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Sandvik Osprey Ltd

Agricultural Land Classification and Soil Resources

at

Junction 38, M4, Margam

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1 INTRODUCTION.....1

2 SITE AND CLIMATIC CONDITIONS2

3 AGRICULTURAL LAND QUALITY4

APPENDIX 1: LABORATORY DATA.....7

APPENDIX 2: SOIL PROFILE SUMMARIES AND DROUGHTINESS CALCULATIONS.....9

APPENDIX 3: SITE PHOTOGRAPHS11

FIGURE RAC9209-1: OBSERVATIONS.....13

FIGURE RAC9209-2: AGRICULTURAL LAND CLASSIFICATION.....14

1 Introduction

- 1.1 Reading Agricultural Consultants Ltd (RAC) is instructed by Sandvik Osprey Ltd to investigate the Agricultural Land Classification (ALC) and soil resources of land at Junction 38 of the M4 at Margam, by means of a detailed survey of soil and site characteristics.
- 1.2 Guidance for assessing the quality of agricultural land in England and Wales is set out in the Ministry of Agriculture, Fisheries and Food (MAFF) revised guidelines and criteria for grading the quality of agricultural land (1988)¹.
- 1.3 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. The principal physical factors influencing grading are climate, site and soil which, together with interactions between them, form the basis for classifying land into one of the five grades.
- 1.4 Grade 1 land is excellent quality agricultural land with very minor or no limitations to agricultural use. Grade 2 is very good quality agricultural land, with minor limitations which affect crop yield, cultivations or harvesting. Grade 3 land has moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield, and is subdivided into Subgrade 3a (good quality land) and Subgrade 3b (moderate quality land). Grade 4 land is poor quality agricultural land with severe limitations which significantly restrict the range of crops and/or level of yields. Grade 5 is very poor quality land, with very severe limitations which restrict use to permanent pasture or rough grazing.
- 1.5 Land which is classified as Grades 1, 2 and 3a is defined in paragraph 3.58 of Planning Policy Wales² as the best and most versatile (BMV) agricultural land, which should be conserved as a finite resource for the future. Paragraph 3.59 goes on to state that considerable weight should be given to protecting BMV land from development because of its special importance, and that it should only be developed if there is an overriding need for the development and either previously developed land or land in lower agricultural grades is unavailable, or available lower grade land has a recognised environmental value which outweighs the agricultural

¹ **MAFF (1988).** *Agricultural Land Classification of England and Wales. Revised guidelines and criteria for grading the quality of agricultural land.* MAFF Publications.

² **Welsh Government (2021).** Planning Policy Wales, Edition 11, February 2021
https://gov.wales/sites/default/files/publications/2021-02/planning-policy-wales-edition-11_0.pdf

considerations. If BMV land does need to be developed, and there is a choice between sites of different grades, development should be directed to land of the lowest grade.

- 1.6 Natural Resources Wales has published a Predictive ALC Map for Wales³. The map is designed on a 50m grid. Criteria including climate, slope, soil wetness, droughtiness and stone contents have been considered and used to determine the most likely limitation to agricultural land quality within each grid square. The map predicts this site to be of Grade 2 quality in the north and south-west, and Subgrade 3b quality in the south.
- 1.7 However, as explained by the Welsh Government's Frequently Asked Questions on ALC⁴, the only way to accurately determine the agricultural grade of land is by a detailed field survey in accordance with the current ALC guidelines. This survey follows the established methodology and guidelines for carrying out ALC surveys.

2 Site and climatic conditions

General features, land form and drainage

- 2.1 The site extends to approximately 6.1ha of agricultural grassland used for grazing cattle, located on the western side of Junction 38 of the M4. The site is bounded to the east by the A48, to the south by Heolcae'r-Bont and to the west by the Western Wood Energy Plant and the Margam Green Energy Plant. North of the site is a former residential property, currently the subject of a planning application for conversion to a truck stop with café, guest room accommodation and spa facilities.
- 2.2 The topography is level to gently sloping at between 10m and 15m above Ordnance Datum (AOD). The slope directs water westward where it drains into a small unnamed watercourse that connects with Upper Mother Ditch.

Agro-climatic conditions

- 2.3 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 11m AOD and are given in Table 1. The

³ **Natural Resources Wales (2019).** *Predictive Agricultural Land Classification (ALC) Map for Wales.*
<http://lle.gov.wales/map/alc2>

⁴ **Welsh Government (2020).** *Agricultural Land Classification, Frequently Asked Questions.*
<https://gov.wales/sites/default/files/publications/2020-06/agricultural-land-classification-frequently-asked-questions.pdf>

site is warm and very wet with moderately small to moderate moisture deficits. The number of Field Capacity Days (FCD) is very large and is very unfavourable for providing opportunities for agricultural field work. There is an overriding climatic limitation to Grade 2.

Table 1: Local agro-climatic conditions

Parameter	Measurement
Grid Ref	SS 7926486237
Altitude	11m AOD
Average Annual Rainfall	1,147mm
Accumulated Temperatures >0°C	1,549 day°
Field Capacity Days	234 days
Average Moisture Deficit, wheat	78mm
Average Moisture Deficit, potatoes	64mm

Soil parent material and soil type

- 2.4 The principal underlying geology mapped by the British Geological Survey⁵ is the South Wales Middle Coal Measures Formation which includes grey coal-bearing mudstones and siltstones, with seatearths (sedimentary rock beneath a coal seam) and minor sandstones.
- 2.5 Superficial deposits of glaciofluvial sand and gravel overlie the bedrock across most of the site. In the north-west, tidal flat deposits are mapped, containing mainly unconsolidated mud and sand.
- 2.6 The Soil Survey of England and Wales soil association mapping⁶ (1:250,000 scale) shows the site to have soils of the Tanvats association which consist of stoneless, silty, silty over clayey and clayey soils developed in marine alluvium. Profiles are usually seasonally waterlogged and of Wetness Class (WC) IV.
- 2.7 The site borders on the Wick 1 association to the south-east. Contrastingly, the Wick soils are characterised by deep, coarse loamy and sandy soils locally over gravel. Profiles are well drained, WC I⁷.

⁵ **British Geological Survey (2021).** *Geology of Britain viewer*, <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

⁶ **Soil Survey of England and Wales (1984).** *Soils of Wales* (1:250,000), Sheet 2

⁷ **Rudeforth et al (1984).** *Soils and Their Use in Wales*. Soil Survey of England and Wales Bulletin 11, Harpenden.

3 Agricultural land quality

Soil survey methods

- 3.1 Five soil profiles were examined using an Edelman (Dutch) auger at an observation density of one per hectare across the main field parcel at the site, in accordance with the established recommendations for ALC surveys. The north-western field was not surveyed due to the presence of cattle. One observation pit was also excavated to examine subsoil structures. The locations of observations are shown on Figure RAC9209-1. 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 localised mottling);
 - consistency;
 - structural condition;
 - free carbonate; and
 - depth.
- 3.2 One topsoil sample was submitted for laboratory determination of particle size distribution, pH, organic matter content and nutrient contents (P, K, Mg). Results are presented in Appendix 1.
- 3.3 Soil Wetness Class (WC) was determined from the matrix colour, presence or absence of, and depth to, greyish and ochreous gley mottling, and slowly permeable subsoil layers at least 15cm thick, in relation to the number of FCD at the location.
- 3.4 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.

Agricultural land classification and site limitations

- 3.5 Assessment of land quality has been carried out according to the revised ALC guidelines (1988)¹. Soil profiles have been described according to Hodgson (1997)⁸ which is the recognised source for describing soil profiles and characteristics according to the revised ALC guidelines.
- 3.6 The main limitation to agricultural land quality is wetness. Most of the site is limited to Subgrade 3a. The north-western field is assessed as Subgrade 3b.
- 3.7 The topsoil is sandy clay loam with an average depth of 28cm. The colour is very dark greyish brown or dark brown (10YR3/2 or 10YR3/3 in the Munsell soil colour charts⁹) and the volume of stone is low at between 2 and 8%. The topsoil has a friable consistency and a fine angular or subangular blocky structure within which many plant roots and worms were observed. In the north-eastern field, the surface layer of soil is notably more organic.
- 3.8 The upper subsoil comprises sandy clay loam which is dark greyish brown or brown (10YR4/2 or 10YR4/3). The stone content increases to 10-25% by volume. In the west, few mottles are present in the upper subsoil but in the east the mottles are common. The profile observed in the north-east is considered to be gleyed in the upper subsoil. The structure is weakly developed, but with fine subangular or angular blocky peds and a friable consistency, the upper subsoil is permeable.
- 3.9 The stone content increases with depth, and additionally the subsoil was particularly dry at the time of survey, resulting in an average total observation depth of 46cm, ranging from 22cm in the north-east to 80cm in the west. The lower subsoil observed in the west comprises medium to coarse sandy loam which is light olive brown (2.5Y5/3) and distinctly mottled. The lower subsoil is gleyed, but as this mostly occurs at depth and in a coarse subsoil texture, most of the profiles are assessed as WC I.
- 3.10 In the north-east of the site the profile is gleyed in the sandy clay loam upper subsoil. The profile is assessed as WC III.
- 3.11 Profiles of WC I with sandy clay loam topsoil and profiles of WC III with organic sandy clay loam topsoil are all limited by wetness and workability to Subgrade 3a.

⁸ **Hodgson, J. M. (Ed.) (1997).** *Soil survey field handbook*. Soil Survey Technical Monograph No. 5, Silsoe.

⁹ **Munsell Color (2009).** *Munsell Soil Color Book*. Grand Rapids, MI, USA

3.12 The vegetation in the north-western field parcel that was not able to be surveyed due to the presence of cattle is characterised by coarser grass and rushes. These plants thrive in moist conditions. It is therefore not considered likely that the land in this area will be of a quality higher than Subgrade 3b.

3.13 The areas of each ALC grade at the site are given in Table 2 and their distribution is shown in Figure RAC9209-2. Photographs taken at the site are given in Appendix 3.

Table 2: Agricultural land classification

Grade	Description	Ha	%
Subgrade 3a	Good quality	4.7	77
Subgrade 3b	Moderate quality	1.4	23
	Total agricultural	6.1	100

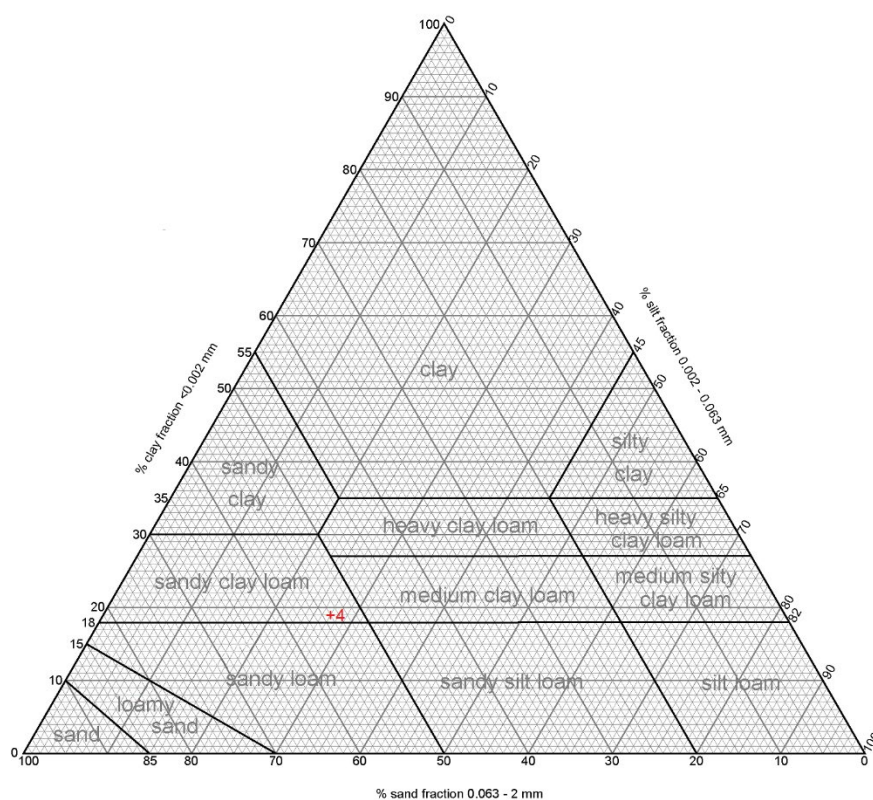
Appendix 1: Laboratory Data

Determinand	Site 4	Units
Sand 2.00-0.063 mm	54	% w/w
Silt 0.063-0.002 mm	27	% w/w
Clay <0.002 mm	19	% w/w
Organic Matter	6.5	% w/w
Texture	Sandy Clay Loam	

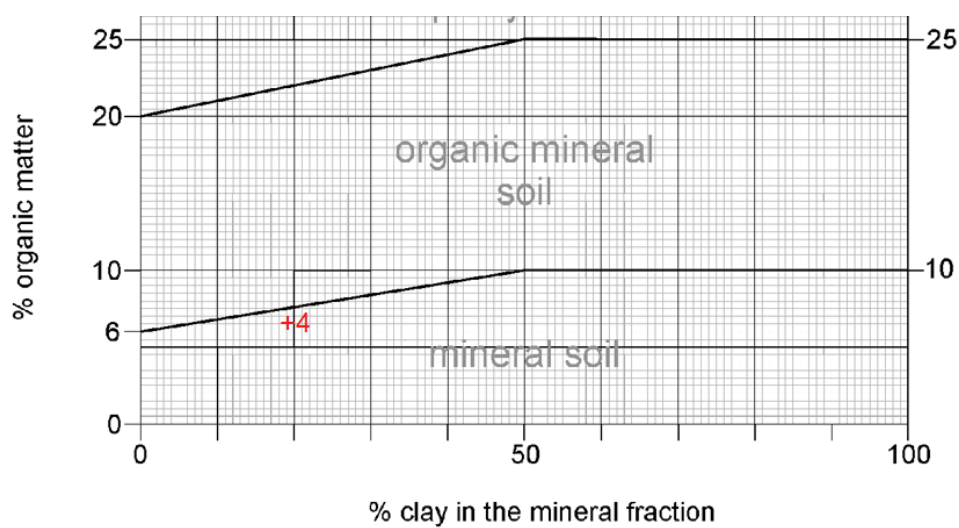
Determinand	Site 4	Units
Soil pH	6.2	
Phosphorus (P)	8.0	mg/l (av)
Potassium (K)	35.5	mg/l (av)
Magnesium (Mg)	111	mg/l (av)

Determinand	Site 4	Units
Phosphorus (P)	0	ADAS Index
Potassium (K)	0	ADAS Index
Magnesium (Mg)	3	ADAS Index

Soil Texture by Particle Size Analysis



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

Wetness calculations are made according to the methodology given in Appendix 3 of the ALC guidelines, MAFF 1988

Droughtiness calculations are made according to the methodology given in Appendix 4 of the ALC guidelines, MAFF 1988.

Grades are shown for drought, wetness and any other soil or site factors which are relevant. The overall Grade is set by the most limiting factor and shown on the right.

Stone types			Climate Data		Wetness Class Guidelines												
%	TAv	EAv	MDwheat	78	SPL within 80cm, gleying within 40cm										1147		
hard	1	0.5	MDpotato	64	SPL within 80cm, gleying at 40-70cm										1549		
.			FCD	234	No SPL but gleying within 40cm												
hard			flint & pebble		Maximum depth of auger penetration is <u>underlined</u>												
Site No.	Depth cm	Texture	CaCO ₃	Colour	Mottle colour	abund- ance	stone% hard	stone% .	Struct- ure	APwheat mm	AP potato mm	Gley	SPL	WC	Wetness grade WE	Final Grade	Limiting Factor(s)
1	T	0	30	SCL	10YR3/2		2		-	50	50	n	n	/	3a	3a	WE
		30	44	SCL	10YR4/2	Fe	few	10		19	19	n	n				
		44	80	mSL	2.5Y5/3	Fe	com	15		36	33	y	n				
		<u>80</u>	120	mSL	2.5Y5/3	Fe	com	15		38	0	y	n				
									Total	143	102						
									MB	65	38						
Droughtiness grade (DR)										1	1						
2	T	0	35	SCL	10YR3/2		2		-	58	58	n	n	/	3a	3a	WE
		35	38	SCL	10YR4/2	Fe	few	20		4	4	n	n				
		<u>38</u>	45	SCL	10YR4/2	Fe	few	20		8	8	n	n				
		45	120	mSL	2.5Y5/3	Fe	com	20		69	30	y	n				
									Total	139	100						
									MB	61	36						
Droughtiness grade (DR)										1	1						
3	T	0	28	SCL	10YR3/3		2		-	47	47	n	n	/	3a	3a	WE
		28	52	SZL	10YR4/2	Fe	few	15		34	35	n	n				
		<u>52</u>	60	SZL	10YR4/2	Fe	few	20		7	11	n	n				

		60	120	mSL		2.5Y5/3	Fe	com	20		54	12	y	n				
										Total	142	104						
										MB	64	40						
									Droughtiness grade (DR)		1	1						
4	T	0	30	SCL		10YR3/2			8	-	47	47	n	n	/	3a	3a	WE
Pit		30	40	SCL		10YR4/3	Fe	com	25		11	11	n	n				
		40	60	SCL		10YR4/3	Fe	com	30		18	21	n	n				
		60	120	mSL		2.5Y5/3	Fe	com	30		48	11	y	n				
										Total	124	90						
										MB	46	26						
									Droughtiness grade (DR)		1	1						
5	T	0	17	oSCL		10YR3/2			5	-	45	45	n	n	///	3a	3a	WE
		17	22	SCL		10YR4/2	Fe	com	15		6	6	y	n				
		22	45	SCL		10YR4/2	Fe	com	25		26	26	y	n				
		45	120	mSL		2.5Y5/3	Fe	com	25		65	28	y	n				
										Total	143	106						
										MB	65	42						
									Droughtiness grade (DR)		1	1						

Appendix 3: Site Photographs



Pit 1



Pit 1 topsoil



Pit 1 topsoil roots and worms



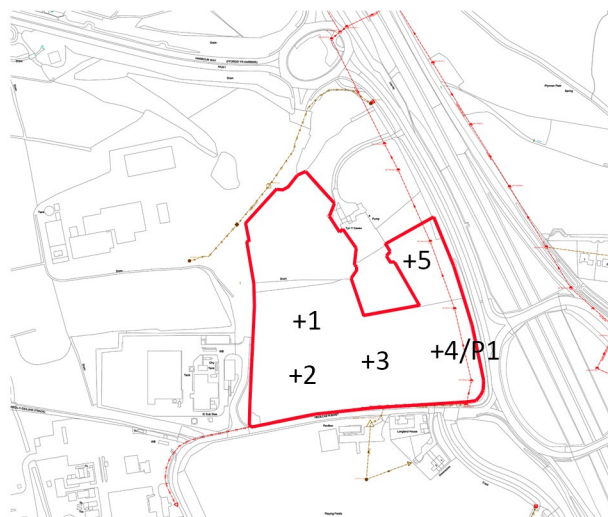
Pit 1 subsoil – large stone separated



Stony lower subsoil from GI excavation



Rushes in north-western field parcel



- Survey Area
 +1 Auger Observation
 .P1 Pit Observation

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Scale 1:10,000@A4 July/2021

Figure RAC9209-1: Observations

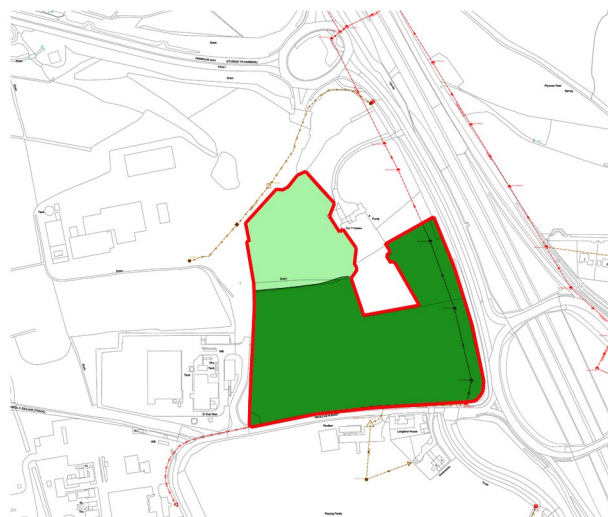
Site: Junction 38, M4

Client: Sandvik Osprey Ltd



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Scale 1:10,000@A4 July/2021

Figure RAC9209-2: Agricultural Land Classification

Site: Junction 38, M4

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