

APPENDIX 13.2
SOILS AND
AGRICULTURAL USE & QUALITY
OF LAND WEST OF ROADE

Report 1002b/1

5th October, 2016

**SOILS AND AGRICULTURAL USE & QUALITY
OF LAND WEST OF ROADE**

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Report 1002b/1
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SUMMARY

This report provides information on the soils and agricultural quality of 52.7 ha of land west of Roade in Northamptonshire.

The land is dominated by heavy soils with impeded drainage formed in glacial till, with minor areas of freely draining soils over sand and gravel or limestone. The majority of the land is limited by soil wetness to subgrade 3b agricultural quality, with minor areas of subgrade 3a land limited by wetness or droughtiness.

Were the site to be developed, the topsoils require careful handling to prevent compaction damage under wet conditions.

1.0 Introduction

- 1.1 This report provides information on the soils and agricultural quality of 52.7 ha of land west of Roade in Northamptonshire. The report is based on a survey of the land in September 2016.

SITE ENVIRONMENT

- 1.2 The land investigated comprises a strip of land proposed as the route of a bypass road. The route traverses sixteen agricultural fields on the western fringe of Roade. The strip meets the A 508 at its northern and southern ends, and is bi-sected by Blisworth Road which crosses east to west in the centre of the site. In the north the site is intersected by a major rail route and in the south it is crossed by a disused railway line.

- 1.3 Most of the site is flat or very gently sloping at approximately 120 m AOD, with southern parts more undulating, falling to a low of 100 m AOD.

AGRICULTURAL USE

- 1.4 At the time of survey the land in the north and south had recently been harvested for cereal or bean crops. Land in central areas was under grass grazed by sheep and cattle.
- 1.5 The land surrounding Hyde Farm is registered under an Entry Level plus Higher Level Stewardship Agreement as part of a wider 37.23 ha holding. A single field in the south-west is registered under a separate ELS/HLS agreement as part of a separate 813 ha holding.

PUBLISHED INFORMATION

- 1.6 1:50,000 scale BGS information records the majority of the site as underlain by chalky till (Oadby Till) over Blisworth Limestone or Clay. Small pockets of superficial sand and gravel over Bilsworth Limestone are shown in central parts of the site. Blisworth Limestone is shown to outcrop in the south (where no surface deposits are recorded).
- 1.7 The National Soil Map (published at 1:250,000 scale) shows the land as predominantly Hanslope Association, comprising mainly slowly permeable clayey soils formed in glacial till. The land in the far south of the site is shown as Aberford Association, shallow freely-draining fine loamy soils over

limestone¹.

- 1.8 Provisional Agricultural Land Classification of the site shows the land as grade 3. No more detailed survey of the site has been published.

¹Jarvis, M.G., et al., 1984. *Soils and their use in Midland and Western England*. Soil Survey of England and Wales Bulletin No. 15, Harpenden.

2.0 Soils

- 2.1 The National Planning Practice Guidance states that the planning system should protect and enhance valued soils and prevent the adverse effects of unacceptable levels of pollution. This is because soil is an essential finite resource that provides important ecosystem services, for example as a growing medium for food, timber and other crops, as a store for carbon and water, as a reservoir of biodiversity and as a buffer against pollution.
- 2.2 A detailed soil resource and agricultural quality survey was carried out in September 2016. It was based on observations at intersects of a 100 m grid, 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 1.2 m. A log of the sampling points and a map (Map 1) showing their location is included in an appendix to this report.
- 2.3 Soils at the site vary in depth and texture. There are four principal soil types, these are described below.

Clayey soils

- 2.4 These soils are dominant at the site at the site. They typically comprise heavy clay loam or clay topsoil over slowly permeable clay subsoil that shows evidence of gleying above 40 cm depth. In pockets these soils have calcareous topsoil, but the topsoils and upper subsoils are typically non-calcareous and grade to calcareous chalky clay at 50 cm depth or greater.
- 2.5 An example profile is described below from a pit at observation 36 (Map 1).
- | | |
|------------|--|
| 0-28 cm | Dark brown (10YR 4/3) heavy clay loam; weakly developed coarse sub-angular blocky structure; slightly stony with medium rounded pebbles and angular flint fragments; firm; few very fine roots; few small and medium macropores; very slightly calcareous; smooth clear boundary to: |
| 28-55 cm | Pale brown (10YR 6/3) clay with greyish brown (10YR 5/2) ped faces and many medium strong brown (7.5YR 5/8) mottles; weakly developed coarse prismatic structure; very slightly stony with medium rounded pebbles and angular flint fragments; hard; rare very fine roots; rare very fine pores; non-calcareous; smooth gradual boundary to: |
| 55-110+ cm | Grey (10YR 5/1) clay with common medium strong brown (7.5YR 5/8) and brownish yellow (10YR 6/8) mottles; moderately developed medium prismatic structure; slightly stony with small chalk fragments; very firm; no roots; very calcareous. |
- 2.6 These soils are poorly-draining (Soil Wetness Class IV to III) and have a limited capacity to absorb winter rainfall.

Fine loamy over clay soils

- 2.7 These soils are found in patches within the dominant clayey soils described in paragraph 2.4 above. The soils have a heavy clay loam topsoil and upper subsoil that does not tend to show evidence of waterlogging (gleying) above 40 cm depth. The upper subsoils grade to calcareous or non-calcareous clay within 70 cm of the land surface.
- 2.8 An example profile is described below from a pit at observation 32 (Map 1).
- | | |
|------------|--|
| 0-28 cm | Dark greyish brown (10YR 3/2) heavy clay loam; moderately developed medium and coarse sub-angular blocky structure; slightly stony with medium angular flints; firm; non calcareous; smooth clear boundary to: |
| 28-67 cm | Greyish brown (10YR 4/2) heavy clay loam with rare fine yellowish brown (10YR 5/8) mottles; weakly developed coarse sub-angular blocky structure; slightly stony; friable to firm; non calcareous; smooth gradual boundary to: |
| 67-110+ cm | Greyish brown (10YR 4/2) clay with common grey (G 5/1) and fine strong brown (7.5YR 5/6) mottles; weakly developed coarse prismatic structure; very firm; ferrimanganiferous concretions; non-calcareous. |
- 2.9 These soils are permeable to depths of between 40 and 70 cm, tending to become slowly permeable at the point of the underlying clay. They are imperfectly-draining (Soil Wetness Class II to III) and have a moderate to low capacity to absorb winter rainfall.

Gravel soils

- 2.10 These soils occur in small pockets of sand and gravel deposits towards the south of the site. A stony sandy clay loam topsoil and upper subsoil overlie gravel at around 70 cm depth. The soils are non-calcareous and show little evidence of waterlogging.
- 2.11 An example profile is described below from a pit at observation 33 (Map 1).
- | | |
|-----------|--|
| 0-28 cm | Dark brown (10YR 4/3) sandy clay loam; weakly developed medium sub-angular blocky structure; moderately stony with small and medium angular flints; friable; non-calcareous; smooth clear boundary to: |
| 28-70+ cm | Strong brown (10YR 7.5YR 5/6) sandy clay loam; weakly developed fine sub-angular blocky structure; very stony with 40% flint gravel; very friable; non-calcareous |
- 2.12 These soils are permeable to at least 70 cm, they are freely-draining (Soil Wetness Class I) with a high capacity to absorb excess winter rainfall.

Shallow fine loams over limestone

- 2.13 These soils occur in the south of the site and mainly comprise stony calcareous clay loam topsoil over shattered limestone at a depth of 30-40 cm. A thin stony subsoil is found in some places, whereas in others topsoil directly overlies limestone bedrock.
- 2.14 An example profile is described below from a pit at observation 41 (Map 1).

0-30 cm	Dark brown (10YR 4/3) medium clay loam; moderately developed fine and medium sub-angular blocky structure; moderately stony with small to large platy hard limestone; very friable; very calcareous; undulating clear boundary to:
30+ cm	Shattered limestone.

- 2.15 These soils are freely-draining (Soil Wetness Class I) with a high capacity to absorb excess winter rainfall.

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 Agricultural Land Classification (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 Classification². The relevant site data for an average elevation of 115 m is given below.

- Average annual rainfall: 670 mm
- January-June accumulated temperature >0°C 1357 day°
- Field capacity period 146 days
(when the soils are fully replete with water) mid Nov–late Mar
- Summer moisture deficits for: wheat: 100 mm
potatoes: 90 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 Agricultural Land Classification issued in 1988 by the Ministry of Agriculture, Fisheries and Food³. There are no climatic limitations at this locality.

SURVEY RESULTS

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

Sub-grade 3a

3.5 This land occurs in western parts of the site where fine loamy over clayey soils are found (see paragraphs 2.7-2.9) The principal limitation to agricultural use of this land is seasonal wetness caused by imperfect drainage (Soil Wetness

²Meteorological Office, (1989). *Climatological Data for Agricultural Land Classification*.

³MAFF, (1988). *Agricultural Land Classification for England and Wales: Guidelines and Criteria for Grading the Quality of Agricultural Land*.

Class II). On such land tillage operations tend to be constrained during the latter parts of Autumn and early Spring.

3.6 This subgrade also includes land over gravel soils (see paragraphs 2.10-2.12). The limited moisture holding capacity of the stony subsoil is likely to cause moderate droughtiness and reduced yields during dry summers under the local climate.

3.7 Also included are soils over limestone (see paragraphs 2.13 to 2.15) which have moderately shallow subsoil. The resultant reduced subsoil moisture storage is likely to cause moderate droughtiness and reduced yields during dry summers under the local climate.

Sub-grade 3b

3.8 The majority of the land is underlain by imperfectly or poorly- draining soils. The combination of high topsoil clay content and seasonal waterlogging means this land is rarely suitable for spring field operations. The agricultural use of this land is limited to arable cropping of autumn sown cereals and oilseeds, or grass.

Non-agricultural land

3.9 This comprises roads, farm tracks, riparian areas and railway lines and embankments.

Grade areas

3.10 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 agricultural land</i>
Sub-grade 3a	4.8	10
Sub-grade 3b	42.0	90
Non Agricultural	5.9	-
Total	52.7	100

4.0 Soil resources and their use

- 4.1. As part of the Government's 'Safeguarding our Soils' Strategy, Defra published a code of practice on the sustainable use of soils on construction sites, which can be helpful in design of developments and setting planning conditions. An Environment Agency strategy Soil a Precious Resource: Our strategy for protecting, managing and restoring soil (Environment Agency, 2007) has complementary aims.

Topsoil

- 4.2. The high clay content of most of the topsoils means they are difficult to handle with machinery and are highly susceptible to compaction damage when wet. Soil handling would be best performed between April and October when the soils are likely to be drier.

Subsoil

- 4.3. The subsoils are susceptible to compaction during construction activities which could result in restricted rooting depth, increased droughtiness and risk of localised flooding. If compacted during construction subsoils should be loosened before any topsoil is spread on them.

Soil Handling

- 4.4. Areas not being built over (e.g. environmental buffers and landscape areas) should not be trafficked by construction vehicles as this will render the soils impermeable, preventing percolation of rainfall beyond the base of the topsoil, which will quickly become saturated.
- 4.5. Stripped topsoil should be stored in separate resource bunds no more than 3 m high and kept grassed and free from construction traffic until required for re-use. The Construction Code of Practice for Sustainable Use of Soils on Construction Sites (Defra, 2009) provides guidance on good practice in soil handling.

APPENDIX
MAPS AND DETAILS OF OBSERVATIONS

Land west of Road: ALC and soil resources survey – Details of observations at each sampling point

Obs No	Topsoil	Upper subsoil		Lower subsoil		Slope	Wetness	Agricultural quality	
	Depth (cm)	Texture	Stones >20 mm (%)	Depth (cm)	Texture	Mottling	Class	Grade	Main limitation
1	28	HCL	5-10	28-47	C	xx			
2	26	HCL	<5	26-43	HCL	xx			
3	32	HCL	5	32-80+	C	xxx			
4	29	HCL	5	29-53	C fm	xxx			
5	26	HCL	5-10	26-55	HCL -> C fm	xxx			
6	27	C ca	5-10	27-50	C ca	x			
7	Non-agricultural								
8	28	HCL	5-10	28-70	HCL	xxx			
9	30	HCL	<5	30-40	HCL	xx			
10	23	HZCL	<5	23-62	C	xxx			
11	Non-agricultural								
12	30	HCL	<5	30-40	HCL	xx			
13	32	HCL	<5	32-40	HCL	xx			
14	29	C v sl ca	<5	29-38	C	xx			
15	32	HCL	5-10	32-60	C fm -> HCL	xxx			
16	32	HCL	5	32-48	C	xxx			
17	30	HCL	<5	30-53	C	xxx			
18	22	HCL ca	<5	22-39	HCL	x			
19	28	HCL	5	28-40	HCL	xx			
20	29	C	<5	29-110+	C	xxx			
21	30	HCL	<5	30-42	HCL/C	cc			
22	26	HCL	5-10	26-50	HCL	x			
23	30	HCL	<5	30-52	C	xx			
24	29	C ca	<5	29-90+	C ca	xxx			
25	27	HCL	5-10	27-70	HCL	x			
26	36	HCL	<5	36-65	C	xxx			
27	25	C sl ca	5-10	25-38+	C chalk stones				
28	32	HCL	5	32-50	HCL	xx			
29	27	HCL	<5	27-50	C	xxx			
30	30	HCL ca	5	30-48	HCL ca	xx			
31	27	HCL	5	27-52	HCL st	xxx			
32	28	HCL	5	28-75	HCL	x -> xx			
33	28	HCL	5-10	28-67	HCL	xx			
34	29	SCL m st	15	29-72	SCL v st	xx			
35	28	HCL	<5	28-80+	C	xxx			
36	26	C	<5	26-40	C	xx			
37	26	HCL	5-10	26-40	HCL sl ca	xx			

Obs No	Topsoil			Upper subsoil			Lower subsoil			Slope (°)	Wetness Class	Agricultural quality	
	Depth (cm)	Texture	Stones >20 mm (%)	Depth (cm)	Texture	Mottling	Depth (cm)	Texture	Mottling			Grade	Main limitation
38	27	HCL	5-10	27-48	HCL sl ca	xx	48-80+	HCL ch'lk stones	xxx	<1	III	3b	W
39	22	HCL	5	22-52	C	xxx	52-80+	C chalks stones	xxx	1	IV	3b	W
40	28	HCL	5-10	28-35	HCL	xxx	35-65	C fm	xxx	3	III	3b	W
41	30	MCL v ca	25	30+	Limestone		65+	Limestone		4	I	3b	D
42	26	MCL v ca	10	26-34	MCL v ca	o	34+	Limestone		6	I	3b	D
43	30	HCL v ca	10-15	30-90+	HCL v ca	x	Disturbed land			3	-	-	-
44	32	HCL ca	5-10	32-61	HCL ca	xx	61+	Limestone		4	I	3a	D
45	31	MCL v ca	25	31+	Limestone					4	I	3b	D
46	34	MCL v ca	25	34+	Limestone					3	I	3b	D

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)

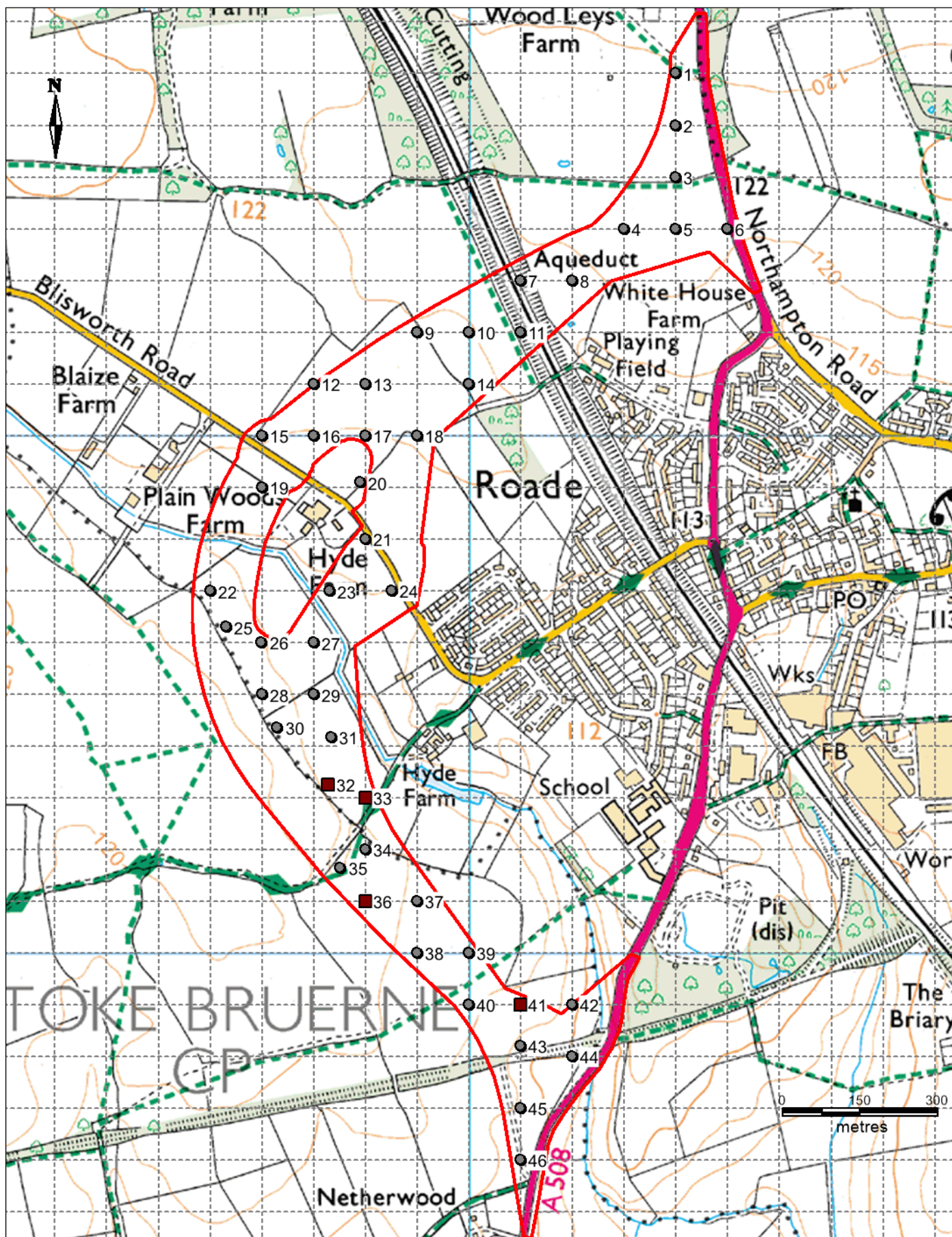
a depth underlined (e.g. 50) indicates the top of a slowly permeable layer
 (a wavy underline indicates the top of a layer borderline to slowly permeable)






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

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



Client		KEY	Scale: 1:10,000
Project	Roade bypass	 Auger observation	Date: 05/10/2016
Map Title	Map 1 Observations	 Soil pit	
		 Survey area	