A1 in Northumberland: Morpeth to Ellingham

Scheme Number: TR010041

6.3 Environmental Statement – Chapter 11 Geology and Soils

Part B

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

June 2020

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

The A1 in Northumberland: Morpeth to Ellingham

Development Consent Order 20[xx]

Environmental Statement

Regulation Reference:	APFP Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010041
Application Document Reference	TR010041/APP/6.3
Author:	A1 in Northumberland: Morpeth to Ellingham Project Team, Highways England

Version	Date	Status of Version
Rev 0	June 2020	Application Issue

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11. GEOLOGY AND SOILS

11.1. INTRODUCTION

11.1.1. This chapter presents the assessment of likely significant environmental effects as a result of Part B: Alnwick to Ellingham (Part B) on geology and soils.

11.1.2. Highway projects have the potential to impact on the geology and soils of a region. Geology and soils are important as they influence key environmental features such as landscape, vegetation, flood risk and natural drainage capacity of an area.

11.1.3. This chapter presents the assessment of likely significant environmental effects as a result of Part B on geology and sensitive soils (including agricultural topsoil) and secondary associated receptors such as groundwater and surface water bodies. This chapter also identifies, where appropriate, proposed mitigation measures to prevent, minimise or control the likely adverse effects on geology and soils arising from the construction and operation phases of Part B and any subsequent residual effects.

11.1.4. This chapter is supported by the following appendices in **Volume 8** of this Environmental Statement (ES) (**Application Document Reference: TR010041/APP/6.8**):

a. **Preliminary Sources Study Report (PSSR)** (**Appendix 11.1**, **Volume 8** of this ES), Highways Agency Geotechnical Data Management System (HAGDMS) No. 29384.
b. **Preliminary Risk Assessment (PRA): Lionheart Business Park** (**Appendix 11.2**, **Volume 8** of this ES).
c. **Ground Investigation Report (GIR)**, 2019 (**Appendix 11.3**, **Volume 8** of this ES).
d. **Ground Investigation Works**, April 2019 (**Appendix 11.4**, **Volume 8** of this ES).
e. **Soils and Agricultural Land Quality Report**, 2019. (**Appendix 11.5**, **Volume 8** of this ES)
f. **Coal Mining Risk Assessment**, 2019. (**Appendix 11.6, Volume 8** of this ES).

11.1.5. For the assessment of the Main Compound, this chapter is also supported by **Appendix 11.1: Preliminary Sources Study Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**), HAGDMS No. 29386.

11.1.6. This chapter should be read together with the introductory chapters of this ES (**Chapters 1 to 4**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**)) in particular **Chapter 2: The Scheme**, **Volume 1** of this ES. An assessment of combined effects of Part B is set out in **Chapter 15: Assessment of Combined Effects** of this ES and combined and cumulative effects of the Scheme are set out in **Chapter 16: Assessment of Cumulative Effects**, **Volume 4** of this ES (**Application Document Reference: TR010041/APP/6.4**).

11.1.7. This assessment covers the Part B Main Scheme Area including Charlton Mires Site Compound, Lionheart Enterprise Park Compound (eastern site and western site) and Main Compound located within Part A: Morpeth to Felton (Part A).

11.1.8. **Section 4.3** of **Chapter 4: Environmental Assessment Methodology, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**) identifies any differences in the assessment methodology employed for Part A and Part B. Further to this, there are other differences between the chapters for Part A and Part B. All key differences include:

a. There are differences between Part A and Part B that relate to the scoping process, for example elements that are scoped in and out of the assessment. Refer to the **Scoping Report** (**Application Document Reference: TR010041/APP/6.10**) and **Scoping Opinion** (**Application Document Reference: TR010041/APP/6.12**) for Part A, and the **Scoping Report** (**Application Document Reference: TR010041/APP/6.11**) and **Scoping Opinion** (**Application Document Reference: TR010041/APP/6.13**) for Part B.

11.2. COMPETENT EXPERT EVIDENCE

11.2.1. **Table 11-1** below demonstrates that the professionals contributing to the production of this chapter have sufficient expertise to ensure the completeness and quality of this assessment.

Table 11-1 – Relevant Experience

Name	Role	Qualifications and Professional Membership	Relevant Experience
Verity Curtis	Author	MSc Environmental Protection Member of the Institute of Environmental Sciences	Environmental Consultant - Preparation of Geology and Soils input into the Scoping Report for the A630 Sheffield Parkway (2019). - Preparation of Geology and Soils ES chapter for the Towy Valley Cycle Path (2018 – 2019). - Preparation of Geology and Soils baseline data and input into the ES chapter for A9 Dualling: Tomatin to Moy (2015 – 2017). - Preparation of Geology and Soils ES chapter for the A5 Western Transport Corridor (2012 – present).
Andrew McCusker	Reviewer	Chartered Engineer (CEng MICE)	Technical Director 25 years' experience in impact assessment. Other recent relevant experience includes:

Name	Role	Qualifications and Professional Membership	Relevant Experience
		Chartered Environmentalist (CEnv) Specialist in Land Condition Suitably Qualified Person	- Maltkin Village - Technical Reviewer for Ground conditions and Groundwater sections - Brent Cross/Cricklewood – Technical Reviewer for Soil and Groundwater sections - A1 Birtley to Coal House – Reviewer for Soils and Geology Chapter. - HS2 – Project Manager and technical review for scheme sections C251/252

11.3. LEGISLATIVE AND POLICY FRAMEWORK

LEGISLATION

International

Water Framework Directive (WFD) 2000 (2000/60/EC) (Ref. 11.1)

11.3.1. An objective of the soil and geology assessment relates to bringing about the effective co-ordination of water environment policy and regulation across Europe by ensuring that all surface water and groundwater reaches 'good' status (in terms of ecological and chemical quality and water quantity, as appropriate) and to reduce pollution.

Directive on Pollution Caused by Certain Dangerous Substances Discharged into the Aquatic Environment 2006 (2006/11/EC) (Ref. 11.2)

11.3.2. This Directive was introduced to control the amount of dangerous substances that are discharged into inland, coastal and territorial waters.

National

Environmental Protection Act 1990 (Ref. 11.3)

11.3.3. Part 2A Section 78 describes a regulatory role for Local Authorities (LAs) in dealing with contaminated land.

Environment Act 1995 (Ref. 11.4)

11.3.4. This Act creates a system whereby the LA must identify and if necessary, arrange for the remediation of contaminated areas. The provisions are set out in Section 57, which inserts Part 2A into the Environmental Protection Act, 1990. In addition to these requirements, the

operation of the regime is subject to regulation and statutory guidance. Contaminated land related risks associated with a scheme are addressed in accordance with this legislation with the LA acting as regulator.

Control of Substances Hazardous to Health Regulations 2002 (Ref. 11.5)

11.3.5. These Regulations provide an assessment of the risk to health created by work involving substances hazardous to health, which may be either present in the ground on site or be brought onto site as part of the construction activities.

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (Ref. 11.6)

11.3.6. These Regulations establish a framework for protecting the water environment.

Environmental Damage (Prevention and Remediation) (England) Regulations 2015 (Ref. 11.7)

11.3.7. These Regulations aim to prevent serious environmental effects or ensure that remediation is carried out. The duty to prevent or remediate falls on operators of activities. The Regulations specifically define three types of environmental damage: biodiversity damage - to European Union protected species and habitats, and Sites of Special Scientific Interest (SSSI); water damage; and land damage.

The Environmental Permitting (England and Wales) Regulations 2016 (Ref. 11.8)

11.3.8. These Regulations replace those parts of the Water Resources Act that relate to the regulation of discharges to controlled waters. Under the Regulations, groundwater activities relate to inputs of pollutants to groundwater. The Regulations also replace the Groundwater Regulations, 2009 which in turn replaced the Groundwater Regulations, 1998. The Regulations also transpose the Groundwater Directive 1980, the WFD and Groundwater Daughter Directive 2006 into UK law.

Control of Asbestos Regulations (CAR) 2012 (Ref. 11.9)

11.3.9. These Regulations prohibit the importation, supply and use of all forms of asbestos. If existing asbestos containing materials are in good condition, they may be left in place; their condition monitored and managed to ensure they are not disturbed. The CAR also includes the ‘duty to manage asbestos’ in non-domestic premises.

Contaminated Land (England) Regulations 2006 (as amended in 2012) (Ref. 11.10)

11.3.10. Regulation 3 provides a definition of what constitutes ‘contaminated land’ and sets out the responsibilities of the LA and the Environment Agency in the identification and management of contaminated land. Contaminated land assessment works associated with Part B are to be conducted in accordance with these regulations.

Construction (Design & Management) Regulations (CDM), 2015 (Ref. 11.11)

11.3.11. These Regulations require clients to use their influence to ensure that the arrangements made by other duty holders are sufficient to safeguard the health and safety of those working or those affected by that work.

POLICY

National

11.3.12. National planning policy relevant to geology and soils and the significance of Part B on the policy objectives is outlined in **Table 11-2** below.

Local

11.3.13. Local planning policy relevant to geology and soils and the significance of Part B on the policy objectives is outlined in **Table 11-3** below.

Table 11-2 – National Planning Policy Relevant to Geology and Soils

Policy	Relevant Policy Objectives	Significance of Part B on Policy Objective(s)
National Policy Statement for National Networks (NPS NN), 2014 (**Ref. 11.12**)	**Assessment Principles:** **Pollution Control and Other Environmental Protection Regimes** – The planning system controls the development and use of land in the public interest. It plays a key role in protecting and improving the natural environment, public health and safety and amenity for example by attaching requirements to allow developments which would otherwise not be environmentally acceptable to proceed and preventing harmful development which cannot be made acceptable even through requirements. Pollution control is concerned with preventing pollution using measures to prohibit or limit the release of substances to the environment from different sources to the lowest practical level. It also ensures that ambient air and water quality meet standards that guard against impacts to the environment or human health. **Land Instability** – The effects of land instability may result in landslides, subsidence or ground heave. Failing to deal with this issue could cause harm to human health, local property and associated infrastructure, and the wider environment. Where necessary, land stability should be considered in respect of new development as set out in the National Planning Policy Framework. **Agricultural Land / Soil Quality / Mineral Resources** – the statement requires scheme promoters to take into account the economic and other benefits of best and most versatile agricultural land, as well as soil quality and safeguard mineral resource.	**Pollution Control and Other Environmental Protection Regimes** - Part B involves the online widening of the existing A1 carriageway and would not be introducing a wholly new development to the area. There is potential for Part B to impact soils and geology via the introduction of potential pollutants as a result of its intended use as a highway. However, the mitigation measures outlined in **Section 11.9** of this chapter to be implemented through Part B would ensure that the policy objectives relating to the natural environment, public health and safety and amenities related to soils and geology would not be compromised. No significant effects are anticipated in relation to pollution control. **Land Instability** - Part B has the potential to impact on ground stability during both construction and operation via earthworks and introduction of additional loading. However, based on the approach set out in **Section 11.9** of this chapter which includes measures such as further investigation at detailed design and assessment and incorporation of appropriate mitigation measures into detailed design there is no indication that policy objectives relating to land instability would be compromised. No significant effects are anticipated in relation to land instability. **Agricultural Land / Soil Quality / Mineral Resources** - Part B has the potential to impact best and most versatile (BMV) agricultural land, soil quality and mineral resources as a direct result of the carriageway widening. Based on the approach set out in **Section 11.9** of this chapter there is no indication that policy objectives relating to agricultural land, soil quality and mineral resources would be compromised. No significant effects are anticipated in relation to soil quality and mineral resources; however, a significant effect is anticipated in relation to the loss of BMV agricultural land.
National Planning Policy Framework (NPPF) (2019) (**Ref. 11.13**)	**Paragraph 170**. Planning policies and decisions should contribute to and enhance the natural and local environment by: *'A) Protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);* *E) Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and,* *F) Remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.'* Reference is also made to document: 56 Circular 06/2005 - to provide further guidance in respect of statutory obligations for biodiversity and geological conservation and their impact within the planning system.	There is potential for Part B to impact soils and geology and mobilise contaminants present. However, the mitigation measures outlined in **Section 11.9** of this chapter to be implemented through Part B would ensure the policy objectives are not compromised. Significance of Part B on air quality and noise policy objectives has been addressed in the corresponding tables in **Chapter 5: Air Quality** and **Chapter 6: Noise and Vibration** of this ES.

Policy	Relevant Policy Objectives	Significance of Part B on Policy Objective(s)
	Paragraph 178. Planning policies and decisions should ensure that: *'A) A site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);* *B) After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and,* *C) Adequate site investigation information, prepared by a competent person, is available to inform these assessments.'* **Paragraph 179.** Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner. The NPPF seeks to contribute to and enhance the natural and local environment by protecting and enhancing valued landscapes, geology conservation interests and soils. In addition, geology and geomorphological features which are considered to be of national importance are designated as SSSI and have some level of legal protection.	

Table 11-3 –Local Planning Policy Relevant to Geology and Soils

Policy	Relevant Policy Objectives	Significance of Part B on Policy Objective(s)
NCC, Northumberland Minerals Local Plan (adopted March 2000) (**Ref. 11.14**)	**Policy S3 Planning Permission** Planning permission should not be granted for development which would sterilise important economically workable deposits unless: - There is an overriding need for the development and prior extraction of the mineral cannot be reasonably undertaken, or - Extraction of the mineral is unlikely to be practicable or environmentally acceptable.	Economically workable mineral deposits would be sterilised by Part B. Sections of Mineral Safeguarding Areas (MSA) relating to sand and gravel, limestone and coal, have been identified with the Study Area. However, the percentages of the total area of each identified MSA affected would be minimal. As a nationally significant infrastructure project, and for the reasons set out in the Application, there is an overriding need for Part B. The mitigation measures outlined in **Section 11.9** to be implemented as part of Part B would aim to minimise the sterilisation of potential mineral resources located in the working area by giving consideration to the incorporation of site won materials from these MSAs into Part B where possible.

Policy	Relevant Policy Objectives	Significance of Part B on Policy Objective(s)
Alnwick District Wide Local Plan (1997) (**Ref. 11.15**)	**Policy S3: Sustainability Criteria** *"Before allocating sites or granting planning permission for new development, the district council would need to be satisfied that the following sustainability criteria are met:* *"3 – Any physical and environmental constraints on the development of the land as a result of contamination, or land stability can be mitigated;* *"5 – That there would be no significant adverse effects on the natural resources, environment, biodiversity and geodiversity, cultural, historic and community assets of the district."*	There is potential for Part B to impact soils and geology, and mobilise contaminants present, however given the historical use of the Study Area limited significant potential sources of contamination have been identified. The potential for poorly compacted or unstable ground as a result of historical coal mining activity or placement of Made Ground associated within former landuse has been identified within the Study Area. It is anticipated that the measures outlined in **Section 11.9** of this chapter to be implemented as part of Part B would ensure that identified physical and environmental constraints posed to Part B as a result of contamination or land stability can be mitigated. Significance of Part B on natural resources, biodiversity and, cultural and historic assets policy objectives have been addressed in the corresponding tables in **Chapter 8: Cultural Heritage**, **Chapter 9: Biodiversity** and **Chapter 13: Material Resources** of this ES.
Northumberland Local Plan: Draft Plan for Consultation (January 2019) (**Ref. 11.16**)	**Policy POL 1 unstable and contaminated land** *"Development proposals will be supported where it can be demonstrated that unacceptable risks from land instability and contamination will be prevented by ensuring the development is appropriately located and that measures can be taken to effectively mitigate the impacts.* *"Planning applications for proposals on land that is potentially unstable or contaminated shall be accompanied by an assessment showing:* *"a) the nature and extent of contamination or instability issues and the possible effects this may have on the development and its future use, biodiversity and the natural and built environment; and;* *"b) the remedial measures needed to allow the development to go ahead safely giving consideration to the potential end users, including, as appropriate:* *i. removing the contamination;* *ii. treating the contamination;* *iii. protecting and/or separating the development from the effects of contamination; and* *iv. addressing land instability; and* *"c) that the benefits of any proposed remediation measures are not outweighed by any harm to the natural, built and historic environment caused by the remediation works themselves. Support will be given to development proposals that allow for the beneficial remediation of contamination or unstable land."*	There is potential for Part B to impact soils and geology, and mobilise contaminants present, however given the historical use of the Study Area limited significant potential sources of contamination have been identified. The potential for poorly compacted or unstable ground as a result of historical coal mining activity or placement of Made Ground associated within former landuse has been identified within the Study Area. It is anticipated that the measures outlined in **Section 11.9** of this chapter to be implemented as part of Part B would ensure that identified physical and environmental constraints posed to Part B as a result of contamination or land stability can be mitigated.

Policy	Relevant Policy Objectives	Significance of Part B on Policy Objective(s)
	Policy POL 2 Pollution and air, soil and water quality *"1) Development proposals in locations where they would cause, or be put at unacceptable risk of harm from, or be adversely affected by pollution by virtue of the emissions of fumes, particles, effluent, radiation, smell, heat, light, noise or noxious substances will not be supported.* *"2) Development proposals that may cause pollution of water, air or soil, either individually or cumulatively, are required to incorporate measures to prevent or reduce their pollution so as not to cause nuisance or unacceptable impacts on the environment, people or biodiversity.* *"3) Development proposed where pollution levels are unacceptable, and unable to mitigate to acceptable levels, will not be supported.* *"5) Development will be required to help:* *a) Maintain soil quality standards and protect the quality of any displaced soil through sustainable use by following the most up to date guidance from the Government."*	Significance of Part B on air quality, biodiversity and noise policy objectives has been addressed in the corresponding tables in **Chapter 5: Air Quality**, **Chapter 9: Biodiversity** and **Chapter 6: Noise and Vibration** of this ES. There is potential for Part B to impact soils and geology via the mobilisation of existing potential contaminants and the introduction of potential contaminants during operation. However, the mitigation measures outlined in **Section 11.9** of this chapter to be implemented through Part B would ensure that pollution events are prevented and Part B would not cause unacceptable impacts on the environment. Significant volumes of soils would be displaced as a result of Part B, however mitigation measures outlined in **Section 11.9** of this chapter, relating to the handling and reuse of soils, are anticipated to ensure that the sustainability of Part B is optimised, and the soil quality of displaced soils is maintained.
	Policy POL 3 Agricultural land quality *"1) Development of the "best and most versatile" agricultural land will not be supported unless it can be demonstrated that:* *a) There are no suitable alternative sites on previously developed or lower quality land; and,* *b) The need for development clearly outweighs the need to protect such land in the long term; or* *c) In the case of temporary/ potentially reversible development (for example, minerals), that the land would be reinstated to its pre-working quality."*	BMV agricultural land (Grade 2 and Grade 3a) as well as moderate quality and poor quality agricultural land would be developed as part of Part B. However, given that Part B comprises the widening of the existing carriageway there are no suitable alternative sites. The need for Part B, as a nationally significant infrastructure project, clearly outweighs the need to protect such land in the long term. There is therefore the potential for Part B to have an adverse impact on agricultural land, however, the mitigation measures outlined in **Section 11.9** of this chapter to be implemented as part of Part B would ensure policy objectives are not compromised.
	Policy MIN 4 safeguarding mineral resources MSAs are identified around areas of: a) Carboniferous limestone b) Clay (including brick clay, brick shale and fireclay) c) Coal d) Igneous rock e) Sand and gravel f) Sandstone Applications for non-mineral related development in a MSA are required to include an assessment of the effect of the proposed development on the mineral resource beneath or adjacent to the development.	Sections of MSAs relating to sand and gravel, limestone and coal would be sterilised as a result of Part B. However, the percentage of the overall MSA which would be sterilised is minimal, affected areas range between 0.3% (sand and gravel) and 1% (coal). Given the extent of the MSAs across the Study Area and beyond there are no reasonable alternative options to Part B which would avoid or further minimise the sterilisation of minerals. The need for Part B, as a nationally significant infrastructure project outweighs the potential loss of mineral resources. Consideration will be given to the incorporation of site won materials from these MSAs into Part B where possible. There is potential for Part B to impact on mineral resources, however, the mitigation measures outlined in **Section 11.9** to be implemented as part of Part B would ensure policy objectives are not compromised.

Policy	Relevant Policy Objectives	Significance of Part B on Policy Objective(s)
	Proposals for non-mineral development which would lead to the unnecessary sterilisation of mineral resources within a MSA will not be supported unless it can be determined that: - No reasonable alternative options are available for the proposed development which would avoid or minimise the sterilisation of minerals. - The minerals can be extracted prior to development proceeding without jeopardising the development. - The overall social, economic or environmental benefits of the proposed scheme outweigh the potential loss of mineral resources.	

11.4. ASSESSMENT METHODOLOGY

SCOPE OF ASSESSMENT

11.4.1. The scope of the assessment is consistent with the **Scoping Report** (**Application Document Reference: TR010041/APP/6.11**), the **Scoping Opinion** (**Application Document Reference: TR010041/APP/6.13**) and the **Scoping Opinion Response Tracker** (**Appendix 4.1, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**)), with the following elements considered as part of this assessment:

a. Impacts associated with historical coal mining activity including ground stability and release of hazardous mine gas during construction and operation.
b. Impacts associated with the potential for encountering potentially contaminated Made Ground during construction and operation.
c. Impacts on soil quality during construction.
d. Impacts on agricultural land.
e. Impacts associated with major earthworks during construction of the highway.
f. Impacts associated with the construction phase such as the establishment of temporary construction compounds, use and maintenance of heavy machinery, fuel or oil and chemical storage, potential spills and stockpiling of materials.
g. Impacts associated with the operational phase of Part B such as surface water runoff (containing chemical and physical contaminants) and the potential for isolated significant release of chemical and physical contaminants.
h. Impacts on potential mineral resources during construction.

11.4.2. Risks to the quality, quantity and flow of surface water and groundwater resources not associated with land contamination are discussed in **Chapter 10: Road Drainage and the Water Environment** of this ES.

11.4.3. Impacts associated with designated sites and sites of geological importance (statutory and non-statutory) have been scoped out of the assessment as detailed in the **Scoping Report** (**Application Document Reference: TR010041/APP/6.11**), **Scoping Opinion** (**Application Document Reference: TR010041/APP/6.13**) and the **Scoping Opinion Response Tracker** (**Appendix 4.1**, **Volume 1** of this ES (**Application Document Reference TR010041/APP/6.1**)), as no such sites are affected by Part B.

CONSULTATION

11.4.4. Consultation was undertaken with Northumberland County Council (NCC) to enquire whether they held any pertinent information to support the assessment. In addition, Natural England have been consulted for advice on soil assessment. The consultation responses (refer to **Appendix 4.2: Environmental Consultation, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**)) are summarised in **Table 11-4** below.

11.4.5. The Coal Authority were consulted as part of the formal scoping process. Refer to the **Scoping Opinion Response Tracker (Appendix 4.1, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**) for details.

Table 11-4 – Summary of Consultation Responses

Consultee	Date and Type of Consultation	Summary of Consultation Response	Action
Natural England	25 May 2018 Email	A response was not received specifically to the consultation request however action was taken in line with the response to the consultation for Part A (dated January 2018) which references the consideration of generic issues and guidance rather than specific issues to Part A. The response is summarised in **Table 11-4** of **Chapter 11: Geology and Soils, Volume 2** of this ES (**Application Document Reference: TR010041/APP/6.2**).	An ALC survey has been completed in accordance with the guidance and mitigation measures have been proposed to minimise effects on agricultural soils.
Coal Authority	3 December 2018 Email	The Coal Authority stated that as Part B is located within several Development High Risk Areas (DHRA), further assessment into the impacts associated with historic mine workings would be required to inform the geology and soils assessment.	A Coal Mining Risk Assessment has been undertaken and the pertinent information included within the relevant parts of the baseline conditions section (refer to **Section 11.7** of this chapter).
NCC – Public Health Protection Unit	7 December 2018 Email	NCC provided information in relation to the following: - Historic land uses with the potential to contaminate. - Current and historic landfill sites. - Environmentally sensitive sites such as SSSIs. - Sites of geological importance such as Regionally Important Geological Sites (RIGS). - Details of previous pollution incidents. Details of private water abstractions. NCC confirmed that there are no sites which have been subject to a contaminated land notice, a decision to make an entry on the contaminated land register or an actual entry on the contaminated land register within the Study Area (as defined in **paragraph 11.6.1**). NCC is not aware of any pollution incidents within the Study Area. NCC has derived their consultation response with reference to the following sources: - NCC's historical land use GIS database. - Landmark's historical land use database. - Environment Agency historic landfill sites dataset. - Coal Authority mine entries and shallow workings - Historic Ordnance Survey maps.	The supplied information has been included within the relevant parts of the baseline conditions section (refer to **Section 11.7** of this chapter).

METHODOLOGY

11.4.6. This chapter assesses the potential impacts of Part B on soil, geology and secondary associated receptors (e.g. controlled waters, designated sites) within the Study Area (as illustrated on **Figure 2.2: Environmental Constraints Plan: Part B**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**). The method of baseline data collection has been undertaken in accordance with the methodology contained within Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 6 Land Use for agricultural land (**Ref. 11.17**), DMRB Volume 11 Section 3 Part 11 Geology and Soils for geology and soils receptors (**Ref. 11.18**) and the Environment Agency Model Procedures for the Management of Land Contamination Document (CLR11) (**Ref. 11.19**).

11.4.7. The assessment includes the following elements:

a. Completion of an ALC survey.
b. Review of information associated with agricultural land quality.
c. Review of baseline soil, geological and environmental information for the Study Area, including historical mapping, to enable an assessment of potential impacts/ constraints associated with land contamination.
d. Review of the potential mineral resources within the Study Area.
e. Review of detailed site survey and ground investigation works to confirm attribute importance and facilitate assessment of potential contaminant linkages.
f. Review of information associated with ground stability related issues.
g. Review of information associated with unexploded ordnance (UXO) related issues.
h. The sensitivity of the attributes.
i. List and assessment of potential impacts.
j. List and assessment of the likely significance of the effects.

11.4.8. The potential impacts take into consideration both the construction and operation of Part B.

Contaminated Land Assessment Methodology

11.4.9. Contaminated land related issues have been assessed in accordance with Model Procedures for the Management of Contaminated Land (CLR11) (**Ref. 11.19**). The document advocates the use of a conceptual site model (CSM) to establish the links between a hazardous source and a sensitive receptor via an exposure pathway. The concept behind this approach is that, without each of the three fundamental elements (source, pathway and receptor), there can be no risk from contamination. Thus, the mere presence of a contamination hazard at a particular site does not necessarily imply the existence of associated risks. Refer to **Appendix 11.3: GIR**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8)** for further details on the assessment methodology.

Agricultural Land and Ground Stability

11.4.10. The agricultural land aspects have been assessed in accordance with Agricultural Land Classification of England and Wales – Revised criteria for grading the quality of agricultural land (**Ref. 11.20**).

11.4.11. The surveying and assessment of agricultural land classification has only been undertaken for land within the Order Limits and not the wider Study Area as only land that falls within the Order Limits would be impacted by Part B in terms of permanent and temporary land take.

11.4.12. The impacts on ground stability have been assessed using professional judgment and experience based on knowledge of similar schemes in the absence of published technical guidance.

Guidance

11.4.13. The following guidance documents have been used during the preparation of this chapter:

- **a.** DMRB Volume 11 Section 3, Part 6: Land Use (2001) – agricultural land assessment only (**Ref. 11.17**).
- **b.** DMRB Volume 11 Section 3 Part 11: Geology and Soils (1993) (**Ref. 11.18**).
- **c.** Health and Safety Executive (HSE) (1991) Guidance Note HS (G) 66, Protection of Workers and the General Public during the Development of Contaminated Land (**Ref. 11.21**).
- **d.** Construction Industry Research and Information Association (CIRIA) C532 (2001) Control of Pollution from Construction Sites (**Ref. 11.22**).
- **e.** HSE (2006) INDG258 Safe Work in Confined Spaces (**Ref. 11.23**).
- **f.** Environment Agency and National House Building Council (2008) Guidance for the safe development of housing on land affected by contamination, Environment Agency R&D Publication 66 (**Ref. 11.24**).
- **g.** British Standards (BS) Institute, BS10175 (2011+A2:2017) Investigation of Potentially Contaminated Sites – Code of Practice (**Ref. 11.25**).
- **h.** British Standards Institute BS5930 (2015) Code of Practice for Ground Investigations (**Ref. 11.26**).
- **i.** Environment Agency (2018) Approach to Groundwater Protection (**Ref. 11.27**).
- **j.** Department for Environment and Rural Affairs (Defra) and Environment Agency Contaminated Land Report 11 (CLR11) – Model Procedures for the Management of Land Contamination (**Ref. 11.19**).
- **k.** Defra (2009) Construction Code Practice for the Sustainable Use of Soil on Construction Sites (**Ref. 11.28**).

11.4.14. The following Planning Practice Guidance are considered relevant to this assessment:

- **a.** Land affected by contamination (July 2019) (**Ref. 11.29**) outlines the system for identifying and remediating contaminated Study Areas.

b. Natural Environment (Section 3) (July 2019) (**Ref. 11.30**) deals with the ecological value placed on brownfield land and outlines why it is important to consider pollution in soils.
c. Water supply, wastewater and water quality (July 2019) (**Ref. 11.31**) outlines why these are important considerations in development.
d. Land Stability (July 2019) (**Ref. 11.32**) outlines the system on how to ensure that development is suitable to its ground condition and how to avoid risks caused by unstable land or subsidence.

Updated DMRB Guidance

11.4.15. Since the assessments reported in this ES were completed, a number of DMRB guidance documents have been superseded and updated with revised guidance. For Geology and Soils the following guidance documents which were used in the preparation of this assessment have been superseded:

a. DMRB Volume 11, Section 3, Part 11; Geology and Soils (**Ref. 11.18).**
b. DMRB Volume 11, Section 3, Part 6: Land Use (2001) (**Ref. 11.17**) for the assessment of agricultural land quality only.

11.4.16. These guidance documents have been replaced by DMRB LA 109 Geology and Soils Revision 0 (LA 109) (**Ref. 11.33**) which was released in October 2019.

11.4.17. In order to determine the implications of the updated guidance to the conclusions of the ES, a sensitivity test has been undertaken to identify key changes in the assessment methodology and determine whether there would be changes to the significant effects reported in this ES if the updated guidance had been used for the assessment.

11.4.18. The findings of the sensitivity test are detailed in **Appendix 11.7: Geology and Soils DMRB Sensitivity Test, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**) and summarised in **Section 11.10** of this chapter and in **Appendix 4.5: DMRB Sensitivity Test, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**). The sensitivity test has determined that the application of the updated guidance would not change the overall significant effects reported in this ES.

DATA SOURCES

11.4.19. Information has been gathered from the sources described below to identify and assess effects on geology and soils.

11.4.20. The **PSSR** (**Appendix 11.1, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) gathered data on the Part B Main Scheme Area (including the Charlton Mires Site Compound) to set out soil and geology related receptors, ground stability data, potential contamination source and associated preliminary risk assessment in the context of Part B. The study included a walkover survey undertaken in 2016 to identify and record sensitive surface water receptors and assess the surface of the land (where access permitted) for potential sources of contamination. The report also included a review of publicly available historical Ordnance Survey maps to identify potential historical sources of contamination. Given no apparent changes in land use have occurred to the Study Area

since 2016, the information within the report is considered representative of the current site conditions within the Part B Main Scheme Area.

11.4.21. The Part A **PSSR** (**Appendix 11.1, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) gathered data on Part A, which includes the Main Compound located within the Order Limits, to set out soil and geology related receptors, ground stability data, potential contamination source and associated preliminary risk assessment in the context of Part A. The study included a walkover survey undertaken in 2015 to identify and record sensitive surface water receptors and assess the surface of the land (where access permitted) for potential sources of contamination. The report also included obtaining historical Ordnance Survey maps to identify potential historical sources of contamination and environmental regulation data via procurement of an Envirocheck Report. Given no apparent changes in land use have occurred to the area since 2015 / 2016, the information within the report is considered representative of the current site conditions within the Main Compound.

11.4.22. The **PRA: Lionheart Business Park** (**Appendix 11.2, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) gathered data on the area to be used as the Lionheart Enterprise Park Compound, to set out soil and geology related receptors, ground stability data, potential contamination source and associated preliminary risk assessment in the context of Part B. The study included a walkover survey undertaken in 2016 to identify and record sensitive surface water receptors and assess the surface of the land (where access permitted) for potential sources of contamination. The report also included obtaining historical Ordnance Survey maps to identify potential historical sources of contamination and environmental regulation data via procurement of an Envirocheck Report. The only changes in land use that have occurred to the Lionheart Enterprise Park Compound since 2016 is the development of a highway depot. As such, the information within the report is considered representative of the current site conditions within the Lionheart Enterprise Park Compound.

11.4.23. Intrusive ground investigation works within the Part B Main Scheme Area were undertaken in 2018 in accordance with British Standards BS5930 Code of Practice for Ground Investigations (**Ref. 11.26**) and BS10175 Investigation of Potentially Contaminated Sites (**Ref. 11.25**). The **GIR** is included within **Appendix 11.3, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**) and the factual data (**Ground Investigation Works**) is included within **Appendix 11.4**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**). The ground investigation included testing soil and groundwater to assess for actual sources of contamination within the Order Limits of the Part B Main Scheme Area.

11.4.24. The ALC survey was carried out in 2019 in accordance with ‘Agricultural Land Classification of England and Wales’ (**Ref. 11.20).** The survey included intrusive sampling of the accessible agricultural land in order to define the agricultural soil grade and is presented in

Appendix 11.5: Soils and Agricultural Land Quality Report, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**).

11.4.25. A Coal Mining Risk Assessment (CMRA) has been completed due to Part B crossing Coal Authority Defined Development High Risk Areas (DHRA). The CMRA is included within **Appendix 11.6**: **Coal Mining Risk Assessment**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**). The report sets out the possible stability issues associated with historical shallow coal workings, shafts and adits, and provides potential mitigation measures to suitably mitigate the risks, subject to the detailed design.

11.4.26. Supplementary desk based sources of data used to inform the baseline conditions include:

a. Agricultural Land Classification 1:250,000 scale series provisional map for north east region (**Ref. 11.34**)
b. Natural England National Character Area Profile No. 01 North Northumberland Coastal Plain (**Ref. 11.35**)
c. Cranfield Soil and AgriFood Institute Soilscapes Database (**Ref. 11.36**)
d. Natural England MAGIC Database (**Ref. 11.37**)
e. British Geological Survey (BGS) Minerals UK Onshore Mineral Resource Maps Northumberland Tyne and Wear (**Ref. 11.38**)
f. NCC Draft Local Plan – Policies Map – Mineral Safeguarding Areas (**Ref. 11.39**)
g. Coal Authority Interactive Map (**Ref. 11.40**)
h. Environment Agency Catchment Data Explorer (**Ref. 11.41**)
i. BGS Geology of Britain Viewer (**Ref. 11.42**)

SIGNIFICANCE OF EFFECTS

11.4.27. The likely significant environmental effects are assessed based on consideration of the sensitivity of receptors and the predicted magnitude of the potential impacts. The magnitude of impact upon the affected receptor or receiving environment is assessed as major, moderate, minor or negligible and the sensitivity is assessed on a scale of high, medium, low and negligible. A sensitivity rating has been assigned to each attribute or land contamination receptor in accordance with the principles established in DMRB Volume 11 Section 2 Part 5 (HA 205/08) (**Ref. 11.43**). Definitions of terms relating to receptor sensitivity and magnitude of impact criteria based on professional experience are provided within **Table 11-5** and **Table 11-6** respectively.

11.4.28. With specific reference to agricultural land, the magnitude of impact would depend on the amount of temporary and permanent land required for Part B. The temporary agricultural land take required for Part B is estimated to be 62.3 ha (the sum of the agricultural land included within the ALC survey (42.3 ha) and the land that was not surveyed (20.0 ha)). The permanent agricultural land take required for Part B is estimated to be 42.4 ha (the sum of the agricultural land included within the ALC survey (29.4 ha) and the land that was not surveyed (13.0 ha)).

11.4.29. There is currently limited guidance on what area of loss is considered significant. 20 ha is the threshold adopted in The Town and Country Planning (Development Management Procedure) (England) Order 2015 (**Ref. 11.44**) for Local Planning Authorities to consult Natural England, as the regulator, before granting planning permission for a non-agricultural development that is not consistent with an adopted local plan and which would involve the loss of BMV agricultural land. This threshold, based on professional judgement, is taken into consideration in the assessment of the magnitude of impacts as shown in **Table 11-6**.

Table 11-5 – Geology and Soil Sensitivity Criteria

Sensitivity	Description	Commentary
High	Areas containing geological, hydrological or habitat features considered to be of national or international interest, for example SSSIs. Agricultural land classified as Grade 1, 2 and 3a (excellent to good) BMV land. Highly permeable superficial deposits allowing free transport of contaminants to groundwater and surrounding surface waters. Study Area located within a Source Protection Zone (SPZ) 1 or 2. Underlying geology classified as a Principal Aquifer. Wetland/watercourse of Good Ecological or Chemical Potential under the WFD. Mineral resource located within an NCC MSA. Residential end use (particularly with gardens).	Potential receptors are typically designated as 'High' where the receptor is more susceptible to the potential impacts of any contamination in soil and groundwater. Examples include: - Higher permeability soil deposits containing sensitive shallow groundwater which is abstracted for use. - Residential developments where homeowners have unlimited access to soils for example children playing or home grown produce
Medium	Areas containing features of designated regional importance, such as RIGS, considered worthy of protection for their educational, research, historical or aesthetic importance. The Study Area located within a SPZ 3.	Examples of 'Medium' sensitivity receptors include: - Shallow soils with medium permeability / less sensitive groundwater where potential contaminants are less likely to migrate to the receiving water

Sensitivity	Description	Commentary
	Underlying geology classified as a Secondary A aquifer. Site operatives / construction workers coming into contact with soils and groundwater. Moderately permeable superficial deposits allowing some limited transport of contaminants to groundwater and surrounding surface waters. Wetland or watercourse of Moderate Ecological or Chemical Potential under the WFD. Agricultural land classified as Grade 3b (moderate quality). Commercial end use.	bodies and/or where groundwater is not locally used. - Site operatives / construction workers who typically use Personal Protective Equipment (PPE) and who are generally exposed to soil and groundwater for limited periods of time. - Commercial buildings where exposure to soils is limited due to the extensive presence of structures and hardstanding.
Low	Geological features not currently protected and not considered worthy of protection. Low permeability superficial deposits likely to inhibit the transport of contaminants. Study Area not located within an SPZ. Underlying geology classified as unproductive strata. Wetland / watercourse of Poor Ecological and/or Chemical Potential under the WFD or no WFD classification. Agricultural land classified as Grade 4 and 5 (poor and very poor quality). Highways and pavements end use. Mineral resource not located within an NCC MSA.	'Low' sensitivity receptors are those where the impacts of any soil and groundwater contamination (were this to impact the receptor) would not result in a significant deterioration of the receptor. Examples include: - Groundwater in areas where other potential impacts have resulted in poor groundwater quality. - Areas below significant infrastructure such as roads.
Negligible	No sensitive environmental receptors identified.	

Table 11-6 – Geology and Soils Magnitude Impact Criteria

Magnitude	Description
Major	Significant (greater than 50%), or total loss of a Study Area of recognised geological importance. Significant contamination identified, in excess of relevant thresholds for protection of Controlled Waters. Loss of ≥ 50 ha of agricultural land. Significant impact upon human health (potential life threatening chronic health disease or acute risks to health). Significant (greater than 50%), loss of building or infrastructure. Significant (greater than 50%) loss or sterilisation of a mineral resource within an NCC MSA.
Moderate	Partial loss (between approximately 10% to 50%) of a study area of recognised geological importance. Localised or marginal contamination or potential but not proven contamination. Loss of 20 – < 50 ha of agricultural land. Moderate impact on human health (potential for reduced chronic health non-life threatening). Partial damage (between approximately 10% to 50%) of buildings and infrastructure. Partial (between 10% to 50%) loss or sterilisation of a mineral resource within an NCC MSA.
Minor	Minimal effect (a loss of up to 10%) on a study area of recognised geological importance. No significant contamination identified or could reasonably be expected based on desk study findings. Loss of 5 – < 20 ha of agricultural land. Minor/insignificant impact upon human health (potential for minor detriment to chronic health). Minimal structural effect (a loss of up to 10%) of buildings and infrastructure. Minimal (up to 10%) loss or sterilisation of a mineral resource within an NCC MSA.
Negligible	Very slight change from baseline conditions. Change hardly discernible, e.g. short-term compaction from machinery movements.

Magnitude	Description
	No groundwater contamination above relevant thresholds identified or could reasonably be expected based on desk study findings. Loss of < 5 ha of agricultural land. No impact upon human health. No damage or loss of buildings and infrastructure. No loss or sterilisation of a mineral resource within an NCC MSA.

11.4.30. The matrix to determine the significance of effects, based on the criteria set out in **Table 11-5** and **Table 11-6** is presented in **Table 11-7**.

Table 11-7 – Matrix for Determining Significance

Magnitude	Sensitivity			
	High	**Medium**	**Low**	**Negligible**
Major	Large or Very Large	Moderate or Large	Slight or Moderate	Slight
Moderate	Moderate or Large	Moderate	Slight	Neutral or Slight
Minor	Slight or Moderate	Slight	Neutral or Slight	Neutral or Slight
Negligible	Slight	Neutral or Slight	Neutral or Slight	Neutral

11.4.31. Environmental effects considered to be Moderate or greater are considered to be potentially significant within the context of this assessment, which is based on professional judgement, gained from experience on similar schemes. Where potential significant adverse effects are identified, measures have been identified to avoid, minimise or mitigate those effects.

11.4.32. In accordance with the DMRB, the assessment covers the likely significant effects arising from the permanent and temporary, direct, indirect, secondary, cumulative, short, medium and long-term, positive and negative effects of Part B.

FUTURE BASELINE

11.4.33. The future baseline describes the baseline conditions that are expected to develop and evolve over an approximate fifteen-year period if Part B were not to proceed. In the future baseline, there are unlikely to be any significant changes to the geology and soils baseline as the geology and ground conditions within the Study Area are unlikely to change.

11.5. ASSESSMENT ASSUMPTIONS AND LIMITATIONS

ASSUMPTIONS

11.5.1. The assessment presented in this chapter has been based on the description of Part B as presented in **Chapter 2: The Scheme, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**).

11.5.2. The construction works would be undertaken in accordance with industry best practice and regulatory requirements, including a Construction Environmental Management Plan (CEMP) to manage environmental risks. This would incorporate the mitigation measures outlined within this chapter as a minimum, in order to manage environmental risks appropriately. An **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) has been produced in support of the DCO application.

11.5.3. There is no recognised, detailed guidance on the method of assessing the magnitude of impact or sensitivity of soils and geology related receptors for the purpose of carrying out EIA. Therefore, the methodology in this assessment has been developed using best practice based on schemes of a similar nature.

11.5.4. To assess the quality of agricultural land, an independent review of the ALC for Part B has been undertaken as reported in **Appendix 11.5: Soils and Agricultural Land Quality Report, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**). This assessment of the likely significant effects relies upon the accuracy of those datasets and information as provided by third parties.

LIMITATIONS

11.5.5. The potential of encountering localised sources of contamination cannot be entirely ruled out. If encountered during the construction phase, works would stop, and a strategy formulated and agreed with NCC to deal with any unexpected contamination.

11.5.6. The ALC survey has been completed however, there are several areas of un-surveyed land within the Order Limits as access had not been granted to these areas to allow the ALC survey to be completed. These un-surveyed areas have been assumed to be agricultural land within the areas quoted for temporary and permanent land take and have been assumed to be Grade 3a BMV land within the assessment as a worst case assumption.

11.6. STUDY AREA

11.6.1. The Study Area incorporates the Order Limits of the Part B Main Scheme Area including Charlton Mires Site Compound plus a buffer of 250 m, as well as Lionheart Enterprise Park Compound and Main Compound plus a 250 m buffer as illustrated on **Figure 2.2: Environmental Constraints Plan: Part B**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**). It is considered that this is the only area that would be affected in terms of geology and soils based on the surrounding sensitive environmental receptors and migration potential associated with potential sources of contamination identified on or within the wider general vicinity of Part B. A 250 m buffer area associated

with contamination migration is consistent with guidance document R&D Publication 66 (**Ref. 11.24**)**,** when considering the impacts of contamination on sensitive environmental receptors.

11.6.2. Part B has been split in as detailed in **Chapter 2: The Scheme, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**), and is as described below:

a. **Part B Main Scheme Area including Charlton Mires Site Compound**; located east of the existing A1, in an existing field to the south of Charlton Mires.
b. **Lionheart Enterprise Park Compound**; located south of Alnwick, adjacent to the Highways England Depot at Lionheart Enterprise Park.

11.6.3. The **Main Compound** which would be located within Part A and would be shared by Part A and Part B is also considered in the assessment.

11.7. BASELINE CONDITIONS

PART B MAIN SCHEME AREA (INCLUDING CHARLTON MIRES SITE COMPOUND)

Topography

11.7.1. The topography of Part B is summarised as follows:

a. The Part B Main Scheme Area is gently undulating with a highpoint along the existing A1 alignment of approximately 112 m above Ordnance Datum (AOD).
b. To the east of the southbound carriageway, the landform gradually rises to approximately 100 m AOD near Rennington Moor.
c. To the west of the northbound carriageway, the land is slightly hillier with more undulations and a high point of approximately 140 m AOD near White House Folly.

Geomorphology

11.7.2. Where geological features are considered to be of national importance, such as strata containing fossils or exposed cuttings, they are assigned SSSI status. Local authorities also have an obligation to designate Regionally Important Geological Sites (RIGS). Records show that no geomorphological sites of interest have been identified on or immediately surrounding the Part B Main Scheme Area Study Area. Impacts to geomorphologically important sites have therefore not been considered further in this assessment.

Soils and Agricultural Land Quality

11.7.3. The ALC system provides a framework for classifying land according to the extent to which its physical or chemical characteristics impose long-term limitations on agricultural use. Agricultural land is classified into five land classification grades (Grades 1 - 5), Grade 1 land being the highest quality and Grade 5 the lowest quality land, according to versatility of the soil and suitability for growing crops. Grade 3 is sub-divided into Subgrades 3a and 3b, to identify good quality agricultural land from moderate quality land. Grades 1, 2 and 3a, are classified as' best and most versatile' (BMV) land. An ALC survey has been carried out to inform the assessment and to sub-divide the agricultural land within the Order Limits the

Part B Main Scheme Area into distinct grades, especially with regard to the Grade 3 soils (refer to **Appendix 11.5: Soils and Agricultural Land Quality Report, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)).

11.7.4. The soils within the Main Part B Scheme Area Study Area, are classified as Grade 3 agricultural land based on the ALC Provisional Map for the North East Region (**Ref. 11.34**).

11.7.5. The temporary and permanent land take associated with Part B would comprise a total area of approximately 184.4 ha, of which approximately 104.7 ha is currently in agricultural use (71.7 ha surveyed, and 33.0 ha not surveyed, assumed to be in agricultural use). The permanent land take associated with Part B would comprise an area of approximately 74.6 ha of which approximately 42.4 ha is in agricultural use (29.4 ha surveyed, and 13.0 ha not surveyed, assumed to be in agricultural use). The temporary land take associated with Part B comprises an area of approximately 109.8 ha of which approximately 62.3 ha is in agricultural use (42.3 ha surveyed, and 20.0 ha not surveyed, assumed to be in agricultural use).

11.7.6. Due to the area of agricultural land potentially impacted by Part B Main Scheme Area, a detailed agricultural land survey was carried out to define the quality within the Order Limits (refer to **Appendix 11.5: Soils and Agricultural Land Quality Report**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)). The survey consisted of using a hand-held 50 mm diameter auger and/or spade to penetrate soils to a maximum depth of 1.20 m at intersects of a 100 m grid with a boring density of at least one observation per ha. A total of 219 sampling points were progressed as part of this survey. Soils and associated agricultural land quality identified as part of the survey is summarised in **Table 11-8** and illustrated in **Appendix 11.5: Soils and Agricultural Land Quality Report**, **Volume 8** of this ES. The agricultural area of the Part B Main Scheme Area includes the area of surveyed agricultural land and the un-surveyed areas (assumed as worst case to comprise agricultural land).

Table 11-8 – Agricultural Soil Quality within the Part B Main Scheme Area

Agricultural Land Quality Grade	Details
Grade 1 (excellent quality)	No land has been categorised as this grade.
Grade 2 (very good quality)	Three small areas of Grade 2 land identified, occupying 5.98 ha, or 5.7%, of the agricultural area of the Part B Main Scheme Area. These are between West Linkhall and Shipperton Bridge and along the access track to the north of Rock South Farm. This land is slightly limited by the local climate but can support good yields of a large variety of crops.

Agricultural Land Quality Grade	Details
	This land is categorised as BMV and is very good quality, capable of producing consistently high yields of a wide range of agricultural and horticultural crops.
Subgrade 3a (good quality)	Subgrade 3a soils were mapped across 24.64 ha, or 23.5%, of the agricultural area of the Part B Main Scheme Area. Access to land with machinery is restricted in winter and early spring, but the land can support late spring as well as autumn sowings. This land is categorised as BMV and is very good quality, capable of producing consistently high yields of a wide range of agricultural and horticultural crops.
Subgrade 3b (moderate quality)	Subgrade 3b soils were mapped across 38.66 ha, or 36.9%, of the agricultural area of the Part B Main Scheme Area. Under the local climate, the combination of moderately high topsoil clay content and the restricted drainage means this land is usually too wet for spring land access with machinery. Arable cropping is mainly limited to autumn-sown cereal-based rotation.
Grade 4 (poor quality)	Grade 4 soils were mapped across 2.42 ha, or 2.3%, of the agricultural area of the Part B Main Scheme Area. This land comprises a small low-lying area in the south with heavy slowly permeable soils formed in alluvium. Wetness restrictions mean arable cropping is rarely possible and this land is more suited to improved pasture. A small area is present in the north over stony historic earthworks which cannot be cultivated and is therefore limited to use as grassland.
Grade 5 (very poor quality)	No land has been categorised as this grade.
Not Surveyed	An area of land in the vicinity of Charlton Mires measuring 31.24 ha (17.1% of the Part B Main Scheme Area) was not surveyed because site access restrictions. Isolated areas amounting to 1.79 ha (0.98% of the Part B Main Scheme Area) were not surveyed as they were outside of the Part B Main Scheme Area at the time of the survey. The land not surveyed has been assumed to be agricultural land and added to the Grade 3a land within the assessment to provide a worst case assumption.

11.7.7. Non-agricultural land has been mapped as present over 79.63 ha, or 43.2%, of the total Part B Main Scheme Area Order Limits. Non-agricultural land includes the existing A1 and its slip roads and junctions, woodland, service roads, farm tracks, recreational, buildings at Charlton Mires and residential land within the Order Limits.

11.7.8. The detailed survey (refer to **Appendix 11.5: Soils and Agricultural Land Quality Report**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) concluded that the agricultural land within the Part B Main Scheme Area is mainly Subgrade 3b limited by wetness, with areas of Subgrade 3a and Grade 2 locally.

11.7.9. A breakdown of the agricultural land soil quality into permanent and temporary areas is summarised in **Table 11-9** below.

Table 11-9 – Breakdown of Temporary and Permanent Land Take by Grade within the Part B Main Scheme Area

Agricultural Land Quality Grade	Permanent Land Take Area (ha)	Temporary Land Take Area (ha)
Grade 1 (excellent quality)	0	0
Grade 2 (very good quality)	2.66	3.32
Subgrade 3a (good quality)	10.28	14.35
Subgrade 3b (moderate quality)	15.68	22.98
Grade 4 (poor quality)	0.77	1.65
Grade 5 (very poor quality)	0	0
Not Surveyed (classed as BMV)	13.00	20.02
Total Agricultural (including not surveyed)	42.39	62.32
Non-agricultural Land	32.21	47.42

11.7.10. Further details of the soil properties within the Part B Main Scheme Area Study Area, as described by the Cranfield Soil and AgriFood Institute Soilscapes database (**Ref. 11.36**), are provided in the sections below.

11.7.11. In the southernmost extent of the Part B Main Scheme Study Area northwards to Rock Nab, soils are classified as Soilscape 17 which are slowly permeable seasonally wet acid loamy and clayey soils. They have medium carbon content, low fertility and have impeded

drainage. They tend to support grassland with some arable land and forestry. The main risks with regards to water protection are overland flow from compacted fields. Organic slurry, dirty water, fertiliser, pathogens and fine sediment can all move in suspension or solution with overland flow or drain water.

11.7.12. From Rock Nab northwards to the northernmost extent of the Part B Main Scheme Area Study Area, soils are classified as Soilscape 6 which are freely draining slightly acid loamy soils. They have a low carbon content, low fertility and drain freely. They tend to support arable land and grassland with neutral and acid pastures and deciduous woodlands. There may be the presence of acid communities such as bracken and gorse in upland areas. The main risks with regards to water protection are groundwater contamination with nitrate. Additionally, siltation and nutrient enrichment of streams from soil erosion is an issue.

11.7.13. Soils within the Charlton Mires Site Compound are classified as Soilscape 17 as described in **paragraph 11.7.11** above.

11.7.14. Within the Part B Main Scheme Area Study Area to the west of Linkhall Access Road, the soils are classified as Soilscape 18 which are slowly permeable seasonally wet slightly acid but base rich loamy and clayey soils. They have a low carbon content, impeded drainage and moderate fertility. They tend to support seasonally wet pastures and woodlands. The main risks with regards to water protection are the same as those detailed in **paragraph 11.7.11** above.

Ground Conditions

Made Ground

11.7.15. British Geological Survey (BGS) mapping (**Ref. 11.42**) has been studied and does not show the presence of Made Ground within the Part B Main Scheme Area Study Area. However, Made Ground is anticipated to be present in developed areas such as beneath the existing A1 carriageway and within farmsteads. Given the current agricultural use of the proposed area for the Charlton Mires Site Compound, although this area could not be surveyed during the ALC Survey, the shallow ground conditions are anticipated to comprise topsoil with the exception of the area where buildings are also present.

11.7.16. The **PSSR** (**Appendix 11.1, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) states there are historical ponds and quarries within the Part B Main Scheme Area Study Area which are no longer present. These may represent localised areas of Made Ground because of historical infilling with soil or waste material or may have been infilled as a result of natural processes such as sedimentation over time.

11.7.17. Available BGS (**Ref. 11.42**) historical records for the Part B Main Scheme Area Study Area do not record the presence of Made Ground.

Superficial Geology

11.7.18. Superficial deposits are shown on BGS maps (**Ref. 11.42**) to be present beneath most of the Part B Main Scheme Area Study Area, except for:

a. The area near Heckley House and Heckley Fence
b. To the east of South Charlton Bog
c. To the north of East Linkhall

11.7.19. The southern section of the Part B Main Scheme Area Study Area, between Alnwick and Rock Nab is shown to be predominantly underlain by Glacial Till. The most southern extent of the Part B Main Scheme Area Compound Study Area is shown to be underlain by Alluvium and there are also small pockets of Alluvium shown near Rock Nab and along the access track to Rock South Farm. A localised area of peat, associated with 'South Charlton Bog', is shown to be present beneath the existing A1 carriageway to the east of South Charlton Bog (**Appendix 11.1: PSSR**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)).

11.7.20. The northern section of the Part B Main Scheme Area, between Rock Nab and North Charlton, is shown to be predominantly underlain by Glaciofluvial deposits comprising sands and gravels. Small localised areas of Alluvium are also shown to be present in the northern section of the Part B Main Scheme Area Study Area.

11.7.21. The proposed Charlton Mires Site Compound within the Study Area is shown to be largely underlain by Alluvium, with Glacial Till towards the eastern extent.

11.7.22. **Figure 11.1: Superficial Geology**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**) summarises the superficial geology present in the Part B Main Scheme Area Study Area.

Bedrock Geology

11.7.23. The BGS maps (**Ref. 11.42**) show the underlying bedrock within the Part B Main Scheme Area Study Area to comprise sedimentary strata of Lower Carboniferous age comprising marine deposits of the Alston Formation, Tyne Limestone Formation and the Scremerston Coal Member. These consist of a succession of limestone, mudstone, siltstone and sandstone with occasional coal seams within the Scremerston Coal Member.

11.7.24. The BGS maps (**Ref. 11.42**) show the bedrock underlying the proposed Charlton Mires Site Compound within the Study Area to comprise sedimentary strata of the Alston Formation consisting of limestone, sandstone siltstone and mudstone which is Carboniferous in age.

11.7.25. **Figure 11.2: Bedrock Geology**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**) summarises the bedrock geology in the Study Area.

Records of Mining

11.7.26. With regards to coal mining hazards, the information outlined in the sections below and presented in **Figure 11.3: Coal Mining Hazards**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**) has been obtained from NCC, the Coal Authority and from the **Coal Mining Risk Assessment** (**Appendix 11.6**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)).

11.7.27. The southernmost extent of the Part B Main Scheme Area Study Area northwards to Heckley Fence lies within a Coal Authority Coal Mining Reporting Area with several parts of this classified as a Development High Risk Area (DHRA).

11.7.28. A DHRA is present within the Part B Main Scheme Area Study Area related to the access track off B1340 which passes to the north of Goldenmoor Farm, to the east of the A1 southbound carriageway. This DHRA is located under part of the access track and there are a number of former shafts present. The Coal Authority interactive map suggests that these are associated with probable shallow coal mining workings. The **Coal Mining Risk Assessment** (**Appendix 11.6**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) considered there to be a low risk from historical mining in this area and no further investigation is required.

11.7.29. A DHRA is present at and to the north and east of Broom House Farm, to the west of the A1 northbound carriageway within the 250 m buffer of the Part B Main Scheme Area Compound Study Area. Again, it is suggested that this is associated with probable shallow coal mining workings. The **Coal Mining Risk Assessment** (**Appendix 11.6, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) considered there to be a low risk from historical mining in this area and no further investigation is required.

11.7.30. Two further DHRAs associated with probable shallow coal mining workings are present to the south and north west of Heckley House, to the west of the A1 northbound carriageway located within the 250 m buffer of the Part B Main Scheme Area Study Area. The **Coal Mining Risk Assessment** (**Appendix 11.6, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) considered there to be a low risk from historical mining in these areas and no further investigation is required.

11.7.31. There are two further DHRAs associated with probable shallow coal mining workings located within the 250 m buffer of the Part B Main Scheme Area Study Area: to the north west of Broxfield; and to the east of Heckley Fence lying to the east of the A1 southbound carriageway. The **Coal Mining Risk Assessment** (**Appendix 11.6, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) considered there to be a low risk from historical mining north west of Broxfield and no further investigation is required.

11.7.32. The Heckley Fence DHRA is located within agricultural land in close proximity to the proposed Heckley Fence Accommodation Overbridge which is due to be constructed using approach embankments and piled foundations. No conclusive evidence of mine workings has been determined in this area during ground investigation. It is proposed within the **Coal Mining Risk Assessment** (**Appendix 11.6**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) that further investigation is completed at the Heckley Fence DHRA during detailed design, and the Heckley Fence Accommodation Overbridge construction area to identify potential mine entries, shallow workings and their extent.

11.7.33. The Part B Main Scheme Area Study Area from north of Charlton Mires to the northernmost extent of the Part B Main Scheme Area is also located within a Coal Authority Coal Mining Reporting Area.

11.7.34. There are two DHRAs located within the 250 m buffer of the Part B Main Scheme and Charlton Mires Site Compound Study Area. One is located to the south-east of Rock Midstead with the other located immediately to the east of Rock Moor Farm.

11.7.35. The Rock Midstead DHRA is located approximately 350 m to the south east of Rock Midstead. The DHRA traverses the Rock South Farm Access Road which is proposed to be upgraded via widening to the western edge of the existing track. The **Coal Mining Risk Assessment** (**Appendix 11.6**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) concluded that there is considered to be a low risk from historical mining in this area and no further investigation is required.

Records of Mineral Resources

11.7.36. Minerals UK Onshore Mineral Resource Tyne and Wear (**Ref. 11.38**) indicates that there are potential mineral resources present across the Part B Main Scheme Area Study Area comprising river sand and gravels, glacial sand and gravels, peat, limestone and coal. NCC draft Local Plan - Policies Map (**Ref. 11.39**) highlights MSAs around deposits of carboniferous limestone, clay (including brick clay, brick shale and fireclay), coal, igneous rock, limestone, sand and gravel and sandstone.

11.7.37. Consultation with NCC (refer to **Appendix 4.2: Environmental Consultation**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**)) has confirmed that with regards to the sterilisation of peat deposits, peat is not considered a mineral resource under the NPPF and therefore peat is not included further in this assessment.

11.7.38. The southernmost extent of the Part B Main Scheme Area Study Area northwards up to National Grid Reference (NGR) 419651, 615429 contains a sand and gravel MSA located to the west of the A1 northbound carriageway and to the east of the A1 southbound carriageway. There is also a limestone MSA to the east of the A1 southbound carriageway.

11.7.39. From Rock Lodge northwards to the northernmost extent of the Part B Main Scheme Area Study Area, there is a sand and gravel MSA to the west of the A1 northbound carriageway and to the east of the A1 southbound carriageway. There is also a limestone MSA to the east of the A1 southbound carriageway.

11.7.40. MSAs relating to coal reserves are present throughout the Part B Main Scheme Area Study Area wherever coal seams are present.

Ground Investigation

11.7.41. A ground investigation was carried out within the Part B Main Scheme Area Study Area between 9 and 30 July 2018 and between 5 September and 31 October 2018, with groundwater monitoring carried out from the end of the ground investigation until 8 January 2019.

11.7.42. The ground conditions recorded in the ground investigation along with data from historic investigations are detailed within the **GIR** (**Appendix 11.3, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) and summarised below.

Topsoil

11.7.43. Topsoil was encountered in the majority of the exploratory holes across the Part B Main Scheme Area Study Area, with the exception of HP/17/01, HP/17/02, HP/17/03, TP/17/48, BH/17/14 and TP/17/05 where Made Ground was encountered at the ground surface. The thickness of the topsoil varied between 0.1 m and 0.4 m, consisting of slightly sandy, slightly gravelly clay.

Made Ground

11.7.44. Made Ground was encountered in 5 No. of the 60 No. exploratory holes completed as part of the 2018 ground investigation (refer to **Appendix 11.3: GIR**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)), generally beneath topsoil. Notable occurrences of Made Ground were encountered in the vicinity of West Linkhall Farm and Rock South Farm.

11.7.45. The composition of Made Ground was variable, comprising hardstanding as well as granular and cohesive fill with fragments of broken brick and clay pipe. Hardstanding was identified at locations TP/17/34 and TP/17/37 which are thought to be located along the route of the former A1.

11.7.46. Further Made Ground was occasionally encountered in the exploratory holes on tracks on agricultural land. This included within TP/17/05, BH/17/14 and TP/17/48, where whole and fragments of brick and clay pipe were encountered within gravelly sandy clay and sandy gravel.

11.7.47. With the exception of land in the vicinity of West Linkhall Farm and a localised area around BH/17/05, described below, Made Ground extended to a maximum proven depth of 1.0 m below ground level (bgl).

11.7.48. A number of boreholes were undertaken in the vicinity of Shipperton Burn within land associated with the culvert and access track to Middlemoor wind farm. The Made Ground was typically observed to be a firm sandy gravelly clay with medium cobbles content. The gravel and cobbles consisted of sandstone, limestone, quartz-dolerite. Fragments of plastic piping and gravel-sized blocks of concrete were also observed.

Alluvium

11.7.49. Based on the Geological Maps, the Alluvium deposits were expected to be encountered in low-lying areas associated with watercourses.

11.7.50. During historical and recent ground investigations in the Part B Main Scheme Area Study Area, Alluvium was predominantly encountered in the vicinity of Heckley Fence, Charlton Mires and Ellsnook Plantation, between Chainages 54650 and 55300, 58400 and 58700, and 56800 and 57500 respectively. Further deposits were found in close proximity to small watercourses within the Part B Main Scheme Area Study Area.

11.7.51. The Alluvial deposits were observed to be generally shallow deposits, encountered directly beneath topsoil, and typically extending to a maximum depth of up to 1.2 m bgl. However,

particularly thick layers of Alluvium were observed at the southern extent of the Part B Main Scheme Area Study Area and at the location of Denwick Burn and White House Burn, where deposits extended to depths of 3.3 m bgl.

11.7.52. Alluvium encountered was reported to be typically cohesive, consisting of soft to firm sandy silty clay with occasional lenses of sand and traces of peat or organic matter. Granular material is occasionally interbedded within the cohesive deposits, consisting of loose to moderately dense clayey sand and gravel with occasional peat traces.

Peat

11.7.53. No distinctive peat layers were encountered during the recent ground investigation. However, traces of black organic matter were encountered intermittently within the Alluvium in numerous historical exploratory holes.

11.7.54. Data from the historic ground investigations indicate the presence of peat as 'peat traces' within Alluvial deposits, generally between Chainages 54600 and 55000. However, peat was also encountered at Chainage 56180 as thin layers (2-4 mm thick).

Glacial Deposits

11.7.55. The Part B Main Scheme Area is primarily underlain by glacial deposits and more specifically Glacial Till, which underlies the majority of low-lying areas of Northumbria. The deposits consist of a variety of sands and gravels with boulders and cobbles, in addition to clays and silts.

Glacial Till

11.7.56. The A1 in Part B the Main Scheme Area Study Area is primarily underlain by thick layers of Glacial Till deposits. The deposits generally comprise sandy gravelly silty clay, though granular layers of gravel, cobbles and boulders were also often encountered.

11.7.57. Cohesive Glacial Till is the principal constituent of the glacial deposits encountered within the Study Area and is present beneath the Topsoil or Made Ground and, where present, beneath the Alluvium or interbedded with other glacial deposits.

11.7.58. Glacial Till encountered in the ground investigation completed in 2018 (refer to **Appendix 11.3: GIR, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) can be described as sandy, gravelly, silty clay, with frequent cobbles and boulders. The cohesive deposits have occasionally been interbedded with granular layers of gravelly, clayey sand.

11.7.59. Particularly thick Glacial Till deposits were encountered near Denwick Burn (Ch 53440 – 54200), Ellsnook Plantation, (Ch 57300 - 57500) and North Charlton (Ch 61000) within the Study Area.

Glacio-lacustrine Deposits

11.7.60. Glacio-lacustrine deposits have been identified by the presence of very soft to firm interlaminated clay and silt with frequent pockets of clay or sand. The deposits were

encountered interbedded within other glacial deposits, at the southern extent of the Part B Main Scheme Area Study Area and north of Ellsnook Plantation at approximate chainage 57900 and, most notably, in the vicinity of Charlton Mires Junction.

11.7.61. The deposits are typically interlaminated clay and silt, with occasional sand laminae, present at depths of 2.0 to 3.2 m bgl, though at Charlton Mires Junction, depths of 1.5 m to 5.7 m bgl with a maximum thickness of 2.5 m were observed.

Glaciofluvial Deposits

11.7.62. Glaciofluvial deposits have been identified predominantly to the north of Charlton Mires Junction, where they have been identified as typically thick layers of granular deposits of sand and gravel, interbedded with other glacial deposits.

11.7.63. The deposits largely consist of gravelly silty sand and gravel with low to medium cobble content. The gravel and cobbles consist of sandstone and mudstone.

11.7.64. In the vicinity of West Linkhall Farm, an extensive amount of granular material was encountered in BH/17/08, BH/17/09 and TP/17/35, extending to a depth in excess of 9 m bgl. The material comprised a combination of gravel and sand, and gravelly silty clay with gravel and occasional cobbles consisting of sandstone and limestone. Based on the topography of the area and the dip in which BH/17/09 was located, the material is thought to represent a historical buried channel.

Bedrock - General

11.7.65. Solid bedrock was encountered in 12 of the exploratory holes at depths generally between 2 m and 5 m bgl beneath the superficial geology within the Part B Main Scheme Area Study Area.

11.7.66. Where bedrock was encountered, it comprised mudstone, sandstone, limestone, siltstone and coal of the Alston Formation, Alston and Tyne Formation (undifferentiated), and Scremerston Coal Formation. Further details regarding the bedrock encountered are included in **paragraph 11.7.68** to **paragraph 11.7.83** below.

11.7.67. Fractures were commonly observed within the competent bedrock, featuring varying degrees of orientation, from vertical to sub-horizontal.

Bedrock – Alston Formation

11.7.68. The Alston Formation was observed in eight exploratory holes across the Part B Main Scheme Area Study Area. The depth at which Alston Formation bedrock was encountered varies. At Charlton Mires, the bedrock was typically observed to be at depths in excess of 15 m bgl, though at West Linkhall the bedrock was not encountered at all during the progression of BH/17/08 and BH/17/09 to 10 m and 13 m bgl respectively.

11.7.69. In the southern extent of the Part B Study Area, in the region of Broxfield Farm, the upper surface of bedrock was encountered between 3.2 m and 4.3 m bgl.

11.7.70. Based on the BGS mapping (**Ref. 11.42**), faults are located at the northern and southern extent of the Alston Formation. Within 300 m of these inferred faults, the depth to which bedrock was encountered increases by in excess of 10 m. Therefore, the structural geology of the Part B Main Scheme Area may explain the varied depth to bedrock across this area.

11.7.71. The Alston Formation typically comprises sandstone and limestone with the sandstone layers varying in thickness between 0.2 m and 3.96 m, characterised as being medium strong to strong, and often thinly bedded or laminated with weak mudstone.

11.7.72. The limestone bedrock varies in strength from extremely weak to strong with layer thicknesses varying between 0.4 m and 3.41 m. All the limestone encountered in the Alston Formation contained bioturbation and / or fossils.

11.7.73. Occasional mudstone layers were observed in BH/17/01 identified as being medium strong, thinly to medium bedded. The layers varied between 0.22 m and 2.37 m thickness with occasional lenses and laminae of sandstone.

Bedrock – Alston and Tyne Formation (Undifferentiated)

11.7.74. The Alston and Tyne (Undifferentiated) Formation was observed in 19 exploratory holes across the Part B Main Scheme Area Study Area. The upper surface of bedrock was typically encountered between 1.6 m and 5 m bgl.

11.7.75. One case of very shallow bedrock was identified at BH/17/11, where sandstone was encountered at 0.7 m bgl. Bedrock was also encountered at particularly deep depths of 7 m bgl in BH/17/12.

11.7.76. Sandstone was the most frequently observed lithology within the Alston and Tyne (Undifferentiated) Formation and was encountered in ten exploratory holes with layer thickness varying between 0.3 m and 2.9 m. Sandstone was occasionally recovered as gravels and sands in BH/17/10, BH/17/12, BH/17/13 and BH/17/14, however the majority of the observed lithology was judged to be competent, medium strong to strongly, thinly bedded sandstone.

11.7.77. Occasionally, mudstone and limestone layers were observed in the Formation. Limestone was observed in BH/17/11, BH/17/13 and historical trial pit, TPA22A with layer thicknesses between 0.81 m and 7.2 m and identified as strong to very strong, massive to bioclastic bedrock. Mudstone was observed in eight exploratory holes as occasionally weathered to shale, or in the most part, as weak, very thinly to thinly bedded rock.

11.7.78. Weak coal was observed between 10.06 m and 12.27 m bgl in BH/17/13.

Bedrock – Scremerston Coal Member

11.7.79. Siltstone of the Scremerston Coal Member was encountered in eight of the exploratory holes. The siltstone was first encountered in these exploratory holes between 4.1 m and 9.72 m bgl with a layer thickness of between 0.2 m and 4.3 m. The siltstone was typically been characterised as slightly weathered, extremely weak to medium strong, thinly laminated to medium bedded.

11.7.80. Mudstone of the Scremerston Coal Member was encountered in nine exploratory holes from depths between 2.2 m and 9.4 m bgl with layer thicknesses varying between 0.2 m and 5.35 m. The mudstone was described as being slightly weathered, extremely weak and thinly laminated.

11.7.81. Sandstone of the Scremerston Coal Member was observed as both weathered and intact in 19 exploratory holes with layer thicknesses varying between 0.2 m and 5.1 m. The sandstone was described as typically being medium strong to strong, thinly laminated to thickly bedded. The weathered sandstone was observed at depths of approximately 2 m to 3 m bgl where the sandstone was recovered as gravel and sand.

11.7.82. Limestone of the Scremerston Coal Member was encountered in five exploratory holes from depths between 1.6 m and 6 m bgl. The limestone was typically described as being medium strong to strong, thinly to medium bedded with layer thicknesses of between 0.26 m and 3.1 m.

11.7.83. Minor, very weak, friable coal layers with thicknesses of between 0.1 m and 0.2 m were observed at depths between 2.7 m and 11.6 m bgl in historical exploratory holes.

Hydrology

11.7.84. Denwick Burn (good chemical and poor ecological WFD status (**Ref. 11.41**)) crosses the A1 at NGR 419196, 616663. It flows southwards adjacent to the east of the A1 southbound carriageway from this point to the southern extent of the Part B Main Scheme Area Study Area.

11.7.85. White House Burn (good chemical and poor ecological WFD status (**Ref. 11.41**) crosses the A1 within the Part B Main Scheme Area Study Area at NGR 418387, 618805 and flows in a westerly direction.

11.7.86. An unnamed tributary of Kittycarter Burn (good chemical and poor ecological WFD status (**Ref. 11.41**) crosses the A1 within the Part B Main Scheme Area Study Area at NGR 417780, 620376 and NGR 417592, 621026 flowing in an easterly direction.

11.7.87. Shipperton Burn (good chemical and ecological WFD status (**Ref. 11.41**) crosses the A1 within the Part B Main Scheme Area at NGR 417049, 621976 and flows in an easterly direction.

11.7.88. Charlton Burn (good chemical and ecological WFD status (**Ref. 11.41**) crosses the A1 within the Part B Main Scheme Area Study Area at NGR 416911, 623154 and flows in a north easterly direction.

11.7.89. These watercourses are shown on **Figure 11.4: Hydrology – Surface Watercourses, Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**).

11.7.90. The Flood Risk Assessment for Part B is presented in **Appendix 10.1: Flood Risk Assessment**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**).

Hydrogeology

11.7.91. Within the Part B Main Scheme Area Study Area, the underlying glaciofluvial deposits are classified by the Environment Agency as a Secondary A Aquifer, and the Glacial Till as a Secondary Undifferentiated Aquifer. The areas of Peat and Alluvium are classed as unproductive strata. The underlying bedrock is classified as a Secondary A Aquifer (**Ref. 11.37**).

11.7.92. Within the proposed Charlton Mires Site Compound Study Area, the underlying Alluvium and glaciofluvial deposits are classified by the Environment Agency as a Secondary A Aquifer, and the Glacial Till in the eastern extent is classified as a Secondary Undifferentiated Aquifer. The underlying bedrock is classified as a Secondary A Aquifer (**Ref. 11.37**).

11.7.93. According to the Natural England MAGIC Database (**Ref. 11.37**), the Part B Main Scheme Area Study Area is not within a groundwater SPZ. There are no records of licensed groundwater abstraction points within the Part B Main Scheme Area Study Area.

Unexploded Ordnance

11.7.94. The **PSSR** (**Appendix 11.1**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) states that a Pre-Desk Study Assessment (PDSA) prepared indicates that there are no readily available records of bombing or other significant military activity within the Study Area. The PDSA suggests that while completion of further detailed investigation is always prudent, in this instance it is likely to only confirm a low risk of UXO, so is not considered essential in this instance.

Designated Sites

11.7.95. NCC have confirmed that there are no RIGS or Local Geological Sites within the Part B Main Scheme Area Study Area (refer to **Appendix 4.2: Environmental Consultation**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**)).

11.7.96. NCC have confirmed that there are no SSSI within the Part B Main Scheme Area Study Area. This Study Area does not lie within an Impact Risk Zone (IRZ) for any SSSI (refer to **Appendix 4.2: Environmental Consultation**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**)).

Waste Activity

11.7.97. There are no current or former landfill or waste sites within the Study Area.

Potential Sources of contamination

11.7.98. The following section sets out potential sources of contamination, receptors potentially sensitive to contamination and potential pathways linking the sources and receptors. This is required to understand potential contaminated land related risks and follows the guidance principles set out in document CLR11 (**Ref. 11.19**).

11.7.99. Potential sources of contamination within the Study Area have been identified from a review of the **PSSR** (**Appendix 11.1**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)), available historical mapping as well as data provided by NCC Environmental Protection Officer (refer to **Appendix 4.2: Environmental Consultation**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**)) and are listed below as well as being displayed in **Figure 11.5: Potential Contamination Sources**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**).

11.7.100. Potential sources of contamination within the Study Area are as follows:

a. Made Ground associated with the construction of the existing A1 including the potential presence of coal tar bearing materials.

b. Made Ground associated with infilled historical quarries, pits and ponds including those located on:

i. Land to the west of Heckley House at NGR 418487, 616187
ii. Land to the north of Broxfield at NGR 420054, 616864
iii. Land to the north of Whinny Plantation at NGR 418124, 617368
iv. Land to the north west of Rennington Moor at NGR 419397, 617522
v. Land to the east of Hollywell Cottage at NGR 418439, 617647
vi. Ellsnook Plantation at NGRs 417897, 619264 and 417890, 619344
vii. Land to the west of Rock Nab at NGR 417480, 620182
viii. Land to the west of Drythropple at NGR 418077, 620685 and 418277, 620796
ix. Land at West Linkhall at NGR 417378, 621220
x. Land to the south of East Linkhall at NGR 417563, 621606
xi. Land to the south of West Lodge at NGR 417213, 621909
xii. Land at Charlton Burn at NGR 417028, 623375

c. Electricity substation to the north of The Steadings at NGR 420960, 616347

d. Former limekiln located at land to the north west of Rennington Moor at NGR 419478, 617494

e. Former limekiln at land to the south of The Avenue at NGR 418083, 620036

f. Former coal pit located at Drythropple at NGR 418037, 620657

g. Former smithy located at Rock Moor at NGR 418579, 620843

h. Former smithy located at West Linkhall at NGR 417398, 621262

i. Former smithy located at North Charlton at NGR 416915, 622921

j. Fuel storage tanks within farmsteads located within the Study Area

k. Storage of agricultural chemicals within farmsteads located within the Study Area

l. Agricultural runoff (nitrates, ammonium, organics, sediments)

m. Runoff and potential fuel / oil spillages from vehicles using the existing A1

LIONHEART ENTERPRISE PARK COMPOUND

Topography

11.7.101. The land within Lionheart Enterprise Park Compound is relatively level with the land sloping down towards the south-east from 65 m AOD to 58 m AOD towards Cawledge Burn.

Geomorphology

11.7.102. No geomorphological sites of interest have been identified within the Lionheart Enterprise Park Compound Study Area, and therefore have not been considered further in this assessment.

Soils and Agricultural Land Quality

11.7.103. With regard to agricultural land quality, soils within the Lionheart Enterprise Park Compound Study Area are classified as Soilscape 6 (**Ref. 11.36**) which are freely draining slightly acid loamy soils. They have a low carbon content, low fertility and drain freely. They tend to support arable land and grassland with neutral and acid pastures and deciduous woodlands. There may be the presence of acid communities such as bracken and gorse in upland areas. The main risks with regard to water protection are groundwater contamination with nitrate. Additionally, siltation and nutrient enrichment of streams from soil erosion is an issue.

11.7.104. The soils within the Lionheart Enterprise Park Compound are classified as Grade 3 agricultural land based on the ALC Provisional Map for the North East Region (**Ref. 11.34**).

11.7.105. A detailed ALC survey has not been undertaken within the Lionheart Enterprise Park Compound as land take within this area (10.3 ha) would only be temporary in order to accommodate the presence of the temporary construction compound.

Ground Conditions

Made Ground

11.7.106. BGS maps (**Ref. 11.42**) do not show the presence of Made Ground within the Lionheart Enterprise Park Compound Study Area. However, given its current use as a Highways England depot, a limited thickness of Made Ground is anticipated to be present.

Superficial Geology

11.7.107. **Figure 11.1: Superficial Geology**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**) summarises the superficial geology present in the Lionheart Enterprise Park Compound Study Area.

11.7.108. The Lionheart Enterprise Park Compound Study Area is shown to be predominantly underlain by glaciofluvial deposits comprising sand and gravel and cohesive Glacial Till towards the southern extent of the Lionheart Enterprise Park Compound Study Area.

11.7.109. Alluvium is present along the north eastern boundary of the Lionheart Enterprise Park Compound associated with Cawledge Burn.

Bedrock Geology

11.7.110. **Figure 11.2: Bedrock Geology**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**) summarises the bedrock geology within the Lionheart Enterprise Park Compound Study Area.

11.7.111. The BGS maps (**Ref. 11.42**) show the underlying bedrock within the Lionheart Enterprise Park Compound Study Area to comprise sedimentary strata of the Alston Formation comprising limestone and undifferentiated limestone, sandstone, mudstone and siltstone which is Carboniferous in age.

Records of Mining

11.7.112. With regard to coal mining hazards, the information outlined in the sections below and presented in **Figure 11.3: Coal Mining Hazards**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**) has been obtained from NCC and the Coal Authority (**Ref. 11.40**).

11.7.113. The Lionheart Enterprise Park Compound lies within a Coal Authority Coal Mining Reporting Area, but the Lionheart Enterprise Park Compound does not lie within a DHRA. A DHRA is however shown to be present to the south-east of the Compound, within the wider Lionheart Enterprise Park Compound Study Area. This appears to be associated with coal outcrops that are present along Cawledge Burn.

Records of Mineral Resources

11.7.114. Minerals UK Onshore Mineral Resource Maps Northumberland Tyne and Wear (**Ref. 11.38**) indicates that there are potential mineral resources present across the whole Lionheart Enterprise Park Compound Study Area comprising river sand and gravels, glacial sand and gravels, peat and coal.

11.7.115. NCC draft Local Plan - Policies Map (**Ref. 11.39**) highlights MSAs around deposits of carboniferous limestone, clay (including brick clay, brick shale and fireclay), coal, igneous rock, sand and gravel and sandstone.

11.7.116. Consultation with NCC (refer to **Appendix 4.2: Environmental Consultation, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**)) has confirmed that with regards to the sterilisation of peat deposits, peat is not considered a mineral resource under the NPPF and therefore peat is not included further in this assessment.

11.7.117. The Lionheart Enterprise Park Compound Study Area is located in an MSA relating to the presence of a sand and gravel mineral resource.

Hydrology

11.7.118. Cawledge Burn (good chemical and ecological WFD status (**Ref. 11.41**)) is located approximately 80 m to the south-east of Lionheart Enterprise Park Compound. The burn flows eastwards and is a tributary to the River Aln.

11.7.119. This watercourse is shown on **Figure 11.4: Hydrology – Surface Watercourses**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**).

Hydrogeology

11.7.120. Within the Lionheart Enterprise Park Compound Study Area, the underlying Alluvium and Glaciofluvial deposits comprising sand and gravel are classified by the Environment Agency as a Secondary A Aquifer. The Glacial Till in the eastern extent is classified by the Environment Agency as a Secondary Undifferentiated Aquifer. The underlying bedrock is classified as a Secondary A Aquifer (**Ref. 11.37**).

11.7.121. According to the Natural England MAGIC Database (**Ref. 11.37**), the Lionheart Enterprise Park Compound Study Area is not within a groundwater SPZ. There are no records of licensed groundwater abstraction points within the Lionheart Enterprise Park Compound Study Area.

Unexploded Ordnance

11.7.122. The Unexploded Bomb risk map (**Ref. 11.45**) for the area indicates that the Lionheart Enterprise Park Compound Study Area lies within a low risk area. A PDSA has been completed for the Lionheart Enterprise Park Compound (**Ref. 11.46**) and states that a detailed desk study, whilst always prudent, is not considered essential in this instance due to the low risk from UXO.

Designated Sites

11.7.123. NCC has confirmed that there are no RIGS or Local Geological Sites within the Lionheart Enterprise Park Compound Study Area (refer to **Appendix 4.2: Environmental Consultation**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**)).

11.7.124. NCC has confirmed that there are no SSSI within the Lionheart Enterprise Park Compound Study Area. The Lionheart Enterprise Park Compound Study Area does not lie within an IRZ for any SSSI (refer to **Appendix 4.2: Environmental Consultation**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**)).

Waste Activity

11.7.125. A historical landfill site, East Cawledge, is present 186 m to the north of the Lionheart Enterprise Park Compound within the Lionheart Enterprise Park Compound Study Area as shown on **Figure 2.2: Environmental Constraints Plan: Part B**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**). NCC records (refer to **Appendix 4.2: Environmental Consultation**, **Volume 1** of this ES) show that the historical landfill which was operated by Denwick Parish Council was first recorded in 1927 and last recorded in 1972. NCC records show that only ash was deposited at the site.

Potential Sources of Contamination

11.7.126. The following section sets out potential sources of contamination, receptors potentially sensitive to contamination and potential pathways linking the sources and receptors. This is required to understand potential contaminated land related risks and follows the guidance principles set out in document CLR11 (**Ref. 11.19**).

11.7.127. Potential sources of contamination within the Lionheart Enterprise Park Compound Study Area have been identified from a review of the PRA (refer to **Appendix 11.2**: **PRA: Lionheart Business Park**, **Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)), available historical mapping as well as data provided by NCC Environmental Protection Officer (refer to **Appendix 4.2: Environmental Consultation**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**) and are listed below as well as being displayed in **Figure 11.5: Potential Contamination Sources**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**).

11.7.128. Potential sources of contamination within the Lionheart Enterprise Park Compound Study Area are:

a. Former tramway crosses this area – the tramway ran from Longdyke colliery to Alnwick gas works.
b. Historical landfill (East Cawledge) located 186 m to the north.
c. Infilled quarry located adjacent to North Cawledge Bridge Road approximately 220 m to the south west at NGR 419555, 610938.
d. Fuel storage tanks within farmsteads located within the Study Area of the Lionheart Enterprise Compound.
e. Storage of agricultural chemicals within farmsteads located within the Study Area of the Lionheart Enterprise Park Compound.
f. Agricultural runoff (nitrates, ammonium, organics, sediments).
g. Current site operation as a salt and gritting depot.

MAIN COMPOUND

Topography

11.7.129. The land within the Main Compound is relatively level at between 58 m AOD and 60 m AOD and slopes along the northern boundary down to the unnamed tributary to Thirston Burn.

Geomorphology

11.7.130. No geomorphological sites of interest have been identified on or immediately surrounding the Main Compound Study Area and therefore have not been considered further in this assessment.

Soils and Agricultural Land Quality

11.7.131. Soils within the Main Compound Study Area are classified as Soilscape 18 (**Ref. 11.36**) which are slowly permeable seasonally wet slightly acidic but base-rich loamy and clayey soils. They have a low carbon content, moderate fertility and have impeded drainage. They

tend to support grassland, arable land and some woodland. The main risks with regard to water protection are associated with overland flow from compacted or poached fields. Organic slurry, dirty water, fertiliser, pathogens and fine sediment can all move in suspension or solution with overland flow or drain water.

11.7.132. The soils within the Main Compound are classified as Grade 3 agricultural land based on the ALC Provisional Map for the North East Region (**Ref. 11.34**).

11.7.133. A detailed ALC survey has not been undertaken within the Order Limits of the Main Compound as land take within this area (7.5 ha) would only be temporary in order to accommodate the presence of the temporary construction compound.

Ground Conditions

Made Ground

11.7.134. BGS maps (**Ref. 11.42**) do not show the presence of Made Ground within the Main Compound Study Area. Given the current agricultural use, shallow ground conditions are anticipated to comprise topsoil.

11.7.135. Available BGS historical records (**Ref. 11.42**) for the Main Compound Study Area dated 2006 record topsoil (possible Made Ground) to a depth of 0.3 m bgl.

Superficial Geology

11.7.136. The Main Compound Study Area is shown to be predominantly underlain by Glacial Till.

11.7.137. **Figure 11.1: Superficial Geology**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**) summarises the superficial geology present in the Main Compound Study Area.

Bedrock Geology

11.7.138. The BGS maps (**Ref. 11.42**) show the underlying bedrock within the Main Compound Study Area to comprise sedimentary strata of the Yoredale Group consisting of limestone, sandstone and mudstone which is of Carboniferous age.

11.7.139. **Figure 11.2: Bedrock Geology**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**) summarises the bedrock geology in the Main Compound Study Area.

Records of Mining

11.7.140. With regard to coal mining hazards, the information outlined in the sections below and presented in **Figure 11.3: Coal Mining Hazards**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**) has been obtained from NCC and the Coal Authority (**Ref. 11.40**).

11.7.141. The Main Compound Study Area lies within a Coal Authority Coal Mining Reporting Area, but not within a DHRA, as such a CMRA is not required.

Records of Mineral Resources

11.7.142. Minerals UK Onshore Mineral Resource Maps Northumberland Tyne and Wear (**Ref. 11.38**) indicates that there are potential mineral resources present across the whole Main Compound Study Area comprising river sand and gravels, glacial sand and gravels, peat and coal.

11.7.143. NCC draft Local Plan - Policies Map (**Ref. 11.39**) highlights MSAs around deposits of carboniferous limestone, clay (including brick clay, brick shale and fireclay), coal, igneous rock, sand and gravel and sandstone.

11.7.144. The Main Compound Study Area is located in an MSA relating to the presence of a sand and gravel mineral resource.

Hydrology

11.7.145. An unnamed tributary of Thirston Burn, which has a 'good chemical and moderate ecological status' (**Ref. 11.41**) under the WFD is present flowing eastwards along the northern boundary of the proposed Main Compound.

11.7.146. This watercourse is shown on **Figure 11.4: Hydrology – Surface Watercourses**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**).

Hydrogeology

11.7.147. Within the Main Compound Study Area, the underlying Glaciofluvial deposits are classified by the Environment Agency as a Secondary A Aquifer, and the Glacial Till as a Secondary Undifferentiated Aquifer. The underlying bedrock is also classified as a Secondary A Aquifer (**Ref. 11.37**).

11.7.148. According to the Natural England MAGIC Database (**Ref. 11.37**), the Main Compound Study Area is not within a groundwater SPZ. There are no records of licensed groundwater abstraction points within the Main Compound Study Area.

Unexploded Ordnance

11.7.149. It is proposed that the Main Compound would be used by both Part A and Part B. The UXO hazard plan provided within the detailed UXO desk study completed for the A1 in Northumberland: Morpeth to Felton PSSR (refer to **Appendix 11.1: PSSR**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) presented the area as a low risk with respect to UXO.

11.7.150. The area proposed for use as the Main Compound lies outside the area included within the detailed desk study assessment for UXO. The Buildability Advisor have confirmed that there are no below ground excavations proposed within the Main Compound and as such, further investigation with respect to UXO is not required.

Designated Sites

11.7.151. NCC has confirmed that there are no RIGS or Local Geological Sites within the Main Compound Study Area (refer to **Appendix 4.2: Environmental Consultation**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**)).

11.7.152. NCC has confirmed that there are no SSSI within the Main Compound Study Area. The Main Compound Study Area does not lie within an IRZ for any SSSI (refer to **Appendix 4.2: Environmental Consultation**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**)).

Waste Activity

11.7.153. There are no active or historical landfills within the Main Compound Study Area.

Potential Sources of Contamination

11.7.154. Potential sources of contamination within the Main Compound Study Area have been identified from a review of the PSSR (refer to **Appendix 11.1: PSSR**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**), available historical mapping as well as data provided by NCC Environmental Protection Officer (refer to **Appendix 4.2: Environmental Consultation**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**)) and are listed below as well as shown in **Figure 11.5: Potential Contamination Sources**, **Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**).

11.7.155. Potential sources of contamination within the Main Compound Study Area are as follows:

a. Eshott Airfield (former WW2 airfield) located immediately to the south.
b. Agricultural runoff (nitrates, ammonium, organics and sediments).

POTENTIAL CONTAMINATION SOURCE TO RECEPTOR PATHWAYS (ALL AREAS)

11.7.156. Potential contaminant linkage pathways include:

Human Health

a. Direct contact, soil ingestion and inhalation.
b. Migration and accumulation of ground gas and / or vapours in excavations and inhalation or asphyxiation by site preparation, earthworks, construction and maintenance workers.

Controlled Waters

a. Infiltration of rainwater and leaching of contamination to shallow perched water and / or groundwater.
b. Surface runoff of contaminants and sediments into surface water bodies (rivers, drains and ponds).
c. Migration from groundwater into surface water bodies (main drains, network drains, ponds).
d. Lateral and vertical leaching of contaminants into underlying Secondary A Aquifer.

11.7.157. In relation to human health the risks to residential occupant receptors are not included due to limited earthworks in the vicinity of potential contamination sources.

GROUND INVESTIGATION CONTAMINATED LAND RISK ASSESSMENT

11.7.158. The GIR is included in **Appendix 11.3: GIR, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**). The ground investigation was completed within the Part B Main Scheme Area Study Area between 9 and 30 July 2018, and between 5 September and 31 October 2018, with groundwater monitoring carried out from the end of the site works until 8 January 2019.

11.7.159. No ground investigation or risk assessment was carried out for the Lionheart Enterprise Park Compound or Main Compound as no breaking of ground is proposed so there would be no impacts from the potential sources of contamination listed for these areas. There is not considered to be a risk from vapours or from dermal contact / ingestion from windblown dust from near surface soils due to the lack of potentially contaminative uses in these temporary compound areas.

11.7.160. Based on the baseline data, there are limited sources of potentially significant contamination within the Part B Main Scheme Area Study Area.

11.7.161. The laboratory results indicate that with regard to a risk to human health, only three soil samples exceeded the conservative generic assessment criteria (GAC) for a commercial or industrial end use. The exceedances relate to slightly acidic pH concentrations recorded within TP/17/20 at 0.3 m, BH/17/06 at 0.15 m and TP/17/14 at 0.2 m, pH was reported to be 6.2, 5.9 and 6.4 respectively, below the GAC of 6.5. The low pH values were all reported within samples of topsoil.

11.7.162. The CAR 2012 (**Ref. 11.9**) make clear that asbestos management procedures are required on sites where asbestos is present, and this covers asbestos in the ground as well as buildings. No asbestos fibres were recorded. However, it should be noted that all Made Ground material has the potential to contain asbestos fibres.

11.7.163. There were several exceedances of the groundwater concentrations when conservatively compared to UK Drinking Water Standards (UK DWS) and Environmental Quality Standards (EQS):

a. Concentrations of Total Petroleum Hydrocarbon (TPH) Aromatic C21-C35 fraction, chromium III, lead, molybdenum, barium, ammoniacal nitrogen and total cyanide were reported above the DWS in one or more groundwater sample analysed.

b. Concentrations of TPH Aromatic C21-C35 fraction, chromium III, copper, lead, mercury, nickel, zinc, fluoranthene, phenol and total cyanide were reported above the EQS in one or more groundwater samples analysed.

11.7.164. All the monitoring installations with the exception of one, have response zones targeting the Glacial Till and underlying bedrock. In consideration of the strata which the response zones are targeting and the limited potential sources of contamination identified in the location of the monitoring wells, these concentrations appear to be representative of the background

concentrations related to the regional geology, with the exception of the petroleum hydrocarbon detections.

SENSITIVITY OF RECEPTORS

11.7.165. Geology and soils related receptors considered sensitive to the potential impacts of Part B are summarised in **Table 11-10**. The sensitivity has been derived using the criteria set out in **Table 11-5**.

Table 11-10 – Geology and Soils Receptors

Aspect	Sensitive Receptor	Sensitivity	Justification
Human Health	Future site users	Low	End use involves a road therefore potential exposure to contaminants would be limited
	Adjacent site users (visitors/workers) during construction	Low	Limited contamination present so potential exposure during construction would be limited
	Construction workers; Below ground maintenance workers	Medium	Potential for direct exposure to potentially contaminated materials
Controlled waters (surface watercourses)	Surrounding surface watercourses	High	Presence of watercourses with good status under the WFD
Controlled waters (groundwater)	Groundwater (Secondary A Aquifer)	Medium	Study Area is underlain by a Secondary A Aquifer, however, is not located within an SPZ
Soil	Agricultural soil	High	Grade 2 and Subgrade 3a agricultural soils present
		Medium	Subgrade 3b soils agricultural soils present
		Low	Grade 4 agricultural soils present
Built Environment	Future infrastructure	Low	End use involves a road so future infrastructure would

Aspect	Sensitive Receptor	Sensitivity	Justification
			be limited to culverts / below ground chambers
	Existing infrastructure and surrounding properties during construction	Low	Limited presence of contamination and low risk of ground instability from historic mine workings
Mineral resources	Carboniferous limestone; Coal; Sand and Gravel	High	MSAs present throughout the Study Area and directly underlying Part B

11.8. POTENTIAL IMPACTS

CONSTRUCTION

11.8.1. The impacts on geology and soils are considered likely to be most significant during the construction phase of Part B, which would include creating embankments, installing new culverts and bridge construction. Further details regarding Part B are presented in **Chapter 2: The Scheme, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**).

11.8.2. The Main Compound would be used by both Part A and Part B and is located within the Order Limits of Part A. As detailed in **Section 2.8** in **Chapter 2: The Scheme, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**), the use of the Main Compound for Part B would lead to additional activities. However, due to the limited number of additional activities, and as the overall footprint of the Main Compound would not change, there would be a negligible impact on Geology and Soils. Management and storage of fuels would be undertaken in accordance with the **Outline Construction Environment Management Plan** (**Outline CEMP**) (**Application Document Reference: TR010041/APP/7.3**). As there would be no additional impacts on Geology and Soils as a result of using the Main Compound for Part B, this is not discussed further within this chapter. The effects of the Main Compound on Geology and Soils are reported in Part A **Chapter 11: Geology and Soils, Volume 2** of this ES (**Application Document Reference TR010041/APP/6.2**).

11.8.3. Potential impacts upon geology and soils as a result of the construction of Part B are summarised in **Table 11-11**.

Table 11-11 – Geology and Soils Potential Construction Impacts

Receptor	Potential Impact	Cause
Construction workers Adjacent site users (visitors/workers) Current site users Below ground maintenance workers	Detriment to human health	If human health receptors (e.g. construction workers) are exposed to contaminants (associated with historical and present land uses or Made Ground) above threshold concentrations protective of human health, there is potential for both temporary and permanent health problems to arise. Construction workers are susceptible to exposure to hazardous gases (primarily methane, hydrogen sulphide, carbon monoxide and carbon dioxide) or depleted oxygen levels associated with underlying coal workings within excavations or confined spaces associated with the earthworks, migration of mine gases caused by pressure changes due to construction works and installation of any below ground infrastructure. Excavation of potentially contaminated soils could pose a health risk to the public in the immediate vicinity of Part B during the construction period, through inhalation of contaminated dusts and particulate matter generated by excavation activities. The use of machinery and plant associated with preparation, earthworks and construction activities (including the establishment of temporary construction compounds) could give rise to contamination risk to soils, through accidental fuel or oil spills and leaks, and storage of chemicals or fuels. Soils impacted by fuel or oil spills and leaks may represent a future source of contamination to human health. Risks of ground collapse during both construction and operational of Part B due to increased loads increasing the pressure on shallow underground voids associated with historical coal mining. Potential risks to construction workers and road users if mining voids remain untreated. Risks associated with encountering UXO during preparation and construction works of Part B.
Underlying aquifers (groundwater) and surface water bodies	Pollution of controlled water bodies	The disturbance of potentially contaminated ground and the storage of fuel or oils within the Study Area during the construction phase have the potential to result in mobilisation and release of contaminants increasing the potential to adversely impact controlled water bodies (primarily underlying Secondary A Aquifer and the seven watercourses within the Study Area). The use of machinery and plant associated with construction activities (including the establishment of construction compounds and storage of any chemicals or fuels in the compound areas) could give rise to a pollution risk to soils, groundwater and surface water features through accidental fuel or oil and chemical spills and leaks. Soils impacted by spills and leaks may represent a source of contamination to controlled waters via leaching. Potential for deep excavations (around bridges and culverts) to require dewatering, water pumped from excavations may contain contaminants, which if not managed appropriately could result in discharge and contamination of surrounding surface watercourses. Risk of potentially generating silt laden contaminated runoff during the construction of the temporary compounds and the earthworks phase of Part B, which is anticipated to cut a total of approximately 180,000 m^3 of material and fill approximately 290,000 m^3 of material, including hydrocarbon contamination and high suspended solid loads, associated with the operation of vehicles. This has the potential to create overland migration pathways and migrate and pollute surrounding surface watercourses.
Agricultural soils	Reduction in agricultural soil quality Permanent loss of agricultural soils	Topsoil strip estimated to generate approximately 26,000 m^3 of material and 18,000 m^3 of topsoil placement, leaving a potential surplus of 8,000 m^3. Agricultural land would be affected by temporary works during construction and restored where possible post construction works and via permanent land take to accommodate the new highway. Agricultural land has been identified to accommodate the temporary construction compounds (refer to Fi**gure 2.6: Temporary Construction Works: Part B, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**))These areas would be out of agricultural use for the duration of the construction activities, and soils eroded and compacted as a result of the temporary use. Topsoil with high organic content would be stripped to facilitate development.

Receptor	Potential Impact	Cause
		Physical and chemical characteristics of topsoil along the route of Part B would be adversely altered (i.e. compacted or covered) during the construction works. Agricultural land would be temporarily and permanently lost due to land take required to deliver Part B.
Existing highway infrastructure, surrounding houses and commercial premises	Migration of hazardous ground gas causing explosion and asphyxiation	Potential for any potential grouting activities (associated with mitigation measures) to release of explosive ground gas (mine gases) into above ground enclosed spaces within buildings service chambers, or surrounding buildings during any grouting works.
	Ground instability	Risk of surface subsidence associated with building over areas of poorly compacted ground.
Mineral resources	Sterilisation of mineral resources	Mineral resources are present within the Order Limits and there is the potential for access to these minerals to be lost (sterilised) due to land take required to deliver Part B.

OPERATION

11.8.4. The potential operational impacts of Part B on geology and soils are summarised in **Table 11-12** below.

Table 11-12 – Geology and Soils Potential Operational Impacts

Receptor	Potential Impact	Cause
Site users; Maintenance workers	Detriment to human health	Site users could be exposed to potential contamination present within landscaped areas of Part B such as grassed verges. Maintenance workers could be exposed to potential contamination within areas requiring groundworks during operation such as within service trenches. Maintenance workers are susceptible to exposure to hazardous gases (primarily methane, hydrogen sulphide, carbon monoxide and carbon dioxide) as well as depleted oxygen levels if required to enter enclosed spaces for maintenance purposes such as newly installed drainage features.
Controlled water bodies (surface watercourses and groundwater)	Pollution of controlled water bodies	Potential for fuel or oil leaks from vehicles using the carriageway to impact surface water bodies. Potential for contaminated surface runoff from the carriageway to impact on controlled waters. Potential for considerable release of physical and chemical contaminants such as fuel, oils, fire water, potentially contaminative vehicle load, due to an isolated incident such as an accident.

11.8.5. There are no impacts anticipated on agricultural soils, MSAs and the built environment during the operation of Part B.

11.9. DESIGN, MITIGATION AND ENHANCEMENT MEASURES

11.9.1. The likely mitigation measures to be applied to Part B to avoid, prevent or reduce significant effects to geology and soils related receptors during the design, construction and operation of Part B are outlined in the sections below.

DESIGN MEASURES

11.9.2. All geotechnical related works would be undertaken in accordance with DMRB guidance document HD 22/08 – Managing Geotechnical Risk (**Ref. 11.47**). This would include the production of a Geotechnical Design Report, which sets out geotechnical parameters to facilitate the safe design of Part B from a ground engineering perspective.

11.9.3. Detailed design elements of Part B have not yet commenced, and the final design would dictate the most appropriate ground stability mitigation measures. However, based on the preliminary design, a number of ground stability mitigation options are set out below and their selection would be subject to the final design.

11.9.4. Elements within the proposed drainage strategy will be designed to reduce the risk of potential physical and chemical contaminants entering the surrounding surface watercourses. The permanent drainage strategy would incorporate the implementation of filter drains, kerb and gully, combined kerb drainage and concrete surface water channels as the primary means of removing and collecting surface water runoff from the highway. These would be sited adjacent to the hardstrip at the edges of the carriageway.

11.9.5. It is proposed that runoff from the highway is discharged into existing surface watercourses via storage retention basin where required. The drainage strategy recognises that there is a requirement to provide treatment prior to discharge to many of the surface watercourses and states that a permanent wet shallow area would be required in detention basins, the details of which are to be confirmed at detailed design. Refer to **Chapter 2: The Scheme, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**) and the **Drainage Strategy Report** (**Appendix 10.4, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)).

11.9.6. Part B has been designed to minimise the amount of land take within agricultural areas. This has included using online widening, keeping areas of land take for mitigation purposes close to the new carriageway and by undertaking discussions with landowners to highlight preferences with regard to land take areas.

11.9.7. Where BMV soils are to be lost through permanent land take, they are generally associated with extending the existing carriageway. No areas of landscape planting mitigation are proposed over BMV soils where land is to be acquired for Part B on a temporary basis.

Construction

11.9.8. The construction of Part B would be undertaken in accordance with industry best-practice and regulatory requirements. An **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) has been developed for the Scheme and forms part of the DCO application to set out how to manage environmental impacts and the measures to ensure compliance during construction. The **Outline CEMP** would be developed by the main contractor into a detailed CEMP prior to construction commencing. Soil and geology related mitigation measures included as part of the CEMP which would be developed by the main contractor are set out below.

Detriment to Human Health

11.9.9. The following measures would be implemented during the construction phase to mitigate risks to human health (construction workers, surrounding site users and visitors, local residents, general public):

a. Earthworks would be completed in accordance with a Contaminated Land: Applications in Real Environments CL:AIRE compliant Materials Management Plan (MMP) to ensure re-used material does not present a risk to human health or the environment and in accordance with Series 600 6/14 and 6/15 that would prescribe criteria for the re-use of soil for the protection of human health and the environment. This would ensure any contaminated materials are re-used suitably as part of the cut and fill earthworks associated with Part B. Further details of the MMP, earthworks volumes, the potential for reuse and likely disposal volumes can be found in **Chapter 13: Material Resources** of this ES.
b. Construction workers are to wear appropriate personal protective equipment (PPE) and use monitoring equipment where appropriate. The preparation of risk assessment and method statements (RAMS) should be undertaken to ensure the appropriate use of PPE including respiratory protective equipment (RPE) where required, to mitigate the potential risk of exposure to hazardous gases and vapour as well as depleted oxygen levels.
c. It is recommended that to control potential risks during construction, suitable procedures and appropriate PPE are adopted to minimise the generation of dust and the potential for exposure when working with Made Ground materials.
d. Should unexpected contamination be encountered as part of the earthworks, then a suitable remedial strategy would be formulated and approved with the regulators to suitably mitigate the effects.
e. Prior to works starting, all personnel involved in earthworks would require a toolbox talk to provide advice on contamination.

Pollution of Controlled Water Bodies

11.9.10. The following measures would be implemented during construction to mitigate risks to controlled water bodies associated with the construction phase:

a. A temporary surface water drainage strategy to limit the uncontrolled runoff entering surrounding surface watercourses, including installing cut off ditches around the perimeter of the construction area to prevent sediment entering the watercourses during periods of heavy rainfall.
b. Areas with a greater risk of spillage (e.g. vehicle maintenance areas and storage areas for hazardous materials) would be carefully sited (e.g. away from drains or areas where surface waters may pond).
c. Measures would be put into place to prevent pollution from construction plant, vehicles and machinery including refuelling in designated areas, on an impermeable surface, away from drains and watercourses.
d. Plant to be maintained in a good condition with wheel washing in place. All refuelling would be supervised and carried out in a designated area.
e. Standing machinery would have drip trays placed underneath to prevent oil or fuel leaks causing pollution.

f. All drains within the Order Limits would be identified and labelled and measures implemented to prevent polluting substances from entering them.

g. All fuel, oil and chemicals would be stored in a designated secure area, with secondary containment provided.

h. Minimise works in the watercourse channels and locate plant, stockpiles and other materials 8 m from the watercourse.

i. Surface water runoff and excavation dewatering would be captured and settled out prior to being tested and disposed of either to foul sewer under license or to surface watercourses, subject to the test result and environmental permit.

j. Stockpiles including excavated materials would be stored in such a way to minimise silt laden runoff and windblown particles, such as by covering or seeding.

k. All loose materials would be covered so as not to give rise to a significant increase in sediment load to the drainage network.

l. Formulation of a detailed incident response plan to mitigate potential risks should leaks or spills occur during construction. The requirement for regular toolbox talks outlining the incident response plan and measures required to minimise the potential for pollution of surface watercourses as detailed within the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**).

m. Migration of Hazardous Ground Gas Causing an Explosion and Asphyxiation.

n. As outlined in the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**), during construction works surface watercourses located within 50 m of earthworks would be visually monitored regularly (weekly) to identify any pollution as a result of e.g. silt, fuel or chemicals. A baseline would be established prior to the commencement of construction.

11.9.11. Elevated concentrations of TPH were recorded within the groundwater during the post-site works monitoring period. Further observations as a precaution should be considered during construction. Consideration should be given to completing additional groundwater monitoring and to the completion of a detailed quantitative risk assessment to further assess the risk from these contaminant concentrations to sensitive receptors.

Agricultural Land

11.9.12. An ALC survey has been completed (refer to **Appendix 11.5: Soils and Agricultural Land Quality Report, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) to inform the assessment and assess the requirement for mitigation measures to be put in place to minimise the reduction of soil quality within the Study Area during construction of Part B.

11.9.13. As set out in the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**), agricultural soils would be stripped as part of the preparation and construction phases and would be sustainably managed and reused where possible. As detailed in the **Outline CEMP**, a suitable soil handling strategy would be developed to help preserve the soil and retain soil functions such as water and carbon storage.

11.9.14. The soil handling strategy would be designed in accordance with key guidance documents including Ministry of Agriculture Fisheries and Food (MAFF) (now part of Defra) Good Practice Guide for Handling Soils (**Ref. 11.48**) and The Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (**Ref. 11.28**). This strategy would as a minimum include the following measures during construction:

a. Stripping and storage of topsoil and subsoil when weather and soil conditions are suitable (subject to other environmental constraints, such as the presence of buried archaeological remains).
b. Separating storage and management of topsoil and subsoil in well aerated covered heaps.
c. Return of topsoil and subsoil to the original areas, in separate layers (where possible and where these areas are not occupied by permanent new infrastructure).
d. Use of appropriate machinery to minimise soil compaction (e.g. reduce the use of heavy plant or tracked vehicles passing over organic soils).
e. Relief of compaction of restored soils such as digging out, aerating any highly compacted areas of organic soil.
f. Dust suppression measures, such as damping down, during periods of dry weather.

Hazardous Ground Gas Exposure

11.9.15. The following measures would be implemented during the construction phase to minimise the risks associated with explosions in confined spaces:

a. All works would be conducted in line with HSE publication, Safe Work in Confined Spaces (**Ref. 11.23**).
b. Confined space specific risks assessment to be undertaken, before producing and implementing suitable Risk Assessment Method Statement (RAMS) to mitigate risks, and ensuring personnel have the appropriate training.
c. Gas monitoring equipment would be used by all operatives entering below ground confined spaces.
d. Mine gas detectors would be placed within surrounding buildings (located within 50 m) if any drilling and grouting activities are required, to monitor whether any hazardous ground gases are being released as void pressure is increased during grouting.
e. In the event that elevated concentrations of ground gas are identified where entry into confined spaces or excavations is required by construction workers, a combination of appropriate PPE, monitoring equipment, safe entry procedures and RPE would be utilised to mitigate the potential risk of exposure to hazardous gas and vapours, and depleted oxygen levels.

Operation

Pollution of controlled water bodies

11.9.16. The following measures would be implemented during the operational phase:

a. Pollution control measures including detention basins and filter drains would be incorporated into the drainage design of Part B. This would reduce the rate of the surface water runoff which would have flowed freely ultimately into surrounding surface watercourses.
b. Sediment and pollutants would settle to the bottom of the detention basins to limit entry to surrounding controlled water bodies.
c. Surface water runoff rates have been restricted to the existing greenfield runoff values for an equivalent storm event.
d. Ongoing maintenance plans would be implemented to ensure the drainage scheme is meeting its operational requirements and preventing contamination within surface runoff from entering surface water bodies migrating to groundwater.
e. Emergency procedures to be in place in case of a considerable release of contaminants as a result of an incident, such as a road traffic accident, on the highway.

11.9.17. Further details and addition measures are presented in **Chapter 10: Road Drainage and the Water Environment** of this ES.

MITIGATION MEASURES

Construction

11.9.18. The mitigation measures to be applied to Part B to avoid, prevent or reduce potentially significant effects to Geology and Soils related environmental receptors during construction are presented below.

Agricultural Land

11.9.19. The permanent loss of agricultural land would be required due to the construction of embankments, additional carriageway and access tracks needed to deliver Part B. However, as discussed in **paragraph 11.9.14** above, agricultural soils would be stripped and reused where possible.

Ground Instability

11.9.20. As detailed in the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**), preparation of RAMS to ensure mitigation measures, such as temporary shoring is incorporated into excavations should there be a risk of loose or unstable ground, would be implemented during the construction phase alongside the following measures (as recommended in **Appendix 11.6: Coal Mining Risk Assessment, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) to minimise the risks associated with ground collapse and ground related structural damage.

11.9.21. Further intrusive ground investigation would be required at the detailed design stage to assess for the presence of shallow workings and inform and enable any grout stabilisation requirements for mitigation of ground instability. The following aspects would be reviewed following the completion of the ground investigation works to ascertain whether these measures would be implemented:

a. The incorporation of a high strength basal geogrid beneath new earthworks to control settlement in the case of surface movement due to collapse of any unrecorded workings, if required, subject to further detailed assessment as part of the detailed design.
b. Additional capacity to be designed into the rigid inclusions and load transfer platform / distribution mat combination to further increase its ability to tolerate minor ground movements resulting from shallow working collapse associated with embankments in areas considered to be at risk from collapse, if required, subject to further ground investigation data undertaken to support the detailed design.
c. If grouting is required, grouting pressure checks to be undertaken when pumping any grout into the ground to monitor whether any anomalies in pressure are noted which could signify that grouting may be reaching areas outside those intended.
d. Where required, a grout curtain would be installed to restrict the flow of grout beyond the treatment boundaries and inhibit the impact upon any surrounding shaft walls.
e. Mine shafts / adits located within the Order Limits would be fenced off for the duration of the works with adequate signage.

Sterilisation of Mineral Resources

11.9.22. To minimise the sterilisation of potential mineral resources located within MSAs in the working area, consideration would be given to the incorporation of site won materials from these MSAs into Part B where possible.

Operation

11.9.23. The mitigation measures to be applied to Part B to avoid, prevent or reduce potentially significant effects to Geology and Soils related environmental receptors during the operational phase of Part B are presented below.

Detriment to Human Health

11.9.24. The following measures would be implemented during operation to minimise the risk to human health via The Health and Safety at Work Act 1974 (**Ref. 11.49**), The Confined Space Regulations 1997 (**Ref. 11.50**), The Management of Health and Safety at Work Regulations 1999 (**Ref. 11.51**) and the HSE Guidance, Safe Work in Confined Spaces (**Ref. 11.23**):

a. Any personnel entering enclosed spaces, such as maintenance drainage chambers, would complete a confined spaces risk assessment and implement measures such as the inclusion of respirators and wearing gas monitors and RPE if deemed necessary.
b. All personnel entering enclosed spaces must have appropriate training before being cleared to enter a below ground enclosed space.
c. All maintenance works to be completed in accordance with appropriate RAMS which stipulate the level of PPE and monitoring required.

Pollution of Controlled Water Bodies

11.9.25. The following measures would be implemented during the operation phase:

a. Pollution control measures including detention basins and filter drains would be incorporated into the drainage design of Part B. This would reduce the rate of the surface water runoff which would have flowed freely ultimately into surrounding surface watercourses.
b. Ongoing maintenance plans would be implemented to ensure the drainage scheme is meeting its operational requirements and preventing contamination within surface runoff from entering surface water bodies migrating to groundwater.
c. Emergency procedures to be in place in case of a considerable release of contaminants as a result of an incident, such as a road traffic accident, on the highway.

ENHANCEMENT MEASURES

11.9.26. No enhancement measures are proposed for the construction and operation of Part B.

11.10. ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

CONSTRUCTION

11.10.1. The following section sets out the likely effects of Part B to sensitive receptors, taking into consideration the mitigation measures above, during construction.

Detriment to Human Health

11.10.2. Limited potential sources of contamination have been identified within the Study Area and the Lionheart Enterprise Park Compound. With the exception of isolated low pH within the topsoil, contaminants have been recorded below UK guideline values protective of human health. However, there could potentially be localised sources of contamination which if encountered could pose a risk to human health during the construction of Part B.

11.10.3. Coal Authority data has indicated shallow (<30 m) coal mining and deeper coal seams beneath the Study Area and Lionheart Enterprise Park Compound, which may have the potential to generate hazardous ground gases which, if they migrate inside enclosed spaces, could pose a risk to human health.

11.10.4. Mitigation measures include suitable risk assessments and control measures (monitors and respirators) for any development or maintenance personnel entering confined spaces (e.g. maintenance chambers associated with the drainage infrastructure and new culverts). As detailed in the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**), measures for encountering any unexpected contamination to ensure the safety of construction workers would be implemented during construction.

11.10.5. The sensitivity of surrounding site users is low, and the magnitude of change is negligible (due to the implementation of mitigation measures). Therefore, there is likely to be a direct, temporary, short term **neutral** effect on human health (**not significant**).

11.10.6. The sensitivity of construction workers is medium, and the magnitude of change is negligible (due to the implementation of mitigation measures). Therefore, there is likely to be a direct, temporary or permanent, short to long term **neutral** effect on human health (**not significant**).

Pollution of Controlled Water Bodies

11.10.7. Controlled water receptors considered as being potentially susceptible to effects from contaminants include the underlying Secondary A Aquifer and surrounding watercourses.

11.10.8. During the construction of Part B there would be vehicles, including plant and machinery, regularly using and parking within the Order Limits (primarily within construction compounds). This activity, along with the storage of any construction plant fuels, oils or chemicals would generate the potential for fuel or oil leaks from vehicles, storage containers or refuelling points, which may result in discharging contamination to ground resulting in pollution of controlled water bodies. During periods of inclement weather, the earthworks areas could potentially generate silt laden runoff which could flow towards surface watercourses causing siltation and deoxygenation subsequently detriment to aquatic ecosystems.

11.10.9. Mitigation measures included within the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) and set out in **paragraph 11.9.10** would be implemented to limit pollution of controlled waters and the temporary drainage system would ensure contaminants either do not reach the ground, or, are attenuated before discharge.

11.10.10. The sensitivity of controlled water receptors is high for surface waters and medium for groundwater, and the magnitude of change is negligible (due to the implementation of mitigation measures). Therefore, there is likely to be a direct, temporary, short term, **slight adverse** effect on surface water receptors (**not significant**) and a direct, temporary, short term **neutral** effect on groundwater (**not significant**) following the implementation of mitigation measures.

Migration of Hazardous Ground Gas Causing an Explosion

11.10.11. Methane producing ground gas sources have been identified beneath Part B, primarily historical coal mine workings, former landfills and infilled pits, quarries or ponds.

11.10.12. All site personnel would be made aware of the findings of the **GIR** (**Appendix 11.3, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**)) and the risk of instability hazards. Risk assessments and method statements be prepared to ensure the protection of workers and the general public during the construction period of Part B. These would include using gas alarms during any periods of drilling or grouting and if any person is required to enter enclosed spaces (e.g. drainage chambers).

11.10.13. The sensitivity of the built environment including on-site infrastructure and surrounding buildings is low and the magnitude of change is negligible due to the implementation of mitigation measures. Therefore, there is likely to be a direct, temporary, short term **neutral adverse** effect on built environment related receptors following the implementation of the mitigation measures (**not significant**).

Ground Instability

11.10.14. There is the potential of areas of poorly compacted or unstable ground to exist within the Order Limits, which pose a risk of collapse that could result in damage to infrastructure if built upon.

11.10.15. The sensitivity of highway related infrastructure is low, and the magnitude of change is negligible due to the implementation of mitigation measures. Therefore, there is likely to be a direct, temporary, short term **slight adverse** effect (**not significant**).

11.10.16. All site personnel would be made aware of the findings of the ground investigation and the risk of instability hazards. Risk assessments and detailed method statements will then be prepared (and included as part of the CEMP) to ensure the protection of workers and the general public during the construction period.

11.10.17. The sensitivity of construction workers is medium, and the magnitude of change is negligible due to the implementation of mitigation measures. Therefore, there is likely to be a direct, permanent, long term **neutral** effect (**not significant**).

Reduction of Agricultural Soil Quality

11.10.18. Part B would result in temporary agricultural land take during construction and would consist of land required for construction compounds, construction working space and access. Further details on the temporary land take required can be found on the **Land Plans** (**Application Document Reference: TR010041/APP/2.2**).

11.10.19. Following construction, temporary land take areas would be reinstated back to their former agricultural use, where possible, in line with a soil handling strategy to be produced alongside the CEMP, although it is acknowledged not all land may be restored to the soil quality prior to construction. Upon completion, areas used as construction compounds would be returned to their original use.

11.10.20. The sensitivity of agricultural soils within the areas of temporary land take has been assessed as ranging between high (BMV land) to low (areas classed as Grade 4) and the magnitude of change is negligible (due to the implementation of mitigation measures and size of the impacted area). Therefore, there is likely to be a direct, temporary and/or permanent, short and/or long term **slight adverse** effect on agricultural soil quality to BMV land and **neutral adverse** effect to all other grades of agricultural land (**not significant**).

Permanent Loss of Agricultural Land

11.10.21. Part B would result in the permanent agricultural land take of approximately 42.4 ha. For the purposes of the assessment the areas not surveyed (13.0 ha) have been included as BMV land. The agricultural soils within the area of permanent land take are generally of high (BMV land including un-surveyed areas (25.9 ha), medium (Subgrade 3b (15.7 ha) to low agricultural quality (areas classed as Grade 4 (0.8 ha)).

11.10.22. On the assumption that there is no retention of agricultural land within the permanent land take, **Table 11-13** below outlines the likely effects relating to the permanent loss of agricultural land.

Table 11-13 – Assessment of Likely Effects – Permanent Loss of Agricultural Land

Grade	Area (ha)	Sensitivity	Magnitude	Effect
1-3a (BMV land; including area not surveyed)	25.94	High	Moderate	Direct, permanent, long term **large adverse**
3b	15.68	Medium	Minor	Direct, permanent, long term **slight adverse** (**not significant**)
4	0.77	Low	Negligible	Direct, permanent, long term **neutral adverse** (**not significant**)

11.10.23. Therefore, for an overall assessment of the agricultural land loss, the sensitivity of agricultural land receptors is low to high, and the magnitude of change is moderate, as between 20 and 50 ha of land would be lost. Therefore, there is likely to be a direct, permanent long-term **neutral to large adverse** effect on agricultural land.

Sterilisation of Mineral Resources

11.10.24. The construction of Part B would result in the sterilisation of mineral resources due to permanent land take. Approximately 33 hectares of mineral resource including sand and gravel, limestone and coal located within MSAs would be affected by permanent land take.

11.10.25. 20 hectares of sand and gravel MSA, 7 hectares of limestone MSA and 6 hectares of coal MSA would be affected. This relates to 0.3%, 0.9% and 1% respectively of the total area of each MSA.

11.10.26. The sensitivity of mineral resources within the Order Limits is high and the magnitude of change is negligible due to the size of the area due to be sterilised. Therefore, there is likely to be a direct, permanent, **slight adverse** effect on mineral resources (**not significant**).

OPERATION

11.10.27. The following section sets out the likely effects of Part B during the operational phase, to sensitive receptors in accordance with the methodology set out in this chapter and taking into account the proposed mitigation measures.

Detriment to Human Health

11.10.28. Potential sources of hazardous ground gas would continue to be present beneath the Order Limits.

11.10.29. If hazardous ground gases migrate into enclosed spaces (below ground drainage chambers) it could potentially pose an asphyxiation or explosion risk to future maintenance workers.

11.10.30. All future maintenance workers would undertake confined spaces training before entering manholes or drainage infrastructure. Risk assessments would be produced ahead of the works to inform the potential risks and appropriate PPE and RPE supplied to workers including gas alarms and respirators.

11.10.31. The sensitivity of human health receptors is medium and the magnitude of change following mitigation is negligible. Therefore, there is likely to be a direct, temporary or permanent, short to long term, **neutral** effect (**not significant**).

Pollution of Controlled Water Bodies

11.10.32. Operational risks to controlled waters receptors would be primarily associated with any future leaks and spills of fuel or oil from vehicles using the carriageway.

11.10.33. The proposed drainage strategy would include filter drains and detention basins as a means of removing and collecting surface water runoff from the highway.

11.10.34. The sensitivity of controlled water receptors is high and the magnitude of change following mitigation is negligible. Therefore, there is likely to be a direct, temporary, short to long term, **slight adverse** effect (**not significant**).

ASSESSMENT PARAMETERS

11.10.35. The Assessment Parameters are presented in **Chapter 2: The Scheme, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**).

11.10.36. Parameters 1 allows for up to a 650 mm increase or 250 mm decrease in height for the Heckley Fence Accommodation Overbridge and Parameter 2 allows for up to a 900 mm increase or 500 mm decrease in height for Charlton Mires Junction Overbridge. Due to the limited magnitude of the height increase and the insignificant additional land take required there would be no additional effects on the geology and soils with the inclusion of the elements within these Assessment Parameters.

11.10.37. Parameter 3 allows for the realignment of the Northern Powergrid Circuit of 66 kV EHV transmission cable to be accommodated within the new highway boundary, within an area where below ground assets are assessed as being directly impacted during construction. As the Assessment Parameters do not require additional land take there are no additional geology and soils effects beyond those identified in this assessment.

UPDATED DMRB GUIDANCE

11.10.38. The findings of the DMRB sensitivity test as described **Section 11.4** are summarised below. Refer to **Appendix 11.7: Geology and Soils DMRB Sensitivity Test, Volume 8** of this ES (**Application Document Reference: TR010041/APP/6.8**) for further details.

11.10.39. The DMRB Geology and Soils Volume 11, Section 3, Part 11 (**Ref. 11.18**) and the DMRB Volume 11, Section 3, Part 6: Land Use (**Ref. 11.17**) guidance did not contain any defined sensitivity and magnitude criteria for use in the assessment of geology and soils impacts. Professional judgement based on knowledge of similar schemes was therefore used to derive assessment criteria.

11.10.40. The updated DMRB guidance LA 109 (**Ref. 11.33**) contains defined sensitivity and magnitude criteria to be used in the assessment of geology and soils.

11.10.41. The sensitivity test undertaken involved applying the newly defined sensitivity and magnitude criteria to the geology and soils receptors and the potential impacts identified during the assessment within this ES. The findings are as follows:

a. The significance of effect to Grade 3b agricultural land would increase from slight adverse to moderate adverse and would therefore become a significant effect following the application of the LA 109 (**Ref. 11.33**) assessment criteria. However, the overall significance of effects relating to permanent loss of agricultural land identified in this ES (refer to **paragraph 11.10.12** would remain a significant adverse effect.

b. No further significant adverse effects have been identified with the application of the LA 109 (**Ref. 11.33**) assessment criteria.

11.10.42. Therefore, with the application of the updated guidance, the conclusions of this ES would remain unchanged.

11.11. MONITORING

11.11.1. Following reinstatement of the temporary land take, there would be a programme of monitoring of soil conditions to identify if there are soil problems which need to be remediated. This would include an assessment of the problem and design of a suitable remediation strategy such as subsoiling or drainage followed by crop establishment.

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