

M60/M62/M66 Simister Island Interchange

TR010064

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
Procedure) Regulations 2009**

**M60/M62/M66 Simister Island Interchange
Development Consent Order 202[]**

**ENVIRONMENTAL STATEMENT
CHAPTER 9 GEOLOGY AND SOILS**

Regulation Reference	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010064
Application Document Reference	TR010064/APP/6.1
Author	M60/M62/M66 Simister Island Interchange Costain Jacobs Partnership Project Team & National Highways

Version	Date	Status of Version
P01	April 2024	DCO APPLICATION ISSUE

CONTENTS

9	Geology and soils	1
9.1	Introduction	1
9.2	Competent expert evidence	1
9.3	Legislative and policy framework	2
9.4	Assessment methodology	13
9.5	Assessment assumptions and limitations	24
9.6	Study area.....	25
9.7	Baseline conditions	25
9.8	Potential impacts.....	45
9.9	Design, mitigation and enhancement measures	49
9.10	Assessment of likely significant effects	51
9.11	Monitoring	54
9.12	Summary.....	54
	Acronyms and initialisms	56
	Glossary.....	58
	References	59

LIST OF TABLES

Table 9.1	Legislation relevant to the geology and soils assessment	2
Table 9.2	NPS NN requirements for geology and soils.....	3
Table 9.3	Draft NPS NN requirements for geology and soils	4
Table 9.4	Other national, regional and local policy relevant to geology and soils	8
Table 9.5	Scoping Opinion feedback for geology and soils	14
Table 9.6	Key statutory consultation feedback for geology and soils.....	17
Table 9.7	Environmental value (sensitivity) and descriptions.....	21
Table 9.8	Magnitude of impact (change) and typical descriptions	22
Table 9.9	Surveyed ALC grade of land within the Order Limits	34
Table 9.10	Summary of ground gas monitoring results	38
Table 9.11	Value (sensitivity) of receptors in the study area for geology and soils	43
Table 9.12	Areas of permanent and temporary land-take by ALC grade	46
Table 9.13	Effects on soils receptors	52
Table 9.14	Summary of residual significant effects for geology and soils	55

9 Geology and soils

9.1 Introduction

- 9.1.1 This chapter presents the information required by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 to be provided in the Environmental Statement for the M60/M62/M66 Simister Island Interchange (the 'Scheme') in respect of geology and soils.
- 9.1.2 This chapter considers geology (bedrock geology and superficial deposits, including geological designations and valuable non-designated features), soil resources (mostly agricultural) and land contamination (effects on human health, surface water and groundwater), in accordance with Design Manual for Roads and Bridges (DMRB) LA 109 Geology and soils (Highways England, 2019).
- 9.1.3 The role of soils in carbon storage and drawdown is addressed in Chapter 14: Climate of this Environmental Statement (TR010064/APP/6.1). Mineral resources are covered in Chapter 10: Material Assets and Waste of this Environmental Statement (TR010064/APP/6.1). Hydrogeology, where not associated with land contamination, is covered in Chapter 13: Road Drainage and the Water Environment of this Environmental Statement (TR010064/APP/6.1). For surface water and groundwater quality, this chapter only considers the effects from land contamination. Detailed assessment of the effects of the Scheme on water quality is provided in Chapter 13: Road Drainage and the Water Environment of this Environmental Statement (TR010064/APP/6.1).
- 9.1.4 This chapter is supported by the following Environmental Statement Figures (TR010064/APP/6.2):
- Figure 9.1: Bedrock Geology
 - Figure 9.2: Superficial Geology and Boreholes
 - Figure 9.3: Agricultural Land Classification (ALC)
 - Figure 9.4: Potential Current and Historical Contamination Sources
- 9.1.5 This chapter is supported by the following Environmental Statement Appendices (TR010064/APP/6.3):
- Appendix 9.1: Chemical Results Screening Tables
 - Appendix 9.2: ALC Survey Report
 - Appendix 9.3: Ground Investigation Report

9.2 Competent expert evidence

- 9.2.1 The assessment has been undertaken and reported by a team of competent Land Quality specialists. The competent expert responsible for the assessment is an Associate Director in Land Quality with a postgraduate degree in Environmental Science and chartership of the Geological Society.

9.2.2 The competent expert has over 20 years' experience of undertaking geology and soils Environmental Impact Assessments (EIA) for major infrastructure and linear schemes, including highways.

9.3 Legislative and policy framework

Legislation

9.3.1 The geology and soils assessment has been undertaken in accordance with the legislation set out in Table 9.1.

Table 9.1 Legislation relevant to the geology and soils assessment

Legislation	Relevance to the Scheme	How this legislation is addressed in the assessment
Environmental Protection Act 1990: Part 2A (Contaminated Land)	Lays out a means of defining and dealing with risks posed by land contamination to human health and the environment.	A contaminated land risk assessment has been undertaken as part of this geology and soils assessment.
Environmental Damage (Prevention and Remediation) (England) Regulations 2015	Lays out a framework for the prevention and remediation of damage to the environment.	A contaminated land risk assessment has been undertaken as part of this geology and soils assessment.
Water Resources Act 1991	Defines Controlled Waters and the methods to protect water quality.	A controlled waters risk assessment has been undertaken as part of this geology and soils assessment.
Control of Asbestos Regulations 2012	Defines the different types of asbestos work and the health and safety requirements for those works.	An assessment of risks from asbestos in soils has been included as part of this geology and soils assessment.

Policy

National Policy Statement for National Networks

9.3.2 The National Policy Statement for National Networks (NPS NN) (Department for Transport (DfT), 2014) sets out the Government's policies relating to the development of Nationally Significant Infrastructure Projects (NSIPs) on the national road and rail networks in England. The Secretary of State uses the NPS NN as the primary basis for making decisions on Development Consent Order (DCO) applications.

9.3.3 Table 9.2 summarises the policy requirements from the NPS NN relating to the applicant's assessment and mitigation requirements for geology and soils and how these requirements have been addressed in the assessment. See also the NPS NN Accordance Tables (TR010064/APP/7.2) for an assessment of the Scheme's compliance with the NPS NN.

Table 9.2 NPS NN requirements for geology and soils

Paragraph reference	Applicant's assessment / mitigation requirement	How this is addressed in the assessment
5.22	<i>'Where the project is subject to EIA the applicant should ensure that the Environmental Statement clearly sets out any likely significant effects on internationally, nationally and locally designated sites of ecological or geological conservation importance (including those outside England) on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity and that the statement considers the full range of potential impacts on ecosystems.'</i>	<p>There are no geological Sites of Special Scientific Interest (SSSIs) within the geology and soils study area. Impacts to geology are scoped out of the assessment (see Table 9.5 of this chapter).</p> <p>Internationally, nationally and locally designated sites dependent on soils for their ecological designations have been scoped out of this assessment as none have been identified within the geology and soils study area. Impacts on priority habitats are scoped in to the assessment.</p>
5.23	<i>'The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.'</i>	
5.168	<i>'Applicants should take into account the economic and other benefits of the best and most versatile (BMV) agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification (ALC) system). Where significant development of agricultural land is demonstrated to be necessary, applicants should seek to use areas of poorer quality land in preference to that of a higher quality. Applicants should also identify any effects, and seek to minimise impacts on soil quality, taking into account any mitigation measures proposed. Where possible, developments should be on previously developed (brownfield) sites provided that it is not of high environmental value. For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination and how it is proposed to address this.'</i>	<p>This assessment takes into account impacts on agricultural land (including Best and Most Versatile (BMV) land). Impacts have been identified (Section 9.8) and mitigation measures identified (Section 9.9) to reduce impacts on agricultural land and inform the assessment in Section 9.10.</p> <p>This assessment uses Environment Agency (2023) Land Contamination Risk Management (LCRM) guidance to assess risks posed to human health and the environment. Where unacceptable risks have been identified, mitigation measures have been identified (Section 9.9) to reduce impacts to land contamination receptors.</p>

Draft National Policy Statement for National Networks

9.3.4 The Government has published a draft of the NPS NN in March 2023 (DfT, 2023). The consultation closed in June 2023 and the draft NPS NN has not yet been designated. However, it is potentially capable of being an important and relevant consideration in the decision-making process. The Environmental Statement continues to reference the 2014 NPS NN though, as it remains the relevant Government policy. Notwithstanding that position, Table 9.3 summarises the policy requirements from the draft NPS NN relating to the applicant’s assessment and mitigation requirements for geology and soils and how these have been addressed in the assessment. See also the Draft NPS NN Accordance Tables (TR010064/APP/7.3) for an assessment of the Scheme’s compliance with the draft NPS NN.

Table 9.3 Draft NPS NN requirements for geology and soils

Paragraph reference	Applicant’s assessment / mitigation requirement	How this is addressed in the assessment
5.42	<i>‘The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests as well as consider how their proposal will deliver Biodiversity net- gain in line with the requirements in a Biodiversity Gain Statement, as set out in paragraphs 4.20 to 4.23 above.’</i>	There are no geological SSSI within the geology and soils study area. Impacts to geology are scoped out of the assessment (see Table 9.5 of this chapter). Sites dependent on soils for their ecological designations have been scoped out of this assessment as none have been identified within the geology and soils study area.
5.148	<i>‘Where necessary, land contamination and stability should be considered in respect of new development. Specifically, proposals should be appropriate for the location, including preventing unacceptable risks from land contamination or instability. If land stability could be an issue, applicants should seek appropriate technical and environmental expert advice from a competent person to assess the likely consequences of proposed developments on sites where subsidence, landslides and ground compression is known or suspected. Applicants should liaise with the Coal Authority, Environment Agency and Local Authority if necessary.’</i>	Several phases of site investigation have been undertaken; a summary of the risk assessment is provided as part of this chapter. In addition, a separate Ground Investigation Report (GIR) (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) contains a full assessment of the relevant ground stability and contamination data has been completed as part of the geotechnical design considerations.

Paragraph reference	Applicant's assessment / mitigation requirement	How this is addressed in the assessment
5.149	<p><i>'For developments on previously developed land, applicants should ensure and demonstrate that they have considered the risk posed by land contamination, through engagement in pre-application discussions, and how it is proposed to address these. A preliminary assessment for land and groundwater contamination to determine the rendition and mitigation is needed under Land Contamination Risk Management. A preliminary assessment of land contamination and ground instability should be carried out at the earliest possible stage before a detailed application for development consent is prepared. Applicants should ensure that any necessary investigations are undertaken to ascertain that their sites are, and will, remain stable or can be made so as part of the development. The site needs to be assessed in the context of surrounding areas where subsidence, landslides and land compression could threaten the development during its anticipated life or damage neighbouring land or property. This could be in the form of a land stability or slope stability risk assessment report.'</i></p>	<p>Several phases of site investigation have been undertaken; a summary of the risk assessment is provided in Section 9.7 this chapter. In addition, the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) contains a full assessment of the relevant ground stability and contamination data that has been completed as part of the geotechnical design considerations.</p> <p>This assessment uses Environment Agency (2023) LCRM guidance to assess risks posed to human health and the environment. Where unacceptable risks have been identified, mitigation measures have been identified in Section 9.9 of this chapter to reduce impacts to land contamination receptors.</p>
5.150	<p><i>'Applicants have a range of mechanisms available to mitigate and minimise risks of land instability. These include:</i></p> <ul style="list-style-type: none"> <i>• Establishing the principle and layout of new development, for example avoiding mine entries and other hazards</i> <i>• Ensuring proper design of structures to cope with any movement expected, and other hazards such as mine and/or ground gases</i> <i>• Requiring ground improvement techniques, usually involving the removal of poor material and its replacement with suitable inert and stable material. For development on land previously affected by mining activity, this may mean prior extraction of any remaining mineral resource'</i> 	

Paragraph reference	Applicant's assessment / mitigation requirement	How this is addressed in the assessment
5.151	<i>'Applicants should submit a coal mining risk assessment as part of their application in specific Development High Risk areas.'</i>	A coal mining risk assessment has not been undertaken. The Coal Authority's Scoping Opinion (TR010064/APP/6.7) response stated that <i>'on the basis of our records, in respect of the route of the Scheme as indicated, we would not expect a Coal Mining Risk Assessment to be included as part of the EIA assessment'</i> (see Table 9.5 of this chapter for further details).
5.180	<i>'Applicants should take into account the economic and other benefits of the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification). Where significant development of agricultural land is demonstrated to be necessary, applicants should seek to use areas of poorer quality land in preference to that of a higher quality. Applicants should also identify any effects, and seek to minimise impacts, on soil health and protect and improve soils, taking into account any mitigation measures proposed. Soil is an important natural capital resource, providing many essential services such as storing carbon (also known as a carbon sink), reducing the risk of flooding, providing wildlife habitats and delivering global food supplies. Guidance on sustainable soil management can be found in Defra's Construction Code of Practice for the Sustainable Use of Soils on Construction Sites. As a first principle, developments should be on previously developed (brownfield) sites provided that it is not of high environmental value (see paragraphs 5.146 to 5.151).'</i>	<p>This assessment takes into account impacts on agricultural land (including BMV land). Impacts have been identified (Section 9.8) and mitigation measures identified (Section 9.9) to reduce impacts on agricultural land and inform the assessment in Section 9.10.</p> <p>This assessment uses Environment Agency (2023) LCRM guidance to assess risks posed to human health and the environment. Where unacceptable risks have been identified, mitigation measures have been identified in Section 9.9 of this chapter to reduce impacts to land contamination receptors.</p>

Paragraph reference	Applicant's assessment / mitigation requirement	How this is addressed in the assessment
		<p>Appendix F: Outline Soil Management Plan of the First Iteration Environmental Management Plan (EMP) (TR010064/APP/6.5) sets out a strategy and action plan for the management of soils which are likely to be excavated and handled during the construction phase of the Scheme. As stated in paragraph F.3.1 of Appendix F of the First Iteration EMP (TR010064/APP/6.5), soil management would be undertaken following the Department for Environment, Food and Rural Affairs (Defra) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (2009) where practicable.</p>
5.181	<p><i>'The Agricultural Land Classification is the only approved system for grading agricultural quality in England and Wales. If necessary, field surveys should be used to establish the Agricultural Land Classification grades in accordance with the current grading criteria, or any successor to it and identify the soil types to inform soil management at the construction, operation and decommissioning phases in line with the Defra Construction Code. Applicants are encouraged to develop and implement a Soil Resources and Management Plan which could help to use and manage soils sustainably and minimise adverse impacts on soil health and potential land contamination. This is to be in line with the ambition set out in the 25 Year Environment Plan to manage all of England's soils sustainably by 2030.'</i></p>	<p>ALC surveys have been undertaken (see Appendix 9.2: ALC Survey Report of the Environmental Statement Appendices (TR010064/APP/6.3) for further details).</p> <p>The ALC grade of soils surveyed within the Order Limits are set out in Table 9.9 of this chapter.</p> <p>Appendix F: Outline Soil Management Plan of the First Iteration EMP (TR010064/APP/6.5) sets out a strategy and action plan for the management of soils which are likely to be excavated and handled during the construction phase of the Scheme.</p>

Other relevant policy

9.3.5 In addition to the NPS NN, other relevant policies have been considered as part of the geology and soils assessment. Table 9.4 sets out other policy relevant to this aspect and how the assessment has considered/addressed these policies.

Table 9.4 Other national, regional and local policy relevant to geology and soils

Plan / Policy document	Key requirements and objectives	How this has been considered/addressed in the assessment
National		
<p>National Planning Policy Framework (NPPF) (Department for Levelling Up, Housing and Communities, last updated September 2023).</p> <p>The NPPF sets out the Government's planning policies for England and how these should be applied.</p>	<p>Section 15 Ground conditions and pollution: planning policies should take into account 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 remediations.</p> <p>Annex 2: Undertaking site investigation to provide a risk assessment of land potentially affected by contamination or ground stability as appropriate.</p>	<p>Ground conditions including land contamination and risks from natural hazards are included within the baseline section of this chapter (Section 9.7). Mitigation for any land contamination and geological risks are included, where required, in the mitigation section of this chapter (Section 9.9).</p> <p>Several phases of site investigation have been undertaken; a summary of the risk assessment is provided as part of this chapter. In addition, the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) contains a full assessment of the relevant ground stability and contamination data that has been completed as part of the geotechnical design considerations.</p>
<p>A Green Future: Our 25 Year Plan to Improve the Environment (Defra, last updated 2021).</p> <p>The 25-Year Environment Plan sets out the Government's long-term approach to protecting and enhancing the environment.</p>	<p>Section 3 Improving soil health and restoring and protecting our peatlands.</p> <p>Section 2. Reducing pollution: minimising the risk of chemical contamination in our water.</p>	<p>Soil health is considered as part of the soil survey which has been undertaken and assessed in Section 9.8 of this chapter.</p>

Plan / Policy document	Key requirements and objectives	How this has been considered/addressed in the assessment
		Contamination of surface waters and groundwater is considered in the risk assessment for controlled waters (paragraphs 9.7.70 to 9.7.82 of this chapter) and in Chapter 13: Road Drainage and the Water Environment of this Environmental Statement (TR010064/APP/6.1).
Safeguarding our Soils: A Strategy for England (Defra, 2011a)	<p>Chapter 1: Safeguarding our Soils – This chapter sets out a strategy to ensure all England’s soils will be managed sustainably and degradation threats tackled successfully.</p> <p>Chapter 2: Better Protection for agricultural soils – This chapter describes policies and guidance which will help farmers, foresters and other land managers to promote good practice and incentivise improved soil management.</p> <p>Chapter 6: Effective soil protection during construction and development – describes actions to be undertaken to ensure the functions of soil in supporting ecosystems, facilitating drainage and providing urban green spaces for communities are sufficiently understood and valued in the planning system and during construction.</p>	Mitigation measures to protect soil health are considered as part of this assessment (see Section 9.9 of this chapter for further details regarding mitigation for this aspect).
Regional and Local		
Places for Everyone Plan (Greater Manchester Combined Authority, 2021)	<p><u>Policy JP-G 1: Valuing Important Landscapes</u></p> <p><i>‘Development should reflect and respond to the special qualities and sensitivities of the key landscape characteristics of its location, including having regard to:</i></p> <ul style="list-style-type: none"> <i>• Topography, geology and drainage...’</i> 	The local geology has been considered in this geology and soils assessment. The geology baseline is described in Section 9.7 of this chapter, and Section 9.9 of this chapter describes embedded and essential mitigation measures.

Plan / Policy document	Key requirements and objectives	How this has been considered/addressed in the assessment
	<p><u>Policy JP-G 9: A Net Enhancement of Biodiversity and Geodiversity</u></p> <p><i>'Across the plan as a whole, a net enhancement of biodiversity resources will be sought, including by:...</i></p> <p><i>7. Safeguarding, restoring and sustainably managing our most valuable soil resources, tackling soil degradation/erosion and recovering soil fertility, particularly to ensure protection of peat-based soils and safeguard 'best and most versatile' agricultural land.'</i></p> <p><i>'Development will be expected to:...</i></p> <p><i>e. Provide robust evidence in accordance with relevant government and other guidance, including field surveys wherever development of 'best and most versatile' agricultural land is proposed or to establish the status of the land within the Agricultural Land Classification system.'</i></p>	<p>Appendix F: Outline Soil Management Plan of the First Iteration EMP (TR010064/APP/6.5) sets out a strategy and action plan for the management of soils which are likely to be excavated and handled during the construction phase of the Scheme.</p> <p>ALC surveys have been undertaken (see Appendix 9.2: ALC Survey Report of the Environmental Statement Appendices (TR010064/APP/6.3) for further details).</p> <p>The ALC grade of soils surveyed within the Order Limits are set out in Table 9.9 of this chapter.</p>

Plan / Policy document	Key requirements and objectives	How this has been considered/addressed in the assessment
Bury Unitary Development Plan (Bury Metropolitan Borough Council, 1997)	<p><u>Policy EN6: Conservation of the Natural Environment</u> <i>'The Council will retain, protect and enhance the natural environment of the Borough, particularly in relation to areas of ecological, wildlife and geological importance.'</i></p> <p><u>Policy EN6/1: Sites of Nature Conservation Interest</u> <i>'Planning permission will not be granted for development in or in the vicinity of a designated or proposed site of national or county/regional importance (Site of Special Scientific Interest or National Nature Reserve or Site of Biological Importance which has been identified as of national or county/regional importance i.e. Grade A) which would destroy or adversely affect, either directly or indirectly, the nature conservation interest of the site, unless it can be demonstrated that other material considerations outweigh the special interest of the site.'</i></p>	There are no geological SSSI within the geology and soils study area. Impacts to geology are scoped out of the assessment (see Table 9.5 of this chapter).
	<p><u>Policy EN7: Pollution Control</u> <i>'The Council will seek to control environmental nuisance and minimise pollution levels associated with development by limiting the environmental impact of pollution, wherever possible, in conformity with current legislation and prescribed standards.'</i></p>	This assessment uses Environment Agency (2023) LCRM guidance to assess risks posed to human health and the environment. Where unacceptable risks have been identified, mitigation measures have been identified in Section 9.9 of this chapter to reduce impacts to land contamination receptors.

Plan / Policy document	Key requirements and objectives	How this has been considered/addressed in the assessment
	<p><u>Policy OL4: Agriculture</u> <i>'The Council will seek to protect both farming activities and the best and most versatile agricultural land in the Borough.'</i></p> <p><u>Policy OL4/1: Agricultural Land Quality</u> <i>'The Council will protect the Borough's best and most versatile agricultural land and will not permit proposals for development which would result in its loss to agriculture.'</i></p>	<p>This assessment takes into account impacts on agricultural land (including BMV land). Impacts have been identified (Section 9.8) and mitigation measures identified (Section 9.9) to reduce impacts on agricultural land and inform the assessment in Section 9.10. Appendix F: Outline Soil Management Plan of the First Iteration EMP (TR010064/APP/6.5) sets out a strategy and action plan for the management of soils which are likely to be excavated and handled during the construction phase of the Scheme.</p>
<p>Manchester Core Strategy (Manchester City Council, 2012)</p>	<p><u>Policy EN15: Biodiversity and Geological Conservation</u> <i>'The Council will seek to maintain or enhance sites of biodiversity and geological value throughout the City. Particular consideration will be given to:...</i></p> <ul style="list-style-type: none"> • <i>sites with international or national designations for their biodiversity value. Manchester contains one Site of Special Scientific Interest (SSSI) (Cotteril Clough)'</i> <p><i>'Development should wherever possible seek to maintain, enhance or restore existing geology.'</i></p>	<p>There are no geological SSSI within the geology and soils study area. Impacts to geology are scoped out of the assessment (see Table 9.5 of this chapter).</p>

Plan / Policy document	Key requirements and objectives	How this has been considered/addressed in the assessment
	<p><u>Policy EN18: Contaminated Land and Ground Stability</u></p> <p><i>'The Council will give priority for the remediation of contaminated land to strategic locations as identified within this document. Any proposal for development of contaminated land must be accompanied by a health risk assessment.</i></p> <p><i>All new development within former mining areas shall undertake an assessment of any associated risk to the proposed development and, if necessary, incorporate appropriate mitigation measures to address them.'</i></p>	<p>This assessment uses Environment Agency (2023) LCRM guidance to assess risks posed to human health and the environment. Where unacceptable risks have been identified, mitigation measures have been identified in Section 9.9 of this chapter to reduce impacts to land contamination receptors.</p> <p>A coal mining risk assessment has not been undertaken. The Coal Authority's Scoping Opinion (TR010064/APP/6.7) response stated that <i>'on the basis of our records, in respect of the route of the Scheme as indicated, we would not expect a Coal Mining Risk Assessment to be included as part of the EIA assessment'</i> (see Table 9.5 of this chapter for further details).</p>

9.4 Assessment methodology

Assessment scope

Scoping Opinion

- 9.4.1 Table 9.5 summarises the key requirements from the Planning Inspectorate's Scoping Opinion (TR010064/APP/6.7) as relevant to the scope of the geology and soils assessment, and identifies any matters scoped out of the assessment as agreed with the Planning Inspectorate and other stakeholders. This table also explains any changes to the assessment methodology as a result of this engagement.

Table 9.5 Scoping Opinion feedback for geology and soils

Stakeholder	Comment	Response
Planning Inspectorate	<p><u>ID 4.5.1</u> – <i>‘Impacts to geology are proposed to be scoped out on the basis that no sensitive geological receptors are identified within the study area. Considering the baseline geological information presented, and the description of the Proposed Development, the Inspectorate is content that this matter can be scoped out.’</i></p>	<p>Noted. Impacts to geology are scoped out of the assessment.</p>
	<p><u>ID 4.5.2</u> – <i>‘On the basis that impacts to soil will be assessed during construction (as permanent and temporary losses), the Inspectorate considers that effects on soils during operation can be scoped out.’</i></p>	<p>Noted. Impacts on soils during operation are scoped out of the assessment.</p>
	<p><u>ID 4.5.3</u> – <i>‘This matter is proposed to be scoped out as contamination is anticipated to be removed during construction therefore, contact with contamination from residents or construction workers during operation is unlikely to occur. Additionally, site-specific risk assessments and method statements will reduce exposure. The Inspectorate agrees to this matter being scoped out, with the exception of ground gas as set out below. However, impacts are scoped in for maintenance and residential properties located in close proximity to the Proposed Development due to the possibility of being affected by ground gas during operation. Elaboration on this is not provided. The ES should explain the type, extent and sources of ground gas contamination anticipated during operation and assess the significant effects on receptors likely to be impacted by it. Any appropriate mitigation should be detailed and secured via the DCO.’</i></p>	<p>Ground gases were monitored as part of the ground investigations and a ground gas risk assessment has been completed and presented in paragraphs 9.7.60-9.7.69 of this chapter.</p> <p>Ground gas is not considered to present a risk to nearby residential properties, therefore no mitigation is required. However, there is a residual risk to construction and maintenance workers, which is addressed in Appendix J: Outline Contaminated Land Management Plan of the First Iteration EMP (TR010064/APP/6.5).</p>
	<p><u>ID 4.5.4</u> – <i>‘Operational effects on surface water and groundwater from contaminated land are scoped out of further assessment on the basis that potential contaminated land linkages would have been assessed as part of the construction phase assessment and contaminated land would only be disturbed during construction. The Inspectorate is content that this matter can be scoped out of the operational assessment.’</i></p>	<p>Noted. Impacts on surface water and groundwater from contaminated land during operation are scoped out of the assessment.</p>

Stakeholder	Comment	Response
	<p><i>ID 4.5.5 – ‘There are multiple references to a programme of ground investigations leading to production of a Ground Investigation (GI) report in Chapter 5 and Chapter 10 of the Scoping Report. Paragraph 10.5.2 states that a GI is to be completed in 2021. The Inspectorate understands that a GI report will be provided in support of the Application and as part of the ES. The scope of the assessment presented in Chapter 10 of the Scoping Report is, in many places, caveated by the statement that no ground investigation data were available at the time of preparing the report (e.g. paragraphs 10.4.10, 10.4.12 and 10.6.1). The location, extent and method of the proposed GI should be described in the ES and be supported by relevant figures. Effort should be made to agree these surveys with the relevant consultation bodies so as to ensure a robust baseline from which to assess the significance of effects. The ES should also be clear about any additional ground investigation that may be proposed as mitigation and which is to be delivered post-consent. Where “ground investigation data are unavailable at the time of drafting the Environmental Statement” (paragraph 10.8.2), the assessment should be clear as to methodological assumptions and inherent limitations and implications for the confidence of the assessment of residual effects.’</i></p>	<p>Three ground investigations (GI) have been completed, as stated in paragraph 9.7.2 of this chapter. This data has been incorporated into a contaminated land risk assessment summarised in Section 9.7.</p> <p>Based on the risk assessment and conceptual site model, no significant contamination sources were identified, therefore no agreement regarding the GI strategy was sought from regulatory bodies.</p> <p>Mitigation measures and management of residual contamination is discussed in Section 9.9 of this chapter.</p>
<p>Environment Agency</p>	<p><i>‘We have no information on the groundwater levels on the site however we do not expect shallow groundwater to be present at the site.....</i></p> <p><i>.....site investigation should be completed to ascertain whether sand bands which may store water exist.’</i></p>	<p>Groundwater has been assessed as part of the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) – summarised in Section 9.7 of this chapter.</p>

Stakeholder	Comment	Response
Natural England	<p><i>'Chapter 10.4.4 confirms that peat deposits are present and will be removed as part of the proposal.</i></p> <p><i>Peat is a precious resource that can take thousands of years to form and should therefore be considered an irreplaceable habitat. Peat represents the largest terrestrial carbon store in the UK and performs an important role in water catchment management. All deep peat (40cm or deeper) is understood by Natural England to be Blanket Bog and we recommend that further investigation is carried out to determine the extent of peat habitat that could be affected.</i></p> <p><i>Natural England advise that impacts to peat should be included in the scoping questions in Table 10.3.'</i></p>	<p>During subsequent consultation, further information was presented based on GI and soil (ALC) survey data, and Natural England agreed that this demonstrates that the peat is not continuous and that impacts would be localised. Natural England also stated that it supports storage compound and spoil pile locations which avoid deep peat, the preparation of a peat handling strategy, and the reuse of peat on site to enhance biodiversity mitigation. Appropriate mitigation for the management and handling of soil materials, including any peat, is described within Appendix F: Outline Soil Management Plan of the First Iteration EMP (TR010064/APP/6.5).</p> <p>Further details of engagement with Natural England will be recorded in the Statement of Common Ground, which will be submitted during the course of the Examination.</p>
Coal Authority	<p><i>'....note that a ground investigation is programmed to inform an assessment of the ground conditions along the route of the Scheme. Any identified risks encountered arising from past coal mining activity at surface or shallow depth during these works should be properly considered and remediated, where necessary, to ensure the safety and stability of the development. However, on the basis of our records, in respect of the route of the Scheme as indicated, we would not expect a Coal Mining Risk Assessment to be included as part of the EIA assessment.'</i></p>	<p>Noted. A Coal Mining Risk Assessment has not been included in the Environmental Statement.</p>

Statutory consultation

- 9.4.2 Table 9.6 identifies the key feedback received from statutory bodies during the statutory consultation. All comments raised during the statutory consultation, as well as the Applicant's responses, are included in Annex Q of the Consultation Report Annexes (TR010064/APP/5.2).
- 9.4.3 identifies the key feedback received from the statutory consultation for geology and soils. All comments raised during the statutory consultation, as well as the Applicant's responses, are included in Annex Q of the Consultation Report Annexes (TR010064/APP/5.2).

Table 9.6 Key statutory consultation feedback for geology and soils

Stakeholder	Comment	Response
Natural England	Natural England raised several concerns over the construction and operation proposals and potential impacts on peat.	<p>During subsequent consultation, further information was presented based on GI and soil survey data, and Natural England agreed that this demonstrates that the peat is not continuous and that impacts would be localised. Natural England also stated that it supports storage compound and spoil pile locations which avoid deep peat, the preparation of a peat handling strategy, and the reuse of peat on site to enhance biodiversity mitigation. Appropriate mitigation for the management and handling of soil materials, including any peat, is described in Appendix F: Outline Soil Management Plan of the First Iteration EMP (TR010064/APP/6.5).</p> <p>Further details of engagement with Natural England will be recorded in the Statement of Common Ground, which will be submitted during the course of the Examination.</p>

Stakeholder	Comment	Response
	<p>Natural England advised that a peat specialist should be utilised who can advise on, and supervise soil (including peat) handling, including identifying when soils can be handled and how to make the best use of soils on site.</p>	<p>The Applicant has engaged soil scientists/peat specialists to advise on soil handling and reuse, and they have provided input into Appendix F: Outline Soil Management Plan of the First Iteration EMP (TR010064/APP/6.5) to ensure that adequate controls are in place to manage peaty soils appropriately.</p>
	<p>Natural England stated that it requires a detailed breakdown of the permanent and temporary land-take in relation to ALC grades. Whilst Natural England broadly agree with the EIA assessment methodology, the assessment should take account of the pattern of ALC grades on a site so that the highest significance value for the agricultural land receptor is that which is then applied to the land subject to permanent and temporary land take as a whole. The Environmental Statement should clearly demonstrate how the master planning has considered the ALC grades and avoided BMV and sensitive soils (including peat) where possible.</p>	<p>A detailed breakdown of the land take by ALC grade is provided in Table 9.12 of this chapter. The pattern of ALC grades has been taken into account within the assessment of effects, but this does not mean that the highest receptor value (very high for Grade 2) has been applied to the entire extent of land take, as Grade 2 soils are only present in one limited area.</p> <p>Chapter 3: Assessment of Alternatives of this Environmental Statement (TR010064/APP/6.1) contains information on how development footprints have evolved to reduce land-take where practicable, thereby avoiding potential impacts on BMV land and sensitive soils.</p>
	<p>Natural England advised that the assessment should make reference to the guidance 'A New Perspective on Land and Soil in Environmental Impact Assessment'</p>	<p>DMRB LA 109 is the established guidance for National Highways' schemes and has been used for the geology and soils assessment.</p>
<p>Environment Agency</p>	<p><i>'Northern Area We have no information on the groundwater levels on the site however we do not expect shallow groundwater to be present at the site... ...site investigation should be completed to ascertain whether sand bands which may store water exist.'</i></p>	<p>Three ground investigations have been completed as part of the works as laid out in paragraph 9.7.1. These data have been incorporated into a contaminated land risk assessment within the GIR(Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)), as summarised in Section 9.7.</p>

Stakeholder	Comment	Response
	<p><i>'Southern Area</i></p> <p><i>No site investigation has yet been completed at the site since the plans are still in development. A site investigation is planned, and this should provide further information on the risks to the environment with respect to groundwater. The current plans show that no infiltration is going to groundwater however there is potential for this to change in the future. We would expect a minimum of a Desk study in line with LCRM guidance to be submitted with any application.'</i></p>	<p>Three ground investigations have been completed, as stated in paragraph 9.7.2 of this chapter. These data have been incorporated into a contaminated land risk assessment within the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)), and summarised in Section 9.7 of this chapter.</p>
	<p><i>'A remediation strategy to deal with the risks associated with contamination of the site in respect of the development, should be undertaken.'</i></p>	<p>As no unacceptable risks to human health or controlled waters have been identified (see Section 9.7 of this chapter), a remediation strategy is not required.</p>
<p>Bury Metropolitan Borough Council</p>	<p>This Section is satisfied that the scoping exercise has identified the information required to be included in the Environmental Statement. The following is required for submission:</p> <ul style="list-style-type: none"> • Ground Investigation Report, Remediation Strategy and Materials Management Plan (if required) and Verification Report. • Confirmation the Environment Agency are satisfied with the Controlled Waters Risk Assessment. 	<p>As no unacceptable risks to human health or controlled waters have been identified (see Section 9.7 of this chapter), a remediation strategy and verification report is not required.</p> <p>No significant risks to controlled waters have been identified by the Generic Quantitative Risk Assessment (GQRA) (see paragraphs 9.7.55 to 9.7.59 of this chapter) and a Detailed Quantitative Risk Assessment (DQRA) is not considered necessary. It is not standard practice for the Environment Agency to approve GQRA.</p>

General approach

- 9.4.4 The assessment of the potential effects on the geology and soils takes into account the DMRB standards LA 109 (Highways England, 2019) LA 104 Environmental assessment and monitoring (Highways England, 2020a), and LA 113 Road drainage and the water environment (Highways England, 2020b). Note that the sensitivity assessment of surface water receptors has been revised as per the draft Departure from Standards agreed with National Highways (National Highways, 2023a). The LCRM (Environment Agency, 2023) and Agricultural Land Classification: Protecting the Best and Most Versatile Agricultural Land Technical Information Note TIN049 (Natural England, 2012) have also been considered.
- 9.4.5 Technical consultation with various statutory and non-statutory bodies was undertaken, to obtain the latest information on baseline conditions. Replies were received from the Environment Agency, Bury Metropolitan Borough Council, Contaminated Land: Applications in Real Environments (CL:AIRE) and the Coal Authority to inform the assessment. This information is presented in Section 9.7.
- 9.4.6 A Preliminary Sources Study was completed as part of the scoping works for the Scheme. Within this document, potential sources of contamination were identified that could pose a risk to human health and the environment.
- 9.4.7 To clarify the risks to human health and the environment, associated with the potential sources of land contamination identified in the Preliminary Sources Study, three phases of GI and post-fieldwork ground gas / groundwater monitoring were undertaken between 2021 and 2023. This was accompanied by a walkover to better understand the site layout and identify any health and safety risks to the works. The potential risks to human health have been assessed by the screening of soil analytical data against generic human health assessment criteria. This screening exercise is included in Appendix 9.1: Chemical Results Screening Table of the Environmental Statement Appendices (TR010064/APP/6.3). The GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) contains a full assessment of the relevant ground stability and contamination data has been completed as part of the geotechnical design considerations. A summary of the GI is presented in Section 9.7 and risk assessment summaries are provided in Section 9.8 of this chapter.

Assessment criteria

Value (sensitivity) of receptors

- 9.4.8 Value (sensitivity) has been assigned to receptors according to the criteria outlined in Table 9.7 (from DMRB LA 109, Table 3.11). Groundwater and surface water receptors are defined as per the Departure from Standards (National Highways, 2023a) discussed in paragraph 9.4.3 of this chapter.

Table 9.7 Environmental value (sensitivity) and descriptions

Value (sensitivity)	Typical description
Very high	<p>Geology: International designated sites of geological value (e.g. UNESCO World Heritage Sites).</p> <p>Soil: ALC grades 1 and 2.</p> <p>Soils directly supporting an EU designated site (e.g. Special Area of Conservation (SAC) or Special Protection Area (SPA)).</p> <p>Human health: Very sensitive land use such as residential or allotments.</p> <p>Groundwater quality: Groundwater that locally supports a groundwater dependent terrestrial ecosystem (GWDTE).</p> <p>Inner source protection zone (SPZ1).</p> <p>Principal aquifer.</p> <p>Surface water quality: Watercourse classified by the Water Framework Directive (WFD) as having an Ecology Status of High or Good.</p> <p>Site protected/designated under European Commission (EC) or UK legislation (SAC, SPA, Sites of Special Scientific Interest (SSSI), Ramsar site, salmonid water/species protected by EC legislation).</p>
High	<p>Geology: Rare and of national importance with little potential for replacement (e.g. geological SSSI).</p> <p>Human health: High sensitivity land use such as public open space.</p> <p>Soil: ALC subgrade 3a. Soils directly supporting a UK designated site (e.g. SSSI).</p> <p>Groundwater quality: Principal or secondary A aquifer providing locally important resource or supporting a river ecosystem. Outer source protection zone (SPZ2).</p> <p>Surface water quality: Watercourse classified by the WFD as having an Ecology Status of Moderate, Poor or Bad. Species protected under EC or UK legislation.</p>
Medium	<p>Geology: Regionally Important Geological Sites (RIGS) with limited potential for replacement.</p> <p>Human health: Medium sensitivity land use such as commercial or industrial.</p> <p>Soil: ALC subgrade 3b. Soils supporting non-statutory designated sites (e.g. Local Nature Reserve (LNR)).</p> <p>Groundwater quality: Aquifer providing water for agricultural or industrial use with limited connection to surface water. Unlicensed private water supply. Total catchment source protection zone (SPZ3).</p> <p>Surface water quality: Watercourses included in the WFD but not having a WFD classification.</p>
Low	<p>Geology: Geology of local importance / interest with potential for replacement (e.g. non designated geological exposures, former quarries / mining sites).</p> <p>Human health: Low sensitivity land use such as highways and rail.</p>

Value (sensitivity)	Typical description
	<p>Soil: ALC grades 4 and 5. Soils supporting non-designated notable or priority habitats.</p> <p>Groundwater quality: Unproductive strata. Groundwater supporting a non-designated site with low groundwater dependency.</p> <p>Surface water quality: Watercourses not having a WFD classification shown in a River Basin Management Plan (RBMP).</p>
Negligible	<p>Geology: No geological exposures, little / no local interest.</p> <p>Human health: Undeveloped surplus land / no sensitive land use proposed.</p> <p>Soil: Previously developed land formerly in 'hard uses' with little potential return to agriculture.</p> <p>Groundwater quality: Not applicable.</p> <p>Surface water quality: Not applicable.</p>

Magnitude of impact (change)

- 9.4.9 Magnitude of impact (change) on receptors has been assessed according to the criteria outlined in Table 9.8 (from DMRB LA 109, Table 3.12) and the application of professional judgement from the competent expert for land quality.
- 9.4.10 The descriptors below all relate to adverse effects. Beneficial effects would be based on the potential for betterment of adverse soil quality which may be harmful to human health, surface water and groundwater. This could be through removal of impacted soils off site or in situ / ex-situ remediation of soils as part of the site development. Where there is the potential for beneficial effects to soil quality as part of the development, professional judgement has been used.

Table 9.8 Magnitude of impact (change) and typical descriptions

Magnitude of impact (change)	Typical description
Major adverse	<p>Geology: Loss of geological feature / designation and/or quality and integrity, severe damage to key characteristics, features or elements.</p> <p>Soil: Physical removal or permanent sealing of >20 ha agricultural land.</p> <p>Human health: Significant contamination identified. Contamination levels significantly exceed background levels and relevant screening criteria (e.g. category 4 screening levels) with potential for significant harm to human health. Contamination heavily restricts future use of land.</p> <p>Groundwater quality: Results in loss of attribute and/or quality and integrity of the attribute. Loss of, or extensive change to, an aquifer. Loss of regionally important water supply. Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies. Reduction in water body WFD classification.</p>

Magnitude of impact (change)	Typical description
	<p>Surface water quality: Loss or extensive change to a fishery. Loss of regionally important public water supply. Loss or extensive change to a designated nature conservation site. Reduction in water body WFD classification.</p>
Moderate adverse	<p>Geology: Partial loss of geological feature / designation, potentially adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.</p> <p>Soil: Physical removal or permanent sealing of 1 ha – 20 ha of agricultural land or permanent loss / reduction of one or more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resource).</p> <p>Human health: Contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria (e.g. category 4 screening levels). Significant contamination can be present. Control / remediation measures are required to reduce risks to human health / make land suitable for intended use.</p> <p>Groundwater quality: Results in effect on integrity of attribute, or loss of part of attribute. Partial loss or change to an aquifer. Degradation of regionally important public water supply or loss of significant commercial/ industrial/ agricultural supplies. Partial loss of the integrity of GWDTE. Contribution to reduction in water body WFD classification.</p> <p>Surface water quality: Partial loss in productivity of a fishery. Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in water body WFD classification.</p>
Minor adverse	<p>Geology: Minor measurable change in geological feature / designation attributes, quality or vulnerability. Minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.</p> <p>Human health: Contaminant concentrations are below relevant screening criteria (e.g. category 4 screening levels). Significant contamination is unlikely with a low risk to human health. Best practice measures can be used to avoid or reduce risks to human health.</p> <p>Soil: Temporary loss / reduction of one or more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resource).</p> <p>Groundwater quality: Results in some measurable change in attributes, quality or vulnerability. Minor effects on an aquifer, GWDTEs, abstractions and structures.</p> <p>Surface water quality: Minor effects on water supplies.</p>
Negligible adverse	<p>Geology: Very minor loss or detrimental alteration to one or more characteristics, features or elements of geological feature / designation. Overall integrity of resource not affected.</p>

Magnitude of impact (change)	Typical description
	<p>Human health: Contaminant concentrations substantially below levels outlined in relevant screening criteria (e.g. category 4 screening levels). No requirement for control measures to reduce risks to human health / make land suitable for intended use.</p> <p>Soil: No discernible loss / reduction of soil function(s) that restrict current or approved future use.</p> <p>Groundwater quality: Results in effect on attribute, but of insufficient magnitude to affect the use or integrity. No measurable impact upon an aquifer and/or groundwater receptor.</p>

Significance of effect

- 9.4.11 Significance of effect has been derived using the significance matrix in Table 4.7 of Chapter 4: Environmental Assessment Methodology of this Environmental Statement (TR010064/APP/6.1). Significance of effect is derived by combining the value (sensitivity) of a receptor and the magnitude of impact (change) on the receptor.
- 9.4.12 Significant effects are those that are within the moderate, large or very large significance categories (see Chapter 4: Environmental Assessment Methodology of this Environmental Statement (TR010064/APP/6.1) for further details).

9.5 Assessment assumptions and limitations

- 9.5.1 Three phases of GI and post-fieldwork ground gas / groundwater monitoring were undertaken between 2021 and 2023 to address the risks to human health and controlled water receptors, identified in the Preliminary Sources Study and Environmental Scoping Report (TR010064/APP/6.6). A GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) was completed and a quantitative contaminated land risk assessment and conceptual site model (CSM), in accordance with LCRM guidance (Environment Agency, 2023), was undertaken, as described in Section 9.7. Assumptions and limitations in relation to the GI can be found in the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)).
- 9.5.2 It is assumed for the purposes of assessment at this stage that all soils identified within the Order Limits would be affected, therefore soils of very high to low value (sensitivity) are likely to be impacted. For the purposes of this assessment, all unsurveyed agricultural land is assumed to be Grade 3b (as the predominant grade).
- 9.5.3 Where the information gathered is limited, professional judgement has been used in interpreting available desk study and GI information.

9.6 Study area

9.6.1 DMRB LA 109 paragraph 3.5 states that the study area ‘shall be identified on a project by project basis based on the following:

- 1) the construction footprint/project boundary (including compounds and temporary land take);
- 2) the location of contamination outside the project boundary / footprint that have the potential to migrate on site and effect receptors; and,
- 3) the location of sensitive off site receptors (i.e. designated sites) that can be affected by the project, i.e. by re-mobilisation or introduction of contaminants.’

9.6.2 A buffer of 250m around the Order Limits has been used to establish baseline conditions and identify potential impacts on receptors. This is primarily based on Guidance for the Safe Development of Housing on Land Affected by Contamination (National House Building Council *et al.*, 2008) and is considered a conservative but sensible approach in the context of the Scheme, considering the distance over which contamination can migrate or which effects on soils or geological features may occur.

9.6.3 For the purposes of soil quality impact assessment, the study area has been limited to the Order Limits as all the impacts are physical and will not impact beyond the Order Limits.

9.6.4 The geology and soils study area is shown on Figures 9.1-9.4 of the Environmental Statement Figures (TR010064/APP/6.2).

9.7 Baseline conditions

Baseline sources

9.7.1 The following sources have been used to establish baseline conditions:

- Soil Survey at Simister Island, Manchester, 2022 (contained within Appendix 9.2: ALC Survey Report of the Environmental Statement Appendices (TR010064/APP/6.3))
- GIR (contained within Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3))
- British Geological Survey (BGS) (2023a), Interactive Map Viewer – GeolIndex
- BGS (2023b), Lexicon of Named Rock Units
- Coal Authority (2017), Coal Mining Report (reference: HMD-252-4559913)
- Cranfield University (2023), LandIS Soilscales Map
- Groundsure (2017a), EnviroInsight report (reference: HMD-252-4559910)
- Groundsure (2017b), GeoInsight report (reference: HMD-252-4559911)
- Groundsure (2017c), MapInsight report (reference: HMD-252-4559912)
- National Highways (2023b), Geotechnical Data Management System (GDMS)

- Defra (2023), Multi-Agency Geographic Information for the Countryside (MAGIC) Map Application

9.7.2 The results of the three phases of GI have been assessed as part of the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)). The results of the contaminated land risk assessment and CSM, undertaken as part of the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)), are summarised below.

Baseline information

Geology

9.7.3 The geological information relating to solid geology, superficial geology, topsoil and made ground is presented below.

Solid geology

- 9.7.4 Figure 9.1: Bedrock Geology of the Environmental Statement Figures (TR010064/APP/6.2) shows the bedrock geology from BGS mapping (2023a), as summarised in this section. Figure 9.1.1: Ground Investigation Location Plan in Annex A of Appendix 9.1: Chemical Results Screening Table of the Environmental Statement Appendices (TR010064/APP/6.3) shows the location of GI exploratory holes.
- 9.7.5 BGS mapping (2023a) indicates that the study area is cross-cut by several faults. The throw (vertical separation across the fault) of these faults has often resulted in bedrock of the Triassic Chester Formation, which includes the Manchester Marls unit, being downthrown (sinking of rocks on one side of a fault) against the older Upper Carboniferous Pennine Middle Coal Measures (PMCM).
- 9.7.6 The BGS Lexicon of Named Rock Units (2023b) describes the Chester Formation as being part of the Triassic Sherwood Sandstone Group. The Manchester Marls Formation, part of the Cumbrian Coast Group, conformably underlie the Chester Formation. It is locally recorded to underlie the study area between 150m to 330m west of M60 J18.
- 9.7.7 The PMCM outcrop occur towards the western end of the study area where the Worsley Four Feet Coal seam is recorded to sub-crop below the drift deposits beneath the M60 mainline, approximately 100m to 150m east of the centre of M60 J17, 3.5km west of M60 J18. The Worsley Four Foot Coal seam dips to the west, underlying the western end of the study area.
- 9.7.8 The PMCM underlie the M66 north of M60 J18, increasing in age towards the north and transitioning into the Pennine Lower Coal Measures (PLCM) around 1.25km south of M66 J3. The PLCM underlie the PMCM. The Arley Coal seam is shown to sub-crop below the drift deposits beneath M66 J3. The sub-crop is broadly orientated northwest-southeast, with the seam dipping towards the west. It is therefore present beneath the M66 carriageway from the junction until being displaced by faulting. Although not shown to sub-crop, other coal seams may underlie the M66 carriageway, south of the faulting.

- 9.7.9 The PMCM underlie the M62 carriageway east of M60 J18, increasing in age towards the east and transitioning into the PLCM around 210m north-east of Egypt Lane bridge. Although not shown to sub-crop, coal seams may be present at shallow depth beneath this section of the M62. The M60 J18 to J19 is underlain by bedrock of the Chester Formation.
- 9.7.10 The Pennine Coal Measures were encountered during the GIs (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) at depths of between 24.50-37.50m below ground level (bgl) (56.48-61.82m Above Ordnance Datum (AOD)), below Glacial Till. The bedrock typically comprised mudstone and sandstone. Siltstone was identified in BH-G01. The GIs did not encounter any coal seams.
- 9.7.11 The Chester Formation was not encountered during the GIs (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)), meaning the Chester Formation is at least 25mbgl. Manchester Marls were also expected to the south west of M60 J18, but were not encountered due to the thickness of the overlying Glacial Till in this area.

Superficial geology

- 9.7.12 Figure 9.2: Superficial Geology and Boreholes of the Environmental Statement Figures (TR010064/APP/6.2) shows the superficial geology and BGS boreholes. Figure 9.1.1: Ground Investigation Location Plan in Annex A of Appendix 9.1: Chemical Results Screening Table of the Environmental Statement Appendices (TR010064/APP/6.3) shows the location of the GI exploratory holes referenced in this chapter.
- 9.7.13 BGS mapping (BGS, 2023a) shows Glacial Till underlying the majority of M60 J18, and the M62 and M66 to the east and north, respectively. During the GIs (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)), Glacial Till was encountered in the majority of the boreholes, between 0.30-19.30mbgl, and proven to thicknesses of between 8.3 and 32.0m. The thinner Glacial Till deposits were identified in boreholes undertaken immediately north of M60 J18. Generally, the Glacial Till comprised cohesive clays with some sand bands and rare gravel bands. The Glacial Till directly overlies bedrock of the Pennine Coal Measures, where encountered.

- 9.7.14 BGS mapping (BGS, 2023a) suggests the presence of peat in three parts of the Order Limits, with the GIs (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) encountering Alluvial Sediment and 'Peat' of varying nature and consistency. The GI field descriptions followed BS 5930:2015, wherein it is stated that *'soils with organic contents up to about 30% by weight and water contents up to about 250% behave largely as inorganic soils...and would not be described as peat'*. However, GI field descriptions often identify peat which is subsequently demonstrated to have much lower organic matter percentages than stated by the guidance. Peat is also defined by Natural England in TIN037 (2008) as soil with an organic matter of >50%, with organic matter levels of between 20-25% and 50% defined as 'peaty' (the lower bound is variable dependent on the percentage of clay). As such, GI descriptions overestimate the presence of peat from a soil science perspective. Therefore, the evaluation of peat in this section is supplemented by the soil (ALC) survey information (Appendix 9.2: ALC Survey Report of the Environmental Statement Appendices (TR010064/APP/6.3)).
- 9.7.15 In total, peaty soil textures or 'peat' were identified in soil survey/GI descriptions at a total of 19 out of 195 locations investigated. The majority of locations only encountered limited buried peat, with occasional peaty textures in surface horizons. A total of 235 soil organic matter laboratory test results are available from 119 of the soil survey/GI locations. These show that soil organic matter levels across the Order Limits are generally low. Only three samples from two locations (WS-N13 and WS-P12B), classify as peat (>50% organic matter), and these were from depths ranging from 0.7m to 1.8mbgl; WS-P12B also contains made ground in the upper soil layers. A further six samples from six locations classify as peaty (20-35% organic matter).
- 9.7.16 Taking into account both the field descriptions and soil organic matter testing, only GI locations WS-P12B and WS-N13 and soil survey location SS22 were found to contain one or more layers of peat as defined by TIN037 (Natural England, 2018). These locations are all north-west of M60 J18 but are not contiguous based on surrounding GI and soil survey data.
- 9.7.17 There are multiple outcrops of Glaciofluvial Deposits within the Order Limits, two of which were identified during the GIs (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)). The first is located on the M60 to the west of M60 J18. The second outcrop is located on the M66, 750m north of M60 J18. Four boreholes (BH-G03A, BH-G11, WS-N07 and WS-N08) encountered the deposits at depths of between 0.35mbgl and 2.50mbgl (90.83m and 93.64m AOD), below Made Ground, 'Peat' and Topsoil, and above Glacial Till. BH-N15 also encountered the material, but at a much greater depth of 6.80mbgl (92.78m AOD), due to a large thickness of overlying Made Ground. Thicknesses ranged between 2.80m and 5.65m, with the base of the unit only proven in the deeper boreholes, BH-G03A and BH-G11. The Glaciofluvial Deposits were typically described as loose to medium dense, brown, clayey, silty, slightly gravelly fine to coarse sand.

- 9.7.18 The Glaciofluvial Ice Contact Deposits identified across the Order Limits were typically encountered as entire swathes of granular material overlying cohesive Glacial Till. It is possible at interfaces with the granular portions of the Glacial Till that the material could be categorised as either deposit. The material encountered by the GIs (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) typically comprised loose to medium dense, brown yellow, slightly gravelly, slightly clayey, slightly silty, fine to coarse SAND. The Glaciofluvial Ice Contact Deposits were encountered beneath Made Ground, Alluvial 'Peat', or from ground level, at depths between ground level and 9.30mbgl (85.12m and 101.64m AOD), with thicknesses of between 0.2m and 17.40m.
- 9.7.19 The GIs (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) identified Hummocky Glacial Deposits at the location of two mapped outcrops. The first location was in two boreholes (BH-G09 and BH-G10) on the M66 north from M60 J18. The material was typically found underlying Made Ground and overlying Glacial Till, at depths of between 0.74mbgl and 1.90mbgl (93.81m and 94.25m AOD), with a thickness of 0.21m to 2.00m. BH-G10 identified a 0.30m layer of firm sandy CLAY, overlying 1.70m of medium dense becoming very dense, grey, clayey, fine to coarse SAND, while BH-G09 identified 0.21m of angular to subangular, fine to coarse gravel including sandstone, limestone, flint and mixed lithologies. The second location was in BH-S05, in the south-west quadrant of M60 J18. The deposits were encountered below Topsoil between 0.40mbgl and 5.20mbgl (106.32m and 101.52m AOD), and comprised loose, light orangish brown, slightly gravelly, slightly silty, fine to coarse SAND with frequent soft, clay bands.
- 9.7.20 Glaciolacustrine Deposits are mapped in the area north-west of M60 J18, interchange encompassing the land north of the M60 motorway. BH-N02A was the only exploratory hole undertaken in this deposit and recorded a 3.2m thick layer of locally laminated, soft and firm, grey, slightly sandy, silty CLAY, beneath a 0.4m thick layer of Topsoil. BGS mapping (2023a) shows an area of mapped peat, but similarities in the formational nature of Peat and Glaciolacustrine Deposits means that no distinction has been made between the two. Deposits encountered in this area do not correspond to the TIN037 (Natural England, 2008) classification of peat.
- 9.7.21 Head deposits are shown on BGS mapping (2023a) either side of the north/southbound M66 and M60, near the location of Pond 2 and Pond 5 (see Figure 2.2: Scheme Design of the Environmental Statement Figures (TR010064/APP/6.2) for the locations of the ponds). However, these deposits were not encountered during the GIs (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3))).
- 9.7.22 Information on superficial deposits as a mineral resource is covered in Chapter 10: Material Assets and Waste of this Environmental Statement (TR010064/APP/6.1).
- Topsoil**
- 9.7.23 Topsoil was encountered in three locations as described below:

- North-east of M60 J18 near Pond 1 and Pond 2. 17 boreholes encountered Topsoil with thicknesses between 0.25m to 0.40m.
- In 13 boreholes undertaken north of the M60 highway associated with the new link road embankment and Pond 7. The Topsoil was between 0.15m to 0.60m thick.
- Three boreholes identified Topsoil in the fields immediately southwest of M60 J18. The topsoil was between 0.35m to 0.40m thick.

Made ground

9.7.24 Five types of Made Ground were identified within the Scheme location by the GIs (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3))):

- Made Ground – Cohesive and Granular
- Made Ground – North-east Mound
- Made Ground – North-west
- Made Ground – Pulverised Fuel Ash (PFA)
- Made Ground – Engineered Fill.

9.7.25 A summary of each material type and their location is provided below.

Made Ground – Cohesive and Granular

9.7.26 Made Ground – Cohesive and Granular was identified in the boreholes undertaken for two ponds. At Pond 2, located east of the M66, opposite the village of Unsworth and north of Pike Fold Golf Course, Made Ground was identified in WS102. 1.5m of Cohesive Made Ground was encountered at a ground level of 90.78m AOD, including 0.3m of Topsoil overlying 1.2m of firm, dark brown, sandy, slightly gravelly clay. At Pond 5, located south of M60 J18 in land north of Heaton Park, Made Ground was encountered in all three boreholes (BH-P02, BH-P03 and WS-P09) from ground level, with thicknesses between 1.7m and 2.8m, and at levels between 95.16m and 96.52m AOD. The Made Ground was described as soft to firm, dark brown, slightly sandy, slightly gravelly CLAY. The gravel comprised sandstone, flint, mudstone, concrete, coal, limestone and brick.

9.7.27 Some boreholes identified thin and shallow Made Ground in the fields bordering the motorways to the northwest of M60 J18 and the north of the northeast mound. The material typically contained fragments of brick and pottery. BH-N15, located 50m east of the highway boundary, identified slag and brick between ground level and 0.25mbgl, and sand containing ash to 6.8mbgl.

Made Ground – North-east Mound

- 9.7.28 A total of 15 boreholes were undertaken in the north-east mound located north of M60 J18. The north-east mound is understood to have been formed from material excavated during the construction of the cutting to the M66 carriageways at M60 J18. The material was encountered from ground level. Seven boreholes reached the base of the north-east mound and the underlying natural strata, with thicknesses ranging between 1.2m and 9.3m. Light Detection and Ranging (LiDAR) data indicates the existing ground level in this location is between 92m and 96m AOD prior to the material being placed here. The base level of some of the fill material reached levels of between 91.99m and 102.65m AOD, which roughly ties in with the base levels indicated from the available information.
- 9.7.29 The material typically comprises dark brown, silty, fine and medium SAND. Some of the material is described as loose and medium dense, and some is gravelly with brick, concrete and mixed lithologies. There was also a lesser amount of firm, brown, slightly sandy, slightly gravelly CLAY. The gravel including brick, concrete, timber, metal pieces, sandstone and mudstone.

Made Ground – North-west

- 9.7.30 Three boreholes, all located north-west of M60 J18, identified material that differed from the adjacent boreholes. The boreholes were all located in the fields north-west of the motorway in what appears to be the embankment for the carriageway. However, due to the descriptions of the material, it is unlikely this material is engineered fill. The material is believed to have been placed over the structural fill comprising the slopes of the highway embankment, potentially for landscaping or re-use of site-won material from the construction of the motorway carriageways and junction.
- 9.7.31 The material is variable and described as very loose sand with brick gravel, very soft to soft clay with brick and granite gravel, and soft silt containing brick.

Made Ground – PFA

- 9.7.32 PFA was identified in a number of boreholes between Sandgate Road overbridge and Haweswater Aqueduct underpass as a construction material for the motorway embankments. 10 boreholes identified PFA within some portion of Made Ground. BH-S01, WS-S02, BH06, BH07 and WS10 identified thickness of PFA between 4.45m and 8.80m, at levels of between 97.96m and 99.82m AOD. The PFA is described as medium dense to dense, grey, silty, clayey, slightly gravelly SAND. In BH-S01 and WS-S02, the material was described as soft to firm, grey, slightly gravelly, sandy SILT. The remainder of the PFA identified was within layers of Made Ground that were described as having a low content of PFA. These thicknesses were between 0.3m and 2.4m in WS03, WS04, HDP03 and HDP09, at levels of between 95.84m and 97.57m AOD.

- 9.7.33 The Preliminary Sources Study identified that PFA was recorded in historical borehole logs SD80NW270 and SD80NW259, at approximate chainage (Ch.) 2100. Possible PFA was identified in historical borehole logs SD80NW258 and SD80NW269, at approximate Ch. 2300. The large thicknesses of PFA identified during the recent GIs (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) were located between approximate Ch. 2200 to 2330, and the boreholes that contained a low content of PFA were identified over a larger area between approximate Ch. 2000 to 2350. These findings correlate with the locations originally identified in the Preliminary Sources Study. Boreholes BH-S04 and BH-S04A also identified a low content of fuel ash as part of stiff CLAY and medium dense SAND layers. However, due to their location at approximate Ch. 2700, it is unlikely that this material was used for embankment construction and is more likely to just be a component of the Made Ground.
- Made Ground – Engineered Fill*
- 9.7.34 Made Ground – Engineered Fill was identified across the majority of the Scheme at varying depths, dependent upon the local earthwork heights. The material has been split into a granular and a cohesive component. The granular portion of this unit also comprises asphalt, tarmac and concrete associated with the existing M60/M62/M66 carriageways. The 2023 GI (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) identified 23 boreholes containing black macadam to depths of between 0.34mbgl and 0.50mbgl. BH10 encountered concrete between 1.3mbgl and 1.5mbgl (95.31m and 95.11m AOD), and WS02 encountered concrete fill at depths of between 1.5mbgl and 2.50mbgl. The 2021 GI (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) recorded combined layers of asphalt, tarmac and concrete in 31 boreholes to depths of between 0.15mbgl and 0.58mbgl.
- 9.7.35 Across the Scheme the Made Ground – Engineered Fill was generally consistent. Gravel was identified immediately below tarmac and asphalt where boreholes had been undertaken on the hard shoulder of the corresponding M60, M62 and M66 motorways. This material was typically described as grey, slightly sandy, slightly silty fine to coarse GRAVEL. Underlying this gravel sub-base in the east of the Scheme, and comprising the majority of the engineered fill across the Scheme, is a medium dense to very dense, brown, slightly gravelly, clayey, fine to coarse SAND. There are layers of soft to stiff, brown, slightly gravelly, sandy, CLAY with a low cobble content, throughout the Made Ground – Engineered Fill in the east of the Scheme, making up a small cohesive component. Additional gravel layers underlying the main embankment fill were encountered intermittently during the 2023 GI (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)).
- 9.7.36 Overall, Made Ground – Engineered Fill was encountered in 82 boreholes at depths of between ground level and 3.80mbgl (91.68m and 105.27m AOD), with thicknesses of between 0.14m and 9.68m.

Soils

- 9.7.37 Figure 9.3: ALC of the Environmental Statement Figures (TR010064/APP/6.2) illustrates the soils baseline information outlined in this section.
- 9.7.38 The economic resource value of soil is primarily measured by its ability to support agricultural uses. This is quantified by its ALC grade, with six grades defined within the ALC criteria for England and Wales as follows:
- Grade 1 (excellent quality)
 - Grade 2 (very good quality)
 - Subgrade 3a (good quality)
 - Subgrade 3b (moderate quality)
 - Grade 4 (poor quality)
 - Grade 5 (very poor quality)
- 9.7.39 Best and Most Versatile (BMV) agricultural land equates to grades 1, 2 and subgrade 3a of the ALC system, and is the most flexible land in terms of the range of crops that can be grown, the level and consistency of yield and the cost of obtaining yield.
- 9.7.40 Provisional pre-1988 ALC data (Natural England, 2019) for the study area show the majority of land within the Order Limits between M60 J17 and J18 is classified as urban. M60 J18 is dominated by Grade 3, which is undifferentiated in the provisional ALC data and does not contain 3a or 3b subclassifications. A small area west of M60 J17 is classified as Grade 4. No pre-existing post-1988 ALC data were available for the study area.
- 9.7.41 In accordance with TIN049 (Natural England, 2012), a site-specific (post-1988) ALC survey was undertaken to assess and classify the agricultural quality of land by evaluating climatic, topographical, flood risk, soil and interactive limitations. The detailed site-specific ALC survey was undertaken in October and December 2021, conforming to an observation density of approximately 1 per hectare, or 1 per 100m in linear sections, with topsoil and subsoil samples taken for laboratory analyses at a rate of approximately 1 per 2 hectares. A total of 41 hand auger locations and three hand pits (IDs 10, 14 and 33) were investigated across the Order Limits, from which 23 topsoil samples and 23 upper subsoil samples were collected and sent for laboratory analysis. One topsoil sample and two subsoil samples were submitted for particle size distribution analysis to support hand-texturing. The ALC survey report is provided in Appendix 9.2: ALC Survey Report of the Environmental Statement Appendices (TR010064/APP/6.3).
- 9.7.42 Table 9.9 below summarises the ALC grades identified and Figure 9.3: ALC of the Environmental Statement Figures (TR010064/APP/6.2) illustrates the grades and survey locations.

Table 9.9 Surveyed ALC grade of land within the Order Limits

ALC grade/subgrade	Area (ha)	Area as percentage of Order Limits (%)
Grade 2	0.4	0.5
Grade 3a	4.5	5.3
Grade 3b	26.2	30.6
Grade 4	2.2	2.6
Non-agricultural land	48.3	56.4
Unsurveyed agricultural land*	4.1	4.8
Total	85.7	100

Notes: The values in this table differ to those in Appendix 9.2: ALC Survey Report of the Environmental Statement Appendices (TR010064/APP/6.3) as they have been recalculated to reflect the Order Limits for the application for development consent.

Values have been rounded to one decimal place.

*Any unsurveyed agricultural land is assumed to be Grade 3b for assessment, as the most predominant grade.

9.7.43 Soils may also be of importance in supporting sites of ecological importance; thus, a high-level review of soil types has been undertaken. The LandIS Soils Map (Cranfield University, 2023) identifies the majority of the area is marked as Soilscape 10, freely draining slightly acid sandy soils. There is a small area of Soilscape 17, slowly permeable seasonally wet acid loamy clayey soils, intersecting the study area towards the western end of the Order Limits, but it should be noted that this area is outside of the Order Limits.

9.7.44 There are a number of deciduous woodland priority habitats within the Order Limits (see Figure 8.1.3: Priority Habitats and Ancient Woodland in Annex A of the Appendix 8.1: UK Habitat Classification Report of the Environmental Statement Appendices (TR010064/APP/6.3)). These sites are considered to be reliant on soils and have been included in the assessment.

Mining and quarrying

9.7.45 Detailed information on mineral resources and mineral safeguarding sites present along the study area and the effects of the Scheme on mineral resources and mineral safeguarding sites are assessed within Chapter 10: Material Assets and Waste of this Environmental Statement (TR010064/APP/6.1).

9.7.46 The Coal Authority Mining Report (Coal Authority, 2017) states that the study area is within an area that could be affected by underground mining in one seam of coal at 430m to 460m depth, which was last worked in 1970. Consequently, any associated ground movements should have ceased. The study area is not within an area where there is active or proposed underground mining, or within the boundary of a former, active or proposed opencast site. There are no recorded mine entries within the study area.

9.7.47 GDMS (National Highways, 2023b) identifies the western and northern extents of the study area as being Grade C: Medium Hazard in terms of Coal Mining, which broadly correlates with the Coal Authority's designation that parts of the study area are within a Development High Risk area. The rest of the study area (east of Sandgate Road overbridge, and from 1.3km south of M66 J3) is classified Grade B: Low, although it is predominantly within the coal field and, as such, the potential for underground coal mining, unrecorded mine workings, or shafts and adits, cannot be discounted.

Historical mineral extraction sites (potentially infilled)

9.7.48 The Groundsure Geolnsight report (Groundsure, 2017b) identifies several ground workings within the study area, including unspecified ground workings and brick pits which have ceased operation. However, the only ground workings within the study area are associated with the motorway construction. There are three BritPits records within the study area, but only one within the Order Limits. This is a sand pit, located at Cowl Gate Farm adjacent to the north-western quadrant of M60 J18.

Landfills

9.7.49 Figure 9.4: Potential Current and Historical Contamination Sources of the Environmental Statement Figures (TR010064/APP/6.2) shows the locations of the historic landfills outlined in this section.

9.7.50 There are three historic landfills within the study area, located directly west and east of the M60, south-west of M60 J18. These are:

- Landfill Site 1 – Historic landfill south-east of the M60, land to the south of Whitehouse Farm in Simister. Inert waste (soil, sand and clay) deposited between 1993 and 1994. Bury Metropolitan Borough Council confirmed low gas generation potential and low likelihood of ground gas migrating and impacting nearby properties. The edge of the site is within the Order Limits.
- Landfill Site 2 – Historic landfill directly west of the M60 between J18 and J19, Bridle Road. Inert waste deposited in 1994. Bury Metropolitan Borough Council confirmed low gas generation potential and low likelihood of ground gas migrating and impacting nearby properties. Within Order Limits.
- Landfill Site 3 – Historic landfill east of M60 J18, land at Egypt Lane. Inert waste, licence Surrendered 1999, No issue date. Bury Metropolitan Borough Council confirmed low risk from ground gas – within 10m of the Order Limits.

Potential sources of contamination

9.7.51 The study area is predominantly in a rural setting (Groundsure, 2017a), consisting of mostly agricultural land use, with residential land dominating in the west of the site. Potential sources of contamination within the study area include:

- Railway infrastructure, including the Manchester Whitefield and Radcliffe branch lines shown on the late 19th century maps, crossing the M60 around 250m east of J17.

- Current and former industrial areas, including a historical brick works.
- Motorway fuel and chemical spillages.
- Fuel station, immediately adjacent to the M60 and the A665.
- PFA and Made Ground within the existing highway embankments.
- Possible PFA and/or Made Ground within the area of raised ground (Northeast Mound) immediately north-east of M60 J18.
- Agricultural activities.

Visual / olfactory contamination

- 9.7.52 In general, visual or olfactory evidence of contamination was not recorded during the GIs (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)), however a hydrocarbon odour was recorded within Made Ground – Engineered Fill at one exploratory hole location (WS-N01 at 3.8mbgl to 4.2mbgl).
- 9.7.53 Asbestos or potentially asbestos containing material were not noted visually during the GI (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)), but asbestos was found at low percentages (<0.003%) during lab testing.

Human health

Human health receptors

- 9.7.54 Human health receptors within the study area that could be impacted by contamination, comprise construction and future maintenance workers, and adjacent residents and land users.

Human health soil contamination sources

- 9.7.55 In accordance with LCRM guidance, a Tier 2: Generic Quantitative Risk Assessment (GQRA) has been undertaken to establish the risks to human health receptors. As part of this GQRA, Generic Assessment Criteria (GAC) have been selected from a hierarchy of published sources for Tier 2 GAC for contamination in soil. These include Defra Category 4 Screening Levels (C4SL) (CL:AIRE, 2014), Land Quality Management (LQM) / Chartered Institute of Environmental Health (CIEH) Suitable for Use Levels (S4UL) (Nathanail *et al.*, 2015), Soil GAC for Human Health Risk Assessment (CL:AIRE, 2010), and SoBRA Acute Generic Assessment Criteria (SoBRA AGAC) (Society for Brownfield Risk Assessment, 2020). Given the nature of the Scheme, the GAC were based on a commercial and industrial end use.
- 9.7.56 A total of 179 environmental soil samples, sampled within Made Ground and natural ground, were recovered from within the Scheme boundary and subjected to chemical analysis. Samples were tested for a range of contaminants including metals, inorganics, asbestos, total petroleum hydrocarbons (TPHs), polycyclic aromatic hydrocarbons (PAHs), volatile organic carbons (VOCs) and phenols. The soil screening table is presented in Appendix 9.1: Chemical Results Screening Tables of the Environmental Statement Appendices (TR010064/APP/6.3).

- 9.7.57 Of the 179 environmental soil samples tested, none recorded contaminant concentrations above the GAC. The screening of the soil analytical data relative to AGAC showed seven exceedances of the Arsenic AGAC, derived for oral consumption in children. These soil exceedances were recorded within Made Ground – PFA and Made Ground – Engineering Fill Granular. However, short-term exposure to soil contaminants would only occur during construction and maintenance works, and since none of the Arsenic concentrations exceed the AGACs based on adult exposure, there is no risk to construction and maintenance workers.
- 9.7.58 Of the 181 environmental soil samples tested for asbestos, two samples of Made Ground – Engineered Fill, and two samples of Made Ground – PFA, recorded asbestos in the form of loose Amosite and Chrysotile fibres, with fibre counts ranging between <0.001% and 0.003% by weight. These asbestos detections were found in made ground soils located beneath the existing M60 J17-J18 mainline between Sandgate Road and Haweswater underpass.
- 9.7.59 In the GIR Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3), the risk to construction workers associated with asbestos has been assessed as Moderate, whilst the risk to adjacent residents and land users has been assessed as Moderate / Low.

Human health ground gas sources

- 9.7.60 The CSM and contaminated land risk assessment, undertaken as part of the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)), did not identify any significant sources of ground gas or potential pollutant linkages (PPLs) to adjacent residential properties, due to the following:
- Landfill Sites 1, 2 and 3 (see paragraphs 9.7.49-9.7.50 of this chapter) have low gas generation potentials given the inert material deposited and the time elapsed since deposition (c. 30 years).
 - Landfill Site 2 is located more than 200m away from residential properties, with intervening soft landscaping, or separated from them by the M66/M60 north-west–south-east cutting. Therefore, any ground gases generated from Landfill Site 2 are likely to be emitted to the atmosphere, rather than impact adjacent residential properties as a result of the Scheme.
 - The Made Ground within the north-east mound (see paragraphs 9.7.27-9.7.28 of this chapter) and M60/M62 embankment is considered to have very low to low gas generation potential.
 - The north-east mound and M60/M62 embankment are raised landforms, therefore any ground gas generated will be released into the atmosphere, rather than migrating laterally or downwards.
 - The natural organic soils, including peat, have very low to low gas generation potentials.
 - The Scheme is not anticipated to create any additional ground gas migration pathways to adjacent properties.

- 9.7.61 Following the main GIs (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)), a total of five post-fieldwork ground gas monitoring rounds were undertaken within installed ground gas/groundwater monitoring wells, between 12 January 2022 and 4 May 2023. It should be noted that not all monitoring wells were subjected to five monitoring rounds due to some wells being inaccessible, flooded, or damaged.
- 9.7.62 The ground gas monitoring results are summarised in Table 9.10. It should be noted that following evaluation of the ground gas monitoring data, some of the data was eliminated due to flooding or partial flooding of monitoring wells, or where smaller diameter (19mm) wells were installed.

Table 9.10 Summary of ground gas monitoring results

Location	Steady state flow rate range	Ground gas concentrations						
		CH ₄	CH ₄ , LEL	CO ₂	O ₂	CO	H ₂ S	VOC Head-space
		%				ppm		
Motorway Construction								
BH-N03	-0.1–0.2	<0.1–0.5	<1–10	0.2 – 3.9	15.3 – 20.8	<1 – 2	<1 – 1	<1
BH-N15	-0.1–0.2	<0.1	<1	0.1 – 3.4	17.4 – 21	<1 – 2	<1 – 1	<1
North-east Mound								
BH-N14	-0.6 – 0.1	<0.1 – 0.5	<1 – 10	0.1 – 33.8	0.3 – 21.7	<1 – 2	<1	<1
BH-N17	-8.9 – 5.7	<0.1 – 15.9	<1 – 345	0.1 – 18.8	<0.1 – 21.1	<1	<1	<1
BH-N18	0.1	34.7	694	7.6	10.2	1	<1	<1
Landfill Site								
BH-P02	-4.5 – 2.5	<0.1	<1	0.1 – 5.9	11.6 – 21.4	<1 – 1	<1 – 1	<1
Surrounding Area								
BH-G06	-0.1 – 0.1	<0.1	<1	1.3 – 2.6	16.9 – 19.4	<1 – 6	<1	<1
BH-N21	0.2	<0.1	<1	1.9	19.6	3	<1	<1
WS-P03A	0.1	<0.1	<1	1.8 – 5.6	4.4 – 18.1	<1 – 2	<1 – 1	<1
WS-P09	-2.8 – 2.4	<0.1 – 0.1	<1 – 2	0.1 – 4.4	14.8 – 20.8	<1 – 7	<1 – 1	<1

Note: CH₄ – methane; LEL – Lower Explosive Limit; CO₂ – carbon dioxide; O₂ – oxygen; CO – carbon monoxide; H₂S – hydrogen sulphide; VOC – volatile organic carbons.

- 9.7.63 To assess the potential risks to construction and maintenance workers during below ground works within excavations and confined spaces, the ground gas monitoring results have been screened against available Workplace Exposure Limits (WELs) for long-term and short-term exposure, in accordance with Health and Safety Executive's EH40/2005 Workplace Exposure Limits (Health and Safety Executive, 2020).
- 9.7.64 CO₂ was recorded in excess of the WEL for long-term (8 hour) exposure (0.5% vol) and short-term (15 mins) exposure (1.5% vol) at all 10 monitoring locations. In general, the highest CO₂ concentrations (>5%) were recorded in monitoring wells with response zones in Made Ground and superficial deposits, with no obvious degradable organic material documented on associated exploratory hole records. The source of elevated CO₂ in BH-N03, BH-N15, BH-N17 and BH-N18 is considered to be the Made Ground associated with the north-east mound or motorway construction. The CO₂ gas recorded could have become trapped during the compaction of the motorway material. The source of elevated CO₂ in the superficial deposits could be unknown off-site sources, or natural aerobic degradation of organic material within the monitoring wells.
- 9.7.65 CO concentrations were not found to exceed the long-term WEL (20 ppm) or short-term WEL (100 ppm) at any of the monitoring locations.
- 9.7.66 H₂S concentrations were not found to exceed the long-term WEL (5 ppm) or short-term WEL (10 ppm) at any of the monitoring locations.
- 9.7.67 The minimum concentration of methane necessary to support its combustion in air is defined as the LEL of 5% volume per volume (v/v). The CH₄ LEL was exceeded on seven occasions in four monitoring locations (BH-N03, BH-N14, BH-N17 and BH-N18). The source of the CH₄ gas concentrations in BH-N03, BH-N17 and BH-N18 is considered to be the Made Ground – Engineering Fill associated with the motorway construction or north-east mound. No visible degradable organic material was noted within these Made Ground soils, and the CH₄ gas recorded could have become trapped during the compaction of the motorway material. The source of the elevated CH₄ gas recorded in BH-N14, which screens the Glaciofluvial Ice Contact Deposits and is located beneath the northeast mound, is considered to be an unknown off-site source, or natural anaerobic degradation of organic material within the well.
- 9.7.68 No detectable VOC concentrations were recorded during headspace testing of the monitoring wells during the monitoring programme.
- 9.7.69 There is no specific exposure limit for depleted O₂. However, the Mines Regulations (HSE, 2014) note that the amount of O₂ in a body of air should not fall below 19%, and this criterion has been adopted as an indicative threshold for depleted O₂. Depleted O₂ concentrations (below 19% v/v) were recorded on 21 occasions at nine monitoring locations.

Surface water and groundwater

- 9.7.70 Detailed information on the surface water and groundwater baseline is provided in Section 13.7 of Chapter 13: Road Drainage and the Water Environment of this Environmental Statement (TR010064/APP/6.1). To avoid duplication, this section does not provide a detailed description of the water environment baseline.

- 9.7.71 Surface water bodies identified within the study area include (see Figure 13.1: Surface Water Receptors of the Environmental Statement Figures (TR010064/APP/6.2)):
- Streams in the south of the study area that flow into a lake within Heaton Park to the immediate west of the M60 corridor, south of M60 J18.
 - Parr Brook flows in a north-west direction, within the culvert beneath the M60 embankment between M60 J17 and J18. Parr Brook eventually discharges into the River Roch approximately 2.5km to the north-west of the M60 carriageway.
 - A series of ponds and ditches are present along the northern Order Limits, located immediately south of Pike Fold Golf Course. The ponds and ditches eventually discharge into the Castle Brook, located approximately 60m northeast of the Order Limits. Castle Brook flows north, passed the Hollins Plantation, and converges with Hollins Brook approximately 370m east of the Order Limits' northern tip.
- 9.7.72 The study area is largely underlain by cohesive glacial deposits, which are designated as Secondary Undifferentiated aquifers (see Figures 13.3 and 13.4 of the Environmental Statement Figures (TR010064/APP/6.2)). The areas of glaciofluvial deposits are designated as Secondary A aquifers, with the areas of Alluvial Peat designated as Unproductive aquifers. The Pennine Lower and Middle Coal Measures are designated as a Secondary A aquifer, while the Chester Formation is a Principal aquifer.
- 9.7.73 Groundwater strikes were recorded during the GIs (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) in 49 boreholes across the Scheme. These were mostly recorded within granular portions of Glacial Till, the Glaciofluvial Deposits, Glaciofluvial Ice Contact Deposits and Alluvial Peat. Groundwater strikes were observed between 0.25mbgl and 39.2mbgl. A smaller number of groundwater strikes were also recorded within the Made Ground – Engineered Fill.
- 9.7.74 The groundwater strikes within the granular Glacial Till and cohesive Glacial Till were identified at depths of between 2.1mbgl and 26.2mbgl, and 4.0mbgl and 39.2mbgl, respectively, indicating that groundwater is typically trapped within the granular lenses and bands of material throughout the wider cohesive unit. Strikes within the cohesive portion of the unit were typically from a greater depth. As the granular glacial units overlie the Glacial Till, the associated strikes were at a shallow depth, typically between 1mbgl and 6mbgl. The cohesive portion of the Alluvial Peat also encountered shallow strikes at depths between 0.6mbgl and 6.40mbgl.
- 9.7.75 Resting groundwater levels recorded during post-fieldwork groundwater monitoring indicate the groundwater table is at an elevation of 76.68m to 103.31m AOD. The data indicates there is no defined groundwater table across the site, and this large range is likely due to isolated and perched groundwater systems within the granular glacial deposits at the surface, and at depth within the cohesive Glacial Till.

- 9.7.76 In accordance with LCRM guidance (Environment Agency, 2023), a Tier 2: GQRA has been undertaken to establish the risks to controlled water receptors. As part of this GQRA, Water Quality Standards (WQS) have been selected from a hierarchy of published sources for Tier 2 GAC for contamination in soil leachate and groundwater. These include the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 – AA-EQS Inland, MAC-ESQ Inland, and Freshwater Standards, and PNEC derived for EU REACH registration dossiers – Freshwater.
- 9.7.77 The CSM and contaminated land risk assessment, undertaken as part of the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)), has identified several surface water bodies, Secondary and Principal aquifers within the study area. Furthermore, groundwater within the superficial deposits may be in hydraulic continuity with some of these surface water bodies. Therefore, for the purposes of the controlled waters risk assessment, the WQS are based on the lowest of the freshwater Environmental Quality Standards (EQS) and the UK Drinking Water Standards (DWS). Where no EQS or UK DWS are available (or unachievable due to laboratory test methods) for a given contaminant, the World Health Organisation (WHO) DWS or the laboratory limit of detection (LoD) has been adopted. Consequently, the controlled waters risk assessment is appropriately protective of both surface water and groundwater receptors.
- 9.7.78 A total of 63 environmental soil samples, sampled within Made Ground and natural ground, were recovered from within the Order Limits and subjected to leachability analysis. Samples were tested for a range of contaminants including metals, inorganics, TPHs, PAHs and phenols. The soil leachate screening table is presented in Appendix 9.1: Chemical Results Screening Tables of the Environmental Statement Appendices TR010064/APP/6.3). Full details of soil leachate WQS exceedances are presented in the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)).
- 9.7.79 Of the 63 environmental soil samples tested, up to 60 samples recorded contaminant concentrations above WQS. Relatively widespread heavy metal soil leachate contamination was recorded within the Order Limits, with more localised inorganic and organic soil leachate contamination (including TPH, PAHs and phenol). The widespread heavy metal exceedances were identified in both the Made Ground and natural ground, whilst the more localised inorganic and organic exceedances were generally recorded in the Made Ground. There appears to be no discernible pattern between elevated soil leachate concentrations and the geological formations. The exception to this was speciated PAH compounds, which were generally recorded in samples of Made Ground – Engineering Fill. These samples generally exhibited visible evidence of pyrogenic materials (e.g., clinker, tarmacadam, etc) or were below formations containing pyrogenic materials.

- 9.7.80 A total of 31 environmental groundwater samples were recovered from within the Order Limits during post-fieldwork monitoring and subjected to chemical analysis. Samples were tested for a range of contaminants including metals, inorganics, TPHs, PAHs and phenols. The groundwater screening table is presented in Appendix 9.1: Chemical results screening tables of the Environmental Statement Appendices (TR010064/APP/6.3). Full details of groundwater WQS exceedances are presented in the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)).
- 9.7.81 Of the 31 environmental groundwater samples tested, up to 30 samples recorded contaminant concentrations above WQS. Relatively widespread exceedances were recorded for ammoniacal nitrogen, aluminium, copper, iron, manganese and nickel, with localised exceedances for thiocyanate, chloride, sodium, sulphate, arsenic, cadmium, chromium (III), zinc and phenol. There appears to be no discernible pattern between groundwater concentrations and the geological formations. However, a single phenol groundwater exceedance was recorded in BH-P03 on 02/02/2022, which is located within the Made Ground of Landfill Site 2.
- 9.7.82 Within the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)), the risk to Secondary aquifers in the superficial deposits, and surface water bodies, associated with elevated soil leachate, has been assessed as Moderate/Low, while the risk to the Secondary A and Principal aquifers in bedrock (Pennine Coal Measures and Chester Formation, respectively) has been assessed as Low. The risk to surface water bodies, associated with elevated groundwater contaminants in the Made Ground and superficial deposits, has been assessed as Moderate/Low, while the risk to bedrock aquifers has been assessed as Low. The risk to licensed groundwater abstractions, associated with elevated groundwater contaminants in the Made Ground and superficial deposits, has been assessed as Moderate/Low.

Future baseline

Geology

- 9.7.83 Based on the likely evolution of the baseline environment without the implementation of the Scheme, the geology would not change.

Surface water and groundwater

- 9.7.84 Based on the likely evolution of the baseline environment without the implementation of the Scheme, the surface water and groundwater quality would not change.

Soils

- 9.7.85 Based on the likely evolution of the baseline environment without the implementation of the Scheme, the soils would not change.

Value (sensitivity) of receptors

- 9.7.86 The value (sensitivity) of surface water and groundwater receptors conforms to the criteria set out in DMRB LA 113. The description of the sensitivity criteria in Table 9.11 below is taken from DMRB LA 109 (and the Departure from Standard – see paragraph 9.4.3) and DMRB LA 113, and has been used to compare against features within the study area.
- 9.7.87 All receptors within the baseline have been assigned a value following criteria in DMRB LA 109, DMRB LA 113 and using professional judgement. Table 9.11 summarises the value of receptors identified within the study area.

Table 9.11 Value (sensitivity) of receptors in the study area for geology and soils

Value / sensitivity	Aspect	Description	Features within the study area
Very high	Geology	International designated sites of geological value (e.g. UNESCO World Heritage Sites).	None identified within the study area.
	Human health	Very sensitive land use such as residential or allotments.	Residential properties and allotments are located immediately adjacent to the M60 between J17 and J18.
	Soil	ALC grades 1 and 2. Soils directly supporting an EU designated site (e.g. Special Area of Conservation or Special Protection Area).	Approximately 0.4ha of Grade 2 soils within the Order Limits (see Table 9.9 of this chapter).
	Groundwater quality	Groundwater that locally supports a GWDTE. Inner source protection zone (SPZ 1). Principal aquifer.	Chester Formation is a Principal Aquifer.
	Surface water quality	Watercourse classified by the WFD as having an Ecology Status of High or Good. Site protected/designated under EC or UK legislation (SAC, SPA, SSSI, Ramsar site, salmonid water) / Species protected by EC legislation.	None within the study area.
High	Geology	Rare and of national importance with little potential for replacement (e.g. geological SSSI).	None within the study area.
	Human health	High sensitivity land use such as public open space.	Heaton Park and Philips Park are located within the study area.

Value / sensitivity	Aspect	Description	Features within the study area
	Soil	ALC subgrade 3a. Soils directly supporting a UK designated site (e.g. SSSI).	Approximately 4.5ha within the Order Limits (see Table 9.9 of this chapter).
	Groundwater quality	Principal or Secondary A Aquifer providing locally important resource or supporting a river ecosystem. Outer source protection zone (SPZ 2).	The PMCM, PLCM and superficial deposits (Glaciofluvial, Glaciofluvial Ice Contact, Glaciolacustrine and Hummocky Glacial Deposits) are Secondary A Aquifers.
	Surface water quality	Watercourse classified by the WFD as having an Ecology Status of Moderate or Poor or Bad. Species protected under EC or UK legislation.	None within the study area.
Medium	Geology	Regionally Important Geological Sites with limited potential for replacement (e.g. RIGS).	None within the study area.
	Human health	Medium sensitivity land use such as commercial or industrial.	Commercial and industrial properties are located throughout the study area.
	Soil	ALC subgrade 3b. Soils supporting non-statutory designated sites (e.g. LNR).	Approximately 30.3ha within the Order Limits (see Table 9.9 of this chapter). This is based on 26.2ha of land surveyed as Grade 3b and 4.1ha of unsurveyed agricultural land assumed to be Grade 3b.
	Groundwater quality	Aquifer providing water for agricultural or industrial use with limited connection to surface water. Unlicensed private water supply. Total catchment source protection zone (SPZ3).	One licensed groundwater abstraction for general use / spray irrigation at Pike Fold Golf Course within 70m of the Order Limits.
	Surface water quality	Watercourses included in the WFD but not having a WFD classification.	None within the study area.
Low	Geology	Geology of local importance / interest with potential for replacement (e.g. non designated geological exposures, former quarries / mining sites).	None within the study area.

Value / sensitivity	Aspect	Description	Features within the study area
	Human health	Low sensitivity land use such as highways and rail.	Railway line crosses the M60 east of J17. Numerous highways are located throughout the study area.
	Soil	ALC grades 4 and 5. Soils supporting non-designated notable or priority habitats.	Approximately 2.2ha of ALC grade 4 soils within the Order Limits (see Table 9.9 of this chapter).
	Groundwater quality	Unproductive strata.	The Alluvial Peat is designated as Unproductive strata.
	Surface water quality	Watercourses not having a WFD classification shown in a RBMP.	A number of unnamed ponds and watercourses, and Castle Brook, are located at Pike Fold Golf Course. Two unnamed watercourses connecting to a lake in Heaton Park are located at the south-eastern extent of the study area. Parr Brook is located in the west of the study area.
Negligible	Geology	No geological exposures, little / no local interest.	None within the study area.
	Human health	Undeveloped surplus land / no sensitive land use proposed.	None within the study area.
	Soil	Previously developed land formerly in 'hard uses' with little potential return to agriculture.	A number of areas within the study area have been previously developed. This is reported as 48.3ha of non-agricultural land (see Table 9.9 of this chapter).
	Groundwater quality	Not applicable.	Not applicable.
	Surface water quality	Not applicable.	Not applicable.

9.8 Potential impacts

Construction

Geology

- 9.8.1 No sensitive geological receptors have been identified within the study area, therefore geology has been scoped out of the assessment.

Soils

- 9.8.2 Soils would be affected in two ways during construction, via: physical removal or permanent sealing of agricultural land; and degradation during stripping, handling and storage, through mechanisms such as compaction and smearing.
- 9.8.3 It is assumed for the purposes of assessment at this stage that all soils identified within the Order Limits would be affected, therefore soils of very high to low value (sensitivity) are likely to be impacted. For the purposes of this assessment, all unsurveyed agricultural land is assumed to be Grade 3b (as the predominant grade).
- 9.8.4 Table 9.12 details the predicted areas of permanent and temporary land-take by ALC grade. It is anticipated that approximately 21.3ha (24.9% of the Order Limits) of agricultural land, including 2.3ha (2.7% of the Order Limits) of BMV land, would be permanently sealed by the Scheme or otherwise lost to agricultural production. An additional 10.0ha (11.7% of the Order Limits) of agricultural land (no BMV land) is anticipated to be temporarily occupied during the construction phase of the Scheme.

Table 9.12 Areas of permanent and temporary land-take by ALC grade

Land acquisition type	ALC grade/subgrade	Area (ha)	Area as percentage of the Order Limits (%)
Permanent	Grade 2	0.4	0.5
	Grade 3a	1.9	2.2
	Grade 3b	15.1	17.6
	Grade 4	1.7	2.0
	Unsurveyed agricultural land	2.2	2.6
	Non-agricultural land	1.8	2.1
	Total permanent land take	23.1	27.0
Temporary	Grade 3b	8.2	9.6
	Grade 4	0.1	0.1
	Unsurveyed agricultural land	1.7	2.0
	Non-agricultural land	1.1	1.3
	Total temporary land take	11.1	13.0

Note: The Total Area as a percentage of Order Limits does not sum to 100% because the Order Limits includes existing highways land which is not new permanent or temporary land take.

Human health

- 9.8.5 The updated CSM and human health risk assessment has confirmed that there is no widespread soil contamination within the Order Limits that poses a risk to human health. However, loose Chrysotile and Amosite asbestos fibres were recorded locally in Made Ground, which poses a risk to construction workers and adjacent residents and land users during construction.
- 9.8.6 It should be noted that risks to construction workers are considered to be addressed, as mitigation/best practice to prevent impacts on workers would be undertaken prior to the construction period. This is in line with the Construction (Design and Management) Regulations 2015 (the 'CDM regulations').
- 9.8.7 The GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) has identified a risk to adjacent residents and land users. This risk will need to be mitigated through the development of working methods and risk assessments in accordance with the Control of Asbestos Regulations (CAR) 2012 (Health and Safety Executive, 2012) and CAR-SOIL industry guidance (CL:AIRE, 2016). As such, the impact on human health to adjacent residents from asbestos during construction has been scoped in.
- 9.8.8 The GIs (see the GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) have not identified any degradable organic materials within the Made Ground of the northeast mound, M60/M62 embankments and Landfill Site 2, which corroborates the initial CSM, that these materials have low gas generation potentials. As discussed in paragraph 9.7.60 of this chapter, the risk to adjacent residential properties from ground gas has not been included in further assessments due to the absence of a viable potential pollution linkage.
- 9.8.9 Ground gas exceedances, in respect to long-term and short-term WELs, were recorded for CO₂, and CH₄ was recorded above the LEL on several occasions during the monitoring programme. Furthermore, depleted O₂ concentrations were recorded in a number of monitoring wells. These elevated ground gas concentrations are likely to be a result of trapped gases within the Made Ground, which could pose a risk to construction workers operating in excavations and confined spaces.

Groundwater and surface water

- 9.8.10 The potential impact on controlled waters from soil leachate and groundwater contaminant exceedances is not considered significant and does not warrant any remediation to facilitate the Scheme. See paragraph 9.7.82 of this chapter for a summary of the groundwater risk assessment.
- 9.8.11 Most of the soil leachate and groundwater chemical exceedances, recorded during the controlled waters risk assessment, are considered to be reflective of conservative leachate testing methods, conservative WQS, and diffused groundwater contamination or background concentrations within the wider area, rather than on-site contamination sources.

- 9.8.12 The GIR (Appendix 9.3 of the Environmental Statement Appendices (TR010064/APP/6.3)) recommends further groundwater and surface water sampling should be undertaken prior to and during the construction phase works to understand baseline conditions and inform future controlled water risk assessments for the study area.

Operation

Geology

- 9.8.13 No sensitive geological receptors have been identified within the study area, therefore geology has been scoped out of the assessment.

Soils

- 9.8.14 Operational impacts on soils have been scoped out of further assessment.

Human health

- 9.8.15 Loose Chrysotile and Amosite asbestos fibres were recorded locally in Made Ground. However, Appendix J: Outline Contaminated Land Management Plan of the First Iteration EMP ((TR010064/APP/6.5)) states that asbestos contaminated soils will be removed during construction, therefore exposure of maintenance workers and adjacent residents / land users to asbestos during operation is unlikely to occur. Furthermore, any residual risks would be mitigated through working methods and risk assessments in accordance with the CAR 2012 (Health and Safety Executive, 2012) and CAR-SOIL industry guidance (CL:AIRE, 2016). As such, the operational impact on human health from asbestos has been scoped out of further assessment.
- 9.8.16 No degradable organic materials within the Made Ground of the north-east mound, M60/M62 embankments and Landfill Site 2 have been identified, therefore the risk to adjacent residential properties from ground gas has been scoped out of further assessment due to the absence of a viable PPL.
- 9.8.17 As discussed in paragraphs 9.7.60 to 9.7.69 of this chapter, ground gas exceedances were recorded for CO₂ and CH₄ during the monitoring programme, which could pose a risk to maintenance workers operating in excavations and confined spaces.
- 9.8.18 There may be a risk during the operational phase to maintenance workers in contact with residual soil contamination and ground gases.

Groundwater and surface water

- 9.8.19 The potential impact on controlled waters from soil leachate and groundwater contaminant exceedances is not considered significant and does not warrant any remediation to facilitate the Scheme. Furthermore, during the operational phase, some potential pollutant linkages would have been broken due to the construction of the carriageway. The operational impacts on surface water and groundwater from contaminated land are therefore scoped out of further assessment. However, impacts during construction are scoped in.

- 9.8.20 There is the potential for pollution incidents from fuel and chemical leaks / spills on the new carriageway by road users. These are covered in Chapter 13: Road Drainage and the Water Environment of this Environmental Statement (TR010064/APP/6.1) and are not addressed further in this chapter.

9.9 Design, mitigation and enhancement measures

- 9.9.1 Mitigation is included in the Register of Environmental Actions and Commitments (REAC) contained within the First Iteration EMP (TR010064/APP/6.5) The First Iteration EMP will be developed into the Second Iteration EMP for implementation during construction and is secured by Requirement 4 of the draft DCO (TR010064/APP/3.1).

Embedded mitigation

- 9.9.2 The environment team has worked in close collaboration with the infrastructure design team to avoid or reduce environmental impacts through the Scheme design. This is referred to as embedded (or design) mitigation. Chapter 3: Assessment of Alternatives of this Environmental Statement (TR010064/APP/6.1) details the design alternatives that have been considered, including the environmental factors which have influenced the decision-making.

Essential mitigation

- 9.9.3 Essential mitigation measures to reduce and, if possible, offset likely significant adverse environmental effects for geology and soils include the following commitments in the REAC, contained within the First Iteration EMP (TR010064/APP/6.5):
- Commitment GS1 – A Detailed Quantitative Risk Assessment (DQRA) for groundwater will be completed, and where unacceptable risks are identified, a remediation strategy will be developed.
 - Commitment GS2 – If significant unforeseen / unrecorded land contamination including groundwater is encountered during detailed design or construction a DQRA will be completed and a remediation strategy will be developed if unacceptable risks are identified by the DQRA.
 - Commitment GS3 – Implementation of remedial treatment (in-situ and/or ex-situ) of targeted areas, where unacceptable risks are still present after DQRA, in accordance with the remediation strategy.
 - Commitment GS4 – Compliance with CDM Regulations which govern the management of risks to construction and maintenance workers.
 - Commitment GS5 – To implement construction techniques to mitigate potential land contamination risks to construction workers, adjacent land users/residents and controlled waters prior to the start of construction works. An Outline Contaminated Land Management Plan has been included in Appendix J of the First Iteration EMP (TR010064/APP/6.5) and would be developed into a Contaminated Land Management Plan in the Second Iteration EMP, in accordance with Requirement 4 of the draft DCO (TR010064/APP/3.1)).

- Commitment GS6 – Excavated materials will be reused appropriately and sustainably following the principals of the CL:AIRE Definition of Waste: Development Industry Code of Practice (DoW:CoP) (CL:AIRE, 2011) guidance. Further details can be found in Chapter 10: Material Assets and Waste of this Environmental Statement (TR010064/APP/6.1).
- Commitment GS7 – Soil Resource Plan developed from the Outline Soil Management Plan (Appendix F of the First Iteration EMP (TR010064/APP/6.5), informed by the results of the soil survey (see Appendix 9.2: ALC Survey Report of the Environmental Statement (TR010064/APP/6.3) for further details) and consistent with Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Defra, 2011b).
- Commitment GS8 – Adopt good practice measures in advance of soil stripping to identify and manage biosecurity risks, including to reduce the potential for soil-borne disease and pathogen transfer between different areas of agricultural land.
- Commitment GS9 – Topsoil will be stripped and sustainably reused wherever practicable from the footprints of all permanent development (hardstanding and materials placement).
- Commitment GS10 – Working methods and risk assessments will be incorporated into construction and maintenance works to manage risks associated with ground gas build-up in excavations and confined spaces.
- Commitment GS11 – The waste hierarchy principle will be used at every stage of the Scheme, as appropriate and proportionate, to identify enhancement opportunities with respect to the reuse of excavated soils and materials on the Scheme development. An Outline Site Waste Management Plan has been included in Appendix C of the First Iteration EMP (TR010064/APP/6.5). Further details can be found in Chapter 10: Material Assets and Waste of this Environmental Statement (TR010064/APP/6.1).
- Commitment GS12 – Risks associated with asbestos to be mitigated through the development of working methods and risk assessments in accordance with CAR 2012 and CAR-SOIL industry guidance (CL:AIRE, 2016).

Enhancement

- 9.9.4 No opportunities for enhancements have been identified for this aspect as no soils will be improved or released to agricultural use, no new sites of geological interest will be improved or created and no contamination will be entirely remediated.

9.10 Assessment of likely significant effects

- 9.10.1 This section summarises the likely significant residual effects of the Scheme on geology, soils, human health and controlled water receptors during construction and operation. Most effects have been qualitatively assessed based on the application of professional judgement to the DMRB LA 109 significance criteria. Additionally, impacts on human health and controlled waters from land contamination have been quantitatively assessed, as discussed in paragraphs 9.7.54 to 9.7.82 of this chapter.
- 9.10.2 Where effects have been identified, these would be reduced where practicable by implementing the mitigation measures outlined in Section 9.9 of this chapter, and by ensuring that the construction of the Scheme responds to the national regulatory or policy standards and local policy requirements relevant to this aspect. The residual effects described in this section assume the implementation of this mitigation.
- 9.10.3 Requirement 6 (contaminated groundwater) of the draft DCO (TR010064/APP/3.1) makes provision for dealing with any contaminated land and groundwater discovered during construction, in consultation with the relevant planning authority and the Environment Agency.

Construction

Geology

- 9.10.4 Construction impacts on geology have been scoped out of the assessment.

Soils and BMV agricultural land

- 9.10.5 The permanent sealing or wastage of topsoil would be avoided as far as practicable via stripping and sustainable reuse elsewhere, as per Commitment GS9 in the REAC, contained within the First Iteration EMP (TR010064/APP/6.5). In addition, by following good practice soil management measures (see the Outline Soil Management Plan (Appendix F of the First Iteration EMP (TR010064/APP/6.5) for further details), degradation during stripping, handling and storage would either be avoided, or would only be temporary in nature.
- 9.10.6 A summary of the likely significant residual effects on soils receptors is presented in Table 9.13.

Table 9.13 Effects on soils receptors

ALC Grade (Sensitivity)	Impact	Effect	Assessment Reasoning
Grade 2 (BMV) (Very High)	Minor Adverse	Moderate adverse	As there is a permanent loss of agricultural land at the lower end of the impact scale as a proportion of the whole Scheme footprint, the effect is Moderate rather than Large. This is due to the small permanent area of Grade 2 agricultural land take (0.4ha), which is approximately 0.5% of the Order Limits.
Grade 3a (BMV) (High)	Moderate Adverse	Moderate adverse	As there is a permanent loss of agricultural land at the lower end of the impact scale, the effect is Moderate rather than Large. This is due to the small permanent area of ALC grade 3a land take (1.9ha), which is approximately 2.2% of the Order Limits.
Grade 3b (Medium)	Major Adverse	Moderate adverse	Permanent loss of 17.3ha of Grade 3b agricultural land (including 2.2ha of unsurveyed agricultural land assumed to be Grade 3b), which is approximately 20.2% of the Order Limits. Temporary land take of 9.9ha of Grade 3b agricultural land (including unsurveyed agricultural land assumed to be Grade 3b), which is approximately 11.6% of the Order Limits.
Grade 4	Moderate Adverse	Slight adverse	Permanent loss of 1.7ha of Grade 4 agricultural land (approximately 2.0% of the Order Limits) and temporary land take of 0.1ha (approximately 0.1% of the Order Limits).

9.10.7 The combined effects on soils receptors are assessed to cause a **moderate adverse (significant) effect**. This is due to the combined land take being >20ha, but the majority of the land being classified as Grade 3b (non-BMV).

9.10.8 In addition, Priority Habitats (deciduous woodlands) have been identified within the Order Limits. There would be a loss of 0.11ha of soils previously occupied by deciduous woodlands. However, as this impact has already been accounted for under the soils assessment, this is not considered an additional impact.

Human health

- 9.10.9 Based on the presence of residential properties within the vicinity of the Order Limits, the sensitivity of human health has been assessed as very high. No exceedances of chemical thresholds designed to be protective of human health were recorded in soils within the Order Limits, however low concentrations of Chrysotile and Amosite asbestos fibres were recorded locally in Made Ground, which poses a potential risk to construction workers and adjacent residents during construction. The magnitude of impact to human health is considered to be minor adverse. After the application of the mitigation measures as detailed in Section 9.9 of this chapter (Commitments GS4 and GS12 in the REAC, contained within the First Iteration EMP (TR010064/APP/6.5)), the effect to human health would be **neutral (not significant)**.
- 9.10.10 Additionally, ground gas exceedances, in respect to long-term and short-term WELs, were recorded for CO₂, and CH₄ was recorded above the LEL on several occasions within the Order Limits. These elevated gas concentrations could pose a potential risk to construction workers operating in excavations and confined spaces. As discussed in paragraph 9.7.60 of this chapter, there are no potential ground gas migration pathways that could pose a risk to residential receptors. The sensitivity of construction workers has been assessed as low, while the magnitude of impact associated with ground gas is considered to be minor adverse, thus the effect is classified as **slight adverse (not significant)**.

Groundwater and surface water

- 9.10.11 Based on the findings of the controlled waters risk assessment, impacts to the Principal aquifer (Chester Formation) are unlikely as the construction is not expected to encounter this groundwater body due to its depth. Therefore the impact of magnitude has been assessed as no change, resulting in a **negligible effect (not significant)**.
- 9.10.12 Groundwater in the Pennine Lower and Middle Coal Measures (Secondary A aquifer) and superficial aquifers (Secondary A and Secondary Undifferentiated aquifers as detailed in paragraph 9.7.72 of this chapter) has been designated as medium sensitivity. Although some exceedances of the WQS were identified during the controlled waters risk assessment (see paragraph 9.7.82 of this chapter), the magnitude of impact to groundwater quality is considered to be minor adverse, thus the effects are classified as **slight adverse (not significant)**.
- 9.10.13 Parr Brook is considered the most sensitive receptor within the study area and has been designated as medium sensitivity. Other streams and ditches have been designated as low sensitivity. Based on the findings of the controlled waters risk assessment (see paragraph 9.7.82 of this chapter), the magnitude of impact to surface water quality is considered to be minor adverse, thus the effects are classified as **slight adverse (not significant)**.

Operation

Geology

- 9.10.14 Operational impacts on geology have been scoped out of the assessment.

Soils and BMV agricultural land

- 9.10.15 No additional impacts are predicted on soils during the operational phase. The permanent loss of agricultural land occurring during construction would persist during operation but is not considered as an additional effect. Operational effects on soils are therefore scoped out of further assessment.

Human health

- 9.10.16 Based on the presence of residential properties within the vicinity of the Order Limits, the sensitivity of human health has been assessed as very high. No exceedances of chemical thresholds designed to be protective of human health were recorded in soils within the Order Limits, however loose Chrysotile and Amosite asbestos fibres were recorded locally in Made Ground.
- 9.10.17 Asbestos contaminated soils will have been removed during construction, therefore exposure of maintenance workers and adjacent residents / land users to asbestos during operation is unlikely to occur. As such, the operational magnitude of impact on human health from asbestos has been assessed as negligible, resulting in a **slight adverse (not significant) effect**.
- 9.10.18 Ground gas exceedances, in respect to long-term and short-term WELs, were recorded for CO₂, and CH₄ was recorded above the LEL on several occasions within the Order Limits. Relevant residual hazards should be noted in the health and safety file in line with the CDM Regulations on completion of the construction phase to be passed on to the operator of the Scheme. As residual risks to people working on the Scheme would be addressed in the CDM Regulations health and safety file (Commitment GS4 in the REAC contained within the First Iteration EMP (TR010064/APP/6.5)), there would be no risk to residential receptors and maintenance workers, meaning the magnitude of impact is negligible, resulting in a **slight adverse (not significant) effect**.

Groundwater and surface water

- 9.10.19 As any impacts during construction would have been remediated and there are not likely to be any additional impacts during operation, the operational impacts on groundwater and surface water have been scoped out of further assessment.

9.11 Monitoring

- 9.11.1 The First Iteration EMP (TR010064/APP/6.5) contains mitigation measures and processes to reduce the impact that the Scheme will have on the environment during the construction and operation stage. Appendix J (Contaminated Land Management Plan) is relevant to the geology and soils aspect and require monitoring during implementation. See the First Iteration EMP (TR010064/APP/6.5) for further information.

9.12 Summary

- 9.12.1 The Scheme has been assessed in line with the requirements set out in the NPS NN (DfT, 2014) and draft NPS NN (DfT, 2023) for geology and soils.

9.12.2 Table 9.14 summarises residual significant effects identified for the geology and soils aspect.

Table 9.14 Summary of residual significant effects for geology and soils

Summary of residual significant effects	
Construction	Operation
Permanent adverse (Moderate) significant effects on ALC grades 2 (BMV), 3a (BMV) and 3b soils due to permanent land take requirements associated with the Scheme.	No residual significant effects.*

*The permanent loss of agricultural land occurring during construction would persist during operation but is not considered as an additional effect.

Acronyms and initialisms

Acronym or initialism	Term
AGAC	Acute Generic Assessment Criteria
ALC	Agricultural Land Classification (in England and Wales)
AOD	Above Ordnance Datum
bgl	below ground level
BGS	British Geological Survey
BMV	Best and Most Versatile
C4SL	Category 4 Screening Levels (Defra)
CAR 2012	Control of Asbestos Regulations 2012
CDM	Construction (Design and Management) regulations
Ch.	Chainage
CH ₄	Methane
CIEH	Chartered Institute of Environmental Health
CIRIA	Construction Industry Research and Information Association
CO	Carbon monoxide
CO ₂	Carbon dioxide
CSM	Conceptual Site Model
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DoW:CoP	Definition of Waste Code of Practice
DQRA	Detailed Quantitative Risk Assessment
DWS	Drinking Water Standard
EC	European Commission
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EQS	Environmental Quality Standard
GAC	Generic Assessment Criteria
GDMS	National Highways' Geotechnical and Drainage Management Service

Acronym or initialism	Term
GI	Ground Investigation
GIR	Ground Investigation Report
GQRA	Generic Quantitative Risk Assessment
GDWTE	Groundwater Dependent Terrestrial Ecosystem
H ₂ S	Hydrogen sulphide
HSE	Health and Safety Executive
LCRM	Land Contamination Risk Management, Environment Agency, 2020.
LEL	Lower Explosive Limit
LiDAR	Light Detection and Ranging
LNR	Local Nature Reserve
LoD	Limit of Detection
LQM	Land Quality Management
MAGIC	Multi-Agency Geographic Information for the Countryside
MHCLG	Ministry of Housing, Communities and Local Government (now called the Department for Levelling Up, Housing and Communities)
MMP	Materials Management Plan
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NPS NN	National Policy Statement for National Networks
NSIP	Nationally Significant Infrastructure Project
O ₂	Oxygen
PAH	Polycyclic aromatic hydrocarbons
PFA	Pulverised fuel ash
PLCM	Pennine Lower Coal Measures
PMCM	Pennine Middle Coal Measures
PPL	Potential Pollutant Linkage
RBMP	River Basin Management Plan
REAC	Register of Environmental Actions and Commitments
RIGS	Regionally Important Geological Site
S4UL	Suitable For Use Levels

Acronym or initialism	Term
SAC	Special Area of Conservation
SoBRA	Society of Brownfield Risk Assessment
SOM	Soil Organic Matter
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
TPH	Total petroleum hydrocarbons
VOC	Volatile organic carbons
WEL	Workplace Exposure Limit
WFD	Water Framework Directive
WHO	World Health Organisation
WQS	Water Quality Standard

Glossary

Term	Definition
Agricultural Land Classification (ALC)	ALC is graded from 1 to 5. Best and Most Versatile (BMV) agricultural land is graded 1 to 3a.
Alluvial	Unconsolidated detrital material deposited by a river, stream or other body of running water as sediment in the bed of the stream or on its floodplain or delta.
Aquifer Designation	An Environment Agency definition reflecting the importance of aquifers as a resource and as supporting surface water flows. These are (most important to least important): Principal, Secondary A, Secondary B, Secondary Undifferentiated and Unproductive.
Bedrock (deposits)	Previously solid geology. The main mass of rocks forming the Earth that are present everywhere. Any deposits older than 2.6 million years.
Coal Tar	A by-product of the coking process, coal tar was previously used as a surfacing material for roads.
Cohesive	Describing material that can hold together (e.g., clayey material).
Dip	The angle of displacement of a planar feature (e.g., a fault) from the horizontal plane.
Engineered fill	Material that has been selected and placed to an appropriate specification, generally as part of engineering works.
Glacial till	Sediments directly deposited by the moving ice of a glacier.

Term	Definition
Glaciofluvial (deposits)	Sediments deposited by flowing glacial meltwater.
Glaciolacustrine (deposits)	Sediments deposited in glacial lakes.
Granular	Rocks or sediments comprising grains of approximately equal size.
Made ground	Artificial deposits.
Potential Pollutant Linkage (PPL)	A possible pathway between a pollution source and receptor.
Pulverised fuel ash (PFA)	The residual solid material from the combustion of coal.
Slag	A metallic mixture of metal oxides and silicon dioxide produced as a by-product of smelting.
Source Protection Zone (SPZ)	Zones defined by the Environment Agency to indicate those areas where groundwater supplies are at risk from potentially polluting activities and accidental releases of pollutants. Defined as Zone 1 (Inner Catchment) to Zone 3 (Total Catchment) and occasionally Zone 4 (Zone of special interest).
Superficial (deposits)	Previously drift geology or drift deposits. The youngest geological deposits formed during the most recent period of geological time, the Quaternary (2.6 million years ago to present),
Throw	Vertical displacement of geological strata across a fault.

References

British Geological Survey (2023a). Interactive Map Viewer – GeoIndex. Accessed May 2023. <https://mapapps2.bgs.ac.uk/geoindex/home.html>.

British Geological Survey (2023b). Lexicon of Named Rock Units. Accessed May 2023. <https://webapps.bgs.ac.uk/lexicon/>.

British Standards Institution (2020). Code of practice for ground investigations. BS 5930:2015+A1:2020.

Bury Metropolitan Borough Council (1997). Bury Unitary Development Plan.

Coal Authority (2017). Coal Mining Report. HMD-252-4559913.

Contaminated Land: Applications in Real Environments (2010). Soil Generic Assessment Criteria for Human Health Risk Assessment.

Contaminated Land: Applications in Real Environments (2011). Definition of Waste: Code of Practice (DoW:CoP).

Contaminated Land: Applications in Real Environments (2014). SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination.

Contaminated Land: Applications in Real Environments (2016). CAR-SOIL™: Control of Asbestos Regulations 2012: Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials: Industry Guidance.

Cranfield University (2023). LandIS Soilscales Map. Accessed May 2023.
<https://www.landis.org.uk/soilscales/>.

D. J. Rudland, R. M. Lancefield and P. N. Mayell (2001). Contaminated land risk assessment. A guide to good practice (C552). CIRIA.

Department for Environment, Food and Rural Affairs (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites.

Department for Environment, Food and Rural Affairs (2011a). Safeguarding our Soils: A Strategy for England.

Department for Environment, Food and Rural Affairs (2011b). Code of practice for the sustainable use of soils on construction sites.

Department for Environment, Food and Rural Affairs (2021). A Green Future: Our 25 Year Plan to Improve the Environment.

Department for Environment, Food and Rural Affairs (2023). MAGIC Map Application. Accessed May 2023. <https://magic.defra.gov.uk/MagicMap.aspx>.

Department for Levelling Up, Housing and Communities (2023). National Planning Policy Framework.

Department for Transport (2014). National Policy Statement for National Networks. London: Her Majesty's Stationery Office.

Department for Transport (2023). Draft National Policy Statement for National Networks. London: His Majesty's Stationery Office.

Environment Agency (2023). Land contamination risk management (LCRM).

Greater Manchester Combined Authority (2021). Places For Everyone Joint Development Plan Document – Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Tameside, Trafford, Wigan Publication Stage Accessed November 2023.
<https://www.greatermanchester-ca.gov.uk/media/4838/places-for-everyone.pdf>.

Groundsure (2017a). EnviroInsight report (reference: HMD-252-4559910).

Groundsure (2017b). GeoInsight report (reference: HMD-252-4559911).

Groundsure (2017c). MapInsight report (reference: HMD-252-4559912).

Health and Safety Executive (2012). Control of Asbestos Regulations.

Health and Safety Executive (2014). The Mines Regulations.

Health and Safety Executive (2020). EH40/2005 Workplace Exposure Limits.

Highways England (2019). Design Manual for Roads and Bridges, LA 109 Geology and soils. Revision 1.

Highways England (2020a). Design Manual for Roads and Bridges, LA 104 Environmental Assessment and Monitoring. Revision 1.

Highways England (2020b). Design Manual for Roads and Bridges, LA 113 Road drainage and the water environment. Revision 1.

Manchester City Council (2012). Manchester Core Strategy.

Nathanail, C.P.; McCaffrey, C.; Gillett, A.G.; Ogden, R.C. & Nathanail, J.F. (2015). The LQM/CIEH S4ULs for Human Health Risk Assessment.

National Highways (2023a). Departure From Standard - LA109 Groundwater and Surface Water Sensitivity. HE548642-JAC-EGT-J18-DF-Y-0001.

National Highways (2023b). Geotechnical Data Management System (GDMS).

National House Building Council (2008). Guidance for the Safe Development of Housing on Land Affected by Contamination.

Natural England (2008). Soil Texture Technical Information Note TIN037. 1st Edition.

Natural England (2012). Agricultural Land Classification: Protecting the Best and Most Versatile Agricultural Land Technical Information Note TIN049. 2nd Edition.

Natural England (2019). Provisional Agricultural Land Classification (ALC) (England).

Society of Brownfield Risk Assessment (2020). Development of Acute Generic Assessment Criteria for Assessing Risks to Human Health from Contaminants in Soil. Version 2.