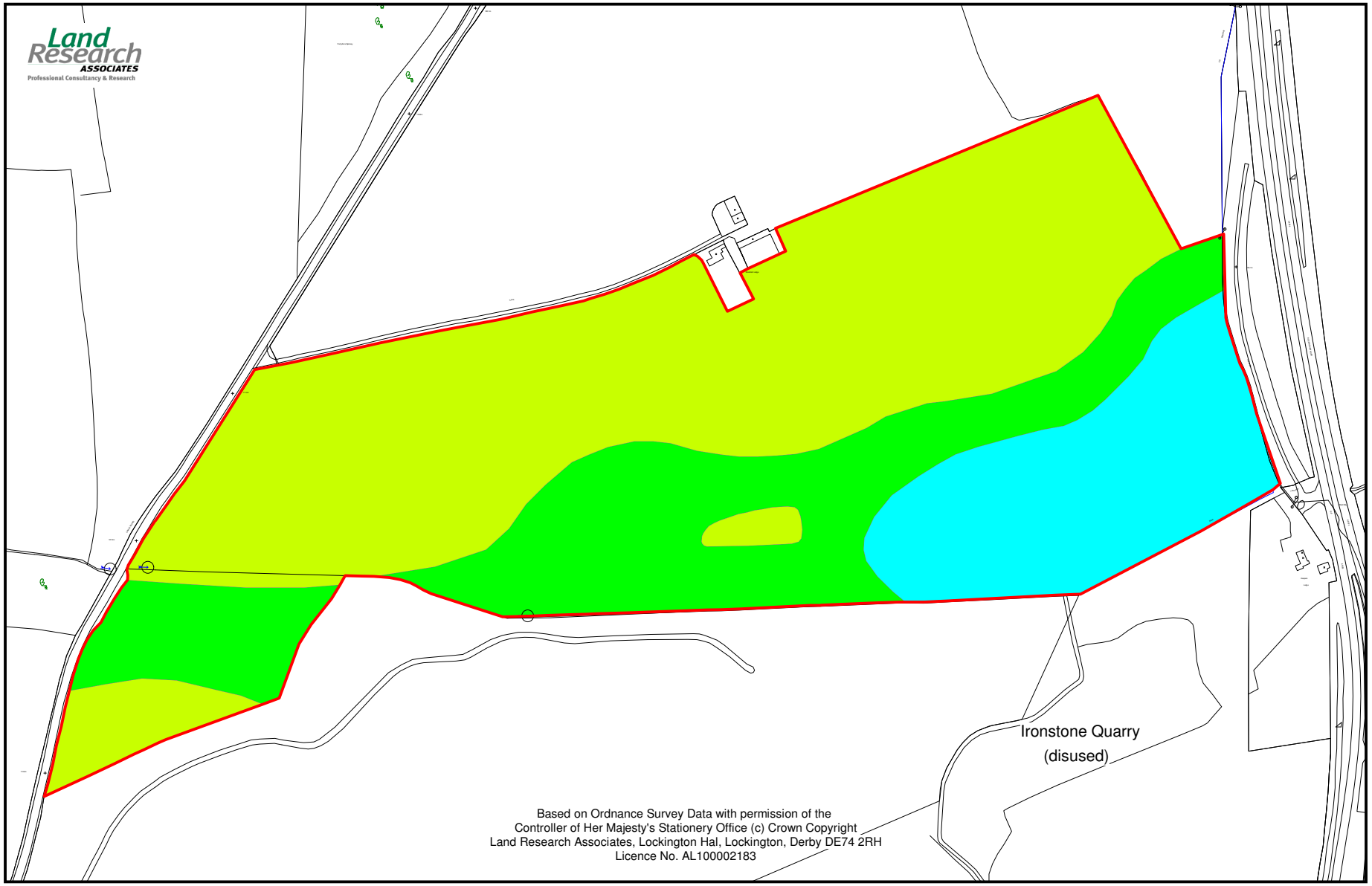
Land north-east of Rushton
Map 1: Agricultural land quality

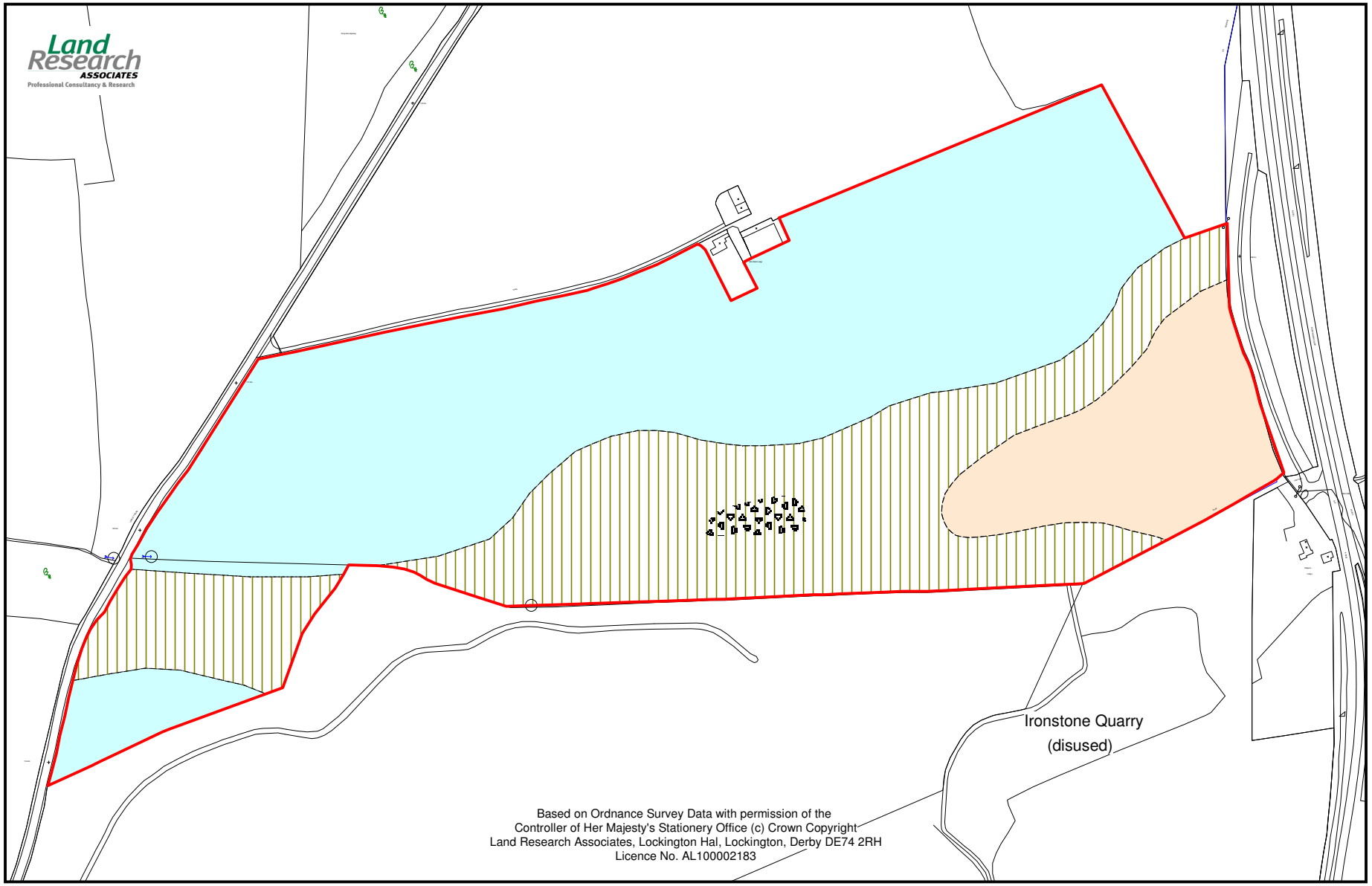
Scale 1: 5,000



Grade 2 (5.1 ha) Subgrade 3a (8.2 ha) Subgrade 3b (17.4 ha)

Land north-east of Rushton
Map 2: Soil resources

Scale 1: 5,000



Loamy topsoils 250-300 mm thick over deep loamy subsoils

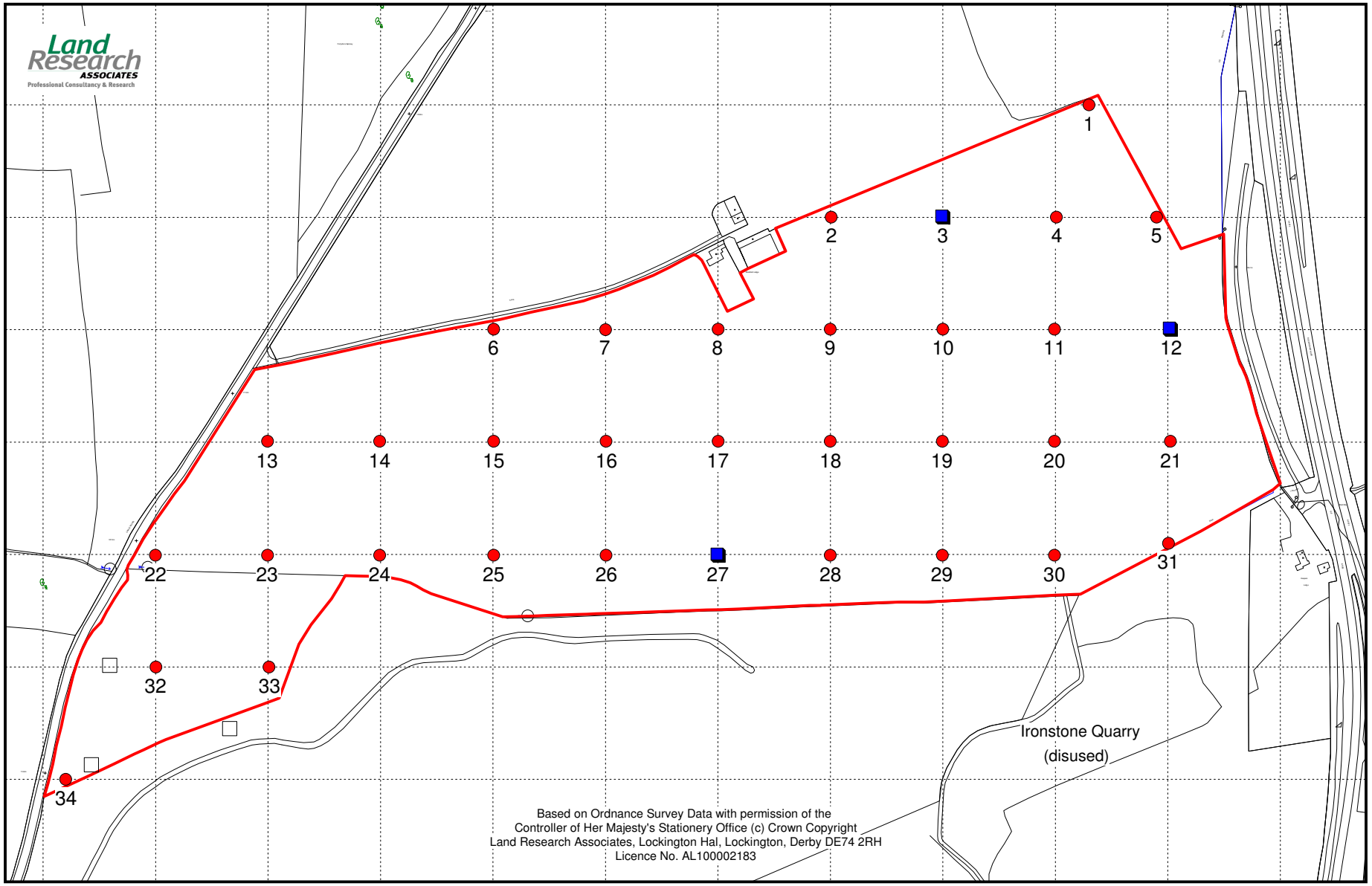
Heavy loam topsoils (250-300 mm thick) and subsoils over limestone at 0.6-1 m depth

Area of thin stony soils

Clayey topsoils 250-300 mm thick over dense clayey subsoils

Land north-east of Rushton
Map 3: Location of observations

Scale 1: 5,000



● Augerings ■ Soil description pits □ Large trial pits open at time of survey

AGRICULTURAL USE AND QUALITY AND SOIL RESOURCES OF LAND NORTH-EAST OF RUSHTON, NORTHAMPTONSHIRE

Report 630/1

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28th October, 2008

SUMMARY

A survey has been undertaken of land 30.7 ha of land north of the former Rushton ironstone quarry to investigate its agricultural quality and use and the soil resources across it.

The land comprises a large arable field that was formerly six fields in the early part of the 20th century, and a smaller grass field.

Wet clayey soils developed in chalky till are the dominant land type, providing poor soil resources and giving an agricultural land quality of sub-grade 3b. The lower slopes have relatively freely draining soils over limestone or sandstone. Those over limestone are permeable heavy clay loams and clay but the limited depth over limestone restricts their agricultural quality to sub-grade 3a. The best soils resources are associated with the eastern part of an area of grade 2 land where soils are deep loamy and permeable.

1.0 Introduction

1.1 This report provides information on the agricultural quality and use and the soil resources of 30.7 ha of land north-east of Rushton in Northamptonshire. The report is based on a soil and agricultural desk study and a detailed survey of the land in October 2008.

1.2 SITE ENVIRONMENT

1.2.1 The land investigated abuts the northern edge of the workings of a former ironstone and limestone quarry, now partly used for waste disposal and recycling. It is bounded to the east by the A6003 Rockingham Road and to the west by Oakley Road.

1.2.2 It is mainly occupied by a large arable field that was formed by the amalgamation of six fields in the last century. There is also a small grass field alongside Oakley Road. The land rises gently via slopes of up to 2° from around 100 m aOD in the south-east to almost 115 m aOD in the south-west and in the north by Storefield Lodge.

1.2.3 Published geological mapping at 1:50,000 scale[1] indicates that Lower Lincolnshire Limestone underlies the lower slopes with sandstones, siltstones and mudstones of the Grantham formation outcropping in the south-east. Upper slopes are shown as covered by glacial till.

1.2.4 The only soil map covering the site is the 1:250,000 (reconnaissance scale) *Soils of Eastern England*, which shows the whole land as having slowly permeable clayey soils over chalky till. Reconnaissance agricultural land classification mapping carried out in the 1970s[2] shows the agricultural land as grade 3 (undivided).

[1] *British Geological Survey Shett 171 (Kettering)*

[2] *Provisonal Agricultural Land Classification, 1:250,000 series: Midland and Western England.* Ministry of Agriculture Fisheries and Food 1983.

2.0 Agricultural Quality

2.1 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 Agricultural Land Classification (ALC) system classifies land into five grades numbered 1 to 5, with grade 3 divided into two sub-grades (3a and 3b). The system was devised and introduced in the 1960s and revised in 1988.

2.2 Climate has an important influence on the agricultural potential of land and has been interpolated for the survey area from 5 km gridpoint datasets according to the method in *Climatological Data for Agricultural Land Classification*[3]. The relevant data for the average site elevation of 108 m is given below.

• Average annual rainfall:	626 mm
• January-June accumulated temperature >0°C	1348 day°
• Average field capacity period (when the soils are fully replete with water)	133 days late Nov-early Apr
• Median summer moisture deficit for:	wheat: 104 mm potatoes: 95 mm

2.3 A detailed soil and land classification survey was carried out in early October 2008, based on the intersects of a 100 m grid and giving a sampling density of one observation per hectare. During the survey, soils were examined by a combination of pits and augerings to a maximum depth of 1.1 m. There were also three deep trial pits open in the grass field that provided further information. A log of the sampling points and a map (Map 3) showing their location is in an appendix to this report.

2.4 The results of the survey were used in conjunction with the agroclimatic data above to classify the site using the revised guidelines for agricultural

[3] *Climatological Data for Agricultural Land Classification.* Meteorological Office, 1989

land classification issued in 1988 by the Ministry of Agriculture, Fisheries and Food[4].

2.4 SURVEY RESULTS

2.4.1 The land grades encountered are described below.

Grade 2

2.4.2 An area of grade 2 land occupies the south-east corner of the site, much of it associated with the outcrop of the Grantham formation. The predominant soil has deep permeable sandy loam layers passing to loamy sand and to soft sandstone at around a depth of 1 m. A typical profile from the location of observation 12 is described below:

0-28 cm	Dark brown (10YR 3/3) medium sandy loam to sandy clay loam; rare small angular flint stones; weakly developed coarse subangular blocky structure; 2% fine and medium macropores; very friable; common fine fibrous roots and incorporated cereal stubble; sharp even boundary to:
28-55 cm	Dark yellowish brown (10YR 4/4) sandy clay loam to sandy loam; a few faint coarse brown (10YR 5/3) and faint fine yellowish brown (10YR 5/8) mottles; rare medium stones of sandstone; weak coarse subangular blocky structure, 5% fine to coarse macropores; friable: a few very fine fibrous roots; clear even boundary to:
55-82 cm	Yellowish brown (10YR 5/4) loamy fine sand with many very coarse strong brown (7.5YR 5/8) mottles; stoneless; structureless; 2% fine macropores; very friable; a few very fine fibrous roots, mainly down pores; clear even boundary to:
82-100 cm	Coarsely-mottled light brownish grey (10YR 6/2) and strong brown (7.5YR 5/8) medium sandy loam with clayey partings; a few medium stones of sandstone; structureless.
100 cm +	Sandstone.

2.4.3 This land is freely draining but is slightly droughty in summer.

2.4.4 The western part of the grade 2 land is similar in nature to the sub-grade 3a land described below but has deeper soils over limestone, less droughty than the sub-grade 3a land.

Sub-grade 3a

2.4.5 This sub-grade accounts for 8.2 ha, a quarter of the site. The topsoils are 25-30 cm-thick calcareous heavy clay loams with up to 10% small and

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

medium stones of oolitic limestone. The subsoils are brown heavy clay loams or clays that become progressively more stony with depth until limestone is encountered at 60-80 cm below the surface. These soils are relatively permeable and freely draining but are somewhat droughty in summer as a result of a restricted rooting depth.

2.4.6 A typical soil of the sub-grade 3a land, as examined in a pit at the location of observation 27 (Map 3), is described below:

0-29 cm	Dark yellowish brown (10YR 3/4) heavy clay loam; 3% small and medium stones of limestone; moderately developed medium subangular blocky structure; firm; calcareous; common very fine fibrous roots.
29-70 cm	Dark yellowish brown (10YR 4/4) heavy clay loam; 5% small and medium stones of limestone; weakly developed coarse angular blocky structure; firm; calcareous; a few very fine fibrous roots.
70+cm	Fractured oolitic limestone.

Sub-grade 3b

2.4.7 This is the most extensive grade, occupying over half of the study area, predominantly the higher parts over about 107 m aOD. Topsoils are clay, less commonly heavy clay loam, and contain just a few flints. A few are calcareous. At a depth of 25-30 cm there is a dense clay subsoil. This is usually slowly permeable, grey-mottled and calcareous with chalk stones common, but in places there is a weakly mottled more permeable layer up to 35 cm thick immediately under the topsoil (see description below). The wetness class varies from II to IV depending on the depth to the slowly permeable layer and the agricultural use is limited by a combination of wetness and the very heavy topsoils.

2.4.8 A description of sub-grade 3b land from observation 3 (Map 3) is given below:

0-30 cm	Dark brown (10YR 3/3) heavy clay loam to clay; 2% small and medium flints, medium quartzite pebbles and medium limestones; weakly developed coarse and very coarse adherent subangular blocky structure; 2% fine macropores; very firm; non-calcareous; common very fine fibrous roots.
30-42 cm	Dark yellowish brown (10YR 4/4) clay with a few faint very fine dark yellowish brown (10YR 4/6) mottles and distinct very fine greyish brown (10YR 5/2) mottles; 2% small and medium flints, medium quartzite pebbles and medium limestones; weakly developed coarse subangular blocky structure; very firm; 2% fine macropores; slightly calcareous; a few very fine fibrous roots.
42-75 cm	Dark yellowish brown (10YR 4/4) clay with common distinct fine strong brown (7.5YR 4/6) and light brownish grey (10YR 6/2)

	mottles; 5% small and medium flints, medium quartzite pebbles and small chalk stones; weakly developed coarse prismatic structure; very firm; 3% fine macropores; a few very fine fibrous roots.
75 cm +	Dark yellowish brown (10YR 3/4) clay with very many prominent fine grey (10YR 5/1) and common fine dark yellowish brown (10YR 4/6) mottles; structureless.

2.4.9 A small area of shallow stony soils is also included in the sub-grade 3b land. This appears to be the site of shallow working of limestone in the past.

Grade areas

2.4.10 From the different grades determined at grid points, delineations showing the extent of each grade have been created using ground observations and satellite imagery. The delineations are shown on Map 1 and the areas occupied by each are shown below.

Table 1. Areas occupied by the different land grades

LAND GRADE	*AREA (HA)*	*% OF SURVEY AREA*
Grade 2	5.1	17
Sub-grade 3a	8.2	27
Sub-grade 3b	17.4	56
Total	30.7	100

3.0 Soil resources

3.1 Government policy as outlined in the Defra draft *Soil Strategy for England* and Mineral Planning Guidance No 7 *Reclamation of Mineral Workings* is to protect valuable soil resources from loss or damage during land disturbance and ensure that stripped and stored soils are used to best effect in land reinstatement.

3.2 The soil resources within the site vary in quality and, consequently, in suitability for use in restoration. There are three areas with distinctly different topsoil and subsoil resources (Map 2) and these are described below.

Deep permeable loamy soils

3.3 This area has a sandy loam to sandy clay loam topsoil 250-300 mm thick and containing few stones. The subsoil is a sandy loam or loamy sand that extends to a depth of about 1 m where it passes to sandstone. These topsoils and subsoils are the soil resource that will be most flexible in re-use.

Heavy loams over limestone

3.4 Ten hectares of the lower slopes have heavy loam topsoils 250-300 mm thick over heavy clay loam or clay subsoils 300-800 mm thick over limestone. The topsoils and subsoils are slightly stony, with small and medium stones of oolitic limestone. Although these soils are permeable, they will need careful handling because of their heavy texture.

Clayey soils

3.5 These are the poorest soil resource. The clayey topsoils are poorly structured and easily damaged by mechanised handling when moist or wet. The subsoils are dense clays that are a very poor restoration resource.

3.6 SOIL HANDLING AND RESTORATION

3.6.1 The soil resources would be easily damaged by being stripped or moved when wet. Consequently, stripping should only take place in the driest parts of the year, using the excavator and dumper method as described by Sheet 1 in the MAFF Good Practice Guide for Handling Soils[5].

3.6.2 If direct placement of stripped soils onto areas being restored is not possible, the resources should be stripped and stored separately in low bunds (no more than 3 m high for topsoil). Topsoil should be stripped from areas designated for storing subsoil. The bunds should be constructed either by excavator or bulldozer (Sheets 2 and 14 in the MAFF Good Practice Guide) avoiding over-compaction. They should be sown with grass to help maintain biological activity and prevent water erosion.

3.6.3 The soils should be removed from storage (Sheet 3 in the MAFF Good Practice Guide) and replaced by excavator during the summer using the loose tipping technique (Sheet 4 in MAFF Good Practice Guide), which avoids traffic on the restored surfaces. The restored land should be sown to ensure that ground cover is established before the ensuing winter.

[5] MAFF Good Practice Guide for Handling Soils, (www.defra.gov.uk/farm/environment/land-use/soilguid/)

APPENDIX

LOCATION AND DETAILS OF OBSERVATIONS

Land at south of north-east of Rushton, Northamptonshire - Details of observations at each sampling point

Obs No	Topsoil			Upper subsoil			Lower subsoil			Slope (°)	Wetness Class	ALC grade	Main limitation
	Depth (cm)	Texture	Stones %	Depth (cm)	Texture	Mottling	Depth (cm)	Texture	Mottling				
1	0-30	HCL	2	30-42	C	xx(x)	42-65 65-110	C C chk	xxx xxx	2	III	3b	W
2	0-27	Cca	3	27-75	Cchk	xxx	75-80 80-110	SCL Cchk	xxx xxxx	2	IV	3b	W
3	0-30	HCL/C	2	30-42	C	xx	42-110	Cchk	xxx	2	III	3b	W
4	0-23	C(ca)	3	23-75	Cchk	xxx	75-110	Cchk	xxxx	2	IV	3b	W
5	0-27	C	1	27-45	C	xxx	45-110	Cchk	xxx	2	IV	3b	W
6	0-26	C	1	26-35	C	xxx	35-65 65-110	Cchk Cchk	xxx xxxx	2	IV	3b	W
7	0-28	C	3	28-70	Cchk	xxx	70-110	Cchk	xxxx	2	IV	3b	W
8	0-25	Cca	3	25-65	Cchk	xxx	65-110	Cchk	xxxx	2	IV	3b	W
9	0-25	C	2	25-50	Cca	xx	50-75 75-110	Cchk Cchk	xxx xxxx	1	II	3b	W
10	0-27	HCL/C	2	27-40	C	x	40-65 65-110	C(ca) Cchk	xxx xxx	1	III	3b	W
11	0-26	HCL	2	26-55	C	xxx	55-110	Cchk	xxx	1	IV	3b	W
12	0-28	SCL/MSL	1	28-55 55-82	SCL/MSL LFS	xx xxx	82-100 100+	MSL sandstone		1	I-II	2	D
13	0-23	Cca	3	23-45	Cchk	xx(x)	45-60	Cchk	xxx	1	II	3a	W
14	0-22 22-34	C mixed	3	34-75	Cchk	xxx	75-100	Cchk	xxxx	2	IV	3b	W
15	0-23	HCL	2	23-45	C	o	45-75 75-100	stony C Cca	xxx xxx	1	II-III	3a-b	W
16	0-25	HCL	3	25-48 48-70	C C+SC	o xx(x)	70-95 95-110	Cca Cca+limestone	xxx	1	II-III	3a-b	W
17	0-25	HCL/C	4	25-65	C	o	65-100	C+limestone	o	2	I	2-3a	W
18	0-28	HCL	2	28-45	C(?sp)	xx(x)	45-75 75-110	C Cchk	xxx xxx	1	III	3b	W
19	0-25	HCL	3	25-35	HCLca	x	35-60 60+	Cca limestone	x	1	I	3a	D
20	0-27	MCL	2	27-72	SCL	o	72-90 90+	C limestone	xx	1	II	2	W
21	0-29	MSL	1	29-95	MSL	o	95-110	LMS+sandstone	o	1	I	2	D
22	0-28	C	2	28-52	C	xx	52-100 100+	C stopped	xxx	½	II	3b	W
23	0-28	C	1	28-70	C	xx(x)	70-110	SC	xxx	½	II-III	3b	W
24	0-27	C	1	27-65	C	x	65-110	C	xx(x)	½	II	3b	W
25	0-27	C	1	27-60	C	x	60+	limestone		½	I-II	3a-b	W
26	0-29	HCL	3	29-60	Cca	o	60+	limestone		½	I	3a	D
27	0-29	HCLca	6	29-70	HCLca	o	70+	limestone		½	I	3a	D
28	0-26	HCLca	8	26-65	HCL/Cca	o	65-80 80+	Cca limestone	o	1	I	3a	D
29	0-28	HCL	4	28-65	HCLca	o	65-85 85+	Cca limestone	o	1	I	2	D
30	0-28	HCL	4	28-60	HCL	o	60-110 110+	HCL/Cca limestone	o	1	I	2	D

Obs No	Topsoil			Upper subsoil			Lower subsoil			Slope (°)	Wetness Class	ALC grade	Main limitation
	Depth (cm)	Texture	Stones %	Depth (cm)	Texture	Mottling	Depth (cm)	Texture	Mottling				
31	0-25	HCL	4	25-55	SCL	o	55-85 85+	SCL Ironstone	xx	1	I	2	D
32	0-28	HCL	3	28-70	C	x	70-110	Cca	xxx	2	II	3a	W
33	0-25	HCL	5	25-55	Cca	x	55+	limestone		3	I	3a	D
34	0-28	Cca	2	28-70	Cchk	xxx	70-110	Cchk	xxxx	2	IV	3b	W

Key to table

Mottle intensity:

o	unmottled
x	few to common rusty root mottles (topsoils) or a few ochreous mottles (subsoils)
xx	common to many ochreous mottles and/or dull structure faces
xxx	common to many greyish or pale mottles (gleyed horizon)
xxxx	dominantly grey, often with some ochreous mottles (gleyed horizon)

a depth underlined (e.g. 50) indicates the top of a slowly permeable layer

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

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

Texture suffixes & prefixes:
ca – calcareous
mn - ferrimanganiferous concentrations
org – organic
st/vst – stony/very stony
r – reddish; gy – grey; brn - brown