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HS2

High Speed Rail (Crewe – Manchester) Environmental Statement

Volume 5: Appendix AG-001-0MA01

Agriculture, forestry and soils

MA01: Hough to Walley's Green

Agriculture, forestry and soils assessment

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Department for Transport

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1 Introduction

1.1.1 This report is an appendix to the agriculture, forestry and soils assessment. It presents the following for the Hough to Walley's Green area (MA01):

- agriculture and soils baseline data for agricultural land, including open spaces and natural soils within urban areas; and
- a summary of the farm holding impact assessment.

1.1.2 Additional data used for the agriculture, forestry and soils assessment are set out in Background Information and Data (BID) report Agriculture, forestry and soils baseline data (BID AG-002-0MA01)[1].

[1] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background and Information Data, Agriculture, forestry and soils baseline data,* BID AG-002-0MA01. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

2 Soils and agricultural land classification

2.1 Background

2.1.1 An element of the assessment of the effects of the route of the Proposed Scheme upon agriculture is concerned with the consideration of the quantity and quality of the agricultural land affected. The determination of the quality of agricultural land is undertaken by the application of a secondary evaluation of the interaction of soil and other physical parameters in accordance with a prescribed methodology. That methodology is set out in guidelines[2] prepared by the Ministry of Agriculture, Fisheries and Food (MAFF) in 1988 which enables the classification of land by qualitative grade in accordance with the Agricultural Land Classification (ALC) system. This establishes the inherent productive capability of agricultural land which can be considered on a consistent basis throughout England and Wales.

2.1.2 The approach taken to the collection and collation of baseline data on soil types present, and the other physical characteristics of topography, climate and drainage in the Hough to Walley's Green area is described. The baseline data are described and how the MAFF evaluation methodology has been applied to provide the definitive classification of the quality of agricultural land affected by the route of the Proposed Scheme. This provides the baseline for the assessment of the effects of the project on agricultural land and soils which is detailed in Volume 2, Community Area report: Hough to Walley's Green (MA01), Section 4 Agriculture, forestry and soils.

2.1.3 This document should be read with reference to the Agriculture, forestry and soils baseline data contained in the Background Information and Data (BID AG-002-0MA01)[1] and the Volume 5 Agriculture, forestry and soils Map Book (AG-02-301 and AG-04-300 to AG-04-304a).

2.2 Soils and agricultural land classification surveys - methodology

2.2.1 During the EIA process, soil and ALC information has been considered on two levels. The soils and agricultural land quality baseline conditions reported have been established from initial desktop studies and then with regard to subsequent site-specific surveys, where necessary and possible. The data are presented in this context with that derived from the material and interpretation of publicly available sources addressed first, followed by that

[2] Ministry of Agriculture, Fisheries and Food (MAFF) (1988), *Agricultural Land Classification of England and Wales – Revised guidelines and criteria for grading the quality of agricultural land*.

derived from site specific surveys whereby the initial desk-based work has been extended and/or validated.

2.2.2 At both levels the data have been evaluated in accordance with the MAFF methodology for assessing the quality of agricultural land. The review of available existing ALC information has concentrated on the extent of detailed post-1988 survey information. There were substantive changes to the ALC system in 1988 which rendered previously available information less useful.

2.2.3 The ALC system is concerned with the classification of agricultural land according to the extent to which physical or chemical characteristics impose long-term limitations on agricultural use. The main limiting factors are climate, the physical character of a site, and soil. These factors and their interactions enable land to be attributed to one of five qualitative grades, with Grade 1 being the highest quality and Grade 5 the lowest. Grade 3 land which is the most extensive grade is divided into two subgrades; 3a and 3b.

2.2.4 Of relevance to the assessment of the environmental effects of the route of the Proposed Scheme is that land falling within Grades 1 and 2 and Subgrade 3a of the ALC is determined by planning policy to comprise the best and most versatile (BMV) agricultural land.

2.2.5 The physical factors influencing the agricultural capability of land are considered within the ALC assessment methodology as follows. The main climatic factors are temperature and rainfall. Site factors are gradient, microrelief and flood risk. Relevant soil characteristics are texture, structure, depth and stoniness. These factors can act either separately or in combination influence agricultural capability. The most important interactive limitations are soil wetness and droughtiness.

2.2.6 Soil wetness expresses the extent to which excess water imposes restrictions on crop growth and cultivations. The ALC methodology provides an approach which combines an assignment of soil to one of six categories of wetness class (WC) (I-VI with I being the most freely draining), the texture of the topsoil (sandy textures being freely draining and clays generally poorly draining), and the climatic regime expressed in terms of the number of days when the soil cannot absorb additional water (Field Capacity Days, FCD).

2.2.7 A similar approach is adopted towards the consideration of soil droughtiness. This seeks to determine the extent to which a combination of climate, soil and crop requirements provide adequate reserves of soil moisture during the growing season. The magnitude and duration of any shortfall represents a potential limitation of the land to maintain particular crops.

2.2.8 Soil droughtiness is determined in the ALC methodology with reference to an indicative drought risk based on two crops, winter wheat and maincrop potatoes. The average soils moisture balance for these crops is calculated on the basis of two parameters. Firstly, the measure of the quantity of water held in the soil profile which can be taken up by the specified crop, and secondly the moisture deficit which is the balance between rainfall and potential evaporation calculated over a critical part of a growing season. Land quality is

derived from the moisture balance, this being the difference between the two parameters, with a negative difference relating to increasingly poorer quality in the ALC system.

2.3 Soils and agricultural land classification surveys - publicly available information

2.3.1 Initially, the assessment of the impacts on soils and agricultural land quality is based on publicly available data gathered by desk based studies. This relates primarily to the identification of soil resources in the study area, the associated physical characteristics of geology, topography and climate which underpin the assessment of agricultural land quality, and the disposition of land uses. The main sources of information have included:

- National Soil Map[3];
- Soils and Their Use in Midland and Western England; regional reconnaissance mapping showing soil associations (groupings of spatially related soil types)[4];
- solid and superficial deposits from the Geology of Britain viewer[5];
- grid point meteorological data for ALC of England and Wales[6];
- Provisional ALC of England and Wales (1:250,000)[7];
- Defra Likelihood of Best and Most Versatile Agricultural Land mapping (1:250,000)[8];
- agri-environment schemes[9]; and
- aerial photography.

2.3.2 Publicly available existing detailed ALC information is generally at a mapped scale of 1:10,000 based on field surveys of soils and agricultural land quality carried out by MAFF and the Soil Survey of England and Wales (SSEW). A desk based assessment of soils and agricultural land quality was based on this publicly available data.

[3] Cranfield University (2001), *The National Soil Map of England and Wales 1:250,000 scale,* Cranfield University: National Soil Resources Institute.

[4] Soil Survey of England and Wales (1984), *Soils and Their Use in Midland and Western England*, Harpenden.

[5] British Geological Survey, *Geology of Britain View.* Available online at: www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html.

[6] Meteorological Office (1989), *Grid point Meteorological data for Agricultural Land Classification of England and Wales and other Climatological Investigations.*

[7] Ministry of Agriculture, Fisheries and Food (1983), *Agricultural Land Classification of England and Wales (1:250,000).*

[8] Department for Environment, Food and Rural Affairs (2005), *Likelihood of Best and Most Versatile Agricultural Land (1:250,000).*

[9] Multi-Agency Geographical Information for the Countryside (MAGIC). Available online at: www.magic.gov.uk.

2.3.3 Existing detailed ALC survey data covering agricultural land within the study area is available to the south of Crewe around Shavington[10]. In addition, there is detailed ALC survey data within 5km of the study area to the west of Barrows Green[11], the east of Haslington[12], to the south of Wheelock Heath[13], to the north of Winterley[14], and land between Wheelock and Ettiley Heath[15].

2.3.4 Findings of the desk based studies based on publicly available information are described in the following section. The location and extent of different soil types and ALC grades/subgrades are influenced by topography and drainage, by geology and soil parent materials, and by climate which are now described in turn.

2.4 Soil parent materials

2.4.1 This section only considers geology as a soil parent material[16]. The soil association developed in each parent material is identified below. The soil associations are described under 'Description and distribution of soil types' below.

2.4.2 The majority of the Hough to Walley's Green area is underlain by reddish glacial till and lake deposits. Where these superficial deposits overlie Sidmouth Mudstone, it gives rise to slowly permeable and seasonally waterlogged clay soils in the Crewe association.

2.4.3 River terrace deposits, comprising sand and gravel, are present in a limited strip in the valley of Gresty and Swill Brook, to the south of Crewe. Where this parent material gives rise to well drained, deep sandy loam and loamy sand soils, they are placed in the Newport 1 association. Where this parent material is seasonally waterlogged by a fluctuating ground-water table, it produces soils in the Blackwood association.

[10] Ministry of Agriculture, Fisheries and Food (MAFF) (1989), *Agricultural Land Classification, Crewe and Nantwich Local Plan,* MAFF Ref. ALCW04289.

[11] Ministry of Agriculture, Fisheries and Food (MAFF) (1997), *Agricultural Land Classification, Crewe and Nantwich Local Plan*, MAFF Ref. ALCW11697.

[12] Ministry of Agriculture, Fisheries and Food (MAFF) (1998), *Agricultural Land Classification, Crewe and Nantwich Local Plan*, MAFF Ref. ALCW03698.

[13] Ministry of Agriculture, Fisheries and Food (MAFF) (1997), *Agricultural Land Classification, Crewe and Nantwich Local Plan,* MAFF Ref. ALCW12497.

[14] Ministry of Agriculture, Fisheries and Food (MAFF) (1997), *Agricultural Land Classification, Crewe and Nantwich Local Plan*, MAFF Ref. ALCW03798.

[15] Ministry of Agriculture, Fisheries and Food (MAFF) (1997), *Agricultural Land Classification, Congleton Local Plan*, MAFF Ref. ALCW00891.

[16] British Geological Survey. A 'parent material' is a soil-science name for a weathered rock or deposit from and within which a soil has formed. In the UK, parent materials provide the basic foundations and building blocks of the soil, influencing their texture, structure, drainage and chemistry. Available online at: Soil Parent Material Model - British Geological Survey (bgs.ac.uk).

2.5 Topography and drainage

2.5.1 Topography in the area is characterised by broadly flat countryside across the Cheshire Plain, incised by river courses and streams. The land from Hough to Crewe slopes northwards over a gentle to moderate gradient (less than 7 degrees) from 65m above Ordnance Datum (AOD) to 55m AOD. To the north of Crewe, the open countryside has a gentle gradient of between approximately 0 and 3 degrees, and ranges in elevation from 51m AOD to 53m AOD.

2.5.2 Drainage of the land is predominantly via the River Weaver and the River Wheelock. The River Weaver is located approximately 3km to 4km to the west of the study area between Worleston and Chuch Minshull. The River Wheelock is located approximately 2km to 3km to the east of the study area between Coppenhall Moss and Warmingham. The study area is traversed by the Valley Brook and Gresty Brook near Crewe, both of which feed the River Weaver.

2.6 Agro-climate

2.6.1 The local agro-climatic factors have been interpolated from the Meteorological Office's standard 5km grid point dataset at three representative points within the study area shown in Table 1. There is some variation across the study area.

2.6.2 Average annual rainfall is between 743mm to 755mm, increasing with altitude. FCDs range from 172 days to 176 days. Moisture deficits are between 93mm to 94mm for wheat and 82mm to 91mm for potatoes, with the lower values occurring on the higher ground.

2.6.3 Accumulated temperature is the excess of daily air temperatures above a selected threshold temperature (0ºC), summed over a specified period (January to June which is the critical growth period for most crops). The accumulated temperature within the study area is between 1,395 and 1,407 day ºC.

Table 1: Interpolated agro-climatic data

Agro-climatic parameter	SJ 7208 5214 Hough	SJ 7025 5744 Coppenhall Moss	SJ 6890 6145 Walley's Green
Altitude (mAOD)	64m	54m	52m
Average annual rainfall (mm)	750mm	743mm	755mm
Accumulated temperature >0°C (day°)	1,395 day°	1,407 day°	1,405 day°
Field capacity days (days)	174 days	172 days	176 days
Average moisture deficit, wheat (mm)	93mm	94mm	93mm

Agro-climatic parameter	SJ 7208 5214 Hough	SJ 7025 5744 Coppenhall Moss	SJ 6890 6145 Walley's Green
Average moisture deficit, potatoes (mm)	81mm	83mm	81mm

2.7 Description and distribution of soil types

2.7.1 The characteristics of the soils are described in the SSEW regional bulletin covering the study area and their distribution is illustrated on the National Soil Map[17]. The soils are grouped into soil associations of a range of soil types that are spatially related and are summarised in Table 2. Their distribution is shown on Map AG-02-301 (Volume 5, Agriculture, forestry and soils Map Book).

Table 2: Soil associations

Soil association: code shown on map AG-02-304	Soil association: name	Description	Wetness class
712f	Crewe	Slowly permeable seasonally waterlogged reddish clayey and fine loamy over clayey soils, often stoneless.	IV
551d	Newport 1	Deep well drained sandy and coarse loamy soils, some affected by groundwater.	I
821b	Blackwood	Deep permeable sandy and coarse loamy soils, affected by fluctuating groundwater.	III-IV

2.7.2 The National Soil Map shows the general distribution of the following three soil associations in the study area:

- Crewe association. This association comprises fine loamy over clay soils, and extends from Crewe to Walley's Green. These soils, which are developed in reddish, stoneless, glacial deposits, i.e. till and glaciofluvial sand and gravel deposits, overlying the Sidmouth Mudstone, are seasonally waterlogged for long periods during the winter and are WC IV;
- Newport 1. These are developed in glacial river sand and gravel deposits which extend from Casey Bridge to the south of Crewe. The soils are generally well drained (WC I) and crops experience droughtiness in the summer; and
- Blackwood association. This association comprises deep, permeable sandy and sandy loam soils. These soils occur in the far south of the area between Hough and Casey Bridge. They are developed in glacial river deposits, which are variable in stone content and frequently overlie clay deposited in glacial lakes, or glacial till, at depth. Where undrained, the Blackwood soils are waterlogged for long periods during the winter (WC III

[17] Cranfield University (2001), *The National Soil Map of England and Wales 1:250,000 scale*. Cranfield University: National Soil Resources Institute.

and IV). These soils experience fluctuating levels of groundwater, but where the water-table has been lowered, the soils are well drained (WC I) or only slightly seasonally waterlogged (WC II).

2.7.3 Soils of the Crewe, Newport 1 and Blackwood associations are described further in the Soils Guide[18] which is available at Cranfield University's Landis website.

2.7.4 Detailed descriptions for the dominant soil series in the Crewe, Newport 1 and Blackwood associations, and are given in Table 3.

Table 3: Dominant soil series

Soil series	
Crewe series	
0-20cm	Very dark greyish brown (7.5YR2/2) stoneless clay loam or clay; moderately developed fine subangular block; low packing density; moderately porous; moderately weak soil strength; moderately firm ped strength; abundant fine fibrous roots; slightly calcareous; abrupt smooth boundary.
20-50cm	Strong brown (7.5YR5/4) mottled, stoneless clay; moderate coarse angular blocky structure. Medium packing density; moderately firm soil and ped strength; abundant fine fibrous roots; non-calcareous; few irregular soft ferri-manganiferous concentrations; abrupt smooth boundary.
50-100cm	Reddish brown (5YR4/4) stoneless clay with many medium greenish grey (5GY6/1) mottles; strong coarse prismatic structure. High packing density; very firm soil strength; common very fine fibrous roots; non-calcareous; common irregular soft ferri-manganiferous concentrations; many stress oriented coats; clear irregular boundary.
Newport series	
0-25cm	Dark brown (10YR3/2) slightly stony sandy loam or loamy sand; small stones; moist; moderately developed medium subangular blocky with very dark grey (10YR3/1) faces; high packing density; moderately firm soil strength; abundant fine fibrous roots; non-calcareous; abrupt irregular boundary.
25-55cm	Brown (7.5YR5/6) slightly stony loamy sand or sand; with many extremely fine brown (10YR5/3) mottles; very small stones; moist; weak fine subangular blocky structure with dark greyish brown (10YR4/2) faces; high packing density; moderately strong soil strength; common fine fibrous roots; non-calcareous; few ferri-manganiferous nodules; clear irregular boundary.
55-120cm	Yellowish red or brownish yellow (7.5YR5/6), slightly stony sand; single grain structure.
Blackwood series	
0 -20cm	Very dark greyish brown (10YR3/3) slightly stony ot stoneless loamy sand; moist; moderately developed medium angular blocky; low packing density; moderately weak soil strength; few very fine fibrous roots; non-calcareous; sharp smooth boundary.
20-35cm	Pale brown (2.5Y5/2) slightly stony loamy sand with very many fine strong brown (7.5YR5/8) mottles; moist; weak medium and coarse subangular blocky structure; medium packing density; moderately firm ped strength; few very fine fibrous roots; non-calcareous; few irregular soft ferri-manganiferous concentrations; abrupt smooth boundary.
35-90cm	Light brownish grey (10YR4/1) slightly stony loamy sand with many medium yellowish brown (10YR5/6) mottles; very moist. Weak medium subangular blocky or single grain structure,

[18] Cranfield University (2017), *The Soils Guide, UK.* Available online at: www.landis.org.uk.

Soil series	
	moderately developed coarse prismatic with dark greyish brown (10YR4/2) faces; medium packing density; moderately firm soil strength; few very fine fibrous roots; non-calcareous; few rounded ferri-manganiferous nodules; clear smooth boundary.
90-100cm	Greyish brown (10YR4/2) slightly or moderately stony sand with many medium reddish brown (5YR4/4) mottles; single grain structure; very moist; moderately developed medium prismatic with dark grey (10YR4/1) faces; medium packing density; moderately weak soil strength; common very fine fibrous roots; non-calcareous; common rounded soft ferruginous concentrations; abrupt wavy boundary.

2.8 Soil and land use interactions

2.8.1 As described earlier, the assessment of the quality of agricultural land is derived from the consideration of the extent to which long-term limitations are placed on agricultural productive capability by the key physical factors, either individually or interactively. The publicly available information and general familiarisation with the study area established the following limitations and interactions.

Agricultural land quality

2.8.2 The principal physical factors influencing agricultural production and land quality in this study area are climate, site and soil and the interactions between them. Soil wetness and workability and gradient of slope are particularly relevant limitations in this area.

Agro-climatic limitations

2.8.3 The local agro-climatic factors have been interpolated from the Meteorological Office's standard 5km grid point dataset at three points within the study area, as set out in Table 1. Average annual rainfall is from 743mm to 755mm, increasing with altitude. FCDs range from 172 days to 176 days. Moisture deficits are 93mm to 94mm for wheat and 81mm to 83mm for potatoes, with the lower values occurring on the higher ground.

2.8.4 Climate itself does not place any limitation upon the land in this study area but the interactions of climate with soil characteristics are important in determining the wetness and droughtiness limitations of the soil.

Site limitations

2.8.5 The assessment of site limitations is primarily concerned with the way in which topography influences the use of agricultural machinery and hence the cropping potential of land. In addition, gradient influences the risk of soil erosion on cultivated land, particularly where the soil is weakly structured. Gradient and microrelief are not limiting to agricultural land quality across the study area.

2.8.6 Flood risk is is potentially limiting to agricultural land quality in the floodplain of the Gresty Brook and Valley Brook at Crewe, and the River Wheelock in the east, although site-specific data on duration and frequency of flooding given in Table 2, 'Grade according to flood risk in summer' and Table 3 'Grade according to flood risk in winter' in the MAFF ALC Guidelines (1988) is not available. This land in these floodplains is classed as predominantly Flood Zone 3, in which there is a 1 in 100 or greater annual probability of flooding. Further details are provided in Volume 2, Community Area report: Hough to Walley's Green (MA01), Section 15, Water resources and flood risk.

Soil limitations

2.8.7 The main soil properties which affect the cropping potential and management requirements of land are texture, structure, depth, stoniness and chemical fertility. Together they influence the functions of soil and affect the water availability for crops, drainage, workability and trafficability. The main soil characteristics within the study area are:

- mainly heavy clay and clayey textures, developed in glacial till, affected by high Average Annual Rainfall (AAR) and number of FCDs (see Agro-climatic limitations) from Crewe to Walley's Green; and
- light loamy and sandy textures in river terrace or glaciofluvial drifts between Hough and Crewe.

2.8.8 Soil depth and chemical limitations are not encountered in this study area.

Interactive limitations

2.8.9 The physical limitations which result from interactions between climate, the site and soil are soil wetness, droughtiness and erosion. Each soil can be allocated a WC based on soil structure, evidence of waterlogging and the number of FCDs; the topsoil texture then determines its ALC Grade in accordance with the MAFF ALC guidelines. The conclusions reached on the quality of agricultural land in the study area from the initial desk-based consideration are as follows.

2.8.10 Slowly permeable clayey soil in the Crewe series are predominant between Crewe and Walley's Green. The topsoil ranges between heavy clay loam and clay, overlying slowly permeable clay subsoil which is waterlogged for long periods over the winter (Wetness Class IV). Where these soils occur between Crewe and Parkfield (151-175 FCDs), agricultural quality is limited by soil wetness to Subgrade 3b.

2.8.11 Where soils in the Crewe series are located to the north of Parkfield (i.e. to the north northing 361200) the number of FCDs fall in the 176-225 FCD category in Table 6 of the ALC Guidelines (1988). The quality of agricultural land with heavy clay loam or clay topsoil over slowly permeable and seasonally waterlogged clay subsoil (WC IV) is limited by soil wetness to Grade 4.

2.8.12 Deep, well drained (WC I) light loamy and sandy soils in the Newport series are most affected by soil droughtiness. The severity of limitation is determined by factors such as topsoil and subsoil textures, stone content. As crop moisture deficits are moderate to moderately large, droughtiness limitations range from slight (Grade 2) to moderate (Subgrade 3a) but may be as severe as Subgrade 3b.

2.8.13 At the far southern end of the study area, there are deep, permeable sandy and sandy loam soils in the Blackwood series. These soils are developed in glacial river deposits, which are variable in stone content and frequently overlie clay deposited in glacial lakes, or glacial till, at depth. Where undrained, the Blackwood soils are waterlogged for long periods during the winter (WC III and IV). These soils experience fluctuating levels of groundwater, but where the water-table has been lowered, the soils are well drained (WC I) or only slightly seasonally waterlogged (WC II).

2.8.14 The quality of agricultural land with soils in the Blackwood series is limited by soil wetness to Grade 2 where the subsoil is seasonally waterlogged (WC III) or Subgrade 3a where the subsoil is waterlogged for long periods over the winter (WC IV). Where the agricultural land is drained (WC I and WC II), soil in the Blackwood series are more likely to be limited by soil droughtiness to Grade 2 or Subgrade 3a.

2.9 Soils and agricultural land classification surveys - detailed soil/ALC field surveys

2.9.1 The collection of site-specific information on soil resources and physical conditions has enabled a refinement and extension of published information on agricultural land quality. The analysis of the additional baseline information (topography and soils) identifies individual soil types and definitive agricultural land quality in accordance with the methodology prescribed by MAFF.

2.9.2 Site specific soils data have been collected through the observation of individual soil profiles at density of one observation per hectare across the study area; this being the degree of detail required for a definitive agricultural land classification. The characteristics of soil profiles were recorded to a maximum depth of 120cm where possible, or to any impenetrable layer, in relation to the following attributes:

- soil texture;
- significant stoniness;
- colour (including local gley and mottle colours);
- consistency;
- structural condition;
- free carbonate; and
- depth.

2.9.3 Soil WC was inferred from the matrix colour, presence or absence of, and depth to, greyish and ochreous gley mottling and/or poorly permeable subsoil layers at least 15cm thick. Soil available water capacity, relevant to the assessment of drought risk, was estimated from texture, structure, organic matter content, stone content and profile depth.

2.9.4 Soil data associated with post-1988 detailed ALC surveys are available from Natural England. A full archive of the soil data collected from field surveys undertaken on behalf of HS2 Ltd is presented as a series of soil survey proformas in a separate background information document (BID AG-002-0MA01)[1].

2.9.5 Published soil survey data is available for approximately 20% of the agricultural land in the study area, and additional detailed survey work has increased this coverage to 60%. The distribution of publicly available and validated data within the study area is available in SSEW's soil map and accompanying bulletin covering 'Soils in Cheshire: Crewe West'[19].

2.9.6 The detailed soil data confirm the presence in the study area of the soil series relating to the soil associations shown on the National Soil Map. Representative soil profiles from the Crewe series, Newport series and Blackwood series are described in Table 4.

Table 4: Dominant soil series within study area taken from site survey data

Soil series	
Crewe series (368900, 361600)	
0-26cm	Very dark greyish brown (10YR3/2) stoneless heavy clay loam; moderately developed fine subangular block; low packing density; moderately porous; moderately weak soil strength; moderately firm ped strength; abundant fine fibrous roots; slightly calcareous; abrupt smooth boundary.
26-44cm	Strong brown (10YR5/1) stoneless clay with many prominent ochreous mottles (7.5YR5/8); moderate coarse angular blocky structure. Medium packing density; moderately firm soil and ped strength; abundant fine fibrous roots; non-calcareous; few irregular soft ferri-manganiferous concentrations; abrupt smooth boundary.
44-120cm	Reddish brown (5YR4/2) stoneless clay with common distinct grey (10YR5/1) mottles; strong coarse prismatic structure. High packing density; very firm soil strength; common very fine fibrous roots; non-calcareous.
Newport series (368900, 361600)	
0-26cm	Sandy loam (10YR3/2); moderately developed medium subangular structure; non-calcareous; ; moderately porous; common very fine fibrous roots; moist; abrupt smooth boundary.
26-38cm	Sandy loam (7.5YR5/; many medium (10YR5/3) mottles; weakly developed medium angular blocky structure; moderately porous; few very fine roots; moist; clear smooth boundary.
38-50cm	Sandy loam (7.5YR5/8); many medium (10YR6/3) mottles; very weakly developed coarse angular blocky structure; non-calcareous; few ferruginous nodules; very porous; moist; abrupt smooth boundary.
50-80cm	Sandy loam (10YR6/3); common medium (7.5YR5/6); very weakly developed coarse angular blocky structure; non-calcareous; very porous; moist; abrupt smooth boundary.
80-100cm	Loamy sand (7.5YR5/4); many medium (10YR5/6) mottles; massive structure; non-calcareous; very porous; moist.

[19] Furness. R. R. (1971*), Soil Survey Record 5, Soils in Cheshire I (Sheet SJ 65, Crewe West)*, Soil Survey of England Wales, Harpenden.

Soil series	
Blackwood series (368900, 361600)	
0-18cm	Sandy loam (10YR3/2), moderately developed fine subangular structure; few very small quartzite stones; non-calcareous; very porous; many very fine fibrous roots; moist; clear smooth boundary.
18-43cm	Sandy loam (10YR3/3); few mottles (10YR4/3); moderately developed medium subangular structure; few, very small quartzite stones; non-calcareous; porous; many very fine fibrous roots; moist; abrupt smooth boundary.
43-57cm	Sandy loam (10YR4/3); common fine mottles (5YR5/6); very weakly developed medium angular blocky structure; few, very small quartzite stones; non-calcareous; few ferruginous nodules; moderately porous; common very fine fibrous roots; moist; abrupt smooth boundary.
57-87cm	Loamy sand (10YR5/3); common medium (10YR5/6) mottles; single grain structure; common very small quartzite stones; non-calcareous; extremely porous; common very fine fibrous roots; moist; sharp smooth boundary.
87-100cm	Sandy loam (5YR4/4); common fine (5YR5/3) mottles; massive structure; few small quartzite stones; non-calcareous; few ferri-manganiferous nodules; slightly porous; moist.

2.9.7 Where there is no available published information and it has not been possible to undertake a detailed survey of agricultural land affected by the route of the Proposed Scheme, professional judgement has been used to extrapolate from known data to provide a comprehensive ALC coverage.

2.9.8 The assessment of the quality of agricultural land in the study area based on publicly available data and additional detailed survey data have been reviewed, and the final conclusions on the distribution of agricultural land in the various grades of the ALC in the study area are shown on Maps AG-04-300 to AG-04-304a (Volume 5, Agriculture, forestry and soils Map Book).

2.9.9 The distribution of agricultural land in the different grades is shown in Table 5.

Table 5: Distribution of grades of agricultural land in the study area

Grade	Area (ha)	% of study area	% of Agricultural land area
1	0	0	0
2	0	0	0
3a	5.8	3.0	4.4
BMV subtotal	**5.8**	**3.0**	**4.4**
3b	109.6	56.4	82.6
4	17.3	8.9	13.0
5	0.0	0	0
Non agricultural	61.6	31.7	---
Total area	**194.3**	**100**	**100**

3 Assessment of effects on holdings

3.1.1 The effects on land holdings have been assessed according to the methodology set out in the in the Environmental Impact Assessment Scope and Methodology Report (SMR), (see Volume 5, Appendix CT-001-00001).

3.1.2 The land holdings assessed in this section are also presented in Volume 2, Community Area report: Hough to Walley's Green (MA01), Section 4 Agriculture, forestry and soils and shown on the Volume 5, forestry and soils Map Book (AG-01-300 to AG-01-304a).

3.1.3 A summary of the assessment is provided in Table 6. The nature of the impacts considered includes:

- temporary and permanent land required from the holding;
- the temporary and permanent severance of land;
- the permanent loss of key farm infrastructure; and
- disruption (particularly noise and dust) on land uses and the holding's operations.

3.1.4 These impacts occur primarily during the construction phase of the Proposed Scheme.

Table 6: Summary of assessment of impacts and effects on holdings

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
MA01/1 Heath Farm Rented on Agricultural Holdings Act (AHA) and Farm Business Tenancy (FBT) agreements 100ha arable farm. Diversified enterprises include DIY livery, agricultural contracting and engineering workshop. Medium sensitivity to change **ALSO** significantly affected by HS2 Phase 2a	Land required: Negligible 0.4ha; <1% of holding required for construction of the Crewe tunnel south porous portal. Severance: Negligible Disruption: Negligible Overall temporary assessment: Negligible	Land required: Negligible No land permanently required. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA01/2* Chorlton Bank Farm 7ha grassland enterprise Low sensitivity to change **ALSO** affected by HS2 Phase 2a	Land required: Medium 1.2ha; 17% of holding required for construction of the Crewe tunnel south porous portal and utility diversions. Severance: Negligible Disruption: Negligible Overall temporary assessment: Minor adverse	Land required: Low 0.6ha; 9% of holding required for the main HS2 line. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA01/3 The Moss*	Land required: Negligible	Land required: Negligible No land permanently required.

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
Rented under FBT agreements 92ha arable holding farmed remotely from Proposed Scheme. Medium sensitivity to change **ALSO** significantly affected by HS2 Phase 2a	0.1ha; <1% of holding required for construction of the Crewe tunnel south portal satellite compound and utility diversions. Severance: Negligible Disruption: Negligible Overall temporary assessment: Negligible	Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA01/4 Oakhanger Hall Owner-occupied with land also rented on FBT agreements. 304ha dairy and arable farm. 430-cow milking herd (housed) plus replacements. Land at Gonsley Green and Sutch Farm used to graze young stock and dry cows. Agricultural land is used by Checkley Wood Shoot. Medium sensitivity to change as the land is not used to graze milking cows. **ALSO** significantly affected by HS2 Phase 2a	Land required: Negligible 4.0ha; 1% of holding required for the construction of the Crewe tunnel south portal satellite compound. Severance: Negligible Disruption: Negligible Overall temporary assessment: Negligible	Land required: Negligible 0.7ha; <1% of holding permanently required. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA01/5 Carters Green Farm 61ha holding rented from the Duchy of Lancaster on an AHA; farmed in conjunction with a further 276ha rented in the locality. Dairy with arable cropping High sensitivity to change	Land required: Negligible 0.3ha; <1% of holding required for utility diversions. Severance: Negligible Disruption: Negligible Overall temporary assessment: Minor adverse	Land required: Negligible No land permanently required. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA01/6 Church Farm* 187ha grassland holding based some 3kms form the Proposed Scheme. Medium sensitivity to change	Land required: Negligible 2.5ha; 1% of holding required for the construction of the Crewe tunnel north portal and tunnel portal building, and rescue area. Severance: Negligible Disruption: Negligible Overall temporary assessment: Negligible	Land required: Negligible 1.7ha; 1% of holding required for the Crewe tunnel north portal, tunnel portal building and rescue area, Crewe tunnel north portal auto-transformer station and landscape mitigation planting. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA01/7 Chaise Farm* 24ha grassland enterprise	Land required: High 6.1ha; 25% of holding required for the construction of the Crewe north cutting and a conveyor route.	Land required: Negligible 0.8ha; 4% of holding required for the Crewe north cutting and landscape mitigation planting.

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
Medium sensitivity to change	Severance: Negligible Disruption: Negligible Overall temporary assessment: Major/moderate adverse due to the proportion of land required	Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA01/8 Bridge Farm Owner-occupied 1.3ha grassland holding Low sensitivity to change	Land required: High 1.3ha; 100% of holding required for construction of the Crewe North Portal (retained cutting), and Crewe tunnel north compound. Severance: Negligible Disruption: Negligible Overall temporary assessment: Moderate adverse due to the proportion of land required	Land required: High 0.9ha; 70% of holding required for the Crewe North Portal (retained cutting) and landscape mitigation planting. Severance: Negligible Infrastructure: High Demolition of residential property. Overall permanent assessment: Moderate adverse due to the proportion of land required and property demolition
MA01/9 Moss Bridge Farm (Winton Equestrian Centre (WEC)) Owner-occupied 7.2ha holding with riding school and stables. Diversified activities include a commercial phone mast. Medium sensitivity to change	Land required: High 7.2ha; 100% of holding required for construction of the Coppenhall Moss cutting, Parkers Road overbridge, utility diversions and soil stores. Severance: Negligible Disruption: Medium Riding and exercising horses close to construction activities may need to be limited. Overall temporary assessment: Major/moderate adverse due to the proportion of land required	Land required: High 7.2ha; 100% of holding required for the Coppenhall Moss cutting, Parkers Road overbridge and landscape and ecology mitigation planting. Severance: Negligible Infrastructure: High Demolition of residential property and stables. Overall permanent assessment: Major/moderate adverse due to the proportion of land required and property demolition
MA01/10 Land north of WEC* 7ha grassland holding Low sensitivity to change	Land required: High 5.8ha; 83% of holding required for the construction of the Warmingham Moss southbound embankment No.1, utility diversions and soil stores. Severance: Negligible Disruption: Negligible Overall temporary assessment: Moderate adverse due to the proportion of land required	Land required: High 2.8ha; 39% of holding required for the Coppenhall Moss cutting, Footpath Crewe 29/1 accommodation overbridge and landscape and ecology mitigation planting. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Moderate adverse due to the proportion of land required
MA01/11 Moss Farm, Moss Lane, Crewe Owner-occupied	Land required: High 6.1ha; 29% of holding required for the construction of the Warmingham Moss northbound	Land required: High 6.0ha; 28% of holding required for the Warmingham Moss northbound spur embankment No.1, balancing

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
21ha grassland holding with beef cattle. Low sensitivity to change (land affected not related to any farm buildings and used as off-lying satellite grazing land)	spur embankment No.1, a balancing pond and its associated access. Severance: Negligible Disruption: Negligible Overall temporary assessment: Moderate adverse due to the proportion of land required	pond and associated access, and ecology mitigation planting. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Moderate adverse due to the proportion of land required
MA01/12 Hollyhurst Farm Owner-occupied 16ha grassland holding with beef cattle. Part of the land managed as part of the Mid-tier Countryside Stewardship Scheme. Low sensitivity to change	Land required: High 5.9ha; 37% of holding required for the access to a balancing pond, mitigation planting and utility diversions. Severance: Negligible Disruption: Negligible Overall temporary assessment: Moderate adverse due to the proportion of land required	Land required: High 5.5ha; 35% of holding required for the access to balancing pond and ecology habitat creation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Moderate adverse due to the proportion of land required.
MA01/13 Moss Farm, Moss Lane, Lane End Owner-occupied 26ha grassland holding let to others Fieldscale solar array under construction. Low sensitivity to change	Land required: High 15.8ha; 61% of holding required for the construction of the approach to the Warmingham Moss southbound viaduct, Coppenhall Moss embankment, Warmingham Moss satellite compound, a balancing pond and access, utility diversions and soil stores. Severance: Negligible Disruption: Negligible Overall temporary assessment: Moderate adverse due to the proportion of land required	Land required: High 7.7ha; 30% of holding required for the Warmingham Moss southbound viaduct, Coppenhall Moss embankment, balancing pond and access and landscape mitigation planting. Severance: Negligible Infrastructure: High Demolition of part of, or all, fieldscale solar array. Overall permanent assessment: Moderate adverse due to the proportion of land required and demolition of solar array
MA01/14 Land at Moss Lane, Crewe (1)* 2.3ha grassland holding Low sensitivity to change	Land required: Low 0.2ha; 8% of holding required for the construction of the approach to the Warmingham Moss northbound embankment No. 1 and soil stores. Severance: Negligible Disruption: Negligible Overall temporary assessment: Negligible	Land required: Negligible 0.1ha; 4% of holding permanently required. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA01/15 Land at Moss Lane, Crewe (2)* 2.2ha grassland holding Low sensitivity to change	Land required: High 0.5ha; 24% of holding required for the construction of the approach to the Warmingham Moss northbound embankment No. 1 and soil stores. Severance: Negligible	Land required: Negligible 0.1ha; 4% of holding permanently required. Severance: Negligible Infrastructure: Negligible

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
	Disruption: Negligible Overall temporary assessment: Moderate adverse due to the proportion of land required	Overall permanent assessment: Negligible
MA01/16 Spring Farm Owner-occupied 71ha arable and grassland holding Diversified activities include managing a commercial business park established at the holding and wind turbines. Medium sensitivity to change	Land required: High 24.2ha; 34% of holding required for the construction of the Warmingham Moss northbound viaduct, Moss Lane satellite compound, utility diversions and soil stores. Severance: Negligible Disruption: Low Perceived construction activities (dust and noise) may reduce the uptake of the business park during construction. Overall temporary assessment: Major/moderate adverse due to the proportion of land required	Land required: Medium 8.8ha; 12% of holding required for the Warmingham Moss northbound viaduct, landscape earthworks and landscape mitigation planting. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Moderate adverse due to the proportion of land required.
MA01/17 Lane Ends Farm Part owner-occupied, part rented on grazing licence 93ha dairy and grassland. Part of the land managed as part of the Mid-tier Countryside Stewardship Scheme. Buildings let Medium sensitivity to change (land affected lies too far from dairy buildings to be utilised by grazing dairy cows)	Land required: Negligible 1.3ha; 1% of holding required the construction of the approach to the Warmingham Moss southbound viaduct, Coppenhall Moss embankment and soil stores. Severance: Negligible Disruption: Negligible Overall temporary assessment: Negligible	Land required: Negligible 0.5ha; <1% of holding required for the approach to the Warmingham Moss southbound viaduct and Coppenhall Moss embankment. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA01/18 Parkfield Farm Owner-occupied 112ha dairy holding. Part of the land managed under the requirements of the Entry Level (environmental stewardship) Scheme. Diversified activities include wind turbines. High sensitivity to change	Land required: High 39.3ha; 35% of holding required for the construction of the main line, Warmingham Moss southbound viaduct, Warmingham Moss southbound spur embankment No2, Parkfield access realignment, utility diversions and soil stores. Severance: Low Farm severed by existing WCML and by the Proposed Scheme; existing accommodation access replaced. Disruption: Low	Land required: High 26.6ha; 24% of holding required for the Warmingham Moss southbound viaduct, the Warmingham Moss southbound spur embankment No.2, the Parkfield access realignment and mitigation planting. Severance: Low Farm severed by existing WCML and by the Proposed Scheme; existing accommodation access replaced. Infrastructure: Negligible

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
	Potential for dust arising from construction to affect housed livestock. Overall temporary assessment: Major adverse due to the proportion of land required	Overall permanent assessment: Major adverse due to the proportion of land required
MA01/19 Elm Tree House* 42ha grassland and arable holding Medium sensitivity to change	Land required: Negligible <0.1ha; <1% of holding required for utility diversions. Severance: Negligible Disruption: Negligible Overall temporary assessment: Negligible	Land required: Negligible No land permanently required. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA01/20 Bellaport Home Farm* 30ha grassland holding Medium sensitivity to change	Land required: Negligible 0.6ha; 2% of holding required for utility diversions. Severance: Low Holding severed by construction access. Disruption: Negligible Overall temporary assessment: Minor adverse	Land required: Negligible No land permanently required. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA01/21 Minshull Hill Farm Owner-occupied 95ha dairy holding Medium sensitivity to change (land affected lies too far distant from the dairy buildings, and is severed from the main holding by A530 Middlewich Road to be utilised by grazing dairy cows)	Land required: Negligible 2.3ha; 2% of holding required for ecology habitat creation. Severance: Negligible Disruption: Negligible Overall temporary assessment: Negligible	Land required: Negligible 2.3ha; 2% of holding required for ecology habitat creation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA01/22 Land north of Minshull Hill Farm* 20ha grassland enterprise Medium sensitivity to change	Land required: Medium 2.2ha; 11% of holding required for construction access and mitigation planting. Severance: Negligible Disruption: Negligible Overall temporary assessment: Moderate adverse due to the proportion of land required	Land required: Low 1.3ha; 6% of holding required for ecology habitat creation. Severance: Negligible Disruption: Negligible Overall permanent assessment: Minor adverse
MA01/23 Moat House Farm* 14ha grassland enterprise Medium sensitivity to change	Land required: Negligible 0.6ha; 4% of holding required for construction access. Severance: Low	Land required: Negligible 0.3ha; 2% of holding required. Severance: Negligible Infrastructure: Negligible

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
	Holding severed by construction access. Disruption: Negligible Overall temporary assessment: Minor adverse	Overall permanent assessment: Negligible
MA01/24 The Bull Pen* 12ha grassland enterprise Medium sensitivity to change	Land required: Negligible 0.4ha; 3% of holding required for construction access. Severance: Negligible Disruption: Negligible Overall temporary assessment: Negligible	Land required: Negligible <0.1ha; <1% of holding permanently required. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA01/25 Newfield Hall Farm AHA tenancy from Cheshire County Council. 36ha dairy heifer breeding and rearing. Medium sensitivity to change	Land required: Medium 4.7ha; 13% of holding required for the A530 Nantwich Road realignment and associated balancing pond, utility diversions and access. Severance: Negligible Disruption: Negligible Overall temporary assessment: Moderate adverse due to the proportion of land required	Land required: Low 2.6ha; 7% of holding required for the A530 Nantwich Road realignment, balancing pond and access. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Minor adverse
MA01/26 Park House Farm Owner-occupied 22ha grassland holding managed with sheep; forms part of a larger (111ha) holding based near Chester. Part of the land managed under the requirements of the Mid-tier Countryside Stewardship Scheme. Residential barn conversions let out. Medium sensitivity to change	Land required: Low 7.5ha; 7% of holding required for the construction of Walley's Green embankment, Park Hall Farm accommodation access realignment, utility diversions and soil stores. Severance: Low Holding severed by construction access. Disruption: Negligible Overall temporary assessment: Minor adverse	Land required: Low 7.4ha; 7% of holding required for the Walley's Green embankment, Park Hall Farm accommodation access realignment and ecology habitat creation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Minor adverse
MA01/27 Newfield Farm* 26ha grassland holding Medium sensitivity to change	Land required: Negligible 1.1ha; 4% of holding required for the A530 Nantwich Road realignment and mitigation planting. Severance: Negligible Disruption: Negligible Overall temporary assessment: Negligible	Land required: Negligible 1.0ha; 4% of holding required for the A530 Nantwich Road realignment and woodland habitat creation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible

** It has not been possible to arrange farm impact assessment interviews with these holdings. Publicly available sources have been used to obtain the information presented.*

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