July 2021

Bloor Homes North West

Agricultural Land Classification and Soil Resources

at

Land to the East of Froghall Road, Cheadle, Stoke on Trent

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1 Introduction

1.1 Reading Agricultural Consultants Ltd (RAC) is instructed by Bloor Homes North West to investigate the Agricultural Land Classification (ALC) and soil resources of land to the east of Froghall Road, Cheadle, 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], and summarised in Natural England's Technical Information Note 049[2].

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 in the ALC system is defined as best and most versatile agricultural land.

1.6 As explained in Natural England's TIN049, the whole of England and Wales was mapped from reconnaissance field surveys in the late 1960s and early 1970s, to provide general strategic guidance on agricultural 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 (1:63,360). The Provisional ALC

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

[2] **Natural England (2012).** *Technical Information Note 049 - Agricultural Land Classification: protecting the best and most versatile agricultural land*, Second Edition.

map shows the site as moderate quality Grade 3 land, with poor quality Grade 4 land adjacent. However, TIN049 explains that:

> *"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 1976. 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 …"*

1.7 TIN049 goes on to explain that a definitive ALC grading should be obtained by undertaking a detailed survey according to the published guidelines, at an observation density of one boring per hectare. This survey follows the detailed methodology set out in the MAFF guidelines.

2 Site and climatic conditions

General features, land form and drainage

2.1 The site extends to 8.7ha, consisting of one complete field parcel and the southern approximate third of the adjoining field, both currently under grass. The site is bounded to the west by the A521 Froghall Road and residential properties, to the south by residential properties along Hammersley Hayes Road, and to the east by an access track leading to Broad Haye Farm which sits to the north-east of the site.

2.2 The site is located on a hillside with a southerly aspect, falling in altitude from around 189m AOD in the north to 176m AOD in the south.

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 178m AOD, and are given in Table 1. The climate is cold and wet with moderately small to small moisture deficits. The number of Field Capacity Days is considerably larger than is typical for lowland England (150 days), and is considered to be unfavourable for providing opportunities for agricultural field work.

Table 1: Local agro-climatic conditions

Parameter	Value
Average Annual Rainfall	859mm
Accumulated Temperatures >0°C	1,261 day°
Field Capacity Days	213 days
Average Moisture Deficit, wheat	67mm
Average Moisture Deficit, potatoes	48mm

Soil parent material and soil type

2.4 The principal underlying geology mapped by the British Geological Survey[3] across the site is the Pennine Lower Coal Measures Formation, within which is Kingsley Sandstone, a variant dominated by sandstone and present in the north of the site. The Pennine Lower Coal Measures Formation consists of interbedded grey mudstone, siltstone with pale grey sandstone. There are no mapped superficial deposits.

2.5 The Soil Survey of England and Wales soil association mapping[4] (1:250,000 scale) shows the Bardsey association to be present across the site. The main component soils of the Bardsey association include clay loam or sandy clay loam topsoil over clay loam and clay subsoils, becoming grey with depth. Profiles are primarily poorly drained, of Wetness Class (WC) IV[5].

3 Agricultural land quality

Soil survey methods

3.1 Nine soil profiles were examined across the site using an Edelman (Dutch) auger at an observation density of one per hectare in accordance with the established recommendations for ALC surveys[2]. One observation pit was also excavated to examine subsoil structures, as shown in Appendix 3. The locations of observations are indicated on Figure RAC9178-1. 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;

[3] **British Geological Survey (2021).** *Geology of Britain viewer*, http://mapapps.bgs.ac.uk/geologyofbritain/home.html

[4] **Soil Survey of England and Wales (1984).** *Soils of Midland and Western England* (1:250,000), Sheet 3

[5] **Ragg et al (1984).** *Soils and Their Use in Midland and Western England*. Soil Survey of England and Wales Bulletin 12, Harpenden.

- colour (including localised mottling);
- consistency;
- structural condition;
- free carbonate; and
- depth.

3.2 One topsoil sample and one subsoil sample were 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 Field Capacity Days 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 MAFF revised ALC guidelines (1988)[1]. Soil profiles have been described according to Hodgson (1997)[6] which is the recognised source for describing soil profiles and characteristics according to the revised ALC guidelines.

3.6 Agricultural land quality at the site is affected by wetness and workability. There is one topsoil type present at the site. The topsoil was consistently hand-textured in the field as heavy clay loam: however, the sample analysed for particle size distribution at the laboratory shows that the proportion of clay places the sample on the boundary of medium clay loam and heavy clay loam. Therefore, just +/- 1% clay in each observation point would determine whether the soil is medium clay loam (and the profile of Subgrade 3b) or heavy clay loam (and the profile of Grade 4).

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

3.7 The topsoil is dark greyish brown (10YR4/2 in the Munsell soil colour charts[7]) heavy clay loam and friable, with a moderate, medium subangular blocky structure. Many roots and pores were visible and many worms were observed in the observation pit. Ochreous mottles are present in the topsoil, observed in all but two locations, and are indicative of soil wetness. The topsoil is gleyed In the centre and east of the site (at Observations 6, 7 and 8).

3.8 Upper subsoil typically consists of heavy clay loam or clay with one profile of sandy clay loam. The upper subsoil is primarily brown (10YR5/3). Few pores and roots are present. Common medium prominent ochreous mottles are observed showing the horizon to be gleyed. The upper subsoil has a weakly developed coarse blocky structure and is slowly permeable.

3.9 Lower subsoil consists of medium or sandy clay loam and clay which is mainly greyish brown (10YR5/2), with grey (10YR5/1) in the north-east of the site and yellowish brown (10YR5/4) in the north and west. The lower subsoil is distinctly to prominently mottled, indicating poor drainage.

3.10 The soil profiles are mottled throughout and are gleyed and slowly permeable in the subsoil horizons, resulting in WC IV. With a heavy clay loam topsoil there is a wetness and workability limitation across the site to Grade 4, although as illustrated by the laboratory sample, this can be borderline to Subgrade 3b where the topsoil is medium clay loam. Given the consistent hand-texturing of the topsoil as heavy clay loam in the survey, the classification of the site as Grade 4 is shown in Figure RAC9178-2.

[7] **Munsell Color (2009).** *Munsell Soil Color Book*. Grand Rapids, MI, USA

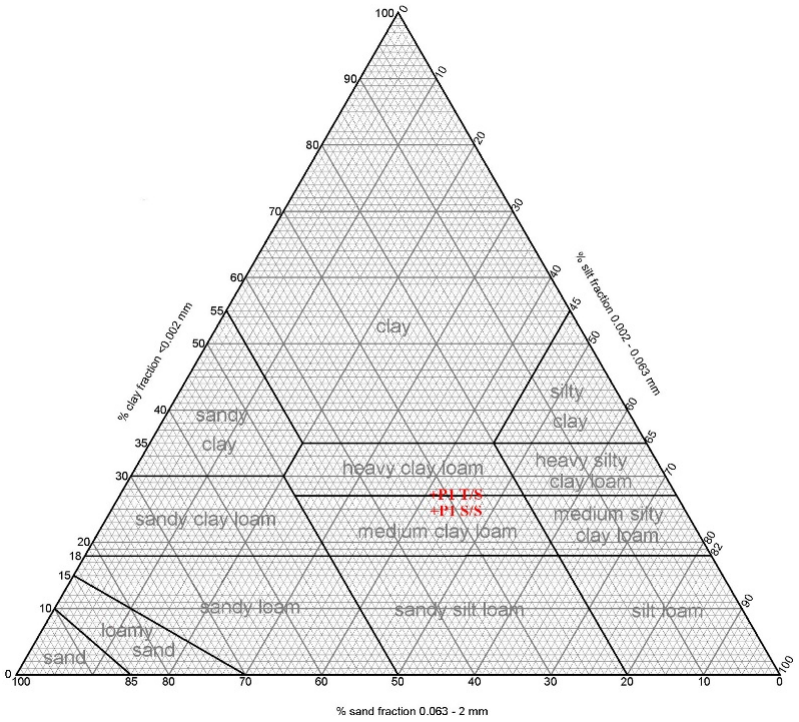
Appendix 1: Laboratory Data

Determinand	Site 7 Topsoil	Site 7 Subsoil	Units
Sand 2.00-0.063 mm	32	33	% w/w
Silt 0.063-0.002 mm	41	42	% w/w
Clay <0.002 mm	27	25	% w/w
Organic Matter	5.3	1.1	% w/w
Texture	Medium Clay Loam/Heavy Clay Loam	Medium Clay Loam	

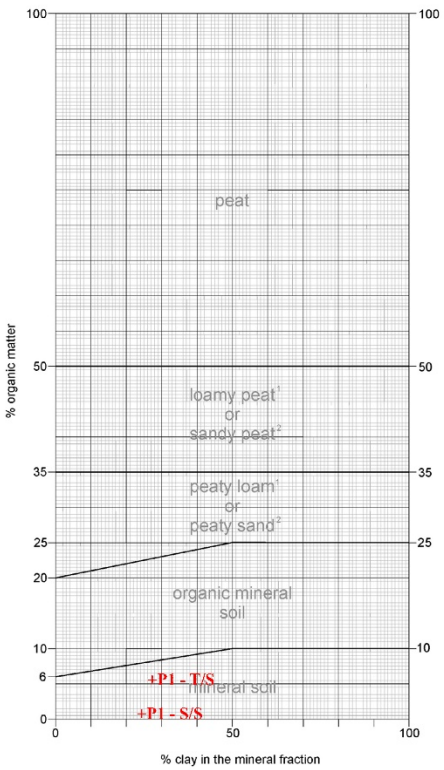
Determinand	Site 7 Topsoil	Site 7 Subsoil	Units
Soil pH	6.1	6.4	
Phosphorus (P)	21.6	2.8	mg/l (av)
Potassium (K)	31.8	25.4	mg/l (av)
Magnesium (Mg)	81.1	82.9	mg/l (av)

Determinand	Site 7 Topsoil	Site 7 Subsoil	Units
Phosphorus (P)	2	0	ADAS Index
Potassium (K)	0	0	ADAS Index
Magnesium (Mg)	2	2	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 / workability limitations are determined 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		
%	TAv	EAv
hard	1	0.5
chalk	10	7

Climate Data	
MDwheat	67
MDpotato	48
FCD	213

Wetness Class Guidelines	*II*	*III*	*IV*	*V*
SPL within 80cm, gleying within 40cm		>58cm	<58cm	
SPL within 80cm, gleying at 40-70cm	>78cm	<78cm		
No SPL but gleying within 40cm	coarse subsoil	*II*	other cases	*III*

hard flint & pebble

Maximum depth of auger penetration is underlined

Site No.		Depth cm		Texture	$CaCO_3$	Colour	Mottle colour	abund-ance	stone% hard	stone% chalk	Struct-ure	APwheat mm	AP potato mm	Gley	SPL	WC	Wetness grade WE	Final Grade	Limiting Factor(s)
1	T	0	30	hCL		10YR4/2	FeMn		0	0		54	54	n	n	*IV*	4	**4**	WE
		30	40	C		10YR5/3	och	mmd	0	0	poor	13	13	y	y				
		40	120	C		10YR5/4	och	mmd	0	0	poor	62	39	(y)	y				
											Total	**129**	**106**						
											MD	62	58						
									Droughtiness grade (DR)			1	1						
2	T	0	30	hCL		10YR4/2			0	0		54	54	n	n	*IV*	4	**4**	WE
		30	60	SCL		10YR5/3	och	cmd	0	0	poor	40	45	y	y				
		60	120	SCL		10YR5/2	och	cmd	0	0	poor	60	15	y	y				
											Total	**154**	**114**						
											MD	87	66						
									Droughtiness grade (DR)			1	1						
3	T	0	30	hCL		10YR4/2	och	fmd	0	0		54	54	n	n	*IV*	4	**4**	WE
		30	60	hCL		10YR5/3	och	mmd	0	0	poor	31	36	y	y				
		60	120	mCL		10YR5/2	och	mmd	0	0	poor	42	12	y	y				
											Total	**127**	**102**						
											MD	60	54						
									Droughtiness grade (DR)			1	1						
4	T	0	30	hCL		10YR4/2	och	fmd	0	0		54	54	n	n	*IV*	4	**4**	WE
		30	50	hCL		10YR5/3	och	mmd	0	0	poor	24	24	y	y				
		50	120	C		10YR5/4	och	mmd	0	0	poor	49	26	y	y				
											Total	**127**	**104**						

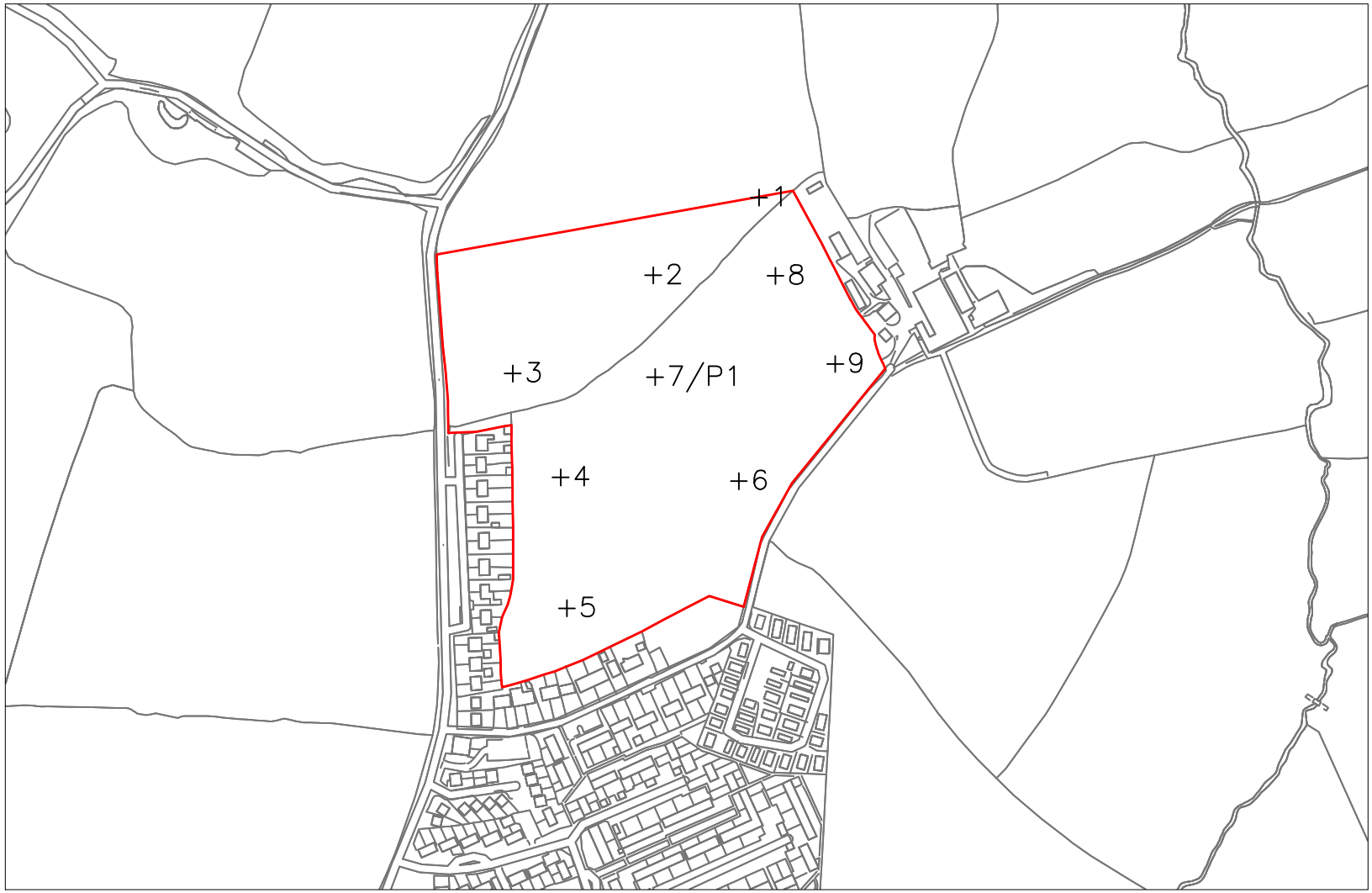
										MD	60	56						
									Droughtiness grade (DR)		1	1						
5	T	0	35	hCL	10YR4/2	och	fmd	0	0		63	63	n	n	*IV*	4	**4**	WE
		35	60	hCL	10YR5/3	och	mmd	0	0	poor	25	30	y	y				
		60	120	mCL	10YR5/2	och	cmd	0	0	poor	48	13	y	y				
										Total	**136**	**106**						
										MD	69	58						
									Droughtiness grade (DR)		1	1						
6	T	0	35	hCL	10YR4/2	och	mmd	0	0		63	63	y	n	*IV*	4	**4**	WE
		35	50	hCL	10YR5/3	och	mmd	0	0	poor	18	18	y	y				
		50	120	mCL	10YR5/2	och	cmd	0	0	poor	56	26	y	y				
										Total	**137**	**107**						
										MD	70	59						
									Droughtiness grade (DR)		1	1						
7	T	0	35	hCL	10YR4/2	och	mmd	0	0		63	63	y	n	*IV*	4	**4**	WE
		35	50	hCL	10YR5/1	och	cmp	0	0	poor	18	18	y	y				
		50	120	mCL	10YR5/1	och	cmp	0	0	poor	56	26	y	y				
										Total	**137**	**107**						
										MD	70	59						
									Droughtiness grade (DR)		1	1						
8	T	0	35	hCL	10YR4/2	och	mmd	0	0		63	63	y	n	*IV*	4	**4**	WE
		35	50	C	10YR5/3	och	cmd	0	0	poor	20	20	y	y				
		50	120	C	10YR5/1	och	cmp	0	0	poor	49	26	y	y				
										Total	**132**	**109**						
										MD	65	61						
									Droughtiness grade (DR)		1	1						
9	T	0	30	hCL	10YR4/2	och	fmd				54	54	n	n	*IV*	4	**4**	WE
		30	40	C	10YR5/3	och	cmd			poor	13	13	y	y				
		40	120	C	10YR5/1	och	cmp			poor	62	39	y	y				
										Total	**129**	**106**						
										MD	62	58						
									Droughtiness grade (DR)		1	1						

Appendix 3: Soil Pit Photographs

Topsoil

Soil pit

Subsoil



N

1:5,000

0 100m 200m

KEY

Survey boundary

+1 Observation

+P Pit

Rev.	Comment	Date

Drawing title

OBSERVATION MAPPING

Contract

LAND TO THE EAST OF FROGHALL ROAD, CHEADLE, STOKE ON TRENT

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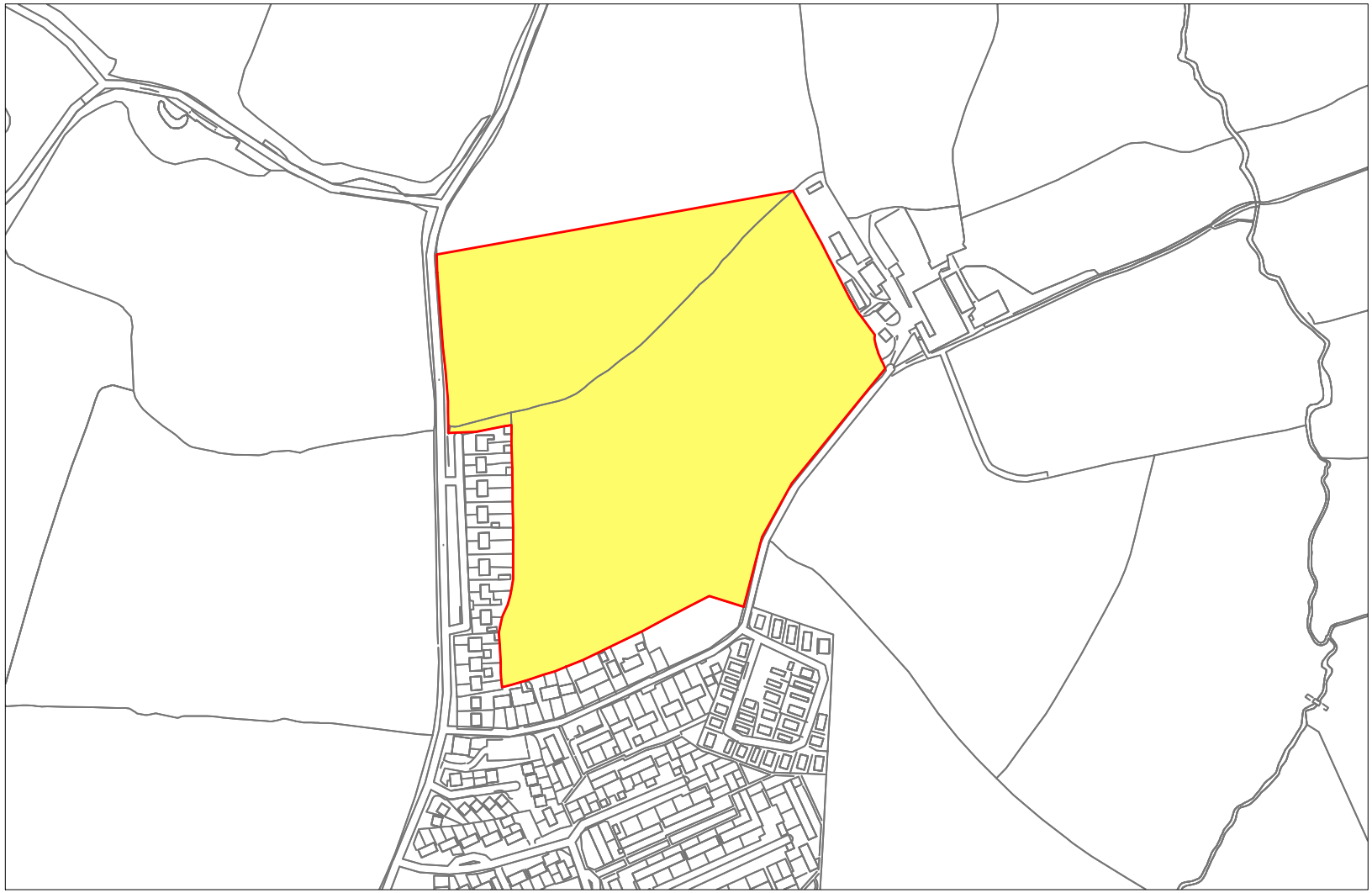

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1:5,000

0 100m 200m

KEY

Grade 1	*	Grade 4	
Grade 2	*	Grade 5	*
Subgrade 3a	*	Non-agricultural	*
Subgrade 3b	*	Not present	*

Rev.	Comment	Date

Drawing title

AGRICULTURAL LAND CLASSIFICATION

Contract

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