

**Agricultural Land Classification
Report for Land at Little Eau, north
of New Fen Dike. Sutton St James**

This report has been compiled from field survey data undertaken by ADAS in December 2010. The Survey and Report has been reviewed by Hyder consulting Limited. The field survey work was commissioned on behalf of the then developer Enfinity UK Limited and the landowner. The development opportunity was later acquired by BE Renewables and Little Eau Solar Limited.

CONTENTS

SUMMARY	3
1. INTRODUCTION	4
2. METHODOLOGY	5
2.1. FIELDWORK.....	5
3. RESULTS.....	6
3.1. CLIMATE	6
3.2. SITE AND FLOOD LIMITATIONS	7
3.3. SOIL AND INTERACTIVE LIMITATIONS.....	9
3.4. LAND USE	12
3.5. LAND QUALITY	12
4. MITIGATION	13
4.1. DURING INSTALLATION	13
4.2. AFTER INSTALLATION.....	14
5. CONCLUSIONS.....	14

REFERENCES

APPENDICES *(A-E included within this report)*

- **APPENDIX A** - AGRICULTURAL LAND CLASSIFICATION AND BORING KEY DESCRIPTION
- **APPENDIX B** - TOPSOIL WETNESS CLASSIFICATION
- **APPENDIX C** - PIT LOG DESCRIPTIONS (Field Survey completed by ADAS December 2010)
- **APPENDIX D** - AUGER BORING LOG DESCRIPTIONS (Field Survey completed by ADAS December 2010)
- **APPENDIX E** - DESCRIPTION OF GRADES AND SUBGRADES
- **APPENDIX 17c** – AGRICULTURAL LAND CLASSIFICATION (Post Construction)
- **APPENDIX 17e** – NATIONAL SOIL RESOURCES INSTITUTE SOILS REPORT – LITTLE EAU

SUMMARY

This report presents the findings and recommendations of an Agricultural Land Classification (ALC) assessment of the proposed Solar Development located in the parish of Sutton St James in Lincolnshire, approximately 3.5km south west of the village. The aims of the study were to:

- Identify the land grade (in terms of ALC);
- Assess the likely impacts of the proposed development on the land resource;
- Outline any recommendations for avoiding, minimising or offsetting any predicted adverse effects.

The study included a desk study and an ALC fieldwork survey and assessment. The assessment was undertaken in accordance with the Agricultural Land Classification (ALC) system for England and Wales. The field work survey was undertaken for Enfinity UK Limited and the landowner and the development opportunity was subsequently acquired by BE Renewables and the applicant Little Eau Solar Limited.

The Site totals ~11Ha divided into three approximately rectangular fields. Typically the land levels range from +1.0 OD to 1.5 OD throughout the three fields. The soils are shown as Wallesea 2 Association and are Wetness Class 2/3, please refer to Appendix B.

During the winter seasonal inspection surface ponding and water impoundment has been observed extensively throughout the three fields. The soils are heavier than are typical for the area.

The impeded drainage is in the form of gley colours and mottling at depths of ~35cm and the field logs indicate a slowly permeable layer (SPL) of clay or silty clay horizon at depths ranging ~35 to 65 cm. The gleying and the SPL are significant limitations to the ALC resulting in the impoundment.

The formation and implications of slowly permeable layers (SPL), stratigraphical relationships and strongly acid subsoils are discussed. The depth to the gleying and semi-permeable soils result in the limitation on the site and it can only be classified as ALC Grade 3b for 72.57% and ALC Grade 3a for 12.27%, please refer to Table 3.

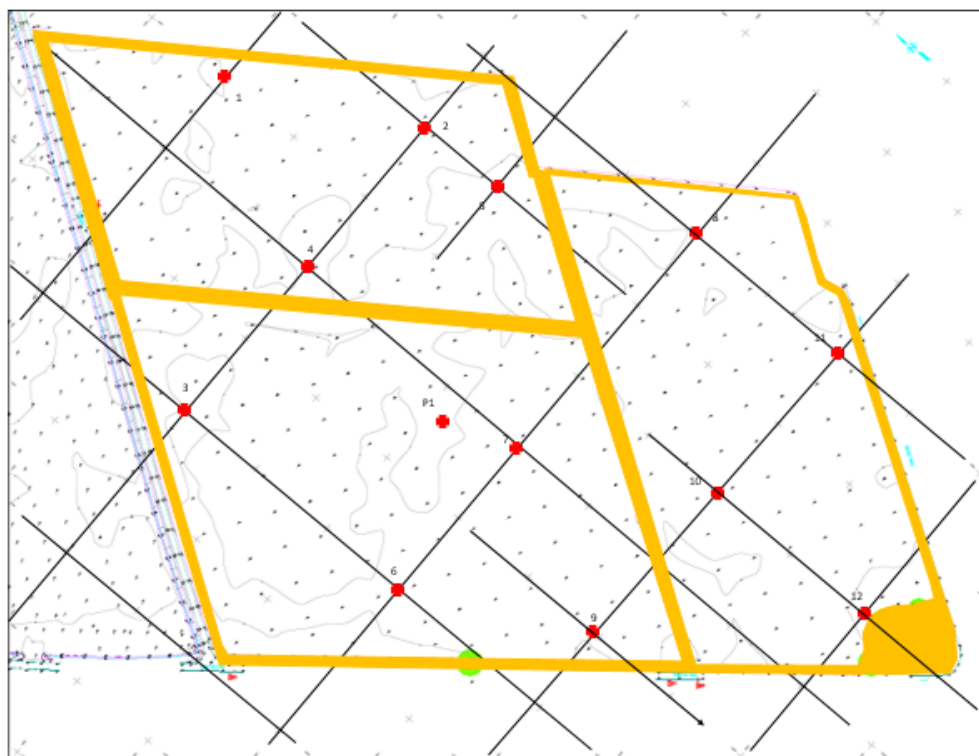
National planning policy given in the National Planning Policy Framework (NPPF) directs local planning authorities to the use of low quality land in preference to that of higher quality land. BE Renewables has investigated an interest in a number of sites within the general geographic area of Sutton St James and the nearby environs and has selected sites based upon the information concerning the availability and proximity to a grid connection to the electricity distribution network, environmental and ecology considerations and use of land that is primarily not classified as Best and Most Versatile and sites where the soil structure and texture will improve as a result of land management associated with the temporary, non-permanent development of a solar farm.

1. INTRODUCTION

This report has been prepared to accompany a planning application for the erection of a solar panel farm. This ALC survey field work was carried out by ADAS in December 2010 and the results of their field survey is attached. Further soil investigations were undertaken and this report has been reviewed by Hyder Consulting Limited, Mr Bruce Lascelles who is a Member and current Chairman at the Institute of Professional Soil Scientists (IPSS).

The field survey was completed in December 2010 by ADAS and a further site walkover assessment was undertaken in March 2014. The soils were augured to a depth of 100 - 120cm. One soil pit was dug at a representative location to determine subsoil characteristics which could not be assessed from the auger. A total of 12 auger borings and 1 pit were examined and this information was used to determine the Agricultural Land Classification (ALC). Soils were tested in the field for calcium carbonate content using a 10% solution of hydrochloric acid and representative samples collected for laboratory analysis of particle size distribution.

Figure (i) – Location of pit and auger borings and pit – Little Eau Solar Farm



2. METHODOLOGY

2.1. FIELDWORK

ADAS were appointed in December 2010 to complete the field work for an ALC survey on the land associated with the proposed Little Eau Solar Farm. Following on from the works completed in 2010 further site inspections and walk-overs were undertaken. These walkover and site inspections were undertaken to verify the requirements of the development, the land area required for the grid connection capacity and to conclude the selection of the agricultural fields which has resulted in some of the selected fields initially selected for the proposed development being removed from the proposed development area.

The land was classified using the system in the Ministry of Agriculture, Fisheries and Food (MAFF now Defra) publication AGRICULTURAL LAND CLASSIFICATION OF ENGLAND AND WALES - *Revised guidelines and criteria for grading the quality of agricultural land*, (October 1988)^{1,2}.

The soil removed during the auguring and pit excavations was examined in accordance with;

Soil Survey Field Handbook
Describing and Sampling Soil Profiles
Soil Survey of England and Wales, Technical Monograph No5, 1976
Soil Classification for Soil Survey
Monographs on Soil Survey
Butler, B E (1980) Clarendon Press, Oxford

In addition this report has also been informed by the National Soil Resources Institute Soils Site Report for Little Eau Solar Farm, please refer to Appendix F.

In relation to the National Planning Policy Framework (NPPF),

'local planning authorities 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 a higher quality.'

They should also *'put in place policies to ensure ... (safeguarding of the long term potential of best and most versatile agricultural land and conserving soil resources) ...'*

Agricultural land in England and Wales is graded between 1 and 5, depending on the extent to which physical or chemical characteristics impose long-term limitations on agricultural use. Grade 1 land is excellent quality agricultural land with very minor or

¹ MAFF - AGRICULTURAL LAND CLASSIFICATION OF ENGLAND AND WALES - *Revised guidelines and criteria for grading the quality of agricultural land*, (October 1988)

² MAFF - AGRICULTURAL LAND CLASSIFICATION OF ENGLAND AND WALES - *Revised guidelines and criteria for grading the quality of agricultural land, Second Revision MAFF, Draft May 1996.*

no limitations to agricultural use, and Grade 5 is very poor quality land, with severe limitations due to adverse soil characteristics, relief, climate or a combination of these. Grade 3 land is subdivided into Subgrade 3a (good quality land) and Subgrade 3b (moderate quality land).

Grades 1, 2 and 3a are defined as the Best and Most Versatile land. This assessment provides sufficient information to allow an assessment of the impacts of the proposed development under this framework.

The detailed survey, undertaken in 2010 involved examination of the soil's physical properties at 12 locations located on a 100 m by 100 m grid, unless varied to avoid field boundaries.

At each location, the soil profile was examined at to a maximum depth of approximately 1.2 m by hand with the use of a 5 cm diameter soil auger. One soil pit was excavated at a recorded location with a spade in order to examine physical soil profile characteristics, including subsoil structure, of the main representative soil types.

The soil profile at each sample location was described using the 'Soil Survey Field Handbook: Describing and Sampling Soil Profiles'³. Each soil profile was ascribed an Agricultural Land Classification (ALC) grade following the MAFF ALC Guidelines.

Other factors used for ALC grading, but which give no limitation to this site, are not discussed.

3. RESULTS

3.1. CLIMATE

The site lies between Holbeach and Wisbech on almost level ground which is drained by a pump drainage system, managed by the North Level Drainage Board. Summarised below are the main climatic parameters, please refer to Table 1 used in the determination of land quality.

This combination of rainfall and temperature indicates that the area is warm and dry, making it good for crop growth so long as the soils are free draining and hold sufficient water to reduce drought stress in crops. The site does not appear to be seriously affected by exposure to the coastal winds. The ALC is therefore not constrained by any climatic matters.

³ Soil Survey Field Handbook: Describing and Sampling Soil Profiles

Table 1- Little Eau Climatic Parameters

Climatic parameters ⁴	
Site at Little Eau, Sutton St James	Grid ref: TF 373163
Accumulated temp. (Jan–June) (degrees C)	1442
Annual average rainfall (mm)	564
Duration of field capacity (days)	99
Moisture deficits for wheat (mm)	122
Moisture deficits for potatoes (mm)	118

3.2. SITE AND FLOOD LIMITATIONS

The area is generally level (flat) and gradient does not therefore constrain or limit the land quality. From the initial site inspection, desk-top study and the topographical survey the site has several minor ridges and hollows within its boundary arising from the variable thicknesses of marginal-marine and estuarine silts and clays deposited during a marine transgression into The Wash bay and across much of the Fenland. Discussions with the landowner indicate that these may also be the line of former watercourses workings and levees, this results in a complex soil pattern. The site, whilst flat varies from ~0.6mAOD to the high point of ~1.6mAOD. Drainage within the three fields is controlled by ditches and natural drainage through the soils. These ditches drain to the North Level Drain which is controlled by pumps.

The site perimeter of the site and the boundary of each field is well provided with drain/ditches and the water maintained well below typical ground level in the main drains. However due to the low altitude of the site and the undulations and complex soil patterns the fields retain surface water for a considerable number of days throughout the winter months. The site is categorised by the Environment Agency as a Flood Zone 3 and would be very susceptible to flooding from sea and river if the sea defence walls are ever breached or if the pumps fail for significant periods of time. However flood risk via sea and river is not deemed to be a limiting factor regarding ALC.

⁴ Climatological data for Agricultural Land Classifications, The Met Office, 1989.
(<http://data.gov.uk/dataset/climatological-data-for-agricultural-land-classification>)

The EA Flood Map⁵ assesses the likelihood of flooding from surface water and run-off as low, between 1 in 1000 and 1 in 100 years. Hence the flooding of the site should not be considered as an ALC limitation.

However during the applicant's assessment of the proposed site, seasonal winter water-ponding is a significant limiting constraint and this needs to be assessed for any ALC limitation.

The evidence of seasonal winter ponding indicates low permeability soils that can result in a downgrading of the ALC. At the time and since the ALC fieldwork survey was undertaken in 2010 BE Renewables have been able to review the site through a series of subsequent winter seasons, and through discussions with the landowner been able to take consideration of the historic winter water-logging frequency, duration and timing. Seasonal winter flooding as a result of surface water impoundment has been observed therefore subject to consideration under the ALC.

The DEFRA Provisional Soil Maps⁶ provide a strategic level at which the soils are mapped over the site and the general area of the East Midlands on the 1:250,000 Soil Map of the area as the Wallasea 2 Association. These soils have formed in marine alluvium and have a non-calcareous, stoneless silty clay or heavy silty clay loam to clay loam topsoil over similar subsoils. The soils associated with the proposed site fall into primarily Wetness Class 3, but Wetness Class 2 is also identified.

This association is extensive on reclaimed marine alluvium in the marshlands of Lincolnshire, Cambridgeshire and Norfolk. The land is generally level but there are occasional ridges on the sites of former creeks. The soils are mainly Wallasea series, pelo-alluvial gley soils; Newchurch series, pelo-calcareous alluvial gley soils; Blacktoft series, gleyic brown calcareous soils; and Wisbech series, calcareous alluvial gley soils. Wallasea and Newchurch soils are clayey with a greyish brown topsoil over greyish or grey and ochreous mottled subsurface horizons; Newchurch series is calcareous. Blacktoft soils are calcareous and fine silty with grey colours and mottling in the subsoil. Wisbech soils are also calcareous, but have greyish and mottled coarse silty horizons below the plough layer, often with sedimentary laminations. Wallasea series predominates and Newchurch, Blacktoft and Wisbech soils are common. Dymchurch, Snargate, Agney, Stockwith, Tanvats and Paglesham series also occur.

Wallasea soils consistently constitute over half of the association, but the proportion of other soils varies widely throughout the country. Generally, Wisbech and Blacktoft series are found on or near former creeks (rodhams), with Wallasea and Newchurch soils in the intervening areas. The incidence of creek ridges, and so the proportion of coarser soils, increases seawards where Blacktoft soils cover a third of the land, except in Lincolnshire where the similar Agney series is more common. The proportion of the less common Wisbech soils also increases seawards. Inland towards high ground, clayey soils are predominant, Wallasea soils being most common in Lincolnshire and Cambridgeshire, but in Norfolk, Newchurch and Wallasea soils are co-dominant. In places in Lincolnshire, Wallasea soils have developed from former Downholland soils from which topsoil organic matter has been lost by oxidation. Wisbech soils are rare in north Lincolnshire and non-calcareous soils, including Pepperthorpe and Tanvats series, become more common.

⁵ <http://apps.environment-agency.gov.uk/wiyby/37837.aspx>

⁶ East Midlands Region 1:250 000 Series Agricultural Land Classification (DEFRA)

Most of the land is pump-drained and the more permeable Blacktoft and Wisbech soils are well drained (Wetness Class I). Wallasea and Newchurch soils are less permeable but respond to underdrainage; drained soils are occasionally waterlogged (Wetness Class II) but undrained soils are waterlogged for long periods in winter (Wetness Class III or IV). Droughtiness slightly restricts the growth of arable crops in Wallasea and Newchurch soils. Wisbech soils have large available water reserves and are non-droughty whilst Blacktoft soils are intermediate in droughtiness. Grassland suffers from drought on all soils in south Lincolnshire, Norfolk and Essex but growth is less restricted in the higher rainfall area of north Lincolnshire.

With adequate underdrainage, Wallasea and Newchurch soils are moderately easy to work. There are adequate days for safe cultivation in autumn and spring, but in north Lincolnshire the moist climate reduces the opportunity for spring cultivation, particularly in wet years, and the soils are marginal for spring-sown crops. The land is generally used for winter cereals and ley grassland, but sugar beet, peas and field brassicas are grown in the drier districts. The use of heavy machinery often causes topsoil compaction and surface wetness on the heavier soils especially Wallasea series though they can be direct drilled very successfully if subsoiled periodically. Newchurch soils which are calcareous have a more stable structure. Wisbech and Blacktoft soils are less suitable for direct drilling because of the problems associated with this system on silty soils.

In the map legend the soils are described thus:

Map Symb	Soil Association	Ancillary subgroups and soil series	Geology	Soil and site characteristics	Cropping and Land Use
813g	WALLASEA 2	814 Newchurch 532 Blacktoft 812 Wisbech	Marine alluvium	Deep stoneless clayey soils, calcareous in places. Some deep calcareous silty soils. Flat land often with low ridges giving a complex soil pattern. Groundwater controlled by ditches and pumps.	Winter cereals and some sugar beet, potatoes, cereals and field vegetables.

3.3. SOIL AND INTERACTIVE LIMITATIONS

This assessment has been made in accordance with the revised guidelines and criteria (MAFF 1988) for Agricultural Land Classification^{1,2}. The scheme provides a framework for classifying land according to the extent to which its physical or chemical characteristics impose long-term limitations on agricultural use. It allows the relative potential of land for agricultural use to be assessed and compared. The principal physical factors influencing agricultural production are climate, site and soil. These factors together with interactions between them form the basis for classifying land into one of five grades with Grade 3 subdivided into Subgrades 3a and 3b. Grades 1, 2 and Subgrade 3a form the Best and Most Versatile (BMV) land, the most flexible land in terms of the range of crops that can be grown, the level and consistency of yield and the cost of obtaining it. BMV policy has been designed to ensure the retention and protection of the most productive soil resource by directing development decisions made by planning authorities away from these categories of productive land, where possible.

The grading does not necessarily reflect the current economic value of land, land use, range of crops, suitability for specific crops or level of yield. Likewise, the size, structure and location of farms, the standard of fixed equipment and the accessibility of land do not affect grading although they may influence land-use decisions. Grading is assessed on the land's capability at a good but not outstanding standard of management; where elements are sub-standard, as for example lacking an appropriate underdrainage system, grading disregards the shortfall and is based on the severity of the remaining limitations.

Soil texture and structure: these features have a major influence on water retention and movement in a soil, and on workability, trafficability and suitability as a growing medium. They are significant parameters in the assessment of wetness and droughtiness and are included in the soil datasets, please refer to Appendix C and D.

Soil wetness and topsoil texture: A soil wetness and topsoil texture interactive limitation exists where the soil water regime adversely affects plant growth or imposes restrictions on cultivations, made more difficult by heavy topsoil texture. Permeable soils are affected by wetness where there is a ground-water table that cannot be removed by normal field drainage improvements. In less permeable soils the degree of waterlogging depends partly on the depth at which the soil becomes slowly permeable, forming a slowly permeable layer (SPL), and responsible for maintaining a perched water table.

3.3.1 Description of survey findings

The ALC survey noted the soils show signs of impeded drainage in the form of gley colours and mottling at depths at or below 35cm. Notes were also made regarding the observation of slowly permeable clay or silty clay horizon occurs at or below depths of 35cm.

The field survey showed that the plough layer was ~30cm. Most of the field testing indicated that the soils were non-calcareous resulting in soils of primarily poor soil structure in these heavy soils.

The SPL may have formed naturally during deposition during low energy conditions on the surface of the former marsh lands that formed the 'Fens,' alternatively the SPL may have resulted from subsurface compaction that has arisen over many years as a result of water impoundment and farm equipment trafficking creating a plough pan.

From the field survey evidence of subsoil acidity was observed, displayed by pale yellow mottles and concentrations of the mineral 'jarosite'.

Tests for calcium carbonate were undertaken in the field. Calcium carbonate has a beneficial effect on topsoil structure and in maintaining pH. Soil material containing fee carbonate is referred to a calcareous. It is tested in the field by applying dilute hydrochloric acid to soil samples and observing the reaction in accordance the with Table below.

Table 2: Estimating calcium carbonate content

Field description and CaCO ₃ class limits	Typical appearance of HCl application at known CaCO ₃ contents		
	Audible	Visible	CaCO ₃
Non-calcareous (less than 0.5%)	None	None	0.1%

Very-slightly calcareous (less than 0.5-1%)	Faintly increasing to slightly audible	None	0.5%
Slightly calcareous (less than 1-5%)	Faintly increasing to moderately audible	Slight effervescence, confined to individual grains, just visible	1.0%
	Moderately to distinctly audible heard away from ear	Slightly more general effervescence visible on close inspection	2.0%
Moderately calcareous (less than 5-10%)	Easily audible	Moderate effervescence, obvious bubbles upto 3mm diameter	5%
Very calcareous (less than 10%+)	Easily audible	General strong effervescence, ubiquitous bubbles to 7mm easily seen.	10%

3.3.2 Analysis – Wetness Class

Step One

The first step is to determine the soil's **Wetness Class (WC)** on a scale of I to V. To assess the wetness class the guidelines use the depth to an SPL and distinguish soils with different 'gleying' features (a 'g' horizon, evident as greyish or pale colours with ochreous mottles or dominantly grey colours without mottles).

Soil wetness expresses the extent to which excess water imposes restrictions on crop growth and cultivations while droughtiness indicates the degree to which shortage of soil water influences the range of crops which maybe grown and level of yield which may be achieved. Excessive wetness adversely affects seed germination and survival partly by soil temperature and anaerobism. Topsoil texture influences the wetness limitation because of its effect on soil water retention and the mechanical properties of the soil.

Wetness Class is obtained from tables in the guidelines (MAFF 1988, Figures 7 & 8) in which the local climate (as the number of Field Capacity Days), depth to gleying layer and depth to slowly permeable layer are taken into account.

Step Two

The second step is to determine the interactive soil wetness/topsoil texture limitation. using Table 7 of the MAFF guidelines (1988)^{1,2}.

From Table 7 of the MAFF guidelines (1988)^{1,2} the soils are Wetness Class 2 or 3, please refer to Appendix C and D.

3.3.3 Analysis – droughtiness

To achieve full yield potential, a crop requires an adequate supply of soil moisture throughout the growing season. Droughtiness becomes a limitation in areas of low rainfall and where the soil has only small reserves available to plants. The ALC system uses calculations for two reference crops, winter wheat and maincrop potatoes, assuming a full crop rooting depth (120 cm for wheat and 70 cm for potatoes) for the two crop models. Where rooting extends to near the water table, additional moisture

reserves may be available by capillary rise, but this has not been factored into the calculations. Irrigation may be available, subject to licence, with abstraction points possible in the IDB main drains. This would enhance yields and reduce the risk of droughtiness in the potato crop and the limitation would then be lessened, droughtiness is not considered to be a limiting ALC factor as a result of the surrounding potential irrigation.

3.4. LAND USE

The whole site is in arable use and has been for a significant number of years. The exception of the southern corner where an old barn is situated.

3.5. LAND QUALITY

Land quality on this site is mainly Sub grade 3b due to the presence of slowly permeable lower subsoils which have affected the drainage characteristics of the soils. Areas of Sub grade 3a have also been mapped.

Grade 1

No land of this grade is present on site.

Grade 2

No land of this grade is present on site.

Grade 3

This grade has been divided into Sub grades 3a and 3b to separate the higher quality land (Sub grade 3a) from that at the lower end of the grade (Sub grade 3b).

Sub Grade 3a

This Sub-grade is mapped over ~1.5ha and 12.28% of the site. These areas are associated with the land less susceptible to water impoundment including areas of medium textured soils. These soils are typically non-calcareous brown heavy silty clay loam overlying similar sub-soils. There is no gleying layer within 400 mm. The soils show signs of seasonal wetness in the form of grey colours and mottling and have a slowly permeable layer at depths below 500mm. They fall into Wetness Class 2.

Sub Grade 3b

This Sub grade accounts for the majority of the development site area, 8.562 ha and 72.57% of the site. Brown stoneless and non-calcareous or very slightly calcareous silty clay loam to silty clay or heavy silty clay loam topsoil overlying similar subsoils, with gleying and a slowly permeable silty clay or clay horizon within ~50cm of the surface. The slowly permeable layer makes these soils prone to seasonal wetness. These soils fall into Wetness Class 3 and so with a non-calcareous, very slightly calcareous silty clay loam to silty clay topsoil cannot be graded higher.

Grade 4

No land of this quality is present on site.

Grade 5

No land of this quality is present on site.

Table 3 - A Summary of Land Quality

GRADE	Ha	% Agricultural area
1	0	0%
2	0	0%
3a	1.4496	12.27%
3b	8.576	72.6%
4	0	0%
5	0	0%
Farm Buildings	0	0%
Other	1.789	15.13%
Total	11.8118	100%

4. MITIGATION

4.1. DURING INSTALLATION

The land will potentially be lost to arable agriculture for the short duration of the solar panel installation and for their working/operational life. However agricultural use will and can be retained through a variety of differing activities: bee-keeping, haylage and silage harvesting, sheep grazing.

The site is likely to be under drained (but no drainage survey was undertaken to confirm this). From the inspection and discussions with the landowner no land drainage has been installed to his knowledge within the past 30 years and hence any existing land drainage may not be optimum condition. During installation works for the solar farm, there are few, if any, deep excavations, hence there is a negligible risk that any deep excavations would sever land drains. However prior to any works a detailed land drainage survey will be undertaken before work commences to ensure that all drains which may be severed by deep excavation are recorded to enable a suitable water management strategy to be developed. As part of the end-of-life reinstatement works the development fields will benefit from the installation of new land drainage systems.

During the process of the works where excavation is required all top soils should be stripped and stored separately from any of the excavated subsoil. This to ensure that there is no risk of contamination of the topsoil. The soils should be replaced in the correct sequence to ensure that the topsoil is returned as the surface layer.

The land will be restored to a productive agricultural land activity at the end of the operation of the solar farm. The soils at this time will have benefited from the improved soil structure and texture and will also benefit from the installation of a new drainage system.

4.2. AFTER INSTALLATION

Any areas damaged by excavations will be made good by sub-soiling and topsoil replacement. The soils should be sown with the proposed mix of grass seed and the resulting sward will be managed to maintain the long term productivity of the soil and to avoid soil erosion.

Installation of solar panels across the site will not have an adverse long term effect on the soils because it is the intention to sow the land to grass and manage the land to maintain soil structure and fertility. The panels should be constructed at a suitable height/angle to prevent sheep jumping onto them, this is recognised as a minimum height of 600 to 750 mm above ground level.

5. CONCLUSIONS

The 1:250,000 scale Provisional Land Classification Map of the area shows the site as Grade 2. These were provisional maps and were only prepared for 'strategic use', DEFRA and Natural England do not accept their use for detailed land development assessment. These Provisional Maps are only accurate to about 80ha. Fieldwork undertaken for this study has shown that the land is not of such a high quality as depicted within these Provisional Maps and ranges from Sub-grade 3a to Sub-grade 3b.

This land will be retained in low input agricultural use and there will be no long term loss of land because once the panels are removed the land can be brought back into full arable use as most of the soils will not have been disturbed. During the operational phase of the solar farm the lying to grass will benefit the fertility of the soils and enhance the organic matter and soil structure providing longer-term improvement of the soil quality.

APPENDIX A - AGRICULTURAL LAND CLASSIFICATION AND BORING KEY DESCRIPTION

Soil Texture Key

S = sand	F = fine
Z = silt	M = medium
C = clay	
ZCl = silty clay loam	C = coarse
HZCl = heavy silty clay loam	
Sl/Mod calc = Slightly/moderately calcareous	

Structure Key

(V)Wk = (very)weak	M = moderate	S = strong
F = fine	M = medium	C = coarse
SG = single grain	GR = Granular	SAB = sub-angular blocky
AB = angular blocky	PR = prismatic	Fri = friable

Colour key

Br = brown	Bl = black	Yl = yellow
Rd = red	or = orange	pl = pale
Gr = grey		

Others abbreviations

Mot = mottles	Mn = manganese concretions	
Rrm = rusty root mottles	Oc = ochrous	Cons = concretions
Occ = occasional/ly	Com = common	ab = abundant
MB = moisture balance	pot = potatoes	wh = wheat
SPL = slowly permeable layer	mny = many	

Main limitation

We = wetness	Dr = drought	Gr = gradient
Mr = micro relief	Cl = climate	

APPENDIX B – TOPSOIL WETNESS CLASSIFICATION

Site and location details				Soil characteristics							ALC Limitations	
Pit	Easting	Northing	~Elevation (m OD)	Depth to clay (cm)	Depth to gleying (cm)	Depth to SPL (cm)	Wetness Class	Topsoil CaCO ₃ eq	Topsoil texture	~Topsoil thickness (cm)	Limiting ALC Constraint	ALC Grade
Pit 1	537535	315890	0.94	32	32	38	3	v-sl calc	ZC/C	32	We	Grade 3b
1	537600	316100	1.5	28	42	51	2	Non calc	HZCL	28	We	Grade 3a
2	537650	316000	1.18	28	42	51	2	Non calc	HZCL	28	We	Grade 3a
3	537450	316000	1.01	28	38	40	3	Non calc	ZC/C	28	We	Grade 3b
4	537550	316000	0.93	28	35	45	3	Non calc	C/ZC	28	We	Grade 3b
5	537650	315950	0.86	28	35	40	3	Non calc	HZCL	28	We	Grade 3b
6	537450	315850	1.03	30	38	42	3	v-sl calc	HZCL	30	We	Grade 3b
7	537550	315850	1.09	30	38	45	3	v-sl calc	ZC	30	We	Grade 3b
8	537700	315850	1.03	35	50	70	2	Non calc	HZCL	35	We	Grade 3a
9	315750	315750	1.11	28	55	65	2	Non calc	HZCL	28	We	Grade 3a
10	537600	315750	1.21	28	39	50	3	v-sl calc	HZCL	28	We	Grade 3b
11	537700	315750	1.05	28	36	47	3	v-sl calc	HZCL/ZC	28	We	Grade 3b
12	537600	315600	1.51	30	38	48	3	v-sl calc	HZCL	30	We	Grade 3b

**APPENDIX C - PIT LOG DESCRIPTIONS (Field Survey completed by ADAS
December 2010)**

Pit	Depth (mm)	Colour	Texture/ drainage	Structure	Porous	Total Stone
P1	0-320	10YR43/3	V-sl calc ZC/C	MMSAB		<1%
	320-380 sample	10YR5/3 +4/1	V- sl calc ZC, oc many	Platy to Wk, C, PR	< firm	<1%
	380-600	10YR5/3 +4/1	ZC	WkCPR to MCAB	< friable	<1%
Notes	Gleyed at 320mm	SPL at 380mm	Wet Class 3	Limiting constraint We		ALC Grade 3b

APPENDIX D - AUGER BORING LOG DESCRIPTIONS (Field Survey completed by ADAS December 2010)

No	Bottom Depth of horizon, mm	Texture	Colour	Gleyed	Stoniness	Drought	Wetness Class	Main Limitation	ALC Grade
1	280	hZCL non calc	Br	-	<1	N/A	2	We	3a
	420	hZCL	Br/plBr	Oc. com	<1				
	650	SZL, calc	pl pinkish br	Oc. mny	<1				
	1000	SZL + LFS, calc	pl pinkish br	Oc. mny					
No	Bottom Depth of horizon, mm	Texture	Colour	Gleyed	Stoniness	Drought	Wetness Class	Main Limitation	ALC Grade
2	280	hZCL non calc	Br	-	<1	N/A	2	We	3a
	420	hZCL	Br	Oc. com	<1				
	650	SZL, calc	Pl pinkish br	Oc. many	<1				
	1000	SZL + LFS, calc	Pl pinkish br	Oc. many					
No	Bottom Depth of horizon	Texture	Colour	Gleyed	Stoniness	Drought	Wetness Class	Main Limitation	ALC Grade
3	280	ZC/C, non calc	Br	-	<1	N/A	3	We	3b
	380	ZC/ C.	Yl/br	Oc. com	<1				
	1000	C	Gr/br	Oc mny	<1				

No	Bottom Depth	Texture	Colour	Gleyed	Stoniness	Drought	Wetness Class	Main Limitation	ALC Grade
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	of horizon								
4	280	C/ZC non calc	Br	-	<1	N/A	3	We	3b
	350	ZC	Br	Oc com	<1				
	620	ZC	Gr/ br	Oc ab	<1				
	1000	SZL +ZCL	Gr /br	Oc ab					
No	Bottom Depth of horizon	Texture	Colour	Gleyed	Stoniness	Drought	Wetness Class	Main Limitation	ALC Grade
5	280	HZCL, non calc	Br		<1	N/A	3	We	3b
	350	HZCL/ZC	Br	Oc com	<1				
	1000	ZC	Gr /br	Oc mny	<1				
No	Bottom Depth of horizon	Texture	Colour	Gleyed	Stoniness	Drought	Wetness Class	Main Limitation	ALC Grade
6	300	HZCL, v-sl calc	Br		<1	N/A	3	We	3b
	380	ZCL, sl calc	Br	Oc com	<1				
	550	ZC, sl calc	Pl/br	Oc com	<1				
	1000	ZC/C	Gr	Oc few	<1				
No	Bottom Depth of horizon	Texture	Colour	Gleyed	Stoniness	Drought	Wetness Class	Main Limitation	Grade
7	300	ZC, v-sl calc	Br	-	<1	N/A	3	We	3b
	380	ZC, sl calc	Pl /br	Oc, com					
	900+	C	Gr/ br	Oc mny					

No	Bottom Depth	Texture	Colour	Gleyed	Stoniness	Drought	Wetness Class	Main Limitation	ALC Grade
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	of horizon								
8	350	hZCL, non calc	Br	-	<1		2	We	3a
	500	hZCL	Br	Oc, few at 500	<1				
	1000	ZC	Pl /br	Oc com					
No	Bottom Depth of horizon	Texture	Colour	Gleyed	Stoniness	Drought	Wetness Class	Main Limitation	ALC Grade
9	280	hZCL, non calc	Br	-	<1		2	We	3a
	550	hZCL, non calc	Br	Oc, com	<1				
	650	HZCL	Pl/ br	Oc, com	<1				
	1000	ZC	Yl/ br	Oc com	<1				
No	Bottom Depth of horizon	Texture	Colour	Gleyed	Stoniness	Drought	Wetness Class	Main Limitation	ALC Grade
10	280	hZCL, v- sl calc	br		<1		3	We	3b
	390	hZCL, sl calc	pl/br	Oc com	<1				
	650	hZCL, sl calc	br	Oc com	<1				
	1000	hZCL	Pl/ br	Oc com	<1				
No	Bottom Depth of horizon	Texture	Colour	Gleyed	Stoniness	Drought	Wetness Class	Main Limitation	ALC Grade
11	280	hZCL/Z C, v-sl calc	Dk /br	-	<1	N/A	3	We	3b
	360	ZC, sl calc	Dk/ br	Oc com	<1				
	520	ZC	Gr/ br	Oc com	<1				
	750	ZCL + SZL	Or + gr	Oc ab	<1				
	1000	C	Gr	Oc mny	<1				
No	Bottom Depth of horizon	Texture	Colour	Gleyed	Stoniness	Drought	Wetness Class	Main Limitation	ALC Grade

12	300	hZCL, v-sl calc	Br	-	<1	N/A	3	We	3b
	380	hZCL, sl calc	pl/ Br	Oc com	<1				
	480	ZC	pl or br	Oc mny	<1				
	900	ZCL	br	Oc mny	<1				
	1000	ZC	br	Oc mny	<1				

APPENDIX E - DESCRIPTION OF GRADES AND SUBGRADES

The ALC grades and Sub grades are described below in terms of the types of limitation which can occur, typical cropping range and the expected level and consistency of yield. In practice, the grades are defined by reference to physical characteristics and the grading guidance and cut-offs for limitation factors in Section 3 (of the ALC book) enable land to be ranked in accordance with these general descriptions. The most productive and flexible land falls into Grades 1 and 2 and Sub grade 3a and collectively comprises about one-third of the agricultural land in England and Wales. About half the land is of moderate quality in Sub grade 3b or poor quality in Grade 4. Although less significant on a national scale such land can be locally valuable to agriculture and the rural economy where poorer farmland predominates. The remainder is very poor quality land in Grade 5, which mostly occurs in the uplands.

Descriptions are also given of other land categories which may be used on ALC maps.

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 and horticultural crops can usually be grown but 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.

Grade 3 - good to moderate quality agricultural land

Land with moderate limitations which 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.

Sub grade 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.

Sub grade 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 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 agriculture land

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

Description of other land categories used on ALC maps Urban

Built-up or 'hard' uses with relatively little potential for a return to agriculture including: housing, industry, commerce, education, transport, religious buildings, and cemeteries. Also, hard-surfaced sports facilities, permanent caravan sites and vacant land; all types of derelict land, including mineral workings which are only likely to be reclaimed using derelict land grants.

Non-agricultural

'Soft' uses where most of the land could be returned relatively easily to agriculture, including: golf courses, private parkland, public open spaces, sports fields, allotments and soft-surfaced areas on airports/airfields. Also active mineral workings and refuse tips where restoration conditions to 'soft' after-uses may apply.

Woodland

Includes commercial and non-commercial woodland. A distinction may be made as necessary between farm and non-farm woodland.

Agricultural buildings

Includes the normal range of agricultural buildings as well as other relatively permanent structures such as glasshouses. Temporary structures (e.g. polythene tunnels erected for lambing) may be ignored.

Open water

Includes lakes, ponds and rivers as map scale permits.

Land not surveyed

Agricultural land which has not been surveyed.

Where the land use includes more than one of the above land cover types, e.g. buildings in large grounds, and where map scale permits, the cover types may be shown separately. Otherwise, the most extensive cover type will usually be shown.

