

A46 Newark Bypass

Scheme Number: TR010065

6.1 Environmental Statement Chapter 9 Geology and Soils

APFP Regulation 5(2)(a)

Planning Act 2008

**Infrastructure Planning (Applications: Prescribed Forms
and Procedure) Rules 2009**

February 2025

Volume 6

Infrastructure Planning

Planning Act 2008

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

The A46 Newark Bypass
Development Consent Order 202[#]

6.1 Environmental Statement Chapter 9 Geology and Soils

Regulation Number:	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010065
Application Document Reference	TR010065/APP/6.1
Author:	A46 Newark Bypass Project Team, National Highways

Version	Date	Status of Version
Rev 1	April 2024	DCO Application
Rev 2	November 2024	Deadline 3 Submission
Rev 3	February 2025	Deadline 5 Submission

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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 (as amended) to be provided in the Environmental Statement (ES) to enable the identification and assessment of likely significant effects on geology and soils.
- 9.1.2 The Scheme has the potential to cause both adverse and beneficial effects. The geology and soils topic encompasses three sub-topics:
- Geology, which is concerned with the Scheme's effect on designated geological sites (statutory or non-statutory).
 - Contamination, which is concerned with risks to human health and controlled waters from the disturbance of historical contamination and the introduction of new substantial sources of contamination.
 - Soils, which is concerned with the quality of soils as a resource and the Scheme's effect on agricultural land classified as grade 1, 2 or 3a best and most versatile (BMV) or Agricultural Land Classification (ALC) grade 4 or 5 agricultural land.
- 9.1.3 This assessment has been prepared in accordance with the Design Manual for Roads and Bridges (DMRB) LA 109 Geology and Soils,¹ and has also made reference to DMRB LA 113 Road drainage and the water environment² and Chapter 13 (Road Drainage and Water Environment) of the ES.
- 9.1.4 This assessment considers the construction phase for geology, contamination and soils. In line with the Planning Inspectorate's EIA Scoping Opinion [APP-189], the operational phase of the Scheme has been scoped out of the assessment for geology contamination and soils. This is because there are no anticipated direct effects on geology and contamination during the operational period, and any potential long-term effects on soils (as a result of permanent land take) are assessed during the construction stage. The Planning Inspectorate's comments made in the Scoping Opinion [APP-189] relating to the operational phase are addressed in Section 9.5.3 of this Chapter.
- 9.1.5 This Chapter has been undertaken in compliance with the Planning Inspectorate's Scoping Opinion received for this Scheme [APP-189].

¹ Highways England (2019). LA 109 – Geology and Soils Revision 0 [online] Available at [LA 109 - Geology and soils - DMRB \(standardsforhighways.co.uk\)](https://standardsforhighways.co.uk/LA-109-Geology-and-soils) (Last accessed December 2023).

² National Highways (2020). LA 113 – Road drainage and the water environment Revision 1 [online]. Available at: [LA 113 - Road drainage and the water environment - DMRB \(standardsforhighways.co.uk\)](https://standardsforhighways.co.uk/LA-113-Road-drainage-and-the-water-environment). (Last accessed December 2023).

Appendix 4.1 (Scoping Opinion Schedule of Comments and Responses) of the ES Appendices [APP-125] contains further information on how each of the matters raised in the Scoping Opinion have been addressed.

- 9.1.6 Chapter 2 (The Scheme) of this ES contains a detailed description of the Scheme. The drawings referenced in this Chapter can be found in the ES Figures [contained within Volume 6.2 of the ES], and the technical appendices referred to in this Chapter are presented in the ES Appendices [contained within Volume 6.3 of the ES].

9.2 Competent expert evidence

- 9.2.1 The competent geo-environmental expert has a master's level degree in Pollution and Environmental Control and is a Chartered Geologist (CGeol), Chartered Scientist (Csci) and Fellow member of the Geological Society of London. The competent expert has over 20 years of professional experience in the field of land quality, including the provision of technical expertise and input into Geological, Hydrogeological and Environmental Impact Assessments (EIA) for major infrastructure and linear projects including highways, pipelines and flood defence schemes.
- 9.2.2 The competent soil expert has a BSc in Agricultural Science, a MSc in Soil Science. The competent expert has over 36 years' experience in the agricultural, forestry and construction industries with technical expertise including ALC and Soil Resource surveys, soil management planning, precision farming technologies, crop advice and EIA.

9.3 Legislative and policy framework

- 9.3.1 The principal legislation and planning context for the assessment of the environmental effects of the Scheme on geology and soils is presented below. The relevant legislation and policies listed below have been taken account of in the assessment.

Legislation

- 9.3.2 The overarching legislation in relation to geology and soils is provided by:

Part 2A of the Environmental Protection Act 1990³

- 9.3.3 The UK legislation on contaminated land is principally contained in Part 2A of the Environmental Protection Act (EPA 1990) and provides

³ Environmental Protection Act 1990. Available at: [Environmental Protection Act 1990 \(legislation.gov.uk\)](https://www.legislation.gov.uk/ukpga/1990/61/section/2A) (Last accessed December 2023).

The Contaminated Land (England) Regulations 2006 (as amended)⁴

- The Environmental Permitting (England and Wales) Regulations 2016 (as amended)⁵

- The Pollution Prevention and Control Regulations 2000 (as amended 2003)⁶

- ## The Environmental Damage (Prevention and Remediation) Regulations 2015⁷

- ⁷ The Environmental Damage (Prevention and Remediation) Regulations 2015. Available at: [The Environmental Damage \(Prevention and Remediation\) \(England\) Regulations 2015 \(legislation.gov.uk\)](#) (Last accessed December 2023).

2004/35/EC. There is a legal duty to immediately notify regulators and to prevent damage to the environment. This legislation has been considered for the assessment of contamination.

Wildlife and Countryside Act 1981 (as amended)⁸

- 9.3.8 Geological and geomorphological features considered to be of national importance are designated as Sites of Special Scientific Interest (SSSI). The importance of nature conservation, including areas with geological features, is emphasised. This legislation has been considered for the assessment of geology.

Water Environment (Water Framework Directive) (England and Wales) Regulations 2017⁹

- 9.3.9 Aims to protect inland and coastal waters and prevent deterioration of aquatic ecosystems, including groundwaters. A key aim of the Water Framework Directive (WFD) is to achieve 'good' ecological status for all waterbodies by 2015, with a secondary aim to gradually reduce the release of pollutants which may pose significant risks to the aquatic ecosystems. The environmental objectives for the WFD are implemented through actions described in the River Basin Management Plans (RBMPs). This legislation has been considered for the assessment of contamination of controlled waters.
- 9.3.10 The Groundwater Regulations (2009)¹⁰ and the Groundwater Daughter Directive (GDD) clarifies certain objectives of the WFD relating to prevention and control of groundwater pollution and establishes groundwater quality standards. This legislation has been considered for the assessment of contamination of controlled waters.
- 9.3.11 The Environmental Quality Standards Directive 2008/105/EC¹¹ in the field of water policy lays down environmental quality standards (EQS), in accordance with the WFD, for the 33 priority substances identified and eight other pollutants that were already regulated at Union level. This legislation has been considered for the assessment of contamination of controlled waters.

⁸ Wildlife and Countryside Act 1981. Available at: [Wildlife and Countryside Act 1981 \(legislation.gov.uk\)](https://www.legislation.gov.uk/ukpga/1981/69/section/1) (Last accessed December 2023).

⁹ The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. Available at: [The Water Environment \(Water Framework Directive\) \(England and Wales\) Regulations 2017 \(legislation.gov.uk\)](https://www.legislation.gov.uk/uksi/2017/1251/contents/make) (Last accessed December 2023).

¹⁰ The Groundwater Regulations 2009. Available at: [The Groundwater \(England and Wales\) Regulations 2009 \(legislation.gov.uk\)](https://www.legislation.gov.uk/uksi/2009/1251/contents/make) (Last accessed December 2023).

¹¹ The Environmental Quality Standards Directive 2008. Available at: <https://www.legislation.gov.uk/eudr/2008/105/contents> (Last accessed December 2023).

The Water Resources Act 1991(as amended)¹²

9.3.12 The Water Resources Act (WRA) is the primary piece of legislation for the protection of water resources. Risks from historical groundwater pollution can be considered under Section 161 of the WRA. This allows the Environment Agency to recover the costs of cleaning up any poisonous, noxious or polluting matter or any solid waste matter that persons have caused or knowingly permitted to be present in controlled waters (i.e. streams, rivers, canals, marine environment and groundwater). The WRA makes it an offence to discharge to controlled waters without the permission or consent of the regulators of those areas. The WRA and WRA 1991 (amendment) (England and Wales) Regulations 2009, Section 93, provides for the establishment of water protection zones. This legislation has been considered for the assessment of contamination of controlled waters.

The Water Act 2003¹³

9.3.13 The Water Act 2003 modernised the regulation of the water industry in England and Wales and introduced measures to promote competition, improve the quality of water resources, ensure efficient use of resources, and protect public health. This legislation has been considered for the assessment of contamination of controlled waters.

Land Contamination Risk Management¹⁴

9.3.14 Land Contamination Risk Management (LCRM) is the Environment Agency guidance on how to assess and manage the risks from land contamination. This guidance was published by the Environment Agency in June 2019, as an update to Model Procedures for the Management of Land Contamination, which has been subsequently withdrawn.

The Agricultural Land (Removal of Surface Soil) Act 1953¹⁵

9.3.15 The Agricultural Land (Removal of Surface Soil) Act 1953 makes it an offence to remove surface soils from land in certain circumstances; and for purposes therewith. Removal of surface soil without planning permission is an offence against this Act. This legislation has been considered for the assessment of soils.

¹² Water Resources Act 1991. Available at: [Water Resources Act 1991 \(legislation.gov.uk\)](https://www.legislation.gov.uk/ukpga/1991/29/section/161) (Last accessed December 2023).

¹³ The Water Act 2003. Available at: [Water Act 2003 - Explanatory Notes \(legislation.gov.uk\)](https://www.legislation.gov.uk/ukpga/2003/24/section/93) (Last accessed December 2023)

¹⁴ Environment Agency (2021). Land Contamination Risk Management [online] available at: [Land contamination risk management \(LCRM\) - GOV.UK \(www.gov.uk\)](https://www.gov.uk/guidance/land-contamination-risk-management-lcrm) (last accessed December 2023).

¹⁵ Agricultural Land Act 1953 (1953 Chapter 10 1 and 1 Eliz 2). Available at: [Agricultural Land \(Removal of Surface Soil\) Act 1953 \(legislation.gov.uk\)](https://www.legislation.gov.uk/ukpga/1953/10/section/1) (Last accessed December 2023).

Waste legislation (Various)

- 9.3.16 There are also a number of waste-related regulations which serve to protect soils from contamination by waste management, such as the Hazardous Waste (England and Wales) Regulations 2005 (as amended)¹⁶, Environmental Protection (Duty of care) Regulations 1991¹⁷, Waste Management Licensing Regulations 1994 (as amended)¹⁸, Landfill Tax (Contaminated land) Order 1996,¹⁹ the Waste (England and Wales) Regulations 2011 (as amended)²⁰. This legislation has been considered for the assessment of contamination.
- 9.3.17 Additional information relating to waste legislation is contained within Section 10.2 of Chapter 10 (Material Assets and Waste) of this ES.

Other (various)

- 9.3.18 Under the Control of Substances Hazardous to Health Regulations 2002 (COSHH)²¹, Construction Design and Management (CDM) Regulations 2015²² and Building Regulations 2010²³ where a developer knows or suspects the presence of contaminated soil, provision would be made to ensure that risks to the public and site workers are minimised. This legislation has been considered for the assessment of contamination on human health.
- 9.3.19 The Industrial Emissions Directive 2010/75/EU²⁴ is a European Union directive which commits European Union member states to control and reduce the impact of industrial emissions on the environment. This legislation has been considered for the assessment of contamination.
- 9.3.20 The Control of Pollution (Oil Storage) (England) Regulations 2001²⁵ requires the safe storage of oil on site, including provisions of a

¹⁶ The Hazardous Waste (England and Wales) Regulations 2005. Available at: [The Hazardous Waste \(England and Wales\) Regulations 2005 \(legislation.gov.uk\)](#) (Last accessed December 2023).

¹⁷ Environmental Protection (Duty of care) Regulations 1991. Available at: [The Environmental Protection \(Duty of Care\) Regulations 1991 \(legislation.gov.uk\)](#) (Last accessed December 2023).

¹⁸ Waste Management Licensing Regulations 1994. Available at: [The Waste Management Licensing Regulations 1994 \(legislation.gov.uk\)](#) (Last accessed December 2023).

¹⁹ Landfill Tax (Contaminated land) Order 1996. Available at: [The Landfill Tax \(Contaminated Land\) Order 1996 \(legislation.gov.uk\)](#) (Last accessed December 2023).

²⁰ The Waste (England and Wales) Regulations 2011. Available at: [The Waste \(England and Wales\) Regulations 2011 \(legislation.gov.uk\)](#) (Last accessed December 2023).

²¹ Control of Substances Hazardous to Health Regulations 2002: Available at: [The Control of Substances Hazardous to Health Regulations 2002 \(legislation.gov.uk\)](#) (Last accessed December 2023).

²² The Construction (Design and Management) Regulations 2015. Available at: [The Construction \(Design and Management\) Regulations 2015 \(legislation.gov.uk\)](#) (Last accessed December 2023).

²³ The Building Regulations 2010. Available at: [The Building Regulations 2010 \(legislation.gov.uk\)](#) (Last accessed December 2023).

²⁴ The Industrial Emissions Directive 2010/75/EU. Available at: [Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions \(integrated pollution prevention and control\) \(Recast\) \(Text with EEA relevance\) \(legislation.gov.uk\)](#) (last accessed December 2023).

²⁵ The Control of Pollution (Oil Storage) Regulations 2001. Available at: [The Control of Pollution \(Oil Storage\) \(England\) Regulations 2001 \(legislation.gov.uk\)](#) (last accessed December 2023).

secondary containment facility, such as a bund or drip tray, to prevent oil escaping into the environment. This legislation has been considered for the assessment of contamination.

- 9.3.21 The duty to manage asbestos is a legal requirement under the Control of Asbestos Regulations 2012.²⁶ This legislation has been considered for the assessment of contamination on human health.
- 9.3.22 The Confined Spaces Regulations 1997²⁷ apply where the assessment identifies risks of serious injury from work in confined spaces. This legislation has been considered for the assessment of contamination on human health.

National policy

National Policy Statement for National Networks

- 9.3.23 The National Policy Statement for National Networks (NPSNN) sets out the policy which the Scheme should comply with. It is also the basis for informing a judgement on the impacts of a Scheme, for example whether the Scheme is consistent with the needs of the NPSNN. Compliance of the Scheme with the NPSNN is detailed within the NPSNN Accordance Tables [AS-090].
- 9.3.24 A draft NPSNN was published for consultation in March 2023. The consultation period ended in June 2023. The draft NPSNN may be subject to change following the consultation and once published in its designated form. Although this is currently in draft it may still be an important consideration for the Secretary of State when determining whether to consent the DCO for this Scheme. Accordingly, the Draft NPSNN Accordance Tables [APP-192] summarise compliance of the Scheme with the draft NPSNN.
- 9.3.25 The policies of relevance to geology soils and contaminated land within the NPSNN and detail on how they have been addressed in the assessment are provided below.
- 9.3.26 Paragraph 5.22 – 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.

²⁶ The Control of Asbestos Regulations 2012. available at: [The Control of Asbestos Regulations 2012 \(legislation.gov.uk\)](https://www.legislation.gov.uk) (last accessed December 2023).

²⁷ Confined Spaced Regulations 1997. Available at: The Confined Spaced Regulations 1997 (legislation.gov.uk) (last accessed December 2023),

- 9.3.27 Paragraph 5.23 – The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.
- 9.3.28 Paragraph 5.25 – As a general principle, and subject to the specific policies below, development should avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives.
- 9.3.29 Paragraph 5.167 – *“During any pre-application discussions with the applicant, the local planning authority should identify any concerns it has about the impacts of the application on land-use, having regard to the development plan and relevant applications, and including, where relevant, whether it agrees with any independent assessment that the land is surplus to requirements.”*
- 9.3.30 Paragraph 5.168 – *“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 ALC). 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”.*
- 9.3.31 Paragraph 5.168 makes reference to Model Procedures for Management of Land Contamination (CLR11), which has subsequently been withdrawn and replaced with Environment Agency LCRM²⁸ guidance.
- 9.3.32 Paragraph 5.176 – *“The decision-maker should take into account the economic and other benefits of the best and most versatile agricultural land. The decision maker should give little weight to the loss of agricultural land in grades 3b, 4 and 5, except in areas (such as uplands) where particular agricultural practices may themselves contribute to the quality and character of the environment or the local economy”.*
- 9.3.33 Paragraph 5.179 – *“Applicants can minimise the direct effects of a project on the existing use of the proposed site, or proposed uses near the site by the application of good design principles, including the layout of the project and the protection of soils during construction.”*

²⁸ Environment Agency (2021). Land Contamination Risk Management [online] available at: [Land contamination risk management \(LCRM\) - GOV.UK \(www.gov.uk\)](https://www.gov.uk/guidance/land-contamination-risk-management-lcrm) (last accessed December 2023).

- 9.3.34 The requirements of the NPSNN and relevant policies detailed above in relation to assessing and mitigating the impacts of the Scheme on agricultural land, geological resources and potential land contamination have been taken account of in this assessment, through a combination of desk studies, sampling through ground investigations, and subsequent assessment, in order to identify the likely significant effects that the Secretary of State for Transport needs to give due regard to in decision-making.

National Planning Policy Framework

- 9.3.35 The National Planning Policy Framework (NPPF) (December 2023) sets out the Government's planning policy framework for the whole of England, including the Government's expectation for content and quality of planning applications and local plan policy. The overall strategic aims of the NPSNN and NPPF are consistent. The NPPF may be an important and relevant matter but does not form the basis for a decision on an NSIP.
- 9.3.36 The NPPF²⁹ text relevant to contaminated land and soil is outlined below.
- 9.3.37 Paragraph 124 – *"Planning policies and decisions should give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land"*.
- 9.3.38 Paragraph 180 – *"Planning policies and decisions should contribute to and enhance the natural and local environment by:*
- *protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan).*
 - *recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland.*
 - *maintaining the character of the undeveloped coast, while improving public access to it where appropriate.*
 - *minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures.*
 - *preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve*

²⁹ Department for Levelling Up, Housing & Communities (December 2023). National Planning Policy Framework [online] available at: [National Planning Policy Framework \(publishing.service.gov.uk\)](https://www.gov.uk/government/publications/national-planning-policy-framework) (last accessed March 2024).

local environmental conditions such as air and water quality, taking into account relevant information such as RBMPs.

- *remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate”.*

9.3.39 Paragraph 189 – *“Planning policies and decisions should ensure that:*

- *(a) A site is suitable or its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation).*
- *(b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990.*
- *(c) adequate site investigation information, prepared by a competent person, is available to inform these assessments”.*

9.3.40 Paragraph 190 – *“Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rest with the developer and/or landowner”.*

9.3.41 Paragraph 216 – *“Planning policies should:*

- *(a) provide for the extraction of mineral resources of local and national importance, but not identify new sites or extensions to existing sites for peat extraction.*
- *(b) so far as practicable, take account of the contribution that substitute or secondary and recycled materials and minerals waste would make to the supply of materials, before considering extraction of primary materials, whilst aiming to source minerals supplies indigenously.*
- *(c) safeguard mineral resources by defining Mineral Safeguarding Areas and Mineral Consultation Areas; and adopt appropriate policies so that known locations of specific minerals resources of local and national importance are not sterilised by non-mineral development where this should be avoided (whilst not creating a presumption that the resources defined will be worked).*
- *(d) set out policies to encourage the prior extraction of minerals, where practical and environmentally feasible, if it is necessary for non-mineral development to take place.*
- *(e) safeguard existing, planned and potential sites for: the bulk transport, handling and processing of minerals; the manufacture of concrete and concrete products; and the handling, processing and distribution of substitute, recycled and secondary aggregate material.*
- *(f) set out criteria or requirements to ensure that permitted and proposed operations do not have unacceptable adverse impacts on the natural and historic environment or human health, taking into*

account the cumulative effects of multiple impacts from individual sites and/or a number of sites in a locality.

- *(g) when developing noise limits, recognise that some noisy short-term activities, which may otherwise be regarded as unacceptable, are unavoidable to facilitate minerals extraction.*
- *(h) ensure that worked land is reclaimed at the earliest opportunity, taking account of aviation safety, and that high quality restoration and aftercare of mineral sites takes place”.*

9.3.42 The glossary of the NPPF states the following in relation to “site investigation information”:

- *“Site investigation information: Includes a risk assessment of land potentially affected by contamination, or ground stability and slope stability reports, as appropriate. All investigations of land potentially affected by contamination should be carried out in accordance with established procedures (such as BS10175 Investigation of Potentially Contaminated Sites – Code of Practice”.*

9.3.43 The glossary further states that a “Competent person” involved in the preparation of site investigation information is *“a person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land instability, and membership of a relevant professional organisation”.*

Local policy

9.3.44 In addition to national planning policies, the remediation design (if required) should take into account the requirements of local planning policies in the assessment and management of land contamination.

9.3.45 The local planning framework comprises a number of documents, which include reference to geology, mineral resources and soils, that form the statutory development plans for the local planning authority area in which the Scheme is located:

- Nottinghamshire County Council Nottinghamshire Minerals Local Plan (Adopted 2021)³⁰ with particular reference to Policy DM15 – “Borrow Pits”
- Nottinghamshire County Council Waste Core Strategy (Adopted 2013)³¹

³⁰ Nottinghamshire County Council (2021) Nottinghamshire Minerals Local Plan 2021 [online]. Available at: <https://www.nottinghamshire.gov.uk/media/5079375/adoptedmineralslocalplancompressed.pdf> (last accessed December 2023).

³¹ Nottinghamshire County Council (2013) Waste Core Strategy 2020 [online]. Available at: [waste-core-strategy-1.pdf \(nottinghamshire.gov.uk\)](https://www.nottinghamshire.gov.uk/media/5079375/waste-core-strategy-1.pdf) (last accessed December 2023).

- 9.3.46 The Newark & Sherwood Local Development Framework Core Strategy (adopted 2019)³² Spatial Policy 3 – Rural Areas deals with agriculture, stressing the need to protect agriculture in developments within a rural setting.
- 9.3.47 Newark & Sherwood District Council's contaminated land strategy is in the process of being updated at the time of writing. The Newark & Sherwood District Council's website³³ states that a link to the new contaminated land strategy will be provided once it is complete.

National Highways policy

- 9.3.48 National Highways policies of particular relevance to the assessment of geology and soils include:
- National Highways Environment Strategy³⁴ seeking to help protect, manage, and enhance the quality of the surrounding environment.
 - National Highways Sustainable Development Strategy³⁵ sets out National Highways' approach and priorities related to sustainable development including carbon management to achieve efficiency in raw material consumption and waste generation, responsible sourcing of resources and circular economy.

9.4 Consultation

- 9.4.1 Direct consultation with the Environment Agency and the Local Planning Authority was not required for geology, soils and contaminated land matters during the Options Identification and Options Assessment stages. However, the purchase of an Envirocheck report was completed in July 2018 during these early stages, which contained information held by the Environment Agency and the Local Planning Authority.
- 9.4.2 Direct consultation with Newark & Sherwood District Council has taken place regarding an identified hotspot area of contamination, located near Nether Lock. Consultation included email correspondence from the Environmental Health Technical Officer Public Protection, Newark & Sherwood District Council, dated 20 January 2023. The Environmental Health Technical Officer agreed to

³² Newark & Sherwood Local Development Framework Core Strategy Development Plan Document (adopted March 2019) available at <https://www.newark-sherwooddc.gov.uk/media/newark-and-sherwood/images-and-files/planning-policy/pdfs/core-strategy/ACS2019.pdf> (last accessed December 2023).

³³ Newark & Sherwood District Council website available at: <https://www.newark-sherwooddc.gov.uk/landpollution/> (last accessed December 2023).

³⁴ National Highways (2018) Environmental Strategy [online] available at [Highways England Environment Strategy - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/744441/Highways-England-Environment-Strategy-2018.pdf) (last accessed December 2023).

³⁵ National Highways (2018) Sustainable Development Strategy and Action Plan [online] available at [\[Withdrawn\] Highways England Sustainable Development Strategy and Action Plan - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/744441/Highways-England-Sustainable-Development-Strategy-and-Action-Plan-2018.pdf) (last accessed December 2023).

the proposals of leaving the identified contamination in-situ from a human health perspective, as this is located at a depth which presents a low risk to any potential maintenance workers or other occasional land users from direct exposure. The Environmental Health Technical Officer requested a copy of the final factual ground investigation reports (GIs) from both the main alignment Ground Investigation (Main Alignment GI) and the supplementary Ground Investigation (Supplementary GI) for their records. Following receipt of the Supplementary GI, further consultation was undertaken with the Environmental Health Technical Officer on the 21 June 2023. The consultation included a presentation on the contaminated land methodology and a summary of Appendix 9.2 (Contaminated Land Risk Assessment) of the ES Appendices [APP-164 to APP-169] conclusions. The Environmental Health Technical Officer was in agreement with the Contaminated Land Risk Assessment conclusions, again confirming agreement for the proposal to leave the identified hotspot area of contamination in situ. The Environmental Health Technical Officer was advised that the final factual GI reports will be appended to Appendix 9.2 (Contaminated Land Risk Assessment) [APP-164 to APP-169] of the ES Appendices.

- 9.4.3 Consultation with the Environment Agency and their Groundwater and Contaminated Land (GWCL) officer has commenced. The GWCL officer has acknowledged receipt (23 February 2023) of the initial contact email and has requested that the contaminated land risk assessment report is provided, prior to the GWCL officer issuing comments regarding proposals around the known contamination hotspot and risk to controlled waters. Appendix 9.2 (Contaminated Land Risk Assessment) of the ES Appendices [APP-164 to APP-169] will form part of the DCO submission.
- 9.4.4 In line with DMRB LA 109¹ and Technical Information Note 049,³⁶ Natural England has been consulted on the proposed methodology for ALC surveys undertaken due to the likelihood of more than 20 hectare of BMV land being affected. Natural England gave their approval on the methodology used to assess ALC in March 2023.

9.5 Assessment methodology

- 9.5.1 This section describes the assessment of geology and soils (including groundwater and contaminated land) which may affect or be affected by the construction of the Scheme.

³⁶ Technical Information Note 049, Agricultural Land Classification: protecting the best and most versatile agricultural land, Natural England, (2012) available at: <http://publications.naturalengland.org.uk/publication/35012?category=23033> (last accessed December 2023).

9.5.2 The assessment excludes the following aspects that broadly relate to geology, soils, contamination, and groundwater but are considered separately in other chapters:

- The effects of materials import and export in relation to earthworks construction are considered in Chapter 10 (Material Assets and Waste) of this ES.
- Assessment of potential effects on hydrology and flood risk, fluvial geomorphology and surface water quality is provided in Chapter 13 (Road Drainage and the Water Environment) of the ES.
- Assessment of potential geotechnical hazards and land stability is provided in Appendix 9.1 (A46 Newark Northern Bypass Preliminary Sources Study Report) of the ES Appendices [APP-161 to APP-163] and in the Ground Investigation Report contained in Appendix 9.2 (Contaminated Land Risk Assessment) of the ES Appendices [APP-164 to APP-169]. Risks have been assessed in accordance with (DMRB) LA 109 Geology and Soils¹ and CD 622 'Managing Geotechnical Risk'.³⁷

9.5.3 As part of the EIA Scoping Opinion [APP-189],³⁸ the Planning Inspectorate noted the following in terms of geology and soils "*The Scoping Report seeks to scope out effects on geology, contaminated land or soils, including agricultural land during the operational phase of the Proposed Development as it is considered to be unlikely to result in significant effects. The Inspectorate would expect to see consideration of major incidents which may impact contaminated land and soil in the assessment of Major accidents. On this basis the Inspectorate is unable to agree to scope this matter out at this stage*". Consideration of major incidents which may impact contaminated land and soil has been assessed within Appendix 4.2 (Assessment of Major Accidents and Natural Disasters) of the ES Appendices [APP-126]. The assessment has concluded that the identified risks would not result in major accidents, during either construction or operation of the Scheme, with risk mitigation measures in place. Additionally, the risks associated with natural disasters would be sufficiently managed. Consequently, there would be no additional environmental effects caused by major accidents or natural disasters with mitigation in place, and the Scheme would not increase the chances of these events occurring. Further details are also contained within Appendix 4.1 (Scoping Opinion Schedule of Comments and Responses) of the ES Appendices [APP-126].

9.5.4 The assessment has been undertaken in accordance with DMRB LA 109 Geology and Soils¹. The environmental assessment covers

³⁷ CD622 Managing geotechnical risk (formerly HD 22/08, BD 10/97, HA 120/08) Revision 1, Available at: [CD 622 - Managing geotechnical risk - DMRB \(standardsforhighways.co.uk\)](https://standardsforhighways.co.uk/cd622-managing-geotechnical-risk/), (last accessed December 2023).

³⁸ The Planning Inspectorate (October 2022) Scoping Opinion: Proposed A46 Newark Bypass. [online] available at: [https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010065/TR010065-000032-A46N - Scoping Opinion.pdf](https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010065/TR010065-000032-A46N-Scoping%20Opinion.pdf) (last accessed December 2023).

geology, soil resources, as well as the effects from contamination on human health, surface water and groundwater as outlined in Section 1.4 of DMRB LA 109. The outcome has been used to aid the development of appropriate mitigation measures in order to avoid or reduce potential significant adverse effects.

- 9.5.5 The assessment has been undertaken in accordance with the principles set out in Chapter 4 (Environmental Assessment Methodology) of this ES.

Assessment of sensitivity

- 9.5.6 The sensitivity (value) of receptors has been determined according to descriptions provided within Table 9-1.

Table 9-1: Criteria for evaluating the value (sensitivity) of receptors

Receptor value (sensitivity)	Criteria	Description
Very high	International scale: Very high importance and rarity and very limited potential for substitution	<p>Geology:</p> <p>Very rare and of international importance with no potential for replacement (e.g. UNESCO World Heritage Sites, UNESCO Global Geoparks, (SSSIs) and Geological Conservation Review (GCR) sites where citations indicate features of international importance). Geology meeting international designation criteria which is not designated as such.</p> <p>Soils:</p> <ol style="list-style-type: none"> 1) Soils directly supporting a site within the National Site Network (e.g. Special Area of Conservation (SAC), Special Protected Area (SPA)), or a Ramsar. 2) ALC grade 1 & 2. <p>Contamination:</p> <ol style="list-style-type: none"> 1) Human health: very high sensitivity land use such as residential or allotments. 2) Surface water: Watercourse having a Water Framework Directive (WFD) classification shown in a RBMP and Q95 $\geq 1.0\text{m}^3/\text{s}$. Site protected/designated under EC or UK legislation (SAC, SPA, SSSI, Ramsar site, salmonid water)/species protected by EC legislation LA 108 (from Table 3.70 in Road drainage and water environment LA 113²). 3) Groundwater: Principal aquifer providing a regionally important resource and/or supporting a site protected under EC and UK legislation LA 108 (from Table 3.70 in Road drainage and water environment LA 113). Groundwater locally supports Groundwater Dependent Terrestrial Ecosystems (GWDTE). Source Protection Zone 1 (SPZ1).

Receptor value (sensitivity)	Criteria	Description
High	National scale: High importance and rarity, limited potential for substitution	<p>Geology: Rare and of national importance with little potential for replacement (e.g. geological SSSI, Area of Special Scientific Interest (ASSI), National Nature Reserves (NNR)). Geology meeting national designation citation criteria which is not designated as such.</p> <p>Soils: 1) Soils directly supporting a UK designated site (e.g. SSSI). 2) ALC grade 3a.</p> <p>Contamination: 1) Human health: high sensitivity land use such as public open space. 2) Surface water: Watercourse having a WFD classification shown in a RBMP and Q95 <1.0m³/s. Species protected under EC or UK legislation LA 108 (from Table 3.70 in Road drainage and water environment LA 113). 3) Groundwater: Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater supports a (GWDTE). Source Protection Zone 2 (SPZ2) (from Table 3.70 in Road drainage and water environment LA 113²).</p>
Medium	Regional scale: Medium quality and rarity	<p>Geology: Of regional importance with limited potential for replacement (e.g. RIGS). Geology meeting regional designation citation criteria which is not designated as such.</p> <p>Soils: 1) Soils supporting non-statutory designated sites (e.g. Local Nature Reserves (LNR), Local Geological Sites (LGSs), Sites of Nature Conservation Importance (SNCIs)). 2) ALC grade 3b.</p> <p>Contamination: 1) Human health: medium sensitivity land use such as commercial or industrial. 2) Surface water: Watercourses not having a WFD classification shown in a RBMP and Q95 >0.001m³/s (from Table 3.70 in Road drainage and water environment LA 113²). 3) Groundwater: Aquifer providing water for agricultural or industrial use with limited connection to surface</p>

Receptor value (sensitivity)	Criteria	Description
		water. SPZ3 (from Table 3.70 in Road drainage and water environment LA 113 ²).
Low	District scale: Low quality and rarity	<p>Geology: Of local importance/interest with potential for replacement (e.g. non designated geological exposures, former quarries/mining sites).</p> <p>Soils:</p> <ol style="list-style-type: none"> 1) Soils supporting non-designated notable or priority habitats. 2) ALC grade 4 & 5. <p>Contamination:</p> <ol style="list-style-type: none"> 1) Human health: low sensitivity land use such as highways and rail. 2) Surface water: Watercourses not having a WFD classification shown in a RBMP and $Q_{95} \leq 0.001 \text{ m}^3/\text{s}$ (from Table 3.70 in Road drainage and water environment LA 113). 3) Groundwater: Unproductive strata (from Table 3.70 in Road drainage and water environment LA 113²).
Negligible	Local scale: Very low importance and rarity	<p>Geology: No geological exposures, little or no local interest.</p> <p>Soils: Previously developed land formerly in 'hard uses' with little potential to return to agriculture.</p> <p>Contamination:</p> <ol style="list-style-type: none"> 1) Human health: undeveloped surplus land or no sensitive land use proposed. 2) Surface water: use sensitivity criteria in Road drainage and water environment LA 113. 3) Groundwater: use sensitivity criteria in Road drainage and water environment LA 113².

Source: Table 3.11 of LA109 Geology and Soils

Magnitude of impact

9.5.7 The magnitude of impact includes consideration of its timing, scale, size, and duration. The qualitative magnitude of each impact (in the absence of quantitative data) has been determined according to the descriptions provided in Table 9-2.

Table 9-2: Magnitude of impact and typical descriptions

Magnitude of impact (change)	Typical description	
Major	<p>Geology: Loss of geological feature, designation, quality or integrity, severe damage to key characteristics, features or elements.</p> <p>Soils: Physical removal or permanent sealing of >20 hectares of agricultural land.</p> <p>Contamination:</p> <p>Human health: Significant contamination identified. Contamination levels significantly exceed background levels and relevant screening criteria (eg category 4 screening levels) SP1010 with potential for significant harm to human health. Contamination heavily restricts future use of land.</p>	
	<p>Major Adverse</p> <p>Surface Water: Failure of acute-soluble and chronic-sediment related pollutants in Highways England Water Risk Assessment Table (HEWRAT) and compliance failure with Ecological Quality Standards (EQS) value. Calculated risk of pollution from a spillage $\geq 2\%$ annually (spillage assessment). 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> <p>Groundwater: Loss of, or extensive change to, an aquifer. Loss of regionally important water supply. Potential high risk of pollution to groundwater from routine runoff – risk score >250 (Groundwater quality and runoff assessment). Calculated risk of pollution from spillages >2% annually (spillage assessment). Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies. Reduction in water body WFD classification. Loss of significant damage to major structures through subsidence or similar effects.</p>	<p>Major Beneficial</p> <p>Surface Water: Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification.</p> <p>Groundwater: Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer. Improvement in water body WFD classification.</p>

Magnitude of impact (change)	Typical description	
Moderate	<p>Geology: Partial loss of geological feature or designation, potentially adversely affecting the integrity; partial loss of or damage to key characteristics, features or elements.</p> <p>Soils: Physical removal or permanent sealing of 1 – 20 hectares of agricultural land; or</p> <p>Permanent loss or reduction of one or more soil function(s) and restriction to current or approved future use (eg through degradation, compaction, erosion of soil resource).</p> <p>Contamination:</p> <p>Human health: contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria (eg category 4 screening levels) SP1010. Significant contamination can be present. Control or remediation measures are required to reduce risks to human health and make land suitable for intended use.</p>	
	<p>Moderate Adverse</p> <p>Surface water: Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values. Calculated risk of pollution from spillages $\geq 1\%$ annually and $< 2\%$ annually. 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> <p>Groundwater: Partial loss or change to an aquifer. Degradation of regionally important public water supply or loss of significant commercial/industrial/agricultural supplies. Potential medium risk of pollution of groundwater from routine runoff – risk score 150 – 250. Calculated risk of pollution from spillages $\geq 1\%$ annually and $< 2\%$ annually. Partial loss of the integrity of GWDTE. Contribution to reduction in water body WFD classification. Damage to major structures through subsidence or similar effects or loss of minor structures.</p>	<p>Moderate Beneficial</p> <p>Surface water: HEWRAT assessment of both acute-soluble and chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage by 50% or more (when existing spillage risk $> 1\%$ annually). Contribution to improvement in water body WFD classification.</p> <p>Groundwater: Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is $> 1\%$ annually). Contribution to improvement in water body WFD classification. Improvement in water body catchment abstraction management Strategy (CAMS) (or equivalent) classification. Support to significant improvements in damaged GWDTE.</p>

Magnitude of impact (change)	Typical description	
Minor	<p>Geology: Minor measurable change in geological feature or designation attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.</p> <p>Soils: Temporary loss or reduction of one or more soil function(s) and restriction to current or approved future use (eg through degradation, compaction, erosion of soil resource).</p> <p>Contamination: Human health: contaminant concentrations are below relevant screening criteria (eg category 4 screening levels) SP1010. Significant contamination is unlikely with a low risk to human health. Best practice measures can be required to minimise risks to human health.</p>	
	<p>Minor Adverse Surface water: Failure of either acute-soluble or chronic-sediment related pollutants in HEWRAT. Calculated risk of pollution from spillages $\geq 0.5\%$ annually and $< 1\%$ annually. Minor effects on water supplies.</p> <p>Groundwater: Potential low risk of pollution to groundwater from routine runoff – risk score < 150. Calculated risk of pollution from spillages $\geq 0.5\%$ annually and $< 1\%$ annually. Minor effects on aquifer, GWDTEs, abstraction, and structures.</p>	<p>Minor Beneficial Surface water: HEWRAT assessment of either acute-soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is $< 1\%$ annually).</p> <p>Groundwater: Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage risk $< 1\%$ annually). Reduction of groundwater hazards to existing structures. Reductions in waterlogging and groundwater flooding.</p>
Negligible	<p>Geology: Very minor loss or detrimental alteration to one or more characteristics, features or elements of geological feature or designation. Overall integrity of resource not affected.</p> <p>Soils: No discernible loss or reduction (< 1 hectare) of soil function(s) that restrict current or approved future use.</p> <p>Contamination: Human health: contaminant concentrations substantially below levels outlined in relevant screening criteria (eg Category 4 Screening Levels) SP1010. No requirement for control measures to reduce risks to human health or to make land suitable for intended use.</p> <p>Surface water: No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants). Risk of pollution from spillages $< 0.5\%$.</p> <p>Groundwater: No measurable impact on aquifer and/or groundwater receptors and risk of pollution from spillages.</p>	

Magnitude of impact (change)	Typical description
No change	<p>Geology: No temporary or permanent loss/disturbance of characteristics features or elements.</p> <p>Soils: No loss/reduction of soil function(s) that restrict current or approved future use.</p> <p>Contamination: Human health: reported contaminant concentrations below background levels.</p> <p>Surface water: No loss or alteration of characteristics, features, or elements; no observable impact in either direction.</p> <p>Groundwater: No loss or alteration of characteristics, features, or elements; no observable impact in either direction.</p>

Source: Adapted from Table 3.12 of LA109 Geology and Soils and Road drainage and water environment LA 113

Assessment of significance of effect

9.5.8 In accordance with DMRB LA 109 Geology and Soils Section 3.14, deriving the significance of effect from the receptor value and the magnitude of impact has been undertaken in accordance with DMRB LA 104 'Environmental Assessment and Monitoring'. Subsequent to identifying an appropriate receptor sensitivity and magnitude of impact using Table 9-1 and Table 9-2, the likely significance category and overall significance of effects is identified, as shown in Table 9-3. The approach to assigning significance of effect relies on reasoned argument, the professional judgement of competent experts and using effective consultation to ensure the advice and views of relevant stakeholders are taken into account. Effects of moderate significance and above (adverse and beneficial) are considered 'significant'.

Table 9-3: Criteria for assessing significance of effect

Magnitude of impact						
Value / sensitivity		No Change	Negligible	Minor	Moderate	Major
	Very High	Neutral	Slight	Moderate / Large	Large / Very Large	Very Large
	High	Neutral	Slight	Moderate / Slight	Moderate / Large	Large / Very Large
	Medium	Neutral	Neutral / Slight	Slight	Moderate	Moderate / Large
	Low	Neutral	Neutral / Slight	Neutral / Slight	Slight	Slight / Moderate
	Negligible	Neutral	Neutral	Neutral / Slight	Neutral / Slight	Slight

Source: Adapted from DMRB LA 104 - Section Environmental assessment and monitoring Revision 1: Table 3.8.1

9.6 Assessment assumptions and limitations

General

- 9.6.1 The assessment has been based on the Scheme description and construction strategy presented in Chapter 2 (The Scheme) of the ES and has taken into account the lateral limits of deviation illustrated on the Works Plans [AS-005] and vertical limits of deviation secured under Article 10 of the draft DCO [REP4-003] in order to establish a realistic worst case assessment scenario.

Contaminated land

- 9.6.2 This Chapter is based on the current Scheme alignment (as described in Chapter 2 (The Scheme) of this ES), known ground conditions and knowledge of any potential contamination. The findings may be subject to change during Scheme development. Should any previously unidentified contamination or unforeseen ground conditions become evident the procedure set out in Requirement 8 of the draft DCO [REP4-003] will be followed ensuring that any remediation required will take place.

Soils

- 9.6.3 Soil surveys were initially undertaken on behalf of the Applicant in 2021 (included in Appendix 9.3 (Agricultural Land Classification Report) of the ES Appendices [REP3-016], with further surveys

undertaken in 2023 for areas that were not surveyed previously. Soil surveys were undertaken for all agricultural land within the Order Limits (with the exception of Farndon roundabout as described in the paragraph below) in line with relevant standards and guidance and are therefore considered to be robust.

- 9.6.4 Due to land access constraints and the absence of existing ALC survey information for soils located in the area south of Farndon roundabout, SSEW⁵⁴ soils data was used to determine suitable soil management guidance for the Outline Soil Management Plan (OSMP) (Appendix B.3 to the First Iteration Environmental Management Plan (EMP) [REP4-010]. SSEW maps represent the most reliable and highest resolution soils mapping available in order to provide the most robust information pertaining to soil characteristics in this area.

9.7 Study area

Contaminated land

- 9.7.1 DMRB LA 109¹ states that the study area shall be defined on a project-by-project basis based on the project boundary, the location of contamination with the potential to migrate on site, and sensitive off-site receptors that could be affected by the project.
- 9.7.2 The study area for contamination comprises the Order Limits and an additional buffer of 500 metres as shown in Figure 9.2 (Potential Source of Contamination) of the ES Figures [AS-048]. This area is considered appropriate for the consideration of historical and current potentially contaminative land uses and it aligns with established industry practice for defining land contamination areas for EIA. To summarise the wider study area is necessary with regards to the following:
- An easement zone across the route to accommodate for excavations, site haul roads and other construction features.
 - The presence of potential contamination sources outside the Order Limits which have the potential to migrate to the Order Limits (areas of landfill or historical potentially contaminative land use, for example) and any sensitive receptors which may feasibly be affected by the uncontrolled migration of contaminants outside the Order Limits. Methods of contaminant transport may include migration of soil/landfill leachates and ground gases. Therefore, 500 metres from the Scheme extent is considered to be appropriate to capture the likely extent of impact pathways.
 - BS 10175:2011+A2:2017, Investigation of Potentially Contaminated Sites Code of Practice³⁹ states “*the extent of research into the history*

³⁹ BS 10175:2011 Investigation of potentially contaminated sites - code of practice (+A2:2017).

of the site will depend upon a number of factors including the complexity of past potentially contaminative uses on and adjacent to the site, the vulnerability of the site geology and local water environment". The study area extends 500 metres from the Order Limits to encompass sources outside the Order Limits, and sensitive receptors outside the Order Limits, including underlying groundwaters and surrounding surface waters. This includes localised perched groundwaters and any aquifer units located below or down-gradient of the study area.

- 9.7.3 Groundwater and surface water assessments (excluding effects from contamination) will take into account a larger study area, to encompass the zone of influence on the Water Framework Directive (WFD, 2000/60/EC)⁹ groundwater bodies and groundwater Source Protection Zones. Further details on WFD groundwater bodies and Source Protection Zones are provided in Chapter 13 (Road Drainage and the Water Environment) of this ES and Appendix 13.1 (Water Framework Directive Compliance Assessment) of the ES Appendices [APP-176].

Geology and Soils

- 9.7.4 The study area for the assessment of geology and agricultural soils is the Order Limits since these receptors are only likely to be impacted on where the Scheme directly crosses, or interfaces with them.
- 9.7.5 The soils specific study area can be found detailed in Appendix A of Appendix 9.3 (Agricultural Land Classification Report) of the ES Appendices [REP3-016].
- 9.7.6 The geological study area is shown in Figure 9.4 (Bedrock Geology) of the ES Figures [AS-048]. The assessment of significant effects on geology and soils generally only relates to areas anticipated to be directly disturbed by the works.

9.8 Baseline conditions

- 9.8.1 Throughout this section, reference is made to geology and soils features located in the vicinity of the Scheme. Please see Figures 9.1 to 9.6 of the ES Figures [AS-047 – AS-052] and Appendix 9.3 (Agricultural Land Classification Report) of the ES Appendices [REP3-016], which visually display the location of the features discussed in this section in relation to the Scheme and current baseline mapping including geological and hydrogeological mapping, ALC grades and contaminant sources.

Sources of information

9.8.2 Sources of information used in this Chapter include previous reporting that has been prepared as the Scheme has been developed, historical and geological mapping and online data sources. Key sources of information are detailed below.

Envirocheck report

9.8.3 A landmark Envirocheck Report⁴⁰ was requested for the Scheme area in July 2018. The following information was obtained:

- PDF Historical Mapping Report
- Geo insight report, including: Geological, mining, extraction and natural cavities; ground workings; soil chemistry and radon potential data
- Enviro Insights report, including details of local mining activities, landfill, hydrology and hydrogeology; historical industrial sites; flood and environmental permit data

Highways Agency Geotechnical Data Management System Documents

9.8.4 Reports available on the Highways Agency Geotechnical Data Management System (HAGDMS)⁴¹ website have been reviewed. Table 9-4 summarises the existing available information on the Scheme.

Table 9-4: Summary of existing information on the Scheme sourced from HAGDMAS

Scheme Title	Report Type	Date	Author	HAGDMS Ref
A46 Newark Relief Road Report on Site Investigation	Factual GI Report	1978	Exploration Associates	10095
A46 Newark Relief Road Report on Supplementary Site Investigation	Factual GI Report	1985	Exploration Associates	10090
A46 Newark Relief Road	Geotechnical Report	1985	Travers Morgan & Partners	10102
A46 Newark Relief Road	Geotechnical Feedback Report	1991	Travers Morgan One Ltd	10107

⁴⁰ Envirocheck Report: A46, Newark, NG24 2PG", Order Number 172582399_1_1, Landmark, 09 July 2018.

⁴¹ Highways England, Mott MacDonald HAGDMS Geotechnical Data Management System v5.12.0. [online], available at GDMS (assetia.cloud), last accessed (December 2023) [log in details required].

Scheme Title	Report Type	Date	Author	HAGDMS Ref
A46/A1 Eastern Friendly Farmer Roundabout Improvements	Ground Investigation Report (Only AGS Data available)	2018	Kier	30265
A46 Cattlemarket Roundabout Improvements	PSSR, Ground Investigation Report & GDR	2018	Kier	30231
A46 Western Junction Brownhills Roundabout	PSSR, GIR (Only AGS Data available)	2018	Kier	30204
A46 Newark Northern Bypass	Geotechnical Statement of Intent	2018	Atkins	30221
A46 Newark Northern Bypass	Geotechnical and PSSR	2021	Atkins	32224
A46 Newark Northern Bypass	GISR	2021	Atkins	32225
A46 Newark Northern Bypass	GISR & Specification for supplementary GI	2022	Mott MacDonald	35248
A46 North Newark Bypass	Factual GI Report	2022	Tetra Tech	45128
Factual Ground Investigation Report A46 Newark Bypass	Factual GI Report	2023	Strata Geotechnics	45129

Online sources and previous reports

9.8.5 The following additional sources have been used to establish the baseline:

- British Geological Survey (BGS) Geology of Britain Viewer⁴²
- The Coal Authority website⁴³
- Department for Environment, Food & Rural Affairs' (Defra) MAGIC (Multi-agency geographic information for the countryside) website⁴⁴
- Natural England Designated Sites View⁴⁵
- Nottinghamshire Insight Mapping⁴⁶
- Old Maps Online⁴⁷

⁴² British Geological Survey Map available at: [Geology of Britain viewer | British Geological Survey \(BGS\)](#) (last accessed December 2023).

⁴³ Coal Authority Interactive Map available at: [Interactive Map Viewer | Coal Authority \(bgs.ac.uk\)](#) (last accessed December 2023).

⁴⁴ Defra, Magic (2021). Interactive Map [online] available at: [MAGIC \(defra.gov.uk\)](#) (last accessed December 2023).

⁴⁵ Natural England Designated Sites View available at: [Site Search \(naturalengland.org.uk\)](#) (last accessed December 2023).

⁴⁶ Nottinghamshire Insight Mapping available at: [Nottingham City Council - Insight Mapping GIS Mapping](#) (last accessed December 2023).

⁴⁷ Old Maps online available at: [Old Maps Online](#) (last accessed December 2023).

- Natural England Agricultural Land Classification Map East Midlands Region⁴⁸
- Existing A46 construction progress photos issued from National Highways⁴⁹
- Newark & Sherwood District Council website – Contaminated Land⁵⁰
- Zetica UXO (unexploded ordnance) website (2023) risk mapping⁵¹
- Atkins (2021) Appendix 9.1 (A46 Newark Northern Bypass Preliminary Sources Study Report) of the ES Appendices [APP-161 to APP-163]
- British Glues & Chemicals, History of Quibells Brothers Ltd⁵²
- 'MAGIC Map Application'⁵³
- National Soil Association mapping⁵⁴

Geological setting

- 9.8.6 British Geological Survey (BGS) Sheet 113 Ollerton and 126 Nottingham⁵⁵, together with the associated memoirs (Edwards, W 1967⁵⁶ and Howard, A 2010⁵⁷) provide geological details of the Scheme and study area.

Regionally Important Geological Sites

- 9.8.7 There are no designated or non-designated geological sites/features of interest within 500 metres of the Scheme. No Regionally Important Geological Sites (RIGS) are located within 500 metres of the Scheme⁵⁸.

Topography

- 9.8.8 The area is part of the River Trent floodplain and is low lying and flat. The southern part of the Scheme runs through the River Trent alluvial

⁴⁸ Agricultural Land Classification Map East Midlands Region (ALC005) available at: <http://publications.naturalengland.org.uk/publication/143027?category=5954148537204736> (last accessed December 2023).

⁴⁹ National Highways, As Built Information - A46 Historic Photos and Information (Date not provided but assumed to be 1988 -1991 based on initial construction of existing A46) (last accessed December 2023).

⁵⁰ Newark & Sherwood District Council website available at: <https://www.newark-sherwooddc.gov.uk/landpollution/> (last accessed December 2023).

⁵¹ Zetica UXO Risk Maps available at: [Risk Maps | Zetica UXO](#) (last accessed December 2023).

⁵² British Glues & Chemicals, Quibell Brothers Ltd Available at: https://www.themeister.co.uk/hindley/british_glues_chemicals.htm (last accessed December 2023).

⁵³ Department for Environment, Food and Rural Affairs (Defra) Magic Map Application (2023). Available at: <https://magic.defra.gov.uk/MagicMap.aspx> (last accessed December 2023).

⁵⁴ Hodge, C.A.H. (1984). Soils and their use in Eastern England (Bulletin / Soil Survey of England and Wales).

⁵⁵ BGS (1966), Geological Survey of England and Wales, Ollerton Solid and Drift, Sheet 113, 1:63,360 scale,

⁵⁶ Edwards W. N. (1967). Geology of the Country around Ollerton (Explanation of one-inch Geological Sheet 113, New Series). Geological Survey of Great Britain, Memoir. 2nd edition.

⁵⁷ Howard A (2010). Geology of the Nottingham district, BGS Memoir for sheet E126.

⁵⁸ Nottinghamshire Insight Mapping Available at: [Nottingham City Council - Insight Mapping GIS Mapping](#) (last accessed December 2023).

floodplain where natural ground levels are typically 9 to 10 metres Above Ordnance Datum (AOD) and embankments of the existing A46 rise up to a maximum 13 metres in height with 1V:2.5H slopes. To the east of the Brownhills Junction the land rises out of the floodplain and reaches a maximum 18 metres AOD near the eastern end of the Scheme at Winthorpe Junction. The Kelham and Averham Floodplain Compensation Area (FCA) is also relatively flat, with elevations typically ranging from 10 metre AOD to 13 metre AOD across the Scheme. The topography of the Scheme is shown in Figure 9.1 (Topography) of the ES Figures [AS-047].

Artificial Ground

- 9.8.9 Made Ground is a term used to describe any anthropogenic deposits or fill material. Made Ground can be a potential source of contamination. Made Ground is not mapped within the Order Limits. However, it is mapped within the study area by BGS⁴² located approximately 310 metres to the south-east of the alignment at Newark Castle centred at 479656, 354305, as shown in Figure 9.2 (Potential Sources of Contamination) of the ES Figures [AS-048]. The BGS mapped Made Ground located outside the Order Limits is beyond the likely extent of impact pathways and is therefore not considered as a plausible source of contamination for the Scheme.
- 9.8.10 Infilled land has been mapped⁴² approximately 500 metres west of Farndon Roundabout, centred at 477181, 352524 as shown in Figure 9.2 (Potential Sources of Contamination) of the ES Figures [AS-048].
- 9.8.11 Recorded landfill data is discussed in Section 9.8.40 and 9.8.42 of this Chapter.

Ground stability

- 9.8.12 Risks associated with geotechnical hazards and land stability are assessed in accordance with (DMRB) LA 109 Geology and soils¹ and CD 622 Managing geotechnical risk⁵⁹.
- 9.8.13 The potential ground stability hazards for the Scheme are described in Section 3.23 and assessed in Section 6 Preliminary Engineering Assessment of Appendix 9.1 (A46 Newark Northern Bypass Preliminary Sources Study Report) of the ES Appendices [APP-161 to APP-163].
- 9.8.14 Subsequent to intrusive GI, the Ground Investigation Report contained in Appendix 9.2 (Contaminated Land Risk Assessment) of the ES Appendices [APP-164 to APP-169], includes a revised assessment for ground stability risks.

⁵⁹ CD622 Managing geotechnical risk (formerly HD 22/08, BD 10/97, HA 120/08) Revision 1, Available at: [CD 622 - Managing geotechnical risk - DMRB \(standardsforhighways.co.uk\)](https://standardsforhighways.co.uk/cd622-managing-geotechnical-risk-dmrbs/), (last accessed December 2023).

Superficial deposits

- 9.8.15 The superficial deposits include Alluvium, the Holme Pierrepont Sand and Gravel Member (HPSG) and Balderton Sand and Gravel Member (BDTN) of the River Terrace Deposits⁴² distributed across the study area as shown in Figure 9.3 (Superficial Deposits) of the ES Figures [AS-049].
- 9.8.16 Alluvium is a general term for the unconsolidated detrital material deposited by a river or stream. Normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present. According to the 1985 Geotechnical Report, the Alluvium present within the Order Limits is highly variable with the potential for deep alluvial channels running through the Scheme.
- 9.8.17 HPSG often lies beneath the Alluvium, where present. The HPSG predominantly comprises sands and gravels, detrital in nature, ranging from coarse to fine grained and form beds and lenses of deposits reflecting the channels, floodplains and levees of a river or estuary. Generally pinkish, poorly sorted and compositionally rather immature matrix—supported, sandy, trough—cross bedded (braided river) gravels with syn-depositional ice-wedge casts.
- 9.8.18 BDTN like the HPSG, they are predominantly cold-phase sands and gravels. Orange-brown sandy gravel dominated by rounded pebbles of “Bunter” quartz/quartzite (0.75%) with subordinate subangular flint (c.15%), and rarer Triassic sandstone.

Bedrock geology

- 9.8.19 The bedrock geology within the study area includes the Mercia Mudstone Group (MMG), Gunthorpe Member Mudstone (GUN) and Edwalton Member Mudstone (EDW)⁴² as shown in Figure 9.4 (Bedrock Geology) of the ES Figures [AS-050].
- 9.8.20 MMG is described in the BGS Lexicon as “*Dominantly red, less commonly green-grey, mudstones and subordinate siltstones with thick halite-bearing units in some basinal areas. Thin beds of gypsum/anhydrite widespread; sandstones are also present*”.
- 9.8.21 GUN is described in the BGS Lexicon as “*Mudstone, red-brown, with subordinate dolomitic siltstone and fine-grained sandstone, greenish grey, common gypsum veins and nodule*”.
- 9.8.22 EDW is described in the BGS Lexicon as “*Mudstone and siltstone, red-brown and greenish grey, with beds of indurated, variably dolomitic siltstone and very fine-grained sandstone common in the lower half; finely disseminated gypsum common in upper half*”.

BGS archive borehole data

- 9.8.23 The BGS database⁴² of historical borehole scans shows the location of numerous exploratory holes for the Ground Investigation Reports

which have been retrieved from HAGDMS. There are no additional BGS borehole scans that provide information for the main line works, however there are six trial pits at Home Farm, near to Kelham and Averham Flood Compensation Area, that indicate topsoil being underlain by Sand and Gravel. Two further historical boreholes indicate the depth of sand and gravel to vary between 6.8 metres and 7.8 metres, with Mercia Mudstone present beneath.

Hydrogeology

- 9.8.24 The HAGDMS website⁶⁰ indicates that the Superficial Deposits are designated as Secondary A Aquifers, as indicated in Figure 9.5 (Superficial Deposits Aquifer Designation) of the ES Figures [AS-051]. The Environment Agency⁶¹ provides designation for Secondary A Aquifer: 'Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'.
- 9.8.25 Bedrock formations are designated as Secondary B Aquifers, as indicated in Figure 9.6 (Bedrock Geology Aquifer Designation) of the ES Figures [AS-052]. The Environment Agency⁶¹ provides designation for Secondary B Aquifer: 'Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers'.
- 9.8.26 The Environment Agency has provided information on groundwater sources⁶² within the study area. There are three recorded groundwater abstractions for spray irrigation within the study area. These are associated within a single farm, and are located approximately 120 metres to 220 metres outside the Order Limits, to the extreme north of the Scheme.
- 9.8.27 The Scheme is not located within an Environment Agency⁶¹ designated groundwater source protection zone (SPZ), Drinking Water Protected Area or Drinking Water Safeguard Zone for groundwater (or surface water). The Scheme is located within a WFD drinking water protected area which is designated as "probably not at risk". The study area is therefore considered to be situated in a low risk area regarding contamination impacts on groundwater drinking water supplies.

⁶⁰ National Highways "Highways England Geotechnical Data Management System v.5.12.0". [Online]. Available: <https://www.hagdms.co.uk/> (last accessed December 2023).

⁶¹ Defra, Magic (2021). Interactive Map [online] Available: [MAGIC \(defra.gov.uk\)](https://magic.defra.gov.uk/) (last accessed December 2023).

⁶² In response to Request for information EMD-294943 submitted November 2023.

Hydrology

- 9.8.28 The surface water baseline is described in detail in Chapter 13 (Road Drainage and the Water Environment) of this ES and the surface water receptors are shown on Figure 13.1 (Surface Water Constraints) of the ES Figures [AS-073].
- 9.8.29 To summarise, the River Trent flows through the centre of the study area flowing in a northerly direction. The A46 crosses the River Trent twice, near Crankley Point and Farndon Junction. The A46 also crosses the Old Trent Dyke twice, near Newark Cricket Ground and west of Hiram's Paddocks and crosses the Slough Dyke (the Fleet) once, west of Brownhills Roundabout.
- 9.8.30 There are several lakes/ponds identified within the study area which are associated with various land use. Including: the British Sugar Factory, Staythorpe Power Station, Smeatons Lake Camping Site, Nottingham Piscatorial Society, Farndon Local Nature Reserve and assumed attenuation ponds based on historical aerial imagery.
- 9.8.31 There are also three marinas, field drains, and smaller unnamed watercourses within the study area.

Previous Ground Investigations

- 9.8.32 From the HAGDMS website⁴¹, the following historical ground investigations have been reviewed:
- A46 Newark Relief Road 1978
 - A46 Newark Relief Road 1985
 - A46 Cattlemarket Roundabout Improvements 2018
 - A46/A1 Eastern Friendly Farmer Roundabout Improvements 2018
 - A46 Western Junction Brownhills Roundabout 2018
 - A46 Newark Bypass 2021 – 2022
- 9.8.33 A Scheme specific ground investigation, referred to as the Main Alignment GI was completed in July 2021. A copy of the Main Alignment GI exploratory hole location plan and schedule of investigative locations has been included within Appendix 9.2 (Contaminated Land Risk Assessment) of the ES Appendices [APP-164 to APP-169].
- 9.8.34 A Supplementary GI was completed between October 2022 and May 2023 for the Scheme. The Supplementary GI was undertaken to obtain information on the underlying ground conditions at the additional areas included in the final Order Limits specifically, Kelham and Averham FCA, Farndon Borrow Pits West FCA, Farndon Borrow Pits East FCA and Brownhills Borrow Pit. The Supplementary GI was also designed to delineate contamination identified during the 2021 Main Alignment GI at exploratory hole WS46 at Nether Lock. The location of the supplementary exploratory holes are shown within Appendix 9.2 (Contaminated Land Risk Assessment) of the ES Appendices [APP-164 to APP-169].

Ground model

9.8.35 An overview of the encountered geology from previous GIs is detailed below in Table 9-5.

Table 9-5: Summary of encountered geology

Stratum	Description	Depth to Top (mbgl)	Typical Thickness (m)
Topsoil	Present on the surface of the existing A46 embankment slopes, across the natural landscape at the toe of embankments and present within the proposed flood compensation areas, consisting of brown to dark brown gravelly clayey sand. Exploratory holes through natural ground.	0.00	0.10 – 0.60
Made Ground / Fill	Mostly consisting of existing A46 embankment make up including granular starter layers, Class 6B fill for scour resistance, Class 1A embankment fill, Class 2B seepage cut off and Class 2E PFA fill.	0.00 – 15.40	4.00 – 6.00
Cohesive Alluvium	Encountered throughout the River Trent Flood Plain Ch.0000-4500 and generally has a firm crust where desiccation has caused consolidation for up to 1m depth with very soft and soft clay and silt below.	0.10 – 6.00	2.00 – 2.20
Granular Alluvium and Terrace Gravels	Encountered throughout the Order Limits consisting of sand and gravel with gravel being generally sub angular to sub rounded.	0.20 – 6.20	3.30 – 8.50
Mercia Mudstone	Underlying the superficial deposits recorded as stiff clay weathered mudstone overlying very weak to moderately strong mudstone.	1.10 – 17.00	Base not proven

Groundwater

9.8.36 The GIs associated with the original development of the A46 single carriageway noted the level of the upper water table is directly related to the level of water in the River Trent.

9.8.37 Further monitoring of groundwater levels undertaken as part of the Main Alignment GI identified that groundwater is present principally in the Alluvium and Mercia Mudstone. Groundwater levels across the Scheme alignment ranged between 0.33 metres below ground level and 4.13 metres below ground level. It is understood that the design groundwater level is the same as the modelled Flood Level i.e. up to +12.95mOD in the south.

Ground quality (contaminated land)

9.8.38 Newark & Sherwood District Council has not designated any land as contaminated under the definition in Part 2A of the Environmental

Protection Act 1990 and as such does not have any entries on the Contaminated Land Register.

Land use and historical development

- 9.8.39 Using historical Ordnance Survey plans provided in the Envirocheck Report⁴⁰ and available online sources, a summary of the historical development of the Order Limits and surrounding study area is provided in Table 9-6.

Table 9-6: Summary of historical developments and potential sources of contamination

Map dates	Within Order Limits	Within study area
1884 (1:10,560) 1886 (1:2500)	<p>The River Trent is shown crossing the alignment in southern extent and central sections flowing west to east.</p> <p>Malthouse is mapped within the south-west section of the alignment.</p> <p>Old Trent Dyke (spring) is shown crossing the western extent of the alignment flowing away from the river east to west.</p> <p>The Midland Railway: Nottingham to Lincoln line is shown crossing the western extent of the alignment.</p> <p>Great North Road is shown crossing the alignment in central section.</p> <p>Great Northern Railway (currently known as East Coast Mainline) is shown crossing the alignment in the central section.</p> <p>Chemical Manure Works mapped within the central section of the Scheme at Castle Gate in 1884 (1:10,560).</p> <p>Chemical Manure Works expansion, a new factory is labelled off the Winthorpe Road in 1886 (1:2500), understood to be operated by Quibell Brothers Ltd and known locally as 'Quibell's factory' (British Glues & Chemicals²⁷).</p>	<p>Flour mill is marked approximately 50 metres south-east.</p> <p>Windmill (Flour) is mapped approximately 50 metres south-west.</p> <p>Unnamed Road is mapped approximately 100 metres south.</p> <p>Railway crossing mapped 10 metres west.</p> <p>Brewery is mapped 250 metres south-west.</p> <p>Wellington foundry is mapped 250 metres south-west.</p> <p>Malthouses is mapped 200 metre south-west. Windmill (flour) is mapped 100 metres north. Old bleaching house is mapped approximately 100 metres south.</p> <p>Windmill (corn) is mapped approximately 350 metres south-west.</p> <p>Flour mill is marked approximately 300 metres south-east.</p>
1900 (1:2,500) 1900-1901 (1:10,560)	<p>A football ground has been constructed in the central section of the Scheme.</p>	<p>Flour mill is no longer labelled. Windmill (Flour) is now labelled as Windmill (Disused).</p> <p>Two Nurseries are shown present at 200 metres and 250 metres south-west. Goods shed is shown present 250 metres south-west.</p> <p>Tow Path for the River Trent is shown present running from south to north crossing the central section of the alignment.</p>

Map dates	Within Order Limits	Within study area
		<p>Brewery is no longer named. Windmill (Flour) is now named as Mill Cottage.</p> <p>Kings Sconce is now shown present 200 metres south of the central section of the alignment.</p> <p>Windmill (corn) is now labelled as Windmill (Disused).</p> <p>Flour mill is now labelled as corn mill.</p>
<p>1919 – 1920 (1:2,500)</p> <p>1921 (1:10,560)</p>	No substantial changes.	<p>Wicker Works is now shown present 180 metres south-east.</p> <p>Four earthworks are now shown present 250 metres east, 200 metres west, 200 metres west & 200 metres north-west.</p> <p>Boiler works is shown present 200 metres south-west.</p> <p>Nursery is shown present 50 metres south.</p>
1938 (1:10,560)	No substantial changes.	Way (Roman Road) located approximately 50 metres east.
<p>1948 (1:10,560)</p> <p>Aerial Photograph</p>	No substantial changes.	<p>RAF Winthorpe operational adjacent to A17.</p> <p>No significant changes.</p>
<p>1956 (1:10,000)</p> <p>1955-1956 (1:10,560)</p>	Midland Railways is no longer labelled.	<p>Residential houses are now shown present 200 metres south.</p> <p>Sewage works is mapped present 80 metres north-west.</p> <p>Unnamed buildings are shown present 80 metres south.</p>
<p>1965 (1:1250)</p> <p>1966-1969 (1:10,000) 1969 – 1970 (1:1250)</p>	Chemical Manure Works mapped within the central section of the Scheme relabeled as 'Works'. The 'Works' is understood to be The British Glues and Chemicals Ltd Quibell Bros Glue Factory (Croid Glues) (British Glues & Chemicals ²⁷).	<p>RAF Winthorpe closed adjacent to A17.</p> <p>Unnamed Road is now shown present. Roundabout 100 metres south.</p> <p>Sugar works mapped approximately 250 metres west.</p>

Map dates	Within Order Limits	Within study area
	Football ground is mapped towards central section of the alignment.	
1969-1981 (1:2500) 1972-1984 (1:10,000) 1973-1984 (1:1250) 1971-1973 (1:10000)	Drains are now labelled, immediately east of the alignment and 50 metres south-west of Great Northern Road Roundabout.	Newark Air Museum (Former RAF Winthorpe) opened to the public in 1973, adjacent to A17. Wicker Works is now labelled as Works. Nursery in south-west is no longer labelled. Earthwork is now labelled as Civil war earthworks. Sewage pumping station mapped approximately 450 metres south. Drains are mapped 50 metres south-east and 50 metres south-west. Football ground is mapped 50 metres north-west. Chemical manure works now named as Works. School is mapped 250 metres south. Filter bed tanks for sewage works are now present. Kings Sconce is now named as 'Works'. Caravan site approximately 500 metres south-east. Sugar works renamed 'British Sugar Factor'.
1985-1996 (1:2500) 1990-1996 (1:1250) 1992 (1:10,000)	A46 Newark Relief Road is now shown present within the Scheme. Drain is no longer labelled. Bridge is built over River Trent. Football ground no longer labelled. Overpass bridge mapped within Scheme. Track is crossing the alignment. Viaduct is now shown present.	Roundabout is mapped 10 metres south. Civil War earthwork is now labelled as Sandbills Sconce. Football ground to north-west no longer labelled. Cattle Market now, east of Great North Road Roundabout. Road construction within alignment up to existing roundabout 100 metres south. Newark curve now named as dismantled railway.

Map dates	Within Order Limits	Within study area
	Chemical Manure Works (relabelled as Works) 'Quibells factory' closed and the factory buildings to the west of the current A46 alignment demolished in 1976.	A scrap yard is mapped 250 metres north. Earthworks adjacent to Newark crossing now labelled 'Civil War Earthwork Redoubt'.
1999 (1:2500) (Aerial photograph) 2000 (1:10,000)	ADR Automotive labelled in previous location of Chemical Manure Works/Works, adjacent to the east alignment of the A46. DX Freight Newark shown in the central section.	Residential houses mapped 50 metres east. Lorry Park is mapped 10 metres east. Electric substations are mapped 50 metres south-west and 50 metres north-west. Earthwork is shown present 200 metres west. Bus Depot is shown present 250 metres south-west. Sugar works now named 'British Sugar Factory' and is mapped approximately 250 metres west.
2000 (1:10,000) 2006 (1:10,000) 2007 (Aerial photograph Google Earth)	Rectory Farm Civil Airfield grassed airstrip showing in 2007 aerial imagery, located in the north of the Scheme.	Kings Marina is present 180 metres south-west. Residential area present 20 metres south.
2018 (1:10,000)	No substantial changes.	No substantial changes.

Landfill records

- 9.8.40 There are two recorded⁶³ active landfills within 500 metres of the Scheme. They are dedicated for factory curtilage waste and are operated by British Sugar Plc, located to the north-west of the Scheme beyond the Nottingham to Lincoln railway line at approximately 100 metres at its closest point. Impacts on groundwater quality from authorised landfills are considered to be managed by the environmental permit in force for the landfill site.
- 9.8.41 There is a small area (approximately 0.15 hectares (ha)) noted as a historical landfill, located approximately 215 metres east of the Great North Road. At its closest point, the landfill is located 400 metres from the Scheme. The landfill, named as Muskham Road, is recorded as having accepted inert and industrial waste and was operated by the British Sugar Corporation, with waste first input recorded from 1947. Given the small scale and that the identified historical landfill is greater than 400 metres from the Scheme, the landfill is therefore considered to be beyond the likely extent of impact pathways (including from major accidents and disasters).
- 9.8.42 The Environment Agency records a historical landfill to the north of the Kelham flood compensation area. Namely the Newark Quarry Historical landfill (licence holder Hoveringham Gravels Midlands Limited), which is reported to have received inert, industrial, special waste and liquid sludge between 1976 and 1989. It is located approximately 1.3 kilometres from the main Scheme alignment. An area of land adjacent to this historic landfill was previously assessed for flood compensation suitability. This area has since been discounted and is not included in the Order Limits.
- 9.8.43 The locations of the recorded landfills are shown on Figure 2.2 (Environmental Constraints Plan) of the ES Figures [REP2-009].

Pollution incidents

- 9.8.44 The Envirocheck Report indicated there are four significant substantiated pollution incidents recorded within 500 metres of the Scheme, outlined as follows:
- 117 metres north of A46 near Robert Dukeson Avenue – September 2009 Category 2 – ‘Significant incident’ land pollution from soot
 - 165 metres south-west of A46 near Fleming Play Area – October 2012 – Category 2 ‘Significant incident’ land pollution from tyres
 - 249 metres east of A1/A46 Junction – August 2005 – Category 2 ‘Significant incident’ for water pollution and Category 3 ‘Minor incident’ for land pollution from suspended solids

⁶³ Landmark Information Group, Envirocheck Report (order no:172582399_1_1 dated 9/07/2018, Atkins received June 2018).

- 290 metres west of the A46 near Old Trent Dyke – October 2014 Category 2 ‘Significant incident’ for land pollution caused from smoke and commercial waste
- 9.8.45 There are a further 28 recorded pollution incidents to controlled waters recorded within 500 metres of the southern and central areas of the Scheme, all of which were designated Category 3 – Minor Incidents caused by pollutants including oils, organic wastes, sewage, and chemicals to surface watercourses within the River Trent catchment area.

Unexploded ordnance

- 9.8.46 Zetica has produced freely available risk maps⁶⁴ indicating the potential risk of air dropped World War Two unexploded ordnance (UXO) to be present on the Scheme. The mapping classifies the ground directly underlying the Scheme and the wider surrounding area as ‘Low Risk’ with less than 15 surveyed bomb strikes per 1,000 acres. Therefore, no further assessment was deemed necessary at this stage. It should be noted that the risk map is not a risk assessment and does not consider other sources of UXO such as enemy or allied ground ordnance.

Radon

- 9.8.47 The majority of the Scheme is situated in an area of low radon potential. However, the northern extent of the Scheme in the Winthorpe area is situated in an area of high radon, the maximum radon potential recorded is between 5 – 10 %.⁶⁵

Contaminated sources from historical mining

- 9.8.48 Old mines have the potential to be a source of ground gas.
- 9.8.49 The Coal Authority Interactive Map⁶⁶ indicates the study area is not located within a Coal Mining Reporting Area. No coal mining features, or licence areas are recorded in the vicinity of the site.
- 9.8.50 It must be noted, however, that non-coal mining activity was present located on the north-western side of the Nottingham Lincoln railway line, and therefore not directly adjacent to the Scheme.
- 9.8.51 The 1985 Geotechnical Report⁶⁷ states that the A46 route crosses borrow pits used for construction of the nearby Great North Road.

⁶⁴ Zetica, “UXO risk maps”. [Online]. Available: <https://zeticauxo.com/downloads-and-resources/risk-maps/> (last accessed December 2023).

⁶⁵ UK Radon, Available at: [UKradon - UK maps of radon](#), (last Accessed December 2023).

⁶⁶ Coal Authority Interactive Map available at: [Interactive Map Viewer | Coal Authority \(bgs.ac.uk\)](#) (last accessed December 2023).

⁶⁷ Geotechnical Report on A46 Newark Relief Road, Department of Transport East Midland Regional Office, 1985.

This is identified at the location of Kelham roundabout. There are also borrow pits associated with construction of the existing A46, which have potentially been backfilled with locally sourced Alluvium and other inert waste soils. These locations are outside the Order Limits.

Previous Ground Investigations

- 9.8.52 Appendix 9.2 (Contaminated Land Risk Assessment) of the ES Appendices [APP-164 to APP-169] should be referred to for full details of the geo-environmental analysis. For the purpose of the assessment the pertinent points have been summarised and included below.

Scheme Order Limits (excluding hotspot)

- 9.8.53 Investigations completed to date have recorded limited visual or olfactory evidence of soil contamination across the majority of the Order Limits, which testing has also confirmed.
- 9.8.54 Leachate extract from soil, groundwater and surface water testing recorded generally low-level exceedances of several determinants including metals, PAH compounds and inorganics. These exceedances were generally consistent and represent background conditions of the Scheme and do not pose an unacceptable risk to controlled waters.
- 9.8.55 Ground gas monitoring was undertaken along the alignment on six occasions between 11 August 2021 and 15 February 2022. It should be noted that the Scheme does not include above ground structures with confined spaces and the purpose of ground gas monitoring was as a preliminary assessment to consider the risks to construction and maintenance workers. Therefore, concentrations have been compared against the HSE Workplace Exposure Limits (WELs)⁶⁸. Elevated carbon dioxide concentrations (over 0.5%vol) for the long-term WEL were encountered across the Scheme during the monitoring programme. In addition, there were also exceedances of the short-term WEL (5%vol). Given that the elevated recordings are consistent across the Scheme, the source of the ground gas is considered to be natural from the underlying Alluvium and Mercia Mudstone.

Hotspot

- 9.8.56 A localised area of soil contamination was identified in the centre of the Scheme near Nether Lock during the Main Alignment GI.
- 9.8.57 Visual and olfactory evidence of contamination was recorded at exploratory hole location of WS46, shown in Figure 9.2 (Potential Sources of Contamination) of the ES Figures [AS-048] and in Appendix 9.2 (Contaminated Land Risk Assessment) of the ES

⁶⁸ Health and Safety Executive, (2011). EH40/2005 Workplace Exposure Limits. Health and Safety Executive: London

Appendices [APP-164 to APP-169]. The contamination was identified at the base of the Made Ground layer in the Alluvium between 2.5 and 3.65 metres below ground level, the ground was described as cream slightly sandy clayey sand, where a 'chemical odour' was observed. Subsequent laboratory soil testing data from the location of WS46 at 2.3 metres below ground level identified contaminant levels above soil generic screening criteria (GSC) guideline levels, including elevated concentrations of arsenic, aromatic hydrocarbons and naphthalene.

- 9.8.58 The Supplementary GI, which included delineation of the contamination hotspot, identified further visual and olfactory contamination at an exploratory hole (S3BH05) located adjacent to the north of WS46 shown in Figure 9.2 (Potential Sources of Contamination) of the ES Figures [AS-048]. The presence of a soft white paste/chalky textured material, similar to that noted at WS46, was present at the location of S3BH05, where a strong chemical odour was recorded between 1.20 – 2.80 metres below ground level. Furthermore, chemical testing identified a total of 4 exceedances against the commercial screening criteria at S3BH05 only within the Made Ground for dibenz-a-h-anthracene, benzo(b)fluoranthene and benzo(a)pyrene at 1.65m and arsenic at 2.9m. Consequently, the results of the Supplementary GI indicated that the contamination is situated at a depth which presents a low risk to human health and not present in the shallow soils.
- 9.8.59 Available historical mapping and aerial imagery for the Scheme do not identify any buildings/structures or sources of contamination directly at the location of WS46. The potential source of the contamination identified at the location of WS46 is likely the adjacent historical Quibell Brothers chemical manure factory. This factory is reported⁶⁹ ⁷⁰ to have produced a number of products from the late 1890s to early 1900s including; chemical manure (production process used hydrocarbons to extract grease from bones), sheep dip powder and liquid sheep dip (both made through arsenical preparation), a carbolic dip in the form of a solid paste containing carbolic acid, and also a disinfectant called 'kerol'. During the enabling and construction earthworks of the existing A46, it is possible that a small volume of site won material from the demolition location of the chemical manure factory was deposited at the location of WS46.
- 9.8.60 The cream slightly sandy clayey sand, chemical odour and laboratory test data recorded from WS46 appears to be consistent with the products described above. The location of the contamination hotspot and parts of the British Glues and Chemicals Ltd Quibell Bros Glue Factory (previously named "Chemical Manure Works" on other

⁶⁹ Quibells Brothers Ltd, Available at: [British Glues and Chemicals \(themeister.co.uk\)](https://themeister.co.uk/), (last accessed December 2023).

⁷⁰ Nottingham County Council, Inspire Archive: Croid's Glue Factory, Winthorpe Road, Newark on Trent, 1948 Available at: [Croid's Glue Factory, Winthorpe Road, Newark on Trent, 1948 | Inspire \(inspirepicturearchive.org.uk\)](https://inspirepicturearchive.org.uk/) (last accessed December 2023).

historical mapping) are shown to be demolished during construction of the existing A46 in Photo 9-1 below.

Photo 9-1: Contamination hotspot aerial photograph from construction of existing A46 road



Source: National Highways (photograph ID 2164) Viewed south-west, Date not provided, but is assumed to be 1988 - 1991 based on initial construction period of existing A46.

- 9.8.61 In addition, approximately 240 metres south of WS46, at the location of the former Quibell Brothers chemical manure factory, soil GSC commercial values were exceeded at exploratory hole location of BH11 (as shown on Figure 2 Site Investigation Layout Plan, Sheet 3 of 4, within the 2022 Tetra Tech GI factual report which forms Appendix D.1 of Appendix 9.2 (Contaminated Land Risk Assessment) of the ES Appendices [APP-164 to APP-169]. Laboratory soil test results identified exceedances of concentrations of polycyclic aromatic hydrocarbons (PAHs) at 0.1 metres below ground level in the Made Ground. No visual or olfactory evidence of contamination was recorded in the borehole log. PAHs are formed during the incomplete combustion of organic materials. The sample which recorded the minor exceedances is from shallow Made Ground. The location of BH11 is within an existing small compound area, currently occupied by vehicles and caravans. A review of BGS historical logs has revealed that two exploratory holes (BH234 and BH233) adjacent to BH11 encountered a concrete slab at a depth of up to 0.2 m bgl from ground level. Whilst, historical mapping indicates that the BH11 area was once occupied by Quibell Brothers chemical manure factory (previously demolished), the likely source of the PAHs is from recent land use.

Potential contamination sources

- 9.8.62 A Preliminary Conceptual Site Model (PCSM) has been prepared for the Scheme which considers the site conditions before any Scheme specific GI was undertaken. The PCSM identifies the potential or known sources of contamination, receptors and pathways between the two. Where all three are present or are considered likely to be present (source-pathway-receptor linkage), they are called a potential contaminant linkage (PCL). The PCSM is included in Appendix 9.1 (A46 Newark Northern Bypass Preliminary Sources Study Report) of the ES Appendices [APP-161 to APP-163]. Following completion of the supplementary GI a revised CSM has been produced and reported in Appendix 9.2 (Contaminated Land Risk Assessment) of the ES Appendices [APP-164 to APP-169].
- 9.8.63 Following the Scheme specific GI and review of newly available sources of information, Table 9-7 provides an updated list of the likely contamination sources within the study area.

Table 9-7: Revised sources of contamination within the study area

Potential sources of contamination	Description
Former chemical manure works (later a glue factory) now ADR automotive and adjacent associated hotspot (WS46 and S3BH05) and BH11 at Nether Lock.	A localised area of the Scheme identified soil hydrocarbon and PAH concentration exceedances (one soil sample from WS46 and one from S3BH05, of PAHs). Further delineation during the supplementary GI suggested that this contamination is not widespread. A second area of localised PAH contamination was identified approximately 250m southwest in one soil sample at BH11.

Soils

Soil Associations

- 9.8.64 National Soil Association mapping suggests that the soils across the Scheme comprise the following seven Associations:
- **Fladbury 2:** Stoneless clayey soils variably affected by groundwater some with sandy subsoils. Some similar fine loamy soils. Anticipated toward the eastern side of the A46 Scheme.
 - **Wharfe:** Deep stoneless permeable fine loamy soils. Some similar soils variably affected by groundwater. Anticipated toward the western side of the A46 Scheme.
 - **Arrow:** Deep permeable coarse loamy soils affected by groundwater. Anticipated to cover most of the flood compensation area.
 - **Compton:** Stoneless mostly reddish clayey soils affected by groundwater and subject to seasonal flooding. Only anticipated in the

extreme north-west of the Kelham and Averham floodplain compensation area.

- **Blackwood:** Deep permeable sandy and coarse loamy soils affected by groundwater.
- **Newport 1:** Deep well drained sandy and coarse loamy soils. Some sandy soils affected by groundwater.
- **Dunnington Heath:** Reddish coarse and fine loamy over clayey soils with slowly permeable subsoils and slight seasonal waterlogging.

ALC

9.8.65 An overview of ALC grades, including their definitions and relation to BMV land, is included below⁷¹:

- Grade 1 – excellent quality agricultural land (BMV)
- Grade 2 – very good quality agricultural land (BMV)
- Grade 3 – good to moderate quality agricultural land
 - Subgrade 3a – good quality agricultural land (BMV)
 - Subgrade 3b – moderate quality agricultural land
- Grade 4 – poor quality agricultural land
- Grade 5 – very poor quality agricultural land
- Other land – non-agricultural land, including woodland

9.8.66 Initial desk-top examination of provisional ALC mapping⁷² indicated that the main Scheme area lies in an area characterised as grade 3 ('good-moderate') land. The mapping similarly indicated that the main portion of the Farndon East and West Borrow Pits FCA consists of grade 3 land, with an area of grade 2 ('very good') in the northern extent. The Kelham and Averham FCA is shown to consist of grade 2 ('very good') land, with adjacent areas of grade 3 to the north-west and east.

9.8.67 Notably, provisional mapping only provides a predictive ALC grade at 1:250,000 scale for strategic purpose and does not distinguish between subgrades 3a ('good quality') or 3b ('moderate quality'). This represents the crucial boundary between BMV land (grades 1 – 3a) and moderate or poorer quality land (grades 3b, 4 and 5). As such, ALC surveys were undertaken throughout the main Scheme alignment and in both the Farndon East and West Borrow Pits FCA and Kelham and Averham FCA.

9.8.68 The 2021 ALC survey was conducted by Atkins along the main Scheme alignment, with only minor coverage of the Farndon East and West Borrow Pits FCA and no coverage of the Kelham and Averham

⁷¹ Ministry of Agriculture, Fisheries and Food (1988). Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land.

⁷² Natural England (2020). Provisional Agricultural Land Classification (ALC) dataset (last accessed December 2023).

FCA. This identified grade 3a and grade 3b, which were extrapolated to cover additional areas within the Order Limits, namely the field centred around coordinates 480715, 356486. Further surveys undertaken in 2023 identified additional grade 3b land within the main Scheme alignment. The resulting grades in the main scheme alignment identified from the 2021 survey, 2023 survey and extrapolated data were grade 3a (28.0 ha, representing 49.9% of the agricultural land in the main scheme alignment), and 3b (28.1 ha, representing 50.1% of the agricultural land in the main scheme alignment). The area in the vicinity of Winthorpe Roundabout was divided relatively equally between grades 3a and 3b land, while the area situated between Newark-on-Trent town and Farndon Roundabout was dominated by grade 3b land, with only a small area of grade 3a adjacent to Great North Road.

- 9.8.69 The ALC survey conducted in 2023 (undertaken by Skanska Mott MacDonald) found the Farndon East and West Borrow Pits FCA to consist of grade 3b (35.9 ha, 85%), grade 4 (5.7 ha, 13%) and non-agricultural (0.7 ha, 2%). The Kelham and Averham FCA was found to consist of grade 2 (5.9 ha, 44%), 3a (3.4 ha, 26%), 3b (3.3 ha, 25%) and woodland (0.7 ha, 5%). Further information on soil types and limiting factors can be found in Appendix 9.3 (Agricultural Land Classification Report) of the ES Appendices [APP-164 to APP-169]. For a tabulated overview of the ALC grades across the Order Limits, refer to Table 9-8. The total area of BMV land identified within the Order Limits (grades 2 and 3a) is 37.3 ha, with 73.5 ha of non-BMV land (grades 3b and 4). Appendix 9.3 (Agricultural Land Classification Report) of the ES Appendices [REP3-016] also noted 1.6 ha of woodland within the Order Limits. Please refer to Appendix B and C of Appendix 9.3 (Agricultural Land Classification Report) of the ES Appendices [REP3-016] for full details and mapping of the ALC grades.

Baseline receptor summary

- 9.8.70 From the baseline data above, the receptors that have the potential to be affected by the Scheme are summarised within Table 9-8 below.

Table 9-8: Principal receptors

Receptor	Details
Geology	There are no designated or non-designated geological sites/features of interest within 500 metres of the Scheme.
Surface Water	River Trent (the A46 crosses this twice), Old Trent Dyke (the A46 crosses this once), Broadgate Lane Feeder (0.4km north of proposed 'Kelham and Averham FCA'), Slough Dyke (the fleet) (the A46 crosses this watercourse immediately west of Brownhills roundabout) Kings Waterside and Marina (approximately 2.5 kilometres downstream of where the A46 crosses the River Trent near Farndon), Newark on Trent Marina (0.96 kilometres downstream of where the A46 crosses the River Trent), Farndon Marina (0.6 kilometres west of the Scheme), Farndon Ponds (0.9km west), Nottingham Piscatorial society

Receptor	Details
	waterbodies (0.3km north-west of Scheme), Smeaton lakes camping site (1 kilometres north-west of Scheme), ponds north of British Sugar Factory (0.2 kilometres west of Scheme), ponds at Staythorpe Power Station (0.7 kilometres east), field drains, unnamed ponds and smaller unnamed watercourses.
Groundwater	<ul style="list-style-type: none"> Bedrock underlying the Scheme – Environmental Agency designated Secondary B Aquifer Superficial deposits underlying the Scheme – Environmental Agency designated Secondary A Aquifer
Human Health: Construction workers	Contact of construction and maintenance workers on site, with potentially contaminated soils, leachates, or ground gases.
Human Health: Site users	People using public spaces/commercial/industrial properties within the vicinity of the Scheme and residents living close to the Scheme.
Agricultural land	Agricultural land: ALC grade 2 ('very good', BMV): <ul style="list-style-type: none"> Kelham and Averham FCA: 5.9 ha
	Agricultural land: ALC grade 3a ('good', BMV): <ul style="list-style-type: none"> Main Scheme alignment (area assessed as part of 2021 and 2023 ALC surveys): 28.0 ha Kelham and Averham FCA: 3.4 ha
	Agricultural land: ALC grade 3b ('moderate'): <ul style="list-style-type: none"> Main Scheme alignment (area assessed as part of 2021 and 2023 ALC survey): 28.1 ha Farndon West Borrow Pit FCA: 23.0 ha Farndon East Borrow Pit FCA: 12.9 ha Kelham and Averham FCA: 3.2 ha
	Agricultural land: ALC grade 4 ('poor'): <ul style="list-style-type: none"> Main Scheme alignment (area assessed as part of 2021 and 2023 ALC survey): 0.5 ha Farndon West Borrow Pit FCA: 1.9 ha Farndon East Borrow Pit FCA: 3.8 ha

9.9 Potential impacts

9.9.1 The following potential impacts from the Scheme have been identified for both the construction and operational stages.

Construction

Contamination

9.9.2 Potential impacts are likely to relate to the introduction of new substantial sources of contamination and disturbance of localised contamination and its interaction with the Scheme during construction. For example, the mobilisation of contaminated material, the uncontrolled release of contaminated soil-derived dust, contaminated surface water runoff or contaminated groundwater. Potential contamination impacts may relate to the following receptors:

- Human health
- Groundwater Surface water

- 9.9.3 A contamination hotspot was identified in the central area of the Scheme adjacent to Nether Lock, between 1.2 and 3.65 metres below ground level, as described in Section 9.8.56 – 9.8.61. Earthworks and vegetation clearance are not proposed in the footprint of the contamination hotspot area and the contamination would therefore remain in-situ at this location. At its closest point, excavation works are anticipated for the construction of the A46 embankment, located approximately 8 metres east of the contamination hotspot, between the existing ditch and toe of the embankment.
- 9.9.4 Piling is necessary for the development of several bridge and viaduct structures which accommodate the proposed road infrastructure. Piling is required at Nether Lock Viaduct adjacent to an area where soil contamination has been identified at BH11 at 0.1m bgl. The location of exploratory hole BH11 is shown on Figure 2 Site Investigation Layout Plan, Sheet 3 of 4, within the 2022 Tetra Tech GI factual report, which forms Appendix D.1 of the Appendix 9.2 (Contaminated Land Risk Assessment) of the ES Appendices [APP-164 to APP-169]. Although considered unlikely there is potential for the mobilisation of contaminants at this area.
- 9.9.5 Concentrations of carbon dioxide were identified exceeding the short-term and long-term WELs. The proposed Scheme does not include structures with confined spaces therefore the risks from ground gases are associated with construction and maintenance workers only.
- 9.9.6 There is a risk of sediment runoff into nearby watercourses from open excavations and piling taking place in close proximity to the River Trent. In the south of the Scheme excavation works adjacent to the River Trent include those associated with the Farndon East and Farndon West Borrow Pits FCAs. Nearby, the Windmill Viaduct crosses the River Trent. Further excavation and piling is associated with the construction of this structure. In the centre of the Scheme, excavation and piles are required for Nether Lock Viaduct and Nether Lock railway bridge which crosses the River Trent.
- 9.9.7 Dewatering activities are anticipated during excavation particularly in the floodplain compensation and borrow pit areas which would generate groundwater that would need to be managed and discharged appropriately from the Scheme. Where discharges from the Scheme are required, Environment Agency guidance on discharges to surface water and groundwater: environmental permits⁷³ and groundwater protection position statements⁷⁴ would be followed. Necessary consents and permits for activities such as discharging into surface water will be sought and details regarding

⁷³ Environment Agency (2022) Discharges to surface water and groundwater: environmental permits [online] available at: <https://www.gov.uk/guidance/discharges-to-surface-water-and-groundwater-environmental-permits> (last accessed December 2023).

⁷⁴ Environment Agency (2018) The Environment Agency's approach to groundwater protection [online] available at: <https://www.gov.uk/government/publications/groundwater-protection-position-statements> (last accessed December 2023).

these consents are detailed in the Scheme within the Consents and Agreements Position Statement [REP4-007].

- 9.9.8 There is potential for new contaminated materials to be introduced into the environment from demolition activities. Anticipated demolition activities are reported in Chapter 10 (Material Assets and Waste) of the ES.
- 9.9.9 Introducing new sources of contamination through accidental spills and leaks relating to construction plant and fuels/oils.
- 9.9.10 Introducing new human health receptors such as site staff/construction workers has the potential to result in adverse impacts. Given the nature of their work, construction workers may come into contact with potentially contaminated soils, leachates, and elevated carbon dioxide and reduced oxygen conditions in excavations.

Soils

- 9.9.11 Potential impacts include:
- Permanent loss of agricultural land due to permanent land take and, more critically, loss of BMV land
 - Temporary removal of land from agriculture
 - Deterioration of ALC grade due to increased flooding from soil reprofiling
 - Deterioration of soil resources during construction and stockpiling
- 9.9.12 Permanent land take is planned in the main Scheme alignment and in parts of the FCAs (as described below).
- 9.9.13 In the main Scheme alignment, the land required permanently comprises 14.45 ha of ALC grade 3a (BMV) and 23.8 ha of grade 3b land according to the 2021 ALC survey and 2023 ALC survey.
- 9.9.14 In the Farndon East Borrow Pit and Farndon East FCA, it is anticipated that 12.9 ha ALC grade 3b land and 3.8 ha grade 4 land would be required permanently to facilitate essential mitigation in the form of a lake as shown on Figure 2.3 (Environmental Masterplan) of the ES Figures [AS-026]. Although a degree of soil function would remain as part of the proposed lake land use, land would be lost to agriculture. This land was not graded as BMV land in the ALC survey (Appendix 9.3 (Agricultural Land Classification Report) of the ES Appendices [REP3-016]). Assessment at this stage adopts the maximum design (reasonable worst case) scenario where all agricultural land within Farndon East would be required permanently.
- 9.9.15 In Farndon West Borrow Pit and Farndon West FCA, it is anticipated that 23.0 ha ALC grade 3b and 1.9 ha ALC grade 4 would be required permanently to facilitate the proposed marshland and ecological mitigation features (as detailed in Section 8.10 of Chapter 8 (Biodiversity) of the ES and shown on Figure 2.3 (Environmental

Masterplan) of the ES Figures [REP2-009]. This land was not graded as BMV land in the ALC survey (Appendix 9.3 (Agricultural Land Classification Report) of the ES Appendices [REP3-016]).

Assessment at this stage adopts the maximum design (reasonable worst case) scenario where all agricultural land within Farndon West would be required permanently.

- 9.9.16 The impact of re-profiling the land at Farndon West FCA to improve drainage towards Old Trent Dyke is not likely to be adverse. Given that ALC grades in the area are already predominantly limited by flooding, the planned re-profiling would not result in a decrease in ALC grade.
- 9.9.17 A small area of land (<1 hectare) would be required permanently within Kelham and Averham FCA, associated with a ditch, culvert and access track. This would result in the removal of BMV agricultural land, ALC grade 2.
- 9.9.18 While Kelham and Averham FCA is allocated for permanent acquisition, as this use is compatible with an agricultural use, it can be returned to that use after the establishment of the FCA.
- 9.9.19 At Kelham and Averham FCA, 5.7 ha of ALC grade 2 and 2.3 ha of grade 3a land, totaling 8.0 ha of BMV land and 3.2 ha of non-BMV grade 3b land, would be returned to agriculture following the temporary use of the land.
- 9.9.20 In the absence of correct soil handling procedures, soil resources are likely to be damaged during construction. Stripping, stockpiling and reinstatement of soils can result in deterioration to soil structure under inappropriate weather conditions and inappropriate use of machinery. Such impacts would result in changes to soil properties and a fundamental loss of the ability to fulfil key soil functions.

Operation

Soils

- 9.9.21 There would be no effects of loss of agricultural land during the operational phase as land lost permanently from agriculture would already be removed in the construction phase.

9.10 Design, mitigation and enhancement measures

Design measures

- 9.10.1 The development of the Scheme design has been an iterative process undertaken through an integrated design team to adhere to the principles of the design and mitigation hierarchy outlined in DMRB LA 104. The first principle being to avoid potential adverse effects, if at all

possible, before seeking to minimise or mitigate for any unavoidable impacts through a well-developed mitigation strategy.

9.10.2 The Scheme has been designed, as far as reasonably practicable, to minimise contamination and agricultural land and soils effects on sensitive receptors. Embedded mitigation for the Scheme is set out in Chapter 2 (The Scheme) of this ES in Section 2.5.131 and for the purpose of this Chapter has been summarised below.

- The avoidance of a contamination hotspot near Nether Lock that was identified as part of the Main Alignment GI. The design and construction strategy have been modified to ensure that the works would be between the existing ditch and toe of the embankment (and may also use the existing track) only, and there would not be any works within the area of the contamination hotspot and the vegetation is to be retained. This is shown on the Environmental Master Plan [AS-026] and General Arrangement Plans [AS-007].
- The minimisation of the area of permanent and temporary land take of agricultural land within the Order Limits has been a fundamental consideration throughout the design of the Scheme.

Mitigation measures – construction

9.10.3 Mitigation measures of relevance during construction are included within the First Iteration EMP [REP4-010] which would be developed into a Second Iteration EMP for implementation during construction of the Scheme. A Materials Management Plan and Soil Management Plan would also be prepared in full as part of the Second Iteration EMP prior to construction commencing. Details on the First and Second Iteration EMPs, including how mitigation is secured within the draft DCO [REP4-003], is provided within Section 4.4 of Chapter 4 (Environmental Assessment Methodology) of this ES. Those mitigation measures of relevance to geology, soils and contaminated land are detailed below.

Contamination

Land contamination risk management (LCRM)

9.10.4 Appendix 9.1 (A46 Newark Northern Bypass Preliminary Sources Study Report) of the ES Appendices [APP-161 to APP-163] includes a Preliminary Risk Assessment which was prepared to inform the design of the intrusive GI that took place for the Scheme.

9.10.5 Following a preliminary review of the geo-environmental testing results, a Supplementary GI was undertaken to target the floodplain compensation and borrow pit sites and one area of localised contamination. The GIs were undertaken in accordance with regulatory standards and current best practice. Including but not limited to Land Contamination Risk Management (LCRM)²⁸, BS5930 and BS10175, to confirm the materials present at the Scheme,

including geological materials, site soils, groundwaters and surface waters.

9.10.12 For the protection of controlled waters, the First Iteration EMP [REP4-010] covers all essential mitigation required including:

- Only excavated materials that have been previously assessed as geotechnically and environmentally suitable are to be reused on site.
- Stockpiles to be located away from principal surface watercourses. The design plans for temporary soil stockpiles to be located 1 kilometre from the River Trent.
- Management of construction site drainage, the proposal is to use the swales, ponds, and basins in their end state during temporary work and construction.
- Management of excavated topsoil and subsoils would be in line with the guidance provided within the Appendix B Outline Soils Management Plan contained in the First Iteration EMP [REP4-010].
- Works would be monitored by a suitably qualified Site Environmental Clerk of Works, to be responsible in identifying and approving all methods of pollution control.
- An auditing programme would be implemented to verify environmental performance.

Protection of controlled waters – excavation and foundation works

9.10.13 Where piling is required, the works would be carried out in accordance with the Environment Agency guidance.^{78 79}

9.10.14 Nether Lock Viaduct requires piled foundations, these are located adjacent to BH11 where exceedances were noted. The location of exploratory hole BH11 is shown on Figure 2 Site Investigation Layout Plan, Sheet 3 of 4, within the 2022 Tetra Tech GI factual report, which forms Appendix D.1 of Appendix 9.2 (Contaminated Land Risk Assessment) of the ES Appendices [APP-164 to APP-169]. The risk of creation of new pathways for contaminants is mitigated by the adoption of cast in-situ piles (rotary bored or CFA) for these structures. It is recommended that a Piling Works Risk Assessment is undertaken, if deemed necessary, prior to construction of the Scheme as detailed in REAC reference GS4 of the First Iteration EMP [REP4-010].

9.10.15 Excavations may require dewatering of runoff waters, perched waters or groundwater. In particular, dewatering is likely in the identified flood compensation areas. Where discharges from the Scheme are required, Environment Agency guidance on discharges to surface

⁷⁸ Environment Agency (2001) Piling and penetrative ground improvement methods on land affected by contamination: guidance on pollution prevention. National Groundwater and Contaminated Land Centre Report NC/99/72 [online] available at: [Piling and penetrative ground improvement methods on land affected by contamination: guidance on pollution prevention - The Construction Information Service \(ihs.com\)](#) (last accessed December 2023).

⁷⁹ Environment Agency (2002) Piling into contaminated sites. National Groundwater and Contaminated Land Centre Report [online] available at: [\[ARCHIVED CONTENT\] \(nationalarchives.gov.uk\)](#) (last accessed December 2023).

water and groundwater: environmental permits⁸⁰ and groundwater protection position statements⁸¹ would be followed. Necessary consents and permits for activities such as discharging into surface water will be sought and details regarding these consents are detailed in the Scheme Consents and Agreements Position Statement [REP4-007].

Management of construction plant and materials

9.10.16 Working method statements would be in place during construction to reduce adverse effects as detailed in REAC reference GS6 and RDWE6 of the First Iteration EMP [REP4-010] and Second Iteration EMP and include the following:

- The storage of oil, fuel and other potentially hazardous substances would be within a secure site compound located on a hardstanding area. Storage of these substances would be within an appropriately bunded area (110% of total capacity volume), located greater than 10 meters away from watercourses.
- There would be a designated refuelling and maintenance area located on impermeable hardstanding with drainage treated appropriately.
- Regular inspections of site plant would be carried out and the use of drip trays and training in the location and use of spill kits and emergency spillage procedures would be provided for site workers. Action Plans would be in place to effectively deal with any contamination issues during construction for example spillages and leaks from construction plant.
- Wheel washing facilities with a washwater treatment system in place would be utilised to prevent transfer of site soils to adjacent roads and best practice dust suppression methods would be employed on site.

Outline Materials Management Plan (MMP)

9.10.17 If excavated Made Ground (soil and stones (from construction and demolition sites) not containing hazardous substances) is proposed to be reused on-site, then up to 1000t may be placed under a U1 Exemption. In accordance with CL:AIRE Definition of Waste Development Industry Code of Practice, if the amount of Made Ground proposed for reuse exceeds the exemption limit, a Materials Management Plan (MMP) or re-use of waste environmental permit must be used.

9.10.18 An Outline MMP has been included in Appendix B.2 of the First Iteration EMP [REP4-010]. This document conforms to the CL:AIRE Definition of Waste Development Industry Code of Practice and

⁸⁰ Environment Agency (2022) Discharges to surface water and groundwater: environmental permits [online] available at: <https://www.gov.uk/guidance/discharges-to-surface-water-and-groundwater-environmental-permits> (last accessed December 2023).

⁸¹ Environment Agency (2018) The Environment Agency's approach to groundwater protection [online] available at: <https://www.gov.uk/government/publications/groundwater-protection-position-statements> (last accessed December 2023).

provides the framework to be used for completion of earthworks and from which future, more detailed site-based MMP's would be developed. The Outline SMP contained in Appendix B.3 of the First Iteration EMP [REP4-010] should be taken into account during any future iterations of the Outline MMP.

Soils

Outline Soil Management Plan

- 9.10.19 The Outline SMP (Appendix B.3 of the First Iteration EMP [REP4-010]) details the mitigation measures required to maintain agricultural soil quality and grade, ensuring where planned, land can be returned to agriculture. The Outline SMP guidance is designed to ensure that soil structure and overall quality does not unduly deteriorate during any instances of soil handling.
- 9.10.20 The Outline SMP (Appendix B.3 of the First Iteration EMP [REP4-010]) provides guidance on the best practices surrounding excavation. Additional details are provided in the Outline SMP, including for:
- Pre-construction planning
 - Soil handling constraints
 - Appropriate weather and ground condition
 - Soil stripping (topsoil and sub-soil)
 - Soil stockpiling and stockpile formation and maintenance
 - Soil reinstatement and reuse
 - Soil placement
 - After care and monitoring
- 9.10.21 The Outline SMP incorporates the hierarchical system of avoidance, reduction and remediation, following DRMB LA104 guidance.⁸² For agricultural land and soil resources, key documents also referenced within the Outline SMP include:
- Defra's 2009 'Code of Practice for the Sustainable Use of Soils on Construction Sites'⁸³
 - Safeguarding our Soil: A Strategy for England⁸⁴
 - BS 3882 Specification for topsoil⁸⁵

⁸² Highways England (2020). LA 104 – Environmental assessment and monitoring. Design Manual for Roads and Bridges (DMRB).

⁸³ Department for Environment, Food and Rural Affairs (Defra) (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites.

⁸⁴ Department for Environment, Food and Rural Affairs (Defra) (2009). Safeguarding our Soils. A strategy for England. Available:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69261/pb13297-soil-strategy-090910.pdf (last accessed December 2023).

⁸⁵ British Standards Institution (BSI) (2015). BS 3882 Specification for topsoil.

- BS 8601 Specification for subsoil⁸⁶
- The CL:AIRE Definition of Waste Development Industry Code of Practice⁸⁷

Enhancement measures

9.10.22 No enhancement measures have been identified for geology and soils.

9.11 Assessment of likely significant effects

9.11.1 The assessment of likely significant effects considers effects on geology, contamination and agricultural soils during construction. These effects are determined following the incorporation of the essential mitigation measures outlined in Section 9.9 of this Chapter and embedded mitigation measures in Section 2.5 of Chapter 2 (The Scheme) of this ES.

Construction

- 9.11.2 The following section describes the likely significant effects upon geology and soils receptors within the Scheme study area during construction. The Scheme would include a range of construction activities including site clearance, demolition works, piling and foundation works for new bridge structures, excavation and earthworks, which have the potential to result in adverse effects on geology and soils. Section 2.6 of Chapter 2 (The Scheme) of the ES provides further details the construction methodologies identified at the preliminary design stage.
- 9.11.3 Soils (agricultural land) within the Order Limits have been identified to include ALC grade 2 land of very high sensitivity. Construction works would result in temporary loss of 5.7 ha of ALC grade 2 BMV land in the Kelham and Averham FCA. Essential mitigation is detailed in the Outline SMP (tailored to results of the ALC) (Appendix B.3 of the First Iteration EMP [REP4-010]). There would be a residual temporary Moderate Adverse effect. With the mitigation detailed in Section 9.10 of this Chapter in place, there would be an overall residual Slight Adverse effect as a result of the permanent loss of soils.
- 9.11.4 ALC grade 3a land, assessed as high sensitivity would be impacted during construction with the temporary loss of 15.8 ha ALC grade 3a BMV land (13.5 ha in the main scheme alignment and 2.3 ha in the Kelham and Averham FCA. No ALC grade 3a land was identified in

⁸⁶ British Standards Institution (BSI) (2013), BS 8601 Specification for subsoil.

⁸⁷ CONTAMINATED LAND: APPLICATIONS IN REAL ENVIRONMENTS (CL:AIRE) (2011), The Definition of Waste: Development Industry Code of Practice, Version 2.

the Farndon East FCA and West FCA). Essential mitigation measures detailed in the Outline SMP (Appendix B.3 of the First Iteration EMP [REP4-010]) are being provided to minimise loss of soil function as a resource. With the mitigation detailed in Section 9.10 of this Chapter in place, there is an overall residual temporary Slight Adverse effect. Construction would result in a permanent loss of 15.6 ha of grade 3a land (14.5 ha in the main Scheme alignment and 1.1 ha in the Kelham and Averham FCA. No ALC grade 3a land was identified in the Farndon East FCA and Farndon West FCA). Essential mitigation includes design to minimise the area of land lost and measures within the Outline SMP (Appendix B.3 of the First Iteration EMP [REP4-010]) to minimise loss of soil function as a resource. With the mitigation detailed in Section 9.10 of this Chapter in place, there is an overall residual permanent Moderate Adverse effect.

- 9.11.5 ALC grade 3b land, assessed as medium sensitivity, would be temporarily and permanently affected during Scheme construction. There would be a temporary loss of 7.6 ha ALC grade 3b land (4.4 ha in the main Scheme alignment north of Winthorpe roundabout and 3.2 ha in the Kelham and Averham FCA). Essential mitigation measures detailed in the Outline SMP (Appendix B.3 of the First Iteration EMP [REP4-010]) are being provided to minimise loss of soil function as a resource. With the mitigation detailed in Section 9.10 of this Chapter, there is an overall residual temporary Slight Adverse effect. Construction would result in the permanent loss of 59.7 ha grade 3b land (23.8 ha in the main Scheme alignment, 12.9 ha in the Farndon East FCA, and 23.0 ha in the Farndon West FCA). Essential mitigation measures include designing to minimise the area of land lost and the measures detailed in the Outline SMP (Appendix B.3 of the First Iteration EMP [REP4-010]) to minimise loss of soil function as a resource. With the mitigation detailed in Section 9.10 of this Chapter, there is an overall residual permanent Large Adverse effect.
- 9.11.6 ALC grade 4 land would be temporarily and permanently affected during Scheme construction. Scheme construction would result in the temporary loss of 0.5 ha ALC grade 4 in the main scheme alignment. Essential mitigation measures include design to minimise area of land lost and the measures detailed in the Outline SMP (Appendix B.3 of the First Iteration EMP [REP4-010]) to minimise loss of soil function as a resource. Within the mitigation detailed in Section 9.10 of this Chapter there is an overall residual Neutral effect. Scheme construction would result in the permanent loss 5.7 ha ALC grade 4 land (1.9 ha in the Farndon West FCA and 3.8 ha in Farndon East FCA), which is assessed as low sensitivity. Essential mitigation measures detailed in the Outline SMP (Appendix B.3 of the First Iteration EMP [REP4-010]) are being provided to minimise loss of soil function as a resource. Within the mitigation detailed in Section 9.10 of this Chapter there is an overall residual permanent Slight Adverse effect.

- 9.11.7 The geology underlying the Scheme comprises bedrock of the Mercia Mudstone Group, with overlying superficial deposits of Granular Alluvium and Cohesive Alluvium. There are no designated or non-designated geological sites/features of interest within the Order Limits of the Scheme or the wider study area. Therefore, the receptor sensitivity is assessed as negligible, no change is anticipated for geology, essential mitigation is not required and the residual effect on the receptor is Neutral. The effect of mineral resources, material import and export in relation to earthworks construction are considered in Chapter 10 (Material Assets and Waste) of the ES.
- 9.11.8 Human receptors are anticipated to be construction workers and site users (people using public spaces/commercial/industrial properties within the vicinity of the Scheme and residents living close to the Scheme) and are assessed as low sensitivity. A localised area of the Scheme identified soil hydrocarbon and PAH concentration exceedances of GAC (one soil sample from WS46 and one from S3BH05, of PAHs). Further delineation during the Supplementary GI suggested that this contamination is not widespread. A second area of localised PAH contamination was identified approximately 250 metres southwest in one soil sample at BH11. Construction earthworks are not proposed in the contamination hotspot area and the contamination would not be disturbed at this location (between 1.2 and 3.65 meters below ground level) and the land at BH11 is likely to be permanent hardstanding associated with the proposed piled foundations. Therefore, construction of the Scheme is unlikely to create a source-pathway-receptor linkage. The Principal Contractor would undertake management of the potential contamination risk, ensuring that no earthworks are undertaken in the contamination hotspot area, as detailed in the First Iteration EMP [REP4-010]. This would result in a temporary Slight Adverse effect at the contamination hotspot area.
- 9.11.9 Although the Generic Assessment Criteria cannot be used to assess the risk short-term (acute) risk to human health to construction workers, there was limited visual or olfactory evidence of contamination and testing did not highlight significant concentrations of contaminants during the GI, therefore the risk to construction workers is minimal. Concentrations of carbon dioxide were identified exceeding the short-term and long-term WELs during the GI gas monitoring. Construction activities can result in the mobilisation of material, such as uncontrolled release of contaminated soil-derived dust, contaminated surface water runoff or contaminated groundwater on human health receptors. The Principal Contractor would ensure standard health and safety procedures are in place and best practices are followed during construction, as detailed in the First Iteration EMP [REP4-010]. Consequently, the residual effect on construction workers and site users across the Scheme in general (non-hotspot area) would be Slight Adverse.

- 9.11.10 The River Trent is located within the Order Limits of the Scheme adjacent to the location of the contamination hotspot area and is assessed as very high sensitivity. Potential effects during construction include for surface water runoff to become entrained with sediment and pollute the River Trent. Essential mitigation by the Principal Contractor during construction would include protection of controlled waters receptors in general and the management of construction plant and materials as detailed in the First Iteration EMP [REP4-010]. Where discharges from the Scheme are required, necessary consents and permits will be sought and details regarding these consents are detailed in the Scheme Consents and Agreements Position Statement [REP4-002]. Consequently, the residual effect on the River Trent from surface water runoff and dewatering activities would result in a Slight Adverse effect.
- 9.11.11 Surface water receptors across the general Scheme (non-hotspot area), have been identified to include the River Trent, Old Trent Dyke, Broadgate Lane Feeder Slough Dyke (the fleet), Kings Waterside and Marina, Newark on Trent Marina, Farndon Marina, Farndon Ponds, Nottingham Piscatorial society waterbodies, Smeaton lakes camping site, ponds north of British Sugar Factory, ponds at Staythorpe Power Station field drains, unnamed ponds and smaller unnamed watercourses. Effects on these receptors include the introduction of new sources of contamination through accidental spills and leaks relating to construction plant and fuels/oils and demolition activities.
- 9.11.12 There is the potential for surface water runoff to become entrained with sediment and pollute nearby watercourses. The Principal Contractor would adopt mitigation measures for the protection of controlled waters, management of construction plant and materials and follow best practices during construction. These measures are detailed in the First Iteration EMP [REP4-010]. Where discharges from the Scheme are required, Environment Agency guidance on discharges to surface water and groundwater: environmental permits and groundwater protection position statements would be followed. In addition, necessary consents and permits for activities such as discharging into surface water will be sought and details regarding these consents are detailed in the Consents and Agreements Position Statement [REP4-007]. There are to be no uncontrolled discharges to surface water and/or groundwater. This would result in a Neutral or Slight Adverse effect.
- 9.11.13 Groundwater receptors within the Order Limits include designated Secondary B bedrock Aquifers and Secondary A superficial deposit Aquifers, which have been assessed as medium sensitivity. Construction activities have the potential for creation of contamination pathways/driving down of contaminants during excavation and foundation works, introduction of new sources of contamination through accidental spills and leaks relating to construction plant and fuels/oils and demolition activities, presenting a risk to groundwater.

The Principal Contractor would adopt mitigation measures for the protection of controlled waters, management of construction plant and materials and follow best practices during construction. These measures are detailed in the First Iteration EMP [REP4-010]. Where discharges from the Scheme are required, Environment Agency guidance on discharges to surface water and groundwater: environmental permits and groundwater protection position statements would be followed. Necessary consents and permits will be sought and details regarding these consents are detailed in the Scheme Consents and Agreements Position Statement [REP4-007]. There is to be no uncontrolled discharges to surface water and/or groundwater. This would result in a Slight Adverse effect.

- 9.11.14 Table 9-9 summarises the Scheme assessment of likely significant construction effects, detailing the potential effect identified and appropriate mitigation measures for a particular receptor. The receptor sensitivity and magnitude of impact has been estimated followed by the identification of the significance category after mitigation (as detailed in Section 9.5 of this Chapter). For the summary of effects associated with agricultural land and soils, please refer to the descriptions of impacts of land take during the construction phase (land to be returned to agriculture following construction) in Section 9.9 of this Chapter.

Table 9-9: Assessment of likely significant effects for the construction phase

Receptor		Value (Receptor sensitivity)	Magnitude	Summary of impact	Essential mitigation (further details contained in section 9.9)	Residual Effect
Soils – Agricultural land	ALC grade 2 land	Very High	Minor	Temporary loss of 5.7 ha ALC grade 2 BMV land in the Kelham and Averham FCA.	Outline SMP (tailored to results of ALC) (Appendix B.3 of the First Iteration EMP [REP4-010]). Details in 9.10 Mitigation section. Protection of site soil quality with respect to plant and working methods as detailed in the Register of Environmental Actions and Commitments (REAC) commitment GS5 of the First Iteration EMP [REP4-010].	Moderate Adverse
		Very High	Negligible	Permanent loss of <1ha ALC grade 2 BMV land in the Kelham and Averham FCA.	Outline SMP (Appendix B.3 of the First Iteration EMP [REP4-010]) to minimise loss of soil function as a resource. Details in 9.10 Mitigation section. Protection of site soil quality with respect to plant and working methods as detailed in REAC commitment GS5 of the First Iteration EMP [REP4-010].	Slight Adverse

Receptor		Value (Receptor sensitivity)	Magnitude	Summary of impact	Essential mitigation (further details contained in section 9.9)	Residual Effect
	ALC grade 3a land	High	Minor	Temporary loss of 15.8 ha ALC grade 3a BMV land (2.3 ha in Kelham and Averham FCA, 13.5 ha in main scheme alignment).	Outline SMP (Appendix B.3 of the First Iteration EMP [REP4-010]). Protection of site soil quality with respect to plant and working methods as detailed in REAC commitment GS5 of the First Iteration EMP [REP4-010].	Slight Adverse
	ALC grade 3a land	High	Moderate	Permanent loss of 15.6 ha of grade 3a land (1.1 ha in Kelham and Averham FCA and 14.5 ha in the main Scheme alignment).	Design to minimise area of land lost. Outline SMP (Appendix B.3 of the First Iteration EMP [REP4-010]) to minimise loss of soil function as a resource. Protection of site soil quality with respect to plant and working methods as detailed in REAC commitment GS5 of the First Iteration EMP [REP4-010].	Moderate Adverse

Receptor		Value (Receptor sensitivity)	Magnitude	Summary of impact	Essential mitigation (further details contained in section 9.9)	Residual Effect
	ALC grade 3b land	Medium	Minor	Temporary loss of 7.6 ha grade 3b land (4.4 ha in the main Scheme alignment, 3.2 ha in the Kelham Averham FCA).	Design to minimise area of land lost. Outline SMP (Appendix B.3 of the First Iteration EMP [REP4-010]) to minimise loss of soil function as a resource. Details in 9.10 Mitigation section. Protection of site soil quality with respect to plant and working methods as detailed in REAC commitment GS5 of the First Iteration EMP [REP4-010].	Slight Adverse
		Medium	Major	Permanent loss of 59.7 ha grade 3b land (23.8 ha in the main Scheme alignment including north on Winthorpe roundabout, 12.9 ha in the Farndon East FCA, 23.0 ha in the Farndon West FCA).	Design to minimise area of land lost. Outline SMP (Appendix B.3 of the First Iteration EMP [REP4-010]) to minimise loss of soil function as a resource. Details in 9.10 Mitigation section. Protection of site soil quality with respect to plant and working methods as detailed in REAC commitment GS5 of the First Iteration EMP [REP4-010].	Large Adverse
	ALC grade 4 land	Low	Negligible	Temporary loss of 0.5 ha grade 4 land.	Design to minimise area of land lost. Outline SMP (Appendix B.3 of the First Iteration EMP [REP4-010]) to minimise loss of soil function as a resource. Details in 9.10 Mitigation section. Protection of site soil quality with respect to plant and working	Neutral

Receptor		Value (Receptor sensitivity)	Magnitude	Summary of impact	Essential mitigation (further details contained in section 9.9)	Residual Effect
					methods as detailed in REAC commitment GS5 of the First Iteration EMP [REP4-010].	
	ALC grade 4 land	Low	Moderate	Permanent loss of 5.7 ha grade 4 land (1.9 ha in the Farndon West FCA and 3.8 ha in Farndon East FCA).	Design to minimise area of land lost. Outline SMP (Appendix B.3 of the First Iteration EMP, Volume 6.5) to minimise loss of soil function as a resource. Details in 9.10 Mitigation section. Protection of site soil quality with respect to plant and working methods as detailed in REAC commitment GS5 of the First Iteration EMP, Volume 6.5.	Slight Adverse
Geology	Bedrock geology: Mercia Mudstone Group Superficial deposits: Granular Alluvium and Cohesive Alluvium	Negligible	No Change	There are no designated or non-designated geological sites/features of interest within the study area. Therefore no change is anticipated for geology. The effect of mineral resources, material import and export in relation to earthworks construction are considered in Chapter 10 (Material Assets and Waste) of the ES.	N/A	Neutral
Human receptors	Construction workers at the	Low	Moderate	A localised area of the Scheme identified soil	LCRM – CLRA (Appendix 9.2 (Contaminated Land Risk	Slight Adverse

Receptor		Value (Receptor sensitivity)	Magnitude	Summary of impact	Essential mitigation (further details contained in section 9.9)	Residual Effect
	contamination hotspot area			<p>hydrocarbon and PAH concentration exceedances of GAC (one soil sample from WS46 and one from S3BH05, of PAHs). Further delineation during the supplementary GI suggested that this contamination is not widespread. A second area of localised PAH contamination was identified approximately 250m southwest in one soil sample at BH11.</p> <p>Earthworks are not proposed in the contamination hotspot area and the contamination would remain in-situ at this location (between 1.2 and 3.65m below ground level) and the land at BH11 is likely to be permanent hardstanding associated with the proposed piled foundations. Therefore construction of the</p>	<p>Assessment) of the ES Appendices [APP-164 – APP-169])</p> <p>Management of contamination risks -Principal Contractor, including ensuring that no earthworks are proposed in the contamination hotspot area As detailed in REAC commitment GS7 of the First Iteration EMP [REP4-010].</p>	

Receptor		Value (Receptor sensitivity)	Magnitude	Summary of impact	Essential mitigation (further details contained in section 9.9)	Residual Effect
				Scheme is unlikely to create a source-pathway-receptor linkage.		
	Construction workers general Scheme	Low	Minor	<p>Although the Generic Assessment Criteria cannot be used to assess the risk short-term (acute) risk to human health to construction workers, there was limited visual or olfactory evidence of contamination and testing didn't highlight significant concentrations of contaminants during the GI, therefore the risk to construction workers is minimal.</p> <p>Concentrations of carbon dioxide were identified exceeding the short-term and long-term WELs during the GI gas monitoring.</p>	<p>LCRM – CLRA (Appendix 9.2 (Contaminated Land Risk Assessment) of the ES Appendices [APP-164 to APP-169]).</p> <p>Management of contamination risks - Principal Contractor. As detailed in REAC commitment GS7 of the First Iteration EMP [REP4-010].</p>	Slight Adverse
	Site users (people using public spaces/ commercial/ industrial properties within the vicinity of	Low	Negligible	Construction activities can result in the mobilisation of material, such as uncontrolled release of contaminated	LCRM – CLRA (Appendix 9.2 (Contaminated Land Risk	Slight Adverse

Receptor		Value (Receptor sensitivity)	Magnitude	Summary of impact	Essential mitigation (further details contained in section 9.9)	Residual Effect
	the Scheme and residents living close to the Scheme).			soil-derived dust, contaminated surface water runoff or contaminated groundwater on human health receptors.	Assessment) of the ES Appendices [APP-170]). Principal Contractor – Management of contamination risks. As detailed in REAC commitment GS7 of the First Iteration EMP [REP2-010].	
Controlled Waters	Surface Water - at hotspot	Very High	Minor	Impact on Surface water: River Trent. Potential for surface water runoff to become entrained with sediment and pollute nearby watercourses. Discharge of potentially contaminated/sediment laden groundwater to watercourses following dewatering of excavations/foundation works.	LCRM – CLRA (Appendix 9.2 (Contaminated Land Risk Assessment) of the ES Appendices [APP-164 to APP-169]). Protection of controlled water – general as detailed in REAC commitment GS3 of the First Iteration EMP [REP4-010]. Protection of controlled waters - excavation and foundation works. Management of construction plant and materials.	Slight Adverse
	Surface Water – general Scheme	Low – Very High A detailed assessment of likely significant effects for each	Negligible	Impact on Surface water: River Trent, Old Trent Dyke, Broadgate Lane Feeder Slough Dyke (the fleet), Kings Waterside and Marina, Newark on Trent Marina, Farndon Marina, Farndon Ponds, Nottingham Piscatorial	Where discharges from the Scheme are required, Environment Agency guidance on discharges to surface water and groundwater: environmental permits and groundwater protection position statements would be followed. Necessary consents and permits for	Slight Adverse

Receptor		Value (Receptor sensitivity)	Magnitude	Summary of impact	Essential mitigation (further details contained in section 9.9)	Residual Effect
		separate surface water receptor is provided in Chapter 13 (Road Drainage and Water Environment) of the ES.		<p>society waterbodies, Smeaton lakes camping site, ponds north of British Sugar Factory, ponds at Staythorpe Power Station field drains, unnamed ponds and smaller unnamed watercourses. Refer to Chapter 13 (Road Drainage and Water Environment) of the ES for a detailed summary of impact for each surface water receptor.</p> <p>Introduction of new sources of contamination through accidental spills and leaks relating to construction plant and fuels/oils and demolition activities. Introduction of new sources of contamination through accidental spills and leaks relating to construction plant and fuels/oils and demolition activities.</p> <p>Potential for surface water runoff to become entrained with sediment</p>	activities such as discharging into surface water will be sought and details regarding these consents are detailed in the Scheme Consents and Agreements Position Statement [REP4-007]. There is to be no uncontrolled discharges to surface water and/or groundwater.	

Receptor		Value (Receptor sensitivity)	Magnitude	Summary of impact	Essential mitigation (further details contained in section 9.9)	Residual Effect
				and pollute nearby watercourses.		
	Groundwater	Medium	Minor	Impact on Secondary B bedrock Aquifers and. Secondary A superficial deposit Aquifers. Potential for creation of contamination pathways/driving down of contaminants during excavation, piling and foundation works, presenting a risk to groundwater. Introduction of new sources of contamination through accidental spills and leaks relating to construction plant and fuels/oils and demolition activities.	LCRM – CLRA (Appendix 9.2 (Contaminated Land Risk Assessment) of the ES Appendices [APP-164 to APP-169]). Protection of controlled water – general as detailed in REAC commitment GS4 of the First Iteration EMP [REP4-010]. Protection of controlled waters - excavation and foundation works including a piling works risk assessment (If required). Management of construction plant and materials.	Slight Adverse

Operational

Soils

- 9.11.15 There would be no effects of loss of agricultural land during the operational phase as land lost permanently from agriculture would already be removed in the construction phase.

9.12 Monitoring

- 9.12.1 For the purpose of this assessment, effects of Moderate Adverse or Beneficial and above have been considered to be significant.
- 9.12.2 After the incorporation of mitigation measures significant effects have been identified for agricultural soils only. In accordance with Requirement 3 of the draft DCO [REP4-003] a Second Iteration EMP will secure the monitoring requirements and procedures to reduce or eliminate impacts on the environment during construction of the Scheme.
- 9.12.3 This would involve monitoring of the works by the PC Environmental Manager to ensure the protection of human health and controlled waters for the duration of the works. Soils should also be monitored by the PC and reported on annually via auger bores or small trial pits at representative locations for a period of five years post-construction.

Contamination

- 9.12.4 In accordance with the requirement 8 of the draft DCO [REP4-003], in the event that contaminated land, including groundwater, is found at any time when carrying out the authorised development, which was not previously identified in the Environmental Statement, it must be reported as soon as reasonably practicable to the Secretary of State, the Environment Agency and relevant planning authority, and the Applicant must complete a risk assessment of the contamination in consultation with the Environment Agency and the relevant planning authority. Where the undertaker determines the remediation of the contaminated land is necessary, a written scheme and programme for the remedial measures to be taken to render the land fit for its intended purpose must be submitted to and approved in writing by the Secretary of State following consultation with the Environment Agency and the relevant planning authority. Remediation must be carried out in accordance with the approved scheme.

Soils

- 9.12.5 The temporary loss of ALC grade 2 agricultural land is considered likely to cause a Moderate Adverse, significant effect during the

construction phase. The Outline SMP (Appendix B.3 of the First Iteration EMP [REP3-016]) provides guidance on aftercare and monitoring of soils after construction. This is to ensure that any reinstated soils are functional at the required level, whether returned to agriculture or for another end use.

- 9.12.6 The permanent loss of ALC grade 3b agricultural land is considered likely to cause a Large Adverse, significant effect during the construction phase. The Outline SMP (Appendix B.3 of the First Iteration EMP [REP4-010]) provides guidance on handling of all soils to ensure they remain of comparable quality and functionality in the event that they are to be re-purposed.

9.13 Conclusions

Geology - construction

- 9.13.1 For geology a Neutral effect has been identified during construction due to the absence of designated or non-designated geological sites/features of interest within the study area.
- 9.13.2 The completed and operational Scheme is not expected to result in any significant effects on geology and was therefore scoped out and not assessed as part of this ES.

Contamination - construction

- 9.13.3 In summary, the contamination assessment has shown that with the inclusion of appropriate mitigation as outlined in Section 9.10 of this Chapter, construction stage effects on identified receptors are not considered to be significant, with the construction effect anticipated to be Slight Adverse at worse.
- 9.13.4 The completed and operational Scheme is not expected to result in any significant effects from contamination. The operational effects were previously scoped out of the assessment and impacts relating to major accidents and natural disasters are considered in Appendix 4.1 (Assessment of Major Accidents and Natural Disasters) of the ES Appendices [APP-126]. The summary of this assessment concluded that the identified risks would not result in major accidents, during either construction or operation of the Scheme, with risk mitigation measures in place.

Soils - construction

- 9.13.5 After the incorporation of mitigation measures significant effects have been identified for agricultural soils only.

For agricultural land and soils, it is considered that with the inclusion of appropriate mitigation as detailed in Section 9.10 of this Chapter, there would be significant adverse effects during the construction phase associated with temporary and permanent land take. Significant effects are associated with temporary loss of ALC grade 2 (considered to be Moderate Adverse), and permanent loss of ALC grade 3a (considered to be Moderate Adverse) and ALC grade 3b (considered to be Large Adverse).

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