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Cheshire and North Wales Sand and Gravel Limited

Agricultural Land Classification and Soil Resources

Land at Ballswood Quarry, Wrexham (Area A)

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1. Introduction

- 1.1. Reading Agricultural Consultants Ltd (RAC) is instructed by Cheshire and North Wales Sand and Gravel Limited to investigate the Agricultural Land Classification (ALC) and soil resources of land to the north-east of Ballswood Quarry, Wrexham, by means of a detailed survey of site and soil characteristics.
- 1.2. 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.
- 1.3. 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 severe limitations which restrict use to permanent pasture or rough grazing.
- 1.4. Land which is classified as Grades 1, 2 and 3a is defined in paragraph 3.58 of Planning Policy Wales (PPW)¹ as the best and most versatile (BMV) agricultural land.
- 1.5. The Predictive ALC map for Wales² is based on the principles of the ALC system of England and 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 Predictive ALC map shows the site as Grade 2, defined as:

¹ **Welsh Government (2021).** *Planning Policy Wales, Edition 11.*

https://gov.wales/sites/default/files/publications/2021-02/planning-policy-wales-edition-11_0.pdf

² https://datamap.gov.wales/layers/inspire-wg:wg_predictive_alc2

³ **MAFF (1988).** *Agricultural Land Classification of England and Wales. Revised guidelines and criteria for grading the quality of agricultural land.*

<http://publications.naturalengland.org.uk/publication/6257050620264448?category=5954148537204736>

“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.”

- 1.6. The predictive ALC map is not suitable for assessing the quality of individual sites, as explained in the Welsh Government’s Frequently Asked Questions on ALC⁴ which states that 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 has been carried out in line with the established ALC guidelines.

2. Site and climatic conditions

General features, landform and drainage

- 2.1. The area surveyed extends to approximately 4.35 ha of mostly agricultural land to the north-east of the existing quarry workings at Ballswood Quarry, south of the B5102 road (Llay Road) and west of Yew Tree Farm.
- 2.2. The site is generally level at an elevation of approximately 30m-40m above Ordnance Datum (AOD). Drainage is through the soil profile.

Agro-climatic conditions

- 2.3. Agro-climatic data for the site have been interpolated from the Meteorological Office’s standard 5km grid point dataset and are given in Table 1. The site has moderate rainfall and is moderately warm, with moderate to moderately large moisture deficits. The number of Field Capacity Days (FCD) is above average for lowland England and Wales (150) and is slightly unfavourable for providing opportunities for agricultural field work. There are no climatic limitations to agricultural land quality at the site.

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>

Table 1: Local agro-climatic conditions

Parameter	
Grid Reference	SJ 350 565
Altitude (AOD)	35m
Average Annual Rainfall	685mm
Accumulated Temperatures >0°C	1,434 day°
Field Capacity Days	171 days
Average Moisture Deficit, wheat	103mm
Average Moisture Deficit, potatoes	93mm

Soil parent material and soil type

- 2.4. The underlying geology mapped by the British Geological Survey⁵ across the site is sandstone of the Kinnerton Sandstone Formation. Superficial deposits of sand and gravel from Glaciofluvial Sheets Deposits are also mapped across the site.
- 2.5. The Soil Survey of England and Wales soil association mapping⁶ (1:250,000 scale) shows the Newport 1 soil association mapped across the site. This association is characterised by well drained, medium sandy loam soils over loamy sand and sand soils. Profiles are typically well drained and assessed as Wetness Class (WC) I⁷.

3. Agricultural land quality

Soil survey methods

- 3.1. Five soil profiles were examined within the site using an Edelman (Dutch) auger at an observation density of one per hectare in accordance with the established recommendation for ALC surveys. One observation pit was also excavated to examine subsoil structures.
- 3.2. The locations of all observations are shown on Figure RAC/9445/1. 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;

⁵ **British Geological Survey (2022).** *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 **Landis**, accessed December 2021

- significant stoniness;
 - colour (including localised mottling);
 - consistency;
 - structural condition;
 - free carbonate; and
 - depth.
- 3.3. 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.
- 3.4. Soil Wetness Class 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.
- 3.5. 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

- 3.6. Assessment of land quality has been carried out according to the ALC guidelines³. Soil profiles have been described according to Hodgson⁸ which is the recognised source for describing soil profiles and characteristics according to the revised ALC guidelines.
- 3.7. Agricultural land quality within the site is limited by soil droughtiness to Grade 2, as demonstrated in Appendix 2.
- 3.8. One soil type is present within the site, photographs of which can be seen in Appendix 3.

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

- 3.9. The topsoil comprises a dark brown (7.5YR3/2, 7.5YR3/3 in the Munsell soil colour charts⁹), medium sandy loam. The topsoil is slightly stony at about 10% by volume. The stones are generally less than 2cm in length with about 2% between 2cm and 6cm in length. The topsoil has a fine medium subangular blocky structure and a friable consistency.
- 3.10. The upper subsoil comprises friable, loamy medium sand or medium sand which is predominantly brown or dark brown (7.5YR4/4, 7.5YR3/4, 7.5YR3/3). The upper subsoil has a granular structure. The upper subsoil is predominantly slightly stony at 10% by volume. Augering to depth was prevented at depths of between 45cm and 60cm.
- 3.11. The lower subsoil comprises brown or reddish brown (7.5YR4/4, 5YR4/4) sandy clay loam. The soil is friable with a fine subangular structure, and stone content is about 25%.
- 3.12. Soils with these characteristics are assessed as WC I and limited to Grade 2 by droughtiness, as shown in Figure RAC/9445/2 and Table 2.

Table 2: Agricultural Land Classification

Grade	Description	Area (ha)	%
Grade 2	Very good quality	4.1	94
Non-agricultural		0.25	6
Total		4.35	100

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

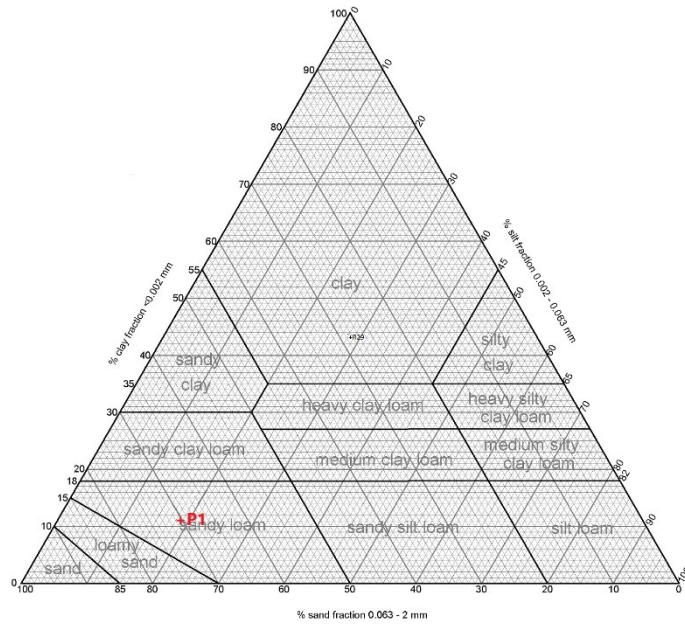
Appendix 1: Laboratory Data

Determinand	Pit 1	Units
Sand 2.00-0.063 mm	70	% w/w
Silt 0.063-0.002 mm	19	% w/w
Clay <0.002 mm	11	% w/w
Organic Matter	5.0	% w/w
Texture	Sandy Loam	

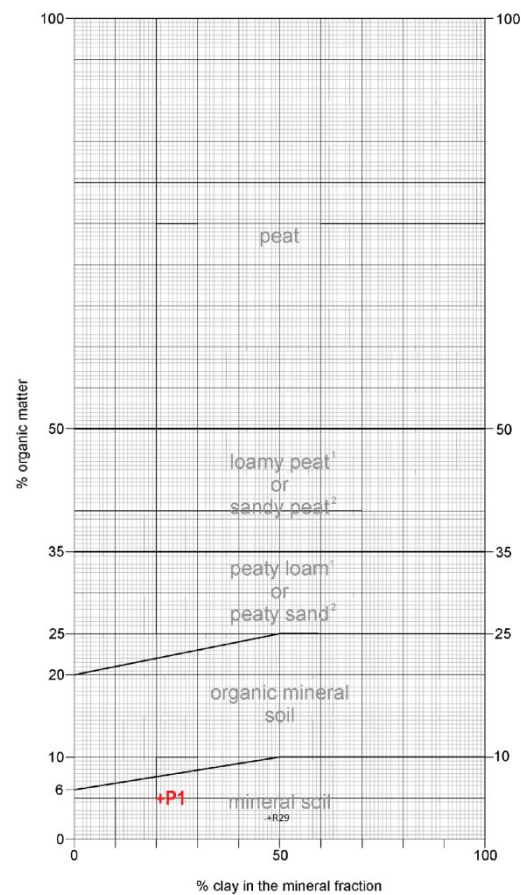
Determinand	Pit 1	Units
Soil pH	8.1	
Phosphorus (P)	59.2	Mg/l (av)
Potassium (K)	240	Mg/l (av)
Magnesium (Mg)	54.8	Mg/l (av)

Determinand	Pit 1	Units
Phosphorus (P)	4	ADAS Index
Potassium (K)	2+	ADAS Index
Magnesium (Mg)	2	ADAS Index

Soil Texture by Particle Size



Organic Matter content



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				
%	TA _v	E _{av}	MDwheat	103		II	III	IV	V
hard	1	0.5	MDpotato	93		SPL within 80cm, gleying within 40cm	>74cm	46-74cm	<46cm
.			FCD	171		SPL within 80cm, gleying at 40-70cm	>61cm	<61cm	
						No SPL but gleying within 40cm	coarse subsoil	I	other cases
									II
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	38	mSL	7.5YR3/3			5		-	61	61			I	1	2	Dr
		35	<u>60</u>	LmS	7.5YR3/4			5		m	19	21						
		60	120	SCL	5YR3/4			5		m	57	14						
										Total	137	97						
										MB	34	4						
										Droughtiness grade (DR)	1	2						
2	T	0	35	mSL	7.5YR3/3			5		-	57	57			I	1	2	Dr
		35	40	LmS	7.5YR3/3			5		m	4	4						
		40	<u>50</u>	mSL	5YR3/4			5		m	14	14						
		50	120	SCL	5YR4/4			20		m	57	24						
										Total	132	99						
										MB	29	6						
										Droughtiness grade (DR)	2	2						

3	T	0	35	mSL	7.5YR3/3	3		58	58	/	1	2	Dr
		35	50	LmS	7.5YR3/4	3	m	13	13				
		50	120	SCL	5YR4/4	20	m	57	24				
				Total	128	95							
				MB	25	2							
				Droughtiness grade (DR)	2	2							
4	T	0	35	mSL	7.5YR3/2	3		58	58	/	1	2	Dr
		35	38	LmS	7.5YR3/2	3	m	3	3				
		38	45	LmS	7.5YR3/4	3	m	6	6				
		45	120	SCL	5YR4/4	20	m	63	30				
				Total	130	96							
				MB	27	3							
		Droughtiness grade (DR)	2	2									
5	T	0	38	mSL	7.5YR3/3	3		63	63	/	1	2	Dr
		38	40	LmS	7.5YR3/2	3	m	2	2				
		40	45	LmS	7.5YR4/4	3	m	4	4				
		45	120	SCL	5YR4/4	20	m	63	30				
				Total	132	99							
				MB	29	6							
		Droughtiness grade (DR)	2	2									

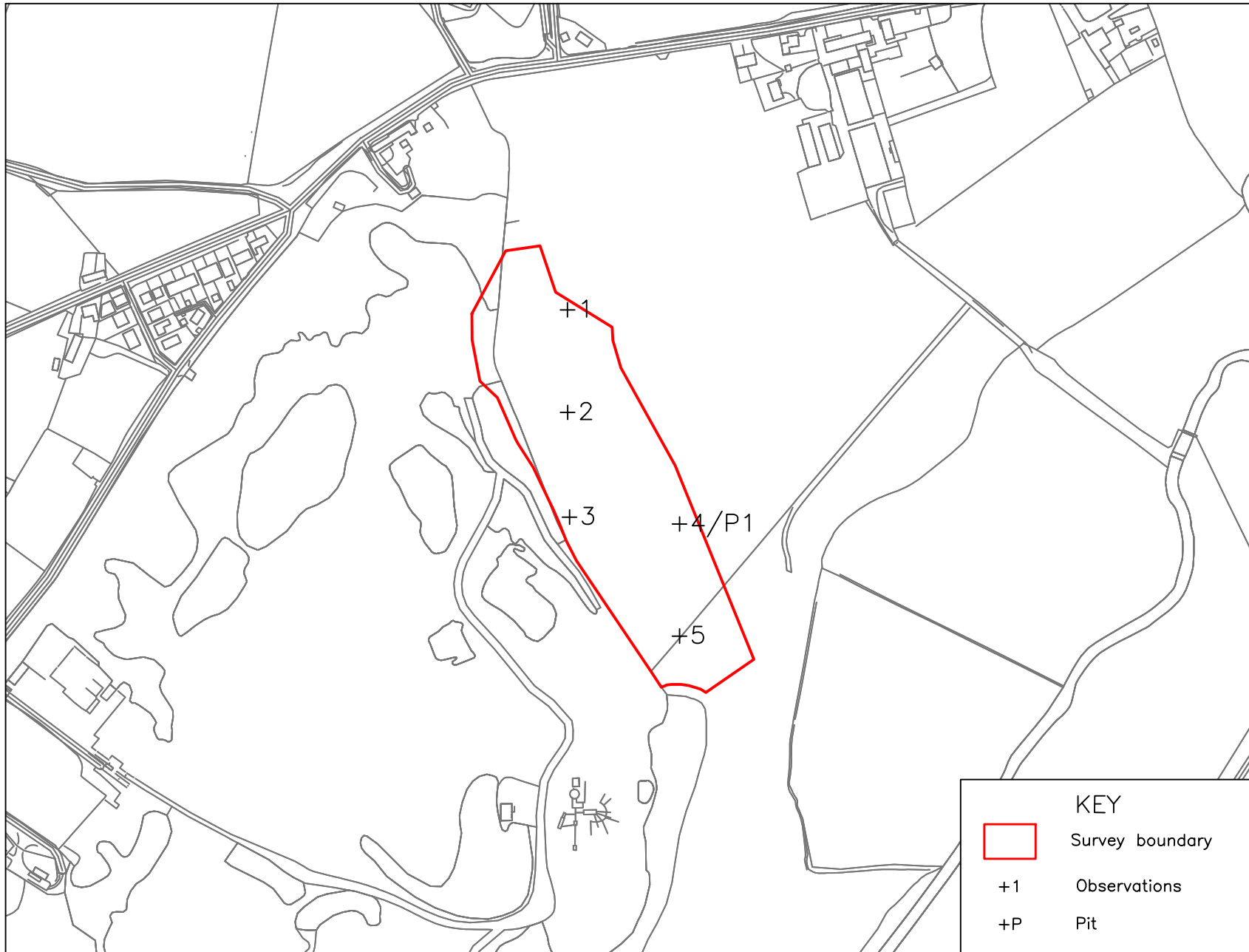
Appendix 3: Site Photographs



Pit 1 near observation 4



View across
site to south west



KEY

Survey boundary

+1 Observations

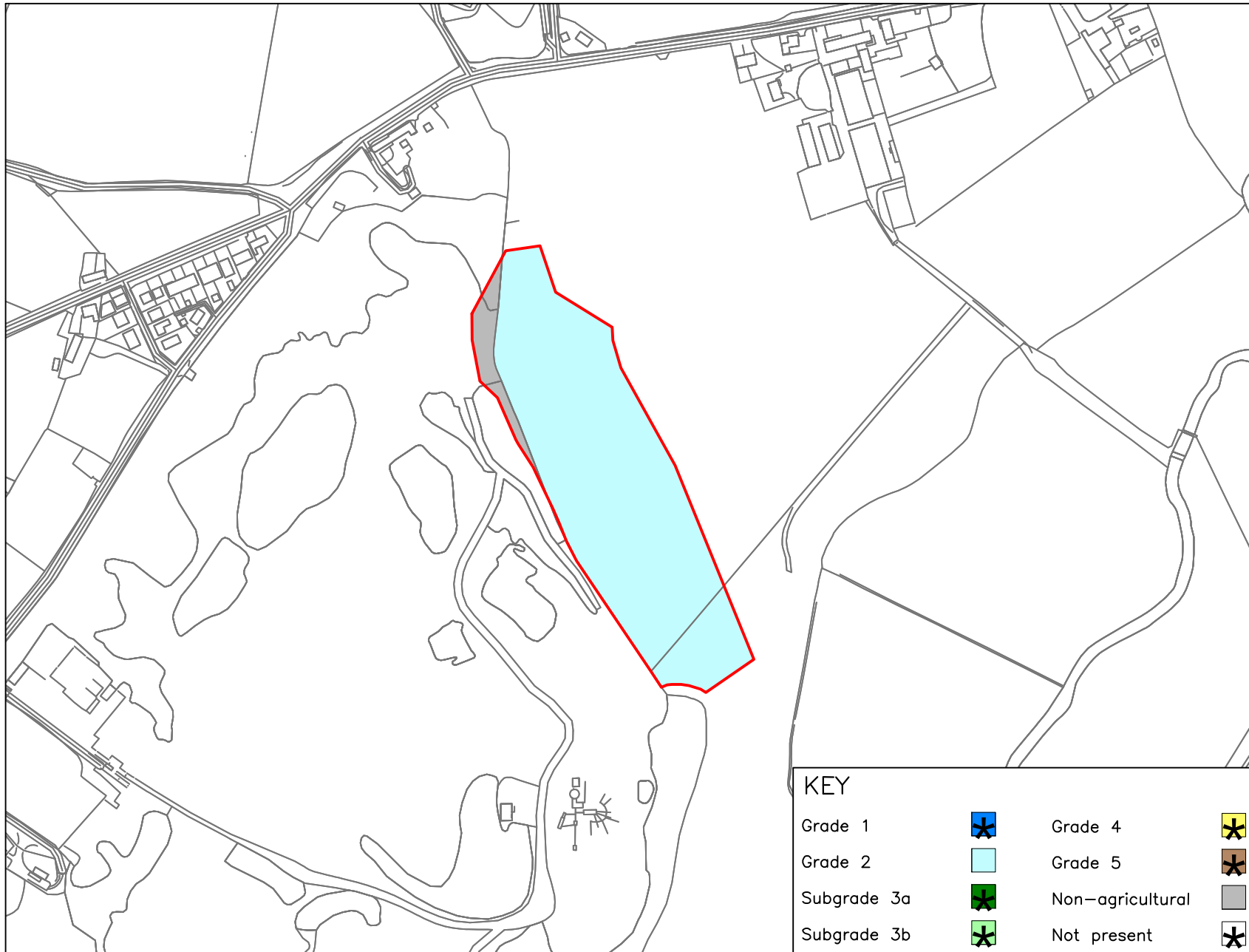
+P Pit

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KEY

Grade 1



Grade 4



Grade 2



Grade 5



Subgrade 3a



Non-agricultural



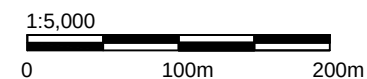
Subgrade 3b



Not present



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