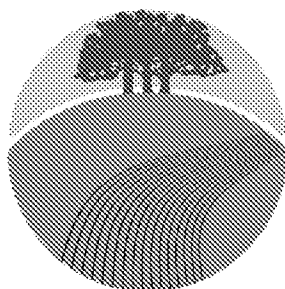


Anesco Ltd



**Land at Brookbarn Farm,
Littlehampton**

**Agricultural Land Classification
and
Soil Resources**

December 2014

Reading Agricultural Consultants Ltd
Beechwood Court, Long Toll, Woodcote, RG8 0RR
www.readingagricultural.co.uk

1. Introduction

1.1. Instruction

- 1.1.1. Reading Agricultural Consultants Ltd (RAC) is instructed by Anesco Ltd to investigate the Agricultural Land Classification (ALC) and soil resources of land at Brookbarn Farm, Littlehampton, by means of a detailed survey of soil and site characteristics.
- 1.1.2. Most of the site is underlain by an historical landfill which has since been restored to agriculture. Subsequent to the survey RAC was informed that, during the landfill and restoration process, field drains were blocked and not reinstated. This was apparent during the survey of the site, with the landfill and non-landfill areas easily distinguishable.

2. Site and Climatic Conditions

2.1. General Features, Land Form and Drainage

- 2.1.1. The site extends to around 5.2ha of agricultural grassland used for grazing cattle, as outlined in Figure RAC6537-1. The site is bounded to the north, west and south-east by other agricultural land, to the east by a residential property and a horticultural nursery, and to the south by a railway line.
- 2.1.2. The site is largely level and lies at around 1m to 3m above Ordnance Datum (AOD).

2.2. Agro-Climatic Conditions

- 2.2.1. Agro-climatic data for the site have been interpolated from the Meteorological Office's standard 5km grid point data set at a representative altitude of 2m AOD. The data are given in Table 1. The site has a warm, moist climate with large crop moisture deficits. The number of Field Capacity Days is relatively high and is considered to be slightly unfavourable for providing opportunities for agricultural field work.

Table 1: Local climatic conditions

Average Annual Rainfall	787mm
Accumulated Temperatures >0°C	1543 day°
Field Capacity Days	164 days
Average Moisture Deficit, wheat	117mm
Average Moisture Deficit, potatoes	114mm

2.3. Soil Parent Material and Soil Type

- 2.3.1. The underlying geology mapped by the British Geological Survey¹ comprises mixed chalk formations, ranging from soft chalk to hard chalk, which is variably flinty.
- 2.3.2. The south of the site is overlain by superficial raised beach deposits, comprising shingle, sand, silt and clay. The north of the site is overlain by superficial raised marine deposits, including gravel, sand, silt and clay, commonly with organic debris.
- 2.3.3. The Soil Survey of England and Wales soil association mapping² (1:250,000 scale) shows the Newchurch 1 association to be present at the site. In West Sussex, this includes clayey and silty soils which occur in a complex pattern. Generally the soils are deep and stoneless, although may be flinty. Groundwater level is controlled by ditches and pumps, although the soils still remain seasonally waterlogged, of Wetness Class (WC) III³.

3. Agricultural Land Quality

3.1. Soil Survey Methods

- 3.1.1. Five soil profiles were examined using an Edelman (Dutch) auger at an observation density of approximately one per hectare in accordance with the recommendations set out in Natural England's Technical Information Note 049⁴. One observation pit was also excavated to examine subsoil structures. The locations of observations are indicated on Figure RAC6537-1. At each observation point the following characteristics were assessed for each soil horizon up to a maximum of 120cm or any impenetrable layer:

- soil texture;
- significant stoniness;
- colour (including local gley and mottle colours);
- consistency;
- structural condition;
- free carbonate; and
- depth.

¹ **British Geological Survey (2014).** *Geology of Britain* viewer, <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

² **Soil Survey of England and Wales (1984)** 1:250,000 scale soil association mapping, Sheet 3 – Soils of Midland and Western England.

³ **Jarvis et al. (1984).** *Soils and their use in South East England*, Soil Survey of England and Wales, Bulletin 15: Harpenden.

⁴ **Natural England (2012).** *Agricultural Land Classification: protecting the best and most versatile agricultural land* Technical Information Note 049.

- 3.1.2. One soil sample was submitted for laboratory determination of particle size distribution, pH, organic matter content and nutrient contents (P, K, Mg). Results are given in Appendix 1.
- 3.1.3. Soil Wetness Class (WC) was inferred from the matrix colour, presence or absence of, and depth to, greyish and ochreous gley mottling and/or poorly permeable subsoil layers at least 15cm thick.
- 3.1.4. Soil droughtiness was investigated by the calculation of moisture balance equations (given in Appendix 2). Crop-adjusted Available Profile Water (AP) is estimated from texture, stoniness and depth, and then compared to a calculated moisture deficit (MD) for the standard crops wheat and potatoes. The MD is a function of potential evapotranspiration and rainfall. Grading of the land can be affected if the AP is insufficient to balance the MD and droughtiness occurs. When a profile is found with significant stoniness, sufficient to prevent penetration of a hand auger, then it is assumed, for the purposes of calculating droughtiness, that similar levels of stoniness continues to the full 1.2m depth considered.

3.2. Agricultural Land Classification and Site Limitations

- 3.2.1. Assessment of agricultural land quality has been carried out according to the MAFF revised guidelines (1988⁵). Soil profiles have been described according to Hodgson (1997⁶) which is the recognised source for describing soil profiles and characteristics according to the MAFF revised ALC guidelines.
- 3.2.2. The main limitation to agricultural land quality at this site is soil wetness and workability, caused by poor drainage and heavy, organic topsoils. Land quality is limited to Grade 4. As highlighted by Appendix 2, there is a subordinate droughtiness limitation to Subgrade 3b due to the large crop moisture deficits and slightly restricted profile depths, but wetness and workability remains the overriding limitation.
- 3.2.3. Topsoil comprises very dark greyish brown, organic clay of around 19cm average thickness across the site. The proportion of organic matter in the topsoil is high enough to class the soil as an organic, rather than a mineral, soil, and therefore the profiles are assessed according to a different set of criteria within the MAFF ALC guidelines (Table 7 of the ALC guidelines).
- 3.2.4. Where undisturbed, this organic top horizon is well to moderately well developed and forms medium subangular blocky peds. The distribution of roots and pores through the topsoil is extensive and the soil is occasionally slightly stony.
- 3.2.5. Subsoil was observed in all but one profile which was of 30cm depth, below which a stony layer was found to be present. This profile is limited by droughtiness to Subgrade 3b, although has been mapped within the wider swathe of Grade 4.

⁵ MAFF (1988) *Agricultural Land Classification of England and Wales. Revised guidelines and criteria for grading the quality of agricultural land.* MAFF Publications.

⁶ Hodgson, J. M. (Ed.) (1997). *Soil survey field handbook.* Soil Survey Technical Monograph No. 5, Silsoe.

- 3.2.6. Across the rest of the site subsoil comprises greyish brown or brown (10YR5/2 or 5/3) clay which displays ochreous mottles and is gleyed. Where upper and lower subsoil horizons are distinguishable, the upper subsoil shows slight compaction, with wedge structures and pressure faces visible within soil clods. The upper subsoil is moderately permeable, with weak, coarse subangular blocky peds breaking to medium. Lower subsoil has a weakly developed structure and is poorly permeable. Where there are no distinguishable subsoil horizons, all subsoil is poorly permeable.
- 3.2.7. Most of the soil is therefore assessed as being of poorly drained, WC IV, which was visually evident at the time of survey.
- 3.2.8. The land above the landfill was waterlogged to the surface with areas of ponding. Often, immediately following extraction of each core segment with the auger, water rose from below ground and overflowed onto the surface. Prior to the survey, weather conditions had been relatively dry: it is likely that the severity of waterlogging would increase significantly during and after periods of wet weather in the areas without suitable drainage. This waterlogging was not apparent in the area that was undisturbed by the landfill and the field drains were still intact.
- 3.2.9. The ALC distribution is shown in Figure RAC6537-2.

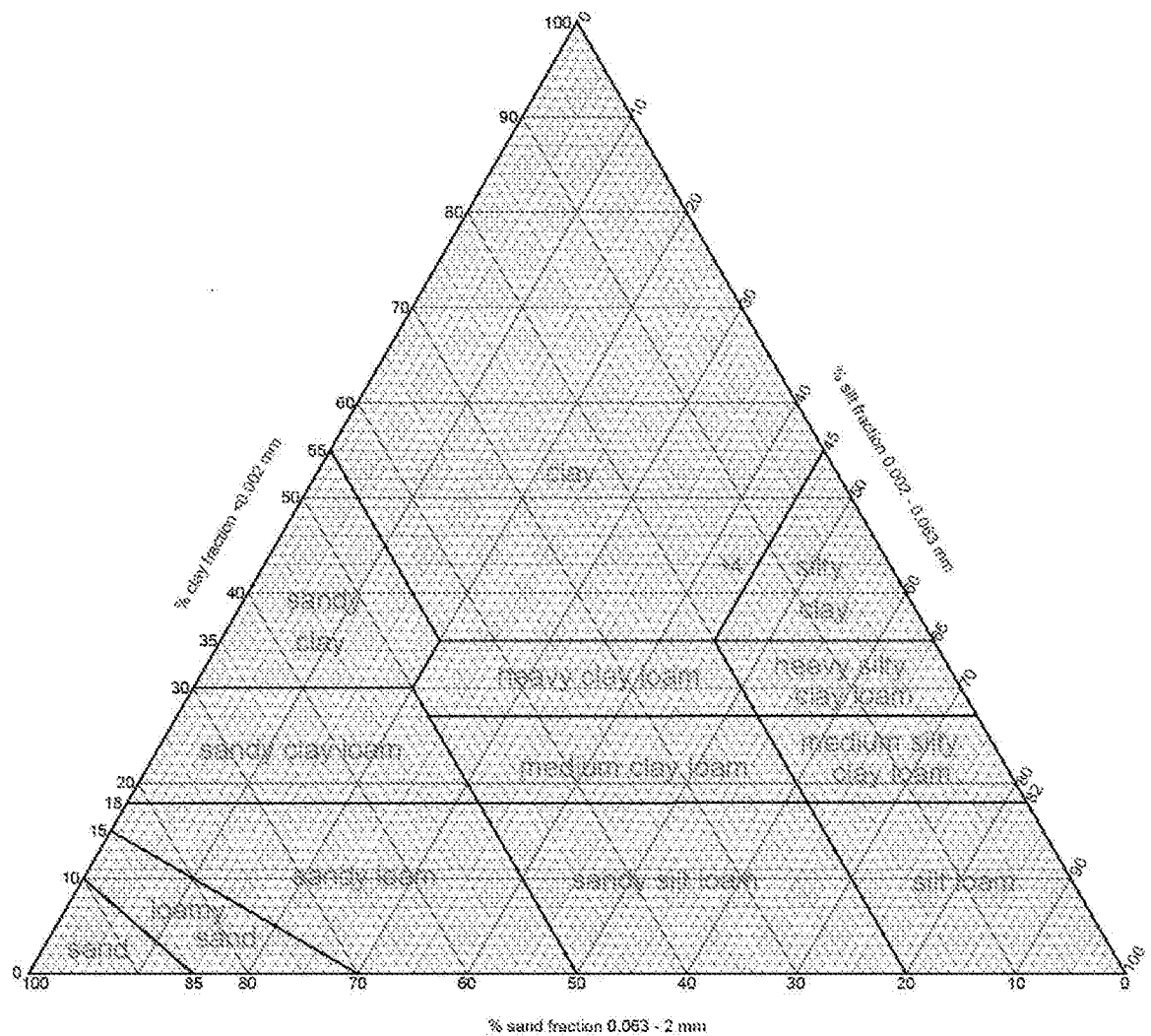
Appendix 1: Laboratory Data

Determinand	Site 4	Units
Sand 2.00-0.063 mm	15	% w/w
Silt 0.063-0.002 mm	42	%w/w
Clay <0.002 mm	43	% w/w
Organic Matter WB	17.4	% w/w
Texture	Organic Clay	% w/w

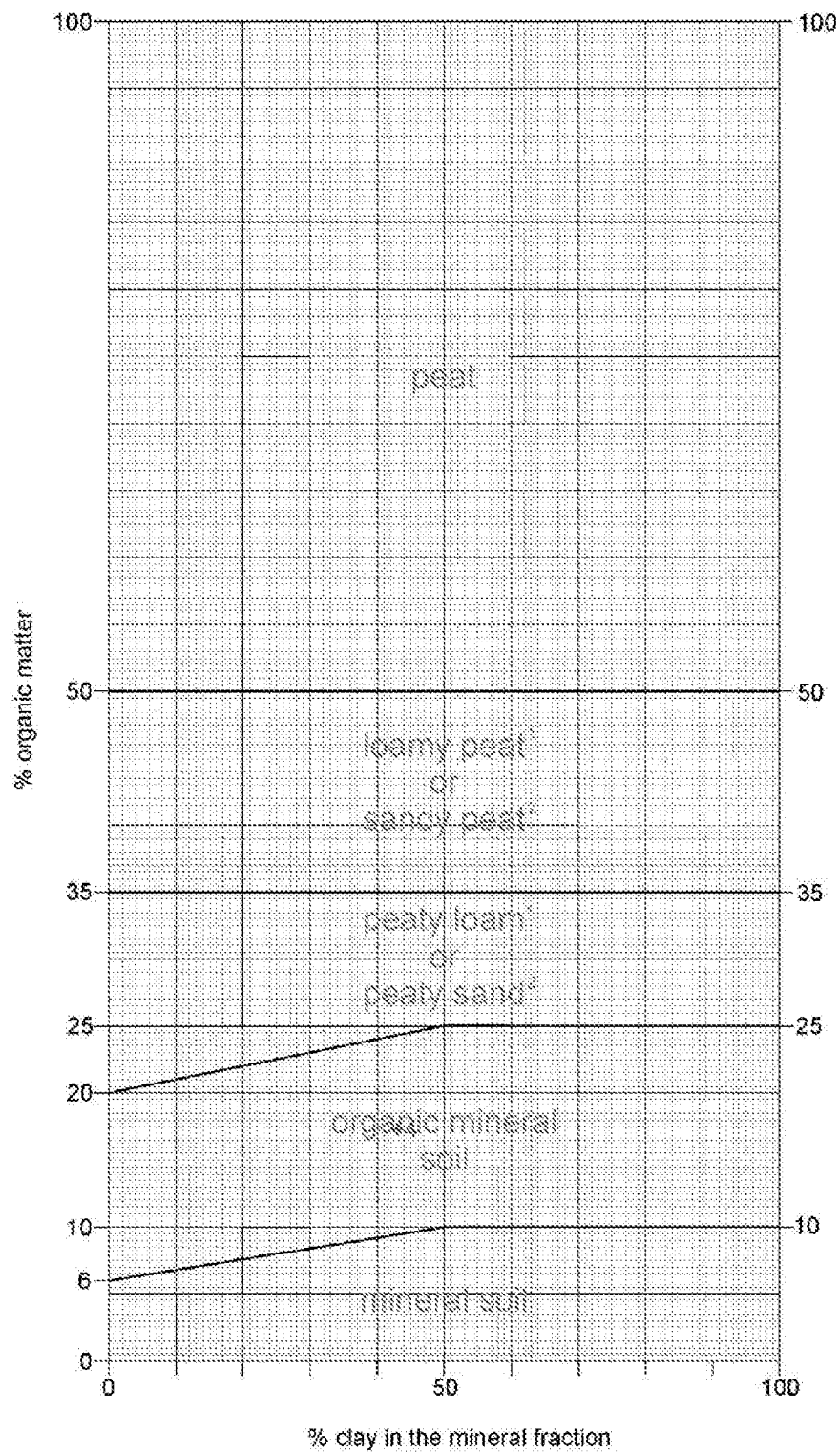
Determinand	Site 5	Units
Soil pH	7.9	
Phosphorus (P)	87.6	mg/l (av)
Potassium (K)	279	mg/l (av)
Magnesium (Mg)	108	mg/l (av)

Determinand	Site 4	Units
Phosphorus (P)	5	ADAS Index
Potassium (K)	3	ADAS Index
Magnesium (Mg)	3	ADAS Index

Soil Texture by Particle Size Distribution



Organic Matter Class



¹ Less than 50% sand in the mineral fraction

² 50% sand or more in the mineral fraction

Appendix 2: Soil Profile Summaries and Droughtiness Calculations

Droughtiness calculations are made according to the methodology given in Appendix 4 of the ALC guidelines, MAFF 1988.
The following grades represent the extent of the limitation posed by droughtiness only. **Other factors will also influence the final grading.**

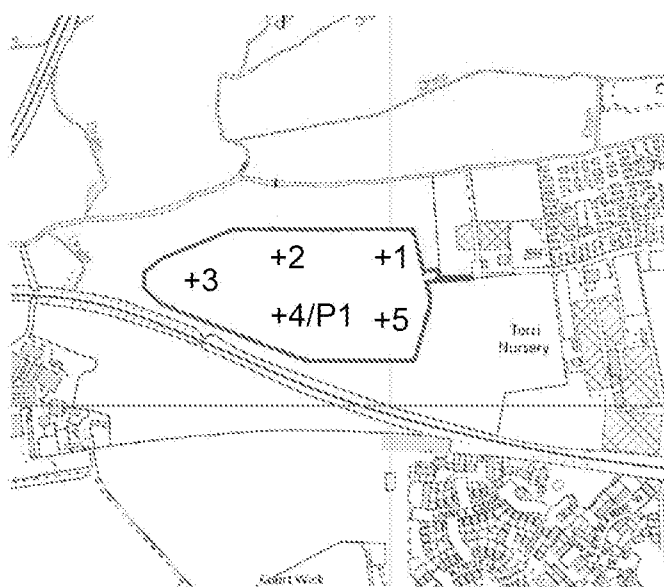
MDw= 117

MDp= 114

Site No.	Depth (cm)		Texture	Colour	Mottle	stones %	Wheat Calculation			Potato Calculation		
							TA _v or EA _v (stones) %	TA _v or EA _v (soil) %	AP (wheat) mm	TA _v (stones) %	TA _v (soil) %	AP (potatoes) mm
1	0	24	Org C	10YR3/2		0	1	23	55.2	1	23	55.2
	24	50	C	10YR4/3	cll och	3	7	16	40.9	7	16	40.9
	50	60	C	10YR4/3	cll och	3	7	8	8.0	7	16	15.7
	60	70	C	10YR4/2+5/2	cll och	0	0.5	7	7.0	0.5	13	13.0
	70	<u>80</u>	C	10YR4/2+5/2	cll och	0	0.5	7	7.0			
							Total (mm)			Total (mm)		
							=			=		
							MBw=			MBp=		
							Grade =			Grade =		

Site No.	Depth (cm)		Texture	Colour	Mottle	stones %	Wheat Calculation			Potato Calculation		
							TA _v or EA _v (stones) %	TA _v or EA _v (soil) %	AP (wheat) mm	TA _v (stones) %	TA _v (soil) %	AP (potatoes) mm
2	0	<u>30</u>	Org C	10YR4/2	fff och	0	1	23	69.0	1	23	69.0
							Total (mm)			Total (mm)		
							=			=		
							MBw=			MBp=		
							Grade =			Grade =		

Wheat Calculation									Potato Calculation			
Site No.	Depth (cm)		Texture	Colour	Mottle	stones %	TAv or EAv (stones) %	TAv or EAv (soil) %	AP (wheat) mm	TAv (stones) %	TAv (soil) %	AP (potatoes) mm
3	0	5	Org C	10YR3/2		0	1	23	11.5	1	23	11.5
	5	50	C	10YR5/2	mfd och	0	0.5	13	58.5	0.5	13	58.5
	50	62	C	10YR5/2	mfd och	0	0.5	7	9.1	0.5	13	16.9
								Total (mm)			Total (mm)	
								=	79.1		=	86.9
								MBw=	-37.9		MBp=	-27.1
								Grade =	3b		Grade =	3a
Wheat Calculation									Potato Calculation			
Site No.	Depth (cm)		Texture	Colour	Mottle	stones %	TAv or EAv (stones) %	TAv or EAv (soil) %	AP (wheat) mm	TAv (stones) %	TAv (soil) %	AP (potatoes) mm
4	0	10	Org C	10YR3/2		5	1	23	21.9	1	23	21.9
	10	30	C	10YR5/2	fff och	0	0.5	16	32.0	0.5	16	32.0
	30	50	C	10YR5/2	mfd och	0	0.5	13	26.0	0.5	13	26.0
	50	62	C	10YR5/2	mfd och	0	0.5	7	9.1	0.5	13	16.9
								Total (mm)			Total (mm)	
								=	89.0		=	96.8
								MBw=	-28.0		MBp=	-17.2
								Grade =	3b		Grade =	3a
Wheat Calculation									Potato Calculation			
Site No.	Depth (cm)		Texture	Colour	Mottle	stones %	TAv or EAv (stones) %	TAv or EAv (soil) %	AP (wheat) mm	TAv (stones) %	TAv (soil) %	AP (potatoes) mm
5	0	25	Org C	10YR3/2		5	1	23	54.8	1	23	54.8
Calcareous	25	28	C	10YR5/3	fff och	0	0.5	16	4.8	0.5	16	4.8
	28	50	C	5YR4/4	few grey	5	0.5	13	27.2	0.5	13	27.2
	50	54	C	5YR4/4	few grey	5	0.5	7	2.7			
								Total (mm)			Total (mm)	
								=	86.8		=	86.8
								MBw=	-30.2		MBp=	-27.2
								Grade =	3b		Grade =	3a



-  Survey Area
 .1 Auger Observation
 .P1 Pit Observation



Plan reproduced from Ordnance Survey map with the permission of the Controller
 of Her Majesty's Stationery Office. Crown Copyright Reserved.
 Ordnance Survey Copyright License Number: 100005584

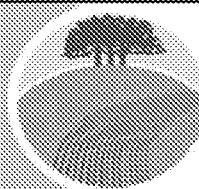
Scale 1:10,000@A4 Dec/2014

Figure RAC6537-1: Observations

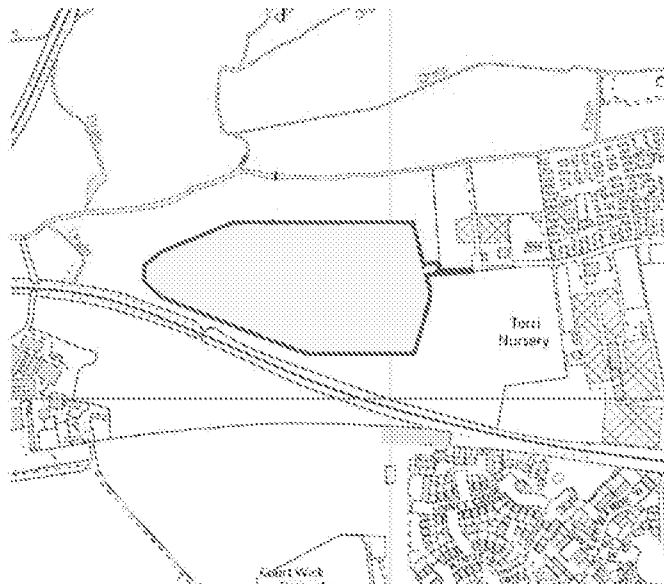
Site: Brookbarn Farm, Littlehampton

Client: Anesco Ltd

Reading
Agricultural
Consultants



© Copyright Reading Agricultural Consultants, 2014, Beechwood Court, Long Toll, Woodhouse, Reading,
 RG50 0RR Tel: 01461 367001 Fax: 01461 350000 www.readingagricultural.co.uk



- | | |
|-------------------------------|----------------------------------|
| ★ Grade 1 - excellent quality | ★ Subgrade 3b - moderate quality |
| ★ Grade 2 - very good quality | Grade 4 - poor quality |
| ★ Subgrade 3a - good quality | ★ Grade 5 - very poor quality |
| ★ Not Present | |
- Best and most versatile land

Plan reproduced from Ordnance Survey map with the permission of the Controller of Her Majesty's Stationery Office. Crown Copyright Reserved.
Ordnance Survey Copyright License Number: 100005584



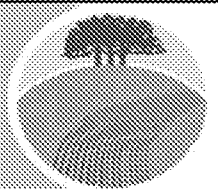
Scale 1:10,000@A4 Dec/2014

Figure RAC6537-2: Agricultural Land Classification

Site: Brookbarn Farm, Littlehampton

Client: Anesco Ltd

**Reading
Agricultural
Consultants**



© Copyright Reading Agricultural Consultants, 2014, Beechwood Court, Long Toll, Woodhouse, Reading, RG50 0RR. Tel: 01461 367001 Fax: 01461 350002 www.readingagricultural.co.uk