

A1 in Northumberland: Morpeth to Ellingham

Scheme Number: TR010041

6.2 Environmental Statement – Chapter 11 Geology and Soils

Part A

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

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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 A: Morpeth to Felton (Part A) 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 A 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 A and any subsequent residual effects.
- 11.1.4. This chapter is supported by the following appendices in **Volume 7** of this Environmental Statement (ES) (**Application Document Reference: TR010041/APP/6.7**):
- a. Preliminary Sources Study Report (PSSR), 2016 (Appendix 11.1, Volume 7 of this ES).**
 - b. Ground Investigation Report (GIR), 2018 (Appendix 11.2, Volume 7 of this ES).**
 - c. Agricultural Land Classification, 2019 (Appendix 11.3, Volume 7 of this ES).**
 - d. Coal Mining Risk Assessment, 2019 (Appendix 11.4, Volume 7 of this ES).**
- 11.1.5. 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 A 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**).
- 11.1.6. **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: Alnwick to Ellingham (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
Gareth Meynell	Author	Chartered Scientist Chartered Member of the Chartered Institute of Water and Environmental Management MSc Soils and Environmental Pollution	Associate 12 years' experience in impact assessment. Other recent relevant experience includes: <ul style="list-style-type: none"> - Preparation of Soils and Geology ES chapter for Birtley to Coal House Highways England Scheme (2017-present) - Preparation of Soils and Geology baseline assessment report and input into Scoping report and Ground conditions ES chapter for the Towy Valley Cycle Path (2018-Present) - Preparation of Soils and Geology ES chapter associated with developing a leisure hall at Meadowhall shopping centre (2016) - Preparation of A19(T) / A1058 Coast Road, Junction Improvement Soils and Geology Chapter (2014-15)
Andrew McCusker	Reviewer	Chartered Engineer (CEng MICE)	Technical Director

Name	Role	Qualifications and Professional Membership	Relevant Experience
		Chartered Environmentalist (CEnv) Specialist in Land Condition Suitably Qualified Person	25 years' experience in impact assessment. Other recent relevant experience includes: <ul style="list-style-type: none"> - 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 A 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 A 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 A on the policy objectives is outlined in **Table 11-3** below.

Table 11-2 - National Planning Policies Relevant to Geology and Soils

Policy	Relevant Policy Objectives	Significance of Part A on Policy Objective(s)
<p>National Policy Statement for National Networks (NPS NN), 2014 (Ref. 11.12)</p>	<p>Assessment Principles:</p> <p>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.</p> <p>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.</p> <p>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.</p>	<p>Pollution Control and Other Environmental Protection Regimes - Part A 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 A 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 A 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.</p> <p>Land Instability - Part A 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.</p> <p>Agricultural Land / Soil Quality / Mineral Resources - Part A 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.</p>
<p>National Planning Policy Framework (NPPF) (2019) (Ref. 11.13)</p>	<p>Paragraph 170. Planning policies and decisions should contribute to and enhance the natural and local environment by:</p> <p><i>‘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);</i></p> <p><i>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,</i></p> <p><i>F) Remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.’</i></p> <p>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.</p> <p>Paragraph 178. Planning policies and decisions should ensure that:</p>	<p>There is potential for Part A 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 A would ensure the policy objectives are not compromised.</p> <p>Significance of Part A 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.</p>

Policy	Relevant Policy Objectives	Significance of Part A on Policy Objective(s)
	<p><i>'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);</i></p> <p><i>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,</i></p> <p><i>C) Adequate site investigation information, prepared by a competent person, is available to inform these assessments.'</i></p> <p>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.</p> <p>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.</p>	

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

Policy	Relevant Policy Objectives	Significance of Part A on Policy Objective(s)
<p>NCC, Northumberland Minerals Local Plan (adopted March 2000) (Ref. 11.14)</p>	<p>Policy S3 Planning Permission</p> <p>Planning permission should not be granted for development which would sterilise important economically workable deposits unless:</p> <ul style="list-style-type: none"> - 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. 	<p>Sections of Mineral Safeguarding Areas (MSAs) relating to sand and gravel and coal have been identified within the Study Area, however no permanent sterilisation of MSA would occur as a result of Part A.</p> <p>Part A is therefore not considered to have a significant adverse impact on MSAs.</p>
<p>Alnwick District Wide Local Plan (1997) (Ref. 11.15)</p>	<p>Policy S3: Sustainability Criteria</p> <p><i>"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:</i></p> <p><i>"3 – Any physical and environmental constraints on the development of the land as a result of contamination, or land stability can be mitigated;</i></p>	<p>There is potential for Part A 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 A would ensure that identified physical and environmental constraints posed to Part A as a result of contamination or land stability can be mitigated.</p>

Policy	Relevant Policy Objectives	Significance of Part A on Policy Objective(s)
	<p><i>“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.”</i></p>	<p>Significance of Part A 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.</p>
<p>Northumberland Local Plan: Draft Plan for Consultation (January 2019) (Ref. 11.16)</p>	<p>Policy POL 1 unstable and contaminated land</p> <p><i>“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.</i></p> <p><i>“Planning applications for proposals on land that is potentially unstable or contaminated shall be accompanied by an assessment showing:</i></p> <p><i>“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;</i></p> <p><i>“b) the remedial measures needed to allow the development to go ahead safely giving consideration to the potential end users, including, as appropriate:</i></p> <ul style="list-style-type: none"> <i>i. removing the contamination;</i> <i>ii. treating the contamination;</i> <i>iii. protecting and/or separating the development from the effects of contamination; and</i> <i>iv. addressing land instability; and</i> <p><i>“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.”</i></p> <p>Policy POL 2 Pollution and air, soil and water quality</p> <p><i>“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.</i></p> <p><i>“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.</i></p>	<p>There is potential for Part A 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 A would ensure that identified physical and environmental constraints posed to Part A as a result of contamination or land stability can be mitigated.</p> <p>Significance of the Part A 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.</p> <p>There is potential for Part A 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 A would ensure that pollution events are prevented, and Part A would not cause unacceptable impacts on the environment.</p>

Policy	Relevant Policy Objectives	Significance of Part A on Policy Objective(s)
	<p><i>“3) Development proposed where pollution levels are unacceptable, and unable to mitigate to acceptable levels, will not be supported.</i></p> <p><i>“5) Development will be required to help:</i></p> <p><i>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.”</i></p> <p>Policy POL 3 Agricultural land quality</p> <p><i>“1) Development of the “best and most versatile” agricultural land will not be supported unless it can be demonstrated that:</i></p> <p><i>a) There are no suitable alternative sites on previously developed or lower quality land; and,</i></p> <p><i>b) The need for development clearly outweighs the need to protect such land in the long term; or</i></p> <p><i>c) In the case of temporary/ potentially reversible development (for example, minerals), that the land would be reinstated to its pre-working quality.”</i></p>	<p>Significant volumes of soils would be displaced as a result of Part A, 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 A is optimised, and the soil quality of displaced soils is maintained.</p> <p>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 A. However, given that Part A comprises the widening of the existing carriageway there are no suitable alternative sites. The need for Part A, as a nationally significant infrastructure project, clearly outweighs the need to protect such land in the long term.</p> <p>There is therefore the potential for Part A 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 A would ensure policy objectives are not compromised.</p>
	<p>Policy MIN 4 safeguarding mineral resources</p> <p>MSAs are identified around areas of:</p> <p>a) Carboniferous limestone</p> <p>b) Clay (including brick clay, brick shale and fireclay)</p> <p>c) Coal</p> <p>d) Igneous rock</p> <p>e) Sand and gravel</p> <p>f) Sandstone</p> <p>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.</p> <p>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:</p> <ul style="list-style-type: none"> - 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. 	<p>Sections of MSAs relating to sand and gravel and coal have been identified, however these would not be permanently sterilised as a result of Part A.</p>

Policy	Relevant Policy Objectives	Significance of Part A on Policy Objective(s)
	<ul style="list-style-type: none">- 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/6.10)**, the **Scoping Opinion (Application Document Reference: TR010041/APP/6.12)** 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 the 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, associated with industrial / military land uses. Impacts
 - 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 A such as surface water runoff (containing chemical and physical contaminants) and the potential for isolated significant release of chemical and physical contaminants.
- 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. Since the **Scoping Report (Application Document Reference: TR010041/APP/6.10)** for Part A the GIR has been completed (refer to **Appendix 11.2: GIR, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) and has not identified sources of contamination in the vicinity of piled bridge abutments. Therefore, due to the lack of a source of contamination, the associated risks of piles creating preferential pathways for mobile contaminants to migrate vertically (as piles have the potential to create preferential pathways) has subsequently been scoped out of this assessment.
- 11.4.4. Also, since the **Scoping Report** was produced (**Application Document Reference: TR010041/APP/6.10**) the Northumberland Local Plan Mineral Resource Safeguard Technical Paper (**Ref. 11.17**) was produced, which illustrates MSAs. Whilst MSAs have been identified within the Order Limits, the potential impacts upon permanent sterilisation of these resources, based on professional judgement, are considered to be negligible, and therefore have been scoped out of the assessment for construction and operation. This is due to them being located primarily in areas of temporary land take as part of the construction works or on the periphery of areas of carriageway widening and it would not be feasible to extract the minerals as part of the works due to their depth without impacting the

structural integrity of the exiting A1 carriageway or due to the extremely small extent of the encroachment onto the MSAs. Therefore, the magnitude threshold criterion for sterilisation of MSAs is not reached as a result of Part A, because:

- a. Where the design would result in changes to the highway, it would so on sections that are already online i.e. the extent to which Part A would further encroach on the MSAs is minimal.
- b. Where MSAs are within the Order Limits, but do not fall under either the (existing) online, or design, the resource would not be impacted by sterilisation due to the temporary nature of the works.

CONSULTATION

- 11.4.5. 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**.
- 11.4.6. 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	31 January 2018 Email	<p>The Applicant should consider the following issues as part of the ES:</p> <ul style="list-style-type: none"> - The degree to which soils are going to be disturbed/harmed as part of this development and whether ‘best and most versatile’ agricultural land is involved. This will normally require a detailed survey if one is not already available. For further information on the availability of existing agricultural land classification (ALC) information refer to www.magic.gov.uk Natural England Technical Information Note 049 - Agricultural Land Classification: protecting the best and most versatile agricultural land (Ref. 11.18) also contains useful background information. - If required, an agricultural land classification and soil survey of the land should be undertaken. This should normally be at a detailed level, e.g. one auger boring per hectare, (or more detailed for a small site) supported by pits dug in each main soil type to confirm the physical characteristics of the full depth of the soil resource, i.e. 1.2 m. - The ES should provide details of how any adverse impacts on soils can be minimised. Further guidance is contained in the Defra Construction Code of Practice for the Sustainable Use of Soil on Development Sites (Ref. 11.19). - For highways or railway schemes and similar linear development involving temporary disturbance of land attention should be given to: <ul style="list-style-type: none"> - The reinstatement of borrow pits, infilling, compounds and access routes etc to a satisfactory standard for their intended after use. - A programme of post – restoration aftercare for such temporarily disturbed areas. - Reinstatement and/or rationalisation of field boundaries. - Provision for existing and future land drainage requirements. - Movement of agricultural traffic (including livestock), and access to fields. - Proposals for severed or irregular blocks of land, which would no longer be viable for farming, etc. - Developers (or their consultants) are also advised to seek guidance from the local Defra Animal and Plant Health Offices, both at the design stage and prior to commencing soil movement operations on agricultural land, to prevent the disturbance of carcass burial pits, or the inadvertent spreading of soil borne plant or animal diseases. 	An ALC survey has been completed in accordance with the guidance and mitigation measures have been proposed to minimise effects on agricultural soils.
NCC – Public Health Protection Unit	24 January 2018 Email	<p>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). The southern part of Part A (Fairmoor to Highlaws) is within a Coal Authority Development Low Risk Area. North of this the majority of the Order Limits of Part A lies outside of any Coal Authority consultation area until Causey Park.</p> <p>To the east of Causey Park and the grid square which includes Causey Park Lodge and Causey Park Hagg are located within a Coal Authority Development Low Risk Area. There appears to be an outcropping seam running parallel to the east of the existing A1 between the north junction for Causey park and the junction at Causey Park Lodge; however, this may subcrop beneath the till.</p> <p>There are also two parcels of land which are Coal Authority Development High Risk Areas associated with the quarry between Causey Park Lodge and Causey Park Hagg (PCL006113). North of Felmoor Park most of the land is within a Coal Authority Development Low Risk Area. The location of the historic</p>	The supplied information has been included within the relevant parts of the baseline conditions section (refer to Section 11.7).

Consultee	Date and Type of Consultation	Summary of Consultation Response	Action
		mine shaft on Eshott Airfield is a High Risk Area but of limited extent. The Development Low Risk Area continues up to the northern extent of the development area. No Regionally Important Geological and Geomorphological Sites (RIGS) have been identified on or surrounding the site.	

METHODOLOGY

- 11.4.7. This chapter assesses the potential impacts of Part A on soil, geology and secondary associated receptors (e.g. controlled waters, designated sites) within the Study Area (as illustrated on **Figure 11.1: Study Area, Volume 5** of this ES (**Application Document Reference: TR010041/APP/6.5**). 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. 11.20**), DMRB Volume 11 Section 3, Part 11; Geology and Soils for geology and soils receptors (**Ref. 11.21**) and the Environment Agency Model Procedures for the Management of Land Contamination Document (CLR 11) (**Ref. 11.22**).
- 11.4.8. 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 effects.
- 11.4.9. The potential impacts take into consideration both the construction and operation of Part A.
- ### Contaminated Land Assessment Methodology
- 11.4.10. Contaminated land related issues have been assessed in accordance with Model Procedures for the Management of Contaminated Land (CLR11) (**Ref. 11.22**). 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 11.2: GIR, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**) for further details on the assessment methodology.

Agricultural Land and Ground Stability

- 11.4.11. 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. 11.18**).
- 11.4.12. 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 A in terms of permanent and temporary land take.
- 11.4.13. 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

- 11.4.14. 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. 11.20**).
 - b.** DMRB Volume 11 Section 3, Part 11: Geology and Soils (1993) (**Ref. 11.21**).
 - 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. 11.23**).
 - d.** Construction Industry Research and Information Association (CIRIA) C532 (2001) Control of Pollution from Construction Sites (**Ref. 11.24**).
 - e.** HSE (2006) INDG258 Safe Work in Confined Spaces (**Ref. 11.25**).
 - 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. 11.26**).
 - g.** British Standards (BS) Institute BS10175 (2011+A2:2017) Investigation of Potentially Contaminated Sites – Code of Practice (**Ref. 11.27**).
 - h.** British Standards Institute BS5930 (2015) Code of Practice for Ground Investigations (**Ref. 11.28**).
 - i.** Environment Agency (2018) Approach to Groundwater Protection (**Ref. 11.29**).
 - 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. 11.21**).
 - k.** Defra Construction Code of Practice for the Sustainable Use of Soil on Construction Sites (2009) (**Ref. 11.19**).
- 11.4.15. The following Planning Practice Guidance are considered relevant to this assessment:
- a.** Land affected by contamination (July 2019) (**Ref. 11.30**) outlines the system for identifying and remediating contaminated Study Areas.

- b.** Natural Environment (Section 3) (July 2019) (**Ref. 11.31**) 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. 11.32**) outlines why these are important considerations in development.
- d.** Land Stability (July 2019) (**Ref. 11.33**) 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

- 11.4.16. 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. 11.21**).
 - b.** DMRB Volume 11, Section 3, Part 6: Land Use (2001) (**Ref. 11.20**) for the assessment of agricultural land quality only.
- 11.4.17. These guidance documents have been replaced by DMRB LA 109 Geology and Soils Revision 0 (LA 109) (**Ref. 11.34**) which was released in October 2019.
- 11.4.18. 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.
- 11.4.19. The findings of the sensitivity test are detailed in **Appendix 11.5: Geology and Soils DMRB Sensitivity Test, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**) 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

- 11.4.20. Information has been gathered from the sources described below to identify and assess effects on geology and soils.
- 11.4.21. The **PSSR (Appendix 11.1, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) gathered data 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 Study Area since 2015 / 2016, the

information within the report is considered representative of the current site conditions within Part A.

- 11.4.22. Intrusive ground investigation works along and in close proximity to the proposed new alignment of the carriageway were undertaken in 2018 in accordance with British Standards BS5930 Code of Practice for Ground Investigations (**Ref. 11.28**) and BS10175 Investigation of Potentially Contaminated Sites (**Ref. 11.27**). The **GIR** is included within **Appendix 11.2, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**) The ground investigation included testing soil and groundwater to assess for actual sources of contamination within the Order Limits and undertook investigation to assess for shallow mine works to define ground stability risks.
- 11.4.23. The ALC survey was carried out in 2018 in accordance with ‘Agricultural Land Classification of England and Wales’ (**Ref. 11.18**). The survey included intrusive sampling of the accessible agricultural land in order to define the agricultural soil grade and is presented in **Appendix 11.3: Agricultural Land Classification, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**).
- 11.4.24. A Coal Mining Risk Assessment (CMRA) has been completed due to Part A crossing a Coal Authority Defined Development High Risk Area (DHRA). The CMRA is included within **Appendix 11.4: Coal Mining Risk Assessment, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**). 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.
- 11.4.25. 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. 11.35**)
 - b.** Natural England National Character Area Profile No. 01 North Northumberland Coastal Plain (**Ref. 11.36**)
 - c.** Natural England MAGIC Database (**Ref. 11.37**)
 - d.** British Geological Survey (BGS) Minerals UK Onshore Mineral Resource Maps Northumberland Tyne and Wear (**Ref. 11.38**)
 - e.** NCC Draft Local Plan – Policies Map – Mineral Safeguarding Areas (**Ref. 11.39**)
 - f.** Coal Authority Interactive Map (**Ref. 11.40**)
 - g.** Environment Agency Catchment Data Explorer (**Ref. 11.41**)
 - h.** BGS Geology of Britain Viewer (**Ref. 11.42**)

SIGNIFICANCE OF EFFECTS

- 11.4.26. 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 receptor or receiving environment is assessed as major, moderate, minor or negligible and the sensitivity of the receptor assessed on a scale of high, medium, low or 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.

- 11.4.27. With specific reference to agricultural land the magnitude of impact would depend on the amount of temporary and permanent land required for Part A. The temporary agricultural land take required for Part A is estimated to be 63 ha. The agricultural permanent land take required for Part A is estimated to be 109 ha.
- 11.4.28. 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 judgment, is taken into consideration in the assessment of the magnitude of impacts as shown in **Table 11-5**.

Table 11-5 - Geology and Soil Sensitivity Criteria

Sensitivity	Description	Commentary
High	<p>Areas containing geological, hydrological or habitat features considered to be of national or international interest, for example SSSI.</p> <p>Agricultural land classified as Grade 1 and 2 and 3a (excellent to good) BMV land.</p> <p>Highly permeable superficial deposits allowing free transport of contaminants to groundwater and surrounding surface waters.</p> <p>Study Area located within a Source Protection Zone (SPZ) 1 or 2.</p> <p>Underlying geology classified as a Principal Aquifer.</p> <p>Wetland/watercourse of Good Ecological and/or Chemical Potential under the WFD.</p> <p>Residential end use (particularly with gardens).</p>	<p>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:</p> <ul style="list-style-type: none"> - 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.

Sensitivity	Description	Commentary
Medium	<p>Areas containing features of designated regional importance, such as RIGS, considered worthy of protection for their educational, research, historical or aesthetic importance.</p> <p>The Study Area located within a SPZ 3.</p> <p>Underlying geology classified as a Secondary A aquifer.</p> <p>Site operatives / construction workers coming into contact with soils and groundwater.</p> <p>Moderately permeable superficial deposits allowing some limited transport of contaminants to groundwater and surrounding surface waters.</p> <p>Wetland or watercourse of Moderate Ecological or Chemical Potential under the WFD.</p> <p>Agricultural land classified as Grade 3b (moderate quality).</p> <p>Commercial end use.</p>	<p>Examples of 'Medium' sensitivity receptors include:</p> <ul style="list-style-type: none"> - Shallow soils with medium permeability/less sensitive groundwater where potential contaminants are less likely to migrate to the receiving water 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	<p>Geological features not currently protected and not considered worthy of protection.</p> <p>Low permeability superficial deposits likely to inhibit the transport of contaminants.</p> <p>Study Area not located within an SPZ.</p> <p>Underlying geology classified as unproductive strata.</p> <p>Wetland/watercourse of Poor Ecological and/or Chemical Potential under the WFD or no WFD classification.</p>	<p>'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:</p> <ul style="list-style-type: none"> - Groundwater in areas where other potential impacts have resulted in poor groundwater quality. - Areas below significant infrastructure such as roads.

Sensitivity	Description	Commentary
	<p>Agricultural land classified as Grade 4 and 5 (poor and very poor quality).</p> <p>Highways and pavements end use.</p>	
Negligible	No sensitive environmental receptors identified.	

Table 11-6 - Geology and Soils Magnitude Impact Criteria

Magnitude	Description
Major	<p>Significant (greater than 50%), or total loss of a Study Area of recognised geological importance.</p> <p>Significant contamination identified, in excess of relevant thresholds for protection of Controlled Waters.</p> <p>Loss of ≥ 50 ha of agricultural land.</p> <p>Significant impact upon human health (potential life threatening chronic health disease or acute risks to health).</p> <p>Significant (greater than 50%), loss of building or infrastructure.</p>
Moderate	<p>Partial loss (between approximately 10% to 50%) of a Study Area of recognised geological importance.</p> <p>Localised groundwater or marginal contamination or potential but not proven contamination.</p> <p>Loss of 20 – < 50 ha of agricultural land.</p> <p>Moderate impact on human health (potential for reduced chronic health non-life threatening).</p> <p>Partial damage (between approximately 10% to 50%) of buildings and infrastructure.</p>
Minor	<p>Minimal effect (a loss of up to 10%) on a Study Area of recognised geological importance.</p> <p>No significant groundwater contamination identified or could reasonably be expected based on desk study findings.</p> <p>Loss of 5 – < 20 ha of agricultural land.</p> <p>Minor/insignificant impact upon human health (potential for minor detriment to chronic health).</p>

Magnitude	Description
	Minimal structural effect (a loss of up to 10%) of buildings and infrastructure.
Negligible	<p>Very slight change from baseline conditions. Change hardly discernible, e.g. short-term compaction from machinery movements.</p> <p>No groundwater contamination above relevant thresholds identified or could reasonably be expected based on desk study findings.</p> <p>Loss of < 5 ha of agricultural land.</p> <p>No impact upon human health.</p> <p>No damage or loss of buildings and infrastructure.</p>

11.4.29. 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

11.4.30. Environmental effects considered to be Moderate or greater are considered to be potentially significant within the context of the 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.

11.4.31. 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 A.

FUTURE BASELINE

- 11.4.32. The future baseline describes the baseline conditions that are expected to develop and evolve over an approximate fifteen-year period if Part A 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 A 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 for assessing the magnitude of impact or sensitivity of soils and geology related receptors for the purposes of carrying out EIA. Therefore, the methodology in this assessment has been developed using best practice based on projects of a similar nature.
- 11.5.4. To assess the quality of agricultural land, an independent review of the ALC for Part A has been undertaken as reported in **Appendix 11.3: Agricultural Land Classification, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**). This assessment of the likely significant effects relies upon the accuracy of those datasets and information as provided by third parties. Two small parcels of land, extending to 1.12 ha or 0.7% of the Order Limits, were not surveyed because site access was not granted by the landowners and therefore this area has been assumed to be BMV for the purposes of this assessment.

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.

11.6. STUDY AREA

- 11.6.1. The Study Area incorporates the Order Limits plus a buffer of 250 m, as illustrated on **Figure 11.1: Study Area, Volume 5** of this ES (**Application Document Reference: TR010041/APP/6.5**). It is considered that this is the only area that would be impacted 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 A. A 250 m buffer area associated with contamination migration is consistent with guidance document R&D Publication 66 (**Ref. 11.26**), when considering the impacts of contamination on sensitive environmental receptors.

11.6.2. Part A was broadly split in to four sub-sections (as illustrated on **Figure 11.1: Study Area, Volume 5** of this ES (**Application Document Reference: TR010041/APP/6.5**)) for the purposes of the ground investigation assessment as set out in the **GIR (Appendix 11.2, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) and is described below:

- a. Section A1** Chainage (Ch.)10870 – Ch.13790; widening to the east of the existing A1 carriageway which is currently largely at grade. Two major embankments up to 3.7 m in height are required where Part A traverses two culverts. One major cutting up to 3.8 m deep is encountered between Ch.11260 and Ch.11365, and two minor cuttings of up to 1.8 m deep are encountered at between Ch.11370 and Ch.11530, and between Ch.11900 and CH.12290.
- b. Section A2** Ch.13790 – Ch.20040; new off-line section of road. Predominantly minor earthworks have been proposed, mainly comprising cuttings up to 2.4 m in depth. Major proposed earthworks include an embankment up to 6.7 m in height between Ch.13950 and Ch.14130, an embankment up to 4.2 m in height between Ch.16810 and Ch.17300, a cutting up to 3.5 m deep between Ch.17490 and Ch.18100, an embankment up to 3.0 m in height between Ch.18100 and Ch.18430, a cutting up to 5.4 m deep between Ch.18430 and Ch.18780, and, an embankment up to 5.9 m in height between Ch.19130 and Ch.20050. Significant past mining activity has been identified in the vicinity of Causey Park.
- c. Section A3** Ch.20040 – Ch.21910; widening is predominantly to the west of the existing A1 carriageway which is currently at grade. No major earthworks have been proposed.
- d. Section A4** Ch.21910 – Ch.23600; widening predominantly to the west of the existing A1. Coquet Bridge is proposed between Ch.22460 and Ch.22670. Three major cuttings up to 12 m deep are proposed and a major embankment is proposed between Ch.23070 and Ch.23260.

11.7. BASELINE CONDITIONS

TOPOGRAPHY

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

- a. Section A1** Ch.10870 – Ch.13800; through this section the existing A1 carriageway runs in a north - south direction and the carriageway itself is generally at grade - a minor earthwork (slope less than 1.5 m high). A major cutting up to 6.5 m deep is encountered between Ch.11260 and Ch.11365. The existing carriageway skirts Hebron Hill to the east of the route, where the A1 rises to a height of 129 m before gently falling to around 85 m at the point where the road traverses Floodgate Burn.

- b. Section A2** Ch.13800 – Ch.20040; there are two low points; one at the River Lyne where the topography slowly rises to 102 m in the vicinity of Tindale Hill before descending again towards a second low point at Earsdon Burn. The route bypasses Causey Park Hag to the west of the route where significant past mining activity has been identified in the vicinity of Causey Park, prior to joining the existing A1 immediately north of Helm with a spot height of 107 m. The A1 follows a south east- north west direction at this location.
- c. Section A3** Ch.20040 – Ch.21910; existing A1 carriageway is currently at grade.
- d. Section A4** Ch.21910 – Ch.23600; the topography through this section is marked by a series of major cuttings up to 10.5 m deep and the carriageway crosses the River Coquet between Ch22400 – 22670 which has a relatively deep sided river valley. The existing A1 crosses another low point on a major 8.0 m embankment through a forested section marked as Park Wood where a subway traverses under the road and an unnamed watercourse drains to the east towards the town of Felton.

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 A 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. Refer to **Appendix 11.3: Agricultural Land Classification, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**) for further information on the ALC system.
- 11.7.4. The temporary and permanent land-take associated with Part A would comprise a total area of approximately 242 ha, of which approximately 172 ha is currently in agricultural use. The permanent land-take associated with Part A would comprise an area of approximately 167 ha of which approximately 109 ha is in agricultural use. The temporary land-take associated with Part A comprises an area of approximately 75 ha of which approximately 63 ha is in agricultural use.
- 11.7.5. Due to the area of agricultural land potentially impacted by Part A, a detailed agricultural land survey was carried out to define the quality within the Order Limits (refer to **Appendix 11.3: Agricultural Land Classification, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)). 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 a boring density of circa 1 auger boring per ha. In addition, soil pits were excavated to determine subsoil characteristics which could not be identified from the auger samples. A total of 503 auger points and 13 soils pits were progressed as part of the survey. Soils and associated agricultural land quality identified as part of the survey is summarised in **Table 11-8** below and illustrated in **Appendix 11.3: Agricultural Land Classification, Volume 7** of this ES. The agricultural area of Part A 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 Order Limits

Agricultural Land Quality Grade	Details
Grade 1 (excellent quality)	No land has been categorised as this grade
Grade 2 (very good quality)	<p>Two small areas of Grade 2 land identified, occupying 2.28 ha, or 1.3%, of the agricultural area of the Order Limits. These are located in the north to the southeast of the River Coquet and in the south on the foot-slopes of Hebron Hill.</p> <p>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.</p>
Subgrade 3a (good quality)	<p>Subgrade 3a soils were mapped across 12.84 ha, or 7.5% of the agricultural area of the Order Limits.</p> <p>This land is also categorised as BMV, of good quality and capable of producing consistently high yields of a narrower range of agricultural crops including cereals, oilseed rape, root crops and/or grass and will be suited to spring cropping. In wetter years the land is likely to be prone to workability and root crop quality issues which may moderate yields and flexibility.</p>
Subgrade 3b (moderate quality)	<p>Subgrade 3b were mapped over 111 ha, or 64.7 %, of the agricultural area of the Order Limits. This Subgrade occupies land of moderate quality with limitations imposed by soil wetness and workability. It will be suited to a relatively narrow range of mainly winter sown combinable crops and grassland. In dry years, yields of combinable crops are likely to be good but when wet, cultivations, sowing, maintenance and harvesting are likely to be more variable, increasing costs and decreasing yields.</p>
Grade 4 (poor quality)	Grade 4 soils were mapped across 44.4ha, or 25.9%, of the agricultural land within the Order Limits.

Agricultural Land Quality Grade	Details
	This land is poor quality with severe limitations imposed by soil wetness and workability due to the heavy topsoil texture, slowly permeable and occasionally disturbed subsoils. The land requires intensive artificial underdrainage schemes to be productive and it will be most suited to winter sown combinable crops of oilseed rape and cereals or to grass used for conservation and grazing. Spring arable cropping is unlikely to be feasible in all but the very driest years.
Grade 5 (very poor quality)	No land has been categorised as this grade.
Not Surveyed	Two small parcels of land measuring 1.12 ha (0.7%) of the Order Limits was not surveyed because of site access restrictions. The land not surveyed has been assumed to be agricultural land and assumed to be BMV.

11.7.6. Non-agricultural land has been mapped as present over 68.58 ha, or 28%, of the total Order Limits. Non-agricultural land includes the existing A1 and its slip roads and junctions, woodland, service roads, farm tracks, recreational and residential land within the proposed Order Limits.

11.7.7. The detailed survey (refer to **Appendix 11.3: Agricultural Land Classification, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) concluded that the agricultural land within the Order Limits is a mix of predominately poorer quality land but ranging from Grade 2 through to Grade 4. Moderate quality land (ALC Subgrade 3b) and poor-quality land (ALC Subgrade 4) occupy approximately 156 ha (c.91%) of the agricultural land within the Order Limits. ALC Grade 2 (very good quality) and Subgrade 3a (good quality) together with the areas which were not surveyed due to access restrictions occupy approximately 16 ha (c.9%) of the agricultural land within the Order Limits and fall within the BMV category.

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

Table 11-9 – Breakdown of Temporary and Permanent Agricultural Land Take by Grade

Agricultural Land Quality Grade	Permanent Land Take Area (ha)	Temporary Land Take Area (ha)
Grade 1 (Excellent quality)	0	0

Agricultural Land Quality Grade	Permanent Land Take Area (ha)	Temporary Land Take Area (ha)
Grade 2 (very good quality)	0.76	1.52
Subgrade 3a (good quality)	7.91	4.93
Subgrade 3b (moderate quality)	72.83	38.29
Grade 4 (poor quality)	27.48	16.92
Grade 5 (very poor quality)	0	0
Not surveyed (classed as BMV)	0.06	1.07
Total Agricultural	109.03	62.73
Non-agricultural land	57.36	12.12

GROUND CONDITIONS

11.7.9. British Geological Survey (BGS) mapping has been studied (as recorded within the **PSSR**, in **Appendix 11.1, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) and indicates the site is underlain by the following geological sequence.

Superficial Geology

11.7.10. The superficial geological sequence within the Order Limits is illustrated on **Figure 11.2: Superficial Geology, Volume 5** of this ES (**Application Document Reference: TR010041/APP/6.5**) and comprises localised deposits of Recent alluvium (sand, silt, clay, peat), river terrace sands and gravels adjacent to the River Coquet in the extreme northern part of the route, above extensive deposits of Devensian, Glacial Till (stoney clay), Glaciolacustrine (laminated clays) and Glaciofluvial (sand and gravel). The glacial deposits are encountered extensively at the surface and attain, in places, thicknesses in excess of 25 m. Glacial Till is sandy or gravelly clay and clayey silt. Cobbles are frequently observed. Gravel and cobbles are sub-angular to sub-rounded clasts of sandstone, mudstone and quartzite.

11.7.11. Granular glacial deposits within the Glacial Till form layers of loose to medium dense, silty sand with gravel. Material is noted as well graded, with sand grains dominant over gravel. The thickness of these layers varies from 1 m to 5 m.

Bedrock Geology

- 11.7.12. The bedrock geology is illustrated on **Figure 11.3: Bedrock Geology, Volume 5** of this ES (**Application Document Reference: TR010041/APP/6.5**). The bedrock geology comprises a succession of Carboniferous rocks that were deposited in a coastal and shallow marine environment. Rock head elevation is variable along the route and coincides with changes in the thickness of Glacial Till. The Stainmore Formation underlies the superficial deposits for the majority of the route. This Formation comprises an interbedded sequence of mudstones, siltstones and sandstones.
- 11.7.13. Minor coal seams also occur within the sequence. Coal Measures occur above the Stainmore Formation cropping into the base of the Glacial Till to the east of the route. Lower Coal Measures are present and comprise a sequence of mudstones, shales, siltstones, sandstones and coal. Seatearth, associated with coal seams, is known to have been worked in the region for use as refractory brick manufacturing. The Corbridge Limestone formation occurs in the vicinity of the River Coquet.
- 11.7.14. Coal seams up to 0.5 m thick occur between 13 m to 17 m below ground level (bgl) at Causey Park, and the Victoria Seam was worked at Causey Park Mine. Thin coal seams (less than 0.1 m) are observed between 30-35 m bgl south of Felton.

Ground Investigation

- 11.7.15. A ground investigation was carried out along the length of Part A in 2018. It is noted that ground investigation works were not undertaken at the site of the proposed River Coquet bridge during this phase of works, although historical ground investigation data is available at this location. The ground conditions recorded in the ground investigation are detailed within the **GIR (Appendix 11.2, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) and summarised below.

Topsoil

- 11.7.16. Topsoil was encountered in the majority of exploratory holes along Part A. A summary of the average depths of topsoil along the route is given in **Table 11-10**.

Table 11-10 - Typical Topsoil Depths

Route Section	Typical Topsoil Depth (m)
Section A1	0.1 – 0.9 (Average depth = 0.3)
Section A2	0.1 – 0.6 (Average depth = 0.3)
Section A3	0.1 – 0.5 (Average depth = 0.27)
Section A4	0.1 – 0.9 (Average depth = 0.28)

Made Ground

- 11.7.17. Made Ground was encountered in 60 No. exploratory holes (17 boreholes, 23 trial pits and 13 window samples). The deposits were generally encountered as engineered or landscape fill associated with the existing A1 and its associated side roads and infrastructure. Occasionally thin deposits (0.3 – 0.5 m thickness) of apparent Made Ground were encountered within the Study Area adjacent to field boundaries and these are thought to be associated with farming processes and potential land drain construction.
- 11.7.18. The composition of Made Ground was variable comprising of granular and cohesive deposits including sandy gravelly clay, clayey gravelly sand and slightly clayey sand. Cobbles and boulders are of various lithologies, along with fragments of plastic bottles, glass, brick, clinker, burnt shale, concrete, pottery, geotextile and drinks cans were noted in a number of the exploratory holes. The deposits were encountered in thicknesses varying between 0.2 m and 16.2 m and were generally associated with exploratory holes formed post construction of the existing A1.

Alluvium

- 11.7.19. Based on the Geological Maps, the Alluvium deposits were expected to be encountered in the low-lying areas of the Order Limits and associated with the main watercourses as listed in **Table 11-10**. Discrete layers of Alluvium can also be found where there are areas of prolonged surface flooding, or notable surface depressions where historical and/ or recent ponds can be found.
- 11.7.20. Alluvium was encountered in 21 exploratory holes along the length of the proposed route (7 boreholes, 5 trial pits and 9 window samples); of these 16 were located in the vicinity of the known watercourses. The top of the stratum was encountered between the ground surface and 0.5 m bgl and the stratum base was encountered between 0.3 m and 3.6 m bgl, with stratum thickness varying from 0.2 m to 2.4 m (average 1.0 m).

Glacial Deposits

- 11.7.21. The route corridor and surrounding area is primarily underlain by glacial deposits and more specifically Glacial Till. The glacial deposits include extensive formations of tills, silts, sands and gravels which cover much of lowland Northumberland.

Glacial Till

- 11.7.22. Cohesive Glacial Till was the principal drift material encountered historically and during the recent **GIR** (presented in **Appendix 11.2, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) being present across the entire Order Limits. The material was encountered along the proposed route in 309 exploratory holes (129 boreholes, 158 trial pits and 22 window samples). The stratum was encountered underlying the Topsoil where Made Ground or Alluvial deposits were absent and was frequently interbedded with material considered to be granular till, and laminated clays deemed to represent Glaciolacustrine deposits.

Granular Glacial Deposits

- 11.7.23. Material considered to represent granular Glacial Till or Glaciofluvial Sands and Gravels was encountered in 98 exploratory holes (40 boreholes, 50 trial pits and 8 window samples). The stratum was typically encountered as discrete layers within the Cohesive Till with the top of the stratum present between 0.2 m and 15.2 m bgl (average 2.7 m bgl) and the stratum base encountered between 0.3 m and 15.3 m bgl (average 3.5 m bgl). The stratum thickness was found to vary from 0.1 m to 3.2 m with an average thickness of 0.85 m.

Glaciolacustine Deposits

- 11.7.24. The material is distributed within 46 exploratory holes (27 boreholes, 18 trial pits and 1 window sample). The majority of these exploratory holes are located north of Ch.19500 where the proposed route merges onto the existing A1. The material is found in discrete and reoccurring layers within the exploratory holes and is frequently interbedded with the other glacial deposits. The top of the stratum was encountered between 0.1 m and 9.7 m bgl (average 3.0 m bgl) and the stratum base was encountered between 2.4 m and 18.65 m bgl (average 5.6 m bgl), with stratum thickness varying from 0.2 m to 11.2 m (average 2.5 m).

Weathered Bedrock Horizon

- 11.7.25. A relatively thin layer of residual soil representing the completely weathered zone of the underlying bedrock was encountered overlying the intact rock across the majority of the route and it was especially obvious where rock head was closer to the ground surface.
- 11.7.26. The completely weathered deposits are generally described as very weak Mudstone, Siltstone or Shale recovered as a stiff clay or firm to stiff sandy gravelly clay and the gravel is composed of material from the underlying parent rock (predominantly mudstone and to a lesser extent siltstone).

Mudstone

- 11.7.27. A large proportion of the bedrock encountered underlying Part A was described as Mudstone. The material was encountered in 52 exploratory holes (47 boreholes, 3 trial pits, 2 window samples) This was proven between depths of 0.6 m and 47.25 m bgl with a maximum stratum thickness of 13.0 m. It predominantly comprised dark grey to black extremely weak to weak Mudstone, occasionally strong and frequently described as carbonaceous and micaceous or finely laminated with subordinate horizons of coal.

Sandstone

- 11.7.28. 66 exploratory holes (65 boreholes and 1 trial pit) encountered Sandstone material between the ground level in the vicinity of the River Coquet, proven to a depth of 46.2 m bgl. Stratum thickness varies between 0.1 m and 10.18 m (average 2.4 m). The intact Sandstone was described as grey, fine to medium grained Sandstone and generally classified as weak becoming medium strong to very strong but occasionally remaining weak even at depth. Frequently the Sandstone was described as interbedded with Mudstone or occasionally Siltstone (Undifferentiated Coal Measures).

Siltstone

- 11.7.29. Siltstone was encountered relatively less frequently across Part A in 24 exploratory holes and is predominantly described as moderately strong to strong, occasionally weak dark grey/ brown occasionally carbonaceous Siltstone. The material is recorded with thicknesses of between 0.05 m and 2.1 m, but typically 0.35 m and proved to depths of up to 35.25 m below ground level. The Siltstone is occasionally described as interbedded with Sandstone (Undifferentiated Coal Measures).

Limestone

- 11.7.30. The Corbridge Limestone is a shelly unit within the Stainmore Formation that occurs in the vicinity of the River Coquet. The material is distributed within in 12 boreholes in the immediate vicinity of the river valley between depths of 4.0 m bgl and 50 m bgl (13.7 m OD - 56.8 m OD) with recurring stratum of thicknesses varying between 0.11 m and 8.78 m (average 2.3 m). The material is described as generally weak but sometimes strong grey silty (historically impure or muddy) fine grained thinly to moderately bedded Limestone with very occasional thinly laminated weak black calcareous Mudstone.

Coal

- 11.7.31. Coal seams with thicknesses of between 0.05 m and 2.1 m, but typically 0.35 m in thickness were encountered in 30 exploratory holes and proved to depths of up to 35.25 m below ground level. Of these, three exploratory holes encountered coal recorded in excess of 1.0 m thick (BH11, TPE, and TPI) and these were excavated between Ch22200 and Ch22360, between elevations of 64.0 m OD and 66.6 m AOD which is above the existing A1 carriageway level.
- 11.7.32. The deposits are described as extremely weak to weak, occasionally strong but historically 'poor quality' black sometimes slightly weathered or fissile Coal. Occasionally the coal is recovered as a non-intact sandy gravel. The material is frequently described as thinly interlaminated with organic mudstone and the grading between these materials appears to be difficult to distinguish in places.

Causey Park Dyke

- 11.7.33. Three boreholes and two trial pits were carried out within the vicinity of the tholeiitic intrusion which has been mapped to underlie Part A. These exploratory holes were excavated to a maximum depth of 17.0 m (68.04 m OD). No boreholes have encountered the material to date.

Records of Mines and Mineral Deposits

- 11.7.34. The NCC draft Northumberland Local Plan - Policies Map (**Ref. 11.39**) highlights Mineral Safeguarding Areas (MSAs) associated with deposits of coal and sand and gravel. MSAs are located in the vicinity of Causey Park Bridge (coal), Hebron (sand and gravel) and the northern extent of Part A in the vicinity of West Thirston (coal and sand and gravel). MSAs are illustrated on **Figure 11.4: Mineral Safeguarding Areas, Volume 5** of this ES

(**Application Document Reference: TR010041/APP/6.5**). The MSA at Causey Park Bridge is within the Order Limits, but within an area of temporary works. The MSA at Hebron borders the existing alignment of the A1. The MSA in the vicinity of West Thirston is within the Order Limits, however, this is within areas of temporary works, or along the existing alignment of the A1.

- 11.7.35. Two coal mining areas have been identified within the **PSSR (Appendix 11.1, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)); one at Causey Park Hagg (Ch.17850) and the other adjacent to Eshott Airfield at the northern end of Part A (Ch.20420 - 21400). A mining plan obtained for the coal workings at Causey Park Hagg shows the location of adits and roadways at this location. No mine plan is available for the workings at the northern end of the route although a disused colliery and an old coal shaft is shown on historical mapping for the area.
- 11.7.36. Coal Mining Hazards identified within the Study Area are illustrated on **Figure 11.5: Coal Mining Hazards, Volume 5** of this ES (**Application Document Reference: TR010041/APP/6.5**).
- 11.7.37. A mining report obtained from the Coal Authority as part of the **PSSR (Appendix 11.1, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) stated:
- a. There are nine mine entries within the Study Area
 - b. No mine gas emissions that the Coal Authority are aware of
 - c. The route is underlain by seams of coal for which no records are known, but which may contain unrecorded workings
- 11.7.38. A **Coal Mining Assessment report** has been completed, as provided in **Appendix 11.4, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**) of this ES. The report states that crown holes have been recorded over Causey Park mine workings, which demonstrates a hazard of gradual surface ground settlement or sudden ground collapse is present. The hazard arises from the presence of voided and/or loosened ground above the mine workings. The mine workings are expected at depths of 10-15 m beneath exiting ground level.
- 11.7.39. The intrusive investigation (**Appendix 11.2: GIR, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) did not identify large voids in the mine workings area. However, the small number of exploratory holes means that workings may remain open.
- 11.7.40. The location of the adits is relatively consistent on the mining plans and historical maps. From the anecdotal evidence from the landowner it is likely that they have been either dug out as part of open cast operations or buried when the area of opencast was backfilled.
- 11.7.41. Although there is no positive evidence of workings (i.e. voids, broken ground, loss of flush) below the proposed route of Part A, it is considered that there is a low (but still present) risk of historical coal workings affecting the site. Further details are presented in the **GIR**

(**Appendix 11.2, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)).

HYDROLOGY

- 11.7.42. A number of west to east flowing watercourses cross the alignment of Part A. A summary of these is presented in **Table 11-11** and their location is illustrated on **Figure 11.6: Hydrology – Surface Watercourses, Volume 5** of this ES (**Application Document Reference: TR010041/APP/6.5**).

Table 11-11 - Summary of Watercourses

Watercourse	Chainage
Cotting Burn	10800
Shieldhill Burn	11820
Floodgate Burn	13650
River Lyne	14040
Fenrother Burn	14950
Earsdon Burn	17060
Unnamed tributary of Thirston Burn	18300
River Coquet	22530
Longdike Burn	22960

- 11.7.43. The risk to Part A associated with flooding from rivers is summarised in **Chapter 10: Road Drainage and the Water Environment** of this ES.

HYDROGEOLOGY

- 11.7.44. The underlying Alluvium and Glaciofluvial Deposits are classified by the Environment Agency as Secondary A Aquifers. Glacial Till has been defined as a Secondary Undifferentiated Aquifer. The aquifer classification of the underlying superficial deposits is illustrated on the Defra interactive mapping website (www.magic.defra.gov.uk).
- 11.7.45. The aquifer classification of the underlying bedrock is illustrated on the Defra interactive mapping website (www.magic.defra.gov.uk). The Stainmore Formation, Pennine Lower Coal Measures Formation and Corbridge Limestone are classified as Secondary A aquifers. The Northern England Carboniferous Tholeiitic Dyke Swarm is classified as a Secondary B Aquifer. The bedrock and superficial soil classification, and therefore the associated aquifer designations, are illustrated on **Figure 11.2: Superficial Geology** and **Figure 11.3:**

Bedrock Geology, Volume 5 of this ES (**Application Document Reference: TR010041/APP/6.5**).

- 11.7.46. The far southern extent of Part A is within a Groundwater Source Protection Zone 3 (SPZ).
- 11.7.47. Groundwater levels obtained from the GIR have identified resting groundwater between 1.2 and 13.1 m bgl, with groundwater generally standing around 3 m bgl.
- 11.7.48. NCC provided information on confidential private groundwater abstraction wells. Eight private abstraction wells were within the Study Area.

UNEXPLODED ORDNANCE

- 11.7.49. A detailed desk study assessment was undertaken for Part A. Strategic targets in the general area of the Order Limits include Eshott Airfield (located immediately east of the Order Limits) and public utilities and infrastructure. It is estimated that there is the potential for up to six unexploded bombs, six incendiary bombs and seven high explosive bombs to have been dropped on the Study Area between 1940 and 1941. The UXO hazard plan provided within the Zetica report (**Appendix 11.2: GIR, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) presents the site as low risk with respect to UXO. Given the low associated risks no further consideration of encountering UXO has been undertaken as part of the assessment.
- 11.7.50. 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 has 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

- 11.7.51. No national or regionally important geological related designations are identified within the Study Area.
- 11.7.52. Part A intersects the River Coquet and Coquet Valley Woodland SSSI in the north. The designation relates to the river being relatively unmodified and fast flowing that supports a wide range of flora and fauna.

POTENTIAL SOURCES OF CONTAMINATION

- 11.7.53. 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. 11.22**).
- 11.7.54. Potential sources of contamination within the Study Area have been identified from a review of the **PSSR (Appendix 11.1, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) and consultation information provided by NCC and are identified below as well as being displayed in **Figure 11.7: Potential Contamination Sources, Volume 5** of this ES (**Application Document Reference: TR010041/APP/6.5**).

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

- a. Existing road network (A1), embankment fill materials (potentially pulverised fuel ash, oils and fuels).
- b. Agriculture – slurry, pesticides, herbicides, fertilisers.
- c. WW2 airfield (Eshott) and associated buildings – asbestos, aviation fuel, gasoline, diesel, antifreeze, radium-226 dials, solvents, fire-fighting agents, PCBs, hydraulic fluid, heavy metals.
- d. Garage and historical filling station – oils/fuels.
- e. Infilled ponds and quarries – filled with unknown Made Ground.
- f. Historical landfills, (Eshott – industrial, commercial, household and liquids/sludge wastes and The Helm, Felton - inert wastes).
- g. Foot and mouth burial pits to the west of the proposed Highlaws Junction.
- h. Above ground storage tank, (present on historical mapping at Northgate Farm, north of the junction between the A1 and A697 between 1973 – 1996, contents and condition unknown).
- i. Shallow Mine Workings at Causey Park Hagg – hazardous mine gas.
- j. Hazardous ground gas associated with areas of infilled ground.
- k. General Made Ground associated with fill materials associated with construction of the existing highway and surrounding structures.

POTENTIAL CONTAMINATION SOURCE TO RECEPTOR PATHWAYS

11.7.56. 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, River Coquet).
- d. Lateral and vertical leaching of contaminants into underlying Secondary A Aquifers.

11.7.57. 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 and the distance to properties (>50 m).

GROUND INVESTIGATION CONTAMINATED LAND RISK ASSESSMENT

- 11.7.58. The GIR, including contaminated land assessment, is included in **Appendix 11.2: GIR, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**).
- 11.7.59. Based on the ground investigation data within the **GIR (Appendix 11.2, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) there are limited sources of contamination along the Part A alignment the laboratory results indicated that analytes in all but one of the soil samples analysed meet the conservative assessment criteria for a commercial end use. A potential source of contamination has been identified in an area of the former WWII Airfield (which includes sources in the near vicinity such as a former below ground fuel installation), to the north of the existing Longdike Burn bridge crossing. Hydrocarbon odours were noted in the Made Ground encountered and laboratory results reported exceedances of the generic assessment criteria (GAC) protective of human health in relation to benzo(a)pyrene. Although not exceeding GAC it is also noted that concentrations of Total Petroleum Hydrocarbons were reported above an arbitrary value of 1,000 mg/kg indicating that there could be a potential point source of contamination in this area.
- 11.7.60. The contaminated land risk assessment within the **GIR (Appendix 11-2, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) identified low risks to sensitive receptors (human health and controlled water receptors) in the context of Part A with the exception of a moderate risk associated with inhalation of hazardous ground gases within confined spaces, primarily associated with areas of known or suspected historical coal mining activities.

SENSITIVITY OF RECEPTORS

- 11.7.61. Geology and soils related receptors considered sensitive to the potential impacts of Part A are summarised in **Table 11-12**. The sensitivity has been derived using the criteria set out in **Table 11-5**.

Table 11-12 - Soils and Geology 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

Aspect	Sensitive Receptor	Sensitivity	Justification
	Construction workers Below ground maintenance workers	Medium	Potential for direct exposure to potentially contaminated materials.
Controlled waters (surface watercourses)	Surrounding surface watercourses	High	A number of surface watercourses cross the Order Limits including the River Coquet which is classed as 'Good' in terms of water quality.
Controlled waters (groundwater)	Underlying Groundwater bodies (Secondary A aquifers, SPZ 3 designation located at the southern extent of Part A)	Medium	SPZ grade three present alongside sensitive groundwater bodies (Secondary A aquifer).
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	Surrounding buildings, residential and commercial premises	Medium	Risks associated with hazardous ground gas accumulation and impacting buildings.
	Existing and future highway Infrastructure (pavement, below ground ducts, embankments)	Low	Limited presence of contamination and low risk of ground instability from historical mine workings.
Designated Sites	SSSI – River Coquet and Coquet Valley Woodlands	High	International important designated site identified along Part A.

11.8. POTENTIAL IMPACTS

CONSTRUCTION

- 11.8.1. The impacts on the geology and soils are considered likely to be most significant during the construction phase of Part A, which would include creating embankments, installing new culverts and bridge construction. Further details regarding Part A are presented in **Chapter 2: The Scheme, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**).
- 11.8.2. Potential impacts upon geology and soils as a result of the construction of Part A are summarised in **Table 11-13**.

Table 11-13 - 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	<p>If human health receptors (e.g. construction workers) are exposed to contaminants (associated with historical and present land uses, Made Ground or foot and mouth burial pits) above threshold concentrations protective of human health (e.g. assessment criteria produced using CLEA 1.0.71) there is potential for both temporary and permanent health problems to arise.</p> <p>Construction workers are susceptible to exposure to hazardous gases (primarily methane, hydrogen sulphide, carbon monoxide and carbon dioxide) and/or depleted oxygen levels associated with underlying coal workings within excavations or confined spaces associated with the earthworks and installation of any below ground infrastructure.</p> <p>Excavation of potentially contaminated soils could pose a health risk to the public in the immediate vicinity of Part A during the construction period, through inhalation of contaminated dusts and particulate matter generated by excavation activities.</p> <p>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.</p> <p>Risks of ground collapse during both construction and operational of Part A 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. Three coal shafts (likely to be adits) located within the Order Limits, and potential further unidentified mine openings, potential for ground stability issues if heavy plant and machinery passes over the shafts/adits during the construction.</p> <p>Risks associated with encountering UXO during preparation and construction works of Part A.</p>
Underlying aquifers (groundwater) and surface water bodies	Pollution of Controlled Water Bodies	<p>The disturbance of 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, the River Coquet and associated SSSI, and the SPZ 3 designation located at the southern extent of the Study Area).</p> <p>The use of machinery and plant associated with construction activities (including the establishment of temporary 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.</p> <p>Potential for deep excavations (around bridges, culverts and the proposed Parkwood subway) to require dewatering, water pumped from excavations may contain contaminants, particularly in areas where mine water is encountered, which if not managed appropriately could result in discharge and contamination of surrounding surface watercourses.</p> <p>Risk of potentially generating silt laden contaminated runoff during the earthworks phase of Part A, which is anticipated to cut c.700,000 m³ of material and fill 385,000 m³ of material, leaving surplus to be placed in bunds slopes or used off site, 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.</p>
Agricultural Soil	Reduction in agricultural soil quality Permanent loss of agricultural soils	<p>Topsoil strip estimated to generate approximately 150,000 m³ of material and 60,000 m³ of topsoil placement, leaving a potential surplus of 90,000 m³.</p> <p>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.</p> <p>Agricultural land has been identified to accommodate the temporary construction compounds (refer to Figure 2.5: Temporary Construction Works: Part A, 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.</p>

Receptor	Potential Impact	Cause
		<p>Topsoil with high organic content would be stripped to facilitate development.</p> <p>Physical and chemical characteristics of topsoil along the route of Part A would likely be adversely altered (i.e. compacted/covered) during the construction works.</p> <p>Agricultural land would be temporarily and permanently lost due to land take required to deliver Part A.</p>
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 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 shallow coal workings and in the vicinity of former coal mine shafts and areas of poorly compacted ground.
SSSI (soil and groundwater)	Contamination of water and soil resources	Risk of contamination of a protected habitat via migration of contaminants through the subsurface and via overland flow.

OPERATION

- 11.8.3. The potential operational impacts of Part A on geology and soils are summarised in **Table 11-14**.

Table 11-14 - Geology and Soils Potential Operational Impacts

Receptor	Potential Impact	Cause
Site users; Maintenance workers	Detriment to Human Health	<p>Site users could be exposed to potential contamination present within landscaped areas of Part A such as grassed verges.</p> <p>Maintenance workers could be exposed to potential contamination within areas requiring groundworks during operation such as within service trenches.</p> <p>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 the newly installed drainage infrastructure.</p>
Controlled water bodies (surface watercourses and groundwater)	Pollution of controlled water bodies	<p>Potential for fuel or oil leaks and spills from vehicles using the carriageway to impact surface water bodies.</p> <p>Potential for contaminated surface runoff from the carriageway to impact on controlled waters.</p> <p>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.</p>

- 11.8.4. There are no impacts anticipated on agricultural soils and the built environment during the operation of Part A.

11.9. DESIGN, MITIGATION AND ENHANCEMENT MEASURES

- 11.9.1. The likely mitigation measures to be applied to Part A to avoid, prevent or reduce significant effects to geology and soils related receptors during the design, construction and operation of Part A 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. 11.45**). This would include the production of a Geotechnical Design Report, which sets out geotechnical parameters to facilitate the safe design of Part A from a ground engineering perspective.
- 11.9.3. Detailed design elements of Part A 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 will 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. The surface water runoff would then be directed into a storage swale (open and natural infiltration basin), a tank, and detention basins. Refer to **Chapter 2: The Scheme, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**) and the **Drainage Strategy Report (Appendix 10.5, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)).
- 11.9.6. Where BMV soils are to be lost through permanent land take they are generally associated with extending the existing carriageway and not the offline section of Part A. No areas of landscape planting mitigation are proposed over BMV soils outside the permanent Part A related land take areas.

Construction

- 11.9.7. The construction of Part A 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

- 11.9.8. 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 A. 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.
- f. Mine shafts/adits to be fenced off to stop plant/construction workers passing over them.

Pollution of Controlled Water Bodies

11.9.9. 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 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 in 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 licence or to surface watercourses, subject to the test results 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 monitored/inspected 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.
- o. Particular consideration around the implementation of the pollution control measures outlined in the CEMP would be undertaken associated with the River Coquet bridge construction works given the sensitivity of the surroundings environment (SSSI designation). This would include sediment barriers between earthworks and the construction zone and the watercourse to prevent sediment from washing into the river.
- p. Piling in the vicinity of the River Coquet would be designed to limit any concrete reaching sensitive surface water features, likely to be with the incorporation of casing.
- q. Use seeded biodegradable fibre matting to encourage re-vegetation after works on, or near, the banks of watercourses. This is more applicable to the larger watercourses such as the Longdike Burn.

Agricultural Land

- 11.9.10. An ALC survey has been completed (refer to **Appendix 11.3: Agricultural Land Classification, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) 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 A. It states that a suitable soil management strategy should be developed for Part A to help preserve land quality on temporary land take and areas of

permanent land take (for example, for the Part A embankments). The strategy would help to preserve the soil and retain soil functions such as water and carbon storage.

- 11.9.11. The loss of agricultural land through construction and creation of embankments and additional carriageway would be required to construct Part A. However, agricultural soil would be stripped as part of the construction phase and would be sustainably managed and re-used, where possible. This would include storage and management within twelve proposed temporary topsoil storage areas, which have been identified along the length of Part A for the duration of the construction works, as illustrated on **Figure 2.5: Temporary Construction Works: Part A, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**). The location of storage areas considers existing watercourses and the ground profile to ensure suitability and minimise any potential impacts upon surface water bodies.
- 11.9.12. Although the guidance has recently been withdrawn, without replacement procedures, soil management operations would be carried out in accordance with Defra's Good Practice Guide for Handling Soils (**Ref. 11.46**). This is made up of nineteen sections which describe various phase and alternative methods of soil handling. A soil management strategy would be developed prior to construction when further details of specific construction and earthworks methodologies are finalised. The soil management strategy would form part of the CEMP.
- 11.9.13. The soil management 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. 11.46**) and The Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (**Ref. 11.19**). 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 storage 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 area of organic soil.
 - f. Dust suppression measures, such as damping down, during periods of dry weather.

Hazardous Ground Gas Exposure

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

- a. All works would be conducted in line with HSE publication, Safe Work in Confined Spaces (**Ref. 11.25**).
- 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

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

MITIGATION MEASURES

Construction

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

Agricultural Land

- 11.9.18. The permanent loss of agricultural land would be required due to the construction of embankments, additional carriageway and access tracks needed to deliver Part A. However, as discussed in **paragraph 11.9.11** above, agricultural soils would be stripped and reused where possible.

Ground Instability

- 11.9.19. 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 11.4: Coal Mining Risk Assessment, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) to minimise risks associated with ground collapse and ground related structural damage.
- 11.9.20. 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 any shallow working collapse associated with embankments in areas considered to be at risks 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.

Operation

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

Detriment to Human Health

- 11.9.22. 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. 11.47**), The Confined Space Regulations 1997 (**Ref. 11.48**), The Management of Health and Safety at Work Regulations 1999 (**Ref. 11.49**) and the HSE Guidance, Safe Work in Confined Spaces (**Ref. 11.25**):
- 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

- 11.9.23. 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 A. 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

- 11.9.24. No enhancement measures are proposed for the construction and operation of Part A.

11.10. ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

CONSTRUCTION

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

Detriment to Human Health

- 11.10.2. Potential sources of contamination have been identified within the Study Area (as illustrated on **Figure 11.7: Potential Contamination and Shallow Mine Related Features, Volume 5** of this ES (**Application Document Reference: TR010041/APP/6.5**)). One area of potential concern has been identified in the **GIR (Appendix 11.2, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) associated with an area located close to Eshott Airfield. 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 A.

- 11.10.3. Coal Authority data has indicated shallow (<30 m) coal mining and deeper coal seams beneath the Study Area, which may have the potential to generate hazardous ground gases which, if they migrate inside enclosed spaces, could pose risks to human health.
- 11.10.4. Three coal adits and potential further unidentified mine openings are located within the Order Limits of Part A, presenting possible ground instability risks if plant and workers are passing over them during the construction phase.
- 11.10.5. 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. Risks associated with adits would be mitigated by fencing them off during the construction works.
- 11.10.6. The sensitivity of human health receptors (surrounding site users and construction workers) is low to medium and the magnitude of change is negligible (due to the implementation of mitigation measures). Therefore, there is likely to be a direct, temporary and/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 aquifers associated with the superficial deposits and bedrock and surrounding surface watercourses, particularly the River Coquet SSSI.
- 11.10.8. Construction activities would include major earthworks and storage of soils within the temporary land take alongside the construction of both minor and major earthworks, including embankments up to 13.0 m in height and cuttings up to 12.0 m deep.
- 11.10.9. During the construction of Part A there would be vehicles, including plant and machinery, regularly using and parking within the Order Limits (primarily within the construction compounds). This activity, along with the storage of any construction plant fuels, oils or chemicals would generate the potential for fuels 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 could potentially generate silt laden runoff which could flow towards surface watercourses causing siltation and deoxygenation subsequently detriment to aquatic ecosystems.
- 11.10.10. Mitigation measures included within the **Outline CEMP (Application Document Reference: TR010041/APP/7.3)** and set out in **paragraph 11.9.9** 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. In addition, earthworks would be undertaken across and close to sensitive surface watercourses (Shieldhill Burn, Floodgate Burn, Earsdon Burn) along with the River Coquet. Works in these areas would need diligent management, particularly during periods of inclement weather which would increase the likelihood of silt reaching surrounding surface watercourses.

- 11.10.11. The sensitivity of controlled water receptors is high for surface waters with respect to the River Coquet and medium for the underlying Secondary A aquifers, 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

- 11.10.12. Hazardous ground gas sources have been identified beneath Part A, primarily historical coal mine workings.
- 11.10.13. All site personnel would be made aware of the findings of the **GIR (Appendix 11.2, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)) 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 A. 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).
- 11.10.14. The sensitivity of the built environment including on-site infrastructure and surrounding buildings is low to medium 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 built environment related receptors following the implementation of the mitigation measures (**not significant**).

Ground Instability

- 11.10.15. Shallow worked coal seams and a number of historical mine shafts/adits have been identified within the Study Area, however they are located outside of the proposed carriageway alignment.
- 11.10.16. All site personnel would be made aware of the findings of **Appendix 11.2: GIR** and **Appendix 11.4: Coal Mining Risk Assessment, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)). 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. Mitigation measures would include fencing off adits/shafts and potentially grout any shallow mine workings posing stability risks to the proposed carriageway or potentially incorporating geogrid into the base of the carriageway to limit settlement.

- 11.10.18. The sensitivity of the highways related infrastructure is low, and the magnitude of change, should this occur, following mitigation is minor due to the implementation of the mitigation measures. Therefore, there is likely to be a direct temporary, short to long term **neutral effect (not significant)**.

Reduction of Agricultural Soil Quality

- 11.10.19. Part A would result in temporary agricultural land take during construction and would consist of land required for construction compounds, construction working space and access.
- 11.10.20. Following construction, temporary land take areas would be reinstated back to their former agricultural use, where possible, in line with a soil management strategy to be produced alongside the CEMP, although it is acknowledged not all land may not be restored to the soil quality prior to construction. Upon completion, areas used as construction compounds would be returned to their original use.
- 11.10.21. The sensitivity of agricultural soil 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 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** all other grades of agricultural land (**not significant**).

Permanent Loss of Agricultural Soil

- 11.10.22. Part A would result in the permanent agricultural land take of approximately 109 ha. The agricultural soils within the area of permanent land take are generally of moderate to poor agricultural quality (mainly Subgrade 3b (73 ha) and Grade 4 (27 ha), totalling 100 ha) with a smaller area, approximately 9 ha, classified as BMV land (Grade 2 (<1 ha) and Subgrade 3a (8 ha)). For the purposes of the assessment the areas not surveyed (<0.1 ha) have been included as BMV.
- 11.10.23. The sensitivity of agricultural soils receptors is high for BMV land (Grade 2 and Subgrade 3a), medium for Subgrade 3b and low for Grade 4.
- 11.10.24. On the assumption that there is no retention of agricultural land within the permanent land take the magnitude of change for BMV land (9 ha) is minor. The magnitude of change for Subgrade 3b (73 ha) is major and the magnitude of change for Grade 4 (27 ha) is moderate. Therefore, there is likely to be a direct, permanent, long term **moderate adverse** effect on agricultural land for BMV soils, **moderate adverse effect** for Subgrade 3b and **slight adverse effect (not significant)** for Grade 4.
- 11.10.25. Therefore, for an overall assessment of agricultural land loss, the sensitivity of agricultural soils receptors is low to high, and the magnitude of change is minor to major. Therefore, there is likely to be a direct, permanent long-term **slight to moderate adverse** effect on agricultural land.

OPERATION

11.10.26. The following section sets out the likely effects of Part A 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

11.10.27. Potential sources of hazardous ground gas (methane, carbon dioxide, carbon monoxide, hydrogen sulphide) related to historical mine workings have been identified beneath the Order Limits.

11.10.28. 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.

11.10.29. 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.

11.10.30. The sensitivity of human health 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

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

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

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

ASSESSMENT PARAMETERS

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

11.10.35. Parameters 1, 2, 6, 7, 8, 9, 10 and 12 require the addition or repositioning of design aspects within the Order Limits. The assessment has considered the soil and geology impacts within the Order Limits and as the Assessment Parameters do not require additional land take, they would not alter the findings or significance of effects.

11.10.36. Parameters 3, 4, and 11 require minor alterations to the heights of design aspects (up to 1.5m) while Parameter 5 provides for the additional earth bunds up to 2m in height in 5 locations. Given the limited magnitude of height increase, there would be no additional

effects on the soil and geology related receptors with the inclusion of the elements within these Assessment Parameters. Therefore, the Assessment Parameters are not considered to alter the findings or significance of effects of this Geology and Soils assessment.

UPDATED DMRB GUIDANCE

- 11.10.37. The findings of the DMRB sensitivity test as described **Section 11.4** are summarised below. Refer to **Appendix 11.5: Geology and Soils DMRB Sensitivity Test, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**) for further details.
- 11.10.38. The DMRB Geology and Soils Volume 11, Section 3, Part 11 (**Ref. 11.21**) and the DMRB Volume 11, Section 3, Part 6: Land Use (**Ref. 11.20**) 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.
- 11.10.39. The updated DMRB guidance LA 109 (**Ref. 11.34**) contains defined sensitivity and magnitude criteria to be used in the assessment of geology and soils.
- 11.10.40. 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 one likely significant adverse effect relating to permanent loss of agricultural land identified in this ES would remain a significant adverse effect following the application of the LA 109 (**Ref. 11.34**) assessment criteria.
 - b.** No further significant adverse effects have been identified with the application of the LA 109 (**Ref. 11.34**) assessment criteria.
- 11.10.41. 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.

REFERENCES

- Ref. 11.1** The Water Environment (Water Framework Directive) (England and Wales) Regulations (2000) Available at:
<http://www.legislation.gov.uk/ukxi/2003/3242/contents/made>
- Ref. 11.2** European Parliament and Council (2006) Directive on Pollution Caused by Certain Dangerous Substances Discharged into the Aquatic Environment (2006/11/EC). Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32006L0011>
- Ref. 11.3** UK Parliament (1990) The Environmental Protection Act 1990. Available at: <http://www.legislation.gov.uk/ukpga/1990/43/contents>
- Ref. 11.4** UK Parliament (1995) The Environment Act 1995. Available <http://www.legislation.gov.uk/ukpga/1995/25/contents> (Accessed: 2018)
- Ref. 11.5** UK Parliament (2002) The Control of Substances Hazardous to Health Regulations 2002 (SI2002/2677). Available at: <http://www.legislation.gov.uk/ukxi/2002/2677/contents/made>
- Ref. 11.6** UK Parliament (2003) The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (SI2017/407). Available at: <http://www.legislation.gov.uk/ukxi/2017/407/made>
- Ref. 11.7** UK Parliament (2015) The Environmental Damage (Prevention and Remediation) (England) Regulations 2015 (SI2015/810). Available at: <https://www.legislation.gov.uk/ukxi/2015/810/contents>
- Ref. 11.8** UK Parliament (2016) The Environmental Permitting (England and Wales) Regulations 2016 (SI2016/1154). Available at: <http://www.legislation.gov.uk/ukxi/2016/1154/made>
- Ref. 11.9** UK Parliament (2012) The Control of Asbestos Regulations 2012 (SI2012/632). Available at: <http://www.legislation.gov.uk/ukxi/2012/632/contents>
- Ref. 11.10** UK Parliament (2012) The Contaminated Land (England) Regulations 2006 (SI2006/1380). Available at: <http://www.legislation.gov.uk/ukxi/2006/1380>
- Ref. 11.11** UK Parliament (2015) The Construction (Design and Management) Regulations 2015 (SI2015/51). Available at: <http://www.legislation.gov.uk/ukxi/2015/51/contents/made>
- Ref. 11.12** Department for Transport (2014) National Planning Policy Statement for National Networks. Available at: <https://www.gov.uk/government/publications/national-policy-statement-for-national-networks>
- Ref. 11.13** Ministry of Housing, Communities and Local Government (2019) National Planning Policy Framework. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf
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