

**SOILS AND AGRICULTURAL QUALITY
OF LAND OFF ARUNDEL ROAD
ANGMERING**

Report 1671/1

21st February 2020

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**SOILS AND AGRICULTURAL QUALITY
OF LAND OFF ARUNDEL ROAD, ANGMERING**

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Report 1671/1
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21st February, 2020

SUMMARY

An agricultural land quality and soil resource survey has been undertaken of 9.1 ha of land off Arundel Road, Angmering in February 2020.

The land has a mixture of loamy and heavy soils with impeded drainage, giving land of subgrade 3a and 3b agricultural quality. Wetness is the principal limitation to agriculture.

The loamy topsoils in the south of the site are a high quality resource for reuse in gardens and landscaping and should be used preferentially. Heavier soils in the north are of moderate quality, but may be sustainably re-used on site. Sufficient soil resources exist on site to meet all landscaping requirements if handled sensitively.

1.0 Introduction

- 1.1 This report provides information on the soils and agricultural quality of 9.1 ha of land off Arundel Road, Angmering, West Sussex.

SITE ENVIRONMENT

- 1.2 The survey area comprises a single agricultural field, plus areas of hard standings and other land in non-agricultural use in the east.
- 1.3 The site is level to very gently sloping, at an average elevation of approximately 15 m AOD.

PUBLISHED INFORMATION

- 1.4 1:50,000 scale BGS information records the geology of the land as Oxford Clay Formation, overlain by Head deposits other than an area in the north and a narrow strip along the western boundary.
- 1.5 A detailed soil map of the area (published at 1:25,000 scale) shows most of the site as Park Gate Series (deep phase). These are silty soils with imperfect to poor drainage formed in wind-blown deposits¹. Land in the north is recorded as Titchford Complex, comprising imperfect and poorly drained clayey soils with variable upper layers, formed in thin drift over Eocene clay.
- 1.6 Most of the site was included in a published MAFF survey from 1994. This shows the land to be a mixture of subgrades 3a and 3b due to wetness limitations (Natural England reference: R067/94).

¹Hodgson, J.M., 1967 *Soils of the West Sussex Coastal Plain: Soil Survey Bulletin No 3*, Harpenden.

2.0 Soils

2.1 A detailed soils and agricultural quality survey was carried out in February 2020 in strict accordance with MAFF (1988) guidelines². It was based on observations at intersects of a 100 m grid, with a sampling density of one observation per hectare. Additional points were investigated in areas of significant variation. During the survey, soils were examined by a combination of pits and augerings to a maximum depth of 1.2 m. A log of the sampling points and a map (Map 1) showing their location is in an appendix to this report.

2.2 Soils at the site were found to vary in clay content and drainage, as described below.

HEAVY SOILS WITH POOR TO IMPERFECT DRAINAGE

2.3 These soils occur in the north of the site, where underlying London Clay is close to the land surface. They comprise heavy silty clay loam topsoil and upper subsoil, grading to dense slowly permeable clay. The soils show evidence of seasonal waterlogging (greyish and ochreous-mottled *gley* colouration) to shallow depth.

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

0-28 cm	Dark greyish brown (10YR 4/2) heavy silty clay loam; very slightly stony (small soft chalk and few sub-angular medium flints); moderately developed coarse sub-angular blocky structure; firm; very slightly calcareous; smooth clear boundary to:
28-47 cm	Grey (10YR 5/1) heavy silty clay loam with common distinct fine and medium strong brown (7.5YR 5/6) mottles; very slightly stony (small soft chalk stones); moderately developed coarse angular blocky structure; firm to friable; no visible macro-pores; slightly calcareous; smooth gradual boundary to:
47-120 cm	Grey (10YR 5/1) clay with many distinct fine and medium reddish yellow (7.5YR 6/8) mottles; stoneless; weakly developed very coarse angular blocky structure to massive (structureless); very firm; non-calcareous.

2.5 These soils are poorly to imperfectly-draining (Soil Wetness Class IV to III).

LOAMY SOILS WITH IMPERFECT DRAINAGE

2.6 These soils occur in central and southern parts of the site, where deeper silty surface deposits occur. They comprise medium silty clay loam topsoil and upper subsoil, grading to slowly permeable heavy silty clay loam. The soils mainly show evidence of seasonal waterlogging (greyish and ochreous-mottled *gley* colouration) to shallow depth.

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

2.7 An example profile is described from a pit at observation 6 (Map 1).

0-26 cm	Dark greyish brown (10YR 4/2) medium silty clay loam; stoneless (<5% small soft chalk and few sub-angular medium flints); moderately developed coarse sub-angular blocky structure; friable; very slightly calcareous; smooth clear boundary to:
26-50 cm	Light yellowish brown (2.5Y 4/3) heavy clay loam with common distinct fine and medium strong brown (7.5YR 5/6) mottles; very slightly stony (small soft chalk stones); moderately developed coarse sub-angular blocky structure; friable; 2-3% fine pores; very slightly calcareous; smooth gradual boundary to:
50-120 cm	Grey (10YR 5/1) heavy silty clay loam with common distinct fine and medium reddish yellow (7.5YR 6/8) mottles; very slightly stony; weakly developed very coarse angular blocky structure; firm; <0.5% visible pores; very slightly calcareous.

2.8 These soils are imperfectly-draining (Soil Wetness Class III).

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 Classification³. The relevant site data for an average elevation of 15 m is given below.

- Average annual rainfall: 772 mm
- January-June accumulated temperature >0°C 1528 day°
- Field capacity period 159 days
(when the soils are fully replete with water) early Nov-mid Apr
- Summer moisture deficits for: wheat: 118 mm
potatoes: 114 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 MAFF⁴. There are no climatic limitations at this locality.

SURVEY RESULTS

3.4 The agricultural quality of the land is determined by wetness. Land of grade 3 has been identified.

Subgrade 3a

3.5 This land has medium textured topsoils and imperfect drainage (Soil Wetness Class III). Under the local climate, this combination means wetness limits machinery access to land in winter and early spring, although late spring as well as autumn cropping is usually possible.

³Meteorological Office, (1989). *Climatological Data for Agricultural Land Classification*.

⁴MAFF, (1988). *Agricultural Land Classification for England and Wales: Guidelines and Criteria for Grading the Quality of Agricultural Land*.

- 3.6 One observation point (point 5) was found to have better than average drainage. However, an extra sample point (observation point 5a) confirmed that this represented natural variation rather than a wider change, and the land is therefore mapped according to the average degree of wetness limitation.

Subgrade 3b

- 3.7 This land has heavy topsoils and imperfect or poor drainage (Wetness Class III or IV). This combination means access with farm machinery is limited in winter and spring in most years. Arable land use is therefore mainly restricted to autumn-sown cereal-based rotations.

Other land

- 3.8 This land includes hard standings and other pre-developed land, areas used for vehicle/caravan storage, a small touring site with electric connections, and a residential property and garden.

Grade areas

- 3.9 The boundaries between the different grades of land are shown on Map 2 and the areas occupied by each are shown below.

Table 1: Areas occupied by the different land grades

<i>Grade/subgrade</i>	<i>Area (ha)</i>	<i>% of the land</i>
Subgrade 3a	3.4	37
Subgrade 3b	3.1	34
Other land	2.6	29
Total	9.1	100

4.0 Land quality in the local area

- 4.1. Agricultural Land Classification (ALC) in England and Wales is undertaken according to guidelines set out by MAFF (now DEFRA) in 1988. This system grades land from 1 (best) to 5 (worst) according to quantitative measurement of limiting factors including climate, slope gradient, flooding risk, soil factors (e.g. depth and stoniness) and interactive factors (wetness and droughtiness). Grade 3 is divided into subgrades 3a and 3b (because the revised 1988 system recognised the need to differentiate between the large areas of grade 3 land in England and Wales which has somewhat variable potential). What is recognised as best and most versatile agricultural land in the planning system includes grades 1-3a, so the division between subgrades 3a and 3b is therefore significant.
- 4.2. Following the creation of the 1988 criteria, ALC surveys were undertaken by surveyors from the Resource Planning Department of MAFF. This continued until 1999 when the department was disbanded. The results of these surveys remain in the public domain, including significant areas within Arun District. Since 1999 all surveys have been undertaken by private surveyors. Surveys are normally conducted by making observations at a density of 1 per hectare, using hand tools to excavate soils to determine the important soil properties affecting land quality/grade.
- 4.3. Prior to 1988 different versions of the ALC system existed. The original system dates from the 1970s and the grade criteria are different to those now in use. Moreover, there was no division of grade 3 into subgrades 3a and 3b. The only national coverage of ALC information is made using this earlier system. They are published at small scale (1:250,000) reflecting the fact they are based on very limited density of field survey observations (often as low as 1 per square km) and rely on interpolation of published soil and geological maps. For these reasons Natural England Statutory consultee advice is that:

“these maps are not sufficiently accurate for use in assessment of individual fields or development sites”

Consequently detailed original surveys are recommended (see Natural England Planning Guidance in an appendix to this this proof).

- 4.4. Detailed agricultural land quality information does not exist for the whole of the Angmering area. In its absence land quality of has been interpolated from published detailed MAFF ALC surveys. While these provide only a partial coverage), they do provide an objective measure of land quality.

PROVISIONAL LAND QUALITY INFORMATION

- 4.5. Provisional 1:250,000 scale Agricultural Land Classification (ALC) mapping shows most of the land around the settlement of Angmering as a mixture of grades 1, 2 and 3 (undifferentiated), with the Site shown as a mixture of grades 2 and 3 (see Map 4 in an appendix to this report). However, as explained in paragraph 4.3, the classification system used for these regional scale maps is obsolete, does not distinguish between subgrades 3a and 3b and the maps are not accurate for individual sites.

DETAILED LAND QUALITY INFORMATION

- 4.6. Five detailed ALC surveys were conducted of land adjoining the settlement of Angmering between 1994 and 1998 (when MAFF ceased conducting these studies) covering a total of 31.7 ha. The lack of accuracy provided by the provisional maps is demonstrated by comparison of Map 4 with Map 5 (in the appendix to this report). In some places land shown provisionally as grade 1 quality has been found by detailed site survey to be of subgrade 3b. This demonstrates why the provisional ALC maps are not a reliable source of information for planning decisions regarding agricultural land quality.
- 4.7. The figures in Table 2 below and the information presented in Map 5 indicate that the agricultural quality of the Site is typical of the land around Angmering, being a mixture of best most versatile land and lower quality land, in roughly equal proportions.

Table 2: Agricultural land quality around Angmering

	Around Angmering	Site
Total area	31.7 ha	6.4 ha
Grade 1	0	0
Grade 2	6.5 ha (21%)	0
Subgrade 3a	7.7 ha (24%)	3.4 ha (52%)
Subgrade 3b	17.5 ha (55%)	3.1 ha (48%)
Grade 4	0	0
Grade 5	0	0
BMV land (1-3a)	45%	52%

5.0 Soil resources

- 5.1. The land in agricultural use has natural soils, which should be protected for reuse should the site be developed. The quality of these soil resources for reuse in landscaping and gardens varies, as described below. The distribution of soil resources is shown by Map 3 in an appendix to this report.

TOPSOILS

TS1

These are medium loamy topsoils, approximately 300 mm in thickness with low stone content and good natural structure. They are a high quality resource for reuse as topsoil in gardens and landscaping and should be used preferentially to those described below.

Estimated yield TS1 (if all stripped): 9,975 m³

TS2

- 5.2. These are heavy loam topsoils with low stone content approximately 300 mm in thickness. Their relatively high clay content makes them susceptible to compaction and structural damage if handled when wet. They are suitable for reuse on site, but would be best reserved for less demanding uses, such as areas of amenity grassland.

Estimated yield TS1 (if all stripped): 9,250 m³

SUBSOILS

SS1

- 5.3. These subsoils occur below TS1 where loamy soils are mapped (see Map 3). They are medium-textured and low in stones, with moderate structure. They are suitable for use as topsoil where wildflower grassland is proposed and if handled sensitively are also suitable for use as permeable backfill for tree pit planting. In areas of excavations they should be removed to a thickness of 300 mm to avoid mixing with the lower quality resources found below.

SS2

- 5.4. These subsoils occur below the topsoil where heavy soils are mapped (see Map 3) and at variable depth where loamy soils are mapped (i.e. below SS1). They are dense and poorly-structured, and of low quality for reuse in

landscaping. Where excavated, they are best used for engineered structures; in situ they are suitable as a base layer for amenity grassland.

PREVIOUSLY DEVELOPED AREA

- 5.5. Although some soil resources may exist, in large parts of the eastern section of the Site the surface layer consists of made ground, lacks topsoil resources or is potentially contaminated. Excess natural soil resources are likely to be available elsewhere on the site, and these materials would be preferable for use as soil than the in-situ material.

6.0 Soil Handling

- 6.1. The topsoils have a moderately high clay content which makes them susceptible to structural damage if over handled by machinery. Soil resources are easily damaged by being stripped or moved when wet, therefore machinery handling should be avoided between October and May.
- 6.2. Stripping should take place using the excavator and dumper method as described by Sheet 1 in the MAFF Good Practice Guide for Handling Soils.
- 6.3. Soil handling will be undertaken when soils are sufficiently dry to be friable and not plastic (this can be judged by whether a 3 mm thick thread can be rolled under current site conditions). Soil handling would be best conducted during dry weather between May and October, when the soils are likely to be in their best handling condition.
- 6.4. Construction traffic will be restricted to designated roadways to avoid widespread soil compaction. Areas within fencing assigned as 'Protected Zones' in the landscaping plan will at no point be trafficked.
- 6.5. Stripped topsoil and subsoil resources will be stored in separate bunds no more than 4 m high, and kept free from construction traffic until required for reuse. The bunds will be constructed either by excavator or bulldozer (Sheets 2 and 14 in the MAFF Good Practice Guide) avoiding over-compaction. Where in use for greater than six months, they will be sown with grass to help maintain biological activity and prevent water erosion. The Construction Code of Practice for Sustainable Use of Soils on Construction Sites (Defra 2009) guidance on good practice in soil handling will be fully adhered to.
- 6.6. The soils will be removed from storage (Sheet 3 in the MAFF Good Practice Guide) and replaced by excavator using the loose tipping technique (Sheet 4 in MAFF Good Practice Guide), which avoids traffic on the restored surfaces.
- 6.7. Upper subsoils on stripped areas will be loosened before topsoil is replaced. De-compaction would be best performed with a tined ripper pulled by an earth-mover or excavator, undertaken when soils are sufficiently dry to be friable and not plastic (judged using the method described paragraph 6.3).

7.0 Soils and landscape design

TREE STANDARDS

- 7.1. Areas of subsoil around proposed planting pits of 10*10 m should be de-compacted. 900 mm planting pits will be backfilled with 600 mm of upper subsoil SS1 (or other suitable imported material meeting British Standards 8601:2013) and 300 mm of topsoil (TS1).

AMENITY GRASSLAND / SUDS PLANTING

- 7.2. Amenity grassland should use a minimum 150 mm of topsoil resource (TS2 or TS1) rotovated to a depth of 100 mm. Subsoil de-compaction should take place on previously trafficked areas before topsoil is emplaced.

ORNAMENTAL/HEDGE PLANTING

- 7.3. In-situ soils should be retained in undisturbed areas and de-compacted elsewhere prior to planting. Planting should involve a 300 mm deep trench, backfilled with topsoil (TS1).

MEADOW/WILDFLOWER GRASSLAND

- 7.4. Areas where species-rich wildflower grassland is mapped will require low nutrient soils to avoid the land becoming overgrown with competitive weed species. Use of subsoil resource SS1 as a topsoil would be appropriate for this purpose. In northern parts of the site, in-situ subsoil (SS2) should be de-compacted before SS1 is placed to a thickness of 200 mm. Where the subsoil SS1 is in-situ at final levels, it can be rotovated to a depth of 100 mm and planted.

RESIDENTIAL GARDENS

- 7.5. In-situ subsoil should be de-compacted under dry conditions. In areas in the east lacking existing subsoil resources, excess SS1 material may be used, ideally emplaced to a minimum thickness of 500 mm.
- 7.6. Topsoil resource TS1 is best suited for this purpose and should be used preferentially, emplaced to a thickness of 250-300 mm.

APPENDIX
DETAILS OF OBSERVATIONS
MAPS
NATURAL ENGLAND PLANNING GUIDANCE

Land at Angmering: 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	0-28	HZCLvsica	<5	<u>28</u> -47	HZCL	xxx	<u>47</u> -120	C	xxx	2	IV	3b	W
2	Mixture of hard standing, rubble and excavations												
2a	0-28	HCL	<5	<u>28</u> -50+	C	xxx				1	IV	3b	W
3	0-33	HZCL	<5	33-44	HZCL	xxx	44-90+	HZCL	xxx	1	III/IV	3b	W
4	0-35	HZCL	<5	35-50	HZCL	xx	<u>50</u> -100+	HZCL	xxx	1	III	3b	W
5	0-37	HZCL(dist)	<5	37-58	HZCL	xx	<u>58</u> -100+	HZCL	xx	2	I?	1/2	D
5a	0-26	MZCL	<5	26-53	MZCL	xxx	<u>53</u> -90+	HZCL	xxx	1	III	3a	W
6	0-26	MZCLvsica	<5	26-50	MZCL	xxx	<u>50</u> -120	HZCL	xxx	0	III	3a	W
7	0-29	MZCL	<5	29-54	MZCL	xxx	<u>54</u> -90+	HZCL	xxx	1	III	3a	W
8	Caravan storage lot												
9	Caravan storage lot												

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)

Texture:

- 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
- R - bedrock

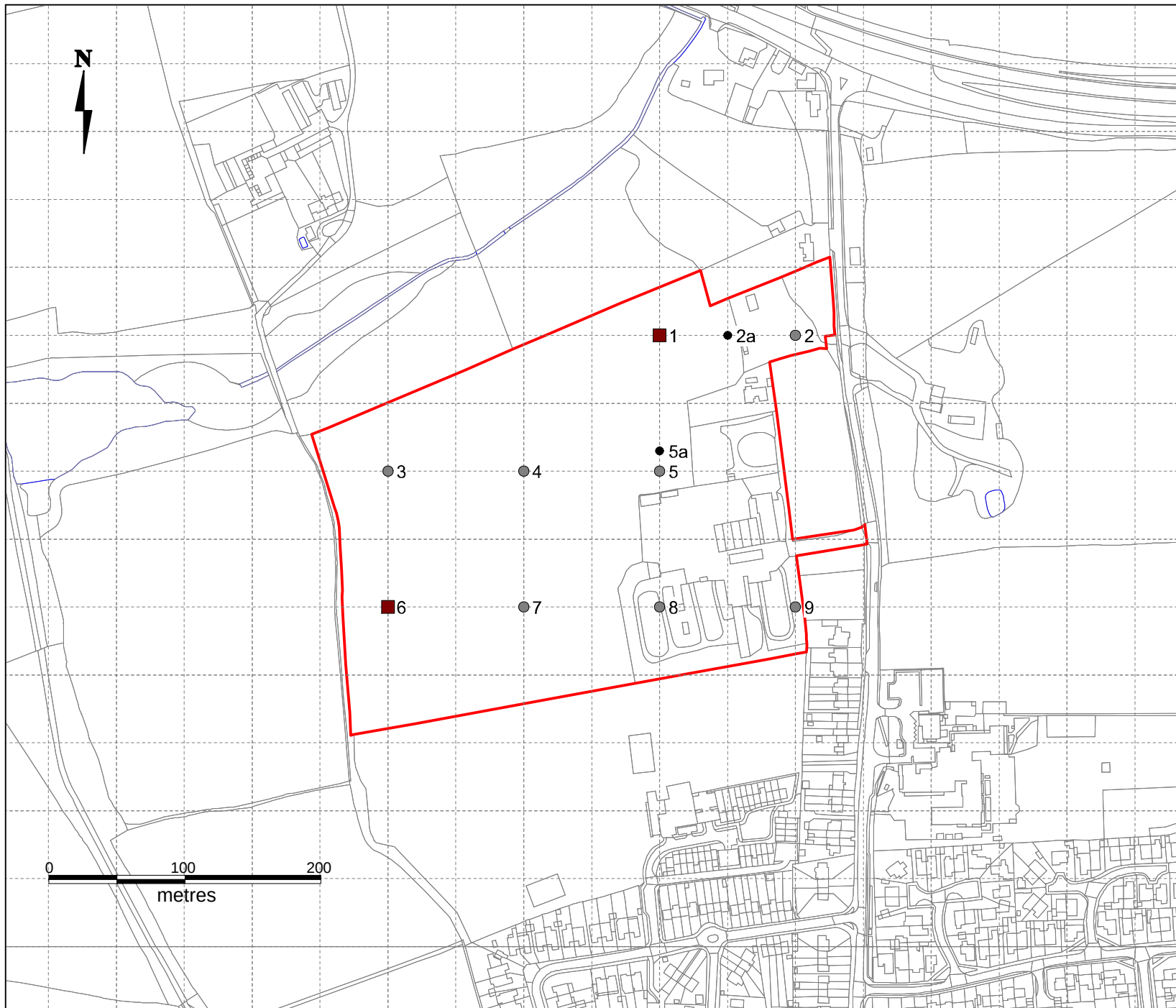
a depth underlined (e.g. 50) indicates the top of a slowly permeable layer
(a wavy underline indicates the top of a layer borderline to slowly permeable)

Limitations:

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

Texture suffixes & prefixes:

- ca - calcareous: x-extremely, v-very, sl-slightly
- (ca) marginally calcareous
- mn - ferrimanganiferous concentrations
- gn - greenish, yb - yellowish brown, rb - reddish brown
- r - reddish; (v)st - (very) stony; sdst-sandstone; lst - limestone
- dist - disturbed soil layer; mdst-mudstone, chky-chalky



KEY

- Observation point
- Soil pit description point
- Survey area

Client:



Site:

**Arundel Road
Angmering**

Map title:

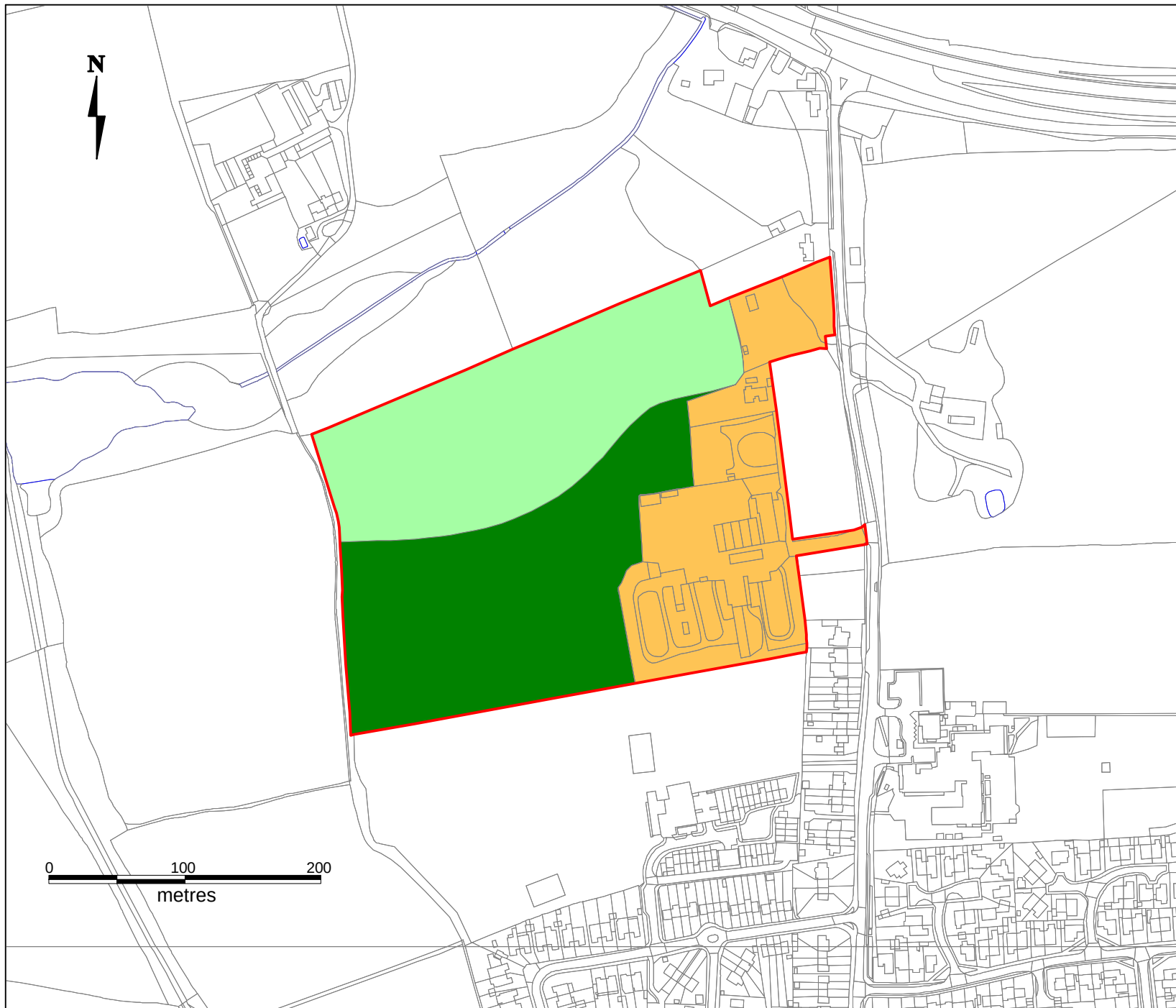
**Map 1
Observations**



Land Research Associates
Lockington Hall
Lockington
Derby DE74 2RH
01509 670570

Scale: 1:4000

Date: 21/02/2020



KEY

- Subgrade 3a
- Subgrade 3b
- Other land
- Survey area

Client:



Site:

**Arundel Road
Angmering**

Map title:

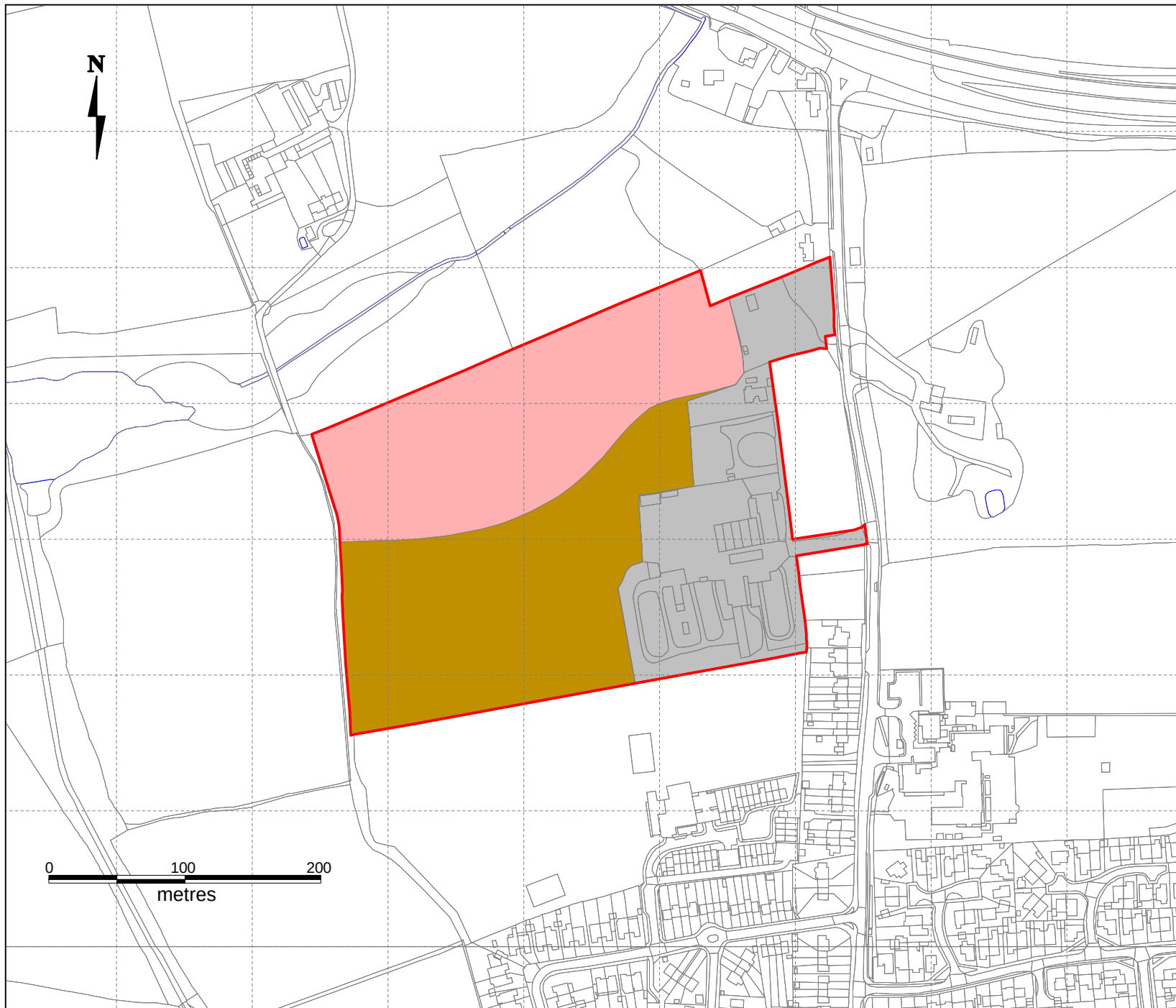
**Map 2
Agricultural Land
Classification**



Land Research Associates
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Derby DE74 2RH
01509 670570

Scale: 1:4000

Date: 21/02/2020



KEY

- Loamy soils
TS1/SS1/SS2
- Heavy soils
TS2/SS2
- No soil resource
- Site area

Client:



Site:

**Arundel Road
Angmering**

Map title:

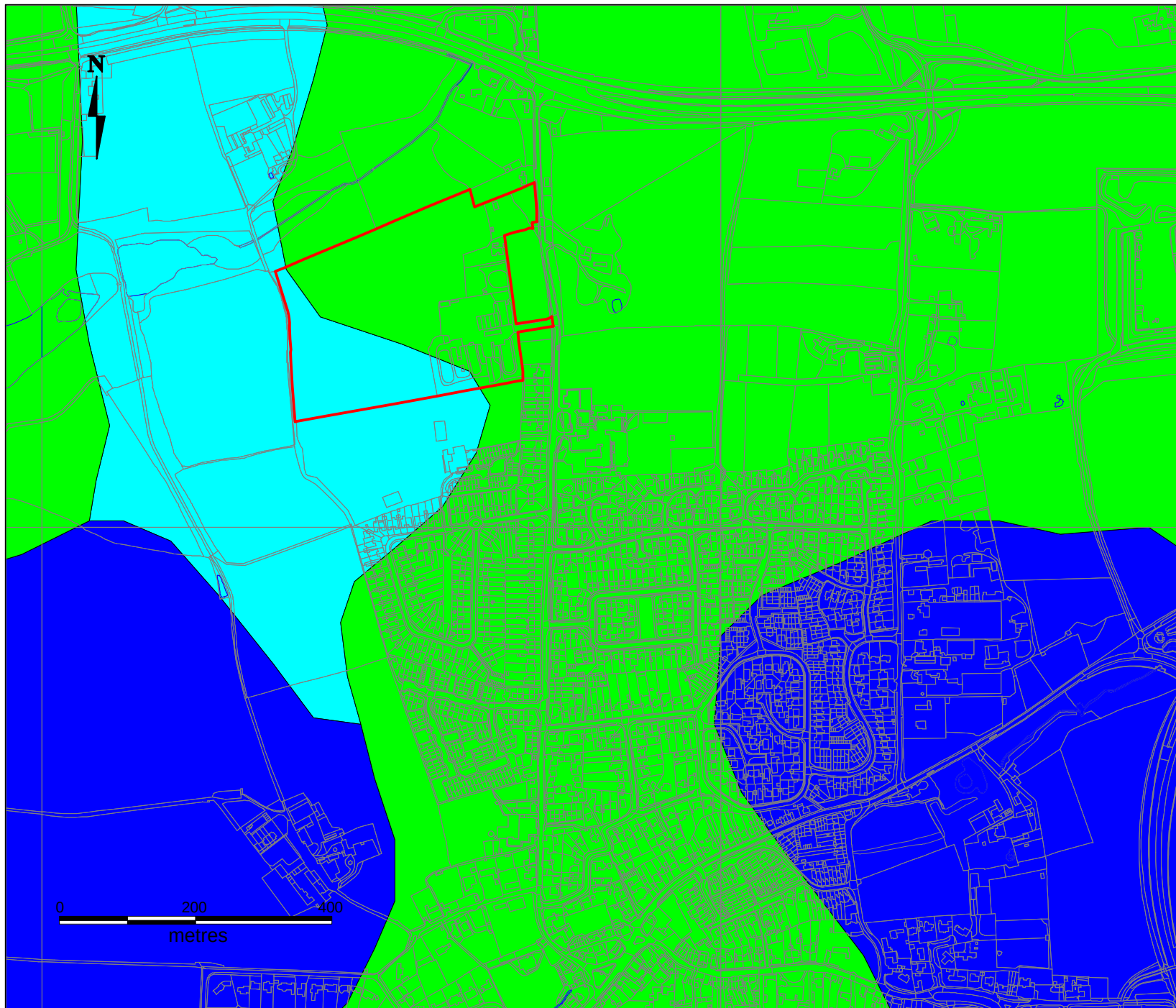
**Map 3
Soil resources**



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Scale: 1:4000

Date: 21/02/2020



KEY

- Grade 1
- Grade 2
- Grade 3
- Site area

Client:



Site:

**Arundel Road
Angmering**

Map title:

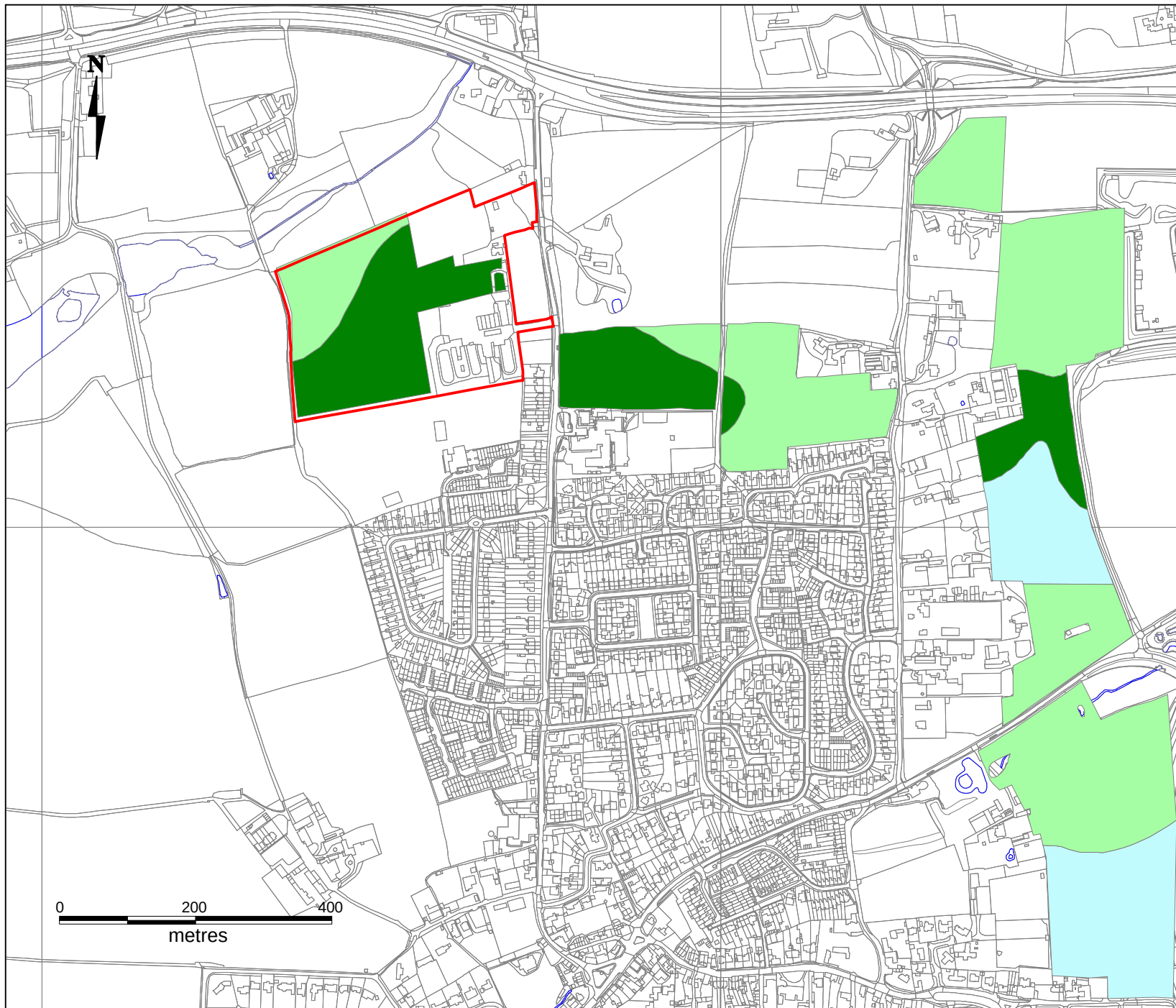
**Map 4
Provisional MAFF
ALC grades**



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Scale: 1:8,000

Date: 21/02/2020



KEY

- Grade 2
- Subgrade 3a
- Subgrade 3b
- Site area

Client:



Site:

**Arundel Road
Angmering**

Map title:

**Map 5
Detailed MAFF survey
ALC grades**



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Scale: 1:8000

Date: 21/02/2020