AGRICULTURAL QUALITY
OF LAND AT DRAGON LNG MEADOW
MILFORD HAVEN

Report 1899/1

8th November 2021

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Report 1899/1
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SUMMARY

An agricultural land quality survey has been undertaken of 16.1 ha of land at Dragon LNG Meadow in November 2021.

The land has a mixture of shallow and deeper fine loamy soils. Land quality is a mixture of grade 2, 3 and 4 agricultural quality, variably limited by shallow soil depth, droughtiness, slope gradient and wetness.

1.0 Introduction

1.1 This report provides information on the soils and agricultural quality of 16.1 ha of land known as the Dragon LNG 'Meadow' near Milford Haven, Pembrokeshire. The report is based on a survey of the land in November 2021.

SITE ENVIRONMENT

1.2 The survey area covers two fields and an artificial embankment to the north. The land is bordered to the north and east by the gas terminal, to the south by Milford Sound, and to the west by rough grassland. The land in the north forms a ridge summit, sloping increasingly steeply to the south. Average elevation is approximately 45 m AOD.

1.3 The land is all in use as sheep pasture.

PUBLISHED INFORMATION

1.4 1:50,000 scale BGS information records the underlying geology of the land as Cosheston Group sandstone.

1.5 The National Soil Map (published at 1:250,000 scale) records the land as Milford Association: mainly reddish fine loamy soils over sedimentary rock, with some deeper soils in thicker drift, particularly on lower slopes[1].

1.6 The Predictive Agricultural Land Classification map of Wales estimates the land as grade 2 with areas of subgrade 3b and grade 4.

[1]Rudeforth C.C. *et al*., (1984).*Soils and their use in Wales,* Soil Survey of England and Wales. Bulletin No. 11, Harpenden.

2.0 Soils

2.1 A detailed soils and agricultural quality survey was carried out in November 2021 in strict accordance with MAFF (1988) guidelines[2]. It was based on observations at intersects of a 100 m grid, giving a density of one observation per hectare. During the survey, soils were examined by a combination of pits and augerings to a maximum depth of 1.0 m. A log of the sampling points and a map (Map 1) showing their locations are in an appendix to this report.

2.2 The soils were mainly found to be shallow medium loams over hard bedrock at variable depth, often with a thin stony subsoil layer. In some areas where the subsoil is deeper, it shows evidence of seasonal waterlogging (greyish colours with ochreous mottles) although none of the subsoils are slowly permeable. The embankment to the north appears to have been formed from rock debris topped with a thin topsoil layer.

2.3 An example deeper profile is described below from a pit at observation 2

0-26 cm	Dark reddish brown (5YR 3/2) sandy clay loam; 5% small and medium hard tabular sandstone fragments; well developed fine and medium sub-angular blocky structure; friable; many fine fibrous roots; smooth gradual boundary to:
26-47 cm	Reddish brown (5YR 5/3) sandy clay loam; very slightly stony; moderately developed coarse sub-angular blocky structure; friable; frequent fissures and worm channels; low packing density; common fine fibrous roots; smooth gradual boundary to:
47-62 cm	Reddish brown (5YR 5/3) sandy clay loam with reddish grey (5YR 5/2) ped faces; 15-20% medium hard tabular sandstone fragments; moderately developed very coarse sub-angular blocky structure; friable; medium packing density; few fine fibrous roots; uneven gradual boundary to:
62 cm+	Fractured sandstone bedrock.

2.4 An example shallower profile is described below from a pit at observation 7 (Map 1).

0-23 cm	Dark reddish brown (5YR 3/2) sandy clay loam; 10% small and medium hard tabular sandstone fragments; well developed fine sub-angular blocky structure; friable; many fine fibrous roots; smooth gradual boundary to:
23-36 cm	Dark reddish grey (5YR 4/2) sandy clay loam; 30% hard tabular sandstone fragments; moderately developed medium sub-angular blocky structure; friable; low packing density; common fine fibrous roots; uneven diffuse boundary to:
36 cm+	Fractured sandstone bedrock.

[2]MAFF, (1988).*Agricultural Land Classification for England and Wales: Guidelines and Criteria for Grading the Quality of Agricultural Land*.

3.0 Agricultural land quality

3.1 To assist in assessing land quality, the Ministry of Agriculture, Fisheries and Food (MAFF) developed a method for classifying agricultural land by grade according to the extent to which physical or chemical characteristics impose long-term limitations on agricultural use for food production. The MAFF ALC system classifies land into five grades numbered 1 to 5, with grade 3 divided into two subgrades (3a and 3b). The system was devised and introduced in the 1960s and revised in 1988.

3.2 The agricultural climate is an important factor in assessing the agricultural quality of land and has been calculated using the Climatological Data for Agricultural Land Classification[3]. The relevant site data for an average elevation of 45 m is given below.

- Average annual rainfall: 1075 mm
- January-June accumulated temperature >0°C 1523 day°
- Field capacity period 219 days
  (when the soils are fully replete with water) Late Sept-mid May
- Summer moisture deficits for: wheat: 84 mm
  potatoes: 71 mm

3.3 The survey described in the previous section was used in conjunction with the agro-climatic data above to classify the site using the revised guidelines for ALC issued in 1988 by MAFF[4]. There are no overriding climatic limitations at this locality.

SURVEY RESULTS

3.4 This report describes the main limitations affecting ALC grades at this site. The agricultural quality of the land is primarily determined by droughtiness, soil depth, gradient and wetness. Other factors were assessed but did not affect the overall grading.

3.5 Land of grade 2, 3 and 4 has been identified.

[3]Meteorological Office, (1989).*Climatological Data for Agricultural Land Classification*.
[4]MAFF, (1988).*Agricultural Land Classification for England and Wales: Guidelines and Criteria for Grading the Quality of Agricultural Land*.

Grade 2

3.6 Land of this grade occurs in the north of the site where soils are deepest. Machinery land access is likely to be restricted by wetness (caused by the combination of moist local climate and moderately high topsoil clay content). Subsoil stoniness and restricted rooting depth are also likely to result in reduced yields of arable crops in dry summers due to droughtiness.

Subgrade 3a

3.7 This subgrade includes land with moderately shallow soils (typically 40-50 cm). The limited rooting depth precludes the growth of some root crops, and results in droughtiness likely to limit average yields of cereal crops.

3.8 One observation (point 3 of Map 1) had deep soils with evidence of waterlogging at depth. The wetness restriction caused by slightly impeded drainage (Soil Wetness Class II) and moderately high topsoil clay content is likely to restrict access to this area with machinery in winter and early spring in an average year.

Subgrade 3b

3.9 This land typically has shallow soils (less than 40 cm). The limited rooting depth causes a droughtiness limitation which means average yields of cereal crops are likely to be low. Some areas have soils less than 30 cm in depth over hard rock, which causes additional restrictions to the growth of root crops and to cultivation through increased machinery wear; limited soil depth is therefore an equally limiting factor in these areas.

3.10 Areas in the south of the site slope at between 7 and 11 degrees. These gradients cause difficulties in the use of some cultivation machinery, and slope gradient is therefore either an equal limitation in these areas, or occasionally the most limiting factor where soils are deeper.

Grade 4

3.11 The steepest slopes within the site have gradients of over 11 degrees. This land is not suitable for cultivation with machinery. In addition to these slopes, the land on the embankment in the north has very shallow soils (less than 20 cm) which could not be cultivated.

Grade areas

3.12 The land grades are shown on Map 2 and the areas occupied shown below.

Table 1: Areas occupied by the different land grades

Grade/subgrade	*Area (ha)*	*% of the land*
Grade 2	2.0	12
Subgrade 3a	4.8	30
Subgrade 3b	7.8	48
Grade 4	1.4	9
Other land	0.1	1
Total	16.1	100

APPENDIX

DETAILS OF OBSERVATIONS

MAPS

Land at Dragon LNG Meadow: Soils and ALC survey – Details of observations at each sampling point

Obs	Topsoil			Upper subsoil			Lower subsoil			Slope	Wetness	Agricultural quality	
No	Depth (cm)	Texture	Stones >20 mm (%)	Depth (cm)	Texture	Mottling	Depth (cm)	Texture	Mottling	(°)	Class	Grade	Main limitation
1	0-27	SCL	<5	27-40	mstSCL	xx	40+	SST		3	I	3b	D
2	0-30	SCL	<5	30-63	SCL(r)	o	63+	SST		3	I	2	D/W
3	0-26	SCL	<5	26-54	SCL	xx	54-100+	SCL/HCL	xxx	2	II	3a	W
4	0-30	SCL	<5	30-43	SCL(r)	o	43+	SST		2	I	3a	De/D
5	0-12	mstSCL	10-15	12+	rubble (dist)	-				12	-	4(5)	Sl/De)
6	0-24	SCL	5-10	24-35	rubble	-	35+	SST		8	I	3b	D/Sl
7	0-23	SCL	<5	23-36	mstSCL	o	36+	SST		5	I	3b	D
8	0-25	SCL	<5	25-90+	SCL(r)	o				2	I	2	W
9	0-27	SCL	<5	27-42	SCL(r)	xx	42-80+	mstSCL(r)	xx	12	I	4	Sl
10	0-31	SCL	<5	31-82	SCL	xx	82+	SST		13	I	4	Sl
11	0-25	SCL	<5	25-33	SCL/rubble	o	33+	SST		5	I	3b	D
12	0-26	MCL/SCL	<5	26-62	SCLMCL(r)	o	62+	SST		3	I	3a/2	D
13	0-25	SCL	5-10	25+	SST					3	I	3b	De/D
14	0-25	MCL	<5	25-37	vstMCL/ SCL(r)	o	37+	SST		2	I	3b	D
15	0-20	SCL	5-10	20+	SST					10	I	3b	D/Sl
16	0-28	MCL	<5	28-78	MCL(r)	o	78+	SST		8	I	3b	Sl

Survey log key

Gley indicators[1]

o	unmottled
x	1-2% ochreous mottles and brownish matrix (or a few to common root mottles (topsoils))[3]
xx	>2% ochreous mottles and brownish matrix and/or dull structure faces (slightly gleyed horizon)
xxx	>2% ochreous mottles and greyish or pale matrix (gleyed horizon) or reddish matrix and >2% greyish, brownish or ochreous mottles and pale ped faces mottles or f-m concentrations (gleyed horizon)
xxxx	dominantly blueish matrix often with some ochreous mottles (gleyed horizon)

Slowly permeable layers[4]

a depth underlined (e.g. 50) indicates the top of a slowly permeable layer
A wavy underline (e.g. 50 indicates the top of a layer borderline to slowly permeable

Texture[2]

C - clay
ZC - silty clay
SC - sandy clay
CL - clay loam (H-heavy, M-medium)
ZCL - silty clay loam (H-heavy, M-medium)
SZL - sandy silt loam (F-fine, M-medium,C-coarse)
LS - loamy sand (F-fine, M-medium, C-coarse)
SL - sandy loam (F-fine, M-medium, C-coarse)
S - sand (F-fine, M-medium, C-coarse)
SCL - sandy clay loam
P - peat (H-humified, SF-semi-fibrous, F-fibrous)
LP - loamy peat; PL - peaty loam

Wetness Class[5]

I (freely drained) to VI (very poorly drained)

Limitations:

W - wetness/workability
D - droughtiness
De - depth
F - flooding
St – stoniness
Sl – slope
T – topography/microrelief

Suffixes & prefixes:

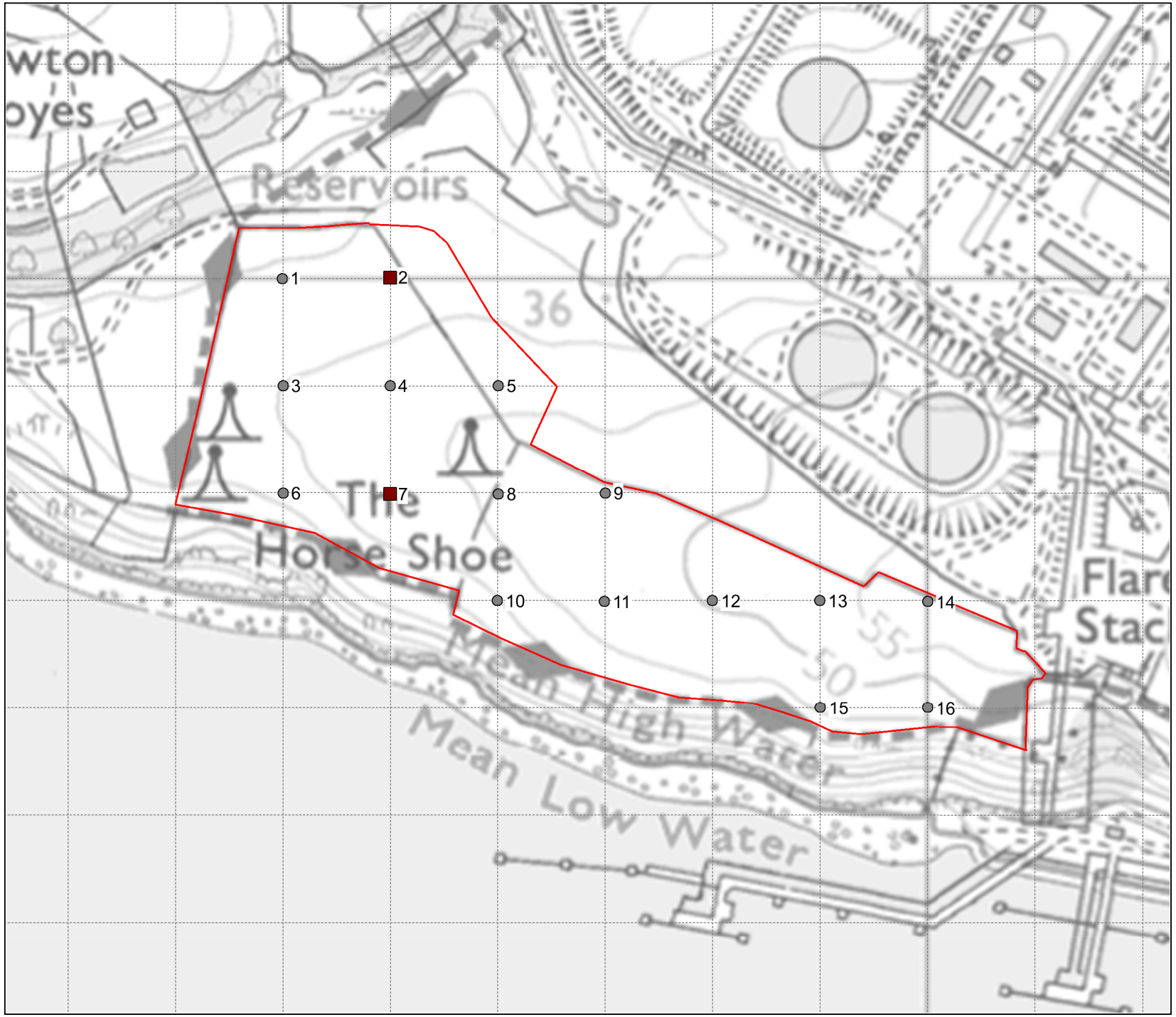
r-reddish, gn – greenish
o - organic
(m, v, x)st – (moderately, very, extremely) stony, chky-chalky
(vsl, sl, m, v, x)(very slightly, slightly, moderately very, extremely) calcareous

Other abbreviations

fmn - ferri-manganiferous concentrations
dist - disturbed soil layer;
R – bedrock (CH – chalk, SST – sandstone LST – limestone, MST – Mudstone)

[1]Gley indicators in accordance with Hodgson, J.M., 1997. Soil Survey Field Handbook (third edition). Soil survey technical monograph No. 5

[2]Texture in accordance with particle size classes in Hodgson (1997)
[3] Occasionally recorded in the texture box



KEY

- Auger observations
- Pits
- Site boundary

Client: Anesco

Site: Dragon LNG Meadow

Map title: MAP 1 Observations

Land Research Associates
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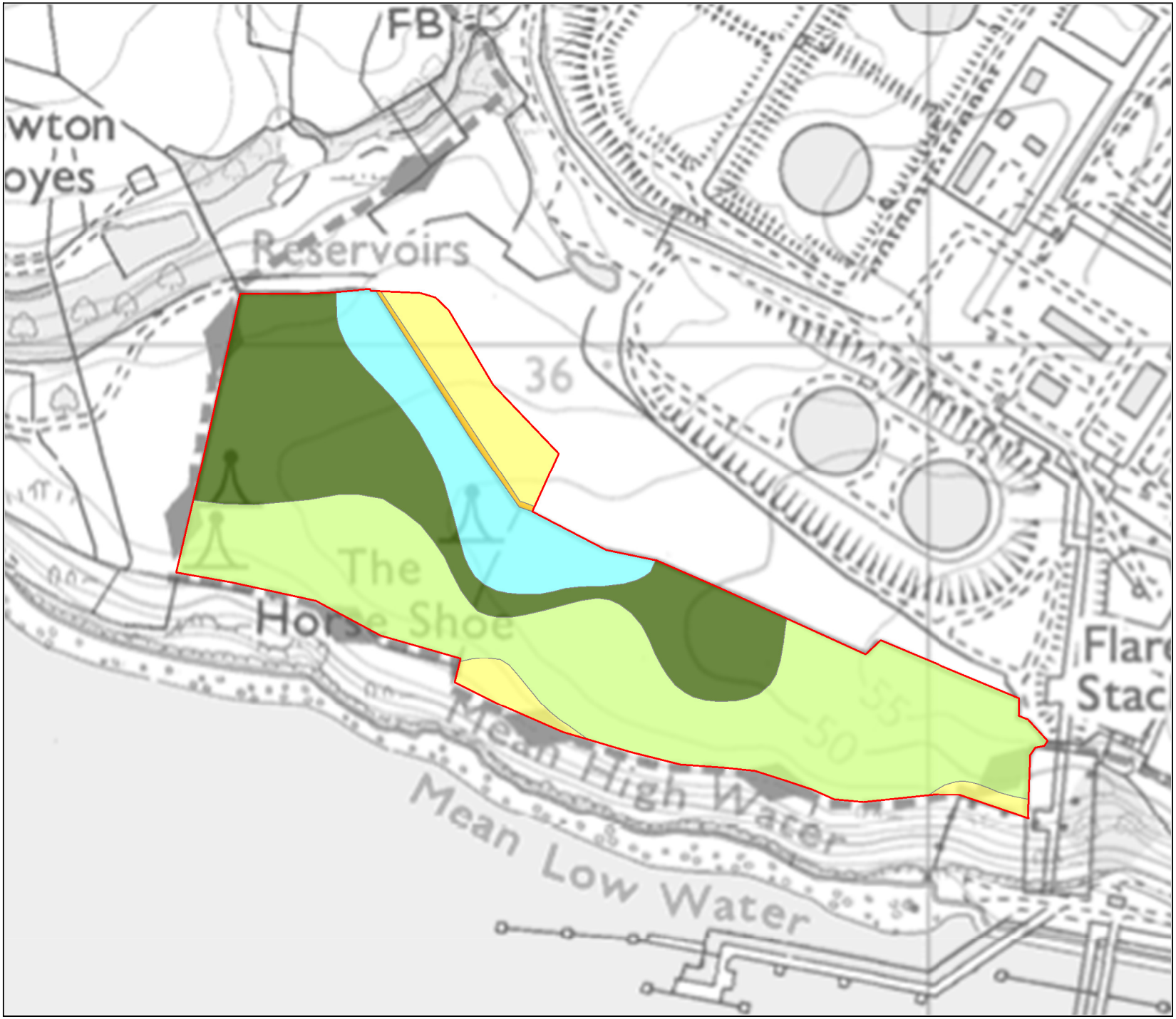
www.lra.co.uk

Date: 08/11/2021

Scale: 1:5,000



KEY

- Grade 2
- Subgrade 3a
- Subgrade 3b
- Grade 4
- Other land
- Site boundary

Client:

Anesco

Site:

Dragon LNG
Meadow

Map title:

Map 2
Agricultural Land
Classification

Land Research Associates

Lockington Hall
Lockington
Derby
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Date: 08/11/2021

Scale: 1:5,000