

SOIL RESOURCES PLAN

WESTERGATE

September 2023





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1 INTRODUCTION

- 1.1 This Soil Resources Plan is to accompany the application for a residential development at Westergate.
- 1.2 The Arun Local Plan 2011 – 2031) (July 2018) Policy SO DM1 “Soils” sets out a number of criteria which, as advised in paragraph 11.1.7, “**shall recognise and promote soil as a valuable and non-renewable resource**”. The policy sets out a number of criteria which need to be provided and satisfied prior to the issuing of a planning consent.
- 1.3 This Plan seeks to provide the required information to satisfy the criteria set out in SO DM1.
- 1.4 This report;
- (i) describes the soils in section 2;
 - (ii) describes the fundamentals of soil use and handling in section 3; and
 - (iii) provides the required Soil Management Plan in section 4.
- 1.5 This report has been prepared by Kernon Countryside Consultants Ltd. We specialise in assessing the effects of development proposals on agricultural land and businesses.

2 THE SOIL RESOURCES

The Site

- 2.1 The proposed housing development will be located on a mixture of pasture and arable land. The site is shown edged in red on the Google Earth plan below.

Insert 1. The Site



Survey Information

- 2.2 The majority of the site was surveyed by MAFF in 1997 (reproduced in **Appendix KCC1**), with the soils described in paragraph 8 through to 10 of the ALC report.
- 2.3 Kernon Countryside Consultants (KCC) Ltd carried out an Agricultural Land Classification and Considerations report which can be found in **Appendix KCC2** which looked at the grading of the soils against planning policy and decision making.
- 2.3 Soils in the Calcetto, Gade, Titchfield, Hook and Park Gate series were mapped in the area.

Unsurveyed Area

- 2.4 There are areas of the site that have not been surveyed, which are considered to be the same soil types and grading as that which has already been surveyed.

The Soils

- 2.5 The soils which are found are described in the table below. All information is taken from the Soils and their Use in South East England. Extracts of which can be found in **Appendix KCC3**.

Table 1. Soil Types

Soil Type	Description
Calcetto	Efford 1 Association Well drained brown fine loamy soils and level or gently sloping river terraces. Often found in the Sussex area. Soils of this type are easy to work. Can find difficulties in wet springs.
Gade	Frome Association Includes soils in chalky and gravelly alluvium besides streams draining the Chalk and adjacent Tertiary formations. Most land in this series is under permanent grassland used for grazing.
Titchfield	Wickham 1 Association The Association is common in Kent, Surrey and Sussex. Most of the Wickham soil have fine silty topsoil's.
Hook	Park Gate Association Deep stoneless silty Park Gate and Hook soils, typical argillic gleys and gleyic argillic brown earths respectively, are dominant in this association. Hook soils which are only occasionally waterlogged and less mottled usually occur slightly higher in the landscape. Soil is easy to work but better suited to autumn and winter cropping.
Park Gate	Park Gate Association Deep stoneless silty Park Gate and Hook soils, typical argillic gleys and gleyic argillic brown earths respectively, are dominant in this association. Park Gate soils are affected by seasonally high groundwater and have grey and ochreous mottled subsoil colours. Soil is easy to work but better suited to autumn and winter cropping.

3 FUNDAMENTALS OF SOIL PROTECTION AND HANDLING

Policy and Guidance

- 3.1 There is a good body of research and guidance on handling soils, including:
- (i) MAFF “Good Practice Guidance for Handling Soils”, April 2000, which contains 200 pages of guidance on different topics of handling soils;
 - (ii) DEFRA “Construction Code of Practice for the Sustainable Use of Soils on Construction Sites”, September 2009, which provides guidance on stripping and moving soils in particular; and
 - (iii) Institute of Quarrying “Good Practice Guide for Handling Soils in Mineral Workings” July 2021, which provides useful guidance for moving and handling soils.
- 3.2 DEFRA’s “Safeguarding Our Soils: a strategy for England” (September 2009) sets out the underlying principles of maintaining soils as a natural resource. Over the decade since that was published there has been growing recognition of the importance of soil. As set out in the strategy, soils have deteriorated due to erosion (wind and rain), compaction and a decline in organic matter following 200 years of intensive agricultural production.
- 3.3 DEFRA’s “A Green Future: Our 25 year plan to improve the environment” (2018) includes soils as a key resource.
- 3.4 Advice on www.gov.uk on “Planning and aftercare advice for reclaiming land to agricultural use (Natural England, 19th April 2022) sets out what to expect in a soil resources report, a soil handling plan and soil storage proposals.

Practice

- 3.5 Within that context, soils need to be protected as a resource. Soil is a store of carbon. It is a biodiversity resource of itself. The key principles are to ensure that:
- soil is moved when it is suitable for being moved without the risk of structural damage;
 - that any structural damage or compaction that is caused is ameliorated;
 - that the storage of moved soils is done well so that the soil remains aerobic and hence the micro-organisms are not affected;
 - that replaced soils are given appropriate aftercare to ensure that they are able to recover rapidly; and
 - that soil is not wasted or unnecessarily lost.

4 SOIL MANAGEMENT PLAN

- 4.1 The SMP assumes that the topsoil across the majority of the site will be moved as part of the development and reinstated for landscaping purposes. If areas are to be left in situ then the following guidance is not applicable to those areas, but otherwise this applies to the whole site.
- 4.2 The SMP considers:
- (i) the key points regarding timing of soil moving and sculpting;
 - (ii) key points about soil handing when stripping the site;
 - (iii) key points about soil storage; and
 - (iv) key points about restoration and replacement.

Construction Timing

- 4.3 The construction programme needs to be devised to assume that topsoil stripping and moving needs to take place across the whole site. This will happen in phased working areas, with topsoil moved and stored and returned following earthmoving.
- 4.4 The programme for construction will need to be flexible so that work to move top and upper subsoils can take place when the soils are suitably dry for moving.
- 4.5 This will generally be unrestricted between mid-April and mid-November, but opportunities for large scale movement of soils (especially topsoil in the winter months will be limited, but will vary according to rainfall patterns.
- 4.6 This does not prevent other construction works from taking place, but the movement of topsoils should be principally in the spring to autumn period.

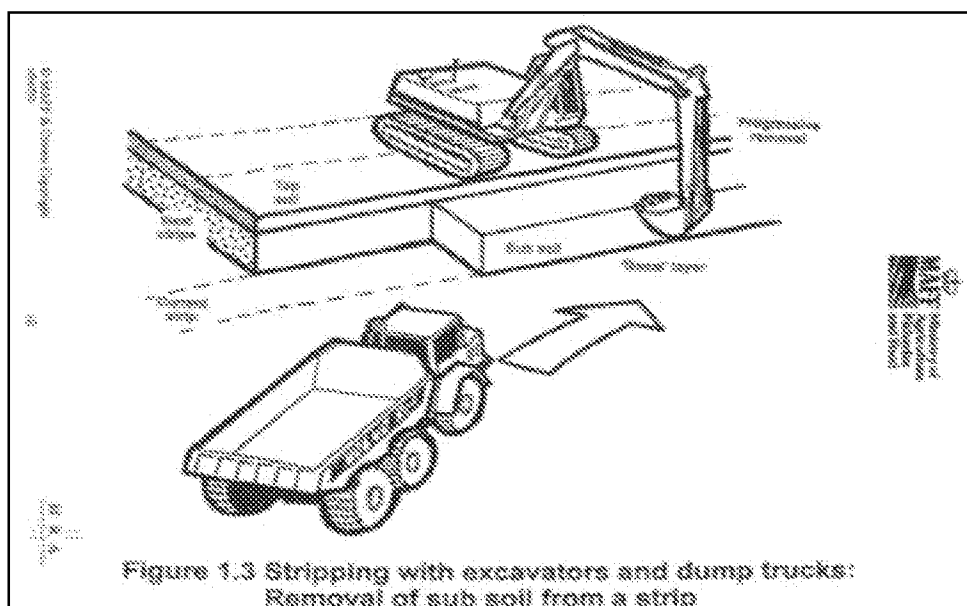
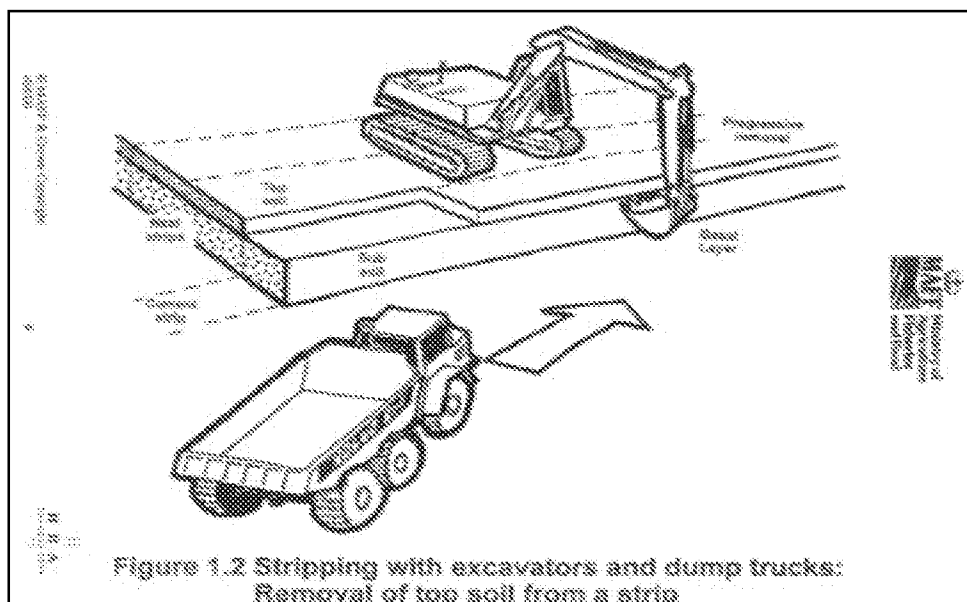
Stripping Soils

- 4.7 Relevant pages from the Construction Code of Practice are reproduced in **Appendix KCC4**.
- 4.8 Topsoil depths are described in the ALC reports. Topsoil tends to have a silty clay loam surface to circa 25-30cm. then a heavier layer of 10-20cm, with subsoil from 40cm-50cm depth.
- 4.9 The topsoil should be stripped to a depth of 30cm. this material should be transported to the edge of the working area and laid out in bunds not exceeding 3m high.

4.10 The upper subsoil from 30cm to 40-50cm, should then be stripped and removed for storage in similar bunds, if that is needed for landscaping of the site.

4.11 The method is shown in the diagrams below (from MAFF (2000))

Inserts 3 and 4 MAFF Guidance for Soil Stripping



4.12 Machinery should only operate when soil conditions are dry. Work should stop, as advised in the Natural England guidance at www.gov.uk:

- when the soil is too wet;
- when it is or has just been raining heavily;
- if heavy rain is forecast imminently;
- if there are puddles on the soil surface;

- if the ground is frozen or covered in snow.

4.13 The MAFF guidance is set out in **Appendix KCC5**.

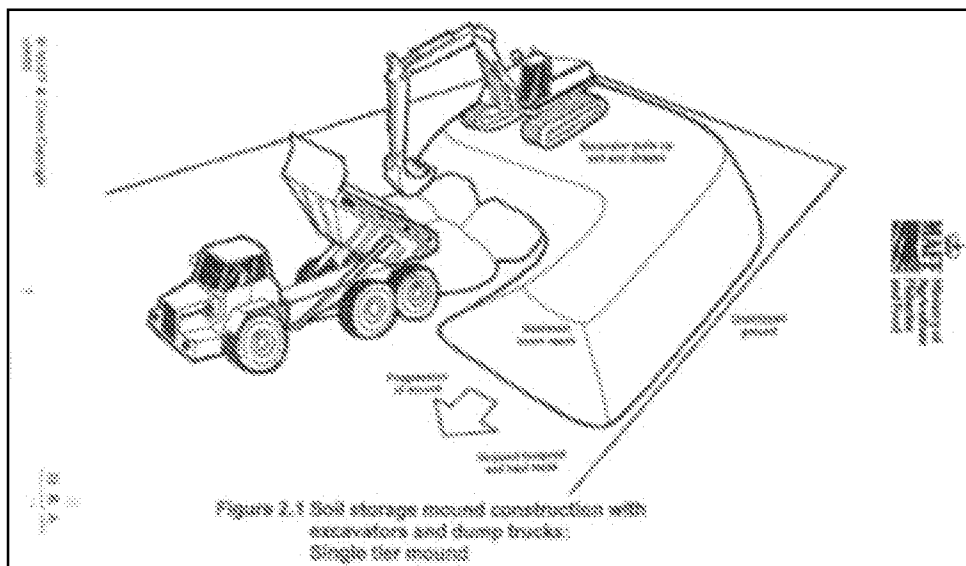
Storing Soils

4.14 Soils are not likely to be stored for more than 12-18 months, potentially much less in some cases.

4.15 The principles of soil storage of topsoils are to store in bunds which are not so large that soils become anaerobic, and which are able to drain. Subsoils can be stored in large bunds than topsoil.

4.16 The MAFF (2000) guidance is at **Appendix KCC6**. Bunds should be build as below.

Insert 5. MAFF Guidance for Soil Storage



Replacement

4.17 Soils should be moved from storage when soil conditions are suitable, meaning that the soil is dry and not “plastic”.

4.18 Detailed MAFF (2000) guidance on moving bunds is set out in **Appendix KCC7**.

**APPENDIX KCC1
MAFF ALC 1997**

AI

ARUN DISTRICT LOCAL PLAN REVIEW
Objector Sites 5 & 12
Land East of Westergate,
West Sussex
Agricultural Land Classification
ALC Map and Report

March / April 1997

Resource Planning Team
Eastern Region
FRCA Reading

RPT Job Number 4202/031/97
FRCA Reference EL 42/00460
LURET Job Number 03050

AGRICULTURAL LAND CLASSIFICATION REPORT

ARUN DISTRICT LOCAL PLAN REVIEW SITES 5 AND 12 LAND EAST OF WESTERGATE, WEST SUSSEX

INTRODUCTION

1 This report presents the findings of a detailed Agricultural Land Classification (ALC) survey of 19.8 hectares of land located to the east of the village of Westergate and south of Eastergate near Bognor Regis in West Sussex. The survey was carried out during March 1997.

2 The survey was commissioned by the Ministry of Agriculture, Fisheries and Food (MAFF) from its Land Use Planning Unit in Reading in connection with the Arun District Local Plan Review. The results of this survey supersede any previous ALC information for this land.

3 Prior to 1 April 1997 the work was conducted by members of the Resource Planning Team in the Guildford Statutory Group of ADAS. After this date the work was completed by the same team as part of the Farming and Rural Conservation Agency (FRCA, Reading). The land has been graded in accordance with the published MAFF ALC guidelines and criteria (MAFF 1988). A description of the ALC grades and subgrades is given in Appendix I.

4 At the time of survey the agricultural land at this site was either permanent grazing, unmanaged grassland or in arable use. The areas mapped as Other Land are located towards the west of the site and comprise impenetrable scrub and public open space.

SUMMARY

5 The findings of the survey are shown on the enclosed ALC map. The map has been drawn at a scale of 1:10,000. It is accurate at this scale but any enlargement would be misleading.

6 The area and proportions of the ALC grades and subgrades on the surveyed land are summarised in Table 1 below.

Table 1 Area of grades and other land

Grade/Other land	Area (hectares)	% surveyed area	% site area
2	8.0	45.2	40.4
3a	1.9	10.7	9.6
3b	7.8	44.1	39.4
Other land	2.1	N/A	10.6
Total surveyed area	17.7	100	89.4
Total site area	19.8		100

7 The fieldwork was conducted at an average density of slightly more than 1 boring per hectare of agricultural land. A total of 23 borings and three soil pits were described.

8 The agricultural land on this site has been classified in the range Grade 2 (very good quality) to Subgrade 3b (moderate quality) including some Subgrade 3a (good quality). The limitations to land quality include soil droughtiness and soil wetness.

9 The areas of Grade 2 and Subgrade 3a within the site are principally limited by soil droughtiness. The soils comprise medium silty textures, occasionally overlying light loams at depth or occasionally becoming moderately to very stony in the lower subsoil. Soil droughtiness may affect plant growth, as the supply of available water may be deficient especially in drier years. A few individual observations are also limited by soil wetness.

10 The area of Subgrade 3b land is located towards the centre and east of the site. To the north of the drainage channel running east-west across the site, soil droughtiness is the principal limitation. In this area the soils are of medium silty texture and are commonly very occasionally extremely stony. In the local climate, the droughtiness limitation that the high stone content causes will affect plant growth, development and yield potential especially in drier years. To the south of the drainage channel there is an abrupt change in soil type. Here the soils are predominantly clayey and they exhibit signs of a moderate soil wetness limitation which, in the local climate, leads to Subgrade 3b being appropriate. Soil wetness restricts land utilisation by adversely affecting plant growth and restricting the timing of mechanised operations or stocking.

FACTORS INFLUENCING ALC GRADE

Climate

11 Climate affects the grading of land through the assessment of an overall climatic limitation and also through interactions with soil characteristics.

12 The key climatic variables used for grading this site are given in Table 2 below; these were obtained from the published 5km grid datasets using standard interpolation procedures (Met Office 1989).

Table 2 Climatic and altitude data

Factor	Units	Values	
Grid reference	N/A	SU 942 044	SU 942 050
Altitude	m AOD	5	10
Accumulated Temperature	day C (Jan-June)	1543	1537
Average Annual Rainfall	mm	769	773
Field Capacity Days	days	157	158
Moisture Deficit, Wheat	mm	118	117
Moisture Deficit, Potatoes	mm	115	114
Overall climatic grade	N/A	Grade 1	Grade 1

13 The climatic criteria are considered first when classifying land as climate can be overriding in the sense that severe limitations will restrict land to low grades irrespective of favourable site or soil conditions

14 The main parameters used in the assessment of an overall climatic limitation are average annual rainfall (AAR) as a measure of overall wetness and accumulated temperature (AT0 January to June) as a measure of the relative warmth of a locality

15 The combination of rainfall and temperature at this site mean that there is no overall climatic limitation. Other local climatic factors such as exposure and frost risk are also believed not to affect the site. The site is climatically Grade 1

Site

16 The site lies at altitudes in the range 5-10m AOD. The highest land is towards the north west and south west of the site. From these points the land slopes gently towards the centre of the site where a drainage channel runs to the eastern boundary which is a stream. None of the slopes are steep enough to adversely affect agricultural land quality

Geology and soils

17 The published geological information for the site (BGS 1975) shows the site to be underlain by three deposits. To the north and north west valley gravels are shown. To the south west brickearth is indicated and in a narrow strip along the stream to the east of the site alluvium has been mapped

18 The most detailed published soils information for the site (SSGB 1967) shows this site to be underlain by a total of four soil series. Hook series soils are shown in the north of the site. These are commonly silty, moderately well drained and variably stony. Soils fitting this general description were found in this area of the site. Across the centre of the site soils of the Calcetto series and Gade and Titchfield complexes are mapped. These generally comprise variably stony and loamy soils which are variably affected by both groundwater and surface water and exhibit this in the form of extensive gleying. The soils encountered in this part of the site were variable, north of the drainage channel running to the east of the site the soils were loamy, rarely gleyed but very stony. To the south of the drainage channel the soils were clayey, gleyed and only occasionally stony in the lower subsoil. Towards the south west of the site Park Gate series soils are mapped. These are described as being typically silty and moderately well drained (SSGB 1967). Soils similar to this description were found in this area of the site

AGRICULTURAL LAND CLASSIFICATION

19 The details of the classification of the site are shown on the attached ALC map and the area statistics of each grade are given in Table 1

20 The location of the sugar borings and pits is shown on the attached sample location map and details of the soils data are presented in Appendix II

Grade 2

21 Land of very good quality has been mapped in two areas at this site to the north west and south west of the site

22 The land in this area is principally limited by soil droughtiness although soil wetness can be equally limiting at some locations. Soils commonly comprise a slightly stony medium silty clay loam topsoil passing to a similarly textured though commonly stone free and occasionally gleyed upper subsoil in some observations this extended to depth (120cm). However the lower subsoil in the majority of the profiles in this mapping unit was more variable. Occasionally it comprised a stone free permeable gleyed heavy silty clay loam which either occurred to depth (120cm) or was impenetrable to the soil auger due to stones between 80 and 85cm. In the remaining observed profiles the lower subsoil was gleyed and comprised either a heavy silty clay loam overlying medium silty clay loam and medium sandy loam or a medium silty clay loam overlying medium sandy loam and loamy medium sand horizons which were commonly stoneless. Such soils are permeable and allocated to Wetness Class I or II depending on the depth to gleying.

23 These soils are generally water retentive but in the locally relatively dry climate they have a tendency to be slightly restricted by soil droughtiness. This leads to the possibility of plant growth and yield being adversely affected especially in drier years. In addition the majority of the observed profiles exhibited signs of soil wetness in the form of gleying due to fluctuating groundwater. This will slightly restrict the versatility of the land by restricting the number of days when cultivations or stocking may occur without damaging the soil structure. However this does not affect the classification in the majority of cases.

Subgrade 3a

24 Land of good quality has been mapped in a single unit towards the south and west of the site. The principal limitation is soil droughtiness. The soil pit 3P is representative of the soil type found in these areas.

25 The soils in this area are essentially similar (Wetness Class I and II) in texture to those described above for Grade 2 except that overall the stone content is greater and as such in the local climate the water available to crops is slightly more restricted. Soils comprise a slightly stony (8% v/v total flints) medium silty clay loam topsoil overlying a moderately stony (up to 15% v/v total flints) medium silty clay loam upper subsoil. This passes to a moderately stony (25% v/v total flints) heavy silty clay loam horizon overlying a medium silty clay loam lower subsoil containing 35% v/v total flints; this was impenetrable to the soil auger and spade at 85cm. Other observations in this map unit were impenetrable to the soil auger at slightly shallower depths (65cm). The stone content of the soil profile is such that the water available to plants is restricted to the extent that moisture balances given local climatic factors are in the Subgrade 3a range. Soil droughtiness will restrict plant growth and yield especially in drier years.

Subgrade 3b

26 Land of moderate quality has been mapped in a single mapping unit. It is located towards the centre and east of the site. Principal limitations to land quality include soil

droughtiness to the north of the drain (located towards the centre of the site) and soil wetness to the south of this feature

27 Within the Subgrade 3b mapping unit two separate soil types were observed. To the north of the drain, the principal limitation is soil droughtiness. In this area the soils are well drained (Wetness Class I) and are characterised by the soil pit 1P (see Appendix II). They comprise a slightly to moderately stony (up to 37% w/v total flints including up to 17% > 2cm) medium silty clay loam topsoil overlying moderately to very stony (up to 65% w/v total flints including up to 50% > 2cm) medium and heavy silty clay loam subsoil horizons. These were commonly impenetrable to the soil auger between 25 and 45cm and to the spade at 55cm. Rooting was observed to extend to at least 55cm and assumed to penetrate further. The stone content of these profiles leads the available water to plants to be restricted to the extent that in the local climate Subgrade 3b is the appropriate classification. Plant growth and yield potential are likely to be significantly and adversely affected by this restriction.

28 To the south of the drain located towards the centre of the site the soils are distinctly different and principally limited by soil wetness. The pit observation 2P (see Appendix II) is representative of the soils observed here. They commonly comprise a stoneless medium or heavy silty clay loam or clay topsoil which may be gleyed. This passes to a stone free poorly structured gleyed and slowly permeable clay subsoil. The depth to the gleyed and slowly permeable horizons results in the soils being ascribed to Wetness Class IV. Given the local climate and topsoil textures Subgrade 3b is the appropriate classification for these wet soils. Soil wetness has the effect of restricting land utilisation by limiting the number of days when cultivation or grazing may occur without damaging the soil structure. It can also restrict crop yield, growth and rooting.

Matthew Larkin
Resource Planning Team
Eastern Region
FRCA Reading

SOURCES OF REFERENCE

British Geological Survey (1975) *Sheet 317 Baginbun Drift Edition 1 63 360 Scale*
BGS London

Ministry of Agriculture Fisheries and Food (1988) *Agricultural Land Classification of England and Wales Revised guidelines and criteria for grading the quality of agricultural land* MAFF London

Meteorological Office (1989) *Climatological Data for Agricultural Land Classification*
Met Office Bracknell

Soil Survey of Great Britain (1967) *Soils of the West Sussex Coastal Plain 1 25 000 Scale*
SSGB Harpenden

Soil Survey of England and Wales (1983) *Soils of South East England 1 250 000 Scale*
SSEW Harpenden

Soil Survey of England and Wales (1984) *Soils of South East England. Bulletin No 15*
SSEW Harpenden

APPENDIX I

DESCRIPTIONS OF THE GRADES AND SUBGRADES

Grade 1 Excellent Quality Agricultural Land

Land with no or very minor limitations to agricultural use. A very wide range of agricultural and horticultural crops can be grown and commonly includes top fruit, soft fruit, salad crops and winter harvested vegetables. Yields are high and less variable than on land of lower quality.

Grade 2 Very Good Quality Agricultural Land

Land with minor limitations which affect crop yield, cultivations or harvesting. A wide range of agricultural or horticultural crops can usually be grown but on some land of this grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than Grade 1 land.

Grade 3 Good to Moderate Quality Land

Land with moderate limitations which affect the choice of crops, the timing and type of cultivation, harvesting or the level of yield. When more demanding crops are grown, yields are generally lower or more variable than on land in Grades 1 and 2.

Subgrade 3a Good Quality Agricultural Land

Land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of a wide range of crops including cereals, grass, oilseed rape, potatoes, sugar beet and the less demanding horticultural crops.

Subgrade 3b Moderate Quality Agricultural Land

Land capable of producing moderate yields of a narrow range of crops, principally cereals and grass, or lower yields of a wider range of crops or high yields of grass which can be grazed or harvested over most of the year.

Grade 4 Poor Quality Agricultural Land

Land with severe limitations which significantly restrict the range of crops and/or the level of yields. It is mainly suited to grass with occasional arable crops (e.g. cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties in utilisation. The grade also includes very droughty arable land.

Grade 5 Very Poor Quality Agricultural Land

Land with severe limitations which restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.

APPENDIX II

SOIL DATA

Contents

Sample location map

Soil abbreviations - explanatory note

Soil pit descriptions

Soil boring descriptions (boring and horizon levels)

SOIL PROFILE DESCRIPTIONS EXPLANATORY NOTE

Soil pit and auger boring information collected during ALC fieldwork is held on a computer database. This uses notations and abbreviations as set out below.

Boring Header Information

- 1 GRID REF national 100 km grid square and 8 figure grid reference
- 2 USE Land use at the time of survey. The following abbreviations are used:

ARA	Arable	WHT	Wheat	BAR	Barley
CER	Cereals	OAT	Oats	MZE	Maize
OSR	Oilseed rape	BEN	Field beans	BRA	Brassicae
POT	Potatoes	SBT	Sugar beet	FCD	Fodder crops
LIN	Linseed	FRT	Soft and top fruit	FLW	Fallow
PGR	Permanent pasture	LEY	Ley grass	RGR	Rough grazing
SCR	Scrub	CFW	Coniferous woodland	OTH	Other
DCW	Deciduous woodland	BOG	Bog or marsh	SAS	Set Aside
HTH	Heathland	HRT	Horticultural crops	FLO	Ploughed
- 3 GRDNT Gradient as estimated or measured by a hand held optical clinometer
- 4 GLEY/SPL Depth in centimetres (cm) to gleying and/or slowly permeable layers
- 5 AP (WHEAT/POTS) Crop adjusted available water capacity
- 6 MB (WHEAT/POTS) Moisture Balance (Crop adjusted AP - crop adjusted MD)
- 7 DRT Best grade according to soil droughtiness
- 8 If any of the following factors are considered significant 'Y' will be entered in the relevant column:

MREL	Microrelief limitation	FLOOD	Flood risk	EROSN	Soil erosion risk
EXP	Exposure limitation	FROST	Frost prone	DIST	Disturbed land
CHEM	Chemical limitation				

- 9 LIMIT The main limitation to land quality. The following abbreviations are used:

OC	Overall Climate	AE	Aspect	ST	Topsoil Strength
FR	Frost Risk	GR	Gradient	MR	Microrelief
FL	Flood Risk	TX	Topsoil Texture	DP	Soil Depth
CH	Chemical	WE	Wetness	WK	Workability
DR	Drought	ER	Erosion Risk	WD	Soil Wetness/Droughtiness
EX	Exposure				

Soil Pits and Auger Boreings

1. **TEXTURE** soil texture classes are denoted by the following abbreviations

S	Sand	LS	Loamy Sand	SL	Sandy Loam
SZL	Sandy Silt Loam	CL	Clay Loam	ZCL	Silty Clay Loam
ZL	Silt Loam	SCL	Sandy Clay Loam	C	Clay
SC	Sandy Clay	ZC	Silty Clay	OL	Organic Loam
P	Peat	SP	Sandy Peat	LP	Loamy Peat
PL	Peaty Loam	PS	Peaty Sand	MZ	Marine Light Silts

For the sand, loamy sand, sandy loam and sandy silt loam classes the predominant size of sand fraction will be indicated by the use of the following prefixes

F	Fine (more than 66% of the sand less than 0.2mm)
M	Medium (less than 66% fine sand and less than 33% coarse sand)
C	Coarse (more than 33% of the sand larger than 0.6mm)

The clay loam and silty clay loam classes will be sub-divided according to the clay content

M	Medium (<27% clay)	H	Heavy (27-35% clay)
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2. **MOTTLE COL** Mottle colour using Munsell notation
3. **MOTTLE ABUN** Mottle abundance expressed as a percentage of the matrix or surface described
F few <2% C common 2-20% M many 20-40% VM very many 40% +
4. **MOTTLE CONT** Mottle contrast
F faint indistinct mottles evident only on close inspection
D distinct mottles are readily seen
P prominent mottling is conspicuous and one of the outstanding features of the horizon
5. **PED COL** Ped face colour using Munsell notation
6. **GLEYS** If the soil horizon is gleyed a 'Y' will appear in this column. If slightly gleyed, an 'S' will appear
7. **STONE LITH** Stone Lithology one of the following is used

HR	all hard rocks and stones	FSST	soft fine grained sandstone
ZR	soft argillaceous or silty rocks	CH	chalk
MSST	soft medium grained sandstone	GS	gravel with porous (soft) stones
SI	soft weathered igneous/metamorphic rock	GH	gravel with non porous (hard) stones

Stone contents (>2cm, >6cm and total) are given in percentages (by volume)

- 8 **STRUCT** the degree of development, size and shape of soil peds are described using the following notation

Degree of development	WK	weakly developed	MD	moderately developed
	ST	strongly developed		
Ped size	F	fine	M	medium
	C	coarse		
Ped shape	S	single grain	M	massive
	GR	granular	AB	angular blocky
	SAB	sub angular blocky	PR	prismatic
	PL	platy		

- 9 **CONSIST** Soil consistence is described using the following notation

L. loose	FM firm	EH extremely hard
VF very friable	VM very firm	
FR friable	EM extremely firm	

- 10 **SUBS STR** Subsoil structural condition recorded for the purpose of calculating profile droughtiness G good M moderate P poor

- 11 **POR** Soil porosity If a soil horizon has less than 0.5% biopores >0.5 mm a 'Y' will appear in this column

- 12 **IMP** If the profile is impenetrable to rooting a 'Y' will appear in this column at the appropriate horizon

- 13 **SPL** Slowly permeable layer If the soil horizon is slowly permeable a 'Y' will appear in this column

- 14 **CALC** If the soil horizon is calcareous a 'Y' will appear in this column

- 15 Other notations

APW	available water capacity (in mm) adjusted for wheat
APP	available water capacity (in mm) adjusted for potatoes
MBW	moisture balance wheat
MBP	moisture balance potatoes

SOIL PIT DESCRIPTION

Site Name ARUN DLP SITES 5 & 12 Pit Number 18
 Grid Reference S094200470 Average Annual Rainfall 769 mm
 Accumulated Temperature 1543 degree days
 Field Capacity Level 157 days
 Land Use Permanent Grass
 Slope and Aspect degrees

HORIZON	TEXTURE	COLOR	STONES +2	TOT STONE	LITH	MOTTLES	STRUCTURE	CONSIST	SUBSTRUCTURE	CALC
0-22	MZCL	10YR3/3 00	8	13	HR					
22-36	MZCL	10YR4/3 00	50	55	HR			FR	H	
36-45	MZCL	10YR4/3 00	40	61	HR			FR	H	
45-55	MZCL	10YR4/2 00	0	65	HR			FR	H	

Watness Grade 1 Wetness Class I
 Clayey cm
 SPL cm

Drought Grade 4 APW 50 mm MBW -58 mm
 APP 61 mm MBP -54 mm

FINAL ALC GRADE 3B
 MAIN LIMITATION Droughtiness

SOIL PIT DESCRIPTION

Site Name ARUN DLP SITES 5 & 12 Pit Number 2P
 Grid Reference S094200460 Average Annual Rainfall 769 mm
 Accumulated Temperature 1543 degree days
 Field Capacity Level 157 days
 Land Use Permanent Grass
 Slope and Aspect degrees

HORIZON	TEXTURE	COLOR	STONES +2	TOT STONE	LITH	MOTTLES	STRUCTURE	CONSIST	SUBSTRUCTURE	CALC
0-25	MZCL	10YR4/2 43	0	0						
25-55	C	2.5 Y4/1 42	0	0		C	MZCAB	FM	P	

Watness Grade 3B Wetness Class IV
 Clayey 25 cm
 SPL 25 cm

Drought Grade APW cm MBW 0 cm
 APP cm MBP 0 cm

FINAL ALC GRADE 3B
 MAIN LIMITATION Watness

SOIL PIT DESCRIPTION

Site Name ARUN DLP SITES 5 & 12 Pit Number 3P

Grid Reference SU94100460 Average Annual Rainfall 769 mm
 Accumulated Temperature 1943 degree days
 Field Capacity Level 157 days
 Land Use Wheat
 Slope and Aspect 2 degrees N

HORIZON	TEXTURE	COLOR	STONES >2	TOT STONE	LITH	POTTLES	STRUCTURE	CONSIST	SUBSTRUCTURE	CALC
0- 28	MCL	10YR4/3 5/3	1	8	HR					
28- 48	MCL	10YR5/3 5A	0	15	HR	F	POCSAB	FR	N	
48- 63	MCL	10YR5/3 0/0	0	25	HR	C	POCSAB	FR	N	
63- 85	MCL	10YR5/2 0/0	0	35	HR	N		FR	N	

Moisture Grade 1 Moisture Class 1
 Gleying 48 cm
 SPL 0 cm

Drought Grade 3A APW 106mm MBW -12 cm
 APP 106mm MBP -5 cm

FINAL ALC GRADE 3A
 MAIN LIMITATION Droughtiness

SAMPLE NO	GRID REF	USE	ASPECT	---WETNESS---				---HEAT---				---PGTS---				H REL	EROSN	PROST	CHSH	ALC	COMMENTS
				GRDNT	GLEY	SPL	CLASS	GRADE	AP	MR	AP	MR	DRY	FLOOD	EXP						
1	SL94200500	PCR	E	3			1	1	31	-87	31	-84	4						OR	38	SEE 1P
1P	SL94200470	PCR					1	1	60	-58	61	-54	4						OR	38	IMP 55 38-120
2	SL94000490	PCR			65		1	1	106	-12	110		4	3A					OR	3A	IMP 70 SEE 3P
2P	SL94200460	PCR			25	25	4	38		0		0							WE	38	PIT 55
3	SL94200490	PCR	E	2	22	22	2	3A	53	-65	53	-62	4						TS	38	IMP 45 SEE 1P
3P	SL94100460	WHT	R	2	48		1	1	106	-12	106	-9	3A						OR	3A	PIT IMP 85
4	SL94100480	PCR					1	1	56	-62	56	-59	4						OR	38	IMP 32 SEE 1P
5	SL94200460	PCR					1	1	49	-69	49	-66	4						OR	38	IMP 30 SEE 1P
6	SL94100470	PCR					1	1	59	-69	59	-66	4						OR	38	IMP 30 SEE 1P
7	SL94200470	PCR					1	1	49	-69	49	-66	4						OR	38	IMP 30 SEE 1P
8	SL94100460	WHT	R	2	28		2	2	97	-21	105	-18	38						OR	3A	IMP 65 SEE 3P
9	SL94200460	PCR			28	28	4	38		0		0							WE	38	SEE 2P
10	SL94100450	WHT			28		2	2	156	38	122	7	2						WD	2	
11	SL94200450	WHT	NE	2			1	1	54	-64	54	-61	4						OR	3A	IMP 30 SEE 1P/3P
12	SL94100440	WHT			65		1	1	157	39	121	6	2						OR	2	
13	SL94200440	WHT	E	4	35		2	2	128	8	125	10	2						WD	2	
14	SL94300440	PCR	E	2	0	25	4	38		0		0							WE	38	SEE 2P
15	SL94140507	PCR					1	1	168	40	123	8	2						OR	2	
16	SL94090490	PCR			22		2	2	48	-70	48	-67	4						OR	38	IMP 30 SEE 1P
17	SL94090460	PCR			0		2	2	82	-36	82	-33	38						OR	38	IMP 50 SEE 3P
18	SL94010474	PCR	S	1	0	20	4	38		0		0							WE	38	SEE 2P
19	SL94000460	PCR			55		1	1	152	34	124	9	2						OR	2	
20	SL94000450	PCR			30		2	2	159	41	123	8	2						WD	2	
21	SL94140489	PCR			45		1	1	118	0	123	8	3A						OR	2	IMP 60 SEE 3P
22	SL94260447	PCR			10	10	4	38		0		0							WE	38	IMP 55 SEE 2P
23	SL94130465	PCR			25	25	4	38		0		0							WE	38	IMP 55 SEE 2P

SAMPLE	DEPTH	TEXTURE	COLOUR	-----MOTTLES-----			PED	-----STONES-----			STRUCT/	SUBS						
				COL	ABUN	CONT		COL	GLY	+2		+6	LITH	TOY	CONSIST	STR	POR	IMP
1	0-14	mac1	10YR32 00 10YR56 00 F							13	5	HR	33					
	14-25	mac1	10YR54 00							0	0	HR	33		M			IMP FLINTS 25
1P	0-22	mac1	10YR33 00							0	4	HR	13					STONES SAMPLED
	22-36	mac1	10YR43 00							50	0	HR	53		FR	M		STONES SAMPLED
	36-45	mac1	10YR43 00							40	0	HR	51		FR	M		STONES SAMPLED
	45-55	mac1	10YR42 00							0	0	HR	55		FR	M		
2	0-30	mac1	10YR43 53 10YR56 00 F							0	0	HR	3					
	30-55	mac1	10YR44 54 10YR56 00 F							0	0	HR	5		M			
	55-70	mac1	75YR54 00 75YR56 00 C							5	0	0	HR	25		M		IMP FLINTS 70
2P	0-25	mac1	10YR42 43							0	0		0					
	25-55	c	25 Y41 42 75YR56 00 C				25 Y41 00 Y			0	0		0	MOCS48	FM	F	Y	Y
3	0-22	mac1	10YR42 00							17	8	HR	37					
	22-45	c	25 Y53 00 10YR58 00 C				00YR50 00 Y			0	0	HR	10			P	Y	IMP FLINTS 45
3P	0-28	mac1	10YR43 53							1	0	HR	8					
	28-48	mac1	10YR53 54 10YR58 00 F				00YR50 00			0	0	HR	15	MOCS48	FR	M		
	48-63	mac1	10YR53 00 10YR58 00 C				00YR50 00 Y			0	0	HR	25	MOCS48	FR	M		STONES SAMPLED
	63-85	mac1	10YR52 00 10YR58 00 M							Y	0	0	HR	35		FR	M	STONE SAMPLE IMP 85
4	0-30	mac1	10YR41 00							0	0	HR	5					
	30-32	mac1	10YR52 00							0	0	HR	50		M			IMP FLINTS 32
5	0-20	mac1	10YR33 00							0	0	HR	2					
	20-30	mac1	10YR34 00							0	0	HR	30		M			IMP FLINTS 30
6	0-23	mac1	10YR33 00							0	0	HR	9					
	23-35	mac1	10YR43 00							0	0	HR	15		M			IMP FLINTS 35
7	0-23	mac1	10YR33 00							4	2	HR	8					
	23-30	mac1	10YR33 00							0	0	HR	30		M			IMP FLINTS 30
8	0-28	mac1	10YR43 53							1	0	HR	5					
	28-50	mac1	10YR53 54 10YR56 00 C							Y	0	0	HR	5		M		
	50-65	mac1	25Y 53 00 10YR58 00 C				00YR50 00 Y			0	0	HR	30		M			IMP FLINTS 65
9	0-28	mac1	10YR33 00							0	0		0					
	28-55	c	10YR53 00 75YR56 00 C							Y	0	0				P		Y
	55-120	c	10YR52 00 75YR56 00 M							Y	0	0				P		Y
10	0-28	mac1	10YR43 00							1	0	HR	5					
	28-60	mac1	10YR53 63 10YR58 00 C				00YR50 00 Y			0	0		0		M			
	60-80	mac1	10YR62 00 10YR58 00 C				00YR50 00 Y			0	0		0		M			
	80-110	mac1	25Y 62 00 75YR58 00 M				00YR50 00 Y			0	0	HR	10		M			
	110-120	mac1	10YR53 00 75YR56 00 M				00YR50 00 Y			0	0		0		M			

SAMPLE	DEPTH	TEXTURE	COLOR	-----MOTTLES-----			PED		-----STONES-----			STRUCT/ CONSIST	SUBS					
				COL	ABUN	CONT	COL	GLE	X2	+6	LITH		TOT	STR	POR	IMP	SPL	CALC
11	0-25	med1	10YR4/3 00							0	0	HR	5					
	25-30	med1	10YR5/4 00							0	0	HR	2	M			IMP FLINTS	30
12	0-30	med1	10YR4/3 53							1	0	HR	5					
	30-65	med1	10YR5/4 00 10YR5/6 00 F							0	0	HR	2	M				
	65-120	med1	10YR5/2 53 10YR5/6 00 C				COHES	00	Y	0	0		0	M				
13	0-35	med1	10YR4/3 00							0	0	HR	2					
	35-55	med1	10YR4/3 00 75YR5/6 00 C				COHES	00	Y	0	0		0	M				
	55-85	med1	10YR5/2 00 10YR5/6 00 M						Y	0	0		0	M			IMP FLINTS	85
14	0-25	med1	10YR4/2 00 75YR4/6 00 C						Y	0	0	HR	2					
	25-45	ac	10YR5/3 51 75YR4/6 00 M						Y	0	0	HR	2	P			Y	
	45-85	c	05 Y5/1 00 75YR5/6 00 M						Y	0	0	HR	5	P			Y	
15	0-30	med1	10YR4/3 53 10YR4/6 00 F							0	0	HR	2					
	30-50	med1	10YR5/3 00							0	0	HR	2	M				
	50-120	med1	75YR5/4 00 10YR5/6 00 F							0	0	HR	2	M				
16	0-22	med1	10YR4/2 52							0	0	HR	10					
	22-30	med1	10YR5/2 00 10YR5/6 00 C						Y	0	0	HR	30	M			IMP FLINTS	30
17	0-25	med1	10YR4/2 52 10YR4/6 00 C						Y	0	0	HR	5					
	25-45	med1	25Y 5/2 62 10YR5/6 00 C						Y	0	0	HR	10	M				
	45-90	med1	25Y 6/3 00 10YR5/6 00 C						Y	0	0	HR	30	M			IMP FLINTS	50
18	0-20	c	25Y 4/2 00 10YR5/6 68 C						Y	0	0	HR	5					
	20-70	c	25Y 5/3 00 10YR5/6 00 M				COHES	00	Y	0	0	HR	10	P			Y	
19	0-30	med1	10YR4/2 00							0	0	HR	2					
	30-65	med1	10YR5/4 00 10YR5/6 00 F							0	0		0	M				
	55-75	med1	10YR5/3 62 10YR5/6 00 C				COHES	00	Y	0	0		0	M				
	75-100	med1	25Y 6/2 00 10YR5/6 00 M						Y	0	0		0	M				
	100-120	med	25Y 6/2 00 10YR5/6 00 M						Y	0	0		0	M				
20	0-30	med1	10YR4/2 00							0	0	HR	3					
	30-55	med1	10YR5/4 64 10YR5/6 00 C						Y	0	0		0	M				
	55-120	med1	25Y 6/2 00 75YR5/6 00 M				COHES	00	Y	0	0		0	M				
21	0-30	med1	10YR4/2 00							0	0	HR	2					
	30-45	med1	10YR4/4 54 COHES							0	0		0	M				
	45-75	med1	10YR5/4 00 10YR5/6 00 C				COHES	00	Y	0	0	HR	3	M				
	75-80	med1	10YR5/4 00 10YR5/6 00 C				COHES	00	5	0	0	HR	30	M				
22	0-10	med1	10YR3/1 41							0	0		0					
	10-55	c	25Y 4/2 00 75YR5/6 00 M				COHES	00	Y	0	0		0	P			IMP FLINTS	55
23	0-25	med1	10YR4/2 00 10YR4/6 00 F							0	0	HR	2					
	25-55	c	25Y 4/1 51 75YR5/6 00 C						Y	0	0		0	P			IMP FLINTS	55

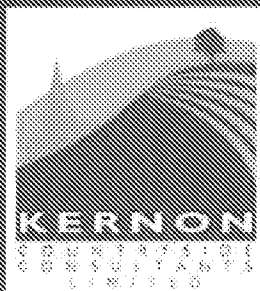
SAMPLE	DEPTH	TEXTURE	COLOR	-----MOTTLES-----			PED		-----STONES-----			STRUCT/ CONSIST	SUBS					
				COL	ABUN	CONT	COL	GLE	X2	X6	LITH		TOT	STR	POR	IMP	SPL	CALC
11	0-25	med1	10YR4/3 00							0	0	HR	5					
	25-30	med1	10YR5/4 00							0	0	HR	2	M			IMP FLINTS	30
12	0-30	med1	10YR4/3 53							1	0	HR	5					
	30-65	med1	10YR5/4 00 10YR5/6 00 F							0	0	HR	2	M				
	65-120	med1	10YR5/2 53 10YR5/6 00 C				COMMON	00	Y	0	0		0	M				
13	0-35	med1	10YR4/3 00							0	0	HR	2					
	35-55	med1	10YR4/3 00 75YR5/6 00 C				COMMON	00	Y	0	0		0	M				
	55-85	med1	10YR5/2 00 10YR5/6 00 M						Y	0	0		0	M			IMP FLINTS	85
14	0-25	med1	10YR4/2 00 75YR4/6 00 C						Y	0	0	HR	2					
	25-45	ac	10YR5/3 51 75YR4/6 00 M						Y	0	0	HR	2	P			Y	
	45-85	c	05 Y5/1 00 75YR5/6 00 M						Y	0	0	HR	5	P			Y	
15	0-30	med1	10YR4/3 53 10YR4/6 00 F							0	0	HR	2					
	30-50	med1	10YR5/3 00							0	0	HR	2	M				
	50-120	med1	75YR5/4 00 10YR5/6 00 F							0	0	HR	2	M				
16	0-22	med1	10YR4/2 52							0	0	HR	10					
	22-30	med1	10YR5/2 00 10YR5/6 00 C						Y	0	0	HR	30	M			IMP FLINTS	30
17	0-25	med1	10YR4/2 52 10YR4/6 00 C						Y	0	0	HR	5					
	25-45	med1	25Y 5/2 62 10YR5/6 00 C						Y	0	0	HR	10	M				
	45-90	med1	25Y 6/3 00 10YR5/6 00 C						Y	0	0	HR	30	M			IMP FLINTS	50
18	0-20	c	25Y 4/2 00 10YR5/6 68 C						Y	0	0	HR	5					
	20-70	c	25Y 5/3 00 10YR5/6 00 M				COMMON	00	Y	0	0	HR	10	P			Y	
19	0-30	med1	10YR4/2 00							0	0	HR	2					
	30-55	med1	10YR5/4 00 10YR5/6 00 F							0	0		0	M				
	55-75	med1	10YR5/3 62 10YR5/6 00 C				COMMON	00	Y	0	0		0	M				
	75-100	med1	25Y 6/2 00 10YR5/6 00 M						Y	0	0		0	M				
	100-120	med	25Y 6/2 00 10YR5/6 00 M						Y	0	0		0	M				
20	0-30	med1	10YR4/2 00							0	0	HR	3					
	30-55	med1	10YR5/4 64 10YR5/6 00 C						Y	0	0		0	M				
	55-120	med1	25Y 6/2 00 75YR5/6 00 M				COMMON	00	Y	0	0		0	M				
21	0-30	med1	10YR4/2 00							0	0	HR	2					
	30-45	med1	10YR4/4 54 COMMON							0	0		0	M				
	45-75	med1	10YR5/4 00 10YR5/6 00 C				COMMON	00	Y	0	0	HR	3	M				
	75-80	med1	10YR5/4 00 10YR5/6 00 C				COMMON	00	5	0	0	HR	30	M				
22	0-10	med1	10YR3/1 41							0	0		0					
	10-55	c	25Y 4/2 00 75YR5/6 00 M				COMMON	00	Y	0	0		0	P			IMP FLINTS	55
23	0-25	med1	10YR4/2 00 10YR4/6 00 F							0	0	HR	2					
	25-55	c	25Y 4/1 51 75YR5/6 00 C						Y	0	0		0	P			IMP FLINTS	55

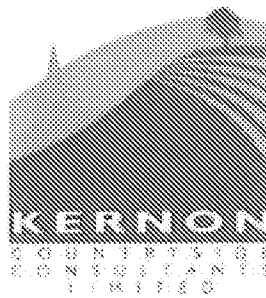
APPENDIX KCC2
KCC Agricultural Land Classification
and Consideration Report, 2023

LAND EAST
OF WESTERGATE

AGRICULTURAL LAND
CLASSIFICATION AND
CONSIDERATIONS

September 2023





LAND EAST OF WESTERGATE

AGRICULTURAL LAND CLASSIFICATION AND CONSIDERATIONS

September 2023

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Consultants - Ellie Cheto BSc(Hons), Amy Curtis BSc(Hons)*

CONTENTS

- 1 Introduction
- 2 Relevant Policy and Guidance
- 3 Agricultural Land Quality of the Site
- 4 Policy Assessment
- 5 Summary and Conclusions

Appendices

- KCC1 Natural England's Technical Information Note (TIN048)
- KCC2 Agricultural Land Classification Report
- KCC3 Extracts from John Nix Pocketbook for Farm Management (53rd Ed.)
- KCC4 Guide to Assessing Development Proposals on Agricultural Land (Natural England, 2021)
- KCC5 Arun Soils Assessment

Plans

- 1 Provisional Agricultural Land Classification Map (1983)
- 3 Agricultural land Classification around Westgate. Site edged red (extract from www.magic.gov.uk)
- 4 Extract from Provisional Agricultural Land Classification map - Arun District edged Black

1 INTRODUCTION

- 1.1 This report considers the agricultural land quality of a site extending to approximately 19.4ha east of Westergate.
- 1.2 The site comprises of six land parcels, shown outlined in red on the arial image below. The land is in a mixture of grassland and arable use.

Insert 1. The Site (Boundary Approx.)



- 1.3 A detailed Agricultural Land Classification (ALC) has been carried out over the site. The site has been graded as Grade 2 and Subgrade 3a quality.
- 1.4 This report:
- (i) reviews the relevant planning policy in section 2;
 - (ii) describes the site and the ALC survey and findings in section 3;
 - (iii) assesses the findings against policy in section 4; and
 - (iv) provides a summary and conclusions in section 5.
- 1.5 This report has been prepared by Kernon Countryside Consultants Ltd. We specialise in assessing the effects of development proposals on agricultural land and businesses.

2 RELEVANT POLICY AND GUIDANCE

National Planning Policy

- 2.1 The National Planning Policy Framework (NPPF) (2023), Paragraph 174 notes that planning policies and decision should contribute to enhance the natural an local environment by, inter alia, recognising “the wider benefits from the natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land”.
- 2.2 The best and most versatile (BMV) agricultural land is defined in Annex 2 of the NPPF as land which is of Grade 1, 2 and Subgrade 3a of the Agricultural Land Classification.
- 2.3 Paragraph 175 of the NPPF discusses plan making. It requires plans to, inter alia, allocate land with the least environmental or amenity value, where consistent with other policies in the Framework. Footnote 58 of the NPPF identifies that “where significant development of agricultural land is demonstrated to be necessary, areas of poorer quality land should be preferred to those of a higher quality”.
- 2.4 There is no definition of what constitutes as “significant” development. However, the “Guide to assessing development proposals on agricultural land” (Natural England, February 2021) advises local planning authorities to “take account of smaller losses (under 20ha) if they’re significant when making your decision”, suggesting that 20ha is a suitable threshold for defining “significant” in many cases.

Local Plan

- 2.5 Th Arun District Local Plan 2011 – 2031 (Adopted July 2018), refers to development of best and most versatile land under Policy SO OM1 (Soils), which states the following:
- “Unless designated by this Plan or a Neighbourhood Development Plan, the use of Grades 1, 2 and 3a of the Agricultural Land Classification for any form of development not associated with agriculture, horticulture or forestry will not be permitted unless need for the development outweighs the need to protect such land in the long term.
- The requirement to protect the best and most versatile land can be outweighed if it is demonstrated through sustainability and options appraisals that:
- Preservation of land of lower agricultural quality has greater benefits in terms of ecosystem services (for example carbon storage, flood water retention, support of biodiversity);
 - That any site preferred for development is demonstrated to be the best and most sustainable option, including but not limited to the terms of land quality, ecosystem services, infrastructure and proven need; and

- c. The proposed development meets the requirements of the countryside policy and/or equine development policy.

Where development is permitted it should, as far as possible, use the lowest grade of land suitable for that development. Development will not be permitted unless:

- d. The applicant has submitted sustainability and options appraisals, mitigation measures, and a soil resource plan for the development site;
- e. Site appraisal documents submitted by the applicant must demonstrate that consideration has been given to DEFRA's Soil Strategy for England;
- f. The productivity of the land is demonstrated using a methodology for assessing gross margins as contained in the Arun Soils and Agricultural Land Assessment Report; and
- g. The applicant has submitted a comprehensive soil resource plan for the development site which demonstrates that care will be taken to preserve the soil resource, such that it can be incorporated into a Productive Green Environment following development.

Development shall also be consistent with all other Local Plan Policies".

Guidance

- 2.6 Natural England's "Guide to Assessing Development Proposals on Agricultural Land" (February 2021) describes the ALC process and sets out guidance on managing soils. It advises on the consultation process where more than 20ha of BMV land is involved.
- 2.7 The Institute of Environmental Management and Assessment (IEMA) produced a Guide "A New Perspective on Land and Soil in Environmental Impact Assessment" in February 2022. Whilst that refers to EA development, it identified in table 3 (page 49) the magnitude of impacts on soil resources. The permanent irreversible loss of between 5ha and 20ha is defined in table 2 as a "moderate magnitude of impact".

3 AGRICULTURAL LAND QUALITY OF THE SITE

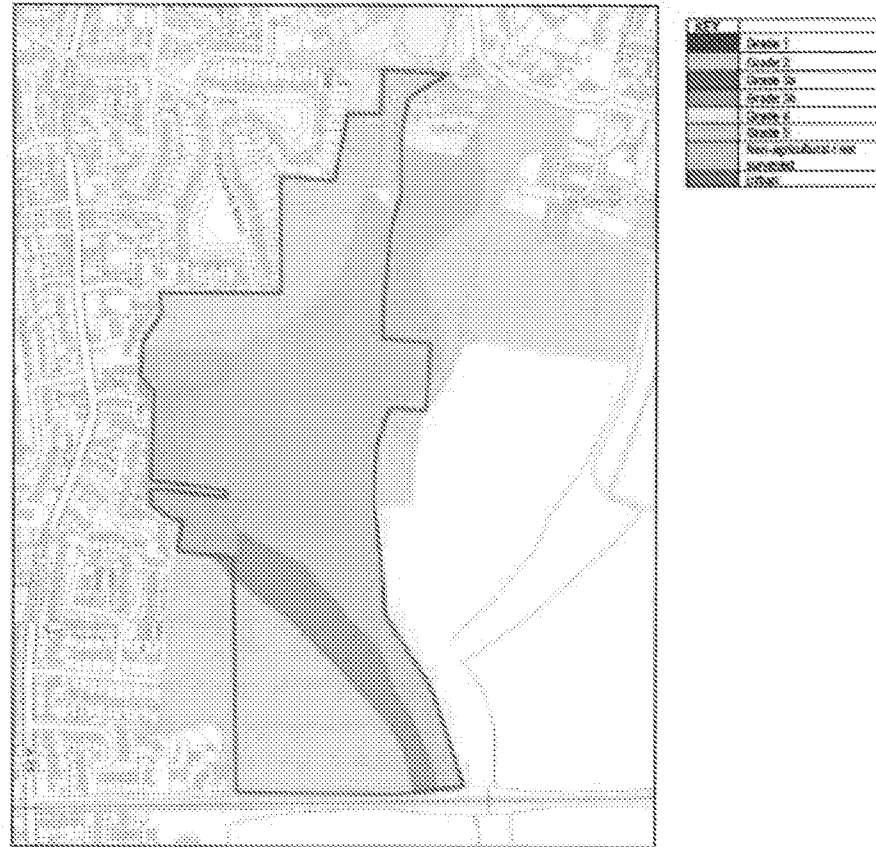
The ALC System

- 3.1 The Agricultural Land Classification (ALC) system provides a framework for classifying land according to the extent to which its physical or chemical characteristics impose long term limitations on the agricultural use of the site. The ALC system divides agricultural land into five grades. Grade 1 of the ALC is described as being of excellent quality and Grade 5, at the other end of the scale, is described as being of very poor quality. The current guidelines and criteria for ALC were published by the Ministry of Agriculture, Fisheries and Food (MAFF) in 1988.
- 3.2 The ALC system is further described in Natural England's Technical Information Note TIN049 which can be found reproduced in **Appendix KCC1**.

Detailed ALC Survey Results

- 3.3 The majority of the Site has been subject to a detailed ALC survey since the ALC Guidelines were most recently updated. An area extending to 19.8 ha was surveyed on behalf of MAFF in March 1997. The ALC report and map published by MAFF are at **Appendix KCC2**.
- 3.4 Agricultural land quality at the Site is limited primarily by a drought limitation to varying degrees due to the relatively dry climate in combination with soil properties and stone content. Soil wetness is less limiting over the Site, except in the south-east where the soils are described as 'distinctly different' and poorly drained.
- 3.5 The ALC results from the survey and other surveys have been digitised by MAFF onto the www.magic.gov.uk information website. The ALC for the area is shown below. The Site is shown as a mixture of Grades 2, 3a and 3b, with the boundary of the site shown on the www.magic.gov.uk base below, and the results set out in the table.

Insert 2: ALC Results, Site Boundary Shown



3.6 The results are as follows:

Table 1. ALC Results

ALC Grade	Area (Ha)	Area (%)
Grade 2 (Very Good)	6.2	32
Subgrade 3a (Good)	1.8	9
Subgrade 3b (Moderate)	8.7	46
Non- Agricultural / Not surveyed	2.7	13
Total	19.4	100

3.7 The ALC survey has determined that agricultural land across the Site is of variable quality. Two areas of 'very good' Grade 2 quality land are located to the south and north of the Site. Subgrade 3a 'good' quality land forms a narrow strip between an area of Grade 2 and the block of Subgrade 3b 'moderate' quality agricultural land which dominates the centre and east of the Site.

4 POLICY ASSESSMENT

4.1 The NPPF (2021) identifies that land of Grades 1, 2 and 3a as the best and most versatile agricultural land and requires that the economic and other benefits of BMV land be recognised.

4.2 In the context of plan making, the NPPF sets out that where significant development of such land is demonstrated to be necessary, poorer quality land is to be used in preference.

Land Quality in the Area Generally and Whether Poorer Quality Land is Available

4.3 The significance of the development involving agricultural land needs to be considered in context. Across England it is estimated that 42% of farmland is of Grade 1, 2 and 3a quality (see TIN049, Appendix KCC1).

4.4 The MAFF statistics from the "provisional" ALC in the 1970's provide provisional grading for 11,433,000ha, 42% of that land would be 4.8 million hectares.

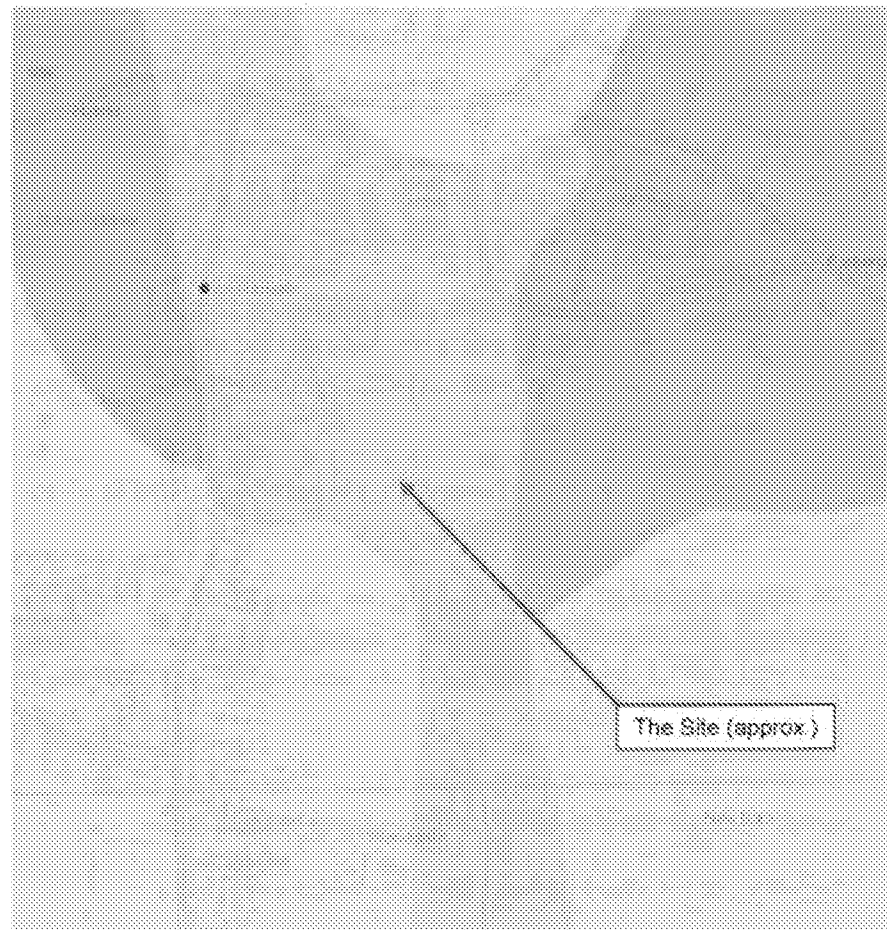
4.5 The Utilised Agricultural Area (UAA) of England, which is less than the total amount of agricultural land, was 8.9 million hectares in 2022 (Agricultural Land Use in England at 1 June 2022, DEFRA, 29 September 2022). This suggests that 3.7 million hectares of BMV land is in active agricultural use.

4.6 Statistically about 40% of Grade 3 land falls within Subgrade 3a. However, in parts of the country the proportion of Subgrade 3a is expected to be much higher.

4.7 Therefore, it is not considered that BMV quality land is a rare resource.

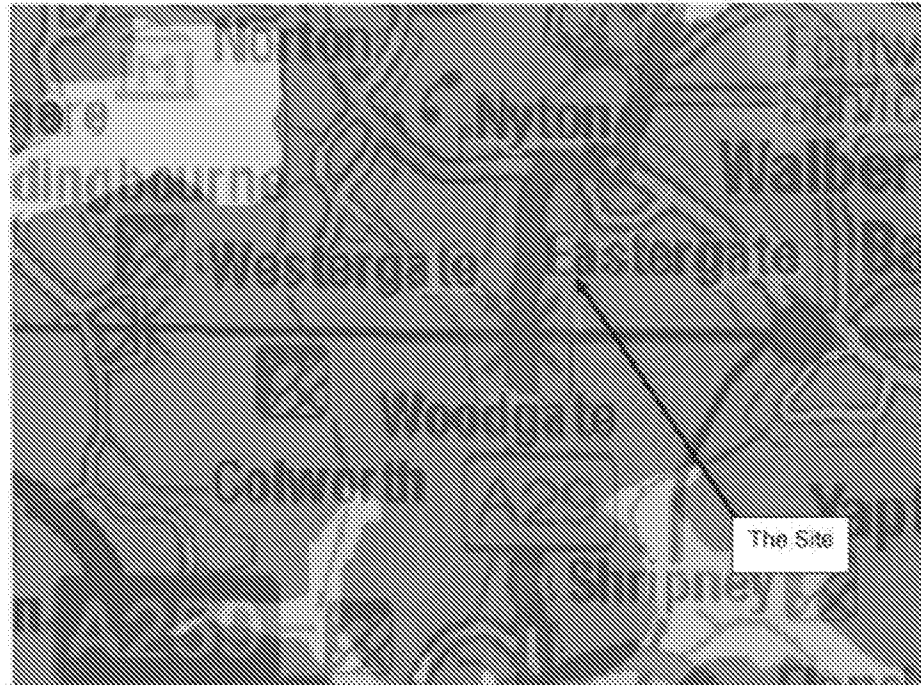
4.8 On the published "provisional" ALC maps from the 1970's that land is shown as undifferentiated Grade 3 with Grade 2, as can be seen on the map below. These maps were digitised in 2020.

Insert 3. Provisional ALC Map



- 4.9 Around Westergate, as can be seen, the Grade 3 is the poorest quality available. The rest of the settlement is shown as Grade 2 or Grade 1 quality. This site includes the poorest quality land available, from the provisional maps.
- 4.10 There are limitations with the "provisional" maps, which are described in TIN049 (**Appendix KCC1**). In 2017 Natural England produced predictive likelihood of best and most versatile maps. These estimate the proportion of land within an area that is of BMV quality. There are three categories which are low (<20% area BMV), moderate (20-60% area BMV) and high (>60% area BMV). For this area the map shows that the site has a high likelihood of BMV in addition to land around the site.

Insert 4. Predictive BMV Map



- 4.10 With the exception of areas associated with watercourses, the land in the wider area is all shown as falling within the high likelihood of BMV.

- 4.11 Based on this, it can be concluded that, in terms of land quality in the local area, that there are no obvious areas of lower quality available.

Economic Benefits

- 4.12 There is no research that we are aware of that seeks to analyse the productive economic advantages of BMV to non-BMV land. Grade 2 land is described in the ALC as capable of growing moderate to high yields of a narrow range of crops, or a moderate yield from a wider range of crops. Subgrade 3a is described as producing a moderate yield of a narrow range of crops, principally cereals or grass, or lower yields of a wider range of crops.
- 4.13 In the absence of any empirical data, any economic assessment is inevitably crude. Taking standard budgeting textbooks, such as the John Nix Pocketbook for Farm Management (extract which have been reproduced in **Appendix KCC3**) it is possible to show the difference between moderate and high yields, as an illustration between crops.
- 4.14 Taking that crude measure and applying it to winter wheat and oilseed rape, the differences are shown below:

Table 2. Assessment of Economics of Farmed Land

Item	Winter Wheat		Oilseed Rape	
	Average	High	Average	High
Yield (t/ha)	8.0t/ha	10.0t/ha	3.5t/ha	4.0t/ha
Output (£)	£2,108/ha	£2,423/ha	£1,803/ha	£2,060/ha
Gross Margin (£)	£1,200/ha	£1,515/ha	£1,066/ha	£1,363/ha
Uplift (£)	-	£315/ha	-	£257/ha

John Nix Pocketbook for Farm Management, September 2022

4.15 The site is partially grassland. However, if it was all to be cropped, the economic benefit of BMV to non-BMV land would be less than £2,500 (£2,030 - £2,489 on 2022 budgets). Hence the economic benefits on a land parcel of this size are fairly limited.

4.16 The Proposed Development will not have a significant adverse impact on a full-time business, nor will it result in any agricultural land being impacted or becoming unfarmable as a result of severance. Other farmland can continue to be managed as it is now.

Whether this is "Significant" Development

4.17 This proposal should not be considered to be "significant development of agricultural land" in the context of the NPPF.

4.18 Paragraphs 174 and 175 of the NPPF consider whether poorer quality land is available with the trigger for an assessment being that the proposal involved "significant development of agricultural land". "Significant development" is not defined in the NPPF. One threshold for determination of what is significant is the threshold for consultation with Natural England, which is set at the loss of 20ha or more of BMV land (as can be seen in the TIN049 in **Appendix KCC1**). This has been the threshold for consultation with MAFF since 1987.

4.19 At 7.9ha, the quantum of BMV is less than 40% of the threshold for consultation with Natural England. Therefore, this quantum is not "significant development".

4.20 The "Guide to assessing development proposals on agricultural land" (Natural England, 5th February 2021) (**Appendix KCC4**) does not define a threshold but does provide some guidance. This adds to our view that 20ha is a reasonable threshold for the definition of what is significant development:

- Paragraph 6 states "you should take account of smaller losses (under 20ha if they are significant when making your decision)", which suggests that losses of under 20ha would not be significant unless there are particular local circumstances. What those particular local circumstances are, is not defined, but it would be reasonable to

consider that the loss of 20ha may be significant in an area where BMV land is rare, for example.

- Paragraph 7.1 states that you can use Natural England's chargeable discretionary advice system "if your proposal is large, for example 20ha or more, and requires more detailed advice". The definition of large as being more than 20ha suggests that a site under 20ha is considered small, and hence, not significant.

4.21 Policy SO DM1 criteria d) to g) require documents to demonstrate that soil resources have been considered carefully in the development proposals. A separate Soil Resource Plan is provided to address criteria d), e) and G.

4.22 Criterion f) requires an analysis using the Council's gross margin assessment. This is set out in **Appendix KCC5**.

5 SUMMARY AND CONCLUSIONS

- 5.1 The proposed site extends to 19.4 ha.
- 5.2 Almost all of the site has been surveyed for ALC. It has been found to comprise a mix of Grade 2, subgrade 3a and subgrade 3b. The site is, therefore, partially of the Best and Most Versatile agricultural land quality.
- 5.3 The NPPF requires the economic benefits and other benefits of BMV land to be considered and assessed. Based on the assessment, the economic benefits of the site are less than £2,500 per annum. This is a minimal return for a site of this size.
- 5.4 The site contains approximately 7.9 ha of BMV. In terms of the NPPF this is not considered "significant" development of agricultural land. Accordingly, poorer quality land does not need to be considered in preference.
- 5.5 It is clear from provisional and predictive mapping that there is very little poorer quality land within the area. Provisional maps show that this is the area expected to be the poorest in the general area. Therefore, it is considered that this is likely to be the poorest quality land available.
- 5.6 Based on the above, we consider that only limited weight should be given to the loss of BMV land at this site.

Appendix KCC1
Natural England
Technical Information Note 049 --
Agricultural Land Classification
(December 2012)

Agricultural Land Classification: protecting the best and most versatile agricultural land

Most of our land area is in agricultural use. How this important natural resource is used is vital to sustainable development. This includes taking the right decisions about protecting it from inappropriate development.

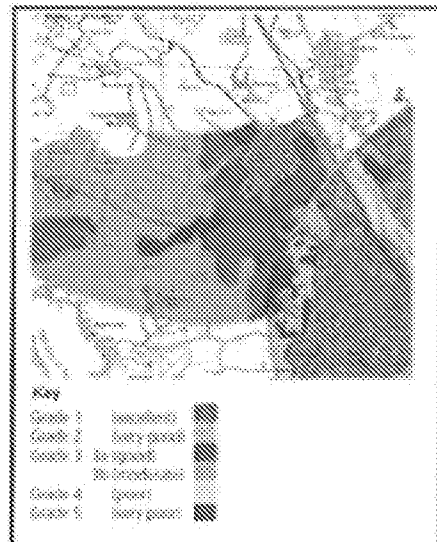
Policy to protect agricultural land

Government policy for England is set out in the National Planning Policy Framework (NPPF) published in March 2012 (paragraph 112). Decisions rest with the relevant planning authorities who should take into account the economic and other benefits of the best and most versatile agricultural land. Where significant development of agricultural land is demonstrated to be necessary, local planning authorities should seek to use areas of poorer quality land in preference to that of higher quality. The Government has also re-affirmed the importance of protecting our soils and the services they provide in the Natural Environment White Paper The Natural Choice, securing the value of nature (June 2011), including the protection of best and most versatile agricultural land (paragraph 2.35).

The ALC system: purpose & uses

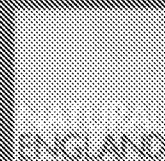
Land quality varies from place to place. The Agricultural Land Classification (ALC) provides a method for assessing the quality of farmland to enable informed choices to be made about its future use within the planning system. It helps

underpin the principles of sustainable development.



Agricultural Land Classification - map and key

Second edition 10 December 2012
www.naturalengland.org.uk



Agricultural Land Classification: protecting the best and most versatile agricultural land

The ALC system classifies land into five grades, with Grade 3 subdivided into Subgrades 3a and 3b. The best and most versatile land is defined as Grades 1, 2 and 3a by policy guidance (see Annex 2 of NPPF). This is the land which is most flexible, productive and efficient in response to inputs and which can best deliver future crops for food and non food uses such as biomass, fibres and pharmaceuticals. Current estimates are that Grades 1 and 2 together form about 21% of all farmland in England; Subgrade 3a also covers about 21%.

The ALC system is used by Natural England and others to give advice to planning authorities, developers and the public if development is proposed on agricultural land or other greenfield sites that could potentially grow crops. The Town and Country Planning (Development Management Procedure) (England) Order 2010 (as amended) refers to the best and most versatile land policy in requiring statutory consultations with Natural England. Natural England is also responsible for Minerals and Waste Consultations where reclamation to agriculture is proposed under Schedule 5 of the Town and Country Planning Act 1990 (as amended). The ALC grading system is also used by commercial consultants to advise clients on land uses and planning issues.

Criteria and guidelines

The Classification is based on the long term physical limitations of land for agricultural use. Factors affecting the grade are climate, site and soil characteristics, and the important interactions between them. Detailed guidance for classifying land can be found in: *Agricultural Land Classification of England and Wales: revised guidelines and criteria for grading the quality of agricultural land* (MAFF, 1968):

- **Climate:** temperature and rainfall, aspect, exposure and frost risk.
- **Site:** gradient, micro-relief and flood risk.
- **Soil:** texture, structure, depth and stoniness, chemical properties which cannot be corrected.

The combination of climate and soil factors determines soil wetness and droughtiness.

Wetness and droughtiness influence the choice of crops grown and the level and consistency of yields, as well as use of land for grazing livestock. The Classification is concerned with the inherent potential of land under a range of farming systems. The current agricultural use, or intensity of use, does not affect the ALC grade.

Versatility and yield

The physical limitations of land have four main effects on the way land is farmed. These are:

- the range of crops which can be grown;
- the level of yield;
- the consistency of yield; and
- the cost of obtaining the crop.

The ALC gives a high grading to land which allows more flexibility in the range of crops that can be grown (its 'versatility') and which requires lower inputs, but also takes into account ability to produce consistently high yields of a narrower range of crops.

Availability of ALC information

After the introduction of the ALC system in 1966 the whole of England and Wales was mapped from reconnaissance field surveys, to provide general strategic guidance on land quality for planners. This Provisional Series of maps was published on an Ordnance Survey base at a scale of One Inch to One Mile in the period 1967 to 1974. These maps are not sufficiently accurate for use in assessment of individual fields or development sites, and should not be used other than as general guidance. They show only five grades; their preparation preceded the subdivision of Grade 3 and the refinement of criteria, which occurred after 1978. They have not been updated and are out of print. A 1:250 000 scale map series based on the same information is available. These are more appropriate for the strategic use originally intended and can be downloaded from the Natural England website. This data is also available on 'Magic', an interactive, geographical information website <http://imagic.defra.gov.uk/>.

Since 1978, selected areas have been re-surveyed in greater detail and to revised

Agricultural Land Classification: protecting the best and most versatile agricultural land

guidelines and criteria. Information based on detailed ALC field surveys in accordance with current guidelines (MAFF, 1988) is the most definitive source. Data from the former Ministry of Agriculture, Fisheries and Food (MAFF) archive of more detailed ALC survey information (from 1988) is also available on <http://nrmagic.defra.gov.uk/>. Revisions to the ALC guidelines and criteria have been limited and kept to the original principles, but some assessments made prior to the most recent revision in 1988 need to be checked against current criteria. More recently, strategic scale maps showing the likely occurrence of best and most versatile land have been prepared. Mapped information of all types is available from Natural England (see Further information below).

New field survey

Digital mapping and geographical information systems have been introduced to facilitate the provision of up-to-date information. ALC surveys are undertaken, according to the published Guidelines, by field surveyors using handheld augers to examine soils to a depth of 1.2 metres, at a frequency of one boring per hectare for a detailed assessment. This is usually supplemented by digging occasional small pits (usually by hand) to inspect the soil profile. Information obtained by these methods is combined with climatic and other data to produce an ALC map and report. ALC maps are normally produced on an Ordnance Survey base at varying scales from 1:10,000 for detailed work to 1:50,000 for reconnaissance survey.

There is no comprehensive programme to survey all areas in detail. Private consultants may survey land where it is under consideration for development, especially around the edge of towns, to allow comparisons between areas and to inform environmental assessments. ALC field surveys are usually time consuming and should be initiated well in advance of planning decisions. Planning authorities should ensure that sufficient detailed site specific ALC survey data is available to inform decision making.

Consultations

Natural England is consulted by planning authorities on the preparation of all development

plans as part of its remit for the natural environment. For planning applications, specific consultations with Natural England are required under the Development Management Procedure Order in relation to best and most versatile agricultural land. These are for non agricultural development proposals that are not consistent with an adopted local plan and involve the loss of twenty hectares or more of the best and most versatile land. The land protection policy is relevant to all planning applications, including those on smaller areas, but it is for the planning authority to decide how significant the agricultural land issues are, and the need for field information. The planning authority may contact Natural England if it needs technical information or advice.

Consultations with Natural England are required on all applications for mineral working or waste disposal if the proposed site is for agriculture or where the loss of best and most versatile agricultural land agricultural land will be 20 ha or more. Non-agricultural sites, for example for nature conservation or amenity, can be acceptable even on better quality land if soil resources are conserved and the long term potential of best and most versatile land is safeguarded by careful land restoration and aftercare.

Other factors

The ALC is a basis for assessing how development proposals affect agricultural land within the planning system, but it is not the sole consideration. Planning authorities are guided by the National Planning Policy Framework to protect and enhance soils more widely. This could include, for example, conserving soil resources during mineral working or construction, not granting permission for peat extraction from new or extended mineral sites, or preventing soil from being adversely affected by pollution. For information on the application of ALC in Wales, please see below.

Natural England Technical Information Note T10040

Agricultural Land Classification: protecting the best and most versatile agricultural land

Further information

Details of the system of grading can be found in: *Agricultural Land Classification of England and Wales: revised guidelines and criteria for grading the quality of agricultural land* (MAFF, 1986).

Please note that planning authorities should send all planning related consultations and enquiries to Natural England by e-mail to consultations@naturalengland.org.uk. If it is not possible to consult us electronically then consultations should be sent to the following postal address:

Natural England
Consultation Service
Hornbeam House
Electra Way
Crewe Business Park
CREWE
Cheshire
CW1 6GJ

ALC information for Wales is held by Welsh Government. Detailed information and advice is available on request from Ian Rugg (ian.rugg@wales.gov.uk) or David Martyn (david.martyn@wales.gov.uk). If it is not possible to consult us electronically then consultations should be sent to the following postal address:

Welsh Government
Rhodfa Padam
Llanbedem Fawr
Aberystwyth
Ceredigion
SY23 3UR

Natural England publications are available to download from the Natural England website: www.naturalengland.org.uk.

For further information contact the Natural England Enquiry Service on 0303 550 0863 or e-mail enquiries@naturalengland.org.uk.

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Appendix KCC2
ALC Report and Sample
Point Map (MAFF 1997)

A1

ARUN DISTRICT LOCAL PLAN REVIEW
Objector Sites 5 & 12
Land East of Westergate,
West Sussex
Agricultural Land Classification
ALC Map and Report

March / April 1997

Resource Planning Team
Eastern Region
PRCA Reading

RPT Job Number 4202/031/97
PRCA Reference EL 02/00460
LURET Job Number 03050

AGRICULTURAL LAND CLASSIFICATION REPORT
ARUN DISTRICT LOCAL PLAN REVIEW
SITES 5 AND 12 LAND EAST OF WESTERGATE, WEST SUSSEX

INTRODUCTION

1 This report presents the findings of a detailed Agricultural Land Classification (ALC) survey of 19.8 hectares of land located to the east of the village of Westergate and south of Eastergate near Bognor Regis in West Sussex. The survey was carried out during March 1997.

2 The survey was commissioned by the Ministry of Agriculture, Fisheries and Food (MAFF) from its Land Use Planning Unit in Reading in connection with the Arun District Local Plan Review. The results of this survey supersede any previous ALC information for this land.

3 Prior to 1 April 1997 the work was conducted by members of the Resource Planning Team in the Guildford Statutory Group of ADAS. After this date the work was completed by the same team as part of the Farming and Rural Conservation Agency (FRCA, Reading). The land has been graded in accordance with the published MAFF ALC guidelines and criteria (MAFF 1988). A description of the ALC grades and subgrades is given in Appendix 1.

4 At the time of survey the agricultural land at this site was either permanent grazing, unmanaged grassland or in arable use. The areas mapped as Other Land are located towards the west of the site and comprise impenetrable scrub and public open space.

SUMMARY

5 The findings of the survey are shown on the enclosed ALC map. The map has been drawn at a scale of 1:10,000. It is accurate at this scale but any enlargement would be misleading.

6 The area and proportions of the ALC grades and subgrades on the surveyed land are summarised in Table 1 below.

Table 1: Area of grades and other land

Grade/Other land	Area (hectares)	% surveyed area	% site area
1	8.9	45.2	49.4
2a	1.9	10.7	9.6
2b	7.8	44.1	39.4
Other land	2.1	10.6	10.6
Total surveyed area	17.7	100	89.4
Total site area	19.8		100

7 The fieldwork was conducted at an average density of slightly more than 1 boring per hectare of agricultural land. A total of 23 borings and three soil pits were described.

8 The agricultural land on this site has been classified in the range Grade 2 (very good quality) to Subgrade 3b (moderate quality) including some Subgrade 3a (good quality). The limitations to land quality include soil droughtiness and soil wetness.

9 The areas of Grade 2 and Subgrade 3a within the site are principally limited by soil droughtiness. The soils comprise medium silty textures, occasionally overlying light loams at depth or occasionally becoming moderately to very stony in the lower subsoil. Soil droughtiness may affect plant growth, as the supply of available water may be deficient especially in drier years. A few individual observations are also limited by soil wetness.

10 The area of Subgrade 3b land is located towards the centre and east of the site. To the north of the drainage channel running east-west across the site, soil droughtiness is the principal limitation. In this area the soils are of medium silty texture and are commonly very occasionally extremely stony. In the local climate, the droughtiness limitations that the high stone content causes will affect plant growth, development and yield potential, especially in drier years. To the south of the drainage channel there is an abrupt change in soil type. Here the soils are predominantly clayey and they exhibit signs of a moderate soil wetness limitation which, in the local climate leads to Subgrade 3b being appropriate. Soil wetness restricts land utilisation by adversely affecting plant growth and restricting the timing of mechanised operations or stocking.

FACTORS INFLUENCING ALC GRADE

Climate

11 Climate affects the grading of land through the assessment of an overall climatic limitation and also through interactions with soil characteristics.

12 The key climatic variables used for grading this site are given in Table 2 below. These were obtained from the published 5km grid datasets using standard interpolation procedures (Met Office 1989).

Table 2 Climatic and altitude data

Factor	Units	Values	
Grid reference	N/A	SU 942 044	SU 942 050
Altitude	m AOD	9	10
Accumulated Temperature	day C (Jan-June)	1543	1237
Average Annual Rainfall	mm	769	775
Field Capacity Days	days	157	158
Moisture Deficit, Wheat	mm	118	117
Moisture Deficit, Potatoes	mm	113	114
Overall climatic grade	N/A	Grade 1	Grade 1

13 The climatic criteria are considered first when classifying land as climate can be overriding in the sense that severe limitations will restrict land to low grades irrespective of favourable site or soil conditions

14 The main parameters used in the assessment of an overall climatic limitation are average annual rainfall (AAR) as a measure of overall wetness and accumulated temperature (ATD January to June) as a measure of the relative warmth of a locality

15 The combination of rainfall and temperature at this site mean that there is no overall climatic limitation. Other local climatic factors such as exposure and frost risk are also believed not to affect the site. The site is climatically Grade 1.

Site

16 The site lies at altitudes in the range 5-10m AOD. The highest land is towards the north west and south west of the site. From these points the land slopes gently towards the centre of the site where a drainage channel runs to the eastern boundary which is a stream. None of the slopes are steep enough to adversely affect agricultural land quality.

Geology and soils

17 The published geological information for the site (BGS 1975) shows the site to be underlain by three deposits. To the north and north west valley gravels are shown. To the south west brickearth is indicated and in a narrow strip along the stream to the east of the site alluvium has been mapped.

18 The most detailed published soils information for the site (SSGB 1967) shows this site to be underlain by a total of four soil series. Flack series soils are shown in the north of the site. These are commonly silty moderately well drained and variably stony. Soils fitting this general description were found in this area of the site. Across the centre of the site soils of the Cokerus series and Gade and Titchfield complexes are mapped. These generally comprise variably stony and loamy soils which are variably affected by both groundwater and surface water and exhibit this in the form of extensive gleying. The soils encountered in this part of the site were variable north of the drainage channel running to the east of the site the soils were loamy rarely gleyed but very stony. To the south of the drainage channel the soils were clayey gleyed and only occasionally stony in the lower subsoil. Towards the south west of the site Park Gate series soils are mapped. These are described as being typically silty and moderately well drained (SSGB 1967). Soils similar to this description were found in this area of the site.

AGRICULTURAL LAND CLASSIFICATION

19 The details of the classification of the site are shown on the attached ALC map and the area statistics of each grade are given in Table 1.

20 The location of the sugar borings and pits is shown on the attached sample location map and details of the soils data are presented in Appendix B.

Grade 2

21 Land of very good quality has been mapped in two areas at this site to the north west and south west of the site

22 The land in this area is principally limited by soil droughtiness although soil wetness can be equally limiting at some locations. Soils commonly comprise a slightly stony medium silty clay loam topsoil passing to a similarly textured though commonly stone free and occasionally gleyed upper subsoil in some observations this extended to depth (120cm). However the lower subsoil in the majority of the profiles in this mapping unit was more variable. Occasionally it comprised a stone free permeable gleyed heavy silty clay loam which either occurred to depth (120cm) or was unpenetrable to the soil auger due to stones between 80 and 85cm. In the remaining observed profiles the lower subsoil was gleyed and compressed either a heavy silty clay loam overlying medium silty clay loam and medium sandy loam or a medium silty clay loam overlying medium sandy loam and loamy medium sand horizons which were commonly stoneless. Such soils are permeable and allocated to Wetness Class I or II depending on the depth to gleying.

23 These soils are generally water retentive but in the locally relatively dry climate they have a tendency to be slightly restricted by soil droughtiness. This leads to the possibility of plant growth and yield being adversely affected especially in drier years. In addition the majority of the observed profiles exhibited signs of soil wetness in the form of gleying due to fluctuating groundwater. This will slightly restrict the versatility of the land by restricting the number of days when cultivations or stocking may occur without damaging the soil structure. However this does not affect the classification in the majority of cases.

Subgrade 3a

24 Land of good quality has been mapped in a single unit towards the south and west of the site. The principal limitation is soil droughtiness. The soil pit 3P is representative of the soil type found in these areas.

25 The soils in this area are essentially similar (Wetness Class I and II) in texture to those described above for Grade 2 except that overall the stone content is greater and as such in the local climate the water available to crops is slightly more restricted. Soils comprise a slightly stony (8% w/v total flints) medium silty clay loam topsoil overlying a moderately stony (up to 13% w/v total flints) medium silty clay loam upper subsoil. This passes to a moderately stony (25% w/v total flints) heavy silty clay loam horizon overlying a medium silty clay loam lower subsoil containing 35% w/v total flints. This was unpenetrable to the soil auger and spade at 85cm. Other observations in this map unit were unpenetrable to the soil auger at slightly shallower depths (65cm). The stone content of the soil profile is such that the water available to plants is restricted to the extent that moisture balances given local climatic factors are in the Subgrade 3a range. Soil droughtiness will restrict plant growth and yield especially in drier years.

Subgrade 3b

26 Land of moderate quality has been mapped in a single mapping unit. It is located towards the centre and east of the site. Principal limitations to land quality include soil

droughtiness to the north of the drain (located towards the centre of the site) and soil wetness to the south of this feature.

27. Within the Subgrade 3b mapping unit two separate soil types were observed. To the north of the drain, the principal limitation is soil droughtiness. In this area the soils are well drained (Wetness Class I) and are characterised by the soil pit 1P (see Appendix II). They comprise a slightly to moderately stony (up to 37% w/v total flints including up to 17% > 2cm) medium silty clay loam (topsoil) overlying moderately to very stony (up to 65% w/v total flints including up to 50% > 2cm) medium and heavy silty clay loam subsoil horizons. These were commonly impenetrable to the soil auger between 25 and 45cm and to the spade at 55cm. Rooting was observed to extend to at least 35cm and assumed to penetrate further. The stone content of these profiles limits the available water to plants to the extent that in the local climate Subgrade 3b is the appropriate classification. Plant growth and yield potential are likely to be significantly and adversely affected by this restriction.

28. To the south of the drain located towards the centre of the site, the soils are distinctly different and principally limited by soil wetness. The pit observation 2P (see Appendix II) is representative of the soils observed here. They commonly comprise a stoniness medium or heavy silty clay loam or clay topsoil which may be gleyed. This passes to a stone free poorly structured gleyed and slowly permeable clay subsoil. The depth to the gleyed and slowly permeable horizons results in the soils being assigned to Wetness Class IV. Given the local climate and topsoil textures Subgrade 3b is the appropriate classification for these wet soils. Soil wetness has the effect of restricting land utilisation by limiting the number of days when cultivation or grazing may occur without damaging the soil structure. It can also restrict crop yield, growth and rooting.

Matthew Larkin
Resource Planning Team
Eastern Region
FRCA Reading

SOURCES OF REFERENCE

British Geological Survey (1975) *Sheet 317 Bognor Drift Edition 1* 63 360 Scale
BGS London

Ministry of Agriculture Fisheries and Food (1986) *Agricultural Land Classification of England and Wales Revised guidelines and criteria for grading the quality of agricultural land* MAF London

Metorological Office (1989) *Chemical Data for Agricultural Land Classification*
Met Office Bracknell

Soil Survey of Great Britain (1967) *Soils of the West Sussex Coastal Plains* 1:25 000 Scale
SSGB Harpenden

Soil Survey of England and Wales (1983) *Soils of South East England* 1:250 000 Scale
SSEW Harpenden

Soil Survey of England and Wales (1984) *Soils of South East England Bulletin No. 15*
SSEW Harpenden

APPENDIX I

DESCRIPTIONS OF THE GRADES AND SUBGRADES

Grade 1: Excellent Quality Agricultural Land

Land with no or very minor limitations to agricultural use. A very wide range of agricultural and horticultural crops can be grown and commonly includes top fruit, soft fruit, salad crops and winter harvested vegetables. Yields are high and less variable than on land of lower quality.

Grade 2: Very Good Quality Agricultural Land

Land with minor limitations which affect crop yield, cultivation or harvesting. A wide range of agricultural or horticultural crops can usually be grown but on some land of this grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than Grade 1 land.

Grade 3: Good to Moderate Quality Land

Land with moderate limitations which affect the choice of crops, the timing and type of cultivation, harvesting or the level of yield. When more demanding crops are grown, yields are generally lower or more variable than on land in Grades 1 and 2.

Subgrade 3a: Good Quality Agricultural Land

Land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of a wide range of crops including cereals, grass, oilseed rape, potatoes, sugar beet and the less demanding horticultural crops.

Subgrade 3b: Moderate Quality Agricultural Land

Land capable of producing moderate yields of a narrow range of crops, principally cereals and grass, or lower yields of a wider range of crops or high yields of grass which can be grazed or harvested over most of the year.

Grade 4: Poor Quality Agricultural Land

Land with severe limitations which significantly restrict the range of crops and/or the level of yields. It is mainly suited to grass with occasional arable crops (e.g. cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties in utilisation. The grade also includes very droughty arable land.

Grade 5: Very Poor Quality Agricultural Land

Land with severe limitations which restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.

APPENDIX II

SOIL DATA

Contents

Sample location map

Soil abbreviations - explanatory note

Soil pit descriptions

Soil boring descriptions (boring and horizon levels)

SOIL PROFILE DESCRIPTIONS EXPLANATORY NOTE

Soil pit and auger boring information collected during ALC fieldwork is held on a computer database. This uses notations and abbreviations as set out below.

Boring Header Information

- 1 GRID REF. national 100 km grid square and 8 figure grid reference
- 2 USE Land use at the time of survey. The following abbreviations are used:

ARA	Arable	WHT	Wheat	BAR	Barley
CER	Cereals	OAT	Oats	MZE	Maize
OSR	Oilseed rape	BEN	Field beans	BRA	Brassicae
POT	Potatoes	SBT	Sugar beet	FCD	Fodder crops
LIN	Linseed	FRT	Soft and top fruit	FLW	Fallow
PGR	Permanent pasture	LEY	Ley grass	BGR	Rough grazing
SCR	Scrub	CFW	Coniferous woodland	OTH	Other
DCW	Deciduous woodland	BOG	Bog or marsh	SAS	Set Aside
HTH	Heathland	HRT	Horticultural crops	PLO	Ploughed
- 3 GRDNT Gradient as estimated or measured by a hand held optical clinometer
- 4 GLEV/SPL Depth in centimetres (cm) to gleying and/or slowly permeable layers
- 5 AP (WHEAT/POTS) Crop adjusted available water capacity
- 6 MB (WHEAT/POTS) Moisture Balance (Crop adjusted AP - crop adjusted MD)
- 7 BRT Best grade according to soil thoroughness
- 8 If any of the following factors are considered significant 'Y' will be entered in the relevant column:

MREL	Microrelief limitation	FLOOD	Flood risk	EROSN	Soil erosion risk
EXP	Exposure limitation	FROST	Frost prone	DIST	Disturbed land
CHEM	Chemical limitation				
- 9 LIMFY The main limitation to land quality. The following abbreviations are used:

OC	Overall Climate	AE	Aspect	ST	Topsoil Structure
FR	Frost Risk	GR	Gradient	MR	Microrelief
FL	Flood Risk	TX	Topsoil Texture	DP	Soil Depth
CH	Chemical	WE	Wetness	WE	Workability
DB	Drought	ER	Erosion Risk	WD	Soil Wetness/Thoroughness
EX	Exposure				

Soil Pit and Auger Borelogs

1. TEXTURE Soil texture classes are denoted by the following abbreviations

S	Sand	LS	Loamy Sand	SL	Sandy Loam
SZL	Sandy Silt Loam	CL	Clay Loam	ZCL	Silty Clay Loam
SL	Silt Loam	SCL	Sandy Clay Loam	C	Clay
SC	Sandy Clay	EC	Silty Clay	OL	Organic Loam
F	Fine	SP	Sandy Peat	LP	Loamy Peat
PL	Peaty Loam	PS	Peaty Sand	MZ	Marine Light Silts

For the sand, loamy sand, sandy loam and sandy silt loam classes the predominant size of sand fraction will be indicated by the use of the following prefixes

F	Fine (more than 66% of the sand less than 0.2mm)
M	Medium (less than 66% fine sand and less than 33% coarse sand)
C	Coarse (more than 33% of the sand larger than 0.6mm)

The clay loam and silty clay loam classes will be sub-divided according to the clay content
M Medium (<37% clay) H Heavy (37-35% clay)

2. MOTTLING Motte colour using Munsell notation

3. MOTTLING ABUN Motte abundance expressed as a percentage of the matrix or surface described

F few <3% C common 3-20% M many 20-40% VM very many 40% +

4. MOTTLING CONT Motte contrast

F	Faint, indistinct mottles, evident only on close inspection
D	Distinct, mottles are readily seen
P	Prominent, mottles are conspicuous and one of the outstanding features of the horizon

5. PED COLOUR Ped face colour using Munsell notation

6. GLEY If the soil horizon is gleyed a 'Y' will appear in this column. If slightly gleyed, an 'S' will appear

7. STONE LITH Stone Lithology one of the following is used

HR	all hard rocks and stones	PSET	soft fine grained sandstone
ER	soft argillaceous or silty rocks	CH	chalk
MSST	soft medium grained sandstone	GS	gravel with pebbles (soft) stones
SI	soft weathered igneous/metamorphic rock	GH	gravel with non pebbles (hard) stones

Stone contents (>2cm, >6cm and total) are given as percentages (by volume)

8. **STRUCT** the degree of development, size and shape of soil peds are described using the following notation:

Degree of development	WK	weakly developed	MD	moderately developed
	ST	strongly developed		
Ped size	F	fine	M	medium
	C	coarse		
Ped shape	S	single grain	M	massive
	GR	granular	AB	angular blocky
	SAB	sub angular blocky	PR	prismatic
	PL	platy		

9. **CONSIST** Soil consistence is described using the following notation:

L. loose	FM. firm	EH. extremely hard
VF. very friable	VM. very firm	
FR. friable	EM. extremely firm	

10. **SHES STR** Soil soil structural condition recorded for the purpose of calculating profile droughtiness: G. good M. moderate F. poor

11. **POR** Soil porosity: If a soil horizon has less than 0.2% biopores >0.5 mm a 'Y' will appear in this column

12. **IMP** If the profile is impenetrable to rooting a 'Y' will appear in this column at the appropriate horizon

13. **SPL** Slowly permeable layer: If the soil horizon is slowly permeable a 'Y' will appear in this column

14. **CALC** If the soil horizon is calcareous a 'Y' will appear in this column

15. **Other notations:**

APW	available water capacity (in mm) adjusted for wheat
AFP	available water capacity (in mm) adjusted for potatoes
MBW	moisture balance: wheat
MBP	moisture balance: potatoes

SOIL PIT DESCRIPTION

Date Recd: ARUN DLP SITES 5 & 12 Pit Number: 10
 Grid Reference: 0994200670 Average Annual Rainfall: 185 mm
 Accumulated Temperature: 1543 degree days
 Field Capacity Level: 152 days
 Land Use: Permanent Grass
 Slope and Aspect: degrees

DEPTH	TEXTURE	SOIL NO.	STONES %	TOT STONE	LINK	ROOTLES	STRUCTURE	DENSITY	SUBSTRUCTURE	CLC
0-20	MOCL	109942 00	0	15	68					
20-35	MOCL	109942 00	50	55	68			FR	N	
35-45	MOCL	109942 00	40	65	68			FR	N	
45-55	MOCL	109942 00	0	60	68			FR	N	

Moisture Grade: 1
 Moisture Class: 2
 Claying: 100
 SP: 100
 Drought Grade: 4
 AP: 60 mm PDP: -50 mm
 AP: 65 mm PDP: -54 mm
 F160, ALC GRADE: 30
 ROCK LITERATION: Drought Grade

SOIL PIT DESCRIPTION

Date Recd: ARUN DLP SITES 5 & 12 Pit Number: 20
 Grid Reference: 0994200660 Average Annual Rainfall: 185 mm
 Accumulated Temperature: 1543 degree days
 Field Capacity Level: 152 days
 Land Use: Permanent Grass
 Slope and Aspect: degrees

DEPTH	TEXTURE	SOIL NO.	STONES %	TOT STONE	LINK	ROOTLES	STRUCTURE	DENSITY	SUBSTRUCTURE	CLC
0-25	MOCL	109942 43	0	8						
25-55	C	25 44 42	0	8		0	MOCL	FR	P	

Moisture Grade: 30
 Moisture Class: 14
 Claying: 25 mm
 SP: 22 mm
 Drought Grade: 4
 AP: 100 mm PDP: 0 mm
 AP: 100 mm PDP: 0 mm
 F160, ALC GRADE: 30
 ROCK LITERATION: Moisture

2011 PIT DESCRIPTION

Site Name: ARUN D.P. SITE 2 & 12 Pit Number: 30
 Site Reference: 0204100000 Average Annual Rainfall: 750 mm
 Accumulated Temperature: 1963 degree days
 Field Capacity Level: 150 days
 Land Use: Wheat
 Slope and Aspect: 2 degrees N

NO. OF STONES	STONE	CHLORIDE	STONES	AD	TOTAL STONE	LIQUID	ADDITIONAL	STRUCTURE	CONCRETE	STRUCTURE	DATE
0- 25	NO. 1	100000	50	1	5	HR					
25- 45	NO. 2	100000	50	0	15	HR	1	NO. 2	FR	K	
45- 65	NO. 3	100000	50	0	25	HR	2	NO. 3	FR	K	
65- 85	NO. 4	100000	50	0	35	HR	3	NO. 4	FR	K	

Netness Grade: 5 Netness Class: 3
 Clayey: 80 mm
 30%
 Drought Grade: 50
 AD: 100mm 100 -10 mm
 AD: 100mm 100 -5 mm

FIELD ALC GRADE: 30
 NOUN LIMITATION: Drought: none

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Project: ALG011

COMPLETE LIST OF HOSPITALS 10/05/97 ARUN DISTRICT COUNCIL

Page 1



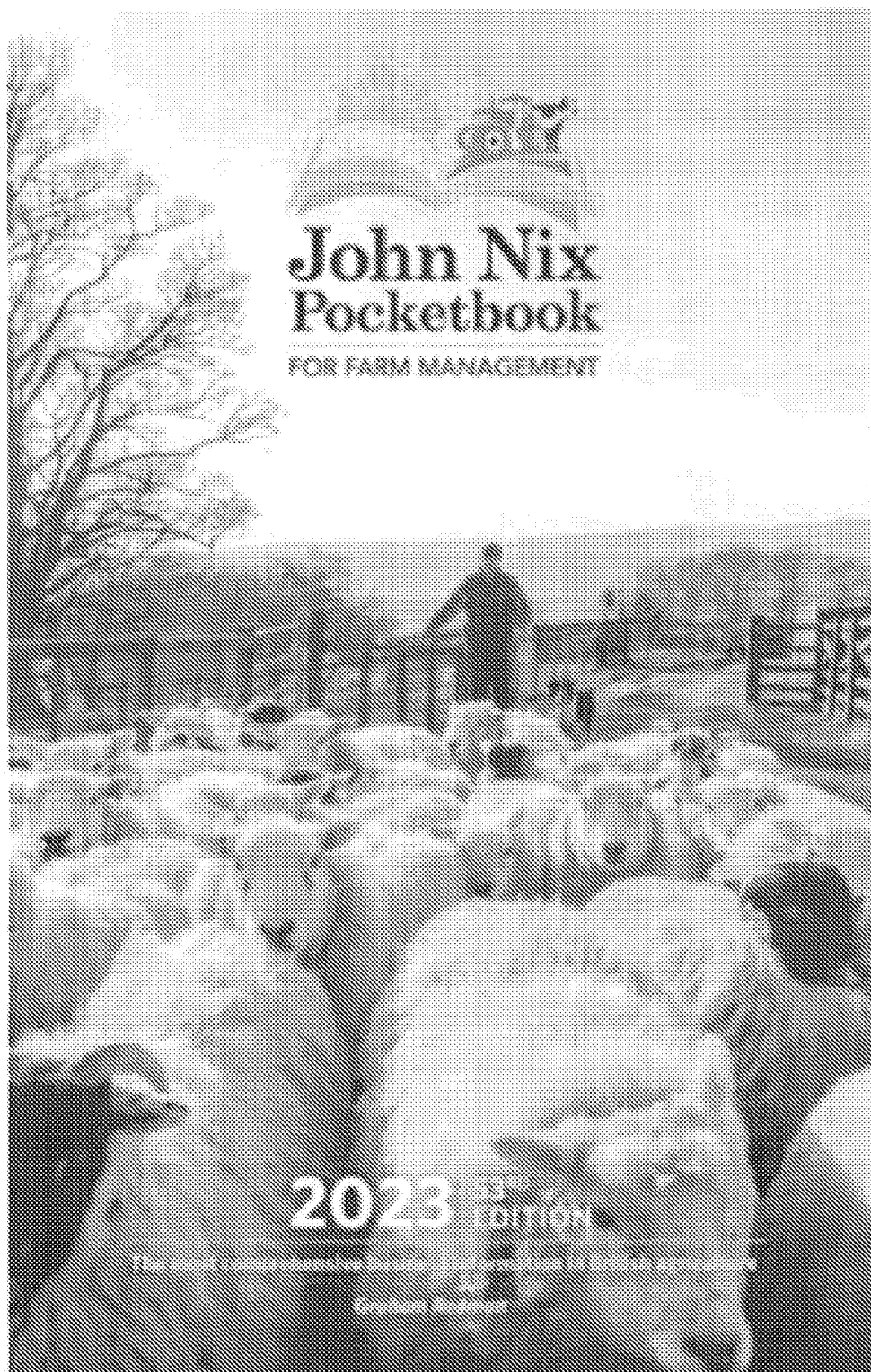
SAMPLE	DEPTH	TEXTURE	COLOR	---HOTTLES---		PSS	---STONES---		STRUCT	SUBS	STR	FOR	IMP	SP	CHC
				COL	ARM	CON	COL	GLY	42	46	1174	101			
1	0-14	sec1	109832 00	109856 00	F			13	0	00	33				
	14-25	sec1	109856 00					0	0	00	33		N		IMP FLINTS 25
19	0-22	sec1	109833 00					0	0	00	13				STONES SAMPLED
	22-36	sec1	109843 00					0	0	00	35		FE H		STONES SAMPLED
	36-45	sec1	109843 00					0	0	00	61		FE H		STONES SAMPLED
	45-55	sec1	109842 00					0	0	00	65		FE H		
2	0-30	sec1	109843 00	109866 00	F			0	0	00	3				
	30-65	sec1	109866 00	109866 00	F			0	0	00	3		N		
	65-70	sec1	109864 00	109866 00	C			0	0	00	25		N		IMP FLINTS 30
20	0-25	sec1	109862 00					0	0	00	0				
	25-55	sec1	109862 00	109866 00	C			0	0	00	0		POSSAB	FE H	
3	0-22	sec1	109862 00					17	0	00	37				
	22-45	sec1	109862 00	109866 00	C			0	0	00	10				IMP FLINTS 45
20	0-20	sec1	109863 00					1	0	00	0				
	20-40	sec1	109863 00	109866 00	F			0	0	00	15		POSSAB	FE H	
	40-63	sec1	109863 00	109866 00	C			0	0	00	25		POSSAB	FE H	STONES SAMPLED
	63-85	sec1	109862 00	109866 00	H			0	0	00	35		FE H		STONE SAMPLED IMP 85
4	0-30	sec1	109861 00					0	0	00	5				
	30-50	sec1	109862 00					0	0	00	50		N		IMP FLINTS 30
5	0-20	sec1	109863 00					0	0	00	2				
	20-30	sec1	109864 00					0	0	00	30		N		IMP FLINTS 30
6	0-23	sec1	109863 00					0	0	00	5				
	23-35	sec1	109863 00					0	0	00	50		N		IMP FLINTS 35
7	0-23	sec1	109863 00					0	0	00	8				
	23-30	sec1	109864 00					0	0	00	30		N		IMP FLINTS 30
8	0-20	sec1	109861 00					1	0	00	5				
	20-50	sec1	109863 00	109866 00	C			0	0	00	5		N		
	50-65	sec1	109863 00	109866 00	C			0	0	00	30		N		IMP FLINTS 65
9	0-25	sec1	109863 00					0	0	00	0				
	25-35	sec1	109863 00	109866 00	C			0	0	00	0				
	35-100	sec1	109862 00	109866 00	H			0	0	00	0				
10	0-20	sec1	109863 00					1	0	00	5				
	20-40	sec1	109863 00	109866 00	C			0	0	00	0		N		
	40-60	sec1	109862 00	109866 00	C			0	0	00	0		N		
	60-110	sec1	109862 00	109866 00	H			0	0	00	10		N		
	110-120	sec1	109862 00	109866 00	H			0	0	00	0		N		

SAMPLE	DEPTH	TEST/USE	CER. DATE	-----PROFILES-----			PER	-----STONES-----			STRUCT/	SURE
				CCR	ABW	DCAT		GLY	XE	LETH	POST	
11	0-25	acc1	10/04/02						0	0	0	
	25-50	acc1	10/05/04	20					0	0	0	
												IMP FLINT 30
12	0-30	acc1	10/04/02						1	0	0	
	30-60	acc1	10/05/04	00	10/05/04	00	F		0	0	0	
	60-120	acc1	10/05/02	03	10/05/02	00	C	004400	00	Y	0	0
13	0-30	acc1	10/04/02						0	0	0	
	30-60	acc1	10/04/02	00	10/05/02	00	C	004400	00	Y	0	0
	60-120	acc1	10/05/02	00	10/05/02	00	M		Y	0	0	
												IMP FLINT 25
14	0-20	acc1	10/04/02	00	10/04/02	00	C		Y	0	0	
	20-40	acc1	10/05/02	01	10/04/02	00	M		Y	0	0	
	40-60	acc1	05	05/01	00	10/05/02	00	M		Y	0	0
15	0-30	acc1	10/04/02	03	10/04/02	00	F		0	0	0	
	30-60	acc1	10/05/02	00					0	0	0	
	60-120	acc1	10/05/04	00	10/05/04	00	F		0	0	0	
16	0-20	acc1	10/04/02	02					0	0	0	
	20-30	acc1	10/05/02	00	10/05/02	00	C		Y	0	0	
												IMP FLINT 30
17	0-20	acc1	10/04/02	02	10/04/02	00	C		Y	0	0	
	20-40	acc1	20/05	02	10/05/02	00	C		Y	0	0	
	40-60	acc1	20/05	03	10/05/02	00	C		Y	0	0	
												IMP FLINT 50
18	0-20	acc1	20/05	02	10/05/02	00	C		Y	0	0	
	20-30	acc1	20/05	03	10/05/02	00	M	004400	00	Y	0	0
19	0-30	acc1	10/04/02	00					0	0	0	
	30-60	acc1	10/05/04	00	10/05/04	00	F		0	0	0	
	60-120	acc1	10/05/02	02	10/05/02	00	C	004400	00	Y	0	0
20	0-30	acc1	10/04/02	00					0	0	0	
	30-60	acc1	10/05/04	00	10/05/04	00	C		Y	0	0	
	60-120	acc1	20/05	02	10/05/02	00	M	004400	00	Y	0	0
21	0-30	acc1	10/04/02	00					0	0	0	
	30-45	acc1	10/04/04	04	004400	00	F		0	0	0	
	45-75	acc1	10/05/04	00	10/05/04	00	C	004400	00	Y	0	0
	75-120	acc1	10/05/04	00	10/05/04	00	C	004400	00	Y	0	0
22	0-10	acc1	10/04/02	01					0	0	0	
	10-20	acc1	20/05	02	10/05/02	00	M	004400	00	Y	0	0
												IMP FLINT 25
23	0-25	acc1	10/04/02	00	10/04/02	00	F		0	0	0	
	25-50	acc1	20/05	03	10/05/02	00	C		Y	0	0	
												IMP FLINT 50

SAMPLE	DEPTH	TEXTURE	COLOR	MOISTURE		PSD	SOUNDNESS		STRUCTURE	SURF	STR	FOR	DRP	SPR	CALC
				COL	AGRM	CONT	COL	SLURRY	>2	>6	1.18	100	SEMI	SEMI	SEMI
11	0-25	sec1	10YR4/3 20						0	0	0	0			
	25-30	sec2	10YR5/4 20						0	0	0	0			DRP FL100% 30
12	0-30	sec1	10YR4/3 50						1	0	0	0			
	30-65	sec2	10YR5/4 20 10YR5/5 50 F						0	0	0	0			
	65-120	sec3	10YR5/2 50 10YR5/5 50 C				00YR5/2 50 Y		0	0	0	0			
13	0-35	sec1	10YR4/3 00						0	0	0	0			
	35-55	sec2	10YR4/3 00 75YR5/5 00 C				00YR5/2 50 Y		0	0	0	0			
	55-85	sec3	10YR5/2 00 10YR5/5 00 M						0	0	0	0			DRP FL100% 85
14	0-25	sec1	10YR4/3 00 75YR5/5 00 C						0	0	0	0			
	25-45	sec2	10YR5/3 50 75YR5/5 00 M						0	0	0	0			
	45-65	sec3	00 75Y 00 75YR5/2 00 M						0	0	0	0			
15	0-30	sec1	10YR4/3 50 10YR4/3 00 F						0	0	0	0			
	30-50	sec2	10YR4/3 00						0	0	0	0			
	50-120	sec3	75YR5/4 00 75YR5/5 00 F						0	0	0	0			
16	0-20	sec1	10YR4/2 50						0	0	0	0			
	20-30	sec2	10YR5/2 00 10YR5/5 00 C						0	0	0	0			DRP FL100% 30
17	0-25	sec1	10YR4/2 50 10YR4/5 00 C						0	0	0	0			
	25-45	sec2	25Y 50 60 10YR5/5 00 C						0	0	0	0			
	45-60	sec3	25Y 60 00 10YR5/5 00 C						0	0	0	0			DRP FL100% 60
18	0-25	sec1	25Y 40 00 10YR5/5 00 C						0	0	0	0			
	25-30	sec2	25Y 00 00 10YR5/5 00 M				00YR5/2 50 Y		0	0	0	0			
19	0-30	sec1	10YR4/2 00						0	0	0	0			
	30-55	sec2	10YR5/4 00 10YR5/5 00 F						0	0	0	0			
	55-75	sec3	10YR5/3 50 10YR5/5 00 C				00YR5/2 50 Y		0	0	0	0			
	75-100	sec4	25Y 00 00 10YR5/5 00 M						0	0	0	0			
20	0-30	sec1	10YR4/2 00						0	0	0	0			
	30-55	sec2	10YR5/4 50 10YR5/5 00 C						0	0	0	0			
	55-120	sec3	25Y 00 00 75YR5/5 00 M				00YR5/2 50 Y		0	0	0	0			
21	0-30	sec1	10YR4/2 00						0	0	0	0			
	30-45	sec2	10YR4/3 50 00YR5/2 00 F						0	0	0	0			
	45-75	sec3	10YR5/4 00 10YR5/5 00 C				00YR5/2 50 Y		0	0	0	0			
	75-80	sec4	10YR5/4 00 10YR5/5 00 C				00YR5/2 50 Y		0	0	0	0			
22	0-10	sec1	10YR3/1 40						0	0	0	0			
	10-55	sec2	25Y 40 00 75YR5/5 00 M				00YR5/2 50 Y		0	0	0	0			DRP FL100% 55
23	0-25	sec1	10YR4/2 00 10YR4/5 00 F						0	0	0	0			
	25-55	sec2	25Y 40 50 75YR5/5 00 C						0	0	0	0			DRP FL100% 55

Appendix KCC3

Extracts from the Pocketbook for Farm
Management



II. ENTERPRISE DATA

1. CROPS

WHEAT

Feed Winter Wheat

Production level	Low	Average	High	
Yield: t/ha (t/ac)	7.23 (2.8)	8.41 (3.3)	10.00 (4.1)	
	£	£	£	£/t
Grain at £223/t	1,631	1,885 (784)	2,200 (911)	
Straw in Swath	173 (70)	173 (70)	173 (70)	
Total Output	1,804 (731)	2,108 (854)	2,423 (981)	243
Variable Costs (£/ha (£/ac))				
Seed.....		97 (39)		11
Fertiliser.....		533 (216)		62
Sprays.....		178 (113)		32
Total Variable Costs		808 (368)		106
Gross Margin (£/ha (£/ac))	896 (363)	1290 (486)	1,615 (613)	140

Fertiliser Basis 8.6t/ha				Seed:	Sprays £/ha:	
Nutrient	kg/t	kg/ha	£/ha	£/t C2	£805	Herbicides £121
N	22	150	£358	kg/ha	175	Fungicides £110
P	7.0	50	£85	% HOS	30%	Insecticides £3
K	10.5	50	£90	£/t HOS	£435	PCRs £17
						Other £28

1. Yields: The average yield is for all winter feed wheat, i.e. all varieties and 1st and subsequent wheats. See over for First and Second Wheats. The yield used for feed and milling wheats including spring varieties is 8.4t/ha.

The table below offers a weighted estimate of yield variations according to wheat type based on a national yield of 8.41t/ha. Percentages compare yield categories with 'all wheat'. These yields are used in the gross margins.

Calculation of spread of average yield depending on wheat type -

	Winter	1st WW	2nd WW	spring	Total
t/ha	101%	102%	93%	85%	
Total	100%	8.48	8.63	7.82	8.41
Feed	101%	8.58	8.71	7.90	8.40
Bread	93%	7.90	8.02	7.27	7.82
Rescue	95%	8.41	8.58	7.74	8.32

2. Straw is sold in the swath. Fertiliser accounts for mineral depletion.
3. Seed is coated with a single purpose dressing. Up to a third of growers require additional seed treatments, specifically to suppress BYDV. This can add £150/t of seed (£28.50/ha). This has not been added in the gross margins so should be considered.
4. This schedule does not account for severe grass weed infestations such as Black Grass or Sterile Brome. Costs associated with managing such problems can amount to up to £170/ha extra additional agrochemical costs. Yield losses increase as infestation rises.

ORLSEED RAPE

Winter Oilseed Rape

Production level	Low	Average	High	
Yield: t/ha (t/acre)	3.00 (1.2)	3.50 (1.4)	4.00 (1.6)	
	£	£	£	£/t
Output at £515/t	1545 (626)	1,803 (720)	2,060 (834)	515
Variable Costs £/ha (£/acre)				
Seed		74 (30)		71
Fertiliser		410 (166)		117
Sprays		253 (102)		72
Total Variable Costs		737 (298)		210
Gross Margin £/ha (£/acre)	808 (327)	1066 (432)	1,323 (536)	305

Fertiliser Basis 3.5t/ha				Seed:		Sprays:	
Nutrient	Kg/t	Kg/ha	£/ha	£/ha C	45	Herbicides	£125
N	46	160	£301	£/ha H5	90	Fungicides	£68
P	14	49	£69	£/ha H55	30	Insecticides	£16
K	11	39	£39	C-Hy-H55	20,20,60	PGRs	£0
Seed write-off		7%	Kg/ha	5.5		Other	£04

- Prices. The price used for the 2023 crop is £484/t plus oil bonuses at 44% oil content. The bonus is paid on the percentage of oil over 40%, at 1.5 times the sale value of the crop and an equal but opposite penalty below 40%. For example, in this case, the bonus is on 4% oil x £484 x 1.5 = £29. (Figures are rounded to the nearest £5.00 in the margin)

Spring Oilseed Rape

Production level	Low	Average	High	
Yield: t/ha (t/acre)	2.00 (0.8)	2.28 (0.9)	2.50 (1.0)	
	£	£	£	£/t
Output at £515/t	1030 (417)	1,172 (475)	1,288 (522)	515
Variable Costs £/ha (£/acre)				
Seed		71 (28)		31
Fertiliser		262 (107)		89
Sprays		132 (53)		58
Total Variable Costs		465 (184)		178
Gross Margin £/ha (£/acre)	625 (253)	767 (311)	883 (350)	337

- Inputs: Seed as per WOSR, but 45% conventional, 5% H55, 50% hybrid. Fertiliser: N/P/K at 80/32/25 kg/ha. Sprays: Herbicides, £51, Fungicides, £41, Insecticides £13, and Others £28/ha
- Winter Versus Spring: As little as 8,000 hectares of spring OSR are grown in the UK which is 2.5% of the entire crop. As can be seen, the financial reward is slim compared with other combinable crops.

Appendix KCC4
Guide to Assessing Development
Proposals on Agricultural Land (Natural
England, 2021)



Guidance

Guide to assessing development proposals on agricultural land

Updated 5 February 2021

Applies to England

Contents

1. Policies to protect agricultural land and soil
2. LPAs: consult Natural England
3. LPAs: how to use agricultural land classification (ALC)
4. About ALC grades
5. LPAs: carry out ALC assessments to support your planning decisions
6. Use ALC to support your planning decisions
7. Developers: check if your proposal affects agricultural land



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1. Policies to protect agricultural land and soil

Developers and local planning authorities (LPAs) should refer to the following government policies and legislation when considering development proposals that affect agricultural land and soils. They aim to protect:

- the best and most versatile (BMV) agricultural land from significant, inappropriate or unsustainable development proposals
- all soils by managing them in a sustainable way

Natural England uses these policies to advise on development proposals as a [statutory consultee](https://www.gov.uk/guidance/consultation-and-pre-decision-matters#statutory-consultees) (<https://www.gov.uk/guidance/consultation-and-pre-decision-matters#statutory-consultees>) in the planning process.

1.1 A Green Future: Our 25 Year Plan to improve the Environment 2018

[A Green Future: Our 25 Year Plan to improve the Environment](https://www.gov.uk/government/publications/25-year-environment-plan) (<https://www.gov.uk/government/publications/25-year-environment-plan>) sets out the government's 25-year plan to improve the health of the environment by using natural resources more sustainably and efficiently. It plans to:

- protect the best agricultural land
- put a value on soils as part of our natural capital
- manage soils in a sustainable way by 2030
- restore and protect peatland

1.2 National Planning Policy Framework (NPPF)

LPAs should use the NPPF to make decisions about the natural and local environment to:

- protect and enhance landscapes, biodiversity, geology and soils
- recognise soils as a natural capital asset that provide important ecosystem services
- consider the economic and other benefits of BMV agricultural land, and try to use areas of poorer quality land instead of higher quality land
- prevent soil, air, water, or noise pollution, or land instability from new and existing development

Read Chapter 15: Conserving and enhancing the natural environment (<https://www.gov.uk/guidance/natural-planning-policy-framework/15-conserving-and-enhancing-the-natural-environment>) for full details.

1.3 Town and Country Planning (Development Management Procedure (England) Order) (DMPO) 2015

Planning authorities must consult Natural England on all non-agricultural applications that result in the loss of more than 20 hectares (ha) of BMV land if the land is not included in a [development plan](https://www.gov.uk/guidance/natural-planning-policy-framework/3-plan-making) (<https://www.gov.uk/guidance/natural-planning-policy-framework/3-plan-making>). For example, this includes the likely cumulative loss of BMV land from the proposed development if it's part of a phased development.

This is required by [schedule 4\(1\) of the Order](https://www.legislation.gov.uk/ukui/2015/595/schedule/4/made) (<https://www.legislation.gov.uk/ukui/2015/595/schedule/4/made>).

1.4 Planning Practice Guidance for the Natural Environment

[Paragraphs 991 and 992: Planning Practice Guidance for the Natural Environment](https://www.gov.uk/guidance/natural-environment/ffarmfield-land-soils-and-agricultural-land) (<https://www.gov.uk/guidance/natural-environment/ffarmfield-land-soils-and-agricultural-land>) explain why planning decisions should take account of the value of soils and agricultural land classification (ALC) to enable informed choices on the future use of agricultural land within the planning system.

2. LPAs: consult Natural England

You must consult Natural England for development proposals that are both:

- likely to cause the loss (or likely cumulative loss) of 20ha or more of BMV land
- not in accordance with an approved development plan

Natural England will advise you on the level of impact the proposal may have on BMV agricultural land. Natural England will take into account the type of development and its likely long-term effects.

Email consultations@naturalengland.org.uk or write to:

Natural England consultation service
Hornbeam House
Electra Way
Crewe Business Park
Crewe
Cheshire
CW1 6GJ

3. LPAs: how to use agricultural land classification (ALC)

You can use ALC to help inform decisions on the appropriate sustainable development of land.

ALC uses a grading system to enable you to assess and compare the quality of agricultural land in England and Wales.

A combination of climate, topography and soil characteristics and their unique interaction determines the limitation and grade of the land. These affect the:

- range of crops that can be grown
- yield of crop
- consistency of yield
- cost of producing the crop

4. About ALC grades

ALC is graded from 1 to 5.

The highest grade goes to land that:

- gives a high yield or output
- has the widest range and versatility of use
- produces the most consistent yield
- requires less input

BMV agricultural land is graded 1 to 3a.

4.1 Grade 1 – excellent quality agricultural land

Land with no or very minor limitations. A very wide range of agricultural and horticultural crops can be grown and commonly includes:

- top fruit, for example tree fruit such as apples and pears
- soft fruit, such as raspberries and blackberries
- salad crops
- winter harvested vegetables

Yields are high and less variable than on land of lower quality.

4.2 Grade 2 – very good quality agricultural land

Land with minor limitations that affect crop yield, cultivations or harvesting. A wide range of agricultural and horticultural crops can usually be grown. On some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops, such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than grade 1.

4.3 Grade 3 – good to moderate quality agricultural land

Land with moderate limitations that affect the choice of crops, timing and type of cultivation, harvesting or the level of yield. Where more demanding crops are grown yields are generally lower or more variable than on land in grades 1 and 2.

4.4 Subgrade 3a – good quality agricultural land

Land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of crops including:

- cereals
- grass
- oilseed rape
- potatoes
- sugar beet
- less demanding horticultural crops

4.5 Subgrade 3b – moderate quality agricultural land

Land capable of producing moderate yields of a narrow range of crops, principally:

- cereals and grass
- lower yields of a wider range of crops
- high yields of grass which can be grazed or harvested over most of the year

4.6 Grade 4 – poor quality agricultural land

Land with severe limitations which significantly restrict the range of crops or level of yields. It is mainly suited to grass with occasional arable crops (for example cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties using the land. The grade also includes arable land that is very dry because of drought.

4.7 Grade 5 – very poor quality agricultural land

Land with very severe limitations that restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.

5. LPAs: carry out ALC assessments to support your planning decisions

For an overview of ALC use:

- 1:250,000 scale regional ALC maps (<http://publications.naturalengland.org.uk/category/5854148327204736>) (grade 3 land is not divided into subgrades 3a and 3b)
- 1:250,000 scale regional maps predicting the likelihood of BMV agricultural land (<http://publications.naturalengland.org.uk/category/5208993007403008>)

These maps are not at a scale suitable or accurate for assessment of individual fields or sites.

You can assess if a development proposal is likely to affect BMV agricultural land by using the post 1998 ALC Magic map (http://magic.defra.gov.uk/MagicMap.aspx?chosenLayers=sludefsystemindex,backgroundindex,backgroundindex_eurocoindex,msiBMVindex,1:250kBMVindex,30kBMVindex,250kBMVindex,miniscaleBMVindex,lossindex&box=49447.459,357.467834,4753294&useDefaultcheckboxesandhappine-false) and detailed site survey reports (<http://publications.naturalengland.org.uk/category/5245362855836648>).

If no site survey reports are available, a new detailed survey may be necessary.

6. Use ALC to support your planning decisions

Use ALC survey data to assess the loss of land or quality of land from a proposed development. You should take account of smaller losses (under 20ha) if they're significant when making your decision. Your decision should avoid unnecessary loss of BMV land.

6.1 Protect soil

You should make sure development proposals include plans to:

- manage soils in a sustainable way during construction (<http://www.gov.uk/government/publications/code-of-practice-for-the-sustainable-use-of-soils-on-construction-sites>)

- avoid peat extraction
- protect soils from contamination
- reclaim land after mineral working or landfilling
(<https://www.gov.uk/government/publications/reclaim-minerals-extraction-and-landfill-what-to-agriculture>)

6.2 Carry out new surveys

If there's not enough information from previous data, you may need to have a new field survey to plan for development or to inform a planning decision. You should use soil scientists or experienced soil specialists to carry out new surveys. They should be:

- members of the British Society of Soil Science, the British Institute of Agricultural Consultants or similar professional body
- knowledgeable about the ALC 1998 guidelines
(<https://publications.naturalengland.org.uk/publication/6267360620204448>)
- experienced in soil description and ALC assessments

6.3 Survey requirements

For a detailed ALC assessment, a soil specialist should normally make boreholes:

- every hectare on a regular grid on agricultural land in the proposed development area
- up to 1.2m deep using a hand-held auger

They should:

- dig small inspection pits by hand to a minimum depth of 1m to add supporting evidence to the borehole data
- dig pits where there's a change in main soil type and ALC grade to provide a good depiction of the site
- combine the survey results with local climate and site data to plot on an Ordnance Survey (OS) base map
- use a base map at an appropriate scale for detailed work, such as 1:10,000 scale

7. Developers: check if your proposal affects agricultural land

Use the [post.1989 ALC Magic map](http://post.1989.ALC.Magic.map) (<http://magic.defra.gov.uk/MagicMap.aspx?chosenLayer=duffsystem&index.backgroundIndex.backgroundIndex.europeIndex.miniSVIndex.25kSVIndex.50kSVIndex.750kSVIndex.miniscaleSVIndex.backgroundIndex&town=43447.458357.467834.473294&useDefaultBackgroundMapping=false>) and [detailed site survey reports](http://publications.naturalengland.org.uk/category/3249362388623848) (<http://publications.naturalengland.org.uk/category/3249362388623848>) to help you assess whether a development proposal is likely to affect BMV agricultural land. If no suitable data exists, you may need to carry out a [detailed survey](#) to support your planning application.

7.1 Free and chargeable advice

Natural England offers advice for proposals. Some initial advice is free. More [detailed advice is chargeable](http://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposal#when-you-can-pay-for-agency-advice) (<http://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposal#when-you-can-pay-for-agency-advice>), for example if your proposal is 20ha or more and requires more detailed advice.

Email: consultations@naturalengland.org.uk

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Appendix KCC4KCC5
Arun Soils Assessment

WESTERGATE
ARUN SOILS ASSESSMENT

September 2023

Purpose of this Document

- 1 Arun District Council Local Plan Policy DM1 part 1 states *"the productivity of the land is demonstrated using a methodology for assessing gross margins as contained in the Arun Soils and Agricultural Land Assessment report"*.
- 2 There is no explanation in the policy or the supporting text about what policy judgement/planning weight arises from such an assessment.

The Arun Soils and Agricultural Land Assessment Study (2013)

- 3 Agricultural productivity is referred to in that study in section 5, which cross references Appendix 1, see **Attachment A**. The relevant text and the Annex are attached to this document.
- 4 The calculation came up with an Average Annual Gross Margin (AAGM) for comparative purposes. Paragraph 6.1.6 identified one hectare of high yielding land (Grades 1 and 2, see Appendix 1) as £750/ha, and average yielding land (Subgrades 3a and 3b, see Appendix 1) as £490/year.
- 5 The main report went on to compare the AAGM of four strategic development sites. The report did not provide any commentary about how to make a planning judgement from the results of the AAGM.

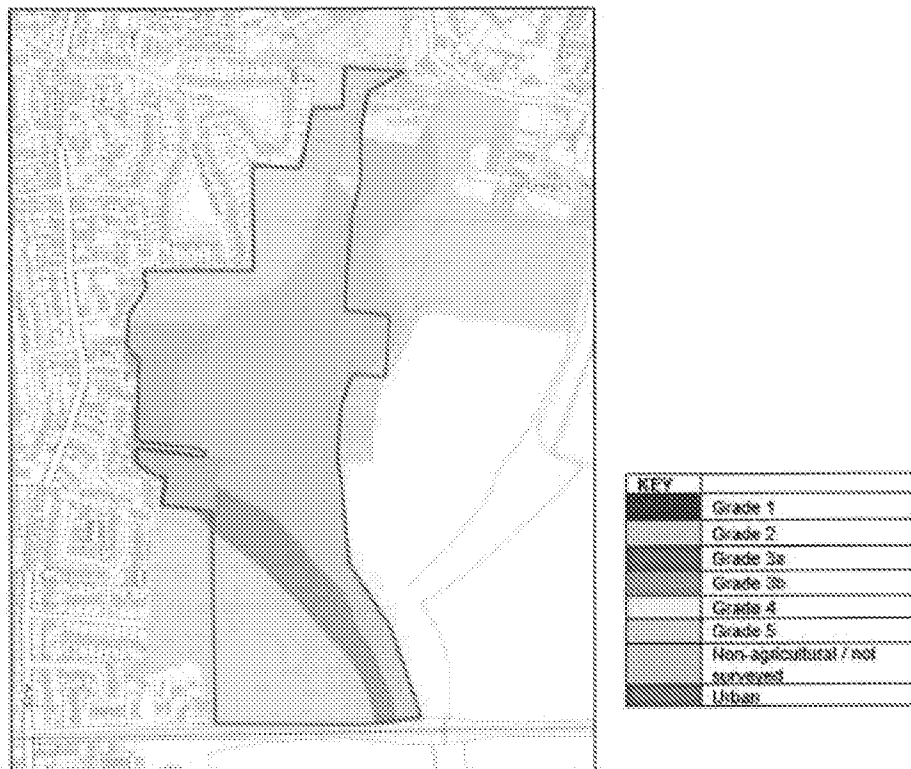
Calculating AAGM for this Site

- 6 The methodology is set out in Appendix 1 of the report, **Attachment A**.
- 7 To be able to assess this, there is a three part process:
 1. The total area of the crop ÷ total farmed area x 100 = % of the land covered by each crop;
 2. Gross Margin (taken from John Nix (53rd Ed.) x % of the land covered by each crop = the number of ha per 100ha which the crop would occupy given that crop mix; and
 3. The number of ha per 100ha which the crop would occupy given the crop mix ÷ 100 = the gross margin of the crop within 1 representative ha.

8 Within the report it explains that soils are graded Grades 1 and 2 and considered able to produce high yields. Soils which are of Grades 3a and 3b are considered to produce average yields.

9 The ALC of Westergate is a mixture of Grade 2, Subgrade 3a and Subgrade 3b. This is shown in the ALC map below.

Insert 1. Distribution of Grades



10 Accordingly:

- 8.2ha is high yielding; and
- 10.3ha is average yielding

11 Part of the site that was not surveyed is expected to be similar quality, i.e. mostly a 3a/3b mix and hence average yielding. We assume a proportion of Grade 2 also.

12 Using the John Nix Pocketbook for Farm Management 2022 (53rd Ed.) the gross margin for each average yield is taken as part of the calculation.

13 We have used the crop data for West Sussex from the 2021 DEFRA statistics. Using the Gross Margins, the calculation table is at **Attachment B**.

- 14 The AAGM per hectare is £341.88.
- 15 The AAGM for the 10.5ha surveyed as 3a and 3b is £3,589.74.
- 16 If we take just the cereals, the GM for cereals (high yield) is £1,515/ha. For the 6.2ha of Grade 2 the GM would be £9,393. Not all crops have average and high yields in John Nix, so if we take the AAGM (average) at £341.88, that is 29% of the cereal GM. Multiplying the cereal (high) GM by 29% gives an AAGM estimate of £439.35.
- 17 Therefore, the AAGM for the 6.2ha of Grade 2 is £2,724.
- 18 To estimate the AAGM of the unsurveyed land we assume the average AAGM for the surveyed area being £439.35 plus £3,589.74 divided by 16.7 hectares, equals £241.26. For 2.4ha not surveyed the AAGM is £579.02. This reflects a similar mix of Grades 2, 3a and 3b.

Conclusion

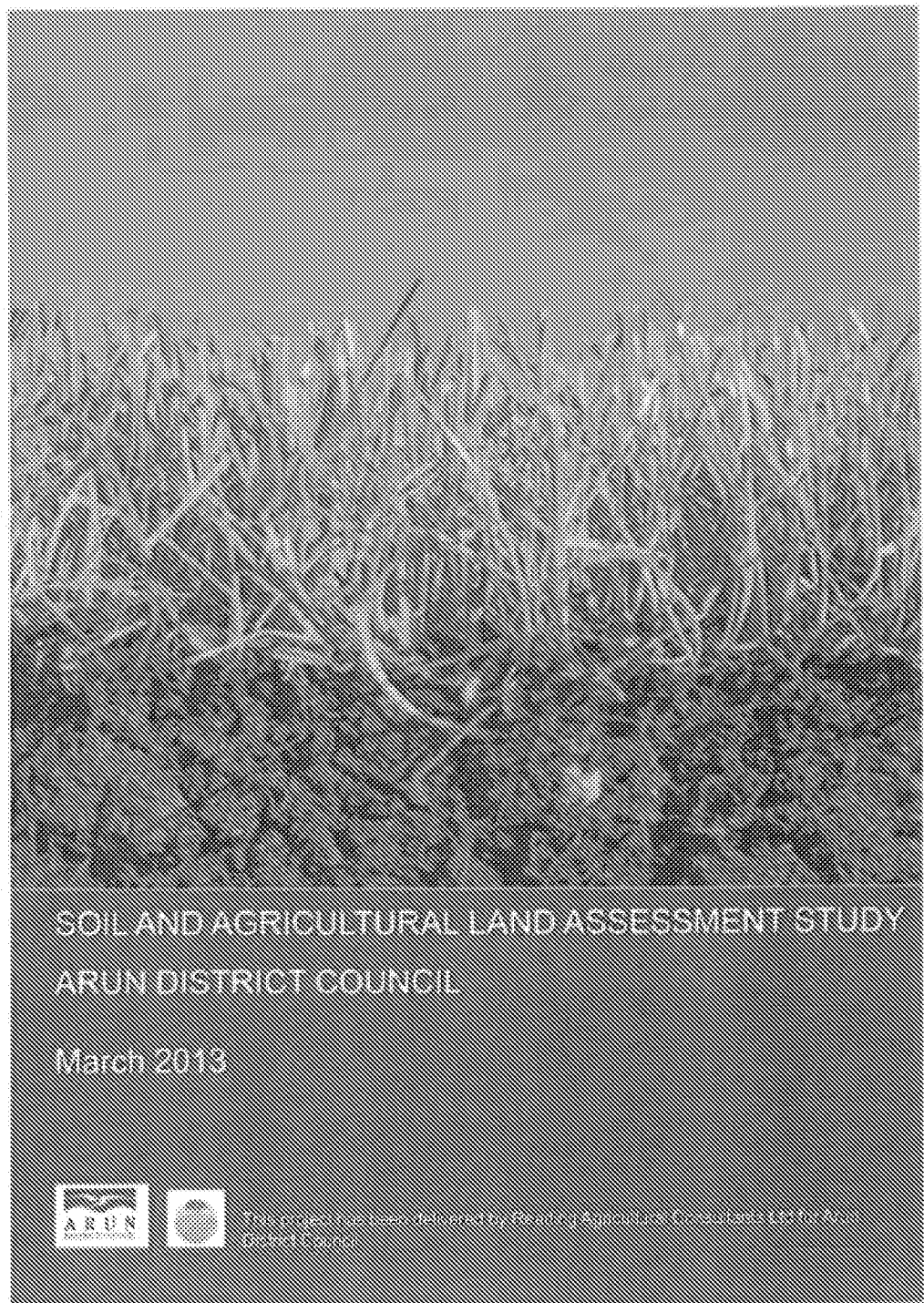
- 19 Policy DO DM1 requires a productivity assessment.
- 20 The productivity assessment of the Westergate is as follows:

Table 1. ALC Grades

Area	Ha	GM (£)
Grade 2	6.2	2,724
Subgrade 3a and 3b	10.5	3,590
Non-agricultural / Unsurveyed	2.4	579
Total	19.1	6,893

Attachment A

Extract Arun Soils
Report



- 5.3. The remainder of land provisionally mapped as being of Subgrade 3b quality tends to occur in areas in which Park Gate soils are mapped. These soils are clayey or loamy in texture and are typically seasonally waterlogged.

Agricultural Productivity – Arun, Adur and Worthing Districts

- 5.4. The latest Defra statistics (2010) on agricultural land use in Arun are combined with those from the neighbouring districts of Adur and Worthing. In 2010, the total farmed area across the three districts was 13,738 hectares, which included:

- * 4,300ha cereal crops;
- * 1,938ha other arable crops (excluding cereals);
- * 331ha of fruit and vegetables; and
- * 5,938ha grassland.

- 5.5. The distribution of four crop types across Arun District (outlined in blue) in 2010 are represented in Figure 6, and can be seen in the context of West Sussex (outlined in red) and the wider south east England region.

- 5.6. From these figures, it can be seen that cereal and oilseed rape crops do not make up as substantial a contribution to the overall agricultural output of Arun district, as they do in other areas of West Sussex and the south east. The difference may be attributed to the potential for the relatively high quality land of Arun District to produce good yields of higher value fruit and vegetable crops.

- 5.7. The productivity of crops in terms of economics across the Strategic Development Sites been estimated using crop statistics for West Sussex, obtained from Defra and standard gross margins for 2012 to produce an average annual gross margin (AAGM), expressed in terms of per unit area and across the whole site. The full methodology for assessing the AAGM of one hectare of land is given in Appendix 1. For the purpose of this assessment, it is assumed that land of Grades 1 and 2 will consistently produce high crop yields, and that land of Subgrades 3a and 3b will produce average crop yields. It is also assumed that fruit and vegetable crops are grown only on high quality land.

6.3.6. Economic Productivity

Based on the predicted land quality distribution, it is estimated that around 35ha is high yielding land. The AAGM of one hectare of high yielding land has been calculated at £750, and therefore the AAGM at the BREQ site is in the region of £27,000.

The remaining 98ha of the agricultural land of Subgrades 3a and 3b is considered to be capable of producing average crop yields. One hectare of average yields of crops, excluding fruit and vegetables, has an AAGM of around £490 per year. The AAGM of these crops on 98ha at the BREQ site is therefore estimated at around £48,000.

In total, agriculture at the BREQ site is estimated to have an AAGM of around £75,000 per year.

6.3.7. Impact of Development

Most of the site is predicted to be of best and most versatile quality, with the exception of some Subgrade 3b quality land. In the national planning context, loss of Subgrade 3b land is not considered to be of as high significance as loss of best and most versatile land. Therefore, national planning policy states that Subgrade 3b should be used in preference of Grades 1, 2 and 3a.

The loss of the two northernmost fields would have the most significant impact in terms of loss of agricultural land and economic productivity, as they are of Grade 1 and 2 quality and have the most potential to support high value horticultural and field crops. As much of the remainder of the area is also of best and most versatile quality of Subgrade 3a, the resulting impact of development of the BREQ site is likely to be considered a major negative effect.

6.2. Barnham, Eastergate and Westergate (Three Villages)

6.2.1. Site Context

The Site is approximately 3km north of Begnor Regis and is largely enclosed by an arc formed by the villages of Barnham, Eastergate and Westergate. The Site is dissected from east to west by a railway line and in total is estimated at around 160ha.

Appendix 1: Methodology for assessing land gross margins

The value of agricultural land has been calculated on a per hectare basis, using two values: high and average, which refer to the potential crop yields obtainable from the land. It has been assumed in this study that land of agricultural land quality Grades 1 and 2 (excellent to very good quality land) will produce high crops yields, and that land of Subgrades 3a and 3b (good to moderate quality land) will produce average crop yields.

Using food and farming statistics obtained from Defra's June 2010 survey results, the cropping mix across the total farming area of West Sussex could be calculated. Values for horticultural crops were included in the assessment of high yielding land, but were replaced with an equivalent area of wheat crop for the average yielding land, as this is a more representative crop for the associated land capability.

The values of each crop within the cropping mix were derived from the John Nix Farm Management Handbook 42nd edition (2013), which gives gross margin values for high and average yields of crops per hectare grown.

The percentage of the total land area covered by each crop (CA%) was calculated by dividing the area of the crop (TCA) by the total farmed area (TA) of West Sussex, and multiplying by 100.

$$TCA/TA*100 = CA\%$$

The gross margin of one hectare (GMha) of a given crop (taken from Nix, 2013) was multiplied by the percentage of the total farmed area in West Sussex occupied by that crop (CA%). This figure represents the number of hectares out of 100 hectares (or 100%) which the crop would occupy given the crop mix of West Sussex. Dividing this by 100 gives the representative gross margin of the crop within one representative hectare (GMrep).

$$GMha*(CA\%/100) = GMrep$$

Some cereal crop examples are given below:

	Farming Area West Sussex	Arable crops			
	TA (ha)	Wheat TCA (ha)	Winter barley TCA (ha)	Spring barley TCA (ha)	Oats TCA (ha)
	114226	17017	1545	3856	2997
Crop % of total area	TCA/TA*100	14.9	1.4	3.5	2.6
Crop GM per ha GM/CA%/100	GM/ha (high) GM/ha (E)	959.0 142.9	781.0 10.2	738.0 25.6	655.0 17.2
Crop GM per ha GM/CA%/100	GM/ha (average) GM/ha (E)	743.0 115.7	608.0 8.2	600.0 20.8	515.0 13.5

These GM per representative hectare were then multiplied across the number of hectares at each Strategic Development Site containing either Grade 1 or 2 land (high yield values), or Subgrades 3a or 3b land (average values) to give a total average annual gross margin per hectare.

Attachment B

Arun Soils Assessment

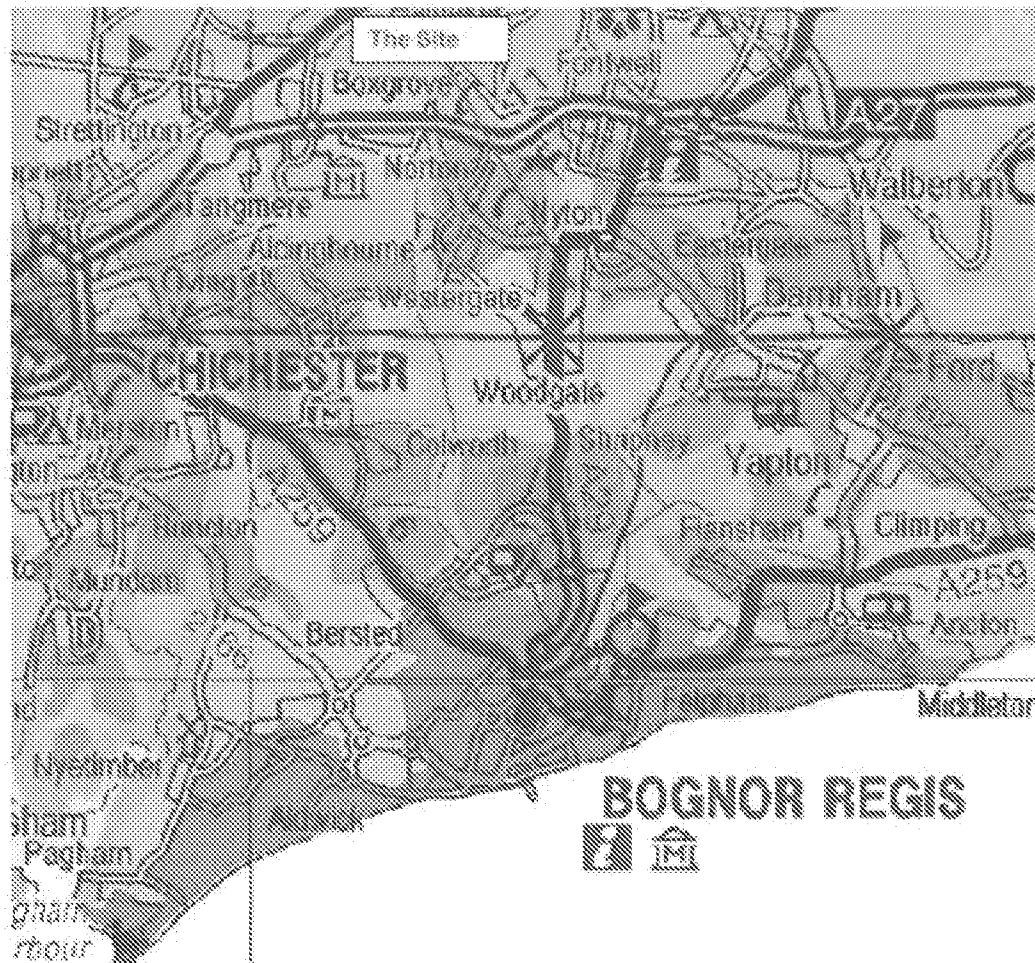
Crop	Wheat	W Barley	S Barley	OSR	Field Beans	Other Cereals
Total area of crop	10,825	1,424	3,206	1,329	1,224	2,780
Total Farmed Area	64,610	64,610	64,610	64,610	64,610	64,610
% of land covered	17%	2%	5%	2%	2%	4%
Gross Margin (average)	1,200	899	951	917	771	938
Number of ha	20105.25	1981.39	4718.94	3886.23	1460.616	4035.97
Gross margin/ha (average)	201.05	19.81	47.19	18.86	14.61	40.36

Plan KCC1

Provisional Agricultural
Land Classification Map
(1983)

88

KCC2243 ALC&C Sept 23



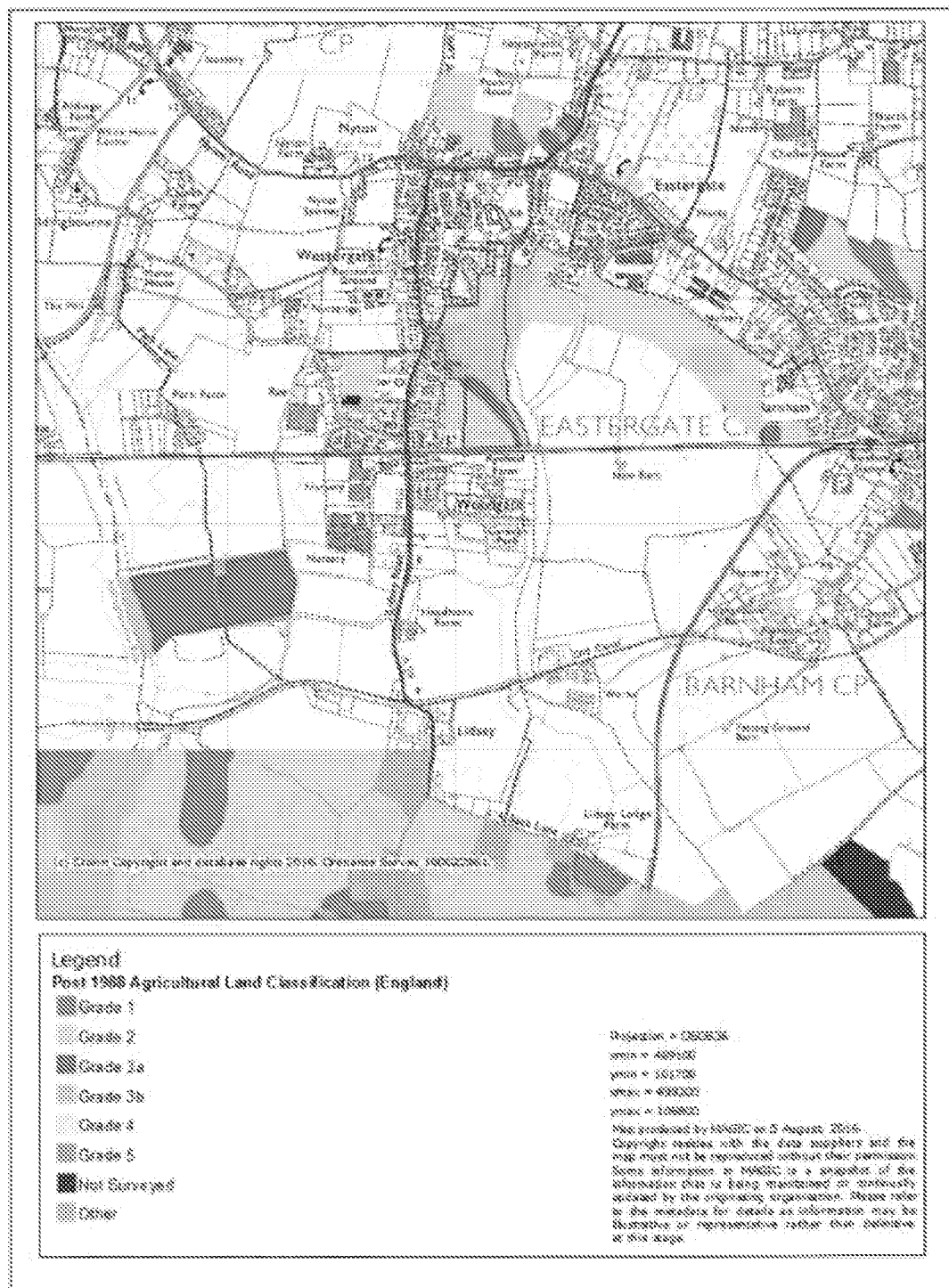
		PLAN	KCC 1
		TITLE	Extract from Provisional ALC Map
		SITE	Land east of Westergate
		CLIENT	Cala Homes (South Home Counties) Limited
		NUMBER	KCC2243/01
		SCALE	NTS
Grade Description 1 Excellent 2 Very Good 3 Good to Moderate 4 Poor 5 Very Poor Non-Agricultural Land Other land primarily in non-agricultural use Land predominantly in urban use		KERNON COUNTRYSIDE CONSULTANTS LIMITED GREENACRES BARN, STONE COMMON LANE, PURTON STOKE, SWINDON, WILTSHIRE, SN6 4LL Tel 01793 771333 Email: info@kernon.co.uk This plan is reproduced from the Ordnance Survey under copyright licence 100014228	

Plan KCC3

Agricultural Land Classification
around Westergate

Site edged red (extract from



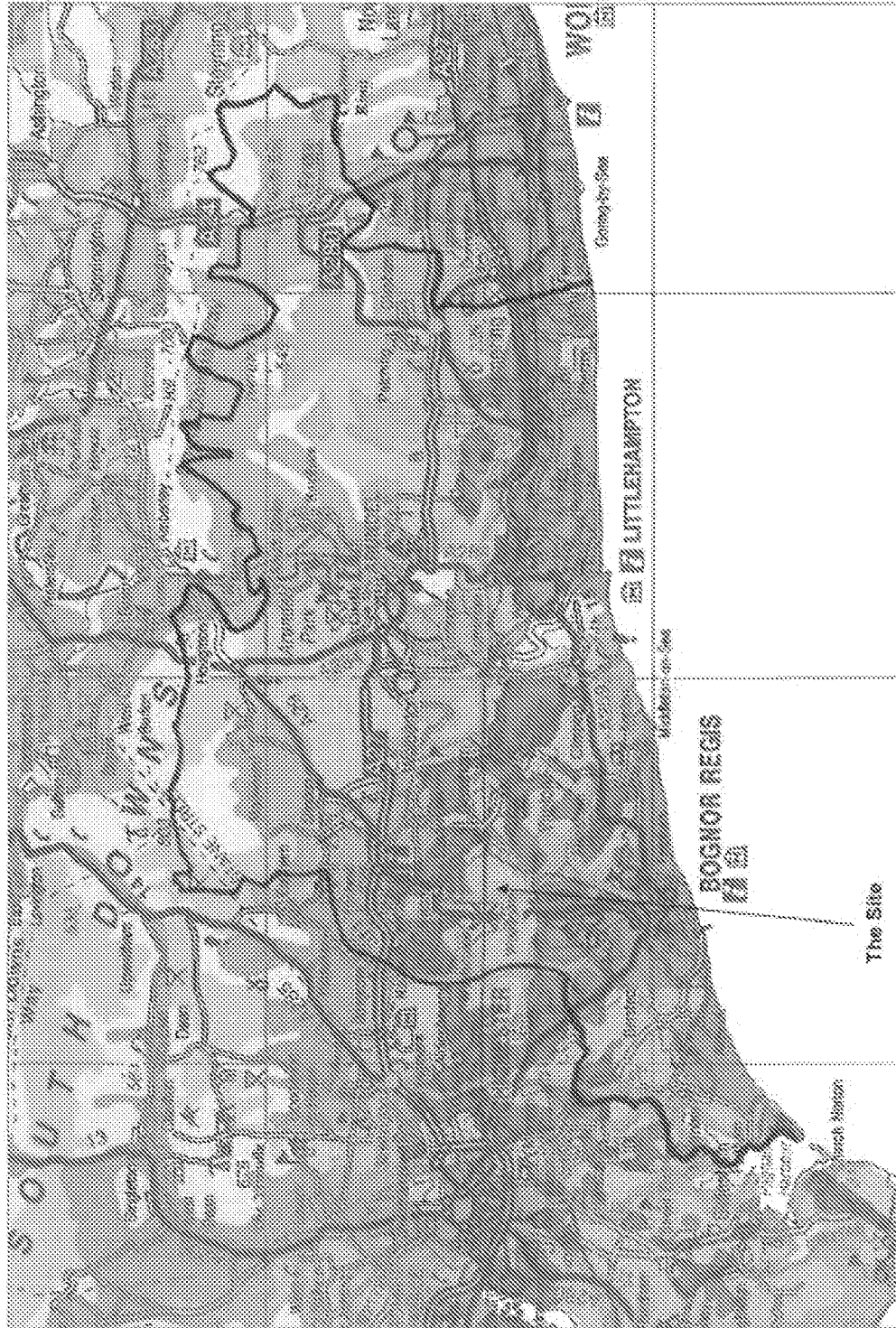


Plan KCC4

Extract from Provisional Agricultural

Land Classification map

Arun District edged black





APPENDIX KCC3
Extracts from Soils and their Use in
South East England (1984)



**Soil Survey of
England and Wales**

**Soils and their Use in
South East
England**

Key to component soil series

Subsoils calcareous above 40 cm	1
Subsoils non-calcareous above 40 cm	3
1. Peat within 80 cm; clayey	FAIRFIELD
No peat within 80 cm	2
2. Clayey	NEWCHURCH
Coarse silty	WISBECH
Fine silty	AGNEY
Silty over clayey	STOCKWITH
3. Peat within 80 cm; clayey	DOWELS
No peat within 80 cm; clayey	Walsnes

Soil water regime

Although pumps are installed, effective control of the water-table is hampered by the low-lying land. The silty soils on the ridges are moderately permeable and sufficiently raised to be well drained (Wetness Class I), or only occasionally waterlogged in winter (Wetness Class II), but the low-lying Dowels, Fairfield and Newchurch soils have a high water-table throughout winter and groundwater may occur in the lower part of the soil in summer in the wettest spots (Wetness Classes III and IV). Peat shrinkage and ground surface subsidence following drainage makes further improvement difficult to achieve. Agney and Wisbech soils retain large amounts of water available to plants and are non-droughty. Dowels, Fairfield and Newchurch soils have a smaller water holding capacity, but the underlying peat is water retentive and crops benefit from the relatively high summer groundwater.

Cultivation and cropping

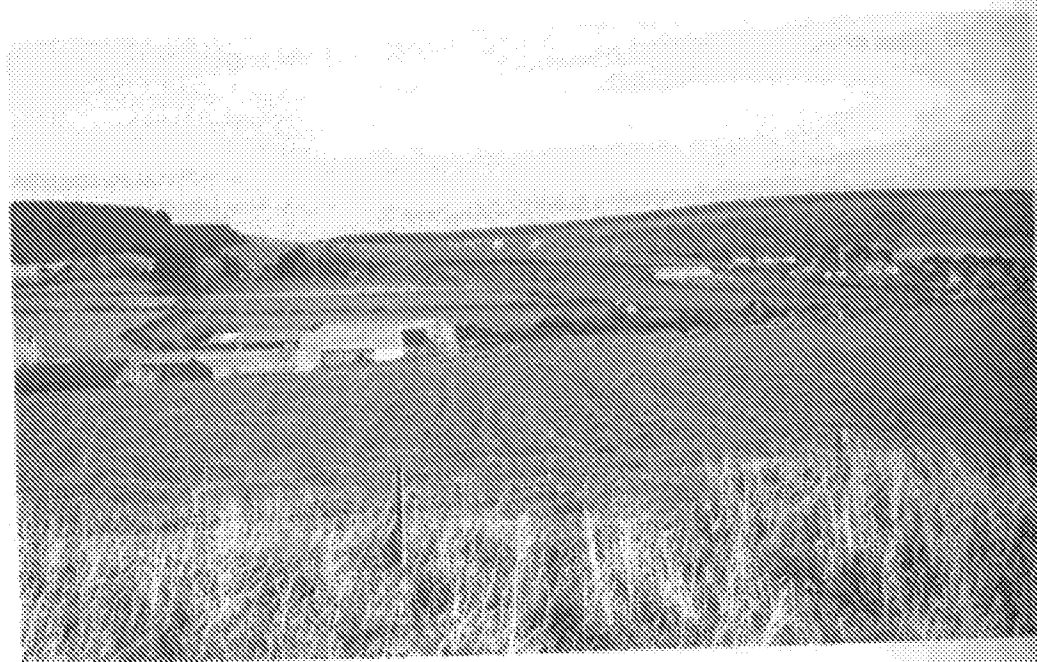
The land in Romney Marsh is mainly permanent grassland carrying both sheep and cattle although there is some arable. Much of the land is difficult to drain effectively and so is unsuitable for cultivation. There are ample opportunities for traditional cultivations in autumn on the silty soils, but even where the land is drained, suitable conditions for the tillage of the extensive clay soils are limited and this controls the timing of all cultivations. In wet years, opportunities for spring landwork are negligible. Where the clayey soils contain large amounts of exchangeable sodium the structure is poor and careful management is necessary to avoid damage. Available phosphorus and potassium are low in the subsoils of the silty soils and manganese deficiency may occur in crops on the heavy textured alkaline soils affected by high groundwater (Green 1968).

§ 36. EFFORD 1 ASSOCIATION

571a

Well drained brown fine loamy soils on level or gently sloping river or marine terraces where drift overlies non-calcareous gravel are dominant in this association. Efford soils

are slightly or moderately stony, fine loamy typical argillic brown earths with gravelly subsoils. The associated Ludford soils are similar argillic brown earths but occur where thicker loamy drift covers the gravel. Fine loamy Waterstock soils, gleyic argillic brown earths, and Shabbington soils (§ 99), typical argillic gley soils, are confined to narrow valleys and lower ground at the margins of river terraces. The association occurs mainly in Hampshire, Bedfordshire and Cambridgeshire, but there are small areas in Essex, West Sussex, Dorset and the Isle of Wight (Plate 17).



M. G. Jones

Plate 17. Brighthelm, Isle of Wight. In the foreground are well drained loamy soils of the Efford 1 association with slowly permeable Oxpasture soils behind the buildings. The sloping land to the left is on Fyfield 4 association. On the distant high ground of the Chalk there are shallow Icknield soils on the slopes with Carstens association in the woods on the crest.

The association is found mainly on the lower parts of the south Hampshire coastal plain, where thin loamy drift covers gravel, possibly of marine origin (Jones 1981). The soils are predominantly fine loamy, but some coarse loamy well drained soils of the Hucklesbrook (§ 60) and Maplestead series (§ 89) occur between Exbury, Lepe and Fawley. On lower slopes and valley bottoms there are inclusions of Swanwick (§ 92), Hurst (§ 61) and Park Gate soils (§ 74).

The soils are developed over marine gravel in West Sussex (Fig. 48, § 54) where they were formerly mapped as Lyminster and Calcetto series by Hodgson (1967). In the Arun

Efford series

(Full description p.377)

0-20 cm — Ap

Dark greyish brown, slightly stony sandy silt loam or sandy loam.

20-30 cm — Eb

Dark greyish brown, slightly stony clay loam; weak medium angular blocky structure.

30-60 cm — Bt1

Yellowish brown, stoneless clay loam; moderate coarse prismatic structure.

60-75 cm — Bt2

Yellowish brown, moderately stony clay loam; weak coarse prismatic structure.

75-100 cm — 2BCt

Brownish yellow, very stony, sandy gravel.

Ludford series

(Full description p.384)

0-25 cm — Ap

Brown, slightly stony sandy silt loam or clay loam.

25-50 cm — Eb

Dark yellowish brown, slightly stony clay loam or sandy clay loam; moderate medium angular blocky structure.

50-120 cm — Bt

Yellowish brown, slightly or moderately stony clay loam; moderate medium angular blocky or prismatic structure.

Waterstock series

(Full description p.391)

0-25 cm — Ap

Brown, slightly stony clay loam.

25-40 cm — Bt

Yellowish brown, slightly stony clay loam; moderate medium subangular blocky structure.

40-55 cm — Btg1

Yellowish brown, slightly mottled, slightly stony clay loam; moderate medium subangular blocky structure.

55-65 cm — 2Btg

Pale yellow, mottled, slightly stony clay loam; weak fine angular blocky structure.

65-120 cm — 2BCtg

Brown, mottled, very stony sandy loam; structureless.

valley south of Pulborough, Hucklebrook, Maplestead and Hurst soils are also present on the river terraces. On the Isle of Wight, the association is mapped on thicker relatively stoneless drift over gravel, and Ludford (§ 36) and Maplestead soils predominate. The usual wetter associate soils are absent. In north Hampshire around Eversley, an area dominated by coarse loamy Hucklebrook and Swanwick soils has been mapped with the association.

Key to component soil series

Unmottled soils	1
Mottled soils	4
1. Gravel within 80 cm	2
Deeper soils	3
2. Fine loamy	EFFORD
Coarse loamy	Hucklebrook
3. Fine loamy	LUDFORD
Coarse loamy	Maplestead
4. Subsoil faintly mottled above 60 cm or distinctly mottled between 40 and 80 cm; fine loamy	WATERSTOCK
Prominently mottled or greyish above 40 cm	5
5. Gravel within 80 cm; coarse loamy	Hurst
Deeper soils	6
6. Fine loamy	SHABBINGTON
Coarse loamy	Swanwick
Fine silt	Park Gate

Soil water regime

Soils of this association have a wide range of water regimes, but Efford and Ludford soils are permeable, well drained and rarely wet (Wetness Class I). Winter rain is quickly absorbed and there is little surface run-off, except on arable land with poor soil structure. However, Waterstock and Shabbington soils on valley sides and floors are affected by groundwater held up by underlying impermeable clays and are seasonally waterlogged (Wetness Class III). These soils benefit from drainage measures, but often their small extent and distribution pattern make improvement impractical. Because Efford soils have very stony subsoil layers, they are moderately droughty for cereals; the deeper Ludford soils are less droughty. All the soils are moderately droughty for potatoes and very droughty for grass, and in dry years all crops may suffer severely.

Cultivation and cropping

Most of the flat land on the river terraces is easy to work and in most years there are long periods in autumn and adequate opportunities in spring for farm operations (Fig. 40). Difficulties can arise in wet springs, however. Unless drained, Waterstock and Shabbington soils are little used for arable farming and land in the valleys is under permanent pasture. The large silt and fine sand content of most topsoils causes unstable structure particularly in arable fields where amounts of organic matter are small. Slaking and pan formation are exacerbated by careless timing of farm operations. The physical properties of these soils make them unsuitable for direct drilling of cereals. Under natural conditions, the soils are slightly acid, and liming can be necessary for successful cultivation of crops such as barley and red clover. Phosphorus content is usually low, though moderate amounts in many topsoils reflect past fertilizer dressings.

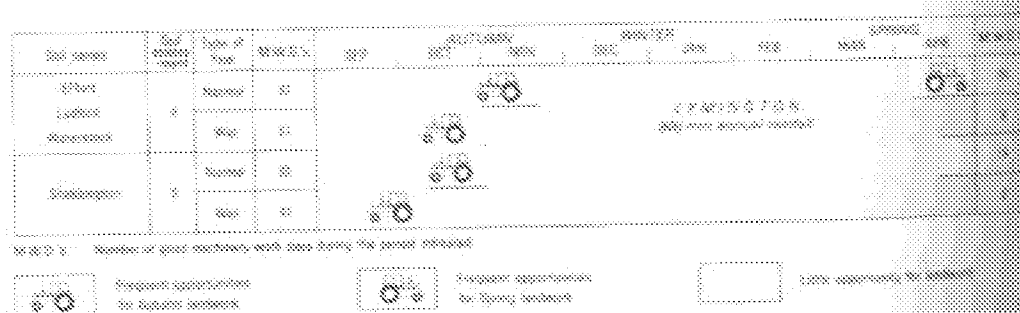


Figure 40. The effects of soil and climate on landwork, Efford I association

Grassland productivity is severely restricted by droughtiness, and cereal ley rotations are the usual practice. Grass yields are enhanced in south Hampshire and West Sussex, however, by an autumn flush of growth. Soft fruit and potatoes are also grown, and respond to irrigation. In south Hampshire, some land remains as woodland and provides cover for game birds. Glasshouse crops are grown north of Lymington.

4. Coarse loamy Fine loamy Fine silty	SWAFFHAM PRIOR SOHAM PANHOLES
5. Calcareous; fine silty Non-calcareous	COMBIE 6
6. Fine loamy Coarse loamy	WEASENHAM Moulton

Soil water regime

The soils are permeable and well drained (Wetness Class I), and on gentle slopes excess winter rain is rapidly absorbed. The soils have moderate reserves of water, though where the crop is able to extract water from the underlying Chalk, there may be more water available to plants. The soils are slightly droughty for common arable crops, but are moderately droughty for grass. Vegetable and salad crops grown on Friham soils need irrigation to achieve maximum yields.

Cultivation and cropping

The association comprises easy working soils so most of the land is cultivated. Figure 44 illustrates the period suitable for landwork in a typical location near Maidenhead. There are plenty of opportunities for both spring and autumn cultivations in average years, but



Figure 44. The effects of soil and climate on landwork, Friham association

there may be only a few suitable days in a wet spring and timely cultivations are essential to avoid compaction and damage to topsoil structure. The soils are suitable for minimum cultivation and direct drilling techniques. Poaching risk is negligible on all these soils but droughtiness reduces grass production. Cereals and short leys are the main crops but vegetables and some fruit are grown locally on Friham and Weasenhams soils in Surrey, near London and in east Berkshire. Rudham and Andover soils on steep slopes are usually under permanent grassland or woodland.

§ 48. FROME ASSOCIATION

§12a

The Frome association includes soils in chalky and gravelly alluvium beside streams draining the Chalk and adjacent Tertiary formations. The thickness of alluvium varies

but in most valleys fine-textured deposits rest on flint and/or chalk gravel; calcareous marl and peat bands occur locally. The soil patterns are commonly complex and the proportions of different kinds of soil vary. Frome series, calcareous alluvial gley soils, is common to most valleys. These soils are grey and mottled silty clay loams affected by high groundwater with calcareous flint and/or chalk gravel at relatively shallow depth. Associated Racton soils, typical alluvial gley soils, are similar but non-calcareous. Extremely calcareous, mottled Wylie soils, gleyic rendzina-like alluvial soils, Gade series, calcareous humic-alluvial gley soils, with humose topsoils and mottled silty over gravelly subsoils and Adventurers' soils, earthy eutro-amorphous peat soils, are extensive in some valleys.

Frome series

(Full description p.379)

0-10 cm — Ah

Dark greyish brown, stoneless silty clay loam; calcareous

10-80 cm — Bg

Grey, mottled, very slightly stony silty clay loam; moderate medium prismatic structure; calcareous.

80-100 cm — 2Cu

Extremely stony sandy loam; calcareous.

Wylie series

(Full description Cope 1976, p.126)

0-15 cm — Ah

Dark greyish brown, silty clay loam; strong fine subangular blocky structure; extremely calcareous.

15-50 cm — BCg

Greyish brown, mottled, silty clay loam; moderate medium prismatic or weak medium subangular blocky structure.

50-100 cm — 2Cug

Light brownish grey, mottled, very stony silty clay loam; weak blocky structure; calcareous.

Racton series

(Full description p.387)

0-15 cm — Ah

Dark brown or dark greyish brown, stoneless silty clay loam; blocky structure.

15-50 cm — Bg

Brownish or greyish, mottled, slightly stony silty clay loam; blocky structure.

50-100 cm — 2Cg

Flinty, chalky gravel.

Adventurers' series

(Full description Seale 1973b, p.84)

0-25 cm — Op

Black, stoneless humified or loamy peat.

25-80 cm — Oh1

Black, stoneless humified peat; weak angular blocky or moderate medium prismatic structure.

80-100 cm — Oh2

Dark reddish brown, stoneless humified peat; massive structure.

100-120 cm — Cg

Grey, stoneless clay loam or sandy loam; massive structure.

Gade series(Full description Jarvis, M.G. *et al.* 1979, p.243)

0-15 cm — Ah

Black, stoneless humic silty clay loam or clay loam.

15-50 cm — Bg

Grey, mottled, stoneless silty clay loam; moderate medium prismatic structure; calcareous.

50-100 cm — Cg

Very stony silty clay loam or silty loam; calcareous.

Racton soils are dominant in Chiltern valleys north of Slough, though Colthrop (Jarvis *et al.* 1979) and Wylie soils are common locally. Sulham (Jarvis *et al.* 1979) and Gade soils characterize the Pang valley, whereas Brimpton (Appendix 2, p.374), Gade and Broadmoor (Jarvis *et al.* 1979) are the main soils along the Kennet. In Kent and parts of Hampshire, for example, the upper Test and Itchen valleys, Gade soils are mixed with Adventurers' peat soils, some of which have gravel at moderate depth. The Whitewater near Hook in Hampshire is flanked by Gade and Racton soils.

Key to component soil series

Peat thicker than 40 cm	ADVENTURERS
Mineral soils	1
1. With grey or brown, distinct topsoil	2
With dark, humose or peaty topsoil	6
2. Calcareous gravel within 80 cm	3
Deeper soils, subsoil calcareous above 40 cm	5
3. Very pale grey, loamy	WYLYE
Fine silty	4
4. Subsoil calcareous	FROME
Subsoil non-calcareous	RACON
5. Fine silty	Watering
Clayey	Thames
6. Silty over gravelly; calcareous above 40 cm	GADE
Coarse or fine loamy; non-calcareous within 40 cm	Sulham
Loamy over peat; very pale grey	Brimpton

Soil water regime

There is much variation in water regime even among soils of the same type. Most soils show some evidence, in the form of grey and ochreous mottling, of periodic or prolonged waterlogging by groundwater. Field observations suggest that mottled soils with humose topsoils may be waterlogged for part of the growing season (Wetness Class IV or V) whereas non-humose alluvial gley soils are wet only in winter (Wetness Class III or IV). Where effective pump or arterial drainage schemes operate, waterlogging is reduced to short periods in winter (Wetness Class III). Floods only occur in the lower reaches of the wider valleys. Much of this alluvial land was formerly used as water meadows (§ 11). Fields were flooded during late winter from a series of ditches to promote early grass growth. The ditches and retaining banks of these now abandoned systems often hinder land use and many have been levelled.

Cultivation and cropping

Most land is under permanent grass used for summer grazing and grass conservation. Where pump drainage schemes operate, some arable crops are grown, chiefly winter cereals. Even where former water meadows have been improved there are still patches of peat filling old ditches which poach easily and have little bearing strength. Though grass grows well, poor trafficability and risk of poaching restricts the land to seasonal use when undrained. Some valleys provide valuable wetland habitats (§ 115).

§ 49. FYFIELD I ASSOCIATION

571d

Some of the most useful agricultural land in Surrey, east Hampshire and West Sussex is included in this association which is developed on the Lower Greensand. The coast

grown in Kent and Sussex, particularly around Hadlow and Marden. Because available soil moisture is limited in summer, especially in the Medway valley near Tonbridge, grass growth is limited although there is little risk of poaching.

§ 100. WICKHAM 1 ASSOCIATION

711c

This association, which is confined to Kent, Surrey and Sussex, is the most extensive in the Low Weald (Fig. 68) where intermittent thin drift rests on Atherfield and Weald Clays. It also occurs in the High Weald (Fig. 36, § 32) over Wadhurst and Grinstead Clays. It includes most of the land mapped as the Thorne-Hildenborough and the Thorne-Titchfield associations by Fordham and Green (1980) in their earlier survey of Kent.

In the Low Weald, the relief is subdued ranging from 30-90 m O.D. and the land is level or gently sloping with a few steeper slopes, often where thin limestone or sandstone bands outcrop. Between Tonbridge and Reigate, springs rise near the foot of the Lower



of N. J. Green

Plate 31. Curriden and Wickham 1 associations, Goudhurst, Kent. Cropping in the High Weald includes top fruit, particularly on the drier soils of the Curriden association, cereals and grass. Here, the high land has slowly permeable soils in the Wickham 1 association. The hidden lower ground is the Teise valley with Fladbury 1 association.

Greensand scarp and dissect the Weald Clay into a series of north-south ridges with gentle or moderate slopes capped in places by flinty and cherty river terrace deposits. Relief is stronger in the High Weald (45–200 m O.D.) (Plate 31) with moderately to steeply sloping valley sides separated by gently sloping interfluvies.

The main soils in this association are seasonally waterlogged and grey and ochreous mottled. Wickham soils are fine silty or fine loamy over clayey typical stagnogleys and Denchworth and Dale soils clayey peis-stagnogleys. Oxpasture soils (§ 73), stagnogleyic argillic brown earths, are similar to Wickham but less mottled. Wickham series includes soils previously described as Titchfield and Hildenborough series by Fordham and Green (1980) and, similarly, Denchworth and Dale soils were mapped together as Thorne series. Denchworth and Dale series differ in their clay mineralogy; Denchworth soils are developed in clays which shrink and crack appreciably on drying, and Dale soils in clays which do not. The thin fine silty bands and generally large silt content of the Weald Clay are commonly reflected in the subsoils of all the soils. Some Wickham soils have stony upper horizons.

Wickham series

(Full description p.392)

0–20 cm — Ap_g

Dark greyish brown, mottled, stoneless or slightly stony silty clay loam or clay loam.

20–40 cm — Eg

Greyish brown, mottled, slightly stony clay loam; moderate medium and fine subangular blocky structure.

40–60 cm — 2B_{tg}

Strong brown with many grey mottles, stoneless or slightly stony clay; strong medium angular blocky structure.

60–100 cm — 2BC_g

Grey with many ochreous mottles, stoneless clay; strong coarse prismatic structure.

Denchworth series

(Full description Palmer 1982, p.153)

0–25 cm — Ap

Dark greyish brown, slightly stony clay loam or clay.

25–65 cm — B_g

Grey with many ochreous mottles, stoneless clay; weak medium subangular blocky structure.

65–100 cm — BC_g

Grey, mottled, stoneless clay; weak coarse prismatic structure; calcareous.

Dale series

(Full description Hollis 1975, p.62)

0–20 cm — Ap_g

Dark greyish brown, slightly mottled, stoneless clay or clay loam.

20–50 cm — B_g1

Strong brown, mottled, stoneless clay; strong coarse prismatic structure.

50–100 cm — B_g2

Grey with many ochreous mottles, stoneless clay; strong coarse prismatic structure.

100–120 cm — BC_g

Grey, mottled, clay; massive or coarse platy structure.

Most of the Wickham soils have fine silty topsoils, probably remnants of aeolian silty drift, although they are thin on moderate or strong slopes. These upper horizons are variably stony, more so in the west of the Weald on ridge crests. Denchworth and Dale series occur on moderate to steep slopes and are often associated with thin limestone bands; in places these soils are dominant as in the broad belt of level or gently sloping land from Shadoxhurst, north of Tenterden, to Biddenden. Reddish Brockhurst (Reeve and Thomasson 1981) and Spetchley soils (§ 104) are found sporadically throughout the Low Weald, in red beds in the Weald Clay. Oxpasture soils occur on valley sides, often where the fine loamy or fine silty drift is thicker than usual. Evesham (§ 39) and Haselcor soils (§ 39) occur locally on or near thin *Paludina* limestone bands.

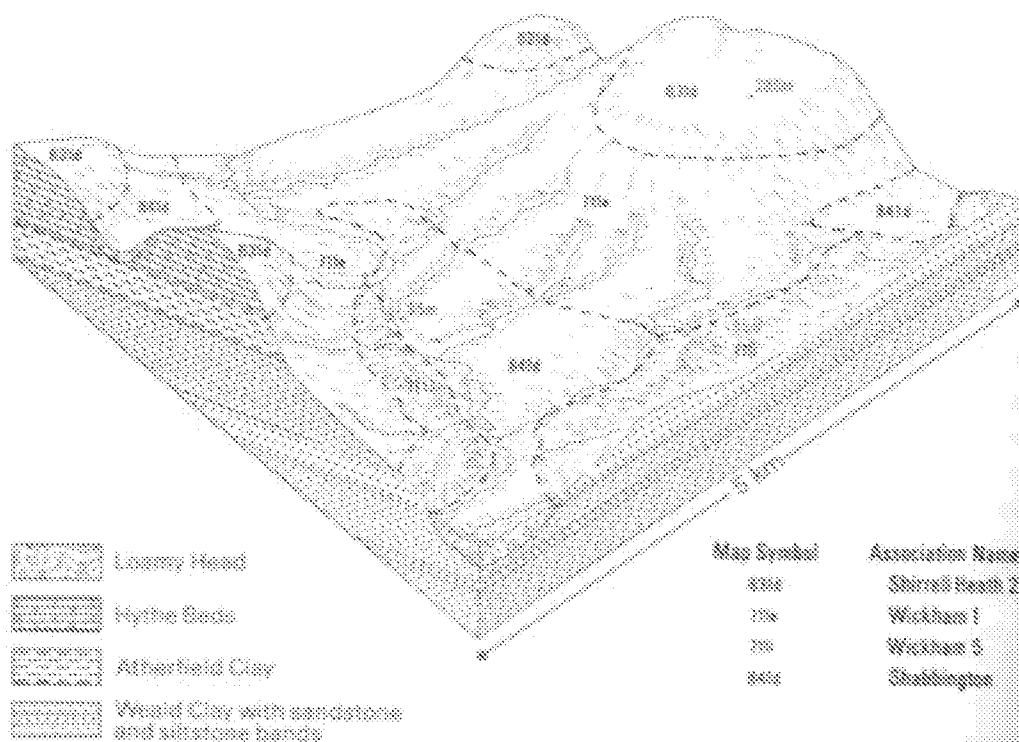


Figure 68. Soil associations in the western Weald

Inclusions of Curtisen (§ 32) and Cranbrook series (§ 32) occur over thin siltstone and sandstone bands, especially in the High Weald. Here, the soil pattern in valleys is made more complex than that on ridge crests by the presence of thin superficial drift, derived in part from the Tunbridge Wells Sand upslope, and Oxpasture soils are more common than elsewhere. Near Dorking, thicker sandstone layers in the Weald Clay form low ridges with some Fyfield soils (§ 51). Small inclusions of Shabbington soils (§ 99) are developed in patches of low-lying stony Head or river terrace deposits in minor valleys and of Conway (§ 45) and Fladbury soils (§ 45) in narrow strips of alluvium too small to separate. Around Edenbridge, Waterstock soils (§ 99) are common on high level river terrace deposits or Head which cover the Weald Clay.

Key to component soil series

Soils with clayey horizons	1
Soils without clayey horizons	4
1. Fine silty or fine loamy over clayey	2
Clayey throughout; prominently mottled or greyish above 40 cm	3

- | | |
|--|-----------------------------------|
| 2. Prominently mottled or greyish above 40 cm
Subsoil faintly mottled above 60 cm or distinctly
mottled between 40 and 80 cm | WICKHAM |
| | OXFORD |
| 3. Over clay or mudstone

In river alluvium | DENCHWORTH or
DALE
Fladbury |
| 4. Prominently mottled or greyish above 40 cm
Subsoil faintly mottled above 60 cm or distinctly
mottled between 40 and 80 cm | 5
7 |
| 5. Fine loamy
Silty | Shabington
6 |
| 6. Over siltstone
In river alluvium; fine silty | Cranbrook
Conway |
| 7. Fine loamy
Silty | Watersnook
Curtisden |

Soil water regime

Wickham, Denchworth and Dale series have slowly permeable subsoils and are waterlogged for long periods in winter (Wetness Class IV) when undrained. Appropriate field drainage measures achieve some improvement, though it is often difficult to reduce



Fig. 32. Erosion

Plate 32. Erosion of Wickham soil series near East Grinstead. Weak-structured topsoils on sloping land in the High Weald are susceptible to erosion during heavy rainfall. Here, silty material has accumulated at the foot of a gullied 11° slope.

Cultivation and cropping

Self service	Self service hours	Type of Year	MWEP's	SEP	DEC	APRIL/JUNE	SEP	DEC	APRIL/JUNE	SEP	DEC	APRIL/JUNE	SEP	DEC	APRIL/JUNE	MWEP's
Weather	10	Normal	40													0
		Wet	10													0
Construction & Dike	0	Normal	00													0
		Wet	00													0
Debris	1	Normal	00													00
		Wet	00													0

MWEP's : Number of good machinery work days during the period indicated


 Frequent opportunities
for farmers' workload


 Frequent opportunities
for farmers' workload


 Little opportunity for workload

The limited opportunities for cultivation are reflected in land use—ley and permanent grass and winter cereals are the main crops. A little top fruit is also grown, for example near Wisborough Green in West Sussex and near Marden in Kent. The grassland is used chiefly for dairying though sheep and beef cattle are also important. There is a moderate risk of poaching, the greatest being on Denchworth and Dale soils, in higher rainfall areas or where the soils are undrained. Summer growth of grass is restricted by drought and the grazing value of some undrained permanent grass fields is reduced by rush infestation. The soils are naturally acid and require regular liming. Amounts of potassium are usually adequate but regular dressings of phosphorus fertilizer are needed.

There is much woodland on these soils, particularly in the High Weald. For new plantings the slowly permeable clayey subsoils restrict the choice to species tolerant of seasonally

waterlogged ground (§ 114) including Corsican pine, Norway spruce, western hemlock and western red cedar. Shallow rooting often leads to poor growth and windthrow where exposed. Weed competition is severe on all soils and fine ploughing is needed before planting to suppress weeds and assist surface drainage.

A large proportion of the older woodland is coppiced and contains many plant species indicative of ancient origin (§ 115), for example butcher's broom (*Ruscus aculeatus*), wild service tree (*Sorbus torminalis*) and hawthorn (*Crataegus laevigata*). Several woods in Kent, Surrey and Sussex are preserved for their scientific value (Ratcliffe 1977). Much land is acid, but calcicole floras are developed locally on Haselor and Evesham soils. Hornbeam coppice, which occurs widely, is dominant in Ham Street Woods along with areas of coppiced hazel, sweet chestnut and oak below oak standards. Wood anemone (*Anemone nemorosa*), primrose (*Primula vulgaris*), bluebell (*Hyacinthoides non-scripta*) and honeysuckle (*Lonicera periclymenum*) are typical of the coppices, with bracken (*Pteridium aquilinum*) and bramble (*Rubus* spp.) in more open areas. Staffhurst Wood near Oxted has oak and beech woodland with hornbeam and beech coppice accompanied by holly and yew. Field maple, dog's mercury (*Mercurialis perennis*) and sanicle (*Sanicula europaea*) occur in base-rich areas. The Mens and The Cut near Wisborough Green have high forest of sessile and pedunculate oak.

§ 101. WICKHAM 2 ASSOCIATION

711f

Fine loamy over clayey Wickham soils (§ 100), typical stagnogleys, developed in thin loamy drift over Jurassic and Cretaceous clays, are dominant in this association which is extensive in lowland vale country in the Midlands and in southern England. Clayey Denchworth soils (§ 100), pelo-stagnogleys, are common where drift is absent. The better-drained Oxpasture series (§ 73), stagnogleytic argillic brown earths, and clayey Evesham series (§ 39), typical calcareous pelosols, are sporadically distributed. The association is found mostly in lowland vale country.

In South East England the association occurs on low ground in Oxfordshire and Buckinghamshire, over Lower Lias (Fig. 70), Oxford (Fig. 60, § 76), Kimmeridge and Gault Clays. On the Lias, it is present on the lower slopes of valleys, particularly along the Cherwell, below ridges capped by Middle Lias ironstone or Great Oolite limestone. Elsewhere the association occurs below the Corallian scarp and at the margins of river terraces. Oxpasture soils feature only occasionally, and Evesham soils are restricted to river terrace bluffs and to ground near the Corallian scarp. Some Kings Newton soils (§ 25) have been recorded on the terrace drifts and near the Upper Greensand outcrop. Where the drift is clayey, Lawford soils (§ 106) occur. Rowsham soils have been recorded in the Tiddington area (Hazelden n.d.).

§ 74. PARK GATE ASSOCIATION

841c

Deep stoniless silty Park Gate and Hook soils, typical argillic gleys and gleyic argillic brown earths respectively, are dominant in this association. Park Gate soils are affected by seasonally high groundwater and have grey and ochreous mottled subsoil colours. Hook soils which are only occasionally waterlogged and less mottled usually occur slightly higher in the landscape. The soils are developed in acolian silty drift, mainly over fluvial and marine gravels. They occur on flat and gently sloping low-lying land on the West Sussex Coastal Plain (Fig. 48, § 54), in Hampshire and Essex. They are also found along the East Stour and Medway valleys in Kent and in the Thames and Colne valleys. In Hampshire and Kent, the silty drift also extends over Tertiary and Weald Clays, giving inclusions of Wickham series (§ 100) locally where the silty drift thins out and clay occurs within the soil profile. There are also inextensive inclusions of Hamble series (§ 53) particularly on the higher, better drained land, and of stony seasonally waterlogged fine loamy Shabbington soils (§ 99) in low-lying positions where silty drift has been mixed with pebbly and more loamy deposits.

Park Gate series*(Full description p. 386)*

0-20 cm — Ap

Brown, stoniless silty clay loam.

20-35 cm — Eg

Brownish grey, mottled, stoniless silty clay loam; weak medium subangular blocky structure.

35-60 cm — Btg1

Brown with many ochreous mottles, stoniless silty clay loam; moderate medium subangular blocky structure.

60-100 cm — Btg2

Brown with many grey mottles, stoniless silty clay loam; moderate coarse subangular blocky structure.

Hook series*(Full description Green and Fordham 1973, p. 151)*

0-25 cm — Ap

Dark greyish brown, stoniless silt loam or silty clay loam.

25-50 cm — Eb

Brown, stoniless silt loam or silty clay loam; weak fine subangular blocky structure.

50-80 cm — Btg

Yellowish brown, mottled, stoniless silty clay loam; weak or moderate medium subangular blocky or prismatic structure.

80-100 cm — BCg

Light brownish grey, mottled, stoniless silt loam or silty clay loam; weak coarse angular blocky structure.

Detailed mapping on the West Sussex Coastal Plain by Hodgson (1967) shows that many areas consist almost wholly of Park Gate soils. Hook and Hamble are the main subsidiary soils, and Shabbington series occurs sporadically. A similar extremely flinty fine silty seasonally waterlogged soil, formerly described by Hodgson (1967) as Binsted series, is present near the foot of the South Downs dip slope. In Hampshire, the association occurs on the westward extension of the coastal plain at Stubbington where silty drift covers river gravels or London Clay. Small inclusions of Wickham series are ubiquitous.

In Kent, the association occurs as narrow strips along valley bottoms and as wider spreads on the lower slopes of the valleys of the Medway north of Paddock Wood and of the East Stour. Here, Park Gate, Hook and Hamble soils occur, with some Wickham soils in places. In the Thames valley east of Slough, Park Gate and Hook soils are found where silty drift overlies London Clay. Along the Colne valley around Denham, Park Gate series is dominant but Hook and Hamble soils are also present, the latter on higher ground. Similar shallow soils occur where the silty drift is thin over flinty river terrace gravels. In Gunnersbury Park, Hamble series is generally found upslope of Hook and Park Gate soils and in Osterley Park, Park Gate and Hook series are present in equal proportions but around Southall, Park Gate is more common than Hook series.

Key to component soil series

Fine silty soils, stoneless	1
Soils with fine loamy horizons; prominently mottled or greyish above 40 cm	2
1. Prominently mottled or greyish above 40 cm	PARK GATE
Subsoil faintly mottled above 60 cm or distinctly mottled between 40 and 60 cm	HOOK
Unmottled	Hamble
2. Fine loamy	Shabbington
Fine loamy over clayey	Wickham

Soil water regime

The soils are moderately permeable and affected by high winter water-tables. Park Gate soils are seasonally waterlogged (Wetness Class III or IV), but Hook soils are only occasionally affected (Wetness Class II). Where there are satisfactory outfalls, appropriate drainage treatments can reduce the duration of waterlogging, especially in the upper layers of the soil, and Park Gate soils are then well drained or occasionally waterlogged (Wetness Class I or II) and Hook soils well drained (Wetness Class I). However, Hodgson (1967) noted that over much of the West Sussex Coastal Plain, drainage shortens the period in which waterlogging persists rather than reducing the maximum height to which the water-table rises. The flat landscapes generally prevent much surface run-off and winter rain passes downward through the soil. Infiltration is impeded by surface soil compaction, and water may stand on fields for much of the winter. Subsoiling when the soil is dry helps to form fissures and so improves infiltration and throughflow. Comparison of the amount of water available for crop growth and potential soil moisture deficits indicate that cereal yields are slightly limited because of droughtiness, and grass yields are likely to be severely depressed in dry summers.

Cultivation and cropping

With appropriate drainage measures, Park Gate and Hook soils are easy to work (Fig. 59). Good crops of cereals and roots can be grown but because of wetness and limited

opportunities for landwork in spring the soils are best suited to autumn and winter crops. In the drier districts of Kent there are, in general, 20 to 30 more days for autumn cultivation than in Hampshire and West Sussex. Although horticultural crops are grown, there are difficulties from soil wetness in winter despite drainage improvements. Since grass growth is seriously limited by drought in summer and there is risk of severe poaching in winter, the land is not well suited for continuous pasture; grass yields are enhanced in Hampshire and West Sussex, however, by an autumn flush of growth.

The large silt content of the soils makes them liable to cap and pan where they are under long term cultivation and organic matter contents are small. Capping often occurs during periods of heavy rain when fields are sparsely vegetated. Pans are easily created by cultivating the soils when too wet and plastic and the topsoil structure is easily damaged during the autumn harvesting of root crops if the soils are wet. The soils are naturally acid, and very low in phosphorus and potassium (Hodgson 1967). Chalking in previous times has done much to alleviate acidity, notably in those areas adjacent to chalk or calcareous drift deposits.

Arable farming is predominant with winter wheat and winter barley the principal crops. Oilseed rape and dry harvest peas are important break crops. Potatoes are grown where irrigation is available and in West Sussex early potatoes are grown. Glasshouse vegetable growing is a prominent but declining enterprise, most notably around Sidlesham on the West Sussex Coastal Plain where the Land Settlement Association estate was established in 1935 (Hodgson 1967). Pears and apples are grown in Kent between Marden and Hadlow, around Iwade and south of Hoo.

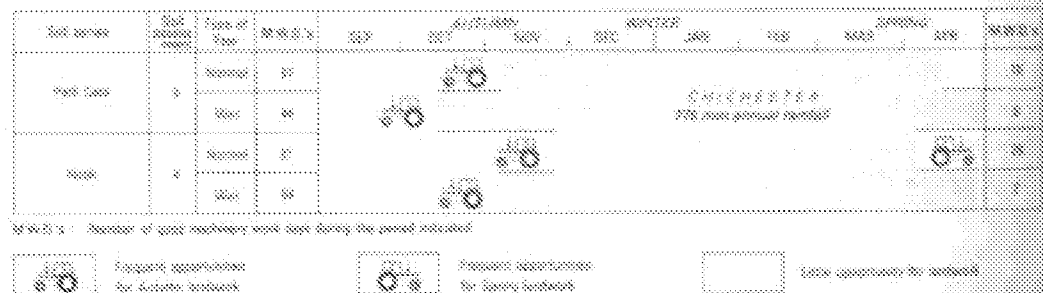


Figure 59. The effects of soil and climate on landwork, Park Gate association

§ 75. POUNDGATE ASSOCIATION

643b

This is the principal soil association in Ashdown Forest, a scenic tract of heathland (Plate 34, § 115) and woodland with a little farmland situated at the heart of the High Weald west of Crowborough in East Sussex. It is characterized by very acid podzolized soils formed and still largely under open heath. Associated with these are other acid soils on

APPENDIX KCC4
Extracts Construction Code of
Practice (2009)

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Construction Code of Practice for the Sustainable Use of Soils on Construction Sites



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Material change for
a better environment

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Department for Environment,
Food and Rural Affairs

Soil management during construction

5.4 Soil stockpiling

Why?

1. Soil often has to be stripped or excavated during the construction process. In order to enable its reuse on site at a later stage, soil needs to be stored in temporary stockpiles to minimise the surface area occupied, and to prevent damage from the weather and other construction activities.



How?

2. The main aim when temporarily storing soil in stockpiles is to maintain soil quality and minimise damage to the soil's physical (structural) condition so that it can be easily reinstated once respread. In addition, stockpiling soil should not cause soil erosion, pollution to watercourses or increase flooding risk to the surrounding area.
3. When soil is stored for longer than a few weeks, the soil in the core of the stockpile becomes anaerobic and certain temporary chemical and biological changes take place. These changes are usually reversed when the soil is respread to normal depths. However, the time it takes for these changes to occur very much depends on the physical condition of the soil.
4. Handling soil to create stockpiles invariably damages the physical condition of the soil to a greater or lesser extent. If stockpiling is done incorrectly the physical condition of the soil can be damaged irreversibly, resulting in a loss of a valuable resource and potentially significant costs to the project. The Soil Resource Survey and Soil Resource Plan should set out any limitations that the soil may possess, with respect to handling, stripping and stockpiling.
5. The size and height of the stockpile will depend on several factors, including the amount of space available, the nature and composition of the soil, the prevailing weather conditions at the time of stripping and any planning conditions associated with the development. Stockpile heights of 3-4m are commonly used for topsoil that can be stripped and stockpiled in a dry state but heights may need to be greater where storage space is limited.
6. Soil moisture and soil consistency (plastic or non-plastic) are major factors when deciding on the size and height of the stockpile, and the method of formation. As a general rule, if the soil is dry (e.g. drier than the plastic limit) when it goes into the stockpile, the vast majority of it should remain dry during storage, and thereby enable dry soil to be excavated and respread at the end of the storage period. Soil in a dry and non-plastic state is less prone to compaction, tends to retain a proportion of its structure, will respread easily and break down into a suitable tilth for landscaping. Any anaerobic soil also usually becomes re-aerated in a matter of days.
7. Soil stockpiled wet or when plastic in consistency is easily compacted by the weight of soil above it and from the machinery handling it. In a compacted state, soil in the core of the stockpile remains wet and anaerobic for the duration of the storage period, is difficult to handle and respread and does not usually break down into a suitable tilth. A period of further drying and cultivation is then required before the soil becomes re-aerated and acceptable for landscaping.

Soil management during construction

Stockpiling methods

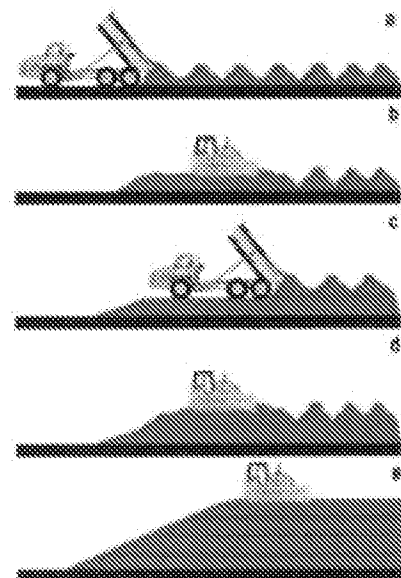
8. There are two principal methods for forming soil stockpiles, based on their soil moisture and consistency.
9. Method 1 should be applied to soil that is in a dry and non-plastic state. The aim is to create a large core of dry soil, and to restrict the amount of water that can get into the stockpile during the storage period. Dry soil that is stored in this manner can remain so for a period of years and it is reuseable within days of respreading.
10. Method 2 should be applied if the construction programme or prevailing weather conditions result in soil having to be stockpiled when wet and/or plastic in consistency. This method minimises the amount of compaction, while at the same time maximising the surface area of the stockpile to enable the soil to dry out further. It also allows the soil to be heaped up into a 'Method 1' type stockpile, once it has dried out.

Soil stockpiling

Soil should be stored in an area of the site where it can be left undisturbed and will not interfere with site operations. Ground to be used for storing the topsoil should be cleared of vegetation and any waste arising from the development (e.g. building rubble and fill materials). Topsoil should first be stripped from any land to be used for storing subsoil.

Method 1 – Dry non-plastic soils

The soil is loose-tipped in heaps from a dump truck (a), starting at the furthest point in the storage area and working back toward the access point. When the entire storage area has been filled with heaps, a tracked machine (excavator or dozer) levels them (b) and firms the surface in order for a second layer of heaps to be tipped. This sequence is repeated (c & d) until the stockpile reaches its planned height. To help shed rainwater and prevent ponding and infiltration a tracked machine compacts and re-grades the sides and top of the stockpile (e) to form a smooth gradient.

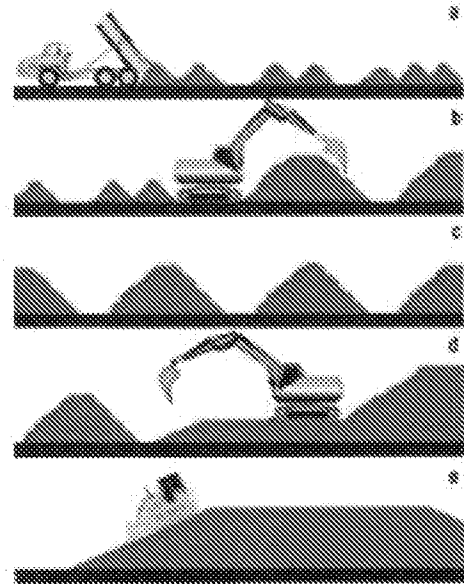


Soil management during construction

Method 2 – Wet plastic soils

The soil is tipped in a line of heaps to form a 'windrow', starting at the furthest point in the storage area and working back toward the access point (a). Any additional windrows are spaced sufficiently apart to allow tracked plant to gain access between them so that the soil can be heaped up to a maximum height of 2m (b). To avoid compaction, no machinery, even tracked plant, traverses the windrow.

Once the soil has dried out and is non-plastic in consistency (this usually requires several weeks of dry and windy or warm weather), the windrows are combined to form larger stockpiles, using a tracked excavator (d). The surface of the stockpile is then regraded and compacted (e) by a tracked machine (dozer or excavator) to reduce rainwater infiltration.



Stockpile location and stability

11. Stockpiles should not be positioned within the root or crown spread of trees, or adjacent to ditches, watercourses or existing or future excavations. Soil will have a natural angle of repose of up to 40° depending on texture and moisture content but, if stable stockpiles are to be formed, slope angles will normally need to be less than that. For stockpiles that are to be grass seeded and maintained, a maximum side slope of 1 in 2 (25°) is appropriate.

Stockpile protection and maintenance

12. Once the stockpile has been completed the area should be cordoned off with secure fencing to prevent any disturbance or contamination by other construction activities. If the soil is to be stockpiled for more than six months, the surface of the stockpiles should be seeded with a grass/clover mix to minimise soil erosion and to help reduce infestation by nuisance weeds that might spread seed onto adjacent land.
13. Management of weeds that do appear should be undertaken during the summer months, either by spraying to kill them or by mowing or strimming to prevent their seeds being shed.



Clearly defined stockpiling of different soil materials



Long term stockpile of stripped topsoil left with only weed vegetation

APPENDIX KCC5
MAFF Good Practice Guide Sheet 1



GOOD PRACTICE GUIDE FOR HANDLING SOILS

Sheet 1:

Soil Stripping with Excavators and Dump Trucks

Issued by the Farming and Rural Conservation Agency, Cambridge

April 2000

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MAFF FOREWORD

Standards of restoration of minerals and waste sites have steadily improved in recent years, with operators increasingly aware of their environmental responsibilities. The industry is putting forward more imaginative restoration concepts to a variety of audiences, and is more aware than ever that it will be judged on the standard of that restoration, and the sustainability of the development.

Sustainable mineral development means balancing economic, environmental and social needs, whilst using resources wisely. The UK Strategy for Sustainable Development recognises the importance of safeguarding agricultural land to meet the needs of future generations, and minimising the loss of soils to new development.*

*Improved restoration standards have sometimes enabled planning permission to be given for best and most versatile agricultural land to be worked for minerals, on the basis that it can be restored in a way that safeguards its long-term agricultural potential**. Inherent in these high standards of restoration is the requirement to handle soils in such a way that damage to their structure is minimised. It is the aim of this Guide to provide comprehensive advice on soil handling "Good Practice" to operators, soil moving contractors, consultants and planning authorities.*

The Guide is in the form of 15 Sheets giving advice on soil stripping, the forming and taking down of soil storage mounds, and soil replacement operations using excavators, earth scrapers or bulldozers. There are also four Guidance Sheets on remedial works involving the removal of stones and damaging materials, and decompaction during the replacement operations.

This document should be cited as MAFF (2000), Good Practice Guide for Handling Soils (version 04/00). FRCA, Cambridge.

Any views expressed in the guidance are those of the consultant and do not necessarily represent the view of the Ministry of Agriculture, Fisheries and Food.

**[DETR, A Better Quality of Life, May 1999, paragraphs 5.66 and 8.50]*

***[MFG7 (November 1996, paragraph 3)]*

Acknowledgements

The Guide was written and prepared by Dr R N Humphries of Humphries Kowell Associates, Charnwood House, Loughborough, LE11 1NP, UK. The art work was by R Sheaton of H J Banks & Co.

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SHEET 1 SOIL STRIPPING WITH EXCAVATORS & DUMP TRUCKS

The purpose of this Guidance Sheet is to provide a model method for best practice where excavators and dump trucks are to be used to strip soil. This Guidance Sheet comprises 6 pages of text, 3 figures and a user response form.

The model method may need to be modified according to site conditions or requirements of the Planning Authority. Where this is the case, deviation from the model should be recorded with reasons. The guidance does not specify the type, size or model of equipment, but this should have been agreed as part of the planning conditions or as a reserved matter. The machines should be of a kind which will cause the minimum compaction whilst being operationally efficient (eg wide tracked), and must be well maintained at all times.

Persons involved in the handling of soils, overburden etc., and in the construction or removal of mounds or tips, must comply with the Health and Safety at Work Etc. Act 1974 and its relevant statutory provisions, and in particular those aspects which relate to the construction and removal of tips, mounds and similar structures. This requirement takes preference over any suggested practice in the Sheets.

The user of these guidelines is solely responsible for all liabilities that might arise. No liabilities are accepted for any losses of any kind arising from the use of this guidance.

This soil handling method uses back-acting excavators in combination with dump trucks (articulated or rigid bodied). An excavator is used to strip soil and load it into dump trucks for transportation to replacement areas or to storage.

The soil handling method can affect the agricultural quality of the restoration through severe soil deformation (compression and smearing). This is primarily caused through trafficking, the effects of which increases with increasing soil wetness.

The advantage of this model method, if correctly carried out, is that it should avoid severe deformation of the soil as trafficking is minimised. Consequently, there should be no need for decompaction treatment during the operation.

The key operational points to ensure avoidance of severe soil deformation are as follows:

- (i) To minimise compaction:
 - the dump trucks must only operate on the 'basal'/non-soil layer, and their wheels must not on any circumstances run on to the soil layer(s).
 - the excavator should only operate on the topsoil layer.
 - the adoption of a bed/strip system avoids the need for the trucks to travel on the soil layers.
 - the machines are to only work when ground conditions enable their maximum operating efficiency.
 - if compaction is caused then measures are required to treat it (see Sheets 18 & 19).
- (ii) To minimise soil wetness and re-wetting:
 - the soil layers should have a moisture content below their lower plastic limit*. Moisture content should be assessed by oven drying* of samples taken from representative locations and mid/lower points of each soil horizon. [*Or as required in the planning conditions.]
 - the bed/strip system provides a basis to regulate the exposure of lower soil layers to periods of rain and a means of maintaining soil moisture contents. The soil profile within the active strip should be stripped to the basal layer before rainfall occurs and before stripping is suspended.

- measures are required to protect the face of the soil layer from ponding of water and maintain the basal layer in a condition capable of supporting dump trucks,
- the area to be stripped is to be protected from in-flow of water, ponding etc. Wet sites should be drained in advance.
- the maintenance of a transpiring crop is important, and an appropriate cropping regime should be established for the year of soil stripping. Before stripping, excess vegetation should be removed, in the case of grassland it should be cut or grazed short and arable crops should have been harvested.

The Stripping Operation:

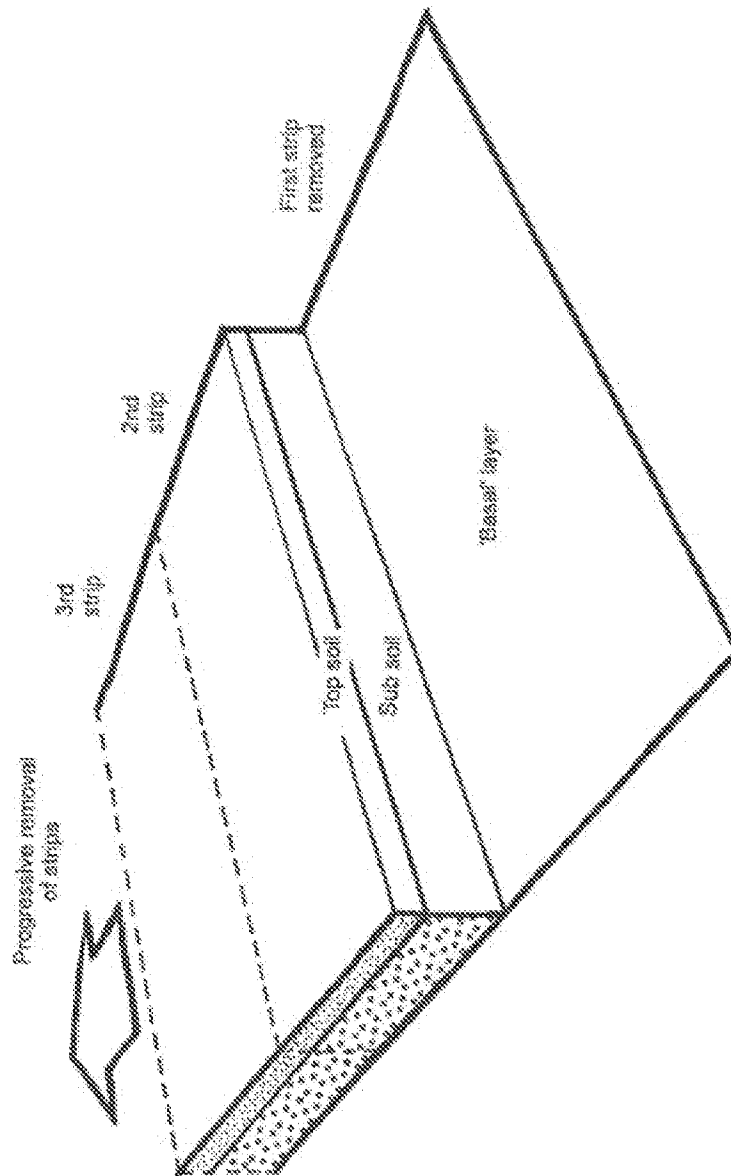
- 1.1 The area to be stripped is to be protected from in-flow of water, ponding etc. Wet sites should be drained in advance.
- 1.2 Soil stripping operations should not start until the required soil moisture levels are reached (as determined by the agreed method), and should be suspended as soon as the water content returns to these levels. Prior to work commencing a Meteorological Office forecast should be obtained which gives reasonable confidence of soil stripping proceeding without interruptions from rainfall events. If significant rainfall occurs during operations, the stripping must be suspended, and where the soil profile has been disturbed it should be removed to base level. Stripping must not restart unless the weather forecast is expected to be dry for at least a full day.

- 1.3 All machines must be in a safe and efficient working condition at all times.
The machines are to only work when ground conditions enable their maximum operating efficiency. The operation is to be suspended before traction becomes a problem or the integrity of the basal layer and haul routes fail.
- 1.4 The operation should follow a detailed stripping plan showing soil units to be stripped, haul routes and the phasing of vehicle movements. The soil units should be defined on the site with information to distinguish types and layers, and ranges of thickness. Detailed daily records should be kept of operations undertaken, and site and soil conditions.
- 1.5 Within each soil unit the soil layers above the base/formation layer are to be stripped in sequential strips with the topsoil layer stripped first, followed by the subsoil layers; each layer stripped to its natural thickness without incorporating material from the lower layers. The next strip is not started until the current strip is completely stripped to the basal layer. This is often referred to as the 'bed or strip system'. The system involves the progressive stripping of the soil in strips (Figure 1.1). Where there is a gradient to the site, the main axis of the soil strips should be along the main axis of the slope.
- 1.6 The haul routes and soil storage areas must be defined, and should be stripped first in a similar manner.
- 1.7 The excavator is only to work on the topsoil layer; the dump trucks are only to travel on the basal/formation layer.
- 1.8 Stripping is to be undertaken by the excavator standing on the surface of the topsoil and digging the topsoil to its maximum depth, and it loading into dump trucks. Generally a bucket with teeth is preferable to one without. The dump trucks draw alongside the exposed soil profile, standing and travelling only on the basal layer (Figure 1.2).

- 1.9 The initial strip width and axis should be demarcated. Strip width is determined by the length of the excavator boom less the stand-off to operate; typically about 3-4m. Effective boom length can also reduce with profile depths greater than 1m; at 1.5m effective reach of standard boom may result in 2m wide strips.
- 1.10 Topsoil should be recovered to the full width of the strip without contamination with subsoil (not more than 20% of the lower horizon should be exposed at the layer junction within the strip). The thickness and identification of the horizon junction must be verified before and during stripping. The full thickness of the topsoil horizon should be stripped progressively along the strip before subsoil horizons are started (Figure 1.2).
- 1.11 The upper subsoil in the current strip is to be stripped and monitored in the same manner. The final 25cm of the subsoil layer should be left as a step to protect the adjacent topsoil layer from local collapses. The process is to be repeated for the lower subsoil and any other lower layer to be recovered as a soil material (Figure 1.3).
- 1.12 On completion of the strip, the procedures are repeated sequentially for each subsequent strip until the area is completely stripped.
- 1.13 Where the soils are to be directly replaced without storage in mounds, the initial strip of the upper horizons will have to be stored temporarily to release the lowest layer and enable the sequential movement of materials. The stored initial soil material would normally be placed on the lower layer removed from the final strip at the end of the programme or on partially completed profiles if rain interrupted the operation.



- 1.14 Where the stripping operation is likely to be interrupted by rain or there is likely to be over-night rain remove any exposed subsoil down to the basal layer before suspending operations. Make provisions to protect base of current or next strip from ponding/runoff by sumps and grips, and also clean and level the basal layer. At the start of each day ensure there is no ponding in the current strip or operating areas, and the basal layer is to level with no ruts.



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Figure 1.1 Soil stripping with excavators and dump trucks:
 The bed system

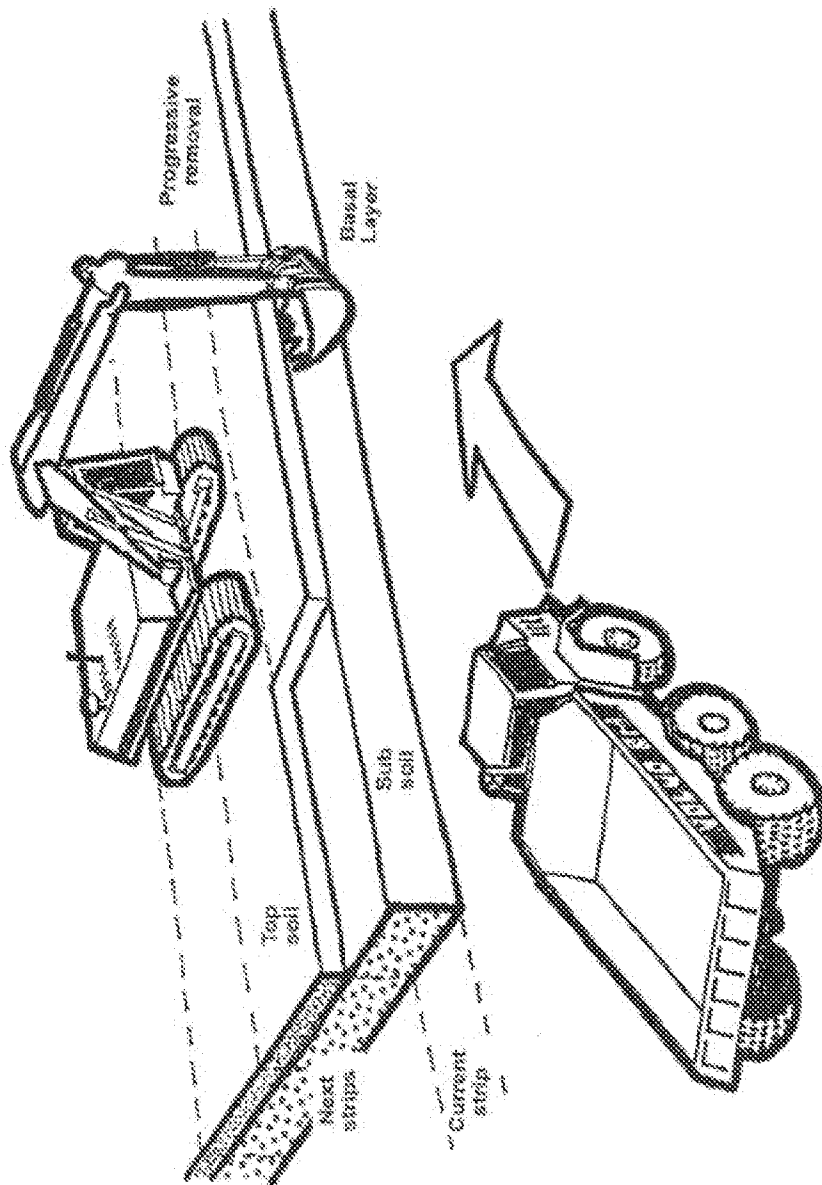


Figure 1.2 Stripping with excavators and dump trucks:
Removal of top soil from a strip

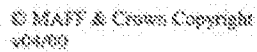


**Figure 1.3 Stripping with excavators and dump trucks:
Removal of sub soil from a strip**

APPENDIX KCC6
MAFF Good Practice Guide Sheet 2



GOOD PRACTICE GUIDE FOR HANDLING SOILS

Sheet 2:

Building Soil Storage Mounds with Excavators and Dump Trucks

Issued by the Farming and Rural Conservation Agency, Cambridge

April 2000

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MAFF FOREWORD

Standards of restoration of minerals and waste sites have steadily improved in recent years, with operators increasingly aware of their environmental responsibilities. The industry is putting forward more imaginative restoration concepts to a variety of afteruses, and is more aware than ever that it will be judged on the standard of that restoration, and the sustainability of the development.

Sustainable mineral development means balancing economic, environmental and social needs, whilst using resources wisely. The UK Strategy for Sustainable Development recognises the importance of safeguarding agricultural land to meet the needs of future generations, and minimising the loss of soils to new development*.

Improved restoration standards have sometimes enabled planning permission to be given for best and most versatile agricultural land to be worked for minerals, on the basis that it can be restored in a way that safeguards its long-term agricultural potential**. Inherent in these high standards of restoration is the requirement to handle soils in such a way that damage to their structure is minimised. It is the aim of this Guide to provide comprehensive advice on soil handling "Good Practice" to operators, soil moving contractors, consultants and planning authorities.

The Guide is in the form of 15 Sheets giving advice on soil stripping, the forming and taking down of soil storage mounds, and soil replacement operations using excavators, earth scrapers or bulldozers. There are also four Guidance Sheets on remedial works involving the removal of stones and damaging materials, and decompaction during the replacement operations.

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*(DEFRA, A Better Quality of Life, May 1999, paragraphs 6.66 and 8.50)

**MPG7 (November 1996, paragraph 3).

Acknowledgements

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SHEET 2 BUILDING SOIL STORAGE MOUNDS WITH EXCAVATORS & DUMP TRUCKS

The purpose of this Guidance Sheet is to provide a model method for best practice where excavators and dump trucks are to be used to build soil storage mounds. This Guidance Sheet comprises 5 pages of text, 2 figures and a user response form.

The model may need to be modified according to site conditions or requirements of the Planning Authority. Where this is the case, deviation from the model should be recorded with reasons. The guidance does not specify the type, size or model of equipment, but this should have been agreed as part of the planning conditions or as a reserved matter. The machines should be of a kind which will cause the minimum compaction whilst being operationally efficient (eg wide tracked), and must be well maintained at all times.

Persons involved in the handling of soils, overburden etc., and in the construction or removal of mounds or tips, must comply with the Health and Safety at Work Etc. Act 1974 and its relevant statutory provisions, and in particular those aspects which relate to the construction and removal of tips, mounds and similar structures. This requirement takes preference over any suggested practice in the Sheets.

The user of these guidelines is solely responsible for all liabilities that might arise. No liabilities are accepted for any losses of any kind arising from the use of this guidance.

This soil handling method uses back-acting excavators to build the storage mound in combination with dump trucks (articulated or rigid bodied) to transport the soil.

The soil handling method can affect the agricultural quality of the restoration through severe soil deformation (compression and smearing). This is primarily caused through trafficking, the effects of which increases with increasing soil wetness.

The advantage of this model method, if correctly carried out, is that it should minimise severe deformation of the soil as trafficking is minimised. However, compaction due to trafficking will be unavoidable in mounds where the height of the mound exceeds the effective reach of the excavator boom and the trucks have to travel on mounded soil. Such compaction will need treatment during the excavation operation (see Sheets 3 and 18).

The key operational points to minimise the degree and extent of severe soil compaction (and for the effective treatment of compaction) are as follows:

(i) To minimise compaction:

- strip in advance the soil to basal layer along haul routes and the operational footprint of the storage mound.
- dump trucks are only to stand and travel on the basal layer (unless raising the next level in multi-tier mounds).
- the machines are to only work when ground or soil surface conditions enable their maximum operating efficiency.
- single-tier mounds are preferred to multi-tier mounds as it avoids the need for trafficking on the soil being stored.
- raise the soil using only the excavator and maximise the mound height before trucks allowed to access upper surface.
- in the raising of multi-tier mounds, trafficking is to be confined to the upper surface of the lower tier. [This layer will require decompaction on excavation of the mound. Sheets 3 & 18]

(ii) To minimise the wetting of soils:

- site soil mounds in dry locations and protect from run-off from adjacent areas. Drain if a wet location.

- raise the soil mound to maximum height progressively along the axis of the mound, and shape the mound as it is being built to shed water and whenever stripping is suspended.
- measures are required to protect the face of the soil layer from ponding of water and maintain the basal layer in a condition capable of supporting dump trucks.

The Storage Operation

- 2.1 The mounds should be sited on dry ground, not in hollows and should not disrupt local surface drainage. Where necessary mounds should be protected from run-off/ponding by a cut-off ditch which is linked to appropriate water discharge facilities. Where the storage mound is in a hollow due to the removal of surface soils, measures should be undertaken to ensure that water is not able to pond within the storage area.
- 2.2 All machines must be in a safe and efficient working condition at all times. The machines are to only work when ground conditions enable their maximum operating efficiency. The operation is to be suspended before traction becomes a problem or the integrity of the basal layer and haul routes fails; haul routes must be maintained.
- 2.3 The operation should follow a detailed soil stripping/storage plan showing soil units to be stripped and stored, haul routes and the phasing of vehicle movements. The soil units should be defined within the site with information to distinguish types and layers, with information about ranges of thickness. Detailed daily records should be kept of operations undertaken, and site and soil conditions.

- 2.4 Remove topsoil and subsoil to basal layer from the haul routes, footprint of the storage mound and any other operating area in advance; adopting the practices outlined in Sheet 1. These soils should be stored in their respective mounds.
- 2.5 The dump trucks must only travel within the haul route and operational areas. The trucks should enter the storage area, reverse and back-tip the soil load starting at the furthest point of the mound from the point of access. The back-acting excavator pulls up the soil into a mound of the required dimensions. The excavator operates by standing on the mound (Figure 2.1). The excavator bucket can be used to shape and firm the sides as the mound is progressively formed to promote the shedding of rain; particularly at the end of each day, but also on the onset of rain during the day. This should include any exposed incomplete surfaces.
- 2.6 The process is repeated with the tipping of soil against the forming mound, and without wheels traversing onto previously tipped material. The operation continues progressively along the main axis of the mound.
- 2.7 Without the trucks rising onto the soil mound, the maximum possible height is related to the boom reach of the excavator (typically 3-4m).
- 2.8 To raise the mound higher, the trucks will have to travel on the upper surface of the rounded soils. In this case the mound should be raised to its maximum height (Figure 2.2). A ramp will have to be provided for the trucks to rise onto the surface of the first tier, which should be capable of trafficking without difficulty. The next tier would be formed repeating the process described above. If further tiers are required, the process would be repeated.
- 2.9 Any exposed edges/surfaces should be shaped using the excavator bucket on the onset of rain during the day. All surfaces should be shaped to shed water

at the end of the day. The final outer surface should be progressively shaped using the excavator bucket to promote the shedding of rain.

- 2.10 Work should stop in wet conditions with measures undertaken to prevent ponding at the base of the mound and on the basal layer. At the start of each day ensure there is no ponding on the basal layers and operating areas.

Operational Variations

- 2.11 If front loading machines are to be used to excavate multi-tier mounds (Sheet 3), then the compacted inter-tier layer must be sequentially decompactified at the building stage by the method described in Sheet 18.

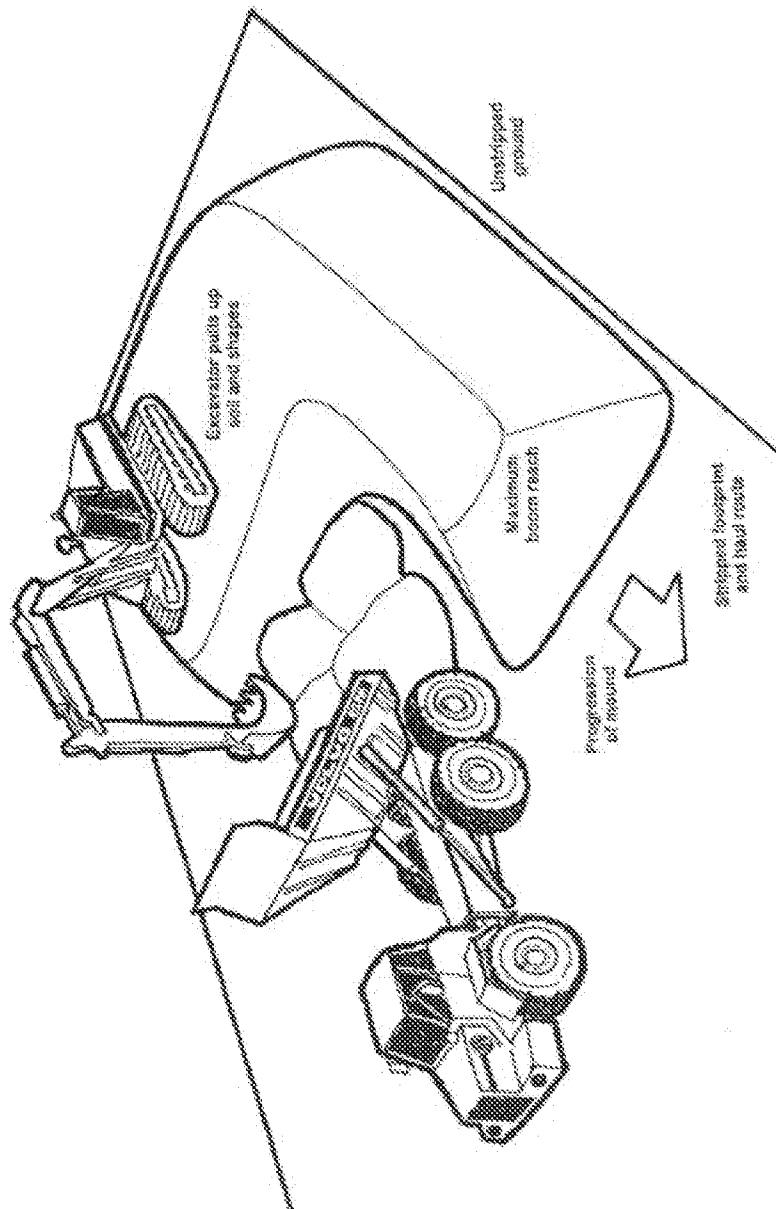


Figure 2.1 Soil storage mound construction with
excavators and dump trucks:
Single tier mound

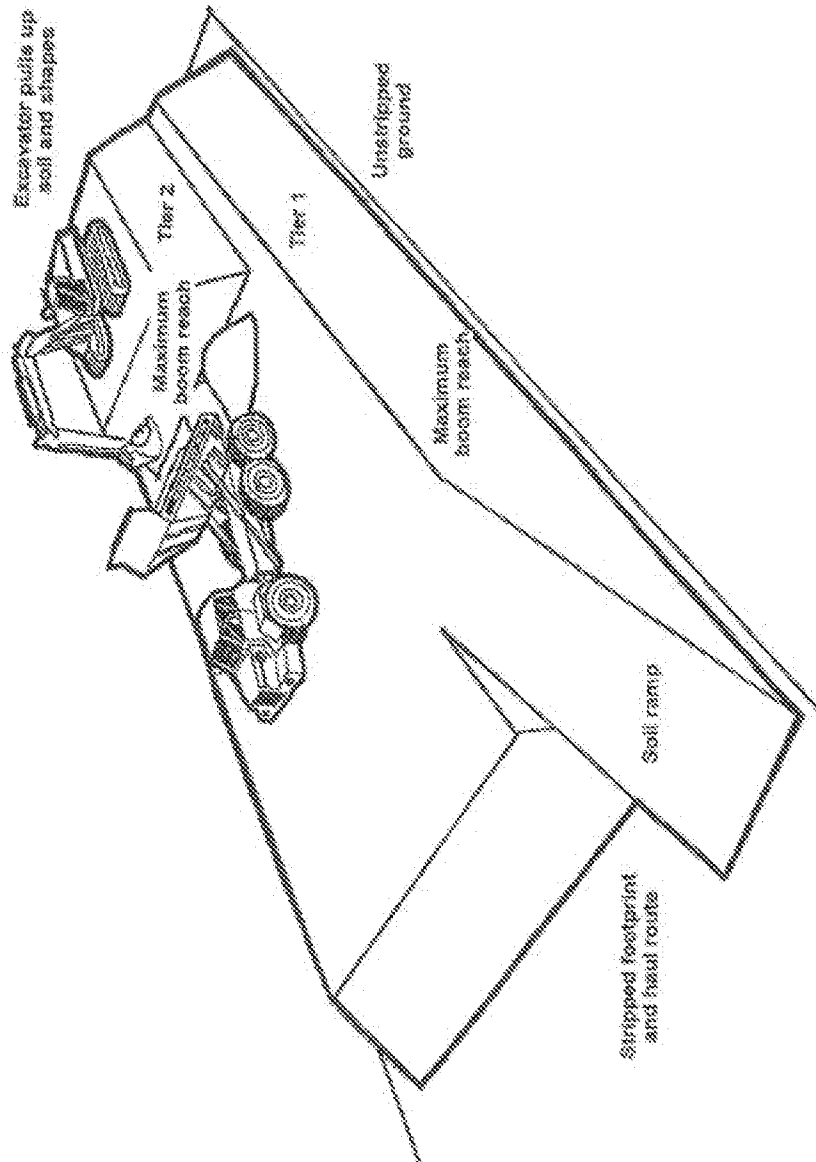


Figure 2.2 Soil storage mound construction with excavators and dump trucks:
Multi-tier mound

APPENDIX KCC7
MAFF Good Practice Guide Sheet 4



GOOD PRACTICE GUIDE FOR HANDLING SOILS

Sheet 4:

Soil Replacement with Excavators and Dump Trucks

Issued by the Farming and Rural Conservation Agency, Cambridge

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MAFF FOREWORD

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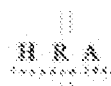
**(DETR, A Better Quality of Life, May 1997, paragraphs 6.66 and 8.36)*

***MPG7 (November 1996, paragraph 3).*

Acknowledgements

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SHEET 4 SOIL REPLACEMENT WITH EXCAVATOR & DUMP TRUCK

The purpose of this Guidance Sheet is to provide a model method for best practice where soils are to be replaced by excavators and dump trucks. This Guidance Sheet comprises 7 pages of text, 4 figures and a user response form.

The model may need to be modified according to site conditions or requirements of the Planning Authority. Where this is the case, deviation from the model should be recorded with reasons. The guidance does not specify the type, size or model of equipment, but this should have been agreed as part of the planning conditions or as a reserved matter. The machines should be of a kind which will cause the minimum compaction whilst being operationally efficient (eg wide tracked), and must be well maintained at all times.

Persons involved in the handling of soils, overburden etc., and in the construction or removal of mounds or tips, must comply with the Health and Safety at Work Etc. Act 1974 and its relevant statutory provisions, and in particular those aspects which relate to the construction and removal of tips, mounds and similar structures. This requirement takes preference over any suggested practice in the Sheets.

The user of these guidelines is solely responsible for all liabilities that might arise. No liabilities are accepted for any losses of any kind arising from the use of this guidance.

This soil handling method uses back-acting excavators in combination with dump trucks (articulated or rigid bodied). An excavator is used to spread the soil tipped from dump trucks used for transportation to replacement areas.

The soil handling method can affect the agricultural quality of the restoration through severe soil deformation (compression and auncuring). This is primarily caused through trafficking, the effects of which increases with increasing soil wetness.

The advantage of this model method, if correctly carried out, is that it should avoid severe deformation of the soil as trafficking is minimised. Consequently, there should normally be no need for decompaction treatment during the replacement operation, unless the soils are in a compacted state following stripping or storage. Where compaction occurs at replacement this will need treatment during the replacement process. Also where required, it will be necessary to integrate the removal of stones or damaging materials with the replacement process. Both decompaction and removal of materials are covered in separate Guidance Sheets (16-19).

The early installation of under drainage is strongly recommended. Where required this should either be undertaken sequentially during the replacement of the soils or in the early aftercare period. Until drains are installed it is recommended that the restored land is sown and managed as grassland.

The key operational points to ensure avoidance of severe soil deformation are as follows:

- (i) To minimise compaction:
 - the dump trucks must only operate on the 'basal'/non-soil layer, and their wheels must not on any circumstances run on to the soil layer(s).
 - the excavator must only operate on the basal layer.
 - the adoption of a bed/strip system avoids the need for the trucks and excavator to travel on the soil layers.
 - the machines are to only work when ground conditions enable their maximum operating efficiency.
 - if compaction has been caused, then measures are required to treat it (see Sheets 18 & 19).

- (ii) To minimise soil wetness and rewetting:

- the bed/strip system provides a basis to regulate the exposure of lower soil layers to periods of rain and a means of maintaining soil moisture contents. The soil profile within the active strip should be completed to the topsoil layer before rainfall occurs and before replacement is suspended.
- measures are required to protect the face of the soil layer from ponding of water and maintain the basal layer in a condition capable of supporting dump trucks.

The Replacement Operation

- 4.1 The area to be restored is to be protected from in-flow of water, ponding etc. Wet sites must be drained in advance. Before the operation starts the basal layer should be to level and clean.
- 4.2 Prior to commencing operations a Meteorological Office forecast should be obtained which gives reasonable confidence of soil replacement proceeding without interruptions from rainfall events. If significant rainfall occurs during operations, the replacement must be suspended, and where the soil profile has been started it should be replaced to topsoil level. Replacement must not restart unless the weather forecast is expected to be dry for at least a full day.
- 4.3 All machines must be in a safe and efficient working condition at all times. The machines are to only work when ground conditions enable their maximum operating efficiency. The operation should only be carried out when the basal layer supports the machinery without ruts or is capable of repair/maintenance. The operation is to be suspended before traction becomes a problem or the integrity of the basal layer and haul routes fails.

- 4.4 The operation should follow a detailed replacement plan showing soil units to be replaced, haul routes and the phasing of vehicle movements. The soil units should be defined on the site with information to distinguish types and layers, and thickness. Detailed daily records should be kept of operations undertaken (including the removal of stones and other damaging materials, and the results of any assessment of the need for additional decompaction and effectiveness of decompaction work undertaken), and site and soil conditions.
- 4.5 The excavator and dump trucks are only to stand, work and travel on the basal/formation layer.
- 4.6 The soil layers above the base/formation layer are to be replaced in sequential strips with the subsoil layer(s) replaced first, followed by the topsoil layer; each layer being replaced to the specified thickness. The next strip is not to be started until the profile in the current strip is completed. This is often referred to as the 'hod or strip system'. The system involves the progressive sequential laying of the materials in strips across the area to be restored (Figure 4.1).
- 4.7 The initial strip width and axis is to be demarcated. Strip width is determined by excavator boom length less the stand-off to operate; typically about 5-8m. Effective boom length can also reduce with profile heights greater than 1m; at 1.5m the effective reach of the standard boom may result in only 2m wide strips. A wide bucket with a blade and not teeth should be used to spread the soil.
- 4.8 Reverse dump truck up to edge of the current strip and tip the lowest layer (subsoil) soil, without the wheels riding onto the strip (Figure 4.1). The dump truck should not drive away until all the soil is deposited within the strip without spillage over the basal layer; this may require assistance from the excavator to 'dig away' some of the tipped soil (Figure 4.2). The excavator is to spread the tipped soil to full thickness by digging, and the pushing and

pulling action of bucket. Each load of soil should be spread following tipping, before another is tipped. Should the spread soil comprise of large blocks (>300mm), normally these should be broken down by using the excavator bucket to 'slice' the blocks into smaller pieces (see Sheet 18) before the next load is spread. The process is repeated from left to right until the strip is completely covered with the required depth of the soil layer (Figure 4.3). Alternatively, decompaction by ripping should be undertaken once the strip is complete (see Sheet 19). Decompaction work must be completed before the next soil layer is placed.

- 4.9 Level boards and soil pits should be used to verify soil thickness in each strip and overall levels. Allowances (ie. a bulking factor) should be made for any settlement that may take place of the replaced loose soil.
- 4.10 Where stones are to be removed as part of the replacement process, normally the method described in Sheet 16 should be used once the strip is complete. An alternative method and one suited to removing potentially damaging materials (eg wire ropes) is described in Sheet 17. These operations must be completed before the next soil layer is placed.
- 4.11 On completion of the lowest (subsoil) layer, repeat the process spreading the next layer (subsoil/topsoil) (Figure 4.4). Tip the soil by reversing to the outer edge of strip/soil previously laid, but without the truck wheels riding onto the already placed layer. The soil is to be spread by the excavator to full thickness by digging, and the pushing and pulling action of bucket described above, and undertaking any necessary decompaction work and removal of stones if using Sheets 16 to 19. Repeat the process progressively (left to right) along the strip and undertake any removal of damaging materials or decompaction. Level boards should be used to verify soil thickness in strip and overall levels.
- 4.12 Where the profile is made up of further soil layers (subsoil/topsoil) the process outlined above should be repeated on completion of the strip.

- 4.13 On completion of topsoil layer the processes outlined above should be repeated for the next strips until the area to be restored is completed. Before the operation starts the basal layer should be to level and clean.
- 4.14 At the end of each day the current strip must be completed if rain is forecast. If during a day it is evident that a full strip cannot be completed, then only start part of a strip, this too must be completed.
- 4.15 At the end of each day, or during the day if interrupted by rain, make provisions to protect base of restored strip from ponding/runoff by sumps and grips, and also clean and level the basal layer. At the start of each day ensure there is no ponding in the current strip or operating areas, and the basal layer is to level with no ruts.

Operational Variations

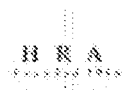
- 4.16 When the replaced soil profiles reach about 0.6-1m in height it may not be possible to discharge the load from some dump trucks directly onto the previously placed layers because of the height of the dump truck body. The preferred solution is to tip the soil against the partially completed profile as heaps without the dump trucks rising onto or reversing into the placed material. The soil material is then lifted by the excavator onto the profile. It is considered preferable to accept some limited soil losses rather than to contaminate the topsoil with overburden. The loss of topsoil is minimised if the basal/formation layer is kept to level and clean.
- 4.16 If the basal/formation layer is to be decompacted, before any soil material is placed, each strip is to be firstly decompacted before the subsoil layer is replaced using either methods described in Sheets 18 or 19. The basal layer must only be decompacted in the strip required for soil replacement, and must



only be prepared on the day of soil placement. During this process it may be necessary to use Sheet 16 or 17 for the removal of stones or damaging materials from the decompacted basal layer.

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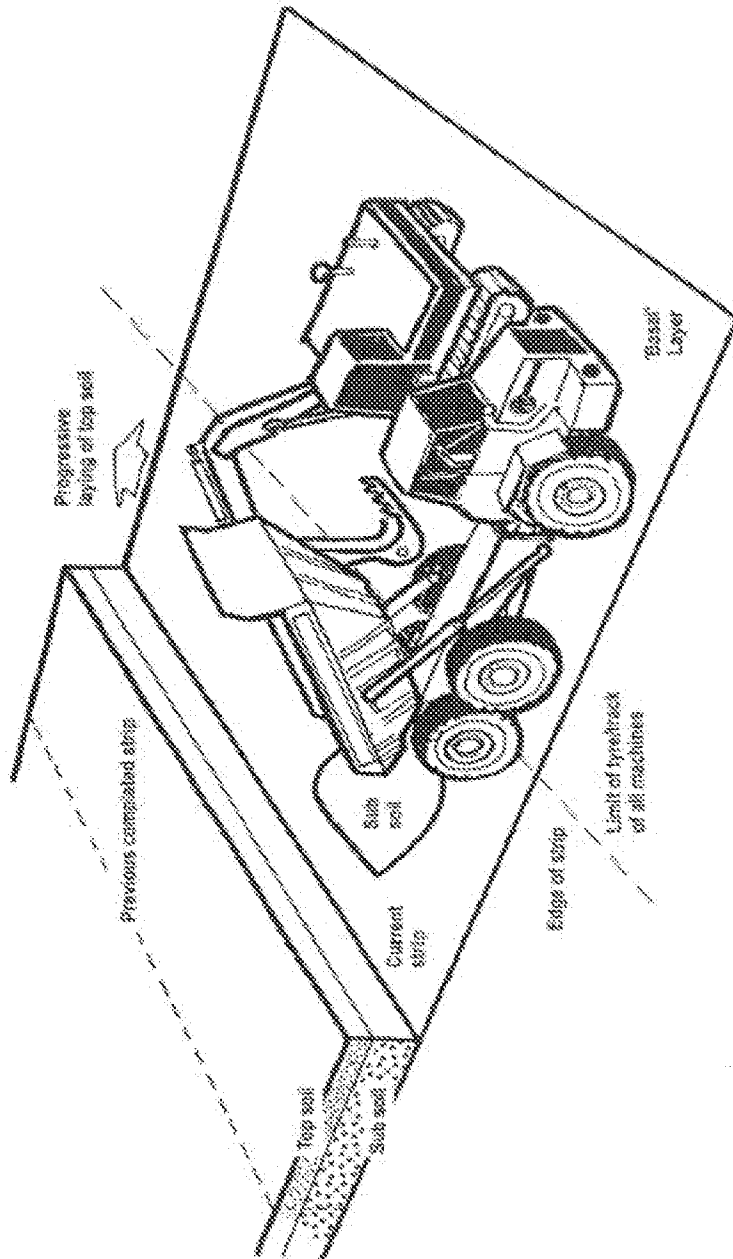


Figure 4.1 Soil replacement with excavators and dump trucks:
Sub soil layer

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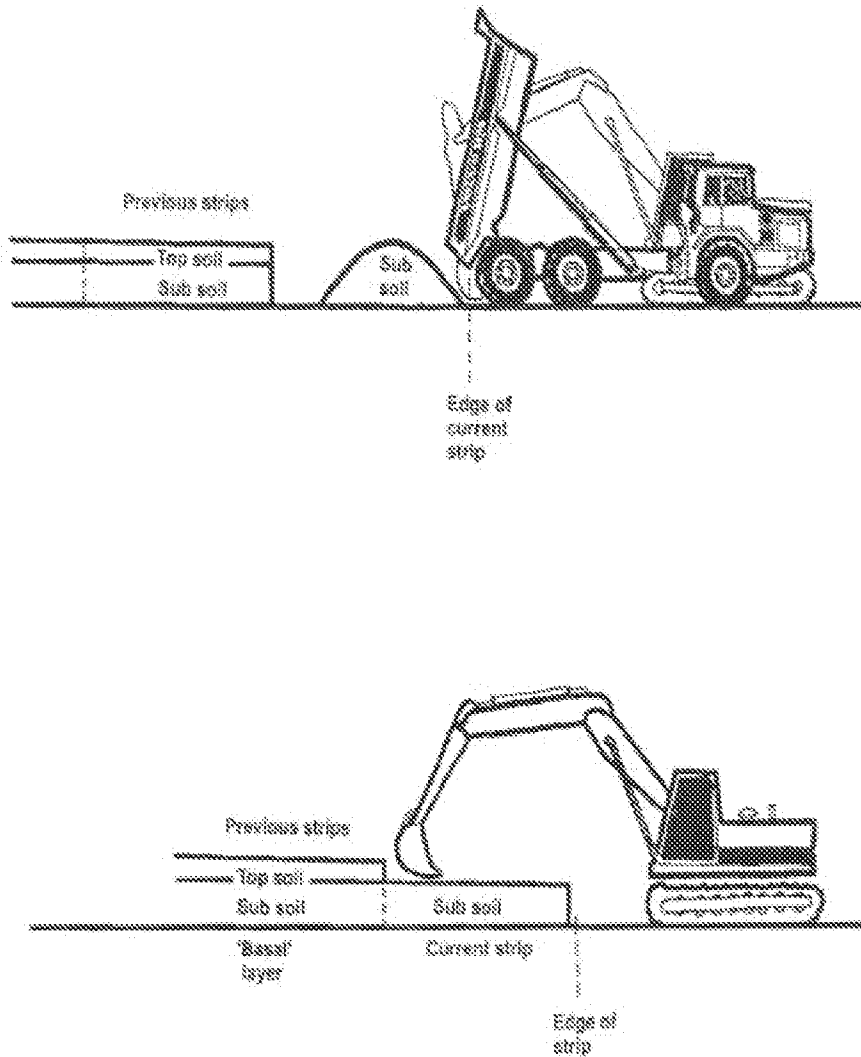


Figure 4.2 Soil replacement with
excavators - dump trucks
Sub soil layer

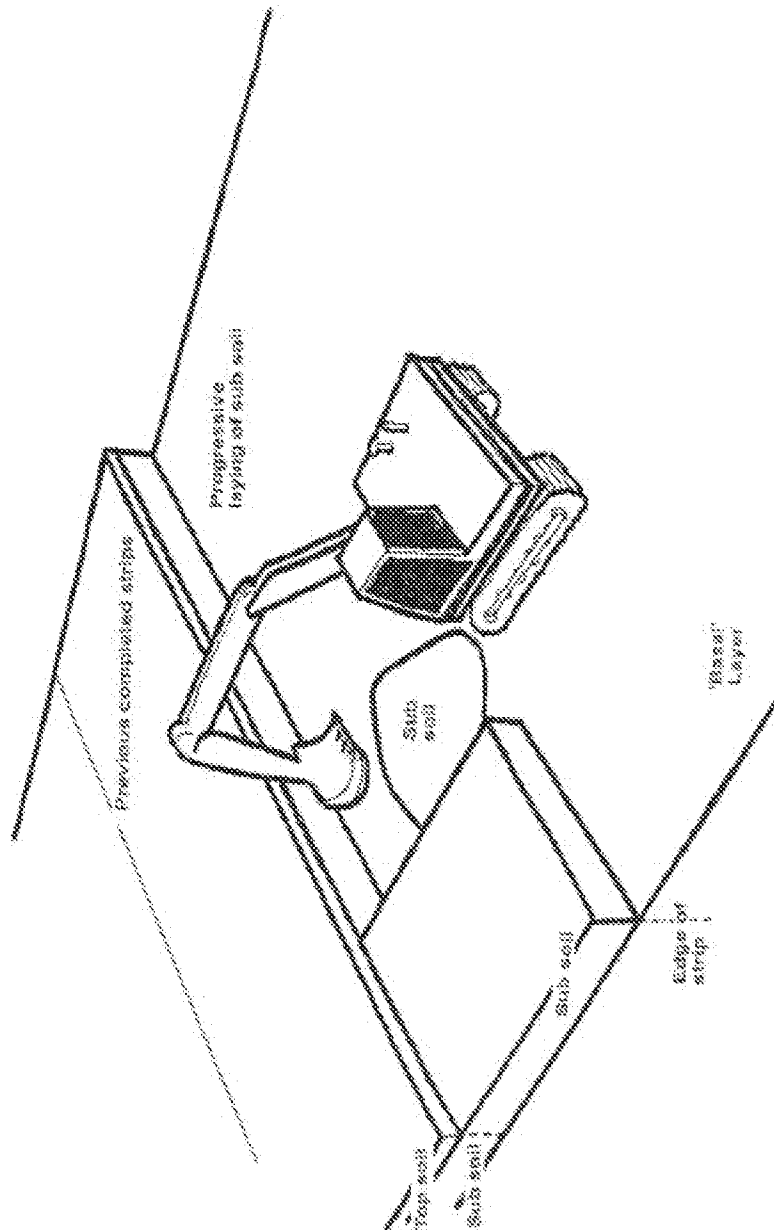


Figure 4.3 Soil replacement with excavators and dump trucks:
Sub soil progressively laid

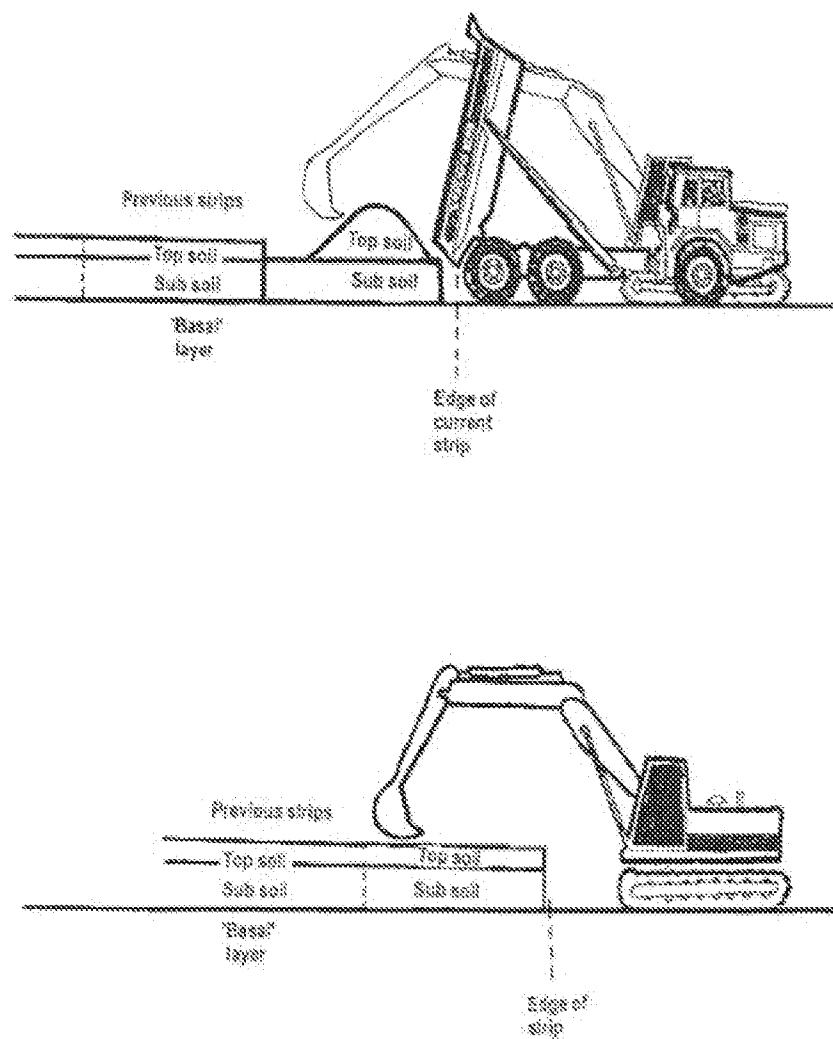


Figure 4.4 Soil replacement with excavators and dump trucks:
 Top soil layer

