.
4. The Geological Classification is given only for mineral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

Borehole Registration Number

Each I.M.A.U. borehole is identified by a Registration Number, eg. **NW 32**. The initial letters refer to the quarter sheet, and the second to the I.G.S. serial number for that quarter. The unique designation for borehole **NW 32** is **TF 25 NW 32**.

Grading Diagrams

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



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

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

CATEGORIES OF DEPOSITS

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

RESOURCE BLOCKS

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

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

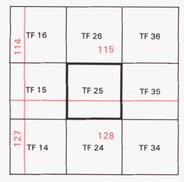


Diagram showing the relationship of this sheet to the National Grid 1:25,000 sheets and to the Geological sheets 114, 115, 127, and 128.

RESOURCE SHEET LOCATION