

A1 Birtley to Coal House

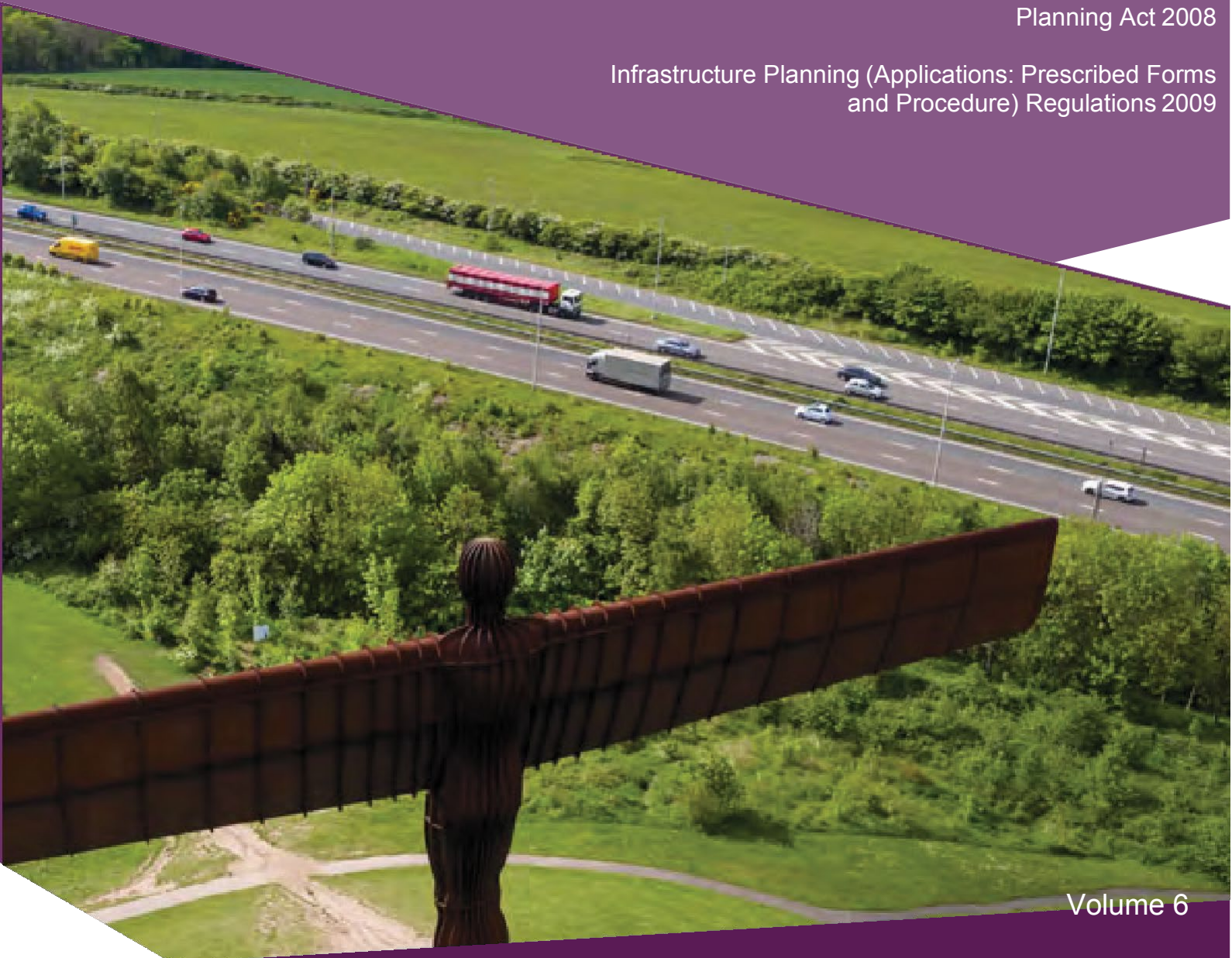
Scheme Number: TR010031

6.1 Environmental Statement Chapter 9 Geology and Soils

APFP Regulation 5(2)(a)

Planning Act 2008

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



Infrastructure Planning

Planning Act 2008

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

**A1 Birtley to Coal House
Development Consent Order 20[xx]**

Environmental Statement

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9. INTRODUCTION

9.1. INTRODUCTION

- 9.1.1. This chapter reports the outcome of the Geology and Soils assessment for the Scheme. This assessment has been carried out following the methodology set out in the Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3, Part 11 Geology and Soils (**Ref 9.1**) and Environmental Agency (EA) Model Procedures Document CLR11 (**Ref. 9.2**) and includes an assessment of geology, geomorphology, designated sites, land stability, mineral resources, hydrology, hydrogeology and land contamination.
- 9.1.2. This chapter summarises the legislative and policy framework and describes the methodology followed for the assessment along with the assessment assumptions and limitations. The chapter identifies the potential impacts as a result of the Scheme, details the design, mitigation and enhancement measures that have been identified and reports the assessment of the significant effects of the Scheme. Details of monitoring that should be carried out for the Scheme are also provided. This chapter is intended to be read as part of the wider Environmental Statement (ES) and in conjunction with its associated figures and appendices.
- 9.1.3. A full description of the Scheme is described in **Chapter 2 The Scheme** of this ES (**Application Document Reference: TR010031/APP/6.1**).
- 9.1.4. This chapter is supported by the following reports:
- a. Preliminary Sources Study Report (PSSR), (Highways Agency, 2016) (**Ref. 9.3**)
 - b. Agricultural Land Assessment (ALC), (ADAS, 2018) (**Ref. 9.4**), presented within **Appendix 9.1** of this ES (**Application Document Reference: TR010031/APP/6.3**)
 - c. Ground Investigation Factual Report (GIR), (Highways England, 2018) (**Ref. 9.5**) presented within **Appendix 9.2** of this ES (**Application Document Reference: TR010031/APP/6.3**)
 - d. Coal Mining Risk Assessment Report (CMRA), (Highways England, 2019) (**Ref. 9.6**), presented within **Appendix 9.3** of this ES (**Application Document Reference: TR010031/APP/6.3**)

ALLERDENE BRIDGE OPTIONS

In this geology and soils assessment, the differences between the Allerdene embankment option and Allerdene viaduct option, as detailed in **paragraphs 2.7.11 to 2.7.18** of this ES, do potentially affect the assessment. This is because the two options will have different construction methodologies which may impact sensitive soils (agricultural topsoil) and secondary associated receptors such as groundwater and surface water courses, in different ways. For the purposes of the soils and geology assessment the two options have been considered separately, where relevant.

9.2. COMPETENT EXPERT EVIDENCE

9.2.1. **Table 9-1** demonstrates that the professionals contributing to the production of this chapter have sufficient expertise to ensure the completeness and quality of this ES.

Table 9-1 – Geology and soils professional competence

Name	Role	Qualifications and Professional Membership	Experience
Gareth Meynell	Author	MSc Soils & Environmental Pollution Chartered Scientist Chartered Member of CIWEM	<ul style="list-style-type: none"> – Preparation of Soils & Geology input into PEIR, Scoping Report and ES chapter for Morpeth to Felton Highways England scheme. – Preparation of Soils and Geology baseline assessment report and input into Scoping report and 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. – Preparation of A19(T)/A1058 Coast Road, Junction Improvement, Soils and Geology ES chapter.
Andrew McCusker	Reviewer	Chartered Engineer (CEng MICE) Chartered Environmentalist (CEnv) Specialist in Land Condition Suitably Qualified Person	<ul style="list-style-type: none"> – Maltkiln Village - Technical Reviewer for Ground conditions and Groundwater sections. – Brent Cross/Cricklewood – Technical Reviewer for Soil and Groundwater sections. – HS2 – Project Manager and technical review for scheme sections C251/252.

9.3. LEGISLATIVE AND POLICY FRAMEWORK

LEGISLATION

9.3.1. The applicable legislative framework is summarised below:

INTERNATIONAL

- a. Water Framework Directive (WFD), 2000 (**Ref. 9.7**). The objectives of the document associated with the Geology and Soil assessment relate 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.

NATIONAL

- a. Control of Substances Hazardous to Human Health Regulations (**Ref. 9.8**), 2002 (as amended) provides 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.
- b. The Water Environment (Water Framework Directive) (England and Wales) Regulations (**Ref. 9.9**), 2003 (2000/60/EC) establish a framework for protecting the water environment.
- c. Dangerous Substances Directive (Amendment) (**Ref. 9.10**), 2006 controls the amount of dangerous substances that are discharged into inland, coastal and territorial waters.
- d. Environmental Damage and Liability (Prevention and Remediation) Regulations (**Ref. 9.11**), 2009 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 Study Areas of Special Scientific Interest; water damage; and land damage.
- e. The Environmental Permitting (England and Wales) Regulations (**Ref. 9.12**), 2010 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 (**Ref. 9.13**), 2009 which in turn replaced the Groundwater Regulations, 1998. The Regulations also transpose the Groundwater Directive 1980, the Water Framework Directive and Groundwater Daughter Directive 2006 into UK law.
- f. Control of Asbestos Regulations (**Ref. 9.14**), 2012 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 Control of Asbestos Regulations also include the 'duty to manage asbestos' in non-domestic premises.
- g. Construction (Design & Management) (CDM) Regulations 2015 (**Ref. 9.15**). This requires 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

- 9.3.2. National planning policy relevant to the Geology and Soils assessment is outlined in **Table 9-2** below.

Table 9-2 - Relevant national planning policies

National Policy	Relevant Policy Objectives	Significance of Impact of the Scheme on Policy Objective
<p>National Policy Statement for National Networks (NPS NN), 2014</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 through the use of 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 the 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 NPPF.</p> <p>Agricultural Land - the statement requires scheme promoters to take into account the economic and</p>	<p>The Scheme has the potential to impact ground stability, agricultural land and to release pollutants into the environment. The Scheme will require agricultural land take. However, the impacts will be limited by the implementation of best practice measures to protected agricultural soil quality. Based on the approach set out in this chapter it is not anticipated that policy objectives would be compromised.</p>

National Policy	Relevant Policy Objectives	Significance of Impact of the Scheme on Policy Objective
	<p>other benefits of Best and Most Versatile (BMV) agricultural land, as well as soil quality and safeguard mineral resource.</p>	
<p>National Planning Policy Framework (NPPF) (2019)</p>	<p>Section 170. Planning policies and decisions should contribute to and enhance the natural and local environment by:</p> <p>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)</p> <p>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,</p> <p>F) Remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate. Reference is also made to document: 56 Circular 06/2005 - to provide further guidance in respect of statutory obligations for biodiversity and geological conservation and their impact within the planning system.</p> <p>Section 178. Planning policies and decisions should ensure that:</p>	<p>There is potential for the Scheme to impact soil, geology and mobilise contamination within the ground, however, the mitigation measures to be implemented for the Scheme would ensure that the policy objectives are not compromised.</p>

National Policy	Relevant Policy Objectives	Significance of Impact of the Scheme on Policy Objective
	<p>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);</p> <p>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,</p> <p>C) Adequate site investigation information, prepared by a competent person, is available to inform these assessments.</p> <p>Section 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>	

LOCAL

9.3.3. Local planning policy relevant to the scope of potential effects on Geology and Soils is outlined in **Table 9-3**.

Table 9-3 - Relevant policies within Gateshead local plan

Local Policy	Relevant Policy Objectives	Significance of Impact of the Scheme on Policy Objective
Gateshead Local Plan Policies, March 2015	General Development Policy DC1 Environmental states: Planning permission will be granted for new development where it addresses the	The Scheme has the potential to introduce or mobilise contamination into the environment which could

Local Policy	Relevant Policy Objectives	Significance of Impact of the Scheme on Policy Objective
	<p>issues of potential land contamination, derelict land, hazardous substances and ground instability.</p> <p>Environmental Policy 54 Land Affected by Contamination states: Applications for development on land affected by contamination will be permitted if: A) the Study Area will be reclaimed to a standard which is suitable for the proposed end use; B) there is no threat to public health or safety; C) environmental standards are not compromised; D) no threat is posed to controlled waters; E) appropriate measures are taken to protect local amenity while works are carried out; F) any nature conservation interest, habitat, species and geological features on the land are protected.</p> <p>Environmental Policy 55 Development Causing Contamination states: Development that would cause or be likely to cause significant contamination of the ground will not be permitted. Where development would be likely to cause less severe contamination of the ground, appropriate conditions will be imposed to limit such contamination and to ensure its removal and treatment when the contaminating use ceases.</p>	<p>potentially lead to policy objectives not being met. However, based on the approach set out in this chapter it is not anticipated that policy objectives would be compromised.</p>

GUIDANCE

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

- a. DMRB Volume 11 Section 3, Part 11 Geology and Soils (1993) (**Ref 9.1**).
- b. DMRB Volume 11 Section 3, Part 6 Land Use (2001) (**Ref. 9.16**).
- 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. 9.17**).
- d. Construction Industry Research and Information Association (CIRIA) C532 (2001) Control of Pollution from Construction Study Areas (**Ref. 9.18**).

- e. HSE (2006) INDG258 Safe Work in Confined Spaces (**Ref. 9.19**).
- f. Environment Agency and NHBC (2008) Guidance for the safe development of housing on land affected by contamination, Environment Agency R&D Publication 66 (**Ref. 9.20**).
- g. British Standards (BS) 10175 (2011+A2:2017) Investigation of Potentially Contaminated Study Areas – Code of Practice (**Ref. 9.21**).
- h. Environment Agency (2018) Approach to Groundwater Protection (**Ref. 9.22**).
- i. British Standards Institute (BSI) BS 5930 (2015) The Code of Practice for Study Area Investigations (**Ref. 9.23**).

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

- a. Land affected by contamination (July 2019) (**Ref. 9.24**) outlines the system for identifying and remediating contaminated Study Areas.
- b. Natural Environment (Section 3) (March 2014) (**Ref. 9.25**) 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. 9.26**) outlines why these are important considerations in development.
- d. Land Stability (July 2019) (**Ref. 27**) 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.

9.4. ASSESSMENT METHODOLOGY

9.4.1. This chapter assesses the potential impacts of the Scheme on soil, geology and secondary associated receptors (controlled waters, designated sites) within the Study Area (**Figure 9.1** of this ES (**Application Document Reference: TR010031/APP/6.2**)). The method of baseline data collection has been undertaken in accordance with the methodology contained within DMRB Volume 11 Section 3, Part 11 Geology and Soils (**Ref. 9.1**) and EA Model Procedures Document CLR11 (**Ref. 9.2**).

9.4.2. Both desk based and intrusive surveys have been undertaken to obtain pertinent baseline information and identify sensitive receptors in the context of the assessment. The desk based reports and survey details are set out in 'Data Sources' - **paragraphs 9.4.9 to 9.4.13**.

9.4.3. The assessment includes the following elements:

- a. Review of baseline soil, geological and environmental information for the corridor, including historical mapping, to enable an assessment of potential impacts associated with land contamination.
- b. Review of information associated with agricultural land quality.
- c. Review detailed site survey and ground investigation works to confirm attribute importance and facilitate assessment of potential contaminant linkages, as required.
- d. Review of information associated with shallow coal mining to inform ground stability related issues.
- e. Listing and assessment of potential impacts.
- f. Assessment of the sensitivity of the attributes.
- g. List and assessment of the likely significance of effects.

9.4.4. The potential impacts take into consideration both the construction and operation phase of the Scheme.

SCOPE OF ASSESSMENT

9.4.5. The scope of the assessment is in line with the Scoping Report (**Ref. 9.27**) considering the following elements:

- a. Coal mining related impacts associated with ground stability and release of hazardous mine gas.
- b. Impacts on agricultural soil quality.
- c. Contaminated land exposure risks associated with disturbance of Made Ground, including an on-site landfill.
- d. Impacts associated with piling bridge abutments and creation of preferential contaminant pathways.
- e. Impacts associated with major earthworks (construction of new embankments and retaining structures).
- f. Impacts associated with construction activities, the use and maintenance of heavy machinery, fuel storage and potential spills.
- g. Impacts associated with continued use of the Study Area as a highway, to include fuel/oil spills, loss of hazardous loads and fire water.

CONTAMINATED LAND ASSESSMENT MODELLING

9.4.6. Contaminated land related issues have been assessed in accordance with Model Procedures for the Management of Contaminated Land (CLR11) (**Ref. 9.28**). The document advocates the use of a conceptual site model in an attempt 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.

SIGNIFICANCE OF EFFECTS

9.4.7. The likely significant environmental effects are assessed based on consideration of the sensitivity of receptors and the predicted magnitude on the potential effects. The magnitude of the affected receptor/receiving environment is assessed as major, moderate, slight or neutral and the sensitivity is assessed on a scale of high, medium, low and negligible. Example receptor sensitivity and magnitude of impact scenarios based on professional judgement are provided within **Table 9-4** and **Table 9-5** respectively. With regards specifically to magnitude of impact on agricultural land, there is little current guidance on what area of loss is considered significant. However, 20 hectares is the threshold adopted in The Town and Country Planning (Development Management Procedure) (England) Order 2015 (**Ref. 9.29**) for Local Planning Authorities to consult Natural England 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 Grades 1, 2 or 3a agricultural land. This threshold is taken into consideration in the assessment of the magnitude of impacts as

shown in **Table 9-5**. **Table 9-6** details how magnitude and sensitivity are combined to determine significance.

Table 9-4 - Geology and soil sensitivity criteria

Sensitivity	Description	Commentary
High	<ul style="list-style-type: none"> – Areas containing geological, hydrological or habitat features considered to be of national or international interest, for example Sites of Special Scientific Interest (SSSI). – Agricultural land classified as Grade 1 and 2 and 3a (excellent to good). – Highly permeable superficial deposits with groundwater allowing free transport of contaminants to groundwater and surrounding surface waters. – Study Area located within a groundwater related Source Protection Zone (SPZ) 1 or 2 – Wetland/watercourse of Good Ecological and or Chemical Potential (WFD). – Residential development (particularly with gardens). 	<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.
Medium	<ul style="list-style-type: none"> – Areas containing features of designated regional importance, for example Regionally Important Geological and Geomorphological Study Areas (RIGS), considered worthy of protection for their educational, research, historical or aesthetic importance. – Study Area located within an SPZ Zone 3 and/or a Principal Aquifer. – Moderately permeable superficial deposits with groundwater allowing some limited transport of contaminants to groundwater and surrounding surface waters. 	<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

Sensitivity	Description	Commentary
	<ul style="list-style-type: none"> – Wetland/watercourse of Moderate Ecological and/or Chemical Potential (WFD). – Agricultural land classified as Grade 3b (moderate quality). – Commercial buildings. – Site operatives/construction workers coming into contact with soils and groundwater. 	<p>Equipment (PPE) and who are generally exposed to soil and groundwater for limited periods of time;</p> <ul style="list-style-type: none"> – Commercial buildings where exposure to soils is limited due to the extensive presence of structures and hardstanding
Low	<ul style="list-style-type: none"> – Geological features not currently protected and not considered worthy of protection. – Low permeability superficial deposits likely to inhibit the transport of contaminants. – Study Area underlain by Secondary aquifer and not located within an SPZ. – Wetland/watercourse of Poor Ecological and/or Chemical Potential or no WFD classification. – Agricultural land classified as Grade 4 and 5 (poor and very poor quality). – Highways and pavements. 	<p>“Low” sensitivity receptors are those where the impacts of any soil and groundwater contamination (where this to impact the receptor) will 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.
Negligible	<ul style="list-style-type: none"> – No sensitive environmental receptors identified. 	

Table 9-5 - Geology and soils magnitude impact criteria

Sensitivity	Description
Major	<ul style="list-style-type: none"> – Significant (greater than 50%), or total loss of a Study Area of recognised geological importance. – Significant contamination identified, in excess of relevant thresholds for protection of Controlled Waters. – Loss of ≥ 50 hectares of agricultural land. – Significant impact upon human health.

Sensitivity	Description
	<ul style="list-style-type: none"> – Significant (greater than 50%), loss of building or infrastructure.
Moderate	<ul style="list-style-type: none"> – Partial loss (between approximately 10% to 50%) of a Study Area of recognised geological importance. – Localised or marginal contamination or potential but not proven contamination. – Loss of 20 – < 50 hectares of agricultural land. – Moderate impact on human health. – Partial damage (between approximately 10% to 50%) of buildings and infrastructure.
Slight	<ul style="list-style-type: none"> – Minimal effect (a loss of up to 10%) on a Study Area of recognised geological importance. – No significant contamination identified or could reasonably be expected based on desk study findings. – Loss of 5 – < 20 hectares of agricultural land. – Minor/insignificant impact upon human health. – Minimal effect (a loss of up to 10%) of buildings and infrastructure.
Neutral	<ul style="list-style-type: none"> – Very slight change from baseline conditions. Change hardly discernible, e.g. short-term compaction from machinery movements. – No contamination above relevant thresholds identified or could reasonably be expected based on desk study findings. – Loss of < five hectares of agricultural land. – No damage or loss of buildings and infrastructure.

Table 9-6 - Matrix for determining significance

Magnitude	Sensitivity			
	High	Medium	Low	Negligible
Major	Major	Major	Moderate	Negligible
Moderate	Major	Moderate	Minor	Negligible
Slight	Moderate	Minor	Minor	Negligible
Neutral	Minor	Negligible	Negligible	Negligible

- 9.4.8. 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. Where potential significant adverse effects are identified measures have been identified to avoid, minimise or mitigate those effects.

DATA SOURCES

- 9.4.9. Information has been gathered from the following primary sources to identify and assess effects on geology and soil related receptors.
- 9.4.10. The PSSR (**Ref 9.3**) 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 the Scheme. The study included a walkover survey 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.
- 9.4.11. The ALC survey was carried out using 'Agricultural Land Classification of England and Wales' (**Ref. 9.30**). The survey included intrusive sampling of the accessible agricultural land in order to define the agricultural soil grade. Further information on the ALC survey methodology is provided in **Appendix 9.1** of this ES (**Application Document Reference: TR010031/APP/6.3**).
- 9.4.12. Intrusive ground investigation works along and in close proximity to the new alignment of the Scheme was undertaken in accordance with British Standards BS5930 Code of Practice for Ground Investigations (**Ref. 9.23**) and BS10175 Investigation of Contaminated Sites (**Ref. 9.21**). The GIR is included within **Appendix 9.2** (**Application Document Reference: TR010031/APP/6.3**). The ground investigation included testing soil and groundwater to assess for actual sources of contamination within the Scheme footprint and undertook investigation to assess for shallow mine works to define ground stability risks.
- 9.4.13. A Coal Mining Risk Assessment has been completed in accordance with Coal Authority guidance, as required due to the Scheme crossing Coal Authority defined Development High Risk Area. The report is included within **Appendix 9.3** of this ES (**Application Document Reference: TR010031/APP/6.3**). 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.

POLICY AND GUIDANCE

- 9.4.14. The following policy and guidance has informed the methodology used in the geology and soils assessment.

Agricultural Land

- 9.4.15. The agricultural land aspects have been assessed in accordance with ALC of England and Wales – revised guidelines and criteria for grading the quality of agricultural use (**Ref. 9.30**). National planning policy seeks to conserve 'best and most versatile' agricultural land and

steer development to areas of lower agricultural quality. However, there is no national guidance on the sensitivity of agricultural land or criteria for impact magnitude. Professional judgment has therefore been adopted to assess the impacts.

Contaminated Land

- 9.4.16. Part 2A of the Environmental Protection Act (**Ref. 9.31**), 1990 describes a regulatory role for Local Authorities in dealing with contaminated land. Part 2A is supported by the Contaminated Land (England) (Amendment) Regulations (**Ref 9.32**), 2012 which provides a definition of what constitutes 'contaminated land' and set out the responsibilities of the Local Authority and the Environment Agency in the identification and management of contaminated land. Contaminated land assessment works associated with the Scheme have been conducted in accordance with these regulations.

Land Stability

- 9.4.17. Planning Practice Guidance - Land Stability (2014) (**Ref. 9.33**), sets out the roles of the regulators and processes to deal with potential stability risks associated with proposed developments. Land stability risks are generally the responsibility of either the Coal Authority or the Local Authority Building Control Department.
- 9.4.18. The impacts on ground stability have been assessed using professional judgement and in general accordance with Coal Authority Guidance.

CONSULTATION

- 9.4.19. Consultation was undertaken with Natural England and Gateshead Council to enquire whether they considered that the assessment scope was adequate and whether any further aspects should be considered within the assessment. This consultation is summarised in **Appendix 4.4** of this ES (**Application Document Reference: TR010031/APP/6.3**).
- 9.4.20. In addition to the consultation responses detailed in **Appendix 4.4** of this ES (**Application Document Reference: TR010031/APP/6.3**), a number of specific coal mining related issues were discussed and are summarised with the CMRA (**Appendix 9.4** of this ES **Application Document Reference: TR010031/APP/6.3**). Given the low sensitivity of the groundwater the Scheme does not meet the sensitivity level of the Environment Agency to engage and comment on the proposed works.

9.5. ASSESSMENT ASSUMPTIONS AND LIMITATIONS

- 9.5.1. The construction works will be undertaken in accordance with industry best-practice and regulatory requirements, including a Construction Environmental Management Plan (CEMP) to be completed by the Principal Contractor, which will incorporate the relevant mitigation measures set out in this chapter in order to manage environmental risks appropriately.
- 9.5.2. There is no recognised, detailed guidance on the method for assessing the magnitude or sensitivity of agricultural land quality for the purposes of carrying out Environmental Impact Assessment. Therefore, the methodology in this assessment has been developed using good practice taken from previously undertaken agricultural impact assessments.

- 9.5.3. To assess the quality of farmland, an independent review of ALC has been undertaken for the Scheme Footprint (refer to the A1 Birtley to Coal House Agricultural Land Classification report in **Appendix 9.1** of this ES (**Application Document Reference: TR010031/APP/6.3**)). This assessment of the likely effects relies upon the accuracy of those datasets and information as provided by third parties.
- 9.5.4. A small parcel of land, approximately 0.53 hectares in area and shown within the ALC Report (**Appendix 9.1** of this ES (**Application Document Reference: TR010031/APP/6.3**)) [could not be surveyed during the ALC surveys due to lack of access. For the purpose of this EIA it is assumed that this land is Grade 3a land based on the land quality of the adjacent field.
- 9.5.5. It is assumed that material moved around the Study Area or imported onto the Study Area during the construction phase (e.g. to obtain required ground elevations) will have been subject to appropriate chemical testing (and will be geotechnically suitable) and will therefore not present a risk to controlled waters (e.g. via leaching of potential contaminants) or human receptors.
- 9.5.6. Ventilation/gas alarms will be used by all personnel when in confined spaces, utility chambers or any other enclosed spaces associated with the Scheme.
- 9.5.7. The draft Development Consent Order (DCO) contains powers of lateral and vertical deviation. The EIA has taken the Limits of Deviation (LoD) into account and the approach taken is described in **Chapter 4 Environmental Assessment Methodology, paragraph 4.5.4** of this ES (**Application Document Reference: TR010031/APP/6.1**)). The outputs of the assessment are not considered likely to change materially as a result of the power of deviation.

9.6. STUDY AREA

- 9.6.1. The Study Area incorporates the Scheme Footprint plus a buffer of 250m beyond the Scheme Footprint, as illustrated on **Figure 9.1** of this ES (**Application Document Reference: TR010031/APP/6.2**)). In the absence of any specific DMRB related guidance, guidance document R&D 66 (**Ref. 9.34**) has been used to identify the Study Area. R&D 66 sets out areas of potential influence from contaminants in the context of residential development. It is considered that this is the only area that would be affected in terms of geology and soils based on the surrounding sensitive environmental receptors and migration potential associated with potential sources of contamination identified on and within the wider general vicinity of the Scheme. The Study Area includes areas of both temporary and permanent land take.

9.7. BASELINE CONDITIONS

TOPOGRAPHY

- 9.7.1. From the north the A1 traverses the base of the River Team Valley, with natural ground elevations between circa 10m and 15m above ordnance datum (AOD) and the existing carriageway generally being elevated above natural ground on embankments or existing

structures (Kingsway Viaduct and Allerdene Bridge). Ground levels then increase as the A1 traverses the eastern flank of the Team Valley, from circa 15m AOD adjacent to Allerdene Bridge to circa 85m AOD at junction 66 (Eighton Lodge), where the ground levels fall slightly (to circa 75m AOD) before rising gently to 110m AOD at the Northside Overbridge.

GEOMORPHOLOGY

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

SOILS AND AGRICULTURAL LAND QUALITY

- 9.7.3. 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. Land is assigned into one of five land classification grades, Grade 1 land being the highest quality and Grade 5 the lowest quality land. Grade 3 is sub-divided into Grades 3a and 3b, to identify good quality agricultural land from moderate quality land. Refer to **Appendix 9.1** of this ES (**Application Document Reference: TR010031/APP/6.3**) for further information on the ALC system. Grades 1, 2 and 3a are classified as BMV land.
- 9.7.4. The Provisional Land Classification maps show the site as an area of Grade 3 land. Post 1998 survey data indicates that the extreme northern tip of the eastern block of land has been classified as Grade 3a whilst the western block has a strip of mainly Grade 3b mapped across the site, with a smaller strip of Grade 3a land by the East Coast Main Line (ECML).
- 9.7.5. The detailed fieldwork undertaken by Reading Agricultural (A1 Birtley to Coal House Agricultural Land Classification Report **Appendix 9.1** of this ES (**Application Document Reference: TR010031/APP/6.3**)) for the Scheme has mapped the agricultural land quality within the (temporary and permanent) Scheme Footprint as 32.5% Grade 3a and 53% Grade 3b as shown in **Table 9-7** (refer to **Appendix 9.1** of this ES (**Application Document Reference: TR010031/APP/6.3**) for ALC map). Approximately 11.2% of the land was non-agricultural and a small section (3.3% could not be surveyed). Grade 3a agricultural land constitutes BMV land and is considered to be of high sensitivity in accordance with **Table 9-4**. The ALC for the Scheme Footprint is summarised in **Table 9-7** and illustrated on drawings WSP9001/1010277/ALC 01 & 02 within **Appendix 9.1** of this ES (**Application Document Reference: TR010031/APP/6.3**).

Table 9-7 - Agricultural land classification measurements

Grade	Area (hectares)	% of Total Area
Grade 1 (excellent quality)	-	-
Grade 2 (very good quality)	-	-
Grade 3a (good quality)	5.31	32.5
Grade 3b (moderate quality)	8.65	53.0
Grade 4 (poor quality)	-	-
Grade 5 (very poor quality)	-	-
Other land	1.83	11.2
Not surveyed	0.53	3.3
Total	16.32	100.0

9.7.6. The Scheme would result in both permanent and temporary land take. Temporary land take would occur during the construction phase and consist of land required for the site and working compounds, construction working space and access (as illustrated on **Figure 2.3** of this ES (**Application Document Reference: TR010031/APP/6.2**)).

9.7.7. Permanent land take would also take place during the construction period but would consist of land permanently acquired for the Scheme. The approximate area of agricultural land take is shown in **Table 9-8**.

Table 9-8 - Agricultural land take

Grade	Approximate Temporary Land Take (hectares)	Approximate Permanent Land Take
Grade 1 (high sensitivity)	-	-
Grade 2 (high sensitivity)	-	-

Grade	Approximate Temporary Land Take (hectares)	Approximate Permanent Land Take
Grade 3a (high sensitivity)	5.55*	0.20*
Grade 3b (medium sensitivity)	7.28	1.37
Grade 4 (low sensitivity)	-	-
Grade 5 (low sensitivity)	-	-
Total	12.83	1.57

* Includes small parcel of land which could not be surveyed and is assumed to be Grade 3a land.

GEOLOGY

- 9.7.8. British Geological Survey (BGS) maps show a large area of Made Ground beneath the existing carriageway east of junction 67 (Coal House) and south of Smithy Lane Overbridge for approximately 300m and 400m respectively. The Scheme is also underlain by Made Ground south of Smithy Lane Overbridge for approximately 100m to the east.
- 9.7.9. Drift deposits are shown to comprise Alluvium along the route of the River Team underlying the existing carriageway for approximately 250m at junction 67 (Coal House) Glaciolacustrine Deposits (clay and silt) are shown located immediately to the east and west of the Alluvium deposits. The remainder of the Study Area is underlain by Glacial Till along the side of the Team Valley to junction 65 (Birtley) in the south.
- 9.7.10. Solid geology comprises the Pennine Middle Coal Measures, indicated to underlie the length of the road and primarily comprising of the High Main Post Member (sandstone), over sandstones, mudstones, siltstones, and coal. A number of coal seams are indicated to sub-crop below the existing and proposed carriageways.

GROUND INVESTIGATION CONDITIONS SUMMARY

- 9.7.11. Ground conditions, as identified within the 2018 GIR report (**Appendix 9.2** of this ES (**Application Document Reference: TR010031/APP/6.3**)), along the length of the Scheme are summarised below.
- 9.7.12. Made Ground comprising of clays, sands and gravels with a thickness of between 0.1-12.9mbgl where encountered along the route of the Scheme. The majority of the Made Ground was less than 5m thick. Black macadam was recorded in one borehole with an associated hydrocarbon odour. Clinker (granular ashy material) was recorded in the window samples along with rare amounts of concrete and slag.

- 9.7.13. From junction 67 (Coal House) to the Smithy Lane Overbridge ground conditions are dominated by an infilled north to south trending Glacial Valley that forms the base of the Team Valley. Rockhead of the Pennine Middle Coal Measures (PMCM) falls from approximately 15m below ground level (bgl) at the western extent to circa 50m bgl below the Kingsway Viaduct, before rising again toward the Smithy Lane Overbridge. Within the infilled valley the drift geology predominantly comprises 'Glacial Lake Deposits: mainly laminated clays', with local Made Ground and Alluvium at the surface and Glacial Till at the base. Coal seams within the PMCM beneath this area are generally recorded to have a horizontal or sub-horizontal dip. A number of coal seams sub-crop (i.e. are present at rockhead beneath the overlying drift deposits) on the eastern (Smithy Lane Overbridge) side of the glacial valley, as rockhead cross-cuts the stratigraphy. Through the centre and east of the glacial valley the coal seams are displaced by faults, and only a single coal seam sub-crops on the western side.
- 9.7.14. From Smithy Lane Overbridge to junction 65 (Birtley) the ground conditions typically comprise predominantly cohesive Glacial Till underlain by solid strata of the PMCM. South of Smithy Lane Overbridge an area of Made Ground associated with colliery spoil from the former Ravensworth Ann Pit is recorded. A number of coal seams are present within the Coal Measures, generally dipping at a shallow gradient to the northwest below this section of the Scheme. With the coal seams dipping at relatively shallow gradients, sub-crops are governed by topography and are generally recorded to the south and west of the Scheme within the valley side. As ground levels fall from junction 66 (Eighton Lodge) toward the Smithy Lane Overbridge, a number of these seams become shallower and sub-crop beneath the line of the A1.

NATURAL GROUND HAZARDS

- 9.7.15. The natural ground hazards underlying the Scheme Footprint, defined by the British Geological Survey as set out in the PSSR (**Ref 9.3**) which also includes mapping, are:
- a. Collapsible ground stability hazard – very low risk
 - b. Compressible ground stability hazard - moderate risk in the north-west of the Scheme footprint and very low in the south-east of the Scheme Footprint
 - c. Ground dissolution Hazard – no hazard
 - d. Landslide stability hazard – low to very low risk
 - e. Running sands stability hazard – low to very low risk
 - f. Shrinking or swelling clay stability hazard – low to very low risk
- 9.7.16. The natural ground hazards are not considered to impact the line of the new carriageway based on the desk based information.

MINING AND MINERALS

- 9.7.17. With the exception of coal, the Scheme footprint does not cross any areas defined as potential mineral resource areas, as illustrated by the Northumberland and Tyne & Wear Mineral Resource (South) map. Given the location of the exiting highway and depth to coal future coal extraction is not considered to be either practically or commercially viable within

the Scheme footprint. Impacts to mineral safeguard areas and sterilisation of mineral resource have therefore not been considered further in this assessment.

- 9.7.18. The Study Area is within the Durham Coal Field and classified by the Coal Authority as being within the Gateshead District (B). Significant historical surface and underground coal mining is known to have occurred throughout the area.
- 9.7.19. The most up to date plans/aerial photography of the Study Area show no evidence of mining or quarrying currently being active on or in the vicinity of the Study Area.
- 9.7.20. Historical Ordnance Survey (OS) maps record the Longbank and Footbridge Quarries to the northeast of the existing carriageway, southeast of junction 66 (Eighton Lodge). The quarried areas are recorded as Made Ground in the geological mapping (BGS 1:50,000 sheet 20 1992, Newcastle). The Coal Authority records no opencast mining on, or within the vicinity of this Study Area. The Longbank and Footbridge quarries are indicated to be above coal subcrops in the geological mapping. Hence it is likely the recorded quarries were used for stone extraction only.
- 9.7.21. Two collieries are recorded on the historical OS maps in close proximity to the Study Area, namely the Allerdene and Team Collieries (operational 1850 to 1962 and 1726 to 1973 respectively), located to the north of the Study Area.
- 9.7.22. Given the Study Area is located within a Coal Reporting Area, a Coal Authority Coal Mining Report was obtained for the Scheme Footprint. The Coal Authority report states that the Scheme Footprint is within the likely zone of influence from workings in thirteen seams of coal from shallow (<30m) to 240 m bgl, with the Coal Authority database recording past and probable shallow mining below the majority of the Study Area east of junction 67 (Coal House). Coal seam details beneath the site are summarised in **Table 9-9**.

Table 9-9 - Summary of coal seams beneath the site

Coal Seam	Standard NCB* Letter	Thickness** (metres)	Recorded as worked by CA	Worked Thickness*** (metres)	Year Last Mined
High Main (Locally splits into the Top and Bottom High Main)	E (E1 and E2)	1.50 – 2.50	No, but identified as 'seam workable'	N/A	N/A
Metal	F1	0.40 to 0.90	No, but identified as 'seam workable'	N/A	N/A
Five Quarter (Bottom Main)	F2	0.50 to 1.05	Yes, from Ravensworth Colliery	0.60	1935

Coal Seam	Standard NCB* Letter	Thickness** (metres)	Recorded as worked by CA	Worked Thickness*** (metres)	Year Last Mined
Main (Yard)	G	0.60 to 1.90	Yes, from Ravensworth, unnamed, Blackhouse and Hallingwell Collieries	0.60 to 1.90	1939
Maudlin	H	0.45 to 1.85	Yes, from Ravensworth, Springwell and Blackhouse Collieries	1.10 to 1.52	1933
Durham Low Main (Brass Thill)	J	0.45 to 2.40	Yes, from Ravensworth Colliery	0.85	1935
Top Brass Thill (Bottom Low Main)	K	0.25 to 1.20	Yes, from Ravensworth, unnamed and Vale Collieries	0.91 to 1.50	1947
Hutton	L	0.9 to 2.10	Yes, from Ravensworth, unnamed, Blackhouse and Mountmoor Collieries	1.30 to 1.70	1947
Plessey	M	0.25 to 0.7	No	N/A	N/A
Harvey (Beaumont);	N	0.45 to 1.20	Yes, from unnamed and Ravensworth Collieries	0.50	1947

* National Coal Board

**Thickness based on BGS Geological Map NZ25NE

***Based on CA records

9.7.23. Numerous pits, shafts and adits, associated with the two collieries referenced above and also individual mining enterprises are present on and in close proximity to the Study Area. The Coal Authority records eleven shafts and two adits on or within close proximity to the Scheme Footprint. From review of the available OS maps, geological mapping,

abandonment plans, and coal seam plans it is considered that seventeen shafts/adits may be present on, or in close proximity to the Scheme Footprint. Areas of shallow coal workings and known shafts are illustrated on **Figure 9.2** of this ES (**Application Document Reference: TR010031/APP/6.2**).

- 9.7.24. Three shafts are recorded to be located within or very close to the Scheme Footprint. Details for the three shafts are summarised in **Table 9-10**.

Table 9-10 - Summary of mine entries recorded within or very close to the Scheme

CA Mine Entry ID	Co-ordinates		Name	Treatment Details in CA Report	Other Details
425558-016	425799	558233	Nanny Pit	Filled in 1951 to an unknown specification. A 1m thick concrete plug was placed 3m below the surface in 1952. In 1986, as part of the A69 Eighton Lodge Road Junction improvement, consulting engineers Mott Hay & Anderson constructed a 4.35m x 4.35m x 0.4m reinforced concrete cap on top of the concrete plug	Shaft depth from 58.52m AOD to the Five Quarter Seam Shaft diameter of 2.5m
427556-018	427800	557000	Moor Inn Pit	No Treatment Details. Owned by: J.B.Bellerby, S.Storey and M.P.Knight	Shaft depth unknown. Shaft diameter unknown
428556-004	428159	556547	-	Filled during 1967. Details unknown	-

Coal Mining Risk Assessment Summary

- 9.7.25. A summary of the stability risks associated with shallow coal workings are summarised in **Table 9-11**. To aid the assessment and reporting of mining risk to the Scheme, it has been split into six sections based on the distribution of geological strata and the nature of the proposed improvement works. The sections also define the associated risks spatially. The six sections adopted are shown on Drawing HE551462-WSP-HGT-DR-GE-00 in **Appendix 9.3** of this ES (**Application Document Reference: TR010031/APP/6.3**).

Table 9-11 - Summary of risk assessment

Section	Assessed Overall Mining Risk	Reason	Limitations
1	Earthworks and Carriageway – Low Structures – Low Mine Gas – Low	<ul style="list-style-type: none"> – One shallow coal seam sub-crop beneath the section but is shown to be unworked. – The CA does not identify the sub-crop as an area of probable shallow mine workings. – The CA records show recorded workings abandoned to the west of the section due to a washout. – There are no recorded mineshafts within the improvement works. – The depth to the sub-crop is circa 30m, suggesting that incidental coal extraction is unlikely. – No deep foundations are anticipated as part of the improvement works. – There are no records of mine gas issues, but recorded shallow workings within close proximity to the site. – No intrusive construction works likely to intersect coal seams/potential workings are proposed. 	<ul style="list-style-type: none"> – No deep boreholes undertaken to investigate for presence of un-worked coal*. – Assumes accuracy of CA records.
2	Earthworks and Carriageway – Very Low Structures – Very Low and Low Mine Gas – Low and High	<ul style="list-style-type: none"> – CA abandonment plan suggests total extraction of the Harvey coal seam. – No evidence of voids or coal identified at anticipated depth of seam. – Greater than 10 times seam thickness of rock expected between recorded level of workings and the anticipated toe of piles** for structures. – Greater than 10 times seam thickness of rock expected between recorded level of workings and rockhead below widened embankments and retaining walls. – No recorded mineshafts within the improvement works. – No records of mine gas issues but recorded shallow workings beneath the site. – Intrusive construction works (piling) to be undertaken. 	<ul style="list-style-type: none"> – Assumes pile rock socket less than 5m**. – Deep boreholes advanced through recorded depth of mine workings via rotary open hole techniques.
3 (with Allerdene embankment option)	Earthworks and carriageway – Low Structures – High Mine Gas –Low andHigh	<ul style="list-style-type: none"> – Worked seams recorded at shallow depth beneath rockhead. – 2.5m thick coal seam and 3 m high voids recorded in exploratory holes. – Significant structures to be constructed as part of the improvement works, including interaction with sensitive third party assets. – Less than 10 times seam thickness of rock expected between recorded level of workings and the toe of piles for structures**. – Less than 10 times seam thickness of rock expected between recorded level of workings and rockhead. 	<ul style="list-style-type: none"> – Area is faulted and position, dip and throw of faults may not be accurately defined.

Section	Assessed Overall Mining Risk	Reason	Limitations
		<ul style="list-style-type: none"> - No recorded mineshafts within the improvement works. - Earthworks to be constructed on rigid inclusion ground improvement and a load transfer platform. - Mine Gas recorded during drilling and shallow workings present. - Intrusive construction (piling) to be undertaken. 	
3 (with Allerdene viaduct option)	Earthworks and carriageway – Low Structures – High Mine Gas –Low andHigh	<ul style="list-style-type: none"> - Worked seams recorded at shallow depth beneath rockhead. - 2.5m thick coal seam and 3m high voids recorded in exploratory holes. - Significant structures to be constructed as part of the improvement works, including interaction with sensitive third-party assets. - Less than 10 times seam thickness of rock expected between recorded level of workings and the toe of piles for structures**. - Less than 10 times seam thickness of rock expected between recorded level of workings and rockhead. - No recorded mineshafts within the improvement works. - Mine gas recorded during drilling and shallow workings present. - Intrusive construction (piling) to be undertaken. - Earthworks to be constructed on rigid inclusion ground improvement and a load transfer platform. 	<ul style="list-style-type: none"> - Area is faulted and position, dip and throw of faults may not be accurately defined. - Small number of deep boreholes undertaken outwith the footprint of Allerdene Bridge. Additional ground investigation will be required if this option is progressed through detailed design.
4	Earthworks and Carriageway – Medium Structures – N/A Known shaft – Low Mine Gas – Low	<ul style="list-style-type: none"> - Shallow seams present and sub-crop within the section. - No recorded workings within shallow seams. - No evidence of workings or voids recorded in boreholes within shallow coal seams. - Known mine shaft (Nanny Pit) has previously been capped and filled. - No records of mine gas issues. - No intrusive construction works likely to intersect coal seams/potential workings proposed. 	<ul style="list-style-type: none"> - Small number of boreholes taken into rock to investigate shallow coal seams*.
5	Earthworks and Carriageway – Low and Medium	<ul style="list-style-type: none"> - Shallow seams are present beneath the section. - Borehole evidence of workings or voids recorded within shallow coal seams. 	<ul style="list-style-type: none"> - Small number of boreholes taken into rock to investigate shallow coal seams outwith Eighton Lodge*.

Section	Assessed Overall Mining Risk	Reason	Limitations
	Structures – Medium and High Mine Gas – Low and High	<ul style="list-style-type: none"> – No recorded mineshafts within the improvement works. – No records of mine gas issues but recorded shallow workings beneath the site. – Intrusive construction works (piling) to be undertaken. 	
6	Earthworks and Carriageway – Low and Medium Structures – Low and High Known shaft - Low Mine Gas – Low, and High	<ul style="list-style-type: none"> – Shallow seams are present beneath part of the section at depths of around 5 times seam thickness below rockhead. – No evidence of workings or voids recorded within shallow coal seams beneath the section. – Less than 10 times seam thickness of rock expected between shallow coal seams and the toe of piles for structures**. – Recorded mineshafts within the vicinity of the improvement works. – No records of mine gas issues and no recorded shallow workings beneath the site. – Intrusive construction works (piling) to be undertaken. 	<ul style="list-style-type: none"> – Small number of boreholes taken into rock to investigate shallow coal seams*. – Assumes piles will have a rock socket of less than 5m.

*The number of rotary boreholes to investigate shallow coal seams was reduced to bring 2017/2018 ground investigation within Highways England's budget. The number and spacing of exploratory hole positions away from the major structures (Kingsway Viaduct, Allerdene Bridge and Eighton Lodge) is therefore less than optimal to assess the risk of shallow workings with a high degree of confidence.

** The anticipated depth of proposed piles/foundations is based on the current preliminary design for the Scheme (refer to associated structural Approval in Principal (AIP) reports for further information). This assessment should be revisited if the foundation depths vary significantly as the designs progress, particularly through detailed design.

HYDROGEOLOGY

- 9.7.26. The underlying alluvium is classified by the Environment Agency as a Secondary A Aquifer, and the Glacial Till as Unproductive Strata. The underlying Pennine Middle Coal Measures are classified as a Secondary A Aquifer. The Environment Agency groundwater vulnerability maps show the site to be in an area defined as Minor Aquifer High Vulnerability to pollution discharge at ground level.
- 9.7.27. The Study Area is not within a Groundwater SPZ, nor is one present within 500m of the Study Area (an area potentially considered to be impacted by highly mobile contamination). There are no licenced groundwater abstraction points within the Study Area or within 500m of the Study Area. The overall sensitivity of groundwater has therefore been assessed as Medium.
- 9.7.28. Groundwater strikes were recorded in available historical borehole records within the superficial deposits between 1.80m bgl and 7.62m bgl (pre-construction of existing A1 levels).

HYDROLOGY

- 9.7.29. A number of surface water features are located both within the Scheme Footprint and within the Study Area (see **Chapter 13 Road Drainage and Water Environment** of this ES (**Application Document Reference: TR010031/APP/6.1**)) these include the following:
- a. Within the Scheme Footprint
 - i. River Team which flows south to north under junction 67 (Coal House).
 - ii. A below surface culverted drain (Allerdene drain); east of junction 67 (Coal House) slip roads, which is located in an engineered above ground drainage channel either side of the exiting carriageway.
 - b. Within the Study Area
 - i. A culvert 150m southeast of Smithy Lane Overbridge.
 - ii. A culvert immediately to the northwest of junction 66 (Eighton Lodge).
 - iii. Bassett's Pond (a Secondary River) flowing to the northeast is culverted beneath the A1 to the north of junction 65 (Birtley).
- 9.7.30. The River Team is the only surface water body within the Study Area to be classified by the Environment Agency as part of the WFD. Based on the last cycle of monitoring in 2016 the water body was classified as Moderate by the Environment Agency for Ecological Quality and failed on Chemical Quality.
- 9.7.31. Pertinent waterbodies located outside of the Scheme Footprint but within the Study Area are:
- a. Foxpond Fishery to the immediate east of junction 65 (Birtley).
 - b. Bowes Lake and Lookout Lake north of junction 65 (Birtley).

- 9.7.32. Further Information related to surface water courses and flooding is included in **Chapter 13 Road Drainage and the Water Environment** of this ES (**Application Document Reference: TR010031/APP/6.1**).

DESIGNATED SITES

- 9.7.33. There are no nationally (e.g. Sites of Special Scientific Interest (SSSI)) or regionally designated sites (e.g. Regionally Important Geological and Geomorphological Sites (RIGS)) within the Study Area and therefore designated sites are not considered further within the assessment.

UNEXPLODED ORDNANCE

- 9.7.34. A desk based unexploded ordnance (UXO) assessment has been commissioned for the Scheme (included within the GIR, **Appendix 9.2** of this ES (**Application Document Reference: TR010031/APP/6.3**)) Footprint and identified a Low Risk associated with encountering below ground UXO.

CONTAMINATED LAND CONCEPTUAL STUDY AREA MODEL

- 9.7.35. 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 principals set out in document CLR11.

Potential Sources of Contamination

- 9.7.36. Based on a review of the PSSR (**Ref 9.3**) the following potential sources of contamination have been identified, and illustrated on **Figure 9.3** of this ES (**Application Document Reference TR010031/APP/6.2**). Where large source areas have been identified such as Made Ground, they have been omitted from the drawing as they would obscure smaller more pertinent point sources:

- a.** One recorded historical landfill within the Scheme Footprint described as Ravensworth Ann Pit Heap, located south of Smithy Lane and to the east of the ECML in the north of the Scheme Footprint.
- b.** One historical landfill (Northside Eighton Banks) located within the Study Area approximately 250m to the north of the carriageway between junction 65 (Birtley) and junction 66 (Eighton Lodge).
- c.** Contamination arising from fuel/oil spillages/spray from vehicles using the existing carriageway.
- d.** Relict paving potentially containing coal tar within macadam, associated with the former alignment of A69 to the north of Eighton Lodge by Longacre Wood.
- e.** Potential for hazardous mine gases (methane, carbon dioxide, hydrogen sulphide carbon monoxide) associated with underground workings (site wide).
- f.** Areas of Made Ground, primarily located in the north of the Scheme associated with colliery spoil deposits.

Potential Environmental Receptors in the Context of Contaminated Land Risk Assessment

9.7.37. Environmental receptors considered to be susceptible to the impacts from contamination sources:

- a. Human Health:
 - i. Construction workers
 - ii. Adjacent Study Area users (visitors/workers)
 - iii. Future Study Area users
 - iv. Below ground maintenance workers.
- b. Controlled Waters:
 - i. Surrounding surface watercourses
 - ii. Underlying Secondary A Aquifers (alluvium and Pennine Middle Coal Measures)

Potential Contamination Source to Receptor Pathways

9.7.38. Potential contaminant linkage pathways include:

- a. Human Health:
 - i. Direct contact, soil ingestion and inhalation.
 - ii. Migration and accumulation of ground gas in excavations and, inhalation/asphyxiation by Study Area preparation, earthworks, and construction and maintenance workers.
- b. Controlled Waters:
 - i. Infiltration of rainwater and leaching of contamination to shallow groundwater.
 - ii. Migration from groundwater into surface water bodies (main drains, network drains, ponds).
 - iii. Lateral and vertical leaching of contaminants into underlying Secondary A Aquifers.
 - iv. Surface water run-off.

Ground Investigation Contaminated Land Risk Assessment

9.7.39. A Ground Investigation was completed on the site in 2018 (**Appendix 9.2** of this ES (**Application Document Reference: TR010031/APP/6.3**)). As part of the investigation, soil samples were sent for chemical analysis to assess for the presence of contaminants associated with the sites current and former use. The results are summarised below.

9.7.40. Asbestos was identified to be present in five locations from 51 tests along the proposed route, as detailed in **Table 9-12**. Quantification was undertaken in those samples where asbestos fibres were identified, all quantification tests recorded concentrations <0.1%.

Table 9-12 - Summary of identified asbestos

Location	Depth	Stratum	Asbestos type and form
BH17-16	1.00	Made Ground	Chrysotile fibre bundles
BH17-28	1.00	Made Ground	Chrysotile fibre bundles
BH17-35	1.00	Made Ground	Chrysotile fibre bundles
BH17-36	0.70	Made Ground	Chrysotile fibre bundles
BH17-77	0.80	Made Ground	Chrysotile fibre bundles

9.7.41. There is no safe minimum threshold for asbestos content in soils, therefore where identified these soils are considered to present unacceptable risks to humans, if soils derived dust particulates are inhaled. There is no Made Ground properties which the presence of asbestos fibres can be directly linked with, therefore there is insufficient evidence to confirm the absence of asbestos elsewhere within Made Ground across the site.

9.7.42. Further soils analysis (heavy metals and hydrocarbons) was undertaken on 51 samples of potential contaminants commonly associated with the potential sources of contamination identified in **paragraph 9.7.36**. The laboratory results record concentrations of analytes below conservative assessment criteria for a commercial end use within all samples, and therefore present negligible risks to human receptors.

9.7.43. The presence of trace asbestos fibres in Made Ground is considered to present unacceptable risks to human health in the context of the Scheme and remedial measures are considered to be required to mitigate the risks.

SOILS AND GEOLOGY SENSITIVE RECEPTORS

9.7.44. Geology and soils related receptors are summarised in **Table 9-13**. The sensitivity has been derived using the assessment matrix set out in **Table 9-4**.

Table 9-13 - Geology and soils receptors and sensitivity

Aspect	Sensitive Receptor	Sensitivity (as set out in Table 9-4)
Human Health	<ul style="list-style-type: none"> – Construction workers – Adjacent Study Area users (visitors/workers) – Future Study Area users 	Medium

Aspect	Sensitive Receptor	Sensitivity (as set out in Table 9-4)
	<ul style="list-style-type: none"> – Below ground maintenance workers 	
Controlled Waters	<ul style="list-style-type: none"> – Surface water courses (primarily River Team) – Groundwater (Secondary A Aquifer – Alluvium) – Groundwater (Secondary A Aquifer – Pennine Middle Coal Measures) 	Medium
Soil	<ul style="list-style-type: none"> – Agricultural Land Grade 3a and Grade 3b 	High to Medium
Property	<ul style="list-style-type: none"> – Existing and future highway Infrastructure (pavement, below ground ducts, embankments) – Surrounding buildings, residential and commercial premises 	Medium

9.8. POTENTIAL IMPACTS

CONSTRUCTION

9.8.1. The impacts on the Geology and Soils are considered likely to be most significant during the construction phase of the Scheme, which will include major earthworks. Potential construction impacts are summarised in **Table 9-14**.

Table 9-14 - Geology and soils potential construction impacts

Receptor	Potential Impact	Cause
Construction		
Agricultural Soil	Reduction in Soil Quality	<ul style="list-style-type: none"> – Agricultural land affected by temporary works during construction and via land take to accommodate the new highway (sensitive agricultural land shown within ALC assessment Appendix 9.1 of this ES (Application Document Reference: TR010031/APP/6.3)). – During construction an agricultural field has been identified to accommodate the contractors' compound, illustrated on Figure 2.3 of this ES (Application Document Reference: TR010031/APP/6.2). This area will be out of agricultural use for the duration of the construction activities, and soils eroded and compacted as a result of the temporary use. – Soils with high organic content (i.e. agricultural topsoil) would be stripped to facilitate development. – The physical and chemical characteristics of sensitive soils along the route of the Scheme will be negatively altered (i.e. compacted/covered) during the construction improvement works. – During the construction phase, the movement of construction plant will impact on agricultural soil characteristics locally due to the compaction of near-surface soils. – Construction of embankments, associated with realignment of the highway and the construction of the Allerdene Bridge, is anticipated to impact any underlying agricultural soils through consolidation due to an increase in vertical load. This will predominantly occur during the construction phase, but a percentage of consolidation will occur during the operational phase.
Current and futures site users, construction workers, maintenance workers	Detriment to Human Health	<ul style="list-style-type: none"> – If human health receptors are exposed to contaminants above threshold concentrations there is potential for both temporary and permanent health problems to arise dependent on a number of factors including type of potential contaminant (e.g. physical contaminants such as asbestos, or chemical contaminants such as diesel), characteristics of receptor and duration of exposure. – The length of exposure will depend on the amount of time workers spend on the Study Area, but it could potentially extend to the full assumed extent of the construction phase of the Scheme (c. three years). – 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 and areas of landfill (illustrated on Figure 9.2 and Figure 9.3 of this ES (Application Document Reference: TR010031/APP/6.2)) excavations or confined spaces associated with the earthworks, grouting and installation of any below ground infrastructure (e.g. drainage chambers). – Excavation of potentially contaminated soils could pose a health risk to the public in the immediate vicinity of the Study Area during the construction period, through inhalation of contaminated dusts and particulate matter generated by excavation activities. – The use of machinery and plant associated with Scheme preparation, earthworks and construction activities (including the establishment of a site compound) could give rise to contamination risk to soils, through accidental fuel/oil spills and leaks, and storage of chemicals or fuels. Soils impacted by fuel/oil spills and leaks may represent a future source of contamination to human health. – Risks of ground collapse during both construction phase and permanent phase of the Scheme 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.

Receptor	Potential Impact	Cause
Underlying aquifers (groundwater) and surface water bodies	Pollution of Controlled Water Bodies	<ul style="list-style-type: none"> – The disturbance of contaminated ground and the storage of fuel/oils within the Study Area during the construction phase have the potential to result in mobilisation and release of contaminants increasing the potential to negatively impact controlled water bodies (primarily underlying Secondary A Aquifer and the River Team). – Potential historical sources of contamination have been identified (illustrated on Figure 9.3 of this ES (Application Document Reference: TR010031/APP/6.2)). Earthworks and excavations associated with the construction of new embankments associated with road realignment and the Allerdene Bridge could potentially disturb and release mobile historical contamination impacting surrounding controlled water bodies. – The use of machinery and plant associated with earthworks, grouting and construction activities (including the establishment of a site compound and storage of any chemicals or fuels in the compound area) could give rise to a pollution risk to soils, groundwater and surface water features through accidental fuel/oil and chemical spills and leaks. Soils impacted by spills and leaks may represent a source of contamination to controlled waters via leaching. – Potential for deep excavations and or piles (around bridges, gantries and retaining walls) 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. – Risk of potentially generating contaminated runoff during the earthworks phase of the Scheme, 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 water courses. – Risk of decreasing groundwater quality (chemistry, turbidity) when grouting historical mine workings.
Existing highway infrastructure, surrounding houses and commercial premises	Migration of hazardous ground gas causing an explosion	<ul style="list-style-type: none"> – Potential for grouting activities to release explosive ground gas (methane) into above ground enclosed spaces within buildings and service chambers.
	Ground instability	<ul style="list-style-type: none"> – Risk of surface subsidence associated with building over shallow coal workings and in the vicinity of former coal shafts and areas of poorly compacted ground. – Risk of grouting destabilising the walls of existing surrounding historical shafts causing collapse.

OPERATION

9.8.2. The potential operational impacts are summarised in **Table 9-15**.

Table 9-15 - Geology and soils potential operational impacts

Receptor	Potential Impact	Cause
Operation		
Agricultural Soil	Permanent loss of agricultural land	<ul style="list-style-type: none"> – Agricultural land affected by operational land take to accommodate the new highway (sensitive agricultural land shown within ALC Assessment Appendix 9.1 of this ES (Application Document Reference: TR010031/APP/6.3)). – Widening and reconfiguring the highway footprint will result in additional land take and loss of agricultural land.
Controlled water bodies	Pollution of controlled water bodies	<ul style="list-style-type: none"> – Potential for leaks and spills on the carriageway to impact surrounding surface water bodies.
Maintenance workers	Detriment to Human Health	<ul style="list-style-type: none"> – Maintenance workers are considered to be susceptible to exposure to hazardous gases (primarily methane, hydrogen sulphide, carbon monoxide and carbon dioxide) and/or depleted oxygen levels within excavations or confined spaces associated with the earthworks and installation of any below ground infrastructure (e.g. drainage chambers). – Potential for any workers on the verges to come into contact with asbestos contaminated soil, consequently impacting their health.

9.9. DESIGN, MITIGATION AND ENHANCEMENT MEASURES

DESIGN

9.9.1. Some design elements pertinent to this assessment would be further developed at detailed design (e.g. Allerdene Bridge design and requirements for grouting). The drainage design includes elements such as silt traps and interceptors to reduce the chances of contaminants entering surrounding surface water bodies.

9.9.2. All geotechnical related works would be undertaken in accordance with DMRB guidance document HD 22/08 – Managing Geotechnical Risk (**Ref 9.36**). This would include the

production of a Geotechnical Design Report, which will set out geotechnical parameters to facilitate the safe design of the Scheme from a ground engineering perspective, and would include design parameters to limit soil settlement.

CONSTRUCTION

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

Reduction of Agricultural Soil Quality

9.9.4. The Agricultural Land Assessment (**Appendix 9.1** of this ES (**Application Document Reference: TR010031/APP/6.3**)) states that a suitable soil handling strategy should be developed for the Scheme to help preserve land quality on temporary land take and areas of permanent land take. The strategy would help to preserve the soil and retain soil functions such as water and carbon storage.

9.9.5. The loss of agricultural land through construction of embankments and additional carriageway would be required to construct the Scheme, this includes embankments associated with both Allerdene Bridge options. However, agricultural soil would be stripped as part of the construction phase and would be sustainably managed and re-used, where possible.

9.9.6. Defra's Good Practice Guide for Soils (**Ref. 9.35**) has recently been withdrawn but no replacement guidance is currently available. Soil management operations would therefore be carried out in accordance with the Defra guidance until new guidance is issued. Defra's Good Practice Guide for Handling Soils is made up of nineteen sections which describe various phases and alternative methods of soil handling. The Soil Handling Strategy required for the Scheme would form part of the CEMP and would be developed prior to construction when further details of specific construction and earthworks methodologies are finalised. An Outline CEMP (**Application Document Reference: TR010031/APP/7.4**) has been produced for the Scheme which includes mitigation measures to be implemented during construction. As a minimum soil management measures during construction would include:

- a. Stripping of topsoil and subsoil, when weather and soil conditions are suitable (i.e. not during wet inclement weather conditions).
- b. Surface stripping then separating storage and management of topsoil and subsoil into storage heaps, which are well aerated and covered to limited infiltration and dust generation.
- c. Return of topsoil/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, for example, reducing the use of heavy plant or tracked vehicles passing over topsoils.
- e. Digging out and aerating any highly compacted areas of organic/agricultural soil to be reused as topsoil in any landscaped areas.
- f. Dust suppression measures, such as damping down, during periods of dry weather.

Pollution of Controlled Water Bodies

9.9.7. As part of the construction works the Principal Contractor would implement the measures within a CEMP to mitigate risks associated with the construction phase, along with those measures, such as a temporary surface water drainage strategy and piling risk assessment associated with future bridge structures are set out in **Chapter 13 Drainage and the Water Environment** of this ES (**Application Document Reference: TR010031/APP/6.1**). The CEMP would include the following measures:

- a. 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).
- b. Measures would be put in place to prevent pollution from construction plant, vehicles and machinery including all refuelling being supervised, in a designated area and on an impermeable surface, away from drains and watercourses.
- c. Plant would be maintained in a good condition with wheel washing in place.
- d. All drains within the Scheme Footprint would be identified and labelled and measures implemented to prevent polluting substances from entering them e.g. silt traps, drain blocker, as appropriate.
- e. All fuel, oil and chemicals would be stored in a designated secure area, with secondary containment provided.
- f. Concrete wash out would only take place at designated concrete washout areas.
- g. A grouting method statement would be produced which would include an assessment of ground conditions, potential receptors and measures included to ensure that pollution of sensitive receptors e.g. groundwater, would not occur.
- h. Grout batching plant and associated materials would be contained within a fully bunded area to prevent escape of spills.
- i. Where required, a grout curtain would be installed (e.g. using pea gravel) to restrict the flow of grout beyond the treatment boundaries;
- j. Spill mats to be placed around grouting wells to catch any grout spillages.
- k. Surface water run-off and excavation dewatering would be captured and settled out prior to disposal to sewer as appropriate. Any contaminants would be removed prior to disposal.
- l. Stockpiles and excavated materials would be stored in such a way to minimise silt laden runoff and/or windblown particles (e.g. by covering or seeding).
- m. All loose materials would be covered so as not to give rise to a significant increase in sediment load to the drainage network.

Detriment to Human Health

9.9.8. The following measures would be implemented during the construction phase to mitigate risks to human health (construction workers and surroundings site visitor/occupants):

- a. Works to be undertaken in accordance with a suitable Remedial Strategy, to be agreed with Gateshead Council ahead of site works starting.
- b. Earthworks would be completed in accordance with a CL:AIRE compliant Materials Management Plan (MMP) to ensure re-used material does not present a risk to human health or the Environment. This would ensure any contaminated material are re-used suitably as part of the cut and fill earthworks associated with the Scheme.

- c. Construction workers would wear appropriate PPE, monitoring equipment and Respiratory Protective Equipment (RPE), for example where asbestos fibres have been identified within the soil. This will be required to mitigate the potential risk of exposure to hazardous gases, dust and/or depleted oxygen levels.
- d. Temporary shoring to be used in excavations when working with loose or unstable ground.
- e. Works undertaken in accordance with a grouting method statement;
- f. All earthworks dealing with asbestos to be undertaken in accordance with the Control of Asbestos Regulations (2012).
- g. 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.
- h. Prior to earthworks being undertaken the Contractor would be provided with a plan illustrating the potential sources of contamination, toolbox talks would then be undertaken to all site operatives prior to earthworks being undertaken.

Explosion Risks within Confined Spaces

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

- a. 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.
- b. Gas monitoring equipment would be used by all operatives entering below ground confined spaces.
- c. Methane detectors would be placed within surrounding buildings (located within 50m) during drilling and grouting activities, to monitor whether any hazardous ground gases are being released as void pressure is increased during grouting.

Ground Collapse and Structural Damage

9.9.10. The following measures would be implemented during the construction phase to minimise risks associated with ground collapse and ground related structural damage:

- a. Drilling and grouting would be required to stabilise shallow voids in the ground associated with historical mine workings at a depth considered to present a risk to the Scheme.
- b. No grouting currently envisaged outside the Scheme's planning boundary.
- c. 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 (e.g. using pea gravel) to restrict the flow of grout beyond the treatment boundaries, and inhibit the impact upon any surrounding shaft walls;
- e. Mine shafts located within the Scheme Footprint would require capping, if not already suitably treated.
- f. Appropriately designed temporary shoring would be used in excavations when working with loose or unstable ground.

OPERATION

Pollution of Controlled Water Bodies

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

- a. The drainage design for the Scheme includes an attenuation pond at a proposed location of the redundant A1 carriageway. All outfalls would be retained with oil interceptors and no requirement for additional outfall points
- b. The attenuation pond would capture all the water drained from the majority of the catchment (i.e. Eighton Lodge North underbridge to Allerdene Bridge south abutment). This would reduce the rate of the surface water run-off which would have flowed freely ultimately into the River Team. The pond would do this by storing surface water run-off during peak flow (i.e. heavy rainfall) and slowly releasing the water after the peak flow has passed.
- c. The attenuation ponds would treat the water. Sediment and pollutants would settle to the bottom of the attenuation ponds and not enter the Allerdene Culvert or the River Team. Additionally, plants associated with the ponds would uptake contaminants, which would reduce the contaminant concentration in the water.
- d. The drainage design would also provide protection against spillage events and subsequent contamination of the River Team. The attenuation pond and other storage facilities would be designed with overflow and isolation systems in order to retain contaminated water before it would flow into the drainage system or watercourses. This would allow contaminated water to be treated before being discharged integral to the incident management routine.

Detriment to Human Health

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

- a. Any personnel entering enclosed spaces would complete a thorough confined spaces risk assessment and implement measures such as the inclusion of respirators and wearing gas monitors to detect for flammable gases (e.g. methane).
- b. A suitable capping layer, likely to comprise either 400mm layer of 'clean' soil or a shallower thickness with a geotextile marker layer in any areas of soft landscaping located over areas of Made Ground contaminated with asbestos. The specific requirements would be included in a site-specific Remediation Strategy to be agreed with Gateshead Council.

Enhancement Measures

9.9.13. No enhancement measures have been identified associated with the construction and operational phases of the Scheme.

9.10. ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

CONSTRUCTION

9.10.1. The following section sets out the likely significant effects of the Scheme, during the construction phase, to sensitive receptors in accordance with the methodology set out in this chapter.

Reduction Agricultural Soil Quality

- 9.10.2. The Scheme would result in temporary land take. Temporary land take would occur during the construction phase and consist of land required for the site and working compounds, construction working space and access (as illustrated on **Figure 2.3** of this ES (**Application Document Reference: TR010031/APP/6.2**)). The construction phase of the Scheme would result in the temporary land take of approximately 5.55 hectares of Grade 3a land of high sensitivity and 7.28 hectares of Grade 3b land of medium sensitivity.
- 9.10.3. Following the construction, temporary land take areas would be reinstated back to their former agricultural use in line with the Soil Handling Strategy, although it is acknowledged not all land would be restored to the soil quality prior to construction.
- 9.10.4. The sensitivity of agricultural soil is **high to medium** and the magnitude of change is **neutral** (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 to long term effect on soil quality of **minor to negligible** significance (not significant).

Detriment to Human Health

- 9.10.5. Potential sources of contamination have been identified within the Study Area (as illustrated on **Figure 9.3** of this ES (**Application Document Reference: TR010031/APP/6.2**)). However, the ground investigation (**Appendix 9.2** of this ES (**Application Document Reference: TR010031/APP/6.3**)) has identified limited levels of ground contamination when targeting these areas, with the exception of the presence of trace asbestos fibres in deposits of Made Ground.
- 9.10.6. Should significant contamination be encountered during the construction phase earthworks, appropriate remediation or mitigation measures would be implemented as part of the steps set out in a Remediation Strategy. Which would also set out health and safety protection measures to protect construction workers.
- 9.10.7. Risk assessments to be undertaken utilising the ground investigation information to inform suitable personal protective measures and method statements to mitigate risks associated with encountering contamination (e.g. asbestos fibres) for construction works.
- 9.10.8. Coal Authority reporting has indicated shallow (<30m) and deep worked coal seams are located beneath the Study Area which may have the potential to generate hazardous ground gasses. Historical landfills are also located within the Study Area which also has the potential to generate hazardous ground gas.
- 9.10.9. Mitigation measures include suitable risk assessments and control measures (monitors and respirators) for any development or maintenance personnel entering confined spaces (e.g. drainage chambers).
- 9.10.10. The sensitivity of human health receptors is medium, and the magnitude of change is neutral (due to the implementation of mitigation measures). Therefore, there is no effect on human health receptors.

Pollution of Controlled Water Bodies

- 9.10.11. Controlled water receptors considered as being potentially susceptible to impact from contaminants include underlying Secondary A aquifers associated with the superficial deposits and bedrock and surrounding surface watercourses, particularly the River Team.
- 9.10.12. During the construction phase of the development there would be vehicles regularly using and parking on the Study Area (primarily within the site compound). This activity would generate the potential for fuels or oil leaks from vehicles, which may result in pollution of controlled water bodies (surface water courses and underlying aquifers). However, proposed pollution control measures incorporated as part of the CEMP would mitigate the associated potential adverse impacts.
- 9.10.13. Earthworks will be undertaken in close proximity to surface water courses, primarily associated with widening of the Kingsway Viaduct which crosses the River Team, extending the existing Allerdene Culvert/Drain (which flows into the River Team), demolition/removal of the existing Allerdene Bridge and construction of the new bridge structure (located over and adjacent to the Allerdene Culvert/Drain). The construction and demolition related earthworks have the potential to generate silt laden run-off during periods of wet weather. Silt laden run-off could potentially reach surrounding surface watercourses, causing deoxygenation of the water and harming aquatic ecosystems. The mitigation measures include the incorporation of a temporary drainage system, including a silt traps which would ensure attenuation of contamination before discharge. These facilities would be subject to routine maintenance and will mitigate the associated risks. Location and continual management of stockpiled material will also be carefully managed to ensure silt-laden run off is not generated during periods of inclement weather.
- 9.10.14. Both Allerdene embankment option and Allerdene viaduct option will be constructed over and adjacent to the Allerdene Culvert/Drain. Given the scale of the associated earthworks there will be potential for silt laden runoff to impact the culvert/drain. The size of the earth embankment and requirement to stockpile material is significantly larger associated with Allerdene embankment option when compared to the viaduct option, which will increase the potential for silt laden run-off to impact surface water quality, particularly during periods of inclement weather. Stringent adherence to the measures within the CEMP are considered to mitigate the risks, however, minor impacts may not be fully eliminated during periods of inclement weather associated with the Allerdene embankment option.
- 9.10.15. Piling and modulus columns associated with construction of bridges could potentially create preferential pathways for contaminants to migrate down into the underlying groundwater and associated aquifer bodies. However, mobile contaminants have not been identified along the Scheme Footprint at concentrations considered to pose a risk to controlled water receptors in areas likely to be piled/improved.
- 9.10.16. Grouting of below ground shallow mine voids may impact the turbidity and chemical quality of the Secondary A Aquifer. However, groundwater is not abstracted for either potable or licenced industrial uses within 500m of the Scheme Footprint. Given the low permeability of

the coal mining stratum any impacted groundwater is likely to be confined at depth and not in hydraulic continuity with surface water courses.

- 9.10.17. The sensitivity of surface water receptors and underlying Secondary A aquifers is **medium** and the magnitude of change is **neutral** and **slight** associated with Allerdene embankment option and Allerdene viaduct option respectively (post implementation of mitigation measures). Therefore, there is likely to be a direct, temporary effect on controlled water receptors of **minor to negligible** significance (not significant) following the implementation of the mitigation measures.

Migration of Hazardous Ground Gas Causing an Explosion

- 9.10.18. A number of hazardous ground gas (carbon dioxide, methane, carbon monoxide) sources have been identified beneath the Scheme, primarily shallow mine workings and landfill.
- 9.10.19. A suitable risk assessment would be produced and implemented to ensure the protection of workers and the public during the Scheme's construction period. These would include using gas alarms during periods of drilling and grouting, or any works within enclosed spaces.
- 9.10.20. The sensitivity of on-site infrastructure and surrounding buildings is **medium**, and the magnitude of change is **neutral** (due to the implementation of the mitigation measures). Therefore, there is likely to be a direct, temporary effect on buildings and infrastructure of **negligible** significance (not significant) following the implementation of the mitigation measures.

Ground Instability

- 9.10.21. Shallow worked coal seams and a number of historical mine shafts have been identified within the Study Area, which if left untreated could pose a below ground collapse risk if built upon.
- 9.10.22. All site personnel would be made aware of the findings of the ground investigation (**Appendix 9.2** of this ES (**Application Document Reference: TR010031/APP/6.3**)) and CMRA (**Appendix 9.3** of this ES (**Application Document Reference: TR010031/APP/6.3**)) and the risk of instability hazards. It is recommended that a risk assessment be prepared to ensure the protection of workers and the general public during the Scheme's construction period.
- 9.10.23. Mitigation measures during the construction phase would include either incorporating geogrid into the highway construction or grouting shallow mine workings associated with shallow coal workings, as illustrated on **Figure 9.2** of this ES (**Application Document Reference: TR010031/APP/6.2**). Further ground investigation would be undertaken to definitively define the extent of mitigation measures.
- 9.10.24. The sensitivity of the highways related infrastructure is considered to be **medium**, and the magnitude of change should this occur, following mitigation is **slight to neutral** (due to the implementation of the mitigation measures). Therefore, there is likely to be a direct temporary, short to long term effect of **minor to negligible** significance (not significant).

OPERATION

- 9.10.25. The following section sets out the likely effects of the Scheme, during the operational phase, to sensitive receptors in accordance with the methodology set out in this chapter.

Reduction of Agricultural Soil Quality

- 9.10.26. The Scheme would result in the permanent agricultural land take of approximately 0.2 hectares of Grade 3a land of high sensitivity and 1.37 hectares of Grade 3b land of medium sensitivity (as illustrated on **Figure 9.1** of this ES (**Application Document Reference: TR010031/APP/6.2**)).
- 9.10.27. The footprint of the embankments associated with Allerdene embankment option would marginally increase the agricultural soil land take of Grade 3b soil in comparison to the viaduct option. However, the marginal area of increased agricultural land take is not considered to be significant due to the small area.
- 9.10.28. The sensitivity of agricultural soils receptors is **high to medium** and the magnitude of change is **neutral** to the size of the area lost. Therefore, there is likely to be a direct, temporary and/or permanent, short to long term effect on agricultural land of **negligible** significance (not significant).

Migration of Hazardous Ground Gas Causing an Explosion

- 9.10.29. Potential sources of explosive gas (methane) have been identified within the Scheme Footprint related to historical mine workings.
- 9.10.30. If methane migrates into enclosed spaces, such as the numerous proposed drainage chambers along the route, which will be potentially accessible by future maintenance workers, it could potentially pose an explosion risk.
- 9.10.31. Monitoring would be undertaken post grouting to understand if any methane is present within enclosed chambers, further mitigation measures such as ventilation pipes would be installed should significantly elevated levels of methane be recorded.
- 9.10.32. The sensitivity of enclosed spaces (below ground drainage chambers) is considered to be **medium**, and the magnitude of change, should this occur, following mitigation is **neutral**. Therefore, there is likely to be a direct temporary, short to long term effect of **negligible** significance (not significant).

Ground Instability

- 9.10.33. Ground instability risks would be mitigated during the construction phase works associated with the drilling and grouting works. The associated effects are therefore neutral.

9.11. MONITORING

- 9.11.1. All monitoring requirements and validation elements (as set out below) will be set out in the CEMP and Handover Environmental Management Plan (HEMP).

- 9.11.2. During construction, surface watercourses would be monitored regularly to identify any pollution as a result of e.g. silt, fuel or chemicals.
- 9.11.3. Dust monitoring associated with earthworks in areas contaminated by asbestos fibres would be carried out during construction, as required. Consideration would be given to carrying out asbestos dust related monitoring at appropriate locations.
- 9.11.4. Gas monitoring to be undertaken when entering any enclosed spaces in the vicinity of historical mine workings.
- 9.11.5. Following reinstatement of the temporary land take, there would be a programme of monitoring of soil conditions to identify if there are soil problems which need to be remediated. This would include an assessment of the problem and design of a suitable remediation strategy such as subsoiling or drainage followed by crop establishment.

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